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THE

ELECTRICAL WORLD

A REVIEW OF CURRENT PROGRESS IN ELECTRICITY
AND ITS PRACTICAL APPLICATIONS

VOLUME LVIII

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CONTENTS.

THE STEAM AUXILIARY QUESTION.

A brief paper in this week's issue gives an interesting account of the work of the Southern Power Company in the installation of auxiliary stations on its hydroelectric system. This is known as one of the large transmission systems of the country, devoted in the main to operating textile mills, in which continuity of service is of fundamental importance. Some of the Southern streams run low in summer, although as a whole they are probably more reliable than the mountain rivers, and the point of economical development is reached only by utilizing something considerably more than the minimum flow of the stream. It therefore becomes very desirable to plan simple and efficient auxiliary equipment, both to tide over the low-water period and to provide reserve capacity in case of a breakdown on the system. This has been successfully done by the Southern Power Company in the stations here described.

The design of an auxiliary station rests on principles differing somewhat from those characteristic of ordinary electrical supply. In such plants the period of auxiliary operation is generally only two or three months per year, and consequently the fixed charges bear heavily upon the cost of the output generated by steam. Great simplicity, low cost and convenient location are the three fundamental requirements in auxiliary plants. It is usually found advantageous, as in the present instance, to locate the auxiliaries at the receiving ends of the line rather than near the hydraulic power stations, where fuel is more difficult to obtain. On a large system, like that of the Southern Power Company, still another requirement comes into play, namely, that the auxiliaries shall not be easily put out of service by the failure of a single transmission line. Hence the wise policy was here adopted of subdividing the auxiliary plant and locating it at, in this instance, three points on the network. In ordinary low-water operation the three steam plants turn energy into the system at or near points of very large consumption, so that the line losses are relatively small. In case of break-down of one of the long transmission lines only a portion of the auxiliary plant, at worst, can be put out of service, so that operations can go on throughout most of the system.

In carrying out this scheme the Southern Power Company has located in each of the three stations, one of which is completed and another rapidly nearly completion, a single great turbo-generator of the horizontal, three-phase type, having a capacity of 8000 kw. This machine is equipped with the ordinary line of auxiliaries and fed with steam from a battery of six vertical water-tube boilers, a type relatively cheap to install and reasonably efficient. The firing is by hand to cut down the relatively large investment charge against automatic stokers. The plant itself is compact and arranged in the simplest possible manner with short runs of steam piping and convenient location of all auxiliaries. The intent was to make it as simple and easy to operate as possible without going to any unnecessary

expense, and the design was well adapted to secure this end. Three such plants form the complete auxiliary equipment. Doubtless 8000 kw is small capacity for an independent station, but, remembering that there are three such units all working together more efficiently than if they were located in the same power house by reason of the lessened transmission lossses, the operating expense per kilowatt is probably materially less than it would have been had the plant been concentrated under a single roof at one point on the system. Altogether the equipment described presents a capital instance of that adaptation of means to ends which is the fundamental requirement in efficient power distribution.

SHORT CIRCUITED TURNS IN WOUND COILS.

A short-circuited turn in a coil of many turns is often, like the worm in the core of an apple, sufficient to condemn the entity, despite its wholesome seeming exterior. Various methods have been employed by magnet and coil winders, at different times, in testing their coils for accidental shorts. They usually embody some variety of the Hughes induction balance. Three very good, and seemingly very practical, means are described by Mr. J. P. Raymond, this week, on page 27. One of these devices is virtually an alternating-current Wheatstone bridge, with a telephone receiver in place of the galvanometer. The second replaces, in such a Wheatstone bridge, a particular type of alternating-current galvanometer. The third method employs a special form of fairly high-frequency induction coil, to which the coil under test is applied as a secondary winding. The advantage of the first method is its simplicity and readiness of application. On the other hand, it is only qualitative; or, if quantitative, only to a small degree. The second method has the advantage of giving quantitative indications with a great variety and range of coils. It sometimes happens that a coil has no positive short-circuit, but behaves as though it had a short-circuit, owing to excessive leakage through the insulation on the wire, from turn to turn, or from layer to layer. The galvanometer method enables a balance to be approached between the leaky coil on the one hand and definitely short-circuited turns on the other. In the past, the green dye in green-silk-covered wire has often given rise to such prejudicial leakage within coils, especially in the presence of moisture. The induction-coil method has the advantage of not requiring a special high-frequency source of alternating currents, and of giving a very searching test with all coils that permit of being strung on a core. In some cases a test of this kind will give rise to so much heat in a short-circuited turn or layer as to call attention to the defect in this way also.

TRADE SECRETS AND CONVENTION VISITS.

A paragraph printed in the program of the American Institute of Chemical Engineers at its recent semi-annual meeting in Chicago is of rather unusual interest. It is headed "Excursions" and reads as follows: "It is understool that chemical engineers who are allied with competing companies will not attend these excursions unless they so declare themselves and extend the same courtesy of inspection from their own plants." The excursions listed after this notice were to a packing plant in the Union Stock Yards, a large glucose establishment, the laboratories of a prominent manufacturer of boiler compounds, the plant of a by-products coke company, the factory of a white-lead manufacturer, the works of a great steel-making corporation, a Portland cement plant and an oil refinery. The list is given to show the character of plants included in the itinerary embraced under this cautionary signal, although it may be that not all of them were apprehensive of the visits of competitors.

To one accustomed to the freedom with which electrical plants are visited the notice quoted seems to smack of excessive prudence and to be rather un-American in spirit. Abroad, and on the Continent especially, it is well known that managers of technical establishments refuse in many instances to allow their plants to be inspected by visitors, thinking, no doubt, that the sharp eyes of the seekers after information may spy out valuable trade secrets. However, while this precaution is one that is clearly within the owner's rights and one to which all others must bow, it has been held in some scorn in this country as inadequate to accomplish the end sought, unwise as a matter of policy and inharmonious with the open, progressive methods which should characterize the advancement of the industrial arts in the twentieth century. The days of the alchemists and the Rosicrucians are past. Why, says the breezy American, should establishments built on the triumphs of modern science imitate the secret ways of the mystics of the Middle Ages?

But it is apparent that this rather disdainful attitude is not held universally even in this country. Here is a 1911 convention, held in Chicago, of all cities, where visitors allied with competing companies are warned not to attend the excursions to plants unless they declare themselves and extend the same courtesy of inspection on the part of their own plants. Apparently an eye for an eye, a tooth for a tooth. We do not recall that this precautionary attitude, which is a modified form of the total-exclusion policy of some European concerns, has been exhibited in the electrical industry of the United States to any noticeable extent. Therefore the warning posted in the program of the chemical engineers' convention is something of a surprise.

Possibly, however, this is taking a superficial view of the matter. We are confident that, in general, electrical manufacturers and operators show no disposition to throw a veil of mystery over their working methods. Few, if any, American electrical plants are barred to visitors bearing proper credentials. But perhaps some of them would be disinclined to admit competitors *en masse*. Possibly, too, the American policy may not be unrelated to the light-hearted way we dispose of problems of magnitude and to our national tendency to show off. Does the warning paragraph quoted from the Chicago convention program indicate that there is some tendency toward a policy of greater secretiveness on the part of American manufacturers? Perhaps, after all, this may to some extent have been suggested by the policy adopted in recent years by our War and Navy Departments of enshrouding the obvious in military mystery—apparently in imitation of the immemorial practice in European countries of giving a sacrosanct

character to the military establishment in order to enhance its prestige with the general public.

SOME FACTORS IN RESIDENCE BUSINESS.

The subject of residence business has been a matter of interesting discussion among managers of electric-light companies for many years, and opinions expressed as to its profitableness have differed widely. Investigation of the subject has been more thorough than ever the past two years, and the results have indicated, as might be expected, that residence business is profitable or not according to whether the density of business is such that there are many consumers per block or only one or two per block. The report of the committee on residence business presented at the last National Electric Light Association convention by Mr. C. N. Stannard, of Denver, gives some figures from which interesting conclusions can be drawn in connection with diversity and demand factors previously determined by other investigators. Mr. Stannard states that the gross revenue per kilowatt connected reported for this kind of business varies from $18 to $22, with an average of $21 per year. It is interesting to reduce this to gross revenue per kilowatt of maximum demand on the power station at time of station peak load, which can be done with the aid of demand and diversity factors of residence business that have been presented at various times the past two years. These factors vary according to the size of the city, but it is seldom that the combined demand and diversity factors of residence business are such that more than 25 per cent of the connected load is turned on at the time of the maximum power-station load, while this figure may go to 14 per cent and even lower. In fact, 14 per cent is probably somewhere near the average. If we take a case where 14 per cent is the correct figure, the gross revenue to the company with $21 per kilowatt connected will be $150 per kilowatt of maximum demand at time of power-station peak. In a case where 25 per cent represents the combined demand and diversity factors the gross revenue would be $84 per kilowatt of demand at time of station peak. It is unnecessary to say that $150 is considerably above the average gross return from electric-light and motor service as a whole, and, in fact, $84 is slightly above the average. To be sure, the cost of serving residence business is higher that that of any other general class, but when the small ratio of demand to connected load is considered, this class of business is not as unprofitable as some have supposed.

The possibility of supplying certain small residence customers through a maximum-demand controlling or limiting device at a flat rate approximating 1 cent per watt contracted for per month has been receiving considerable attention for the past year. The attractive feature of this scheme to some managers who have tried it is the apparently high gross revenue per kilowatt of consumer's maximum demand, which, at a 1-cent rate per watt per month, would be $120 per year per kilowatt of maximum demand. Some very interesting figures on the way this plan actually works in practice were given in a brief paragraph in the National Electric Light Association meter committee report at the last convention. At Superior, Wis., a number of residence consumers have been put on a flat rate with controlling devices, and where meters were formerly used the meter was left in service temporarily to determine the actual income per kw-hour the company was receiving. Starting in September with eighteen such customers, the income per kw-hour was 9.7 cents, which fell to 4.7 cents in December, with sixty-five customers. In February, with 109 customers, the income was 5.3 cents. The decreased revenue per kw-hour between September and December can be partially accounted for, of course, by the increase in hours of darkness. However, there is some reason to believe from these figures that there is an increasing tendency on the part of the flat-rate consumers to keep lamps turned on when not needed. It is probable that at first there was a fear on the part of the consumer that excessive tungsten-lamp renewals would result from unnecessary burning of lamps. As time went on consumers doubtless have come to regard that feature less and hence have become more wasteful. It has been generally admitted that the success of a flat-rate plan of this kind must necessarily depend on a high-efficiency lamp of rather high first cost. The high-efficiency lamp is necessary to serve a customer at a flat rate he can afford and allow for some waste, while the high cost of lamp is necessary to prevent waste by the customer. Of course, the improvement in life and lowering of price of high-efficiency lamps will tend to change this situation.

Another factor in the flat-rate situation was brought up by Mr. H. B. Gear, of Chicago, in a discussion on this subject at the last convention of the Iowa Electrical Association. He made the point that the load curve of any individual residence consumer on a flat rate with controller would probably be of considerably different form from that of a residence consumer on meter. The consumer on meter promptly turns off the lamps he is not using, and his load will show only a few brief high points during an evening; as these points may not coincide with those of his neighbors, the result is a high diversity factor, or, in other words, a great difference between the sum of the consumers' maximum demands and the actual demand made at any one time. The consumer with a flat-rate controller, on the other hand, is likely to turn on the maximum number of lamps for which he has contracted and leave them going a considerable time each evening, so that the load curve would have a flat top instead of consisting of a number of brief peaks. The result would be a lower diversity factor or less difference between the sum of the consumers' maximum demands and the actual maximum demand at one time than in the case of the meter consumers. The meter consumer with a given maximum demand will therefore virtually cause less station demand than a flat-rate consumer with the same maximum. This is a point which has been usually overlooked in discussions on this subject. In a metered residence business there is a great difference between the maximum demand of an individual consumer and the maximum demand per consumer for a group of consumers measured at the power station at the time of peak load, as has already been mentioned in connection with Mr. Stannard's figures. This is due altogether to the intermittent character of the metered load, and makes possible the high gross revenue deduced from Mr. Stannard's figures relating to metered customers.

Chicago A. I. E. E. Convention.

By Telegraph.

[illegible] the [illegible] eighth convention of the American Institute of Electrical [illegible] The sessions are being held in the Louis Seize room of the Hotel Sherman, and the bureaus of the convention are conveniently arranged in nearby apartments of the handsome hostelry. The advance registration was 360, of whom perhaps 180 are from Chicago. About half of those registered in advance attended the opening reception at the hotel on Monday evening. Although a violent thunderstorm affected the local attendance, the scene in the ballroom was an animated one. Before the dance there was a reception with the following in the receiving line: President D. C. Jackson and his sister, Mrs. Louis E. Reber; Past-president L. A. Ferguson and Mrs. Ferguson; President-elect Gano S. Dunn, and Past-presidents Frank J. Sprague, John W. Lieb, Jr., and Dr. Schuyler Skaats Wheeler.

When President Jackson called the opening session to order at 10:15 Tuesday morning there was an attendance of about 400. President Jackson introduced Past-president L. A. Ferguson, of the Commonwealth Edison Company, as chairman of the Chicago convention committee, who in turn introduced Mr. MacLay Hoyne, of the city corporation counsel's office, who welcomed the engineers on behalf of Mayor Harrison.

President Jackson then delivered his annual address, prefacing it with the remark that it was not his intention to irritate the consciences of his hearers.

PRESIDENT JACKSON'S ADDRESS

That the qualifications of the engineer put him in a position which demands from him an attitude in public life of service and of leadership was the keynote of President Jackson's address. As a professional man he must have a masterly knowledge, in addition to skill in a vocation, and he must deal practically in the affairs and needs of men. His duties must be performed with a touch of disinterested spirit, in addition to the vocational spirit of earning his livelihood. Such men have a duty to the public, and in the performance of that duty they must exert their influence on that thought and practice of the day which affect the welfare and progress of the nation. The theory of modern economics is built upon modern engineering development, and it is the duty of engineers to do their utmost in so molding their economic creatures as to entail the greatest practical usefulness to society. Engineering, related as it is to the application of the powers of nature to useful purposes, must necessarily bring its followers into contact with commercial ideas at times when, as in ours, the industries dominate commerce. The true engineer is a devoted follower after truth and differs diametrically from the devotees of pure "commercialism," who are strictly opportunists. He also differs from the pure idealists, who are often notable for refusing to accept any advance unless it wholly meets their personal ideals. The spirit of the engineer rejoices in obtaining any step toward the truth, but he is always seeking for an advance.

Referring to the modern corporation, he said that this has followed in the wake of the one-man business and the simple partnership in response to an inextinguishable natural law; but in adjusting our mental attitude to dealing properly with the situation thus presented we must remember that responsibility for a misdeed is a personal thing that cannot be shifted from the man in responsibility to an impersonal aggregation entitled the corporation which he manages. In building up an industrial structure we must not overlook the plain guideboard of history, and personal answerability must be established. Engineers have a special duty, as professional men who are trained in experience and straight thinking, to use their influence for the establishment and support of right and reason in the dealings between the public and public service corporations; for the problems surrounding the public service corporations in American cities, and their relations to the cities, have been largely brought to their present importance and prominence through the activities of electrical engineers. No engineer does his duty who does not stand with fidelity for equally square treatment from and toward these corporations.

With reasonable restraint and supervision, as by properly constituted public service commissions, the corporations are more quickly responsive to public sentiment than could reasonably be expected by any publicly owned business organization of equal magnitude which would exist under our political conditions. To remove the present barrier of distrust between the servitors of the public and the people which they serve involves a supervision which imposes on the companies an exact bookkeeping system, with presentation to the public of accurate and luminous statements of the business, and it equally demands that the public shall be brought to yield justice to the companies with the same completeness as individuals seek it for themselves. Danger from the leadership of demagogues seriously exists where no public supervision of the public service companies is provided, and also in a lesser degree where such supervision has been established. This danger must be overcome by the exertions of fair-minded and right-thinking men, and electrical engineers should give of their time and efforts to establish convincingly the facts which the public does not understand in regard to the business of the public service companies; to indicate the means for rightly treating the new influences which engineers have been creating by their works, and to aid in establishing measures which will favor a sustained mutual confidence and fair dealing between them and the public. The members of the American Institute of Electrical Engineers should take somewhat to themselves as professional men this difficult problem, and aid in its solution as a matter of duty to the public.

The portion of the address relating to the opportunity for usefulness of engineers in connection with public service problems was received with loud applause.

President Jackson then introduced Mr. Gano S. Dunn, of the Crocker-Wheeler Company, the president-elect, who made a short and graceful speech in which he returned thanks for the honor conferred on him and referred in appreciative terms to the preparations made by the Chicago committee for the entertainment of the attendants on the convention. He said that it was a distinguished honor to head an association of the highly professional character of the American Institute of Electrical Engineers, of which he was deeply sensible, and he pledged his utmost efforts to contribute to the continuance of the Institute as the guild, the university, the club of the electrical engineering profession. Mr. Dunn's speech was cordially received. Secretary R. W. Pope then made some announcements, after which President Jackson expressed his thanks to the various Chicago committees for the admirable arrangements made for the convention.

The first paper read was that on "The Use of Power-Limiting Reactances," by Messrs. R. F. Schuchardt and E. O. Schweitzer, of the Commonwealth Edison Company, which was abstracted by Mr. Schuchardt.

THE USE OF POWER-LIMITING REACTANCES.

Particulars are given in detail by the authors of short-circuit tests made upon a 12,000-kw, 9000-volt, 25-cycle turbo-generator in the Fifth Street Station of the Commonwealth Edison Company of Chicago. Mention of these tests was also made in connection with the paper by Mr. Merriam. The tests reported by the present authors related to instantaneous short-circuit current of the generator without external reactance; instantaneous short-circuit current of the generator with external reactances of 4 per cent and 6 per cent; duration of the transient phenomena incident to

short-circuits; the effect on the generator of the short-circuit currents; the behavior of the external reactance coils, and the effect of the installation of the reactance coils on the stability of the system. The tests indicated that the instantaneous short-circuit current on the generator was not as high as had been thought, but that owing to its comparatively high power-factor the current produced severe stresses on the generator and seriously strained the oil switches. In the case of the generator tested it appeared that the use of an external reactance of approximately 6 per cent was desirable. A lesser value of reactance does not reduce the current sufficiently and a greater value results in a very small increment of decrease. A reactance of this amount limits the current to a value which can be safely interrupted by properly designed oil switches and keeps the torque on the generator at so low a value that even when feeding into the short-circuit on the busbars there is no appreciable lessening in the speed, nor is the unit subjected to severe strains. The authors claim that the use of reactance tends to make the operation of the system as a whole more stable, and thereby increases the reliability of the service. The use of such coils is, therefore, apparently the solution to one of the most serious problems in the operation of alternators of high voltage and large outputs.

Mr. E. B. Merriam, of the General Electric Company, then summarized his paper entitled "Tests of Oil Circuit-Breakers," which gave an account of experiments carried on in connection with those described in the preceding paper.

TESTS OF OIL CIRCUIT-BREAKERS.

The author described the results of 150 short-circuit tests made upon a three-phase, 1200-kw, 9000-volt, 25-cycle turbo-alternator in the Fisk Street station of the Commonwealth Edison Company of Chicago. During the tests it was noted that the field current of the alternator increased when the armature was short-circuited, values as high as ten times normal field current being observed. This phenomenon was attributed to the interaction between the field and armature coils. The records obtained indicated that the voltage thus produced in the field coils under some conditions became as high as seven times normal. When a short-circuit was placed upon only one phase it was noticed that the voltage of the phase not short-circuited rose to a very high value, in some instances as high as two and one-half times normal. The author mentioned the use in connection with the generator of current-limiting reactances, consisting of seventy-six turns of 1,000,000-circ. mil copper cable wound on a cement core and supported by a wooden framework. Tests show that the reactance consumed 6 per cent of the generator voltage when carrying normal full-load current. It was found that with the introduction of this amount of reactance in each phase the maximum instantaneous short-circuit current was reduced to about one-half and the torque on the turbine shaft to about one-seventh of what it would have been without the reactance. When a short-circuit was thrown on the system beyond the reactance the terminal voltage of the alternator was maintained and the alternator recovered its normal voltage after the short-circuit had been removed much more rapidly than would have been the case had the short-circuit been placed directly across its terminals. As a result of the reduction of the torque on the turbine, due to the introduction of reactance, there was practically no drop in speed when the short-circuit was thrown on it. The oil circuit-breakers proved capable of opening all of the loads or short-circuits without producing any external disturbance or developing any undue pressures. During some of the tests a small quantity of oil came out of the oil vessels and was deposited on the cell doors. By actual measurements after a number of severe short-circuits it was found that only 5 per cent of the oil had been lost. The repeated use of the oil in the oil vessels did not appreciably diminish its efficacy, and the introduction of suitably designed oil baffles and diverters overcame the tendency of the oil to come out of the oil vessels. On account of the intensely local action of the oil circuit-breakers when the contacts part the arc which is drawn produces gases which form pockets in the oil and the temperature of the oil is not raised by an appreciable amount.

Dr. C. P. Steinmetz, who was greeted with hearty applause, then gave a verbal outline of his paper entitled "Development of the Modern Central Station." He pointed out how the preceding papers fitted into the history of the art, which, while old in many respects, is yet new. He declared that the problem of synchronizing operation is the problem of the day.

DEVELOPMENT OF THE MODERN CENTRAL STATION.

Dr. Steinmetz made a striking comparison between the earlier interconnected direct-current stations and the modern interconnected alternating-current stations. He claimed that for reliability of service the earlier direct-current stations have been unexcelled even to the present day, and attributed this fact to the following causes: The parallel operation of all the stations, which guarded the system in case of break-down of one or several stations; the storage-battery reserve, which maintained the service even in a complete shutdown of all the generating stations, and especially the nature of the system of low-tension feeders and mains, which limited the effect of any break-down at any point of the system to its immediate vicinity, by limiting the power which could be concentrated at any point to such an extent that no local break-down could seriously affect the entire system. He claimed that the modern polyphase generating stations correspond to the former direct-current generating stations, and the high-voltage feeders from the main stations to the substations, and the tie-lines between the stations, correspond to the 2200-volt feeders and tie-lines between the earlier stations.

The author expressed the opinion that on account of the increase in the loss of economy and reliability, and the complication of control of a system with the increasing number of separate stations, the only feasible method which permits unlimited extension of the system, without any increase of danger and complication, is the parallel operation of the entire system on a single ring bus, which is divided into sections by power-limiting busbar reactances. The limitation of power by the reactances in busbars and generators appears sufficiently safe, but it has the disadvantage of momentarily exposing the busbar section and the feeder switches to the shock of short-circuit in case of the failure of a feeder. It is probable, therefore, that a safer way of operation would result from limiting the power of the feeders by reactances and maintaining service on each feeder in case of a fault until the fault either clears itself or the feeder has to be cut off. That is to say, it seems desirable in the modern high-output, high-voltage station to return to the well-tried principle of the low-tension, direct-current system.

The parallel operation of synchronous machines requires reactance in the circuit between the machines. It is necessary, however, that the combined impedance of the resistance and reactance of the cross-circuit should be sufficiently low to allow a large enough current to be produced to keep the machines together against any tendency to separate them, such as inequality of the driving power, slightly different speed, adjustment of the engine governors, etc. With greatly increased reactance in the circuit it would be necessary to control the speed of the prime movers independently of the alternators, so as to be so closely the same under all conditions as to require a very small synchronizing power between the alternators to pull them into step. That is to say, the prime movers must be synchronized. Although this problem has not yet been solved, its solution presents no difficulty because the governors can be

controlled electrically with the required amount of ease. The governor in the steam supply system would be controlled by the rate of exchange of energy between the stations, in combination with sufficiently powerful dashpots to guard against the hunting of the governors.

[illegible]

later, but briefly, owing to the limitations of time. Mr. John W. Lieb, Jr., praised the acute analysis by Dr. Steinmetz of the central-station problem and said that the other two papers were notable instances of the modern system of applying scientific research to industrial advancement. The New York Edison Company has found a wide variation in the external reactance of generators, the difference being as great as two to one. Disturbances on the large interlaced systems due to short-circuits or generator failures are tremendous. Unique problems in starting up substations are also presented. He referred to the dependence of great industrial operations on the huge electric systems of to-day and added that fortunately central-station companies can feel safe because the art provides well against disastrous break-downs.

Mr. Max H. Collbohm, of Madison, Wis., contributed a written discussion, in which he advocated the horizontal-break type of oil switch rather than the vertical-break instrument, and in connection with synchronizing he favored the liberal use of induction generators.

Mr. David B. Rushmore, of the General Electric Company, said that the problem which the central station has to face is one due to increased magnitude, and is comparable to social and industrial problems incident to modern conditions. While central stations and distributing systems are increasing in magnitude, yet larger sizes of generators are to be expected, and placing a reactance outside the machine allows a larger and a better generator to be designed. The automatic protection of transmission lines has been attained in the aluminum lightning arrester, and what is now needed is an automatic reactance to prevent short-circuits. Probably a larger use than even at present of protective apparatus is indicated.

Mr. Charles W. Stone, of the General Electric Company, said that station ratings could be increased without any material change in the oil switch, and he complimented the engineers of the Commonwealth Edison Company for their thorough work as set forth in their paper. He believed that the vertical-break switch with the baffle has greater possibilities than the horizontal-break type. The high external reactance machine is, he said, an advance in the art; generators, he added, should be so designed as to be as safe as possible, and then supplemented by external reactance.

Mr. B. G. Lamme, of the Westinghouse Electric & Manufacturing Company, said that on very large machines there are bound to be short-circuits sooner or later, and that reactance currents should be kept down. In two-pole and four-pole high-speed machines internal reactance can be easily secured, a comparatively small number of coils tending to give high reactance. High-reactance machines are in many cases high-output machines. If necessary the reactance can be placed outside the generator. Considerable complaint has arisen from flashing when machines are short-circuited; sometimes the cause of such short-circuiting does not lie in the machine, but is attributable to some other reason, such as the construction of the end bells. Repeated short-circuits are much more to be dreaded than individual cases. In making iron reactances a very large internal air gap should be allowed.

Mr. C. F. Scott, of the Westinghouse Electric & Manufacturing Company, read a short communication from Mr. W. L. Waters, of the same company, which was illustrated by a lantern slide. A generator was described with means for reducing possible short-circuits to a minimum.

Mr. L. A. Ferguson asked Mr. Lamme for more specific information on high internal reactance as compared with low reactance. In reply Mr. Lamme said that the leading tendency is to use the largest amount of copper that can be got into the machine in order to increase the output, and this means high reactance. He did not favor reactance outside the machine unless absolutely necessary.

In closing the discussion Mr. Schuchardt described the reactance house at the Fisk Street station of the Commonwealth Edison Company. Mr. Merriam surrendered his time to Dr. Steinmetz, who said that the oil circuit-breaker is based on the control of explosive forces developed by enormous power at the break. He spoke well of the induction generator. This machine, he said, has advantages with respect to short-circuit currents, but there are serious difficulties in the way of introducing it into practice, and, moreover, this type of generator does not solve the momentary short-circuit problem. As to the external and internal reactance for generators, he said that the problem is essentially similar to that which nearly thirty years ago was confronted in the early Edison low-tension station. It was then solved, and, although it cannot now be attacked in the same manner as then, it is nevertheless being solved just as surely.

On Tuesday afternoon the members and visitors took luncheon at the Hawthorne works of the Western Electric Company, and after inspecting the several departments of the factory, visited the Fisk and Quarry Street generating stations belonging to the Commonwealth Edison Company of Chicago.

Convention of Canadian Electrical Association.

The Canadian Electrical Association held its twenty-first annual convention at Niagara Falls, Ontario, on June 21, 22 and 23. The meetings took place in the Convention Hall of the Clifton House in full view of the falls.

On the morning of June 21, shortly after 10 o'clock, the president, Mr. A. A. Dion, called the members to order. Mr. O. E. Dores, the Mayor of the city, delivered an address of welcome, to which the president responded in his usual happy manner, thanking the Mayor for the cordiality of his greeting.

President Dion then addressed the meeting, expressing his pleasure in seeing so many prominent men in the electrical industry present, and in having the opportunity of discussing with them the important questions which would come up for consideration. At first, he said, it had been the intention to meet in Winnipeg this year, but arrangements could not be made and the visit to the West had to be postponed. He referred to the affiliation which had taken place with the National Electric Light Association during the past year, and expressed his belief that this could not but be of great benefit to every member of the association. Provincial committees had been formed throughout Canada and he felt convinced a large increase in membership would be the result. A suggestion had been made some time ago by one of the past-presidents, Mr. Frederick Nicholls, that the past-presidents should not be allowed to fall back into idleness, but should form an advisory board, which could render valuable assistance because of their experience, and he hoped that this idea would be carried out. President Dion concluded his address by thanking Mr. T. S. Young, the secretary-treasurer of the association, for his energetic efforts and timely suggestions in helping to bring about such a successful meeting.

Mr. Young, in presenting his report, which showed the association to be in a flourishing condition, outlined the work of the year, and referred particularly to the correspondence with the Canadian government with respect to the printing of postage stamps in rolls.

The next order of business was the reading of papers, and the president called on Mr. R. F. Pack to read Mr. E. Little's paper entitled "Operating Safeguards."

OPERATING SAFEGUARDS.

Mr. Little's paper contained a review of a few of the necessary safeguards in modern central-station systems. The safeguards described related to life and property and to the insuring of continuity of service. The author discussed oil switches and circuit-breakers, protective relays, lightning arresters and ground detectors, and outlined methods for the care and installation of aluminum-cell arresters and for the safeguarding of life and property.

Quite a number of the members took part in the discussion of the paper. President Dion said that he thought, in reference to giving first aid to those who had received an electric shock, that the best way to educate those who would come in contact with that class of work is a practical demonstration, as more can be learned in that way than by the reading of pamphlets. Mr. Marston, of Chicago, said that, although the use of electric current if properly conducted is quite safe, yet it is best to impress the public with the idea that great care should be used and every precaution taken against accident.

CENTRAL-STATION PUBLICITY.

The advantages of newspaper publicity to the central-station industry were outlined in a paper by Mr. Glenn Marston. The author called attention to the value to the central station of obtaining the publication of legitimate news items relating to the central-station industry. He claimed to possess unbounded faith in the use of display-advertising columns of newspapers in educating the public. He stated that publicity can be made an effective agent in leveling the load curve, and argued that by means of display advertising and legitimate news items the people can be convinced that the convenience of electricity makes it cheap at any price. The value of publicity is greatest by reason of its ability to create gross earnings, but it is of much importance in directing the demand for electricity along lines which will give the company an opportunity to increase its net earnings.

Mr. Marston's paper called forth considerable discussion. Mr. Martin, in discussing the paper, expressed regret that the author had not touched on some other methods of advertising, such as bill posters, window posters, exhibitions of devices, etc., and how far it is wise to go in the matter of expense. Mr. I. H. Wright, of North Bay, thought some of the suggestions in the paper would not apply to small towns. Mr. Larmouth said a great deal of money could be wasted in advertising if care were not taken. Mr. Dion asked whether or not it was advisable to assist in wiring houses for electric lighting. Mr. Marston said he believed that publicity of all kinds pays when carried out along right lines; that as soon as the people know about electricity and what it means to carry the energy to their homes they will appreciate the work that is being done to give them good service.

SERVICE PROTECTION.

At the opening of the afternoon session Mr. George R. Smith presented a paper in which were described numerous methods now employed for preventing the theft of electricity. The devices described included sealable service entrance cut-outs, sealable combination service and meter testing cut-outs, service distribution cut-outs, refillable porcelain fuses, terminal protectors and non-magnetic wiring frames for meters. Descriptions were also given of seals, the most effective of which was stated to be of two designs, the all-porcelain seal with metal shackle and the metal seal and shackle with porcelain breakable button. In the all-porcelain design the seal is so constructed that the barbs of the metallic shackle when driven home engage the interior wall of the seal and cannot be withdrawn without breaking the wire or the porcelain seal itself. The metallic type of seal is essentially the same in principle as the porcelain seal. It is of metal having a breakable porcelain button through which the shackle is passed. This seal may be used indefinitely by installing new breakable buttons.

The discussion on this paper was very general. All agreed that it is a subject of very great interest to central-station men and is becoming more so; that as the public becomes more familiar with electricity it becomes necessary to devise some means of protection against tampering with the wires. It is thought by some difficult to enforce a set of rules, especially where there is competition, but all agreed that this is a very live question which has to be reckoned with. On account of the expense some of the members thought it hardly worth while to put protection on all wires, but only on suspected cases, and in this way cut down the leakage. Mr. Smith, in replying, cited the case of one city where he had been informed the loss had been reduced 50 per cent by the use of protectors. He thought it a wise thing to remove the temptation rather than catch customers taking energy and then prosecute them.

GENERAL ACCOUNTING.

An outline of scientific management as applied to the central-station industry was given in a paper by Mr. C. E. Bowden, which was presented by Mr. R. F. Pack, the author being absent. In scientific management every department of the business is brought under the careful scrutiny of men who are expert in their particular line of work. In this way the best methods and best practices suitable to the conditions of each company can be determined and adopted as found desirable. Thus the efficacy of the entire plant would be raised to the highest possible degree. The author discussed accounting under the heads of payroll accounting, store accounting and cost accounting. He claimed that central-station companies are now at a critical point in their history. They are confronted on one hand by an increase in the price of labor and of almost everything that enters into the cost of their product, and, on the other hand, by public sentiment which would certainly be hostile to any attempt to increase rates; indeed, one which is now demanding lower rates and attempting to enforce this demand by competition. The only remedy for this condition of affairs seems to be reforms from within, by the introduction of a scientific and systematic attempt to secure efficiency, and through efficiency the fullest possible results from every detail of operation of the business.

Mr. Pack read the report of the committee on uniform accounting immediately at the close of Mr. Bowden's paper.

In opening the discussion, the president referred to the great amount of work the committee had done in connection with the report and hoped that the members would take advantage of the information contained in it. It is very important to know not merely that there is an excess of revenue over expenses, but also just what is the cost of each factor in the total expenditure, in order to maintain a proper proportion between them, and comparison with other companies in this regard is very helpful. Some had thought, said Mr. R. F. Pack, that an elaborate system of accounting is a waste of money, but it is certainly a great risk to get along without a system by which a company can tell exactly where it stands. By having a proper check on the expenditure a company is able to rectify mistakes and curtail extravagance. Colonel Street remarked that Mr. Bowden should be commended very highly for his excellent paper, and thought that the smaller stations could adopt some such system, modifying it to their requirements. Mr. I. H. Wright said that it is of the utmost importance to keep track of the stores, and in this regard he thought the paper very valuable.

The convention then adjourned until the following morning at 9:30 o'clock.

Thursday, June 22, being "Coronation Day" and a general holiday in Canada, the convention was largely attended.

President Dion in opening the session called upon Mr. Wills Maclachlan, of the Trenton Electric & Water Company, to read his paper on "Some Notes on Central-Station Management."

MANAGEMENT OF CENTRAL STATIONS.

The keynote of a paper by Mr. Wills Maclachlan on "Management of Central Stations" was that the central-station manager should so conduct himself that he will be looked upon as a good citizen of the town, as well as a representative of a light company. The central-station manager owes it to the public and to his city to take an active interest in public questions. When he does so he may be looked upon with suspicion at first, but the result will be that his present critics will be his future admirers. For the electrical profession to come closely in touch with the public will serve in a great degree to nullify the present idea of the mystery of electricity. The author entered a plea that central-station managers and the electrical profession in general broaden out and give to the municipality and to the public the benefit of their services as broad-minded citizens. A great benefit will result to the public in general, and to the electrical profession in particular, when the members of that profession come to look upon it as their duty to take a broad-minded view of the work they owe to the community as a whole.

Mr. Marston, of Hamilton, thought $1,500 a year would not be too much to pay a good man to go around and talk to customers and in this way bring the company before the public in a favorable way. Exception was taken to the statement in the paper as to the meter reader inquiring about details of the service, as he usually had not time and it was sure to cause trouble unless the man had exceptional ability. Mr. Maclachlan explained that he referred more particularly to small towns.

The next item of business was the reading of the paper "The Relation of Public Utility Corporations with the Public," by Mr. G. B. McNabb.

THE CENTRAL STATION AND THE PUBLIC.

Mr. G. McNabb, in a paper entitled "The Relations of Public-Utility Corporations with the Public," said that the object of a public-utility corporation should be at all times to give the customer the most that can be obtained for his money consistent with good business judgment. He stated that a properly conducted complaint department can do a great deal toward making satisfied consumers. When a consumer makes a complaint he is entitled to have a thorough investigation made, and if matters are found wrong they should be followed up until they are made right. Too much attention cannot be paid to the so-called "crank." The fellow who kicks the hardest can by proper handling be made to boost just as hard. An endeavor should be made at all times to see that orders for service connections are promptly executed, because great annoyance is often caused to the consumer by delays in having the connections made. If the service is poor at the start he forms an initial bad impression of the company and it is difficult subsequently to obtain his friendship. The author called particular attention to discrimination among customers of the same class for like service, and expressed the opinion that the sooner public-utility corporations adopt a schedule of rates which is the same for everybody for the same class of service the better will be the results for all parties concerned. It is preferable for the rates to be so estimated that they may be understood by all customers. In this way can be overcome a great deal of prejudice which is caused by lack of knowledge of the central-station business.

Mr. McNabb had, said Colonel Street, covered the subject very thoroughly. The only other point he felt ought to have been dealt with was the telephone companies, as they were the source of more annoyance to the public than lighting companies. President Dion, in summing up the matter, said it was always to be borne in mind that "a soft answer turneth away wrath" and the public were always susceptible to courteous treatment.

Mr. John F. Gilchrist, the president of the National Electric Light Association, then addressed the meeting in a short, pithy speech in which he pointed out how necessary it was for the members of electrical associations to meet and discuss matters of moment which were continually coming up, especially as there were and could be no up-to-date handbooks on most of these subjects. He hoped that men in this line of business would get together often to discuss the latest developments so that conditions might be uniformly improved. At the conclusion of his address Mr. Gilchrist was heartily applauded.

A paper was then read by Mr. Parker H. Kemble, of the Toronto Electric Light Company, on "New Business." The paper created a great deal of interest.

NEW-BUSINESS GETTING.

In a paper on "New-Business Getting" Mr. Parker H. Kemble discussed new business under four classes, namely: Absolutely new business; new business where the service has been installed by a previous customer but has not been used for some time; succeeding business where as one tenant moves out the other moves in, and additional business on the premises of existing customers. He showed in what respect each of these classes affects the revenue of the company, and claimed that the rating of salesmen by the volume of business turned in is entirely wrong, since there should be some direction or supervision of the salesmen as to the character of the business solicited. He stated that the expenditure of money for securing profitable revenue can be made better and with more satisfactory results if judicious care is exercised in the selection and securing of new business, as compared with the expensive and unsatisfactory attempt to turn an unprofitable customer into a profitable one after the company has incurred a large expenditure and investment. The author claimed that although new business is the lifeblood of the progressive central station, yet a careful analysis of the cost of serving customers of different classes in any large company will show that many hundreds of customers among the smaller stations and many thousands among the larger are actually costing the company from 10 per cent to 30 per cent more per kw-hour delivered than the company receives from the customer. The author explained that his criticism of the new-business campaign related not so much to a desire to decrease the amount of new business as to a wish to call attention to the fact that paying results can be better secured by the concentration of effort along the lines of greatest profit.

In closing the discussion Mr. Kemble said he thought, as Mr. Marston had suggested, that the salesman should study such points as diversity factor and load curves as an aid to carrying on intelligently his work. The best method of paying a salesman he thought a difficult matter to determine, but perhaps a salary, with a bonus commensurate with his services at the end of the year, was a good plan.

METERS AND METER INSPECTION.

The report of the joint committees on meters and meter inspection was then taken up, outlining the work of the committee, and in this connection Mr. Lamb, from the government office, delivered an address on the Canadian system of government control of electric light and motor service, which was listened to with a great deal of interest.

At the close of the morning session Mr. Ralph Beeman of the National Electric Light Association, read his paper on "The Incandescent Lamp and Its Circuit."

INCANDESCENT LAMP FILAMENTS.

In a paper entitled "The Incandescent Lamp and Its Circuits" Mr. Ralph Beman described the features which characterize the filaments of various types of incandescent lamps. He mentioned the faulting of the tantalum filament when used with alternating current, and the microscopic size of filaments of tungsten and tantalum lamps. He stated that the diameter of a 25-watt tungsten lamp designed for operation at 110 volts is 0.0012 in., which is less than one-half the diameter of the average human hair.

A considerable portion of the paper was devoted to the variation in the temperature of the lamp when used with alternating current. Curves were given for showing the cyclic candle-power variations of a 25-watt tungsten filament when operated at 25 cycles, 30 cycles and 60 cycles. The candle-power varied from 90 per cent to 112 per cent at 60 cycles, from 84 per cent to 121 per cent at 30 cycles, and from 74 per cent to 131 per cent at 25 cycles. He stated that when the candle-power varies from 30 per cent above to 30 per cent below normal during a cycle, the life is reduced about 80 per cent of that obtained on direct current at the same effective voltage. When operated at 60 cycles the life is reduced by only about 4 per cent compared with what it would be with direct current.

At 1 o'clock p. m. the session adjourned to attend the association luncheon, with which all were delighted. Two interesting after-dinner speeches were given, one by Mr. A. Munro Grier, K. C., of Niagara Falls, on the "Coronation," and another by Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, after which the members dispersed to enjoy a trip to Chippewa sightseeing.

On Friday morning the association held its executive session for the election of officers, and the following were elected as officers for the ensuing year: Mr. A. A. Dion, president; Mr. R. F. Pack, first vice-president; Mr. W. L. Bird, second vice-president; Mr. T. S. Young, secretary-treasurer. The following were elected members of the managing committee: Messrs. W. C. Hawkins, A. L. Mudge, C. E. A. Carr, D. H. McDougall, F. A. Chisholm, L. V. Webber, W. Phillips, J. H. Larmouth, J. S. Norris, I. H. Wright, J. W. Purcell, R. H. Sperling, J. W. Crosby and R. B. McDonagh.

After the close of the executive session the regular session was called, and the president asked Mr. C. F. Scott, of the Westinghouse Electric & Manufacturing Company, to read his paper on "The Importance of Co-operation Between the Central Stations and the Electrical Manufacturers."

THE CENTRAL STATION AND MANUFACTURER.

The paper treats the subject of co-operation between the central station and the manufacturer of apparatus under the heads of engineering, commercial engineering and commercial. Under the first head it is advised that standard apparatus be purchased if it will meet the requirements, as such apparatus is the outcome of years of evolution in which the best thought of the designer, the best skill of the factory and the results of experience are combined. Conference with the manufacturer is recommended before decision as to a definite type or size of generating unit or other apparatus, thereby securing the advice of the manufacturer's engineering department, which is necessarily in touch with the standard changing conditions and with the operating requirements of other stations. While the wisdom of such conference is obvious, it is stated to be not uncommon for rigid specifications to be presented to manufacturers without provision for alternative propositions. As to commercial engineering, this in many cases consists in a definite adaptation of electrical appliances to bring commercial results. The knowledge of how to accomplish these results requires their careful investigation, and experience which is often beyond the scope of the individual central station, and is something which must be undertaken by the manufacturing company, as it must know what are the exact conditions in order that it may design its apparatus so as to meet them. The information and data which the progressive manufacturing company necessarily acquires in order to design its apparatus to meet requirements of actual service are the precise data which the central station needs in order to understand and effectively represent the situation to the power users whom it should serve. In commercial prosperity and success, as measured by the earning of dividends, the manufacturer and central station have much in common. The central station, in fairness to its patrons and for its own success, requires the best possible apparatus. The loss of direct revenue from a short interruption of service, not considering the loss of prestige and cost of repair, much more than compensates for the difference between the cost of inferior apparatus and the cost of the best. Not only should the best apparatus be bought, but it should command a fair price, and the manufacturer who makes the best should be supported and should be encouraged to make his apparatus still better. The manufacturing companies have expended millions of dollars in developing new and better apparatus, and the central station is reaping the benefit. Such work must go on, and it must be aided both by engineering corporations and by the commercial encouragement of the central-station interests. Upon the progressive policy of the central station in acting with the manufacturer of apparatus on the one hand and the public on the other depend the commercial prosperity of the manufacturer and the central station and the general welfare of the community, in which industries, transportation and daily life are becoming more dependent upon electric power.

A discussion of considerable length took place, which was opened by Mr. R. G. Black, who asked Mr. Scott what his idea was as to the use of coil-wound rotors as compared with squirrel-cage rotors. Mr. Beeman thought that the central station was often blamed where the manufacturer was really to blame by not taking sufficient care in the installation. Mr. Lamb, of the government office, thought the point brought out with reference to standardization was very important. In this country, said Mr. Lamb, standardization was being carried perhaps to excess, while in Europe it was the opposite, where they were too indiscriminate. He thought standardization if carried out would reduce the cost of manufactured articles. Mr. Kemble, Mr. Baker and other members continued the discussion. Mr. Scott in replying to Mr. Black's question as to rotors said it was a question that could not be answered yes or no, as each had advantages. In the matter of standardization, he thought in some cases it would be a great advantage, while in others it could not be applied, as things are in the progressive stage and improvements are continually being made.

The next paper taken up was on "Ornamental Street Lighting," by Mr. T. F. Kelly, of the Hamilton Electric Light & Power Company.

ORNAMENTAL STREET LIGHTING.

In a paper by Mr. T. F. Kelly information was given regarding ornamental street-lighting systems in Canada, with special reference to the system employed at Hamilton, Ont. Ornamental street-lighting systems are used in New Westminster, Vancouver, Victoria, St. Catharines, Ft. William and Ottawa. In the majority of cases the standards installed are equipped with five lamps, although in some cases there are only three, and in one case, at Ft. William, ornamental combined trolley and lighting standards are equipped with only four lamps.

The standards installed at Hamilton contain four side lamps operating pendent, with a center lamp placed upright. There are fifty-eight five-lamp standards along King and James Streets illuminating a total of 2262 ft., the standards being placed from 40 ft. to 45 ft. apart. Each standard is equipped with one 100-cp and four 75-cp tung-

[illegible] The circuits for the standards are run from a transformer in the center of each block. The circuits contain three wires and run down the transformer pole in conduit to the nearest standard and from there are distributed to the different standards in that particular block in conduit placed about 3 in. below the surface of the pavement near the curb. The three-wire arrangement is used in order to permit the top lamp to be used throughout the whole night with the others turned off at 11 o'clock.

The system is installed and maintained by the electric-supply company. The merchants and property owners benefited by the illumination pay for the service at the rate of 12.5 cents net per foot frontage per month. The author expressed the opinion that perhaps the most successful way for a central station to undertake to install such an equipment is to endeavor to induce the merchants and property owners to pay for the cost of installing the system and the city to pay for the maintenance. As a result of the installation of the ornamental lighting the merchants themselves will then begin to realize as they have never done before that lighting attracts trade, so that the system installed is a means of increasing revenue from interior and window lighting.

This paper was the occasion of considerable discussion, the members being interested in the cost of maintenance of the different systems mentioned and the questions of globes etc. It had been found by some of the members that good illumination on the streets caused the increase of window lighting and sign lighting.

The report of the committee on the standardization of line construction was then presented by Mr. Black. He said the committee had as yet no definite report to offer, but referred the members to the volume published by the National Electric Light Association on the subject as being worthy of study and consideration.

On resuming in the afternoon a paper was read by Mr. C. E. Allen, of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, on "The Importance of the Use of Potential Regulators on Distributing Systems."

POTENTIAL REGULATORS ON DISTRIBUTING SYSTEMS.

The paper described in detail an induction type of regulator which is claimed to possess a number of advantages over the step-by-step type of regulator. Referring to the speed of operation of regulators, it is stated that the most economical and satisfactory speed is approximately twenty seconds from maximum boost to maximum buck. It is, however, practically impossible to get a regulator that will take care of very rapid fluctuations such as occur within the correction of a second. With an induction regulator having a speed of twenty seconds, and using a specified adjustment on the primary and secondary coils, it is said that there are practically no conditions on the feeder within the capacity of the regulator that cannot be taken care of satisfactorily. The author states that the advantages of the regulator are such that no modern central station having more than one feeder can economically do without the feeder regulator. A calculation is given showing that the saving from the increased life of lamps due to good regulation more than justifies the investment in such an appliance.

Mr. C. F. Scott though that regulation on a circuit tended to give uniform voltage and in that way improved the quality of the service. It was interruption to the service which gave the central stations so much trouble and the customers annoyance, and he considered the apparatus very necessary. To a question by Mr. McDougall as to whether the noise had been eliminated, Mr. Allen replied that as far as the machine itself was concerned noise was reduced to a minimum.

The next paper was by Mr. Roderick J. Parke, of Toronto, entitled "Some Recent Developments in Electric Heating and Cooking Devices." This paper was pronounced interesting on account of the comparisons given between gas and electric cooking of meats, pastry, etc.

HEATING AND COOKING DEVICES.

After discussing the various methods applied in electric cooking, the paper gives data of a number of competitive cooking tests employing a gas oven, an ordinary electric oven and what is termed an automatic electric oven. In the latter the heating element forms part of removable, adjustable shelves, the element of each shelf being placed in circuit upon pushing the shelf against the back of the oven. The oven is mounted on a stand provided with a shelf carrying open-wire heaters, which may be used for broiling and frying. A bi-metallic thermostat is so installed as to be sensitive to changes of temperature within the oven and controls the cooking temperature. The automatic control is provided with two switches, one to cut off the main current and the other to set the control so that when the current is automatically cut off it will remain off, otherwise the control will operate automatically to restore the heating current whenever the temperature falls below a predetermined value, which can be fixed at any desired temperature. Following are the results given of some of the tests: In baking 2-lb. 6-oz. bread the cost was 1.47 for the gas oven, 5.25 cents for the ordinary electric oven and 1.85 cents for the new electric oven, the time of baking being respectively 50 minutes, 47 minutes and 47 minutes. Roasting 4 lb. beef, 2.45 cents, 5.6 cents and 2.1 cents, and 35 minutes, 40 minutes and 40 minutes respectively. Cooking 1 lb. potatoes and asparagus, 1.7 cents, 4.4 cents and 1.5 cents, the time for the electric ovens being 34 minutes and 33 minutes respectively. Cooking 12 oz. carrots, 1.4 cents, 3.5 cents and 1.25 cents, the times being 34 minutes, 33 minutes and 33 minutes. Baking sponge cake, 1.54 cents, 2.25 cents and 0.55 cent, the time in each case being 25 minutes. In each case the maximum demand was less for the new than the other electric oven in the ratio of 1200 to 1760. In a test for efficiency a quart of water in an open aluminum pan weighing 6 oz. was placed in the cold oven, the door then closed and the consumption of energy measured by a wattmeter. From the data thus obtained an efficiency of 79.31 per cent was calculated.

ADJOURNMENT.

A hearty vote of thanks was given to Mr. W. L. Adams, chairman of the entertainment committee, as he had contributed so much to the pleasure and success of the convention. A vote of thanks was also passed to Mr. Young, the secretary-treasurer, for his zeal and usefulness in bringing about what all admitted was one of the best meetings ever held by the association.

The convention then adjourned to meet next year at a time and place to be arranged by the managing committee.

In another part of the building interesting exhibits of electrical apparatus were displayed by the Pacific Electric Heating Company, E. A. Greene Company, of Toronto, and the Automatic Electric Cook Company, also of Toronto.

Michigan Association Convention Cruise.

The 1911 convention of the Michigan Electrical Association was held on board the splendid new steamship *Minnesota* June 19 to 22, while the vessel was en route on a cruise through Lake Michigan and adjacent waters, which included stops at Grand Haven, Mackinac Island and Sault Ste. Marie, Mich., Chicago and Milwaukee. Nearly 100 persons were on board the vessel, which was chartered for the convention. About half of those present were central-station men, the remainder being manufacturers' representatives.

The convention session was opened Tuesday morning by President J. A. Cavanaugh, of Benton Harbor, who in

his annual address discussed matters relating to public utility regulation in Michigan, the establishment of an association scholarship at the University of Michigan that central-station companies might enjoy the benefit of special research, the design of standard badges for the association, and the matter of co-operation between central stations operating in the State.

CENTRAL-STATION MANAGEMENT.

"The Central Station from a Consulting Engineer's Viewpoint" was the title of the first paper on the program, prepared by Mr. James R. Cravath, of Chicago, and read in the author's absence by Mr. O. H. Caldwell, of the *Electrical World*. Mr. Cravath's remarks were confined mainly to small central-station companies operating in communities of 15,000 population and less, and he pointed out that many of these smaller plants are still owned or controlled by men who have little knowledge of the electrical business and who are thus handicapped in the selection of proper technical management and operators. Many small central stations operated by practical men are to-day making indifferent successes, though the same plants might obtain excellent results if placed under the guidance of men of broad experience and knowledge. This, as Mr. Cravath illustrated, has been shown many times where syndicates or management firms have taken over properties and turned failures into successes, with the same local managers. The author also pointed out how serious mistakes in policy or equipment may be made where the judgment of men of limited training is relied upon. In closing his paper Mr. Cravath presented some interesting general statistics of small central-station facts and figures, showing average gross incomes, operating expenses, etc.

In discussing Mr. Cravath's paper Mr. W. F. Parker objected to what he felt to be an imputation conveyed by Mr. Cravath's paper that salesmen sometimes dispose of apparatus without conscientious regard of the purchaser's needs. He reminded the convention that many manufacturers carry large engineering organizations whose services are at the command of customers. Mr. H. C. Sterling, of Constantine, told of several instances, however, where extra cost of plants had been imposed in this way, and President Cavanaugh cited an example of where additional 133-cycle machinery was recently purchased and put into service only to have the entire installation discarded a few years later.

RELATIONS WITH CUSTOMERS.

"The Unwrittten Law of an Electric-Light Company" was the title of a paper presented by Mr. A. P. Biggs, of Detroit. The author pointed out that the greatest success of any central station demands pleasant relations with customers and the fulfilment of numerous conditions which, although not included in the contract form, make up an important part of the service obligation of the electric company. There should be a minimum of lost energy, Mr. Biggs observed, in the plant where one person is manager, electrician, accountant, sales force and everything else. On the other hand, he added, there is the probability of greatest waste of energy in companies of such size as to require separate departments for the carrying on of the work. Mr. Biggs advocated the preparation of a sales-department booklet explaining policy and rates, methods of securing business and various motor-application data, and also urged the keeping of complete and accurate records of all work done for any customer. Such records, Mr. Biggs added, should even include statements of such minor incidents as might affect the personal attitude of the customer toward the company. "Efficiency," he quoted, "is both attained and maintained by the help of written instructions, thus detecting and eliminating much that is arbitrary and saving from oblivion much that is of value."

President Cavanaugh spoke of the urgency of studying each customer's conditions. Oral contracts, he said, are the greatest source of trouble in dealing with customers, and he now finds it the best practice to include everything in the written agreement. In stating rules for handling customers Mr. F. B. Drees, of Lansing, gave the following hints: Never make promises which cannot be carried out. Treat all customers exactly alike. In case of a customer's question to an employee referring to matters outside of the latter's department, invite the customer to come to the office for an investigation. Mr. Drees also testified to the benefit and practical results of holding fifteen-minute to thirty-minute meetings daily between the department heads of the company. Mr. A. D. Furlong, of Pontiac, declared that in his own experience employees' meetings have worked wonders in fostering a spirit of co-operation, and he, too, advised that service be molded to fit customers.

STREET LIGHTING.

"Improved Street Lighting" was the title of a paper by Mr. R. M. Hemphill, Jr., of Ann Arbor, who described various systems of arc and incandescent street lighting, detailing his own experience with series-tungsten and magnetite-arc lamps. Approximately 200 of each of these lamps are installed on the 4-amp series circuits at Ann Arbor. The tungsten lamps, which give 65 cp, have shown lives of 5000 hours to 6000 hours, and the company receives $18 per lamp per year, which is the equivalent of 6 cents per kw-hour. Mr. Hemphill also illustrated and described his new concrete lighting poles, recently installed at Ann Arbor. After referring to the many well-known advantages of the magnetite-arc lamp, Mr. Hemphill pointed out some of the features which may be termed drawbacks of these illuminants. The lamps are heavier than the older types, requiring the strengthening of bracket arms. The temperature of the rectifier tubes must be kept closly uniform between 80 deg. Fahr. and 90 deg. Fahr., for below 70 deg. much breakage trouble may be expected. Certain sleeve contacts in the Ann Arbor lamps have been productive of short-circuits, causing outages and trouble, he said. Rectifier outfits, he also added, require more attention than the ordinary tube-type constant-current transformers. The cost of magnetite equipment yet remains excessive, said Mr. Hemphill, and he predicted that in time this will be lowered.

Mr. Frank R. Misterski, of Detroit, where 1640 magnetite lamps are in service, told of the extreme longevity of tubes there, which, guaranteed for 500 hours, have reached an average life of 2500 hours, while some tubes even went to 6000 hours before breaking down. Mr. Misterski spoke of the excellent distribution of light from these lamps and said that in the first year the magnetite installation had effected a saving of $14,000 for the city of Detroit. In answer to a question by Mr. W. F. Parker Mr. Klingman said that in the recent types of tungsten lamps the filament strength of the larger-current lamps is but little greater than that of the 4-amp sizes.

ELECTRIC COOKING.

The afternoon session was opened with a paper entitled "The Future of Electric Cooking," by Mr. J. A. Cross, heating specialist for the General Electric Company, Chicago. Mr. Cross referred to the Cleveland continuously connected 150-watt stove, described in the *Electrical World* of April 27. If electric cooking is to become a success, said the speaker, the education of the housewife must be effected for the economical use of electricity. In the order of their ease of introduction energy-consuming electrical devices were classified by Mr. Cross as follows: (1) High-temperature radiation types, requiring intermittent but instantaneous operation; (2) high-temperature apparatus where cleanliness, quickness and comfort are essentials; (3) low-temperature apparatus used for boiling and stewing purposes, replacing low-pressure steam. Mr. Cross also quoted examples of profits with electric toasters and electric-cooking appliances for hotel and restaurant use, and advocated bakers' use of ovens under off-peak conditions.

Mr. J. M. Sidney, of Benton Harbor, cited an income of $300 a month obtained from a single twenty-four-hour heating load on his company's lines, and Mr. H. C. Sterling, of Three Rivers, referred to his own experiments with thermostatically controlled fireless cookers. In the course of the discussion Mr. Cross inquired the opinion of central-station men present on a proposal to have electric companies purchase continuously connected cooking stoves of the Cleveland type at a cost of about $125 each, these stoves to be furnished to customers at a flat rate per month figured on the heater's twenty-four-hour consumption, which, being well known, would obviate the necessity of even a meter connection. The low demand of such a continuously connected unit, averaging 150 watts, would make unnecessary a special meter and 5-kw transformer, as is now necessary with electric ranges, making it possible for the central-station investment to be transferred from the line apparatus to the cooking equipment itself.

THE TUNGSTEN LAMP.

Mr. A. M. Klingman, of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, next read a paper on "The Tungsten Incandescent Lamp and Its Development," in which he traced the history of incandescent illuminants in general, bringing out several points of interest in connection with the manufacture of the newer tungsten lamps of the drawn-wire Mazda type. Tungsten wire, he said, has a tensile strength of from 400,000 lb. to 700,000 lb. per square inch—three to four times that of tantalum wire and four or five times that of mild steel. This wire can be bent into any form and mounted so as to withstand shocks. After the lamp has been burned this ductility is to some extent lost, although the strength still continues greater than that of the older pressed-filament tungsten lamp. Mr. Klingman also referred to the increasing use of the new high-efficiency metallic filaments for automobile and train lighting, country-home illumination, series street lighting, sign lighting, etc.

Mr. W. J. Trott, of Fostoria, Ohio, referred to the effects of introducing tungsten lamps on gasoline and gas competition. To increase the length of life of customers' lamps he sugggested the application of recording voltmeters at outlying points on the line, which would show variations in pressure of which no knowledge is ordinarily obtained, but which nevertheless affect the longevity of the lamps. Mr. J. H. Sielbey, of Benton Harbor, said that while the introduction of tungsten lamps had decreased the average customer's bill in Benton Harbor and St. Joseph, the number of customers had shown increases respectively of 21 per cent, 20⅔ per cent, 22½ per cent and 26 per cent for the years following the introduction of the cheaper illuminant—a rate of gain far exceeding any previous increase. Mr. H. A. Chase, of Hart, described the tungsten street lighting in his town.

TRANSFORMER AND TEST CONNECTIONS.

Mr. Howard Pett, of Big Rapids, read a paper on "The Grounding of Secondaries and Periodical Tests of Transformers," The speaker advised the effectual grounding of all secondaries, and described methods of securing good earth contacts by driving galvanized-iron pipes and by burying copper plates and junk copper cable strands under charcoal. In Big Rapids Mr. Pett cited a case where trouble was experienced with static charges on the arc circuits, in which a flexible cable was attached to a plug, the ground wire in the station being arranged with the coupling so that the arc circuits can be grounded through the plug switches whenever work is being done on the line. The author also described the practice of the Grand Rapids-Muskegon company in fusing its transformers on the primary side, inspection of transformer apparatus, oil, etc. In the discussion Mr. R. W. Hemphill, of Ann Arbor, stated his own practice of grounding all secondaries, and President Cavanaugh referred to a case of destruction of meters installed so as to supply a wireless-telegraph outfit.

Mr. L. B. Andrus, of South Bend, Ind., had prepared a paper on the changing of 2300-volt, two-phase, four-wire distribution systems to three-phase, four-wire systems, which was read at the opening of the evening session by Mr. A. P. Biggs in the author's absence. Mr. Andrus' paper was a practical discussion of the advantages of the two systems above mentioned, describing with the aid of diagrams how a conversion of this character was made under emergency conditions, using standard apparatus.

ACCOUNTING.

Mr. John H. Sielbey, of Benton Harbor, next presented a paper on accounting for electric companies in which he referred to the various systems of records, the loose-leaf card system, voucher system, etc., and the single and double-entry systems of accounting. A uniform system of records and accounting was advocated for electric companies, to which end the author suggested convening of the acountants of the principal companies of the State for the preparation of a uniform schedule, to have the approval of the Michigan Railroad Commission. Mr. Sielbey defined the work of an auditor, and described this official's regular monthly, quarterly, semi-annual and annual reports. For accounting work the author advised the selection of men of high qualifications for this work, and advocated efficient assistants and well-equipped offices for the bookkeeping staff.

Following Mr. Sielbey's paper the report of the committee on accounting was presented by its members, Messrs. F. B. Spencer, H. A. Fee and T. L. Hinks. The system adopted by the committee is that used by the Detroit Edison company and closely follows those approved by the Wisconsin Railroad Commission and the National Electric Light Asssociation. Income is divided under the general heads of operating revenue and non-operating revenue, the former including commercial and municipal electric earnings, re-sale earnings and miscellaneous earnings, and the latter including profit on merchandise and wiring and miscellaneous revenue. Operating expenses are divided under production, which includes operation, fuel, station supplies and maintenance; purchased power; transmission and transformation, including operation and maintenance; storage batteries; distribution; utilization; commercial, general and annual charges. Under the latter headings insurance, taxes and depreciation are stated as general operating expenses, while under the heading of annual charges are included interest on funded debts and contractual sinking-fund requirements.

ELECTRIC BAKING AND COOKING.

The session of Wednesday afternoon was opened by a paper by Mr. Sebring Phelps, of the Electric Fireless Cookstove Company, Buchanan, Mich., on "Heat Conservation as Applied to Electric Cooking and Baking," which was read in the author's absence. Mr. Phelps' paper cited several experiments tending to show that an intense heat is not required so much as a direct heat. He described the cooking of a 6-lb. roast by the expenditure of 500 watt-hours, with a maximum demand of 660 watts, and also the baking of bread at an expense practically the same as that of gas or other flame stoves, comparing $1 gas, 16-cent gasoline, $4 coal and $3 wood with electricity at 6 cents to 15 cents per kw-hour. In the method advocated by Mr. Phelps the electrical demand may continue for only one hour or less, in the case of the roast, although two hours or more will be required to cook the meat thoroughly. This extended cooking action goes on with the aid of the stored heat conserved by the soapstones or secondary heating elements in the thermally insulated fireless cookstoves. The author also cited instances of difficulties in getting electric stoves to operate properly due to insufficient capacity of the customers' meter and transformer apparatus. In closing Mr. Phelps urged that central-station men seek to understand the conditions for successful electrical heating

just as the conditions for successful lighting and motor service are already known. With widely distributed expert knowledge in the electric-heating field, Mr. Phelps insisted that this branch could be made of equal importance with other services now rendered by central-station service.

"Governmental Control of Electric Light and Power Companies in Michigan," a paper by Mr. H. S. Gray, of Benton Harbor, and read by Mr. J. B. Sielbey, enumerated various State acts relating to electric-light companies, especially in connection with street and interurban railways.

ELECTRIC PUMPING.

In his paper on electrically operated municipal pumping Mr. F. B. Spencer, of Cheboygan, pointed out the desirability of the off-peak load afforded by motor-driven water supply and cited the efficiencies of various forms of pumps. While the cost of pumping, said Mr. Spencer, naturally varies with the conditions under which the work is done, in general the consumption ranges from 700 watt-hours to 1220 watt-hours per 1000 gal. pumped. The installation of such electrical municipal pumping has often resulted in decreasing both fuel and labor costs to a surprising degree. Mr. R. B. Champion, of Holland, referred to the desirable annual load-factor of his pumping plant, which, although operated seventeen to eighteen hours a day in summer, requires less during the winter time. Using a 150-hp motor-driven pump, raising water 150 ft., the results at Holland show an expenditure of 860 watts per 1000 gal. Mr. F. Bissell, of Toledo, inquired about the competition offered by producer-gas-engine plants for pumping duty, in reply to which Mr. F. B. Spencer pointed out the heavy depreciation and investment costs of gas-producer apparatus.

THE SMALL STATION'S PROBLEMS.

Mr. George D. Slaymaker, of Rochester, had prepared a paper on "The Promotion of Business in Small Towns," which was read by Mr. E. Coe. Rochester, a town of 2000 inhabitants, composed largely of retired farmers and small merchants, with only a few industries, has been made the subject of a boom entered into with the aid of the Board of Commerce for the purpose of attracting new industries. As a result it now appears that the business undertakings of the town are to be largely augmented by new enterprises. A novel means of electrical solicitation, the encouragement of co-operation and enthusiasm among electrical employees, and the application of modern methods to securing new business have resulted in equipping almost every house and store in Rochester with electricity for light and small power appliances.

In the discussion President Cavanaugh cited a case where a solicitor hitherto unsuccessful was placed in a small community where he proved to be temperamentally exactly the right man, and in sixty days had doubled the electric-lighting business of the community.

ELECTION OF OFFICERS.

At the executive session of Thursday morning the matter of forming a local section of the National Electric Light Association was discussed by the Michigan men, and the proposal was referred to the newly elected executive committee with power to act in effecting such an amalgamation.

Officers of the Michigan Electric Association for the ensuing year were then elected as follows: President, Mr. R. M. Hemphill, Ann Arbor; vice-president, Mr. James DeYoung, Owosso; secretary-treasurer, Mr. Herbert Silvester, 18 Washington Boulevard, Detroit. The members of the new executive committee are Messrs. John A. Cavanaugh, Ora S. Wood, Howard Fee, F. B. Spencer and H. C. Sterling.

Mr. R. M. Hemphill, Jr., the newly elected president of the Michigan Electric Association, is manager of the Washtenaw Division of the Eastern Michigan Edison Company, with headquarters at Ann Arbor, Mich. Mr. Hemphill is a graduate of the Michigan Agricultural College, and was for some time engaged in executive work in Chicago with the street-railway interests of that city. In 1898 he served as construction superintendent of the Detroit, Jackson & Chicago Electric Railway. Entering the electric light and power business in 1900, Mr. Hemphill organized the Washtenaw Electric Company, of Ypsilanti, utilizing several water-powers in the Huron Valley near that city. Later the Ann Arbor Electric Company was acquired by Mr. Hemphill's company, following which the Eastern Michigan Edison Company, of which Mr. Alex. Dow is president, was organized, including a number of power companies in eastern Michigan. With this amalgamation the Washtenaw company became the Washtenaw Division of the Eastern Michigan Edison Company, and Mr. Hemphill continues as division manager for the local interests.

ENTERTAINMENT.

As an outing the convention cruise of the Michigan association proved delightful. The trip was marked by good weather throughout, and the changing variety of shore and water, bright skies, distant mirages, sunsets, starlit nights, the aurora borealis, etc., surpassed any artificial convention entertainment that might have delighted a meeting ashore.

The *Minnesota* reached Sault Ste. Marie early Wednesday morning and the forepart of the day was given over to visiting the government locks, the rapids and water-power plants of the Edison Sault Electric Company and the Michigan & Lake Superior Power Company. Leaving the "Soo" at noon, the vessel proceeded down St. Mary's River and to Mackinac Island, where a three-hour stop was made at sundown, giving the party time for an inspection of the natural beauties in which the island abounds. The dozen or more ladies accompanying their husbands to the convention were driven around Mackinac and the Sault in carriages. During the days aboard ship an orchestra and quartet furnished several musical programs daily, a number of manufacturers displayed exhibits, and the trip was enlivened by pools on the vessel's run, games and other shipboard diversions.

Turin International Electrical Congress.

A preliminary program of the Turin Electrical Congress, to be held Sept. 10-17, has been issued, containing a list of thirty-one subjects to be discussed, accompanied by the names of those who will present papers opening the discussions. Following are the subjects assigned to and accepted by American engineers:

"Selection of Transmission and Distribution Pressures and the Design of Switchboards and Substations for Large Central-Station Systems," by Mr. Philip Torchio, New York Edison Company; "Abnormal Rises of Voltage; Their Prevention and Means of Protection Against Their Effects," by Mr. G. Facciole, General Electric Company, Pittsfield, Mass.; "High-Tension, Direct-Current vs. Single-Phase Traction for Suburban Lines," by Mr. Frank T. Sprague; "Electric Meters with Relation to Different Kinds of Load," by Dr. C. H. Sharp, Electrical Testing Laboratories, New York; "Long-Distance Wire Telephony," by Mr. F. B. Jewett, American Telephone & Telegraph Company, New York. Among other names on the program of discussions are Prof. S. P. Thompson, Dr. Behn-Eschenberg, Prof. Dr. Wedding and Dr. V. Poulsen.

A preliminary list of papers to be presented has also been published. These number twenty-two, the American authors being Drs. Steinmetz and Kennelly and Messrs C. O. Mailloux and T. C. Martin, New York, and S. Q. Hayes, Pittsburgh. Other authors are MM. Boucherot and Montpellier, Paris; Prof. Arno, Milan; Dr. Asano, Tokyo; Dr. Etienne de Fodor, Budapest, and Mr. Leon Gaster, London.

It is announced that the opening session of the Interna-

tional Electrotechnical Commission will be held in Turin on the afternoon of Thursday, Sept. [illegible]. The organizers of the congress have arranged for special hotel rates for attendants. A list of the hotels has been printed, with rates, which range from $2.20 to 80 cents for single bedrooms.

Annual Convention of Brooklyn N. E. L. A. Section.

The third annual convention of the Brooklyn Company Section of the N. E. L. A. was held on the afternoon and evening of June 21 at the Oriental Hotel, Manhattan Beach. Over 600 members of the local association and representatives from New York, Philadelphia, Newark and several other sections of the national organization were present.

After an opening address by the chairman, Mr. E. A. Bailey, and the transaction of official business, a paper entitled "Municipal Lighting," by Mr. J. J. Leddy, of the Brooklyn company, was read and discussed. A paper entitled "Some Reasons for Difference in Price for Different Services," by Mr. Norman T. Wilcox, which was presented at the recent N. E. L. A. convention, was then read by Mr. M. S. Seelman, Jr., and followed by the "Report of Committee on Electrical Apparatus," by Mr. G. L. Knight. Mr. P. M. Safford read a paper on "Tracing Storeroom Material," by Mr. J. T. Brady, also a national convention paper.

At the banquet which followed the presentation of papers Dr. Charles P. Steinmetz gave an interesting address, reviewing the development of the generating systems and stations of the present day and closing with practical suggestions to central-station men relating to their participation in the further development of the industry and to their personal advancement.

Mr. W. W. Freeman, vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, made, as usual, an excellent address, in which he explained in detail many of the essentials of the public welfare report read at the recent convention, showing that the plan is one of mutual advantage to employer and employed, and outlining the moral obligation of both parties concerned.

The silver cup presented by the Westinghouse Electric & Manufacturing Company for competition at the national convention and won by the Brooklyn baseball club in a game with the club of the Philadelphia Electric Company was awarded to the local team by Mr. Freeman, who also presented to each member of the team a gold watch, the prize of the N. E. L. A.

Officers for the ensuing year were then elected as follows: Mr. M. J. Shugrue, chairman, succeeding Mr. E. A. Bailey; Mr. C. W. Hafstrom, vice-chairman, succeeding Mr. F. J. McCormack, and Mr. W. C. Pike, Jr., secretary, succeeding Mr. C. E. White.

Illinois Waterway and Water-Power Bill Fails to Pass.

After a turbulent session the lower house of the Indiana Legislature took a vote on June 23 on the Johnson deep-waterway bill, which had previously passed the State Senate, as related in the *Electrical World* of June 22, page 1593. The vote was seventy-five in favor of the bill and fifty-two against it, but as the measure did not receive the constitutional majority of all the representatives elected, which would require seventy-seven votes, it failed to pass.

Governor Deneen, who is an ardent supporter of the bill, which is intended to develop the water-power possibilities of the Illinois River between Lockport and Utica as much as to create a deep waterway, held a long conference with his lieutenants after the action of the House, but at this writing it is not known what the next step will be. The defeat of the bill in the House is attributed largely to the determined opposition of Speaker Adkins.

Congressman McKinley, head of the Illinois Traction System, which, through a subsidiary company has a water-power development on the Illinois River at Marseilles, Ill., denies that he or his company is fighting the water-power policy of the Governor. He says that he is just as willing to lease water-power rights from the State as from private interests.

Massachusetts Legislative News.

Governor Foss has sent a special message to the Legislature pointing out that the cost of light, heat and power at the State House is excessive. He calls attention to the fact that the Edison Electric Illuminating Company of Boston has offered to take over the complete operation of the State House service for $38,000 per year, representing a reduction at the outset of $12,000 per year below the cost of State operation. The Governor emphasizes the importance of immediately cutting down expenses or else accepting the Edison company's offer, which includes a proposition to share with the State the cost of an investigation of detailed character to determine further posssible economies. A message has been sent in by the Governor again recommending the consolidation of the various public-utility boards into a single commission. The message is based upon a report submitted to the Governor by Mr. C. H. Scovell, a public accountant, upon the policies and administrative work of the Railroad, Gas and Electric Light, Highway and Boston Transit Commissions. Although the report shows that the practices of the different boards are dissimilar, it furnishes no facts indicating that the cost of regulation by separate tribunals would be decreased to any material extent by consolidation, and there is a general feeling that a total cost of $128,887 per year for the regulative duties of the Railroad, Gas and Electric Light, and Highway boards is reasonable in comparison with a total cost in New York of $669,000 per year. There is no expectation that any change in the commission system will be made at the present session.

New York Commission News.

The Public Service Commission, Second District, has closed on its records the pending complaints covering the failure of the Chasm Power Company to light efficiently the streets of the village of Chateaugay and place its street lighting and distributing system in a safe condition. Following an investigation by the commission the company was required to make certain improvements and repairs. As the result of an investigation recently made by an inspector of the commission, he reports that these recommendations have been complied with.

The commission has authorized the Buffalo General Electric Company to issue $150,000 of its thirty-year 5 per cent gold bonds. On Feb. 21, 1911, the commission authorized that company to issue $420,000 of its bonds for the purpose of securing certain property at the corner of Washington and Huron Streets, in the city of Buffalo, and the construction thereon of a building for the uses of the company. This amount of bonds was found to be insufficient and the company applied for authority to issue the additional amount granted at this time. These bonds are to be sold at not less than 95.

Wisconsin Commission News.

The Milwaukee Gas Light Company has filed a schedule of new rates with the commission, to take effect on July 1. The new schedule, which amounts to a reduction of 5 cents in the several rate schedules now in force, is as follows: For 10,000 cu. ft. per month, 75 cents per 1,000 cu. ft. net; next 10,000 cu. ft. per month, 65 cents per 1000 cu. ft. net;

next 80,000 cu. ft. per month, 55 cents per 1000 cu. ft.; all over 100,000 cu. ft., 50 cents per 1000 cu. ft. net. The minimum bill is to be 25 cents per month. This reduction means an apparent decrease in revenues of the company of nearly $15,000 per month. The total number of gas consumers taking service from the Milwaukee Gas Light Company is 35,000. At attempt was made to pass a bill through the Legislature requiring a general reduction of the Milwaukee Gas Company's rates from 80 cents to 60 cents. This attempt failed, not because the Legislature did not consider a reduction justifiable and warranted, but because the bill, if it passed, would usurp the prerogatives of the Public Service Commission.

Maryland Commission News.

The Public Service Commission has dismissed a complaint against the Chesapeake & Potomac Telephone Company alleging that a charge of 10 cents was made for a local call from the Hotel Kernan. The company showed that the hotel management is charged only 3 cents for a call and the additional money is kept by it. The hotel maintains a private switchboard. The commission held that the company is not responsible for such charges.

More dead wires of the Maryland Telephone Company in Baltimore City will have to come down by order of the commission. Chief Engineer Phelps has reported to the commission that the electrocution of a man in East Baltimore was due to his coming in contact with a dead wire of the Maryland Telephone Company, which was crossed by a live electric wire. The commission will order the company to clean up its dead wires at once. Last year a similar order was passed requiring the company to remove many tons of wire not in use.

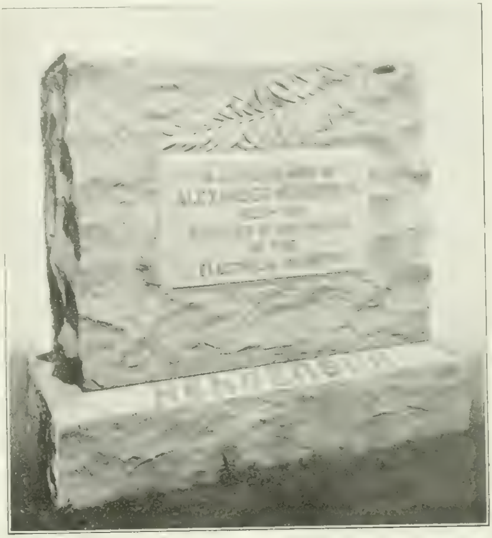
The commission has decided to permit the Chesapeake & Potomac Telephone Company to buy the Western Maryland Telephone Company, which has its headquarters in Cumberland. The opinion was written by Chairman Ambler, and in reply to the argument of the independent companies, to the effect that the sale will break up the independent system, he says that it is a fact that the independent companies do sell out to the larger concerns when they have an opportunity. The Western Maryland Company has a practical monopoly of the local business in Cumberland and Allegany counties. It is, however, said to be bottled up by the C. & P. as far as outside business is concerned. The permission for the deal is made subject to the approval of the Mayor and City Council of Cumberland.

Alexander Henderson Memorial.

A memorial to the late Alexander Henderson will be dedicated Sunday, July 16, at Southampton, L. I., in the form of a monument over his last resting place. This tribute has been erected by his many friends in the electrical field, the subscriptions for the purpose amounting to $1,600.

Mr. Henderson, who died on Aug. 11, 1910, at his country place in New Hampshire, was born in Scotland in 1859 and first became identified with electrical engineering in 1882, when he entered the employ of the Weston Electric Light Company, of New York. Subsequently he became associated with the Brush Electric Illuminating Company, and was with it for about seven years. In 1890 he became chief inspector for the Manhattan Electric Light Company and in 1895 was appointed chief inspector of the Bureau of Fire Alarm Telegraph and Electrical Appliances of the New York Fire Department. In 1898 Mr. Henderson became connected with the Sprague Electric Company and continued with it until 1905, when he associated himself with the American Circular Loom Company, with which concern he was at the time of his death.

The date set for the dedication has been arranged to permit the attendance of those members of the National Electrical Contractors' Association and others who will pass through New York on their way to the convention at Niagara Falls during the week of July 18. Mr. Henderson



Monument to Alexander Henderson.

was for years the master of transportation of this association. Trains will leave the Pennslyvania Station, Long Island Section, at 10:32 a. m., July 16, and return at 4:12 p. m., arriving in New York at 6:51 p. m. It is expected that a large number of former associates and friends will make this journey. Few men have enjoyed warmer friendships and possessed in a higher degree the human qualities that render the world better than Alexander Henderson, royal good fellow in the best sense of the term.

CURRENT NEWS AND NOTES.

Furnace Economy.—The United States Bureau of Mines has just issued a bulletin describing the apparatus and methods in use by the bureau for the sampling and analysis of furnace gases. The authors, Messrs. J. C. W. Frazer and E. J. Hoffman, say in their preface that "the furnace conditions prevailing both in small plants and in large industrial establishments in this country are frequently far from satisfactory. If such conditions are to be improved, they must be more thoroughly understood, and means must be found to insure complete combustion of the fuel and yet to permit operation with such an excess of air as will result in the greatest efficiency. In this work the services of the chemist are indispensable. A very important problem is the determination of the small percentage of unburned combustible matter that escapes from the furnace in the flue gases. Under ordinary circumstances so little as 0.1 per cent of unburned combustible matter in a furnace gas is equivalent to about 1 per cent of the fuel used, and for the determination of such small percentages of gas more accurate and refined methods are required than have ordinarily been available before."

Colorado Electric Club.—The flourishing Colorado Electric Club, of Denver, has issued a new membership list showing a total membership of about 350. The club meets every Thursday noon at the Albany Hotel. Mr. W. P. Carstarphen, Jr., is president.

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Conservation of Niagara Falls.—The United States Senate has passed the Burton resolution to extend for two years the restrictions now in force upon the use of the water of Niagara River and Niagara Falls for power purposes. The measure now goes to the House.

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Indiana Electric Light Association.—The annual convention of the Indiana Electric Light Association will be held in South Bend, Ind., on Aug. 23 and 24, 1911. The detailed program has not been announced as yet. Mr. J. V. Zartman, 120 South Meridian Street, Indianapolis, is secretary of the association.

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Philadelphia I. E. S. Section.—At the annual meeting of the Philadelphia Section of the Illuminating Engineering Society held on Friday, June 16, the following officers were elected for the ensuing year: Chairman, Mr. Joseph D. Israel, Philadelphia Electric Company; secretary, Mr. L. B. Eichengreen, United Gas Improvement Company; directors: Mr. C. W. Wardell, Welsbach Company, and Prof. A. J. Rowland, Drexel Institute.

* * *

Los Angeles Has One Telephone to Every Four Inhabitants.—In a recent address in Los Angeles, Mr. K. B. Miller, who was retained as an expert by the Board of Public Utilities in fixing telephone rates, said that Los Angeles, with its two telephone companies, has over 80,000 telephones, or one to every four inhabitants. There are 750,000 daily calls, or two for every man, woman and child in the city. Los Angeles is better "telephoned" than any city of its size in the country.

* * *

Extensions from Peoria.—Within a few days the 12-mile transmission line now being built by the Peoria Gas & Electric Company to Washington, Ill., will be in operation. The local electric-service plant at Washington has been taken over by the Peoria company and will be operated from the latter city. The property of the Citizens' Gas & Electric Company, Pekin, Ill., near Peoria, has also been acquired by the Peoria Gas & Electric Company, and will be similarly operated by electrical energy transmitted from the larger city within a few months.

* * *

City of Chicago Has Power to Compel Electrification.—The Corporation Counsel of Chicago has given a formal opinion, at the request of the local transportation committee of the City Council, to the effect that the city has power to compel the electrification of the steam railroads within its borders. Under the police powers delegated to the city by the State, the use of smoke-emitting locomotives may be abolished as a nuisance affecting the health, comfort and convenience of the public. However, the allowance of time to make the change should be commensurate with the magnitude of the task.

* * *

Mysterious Manhole Explosions.—Six recent explosion in the manholes of the Commonwealth Edison Company, Chicago, within a period of six weeks have given rise to much conjecture. These explosions, occurring in various parts of the city, are not due to ordinary causes, as traces of fuses and explosives seem to indicate conclusively that they are the result of bombs placed in the manholes with intent to damage the property of the company. The identity of the perpetrators of these explosions is unknown, but the daily newspapers print rumors that the bombs were placed by labor agitators bent on stirring up strife with the company. The Commonwealth Edison company runs an "open shop," but, as far as known, has no serious trouble with union labor at the present time.

* * *

Electrical Extensions in the Extreme Southwest.—The San Diego Consolidated Gas & Electric Company of San Diego, Cal., has begun the work of extending its transmission wires to El Cajon and Lakeside. The poles for this line will be distributed from La Mesa Springs which is the farthest point east now reached by the company. It is said that many of the ranchers in San Diego County are considering the advisability of installing electric motors in place of gasoline engines to operate their pumping plants.

* * *

Central Stations and Contractors.—In an address before the annual meeting of the Indiana Electric Contractors' Association, held at Indianapolis June 15, Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, advised very strongly that lighting companies and electric contractors should keep within their own lines of business, while co-operating with each other for business success. He deplored the fact that there is a tendency on the part of lighting companies in some places to sell material and to do wiring. This should be stopped, he said, as it was the business of the electrical contractor to sell material and wire the buildings, and the lighting company should confine itself to making and selling electricity.

* * *

Complementary Operation of Telephone and Telegraph.—On an average, about 2700 telegrams are handled on every working day through the telephone department of the Western Union Telegraph Company in Chicago. This includes both incoming and outgoing messages, although the number of messages delivered from the main telegraph office by telephone largely exceeds those received in the same manner. A four-position telephone switchboard is installed in this department. There are also operating desks for twenty operators who send or receive telegraph messages by telephone. In addition, a desk for ten additional operators of this description is to be added. The receipt and delivery of telegrams by telephone appears to be adding to the popularity of the telegraph service, although it is said to cost slightly more than delivery by messenger. Messenger service is retained for the central business district and is also used, of course, where the addressee has no telephone. Care is taken also not to transmit over the telephone telegrams which, from their nature, appear to be confidential.

* * *

American Institute of Chemical Engineers.—The third semi-annual meeting of the American Institute of Chemical Engineers was held at the Congress Hotel, Chicago, on June 21 to 24, with an attendance of about fifty. Several papers relating to chemical engineering were discussed, and there were a number of excursions to points of interest, as well as a subscription dinner on the evening of Thursday, June 22. A feature of the meeting was the presentation of the Institute gold medal to Mr. F. J. Wood, of Brooklyn, for his investigation of the multiple-effect distillation of glycerine. Dr. Samuel P. Sadtler, of Philadelphia, presented the report of the committee on "Chemical Engineering Education." Prof. Joseph W. Richards, of Lehigh University, read a paper on "Industrial Chemical Calculations." Mr. W. M. Grosvenor, of New York, spoke of "The Institute and the United States Patent System," and Mr. S. F. Peckham, of Brooklyn, discussed "The Practical Value of Calorific Tests on Anthracite Coal." The other papers presented were strictly of chemical interest. Mr. F. W. Frerichs, of St. Louis, is president of the American Institute of Chemical Engineers, and Prof. John C. Olsen, of the Polytechnic Institute, of Brooklyn, is secretary.

STEAM AUXILIARY TO HYDROELECTRIC INSTALLATION.

An Outline Description of the Southern Power Company's Steam Stations.

By J. W. Fraser.

IN the issue of the *Electrical World* dated March 24, 1910, the present author gave a summary of the hydroelectric generating stations, substations and transmission lines of the Southern Power Company in the Carolinas, together with a description of the 100,000-volt equipment which had then been in service for a short time. About a year ago the company determined to add 24,000 kw in steam apparatus to its existing generating equipment of 75,000 kw in hydroelectric apparatus. The steam-generating plants were intended to be used as auxiliaries to reinforce the hydroelectric stations at periods of low water and for emergency use in case of interruptions to service on the hydroelectric systems. It was considered advisable to divide the 24,000 kw of steam equipment into three units and locate plants at three large distributing points on the transmission system in order to save the line loss and insure continuity of service.

The station at Greenville has recently been put in service and the equipment is now being installed in a station at Greensboro. Construction work has not yet been started on the third station.

As the plants were intended to operate for only from two to four months out of the twelve months, it was important to keep the first cost low. For this reason no economizers, automatic stoker or coal-handling apparatus was provided. However, arrangement has been made so that they can be installed if at any time in the future the plants have to be operated continuously for twenty-four hours per day.

The description given below is based primarily on the Greenville station, although it is applicable almost in entirety to the Greensboro station, the differences being as noted later.

BUILDING.

The boiler-room is 196 ft. long by 49 ft. wide by 43 ft. high. The turbine-room is 90 ft. long by 38 ft. wide by 35 ft. high, with basement 17 ft. 2 in. A concrete foundation extends to the level of the turbine-room floor, where the steel columns which support the crane and roof trusses are carried. The steel columns are incased in brick pilasters which tie in the ends of the 9-in. curtain walls. The brick used is cast of concrete and is known as "unit brick." This brick has been used largely in the building of transformer substations and has proved very satisfactory. The roof trusses are spaced the same distance apart as the pilasters—that is, 15 ft.—and the 3-in. splined sheathing is supported by 8-in. channel purlins spaced 6.5 ft. on turbine-room and 8 ft. on the boiler-room. The waterproofing of the roof is of built-up tarred paper with gravel.

The floor of the turbine-room has been extended only a few feet beyond the turbine in order that the pumps and heater may be accessible to the crane. Part of the floor is removable so that the crane can be used for unloading cars in the basement.

THE EQUIPMENT OF THE GREENVILLE STATION.

One 8000-kva, 60-cycle, 2200-volt, three-phase turbo-generator set.

One Westinghouse-Leblanc jet condenser for the turbine directly connected to non-condensing steam turbine.

One Westinghouse air pump directly connected to a 20-hp motor for service when the generator will be used as a synchronous condenser.

One steam-turbine-driven exciter set, 100-kw, 250-volt generator directly connected to one non-condensing steam turbine mounted upon a common bedplate operating at 240 r.p.m.

One motor-generator exciter set, 100-kw, 250-volt, compound-wound generator directly connected to one 150-hp, three-phase, 2200-volt motor, mounted upon a common bedplate.

One switchboard on which are mounted the necessary indicating and recording meters and control switches for operating the oil circuit-breakers.

Fig. 1—General View of Greenville Station.

Two 17-in. x 12-in. x 15-in. duplex outside center-packed plunger boiler-feed pumps, completely brass-fitted, with Tobin-bronze piston rods and solid-brass water plungers; output rating, 670 gal. per minute against a water pressure of 175 lb.

Two 10-in. x 14-in. x 10-in. plunger and ring low-service pumps, completely brass-fitted; output rating, 570 gal. per minute against a pressure of 75 lb. These pumps are for raising the water from the hot well to the heater.

One Cochrane feed-water heater.

One 400-gal. centrifugal tank pump.

One 10-in. centrifugal cold-well pump. This is a vertical pump placed in the bottom of the cold well and is connected

to a vertical motor on the floor of the turbine-room basement for elevating the water from the cold well to the intake tunnel.

Two sump pumps.

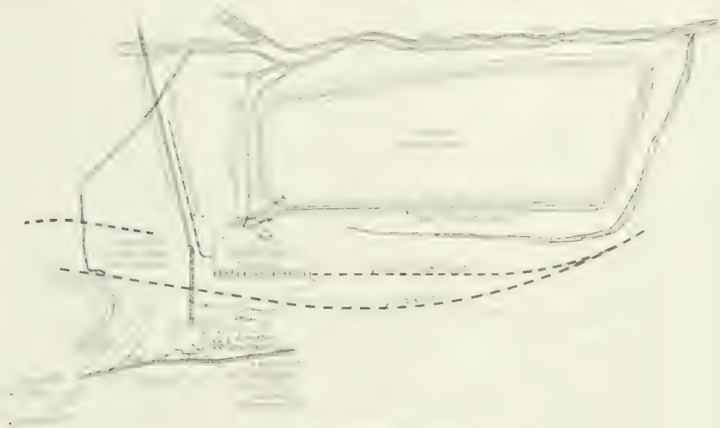


Fig. 2—Map Showing Location.

Six 750-hp Erie City vertical water-tube boilers.

Six Foster superheaters.

One 230-ft. radial brick stack, 14 ft. inside diameter, lined 70 ft. high.

One 30,000-gal. service tank.

One 14,000,000-gal. reservoir.

BOILERS.

The boilers used are of the two-drum vertical type. The lower drum is connected with the upper drum by 432 3-in. seamless tubes in twelve rows of thirty-six each. The furnaces are of the Dutch-oven type with long throats and have 132 sq. ft. of grate surface. The heating surface o the boilers is 6021 sq. ft.

The guaranteed evaporation is 10.5 lb. of water from an at 212 deg. Fahr. when operating at 750 hp, and 10 lb. o water at 1125 hp, per poun of coal containing not les than 14,250 thermal units an not more than 7.5 per cent asl

Three batteries of two boil ers have been installed an space has been provided for fourth battery when foun necessary.

SUPERHEATERS.

The elements of the supe heaters are made of seamles cold drawn sheet tubing fitte with annular cast-iron gri flanges close to each othe They are placed in front o vertical tubes of boilers an are accessible from doors i front of the boiler settin Each superheater will increas the temperature of 22,500 ll of steam per hour at a pre sure of 160 lb. per squa inch by 100 deg. Fahr. when the steam contains not mo than 1 per cent entrained moisture.

CONDENSING WATER.

The condenser requires 6,000,000 lb. of cooling water p hour to produce a vacuum of 28 in. when the temperatu of the injection water is 80 deg. Fahr. Under these co ditions the temperature of the discharge water from th condenser is guaranteed to be within 4 deg. Fahr. of th temperature corresponding to the vacuum. With the i jection water not exceeding 85 deg. Fahr. the condens under the same conditions of load will develop 27.6 in.

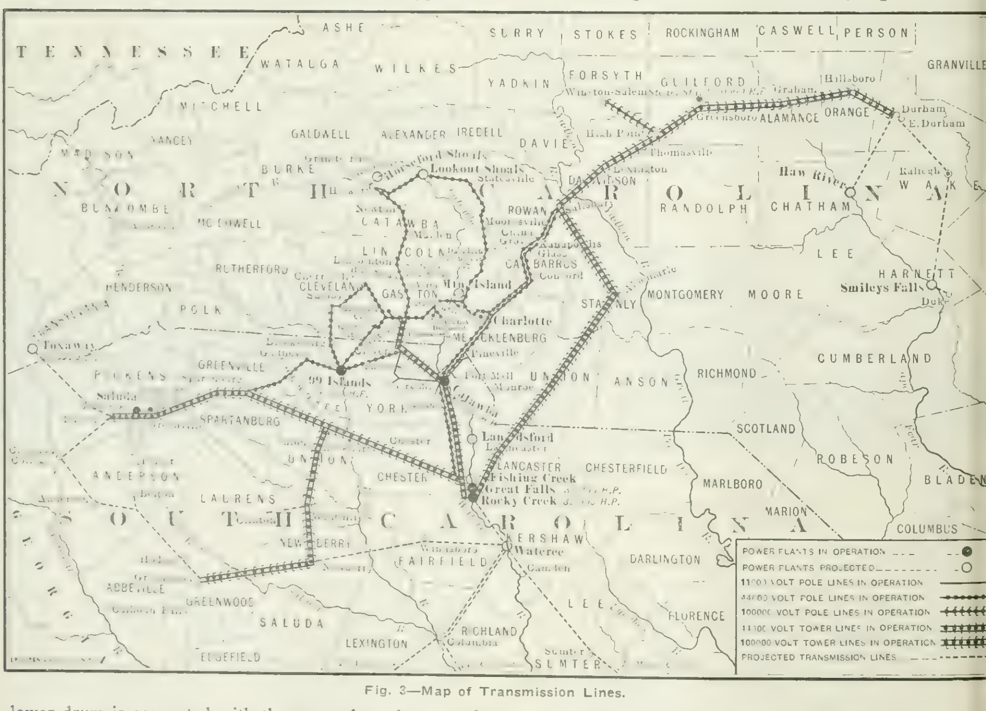


Fig. 3—Map of Transmission Lines.

vacuum. With the injection water not exceeding 90 deg. Fahr. the condenser under the same conditions of load will develop 27.25 in. of vacuum. The normal flow of the Reedy River, from which the condensing water is taken, is over 30 cu. ft. per second, which is ample for condensing purposes at normal load, but as this plant was built to be operated in periods of low water, and as the Reedy River runs as low as 20 cu. ft. per second, it was necessary to build a reservoir for storing the condensing water. This reservoir is 750 ft. long, 300 ft. wide and 9 ft. deep, and will hold approximately 14,000,000 gal. This reservoir has been made of earth embankments.

The water from the river flows by gravity through a 30-in. terra-cotta pipe to a cold well outside the building. This well is connected to another well inside the building by a pipe in which there is a valve that can be shut in times of flood water. The water from the cold well inside the building is elevated into the intake from the pond by a vertical submerged centrifugal pump driven by a motor placed on the basement floor. The pump and reservoir are in par-

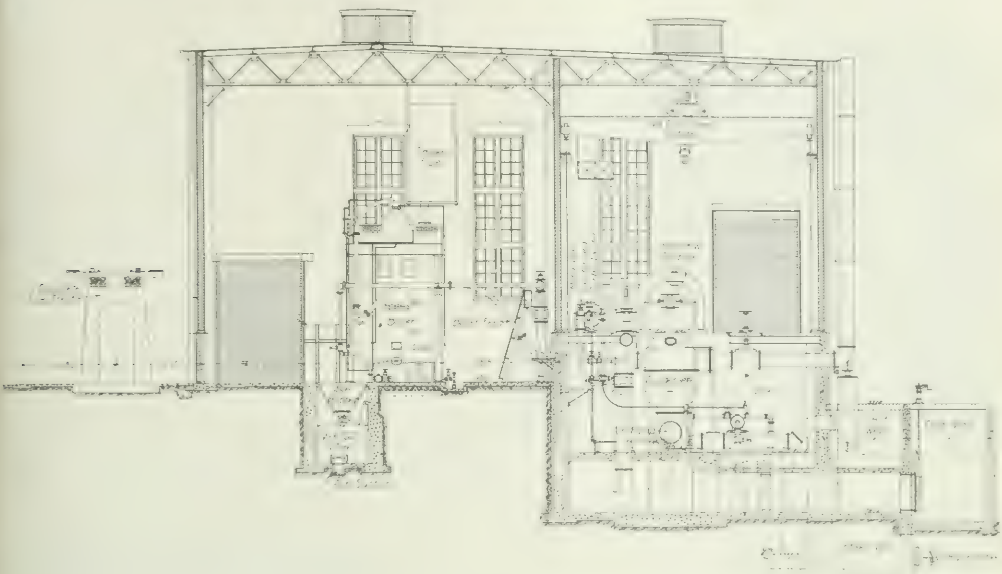


Fig. 4—Cross-Section of Greenville Station.

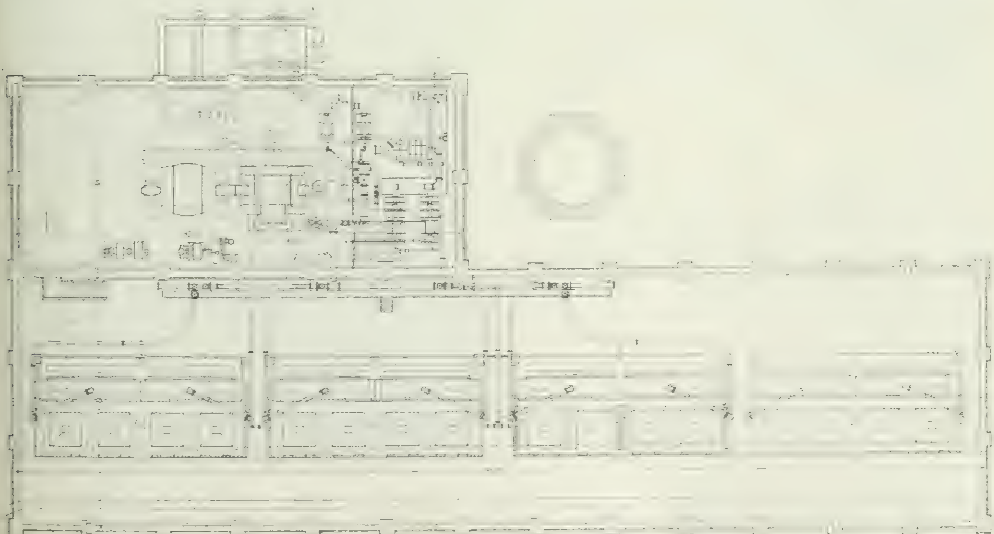


Fig. 5—General Plan of Greenville Station.

allel so that all the cold water from the river runs directly to the condenser and only part of the water is supplied by the reservoir. The reservoir is connected with another cold well outside the building, from which is started the tunnel going to the condenser's suction.

When the plant is being operated ten hours per day at the low stage of the river the water in this reservoir will go once through the condenser in a week. As much water as is taken from the pond is returned to the further end of the pond in an open concrete flume, thus giving it a chance to cool before re-entering the reservoir.

Fig. 6—Boiler-Room.

COAL AND ASH-HANDLING EQUIPMENT.

Along the side of the building on which the boilers front a concrete trestle 16 ft. high has been built for coal storage. The center line of the trestle is 12 ft. from the building wall, in which openings have been provided to admit the coal. These openings are 4 ft. x 6 ft., and there are two of them per bay. The furnace fronts are set 14 ft. from the inside of the wall, so that no shoveling will have to be done to place the coal in position for firing when the bins are full. In addition a track for the firing cars has been provided. This track runs in front of the boilers and extends completely around the storage space, which will hold 2500 tons.

PIPING.

In placing the turbine, boilers, pumps, etc., an endeavor was made to arrange for a simple piping layout. A 12-in. main header is located on the rear boiler-room wall, to which connection is made from superheater nozzles by 7-in. leads with long bends. A 14-in. long bend connects the header and the separator, and the top of the latter is connected by a bend to the throttle valve. The pumps and heater are placed in the turbine end of the basement, making the length of all steam and water connections a minimum.

The arrangement of valves is as follows: In the boiler leads are a 7-in. angle globe and a 7-in. horizontal non-return valve. In the main connection is a 14-in. straight-way gate valve. On the steam ends of the air pump, the exciter turbine, the heater pumps and the oil pumps are straight-way gate valves; on the exciter turbine are angle globe valves. Each pump is arranged to be operated independently of the other pumps.

All valves (including body, bonnet and yokes) and flanged and screwed fittings for high-pressure superheated steam are of crucible steel of extra heavy cast-iron pattern. The body and bonnet flanges of the valves are turned to give 1/32-in. raised seat inside of the bolt holes. The backs of the flanges are spot faced or fully turned. The stems and seats are of nickel steel. All pipe flanges for the high-pressure superheated steam lines of 5-in. size or larger are of the extra-heavy, high-hub, flanged and rolled-steel Van Stone ring type, machine finished all over with 1/32-in. raised seat inside of the bolt holes. All pipe for the high-pressure superheated steam lines is of soft steel, full-weight standard lap welded, tested for 500 lb. per square inch.

PIPE COVERING.

All high-pressure superheated steam lines are covered with a 1-in. layer of special long-fiber asbestos cement, securely bound with a layer of 2-in.-mesh galvanized-wire netting, two layers each 1 in. in thickness of 85 per cent magnesia sectional covering applied so as to break both the longitudinal and the circumferential joints. All joints are filled with cement. A final 0.75-in. layer of special long-fiber asbestos cement was applied to the sectional covering, on top of which was sewed an 8-oz. canvas duck covering backed with resin-sized paper. Each flange is provided with a 2-in. removable covering.

The auxiliary steam piping is covered with 1.5-in. sectional covering and duck. On the high-pressure drip piping, boiler-feed and auxiliary exhaust the flange covering has been omitted. The feed-water heater, the cylinders of the boiler-feed pump and the exposed surface of the boiler drums are covered with 85 per cent magnesia blocks 1.5 in. thick and a layer of hard-finish cement. A covering of 8-oz. canvas duck is pasted and sewed on all of these surfaces. Each manhole and boiler drum, heater, etc., has a 2-in. removable covering.

TIE-IN TRANSFORMER AND SWITCHING STATION.

On the opposite side of the railroad track from the Greenville station there is an 18,000-kw transformer station which is used for reducing the emf from 100,000 volts to 13,000 volts or 2400 volts for local distribution. The generator of the steam station is connected to the 2400-volt busbars in this station and can be operated either in parallel with the high-tension transmission system or directly on a part of the local load.

GREENSBORO STATION.

This station is almost identical with the Greenville station except that the transforming and switching stations have been combined with the generating station. The two-circuit, 100,000-volt trunk line from Great Falls will be switched here for Durham, and there are being installed three 3000-kw transformers to reduce the emf from 100,000 volts to 13,000 volts for power distribution and three 1000-kw transformers to reduce the emf to 2400 volts for city distribution.

Fig. 7—Boiler-Room.

MODERN NAVAL TRAINING STATION.

Electrical and Other Utilities of the New Establishment on Lake Michigan.

ON the west shore of Lake Michigan, 32 miles north of Chicago, near Lake Bluff, Ill., the United States Navy Department has just finished the installation of its splendid new $3,500,000 educational plant for the training of ships' crews of ordinary-seaman grade. This Great Lakes Naval Training Station, as it is officially termed, goes into commission July 1, and occupies a site of 182 acres purchased and presented to the United States government in 1905 through the public-spirited subscription of a number of Chicago business men.

Forty-two buildings have already been constructed on the grounds, including the administration building, instruction building, drill hall, power house, mess hall and cooks' galley, four main dormitories, main guardhouse, receiving guardhouse, receiving building, receiving galley and laundry, six receiving dormitories, general storekeeper's storehouse, the brig or jail, stable, boathouse, commandant's house, thirteen houses for officers' quarters, a hospital building and a laundry building. All of the foregoing structures are of red brick, the principal ones being made noteworthy by the massive style of architecture characteristic of governmental-service construction.

Fig. 1—Great Lakes Naval Training Station, Showing Parade Ground, Administration Building and Others of Main Group, Besides Outdoor Lighting Posts.

The arrangement of the buildings of the main group is shown in the accompanying plan of the station grounds. All of the main buildings with the exception of the harbor boat house, the power house and the hospital are situated on the main plateau. For reasons of isolation the site of the hospital, together with the future contagious-disease buildings, was transferred to a separate plateau, which is connected with the main grounds by a foot-bridge over the dividing ravine. The various buildings of the main group and the dormitories of the receiving group are each ranged about their respective parade grounds, which thus constitute two distinct centers, one for the reception of raw recruits and the other for the later stages in the making of the man-o'-war's man. At the present time the station is designed for training 1500 men, but the power plant has been so designed and the buildings and grounds so laid out as to be capable of ready expansion to an ultimate capacity of 2500 men.

COMBINED ELECTRIC AND HEATING PLANT.

Electricity for lighting and motor service on the station grounds, steam and hot water for heating purposes in the buildings, refrigerated brine circulation for cooling, water supply for service and drinking purposes, etc., are all furnished from the combination power plant at the base of the bluff on which stand the station buildings. From the power house a 6-ft. x 6-ft. concrete tunnel distributes the various utilities underground to the forty-two buildings on the station grounds. With the exception of the overhead arc-lighting lines along several roads about the grounds all wires are carried underground in vitrified conduit.

The power house at the water's edge, which rests on piles on ground reclaimed from the lake by the construction of a timber-crib seawall, is a fireproof steel and brick building, 90 ft. by 100 ft. in floor plan. Coal is received from the Chicago & Northwestern Railroad over a spur track, which is extended across the bridge to the power house, shown in Fig. 3, to the coal bunkers above the boiler-room. The government purchases its coal for this plant on a heat-unit basis, specifying the lower limit to which the fuel may run and deducting proportionate amounts from the payment price in case analysis of samples falls below this figure. Careful calorimeter tests are made on samples from each shipment, so that a close check is maintained on all fuel received.

BOILER-ROOM EQUIPMENT.

From the drop-bottom railroad cars the coal falls into track hoppers leading to a movable crusher beneath, which is arranged to run on its own tracks so as to reach any one of the track hoppers in the station. The crusher has a capacity of 60 tons per hour, and is driven by a 25-hp motor, which is also arranged for propelling along its track the little car on which it is mounted. The crusher in turn discharges into the six coal bunkers, over the boiler-room, which have a capacity for holding 500 long, 2200-lb., tons. In turn these coal bunkers discharge into movable weighing hoppers, running on overhead trackways, as shown in Fig. 4. The counterbalance beams of these hopper scales are brought down to within reach from the boiler-floor level through a system of rods and a suspended platform. All coal fired under the boilers is in this way conveniently weighed as supplied to the mechanical stokers.

The downspouts from the weighing hoppers discharge onto the latest type of Roney stokers, which are installed for each of the six 300-hp Babcock & Wilcox boilers. The stokers have a grate surface of 64 sq. ft. per stroke, and the furnaces are built with the unusual arch depth of 8 ft., designed to prevent production of smoke. The flue gases from this entire battery of boilers, practically smokeless, are delivered into the 195-ft. brick stack, which is 11 ft. in internal diameter at its base. In operation the plant fur-

naces are practically smokeless. The ashes from the grates are raked into ash hoppers beneath the furnaces, from which the ashes are collected by small dump cars, raised to the ground level by hydraulic hoist, and conveyed outside the building, to be used for filling behind the crib on the lake front or to be elevated to the overhead trestle for shipment in the empty coal cars.

STEAM PRODUCTION.

Steam from the boiler equipment above described is used by the power-plant engines, the water-supply pumps, the refrigerating machinery and for heating the hot water circulated through the grounds for the direct-radiation heating of the station buildings, in addition to its use, throttled down through expansion valves, for the indirect-radiation heating of the buildings. All of these various services are supplied from the common battery of boilers, and in the main header of the steam supply line hydraulic remote-controlled valves are inserted, operable from any of a number of emergency-valve stations scattered throughout the plant. In case of accident the supply of steam can thus be immediately closed from any one of the seven emergency shut-off stations.

ELECTRICAL GENERATION AND CONTROL.

The electrical generating equipment of the station, as shown in Fig. 5, comprises three 18-in. x 36-in. simple non-condensing Bates-Corliss engines, each direct-connected to drive a 175-kw, 2300-volt, 60-cycle, three-phase alternator at 120 r.p.m. The 50-ft. x 90-ft. engine-room provides space for a fourth similar unit, the foundation for which is already installed. Excitation at 120 volts is provided by both a 45-kw engine-driven direct-current generator and a similar motor-driven exciter unit supplied from the 2300-volt lines. The plant engines are operated non-condensing during all seasons of the year, no provisions being made for condenser equipment.

Control of the station apparatus, as well as of the outgoing feeders, is concentrated in an elevated switchboard gallery at the northwest corner of the room, Fig. 6. This switchboard comprises a Tirrill regulator panel, two exciter panels, three generator panels and a totalizing panel, besides the five feeder panels and the arc-lamp sections. The switchboard is equipped with the usual complement of indicating and recording instruments, watthour meters, synchroscope, etc., all of Westinghouse manufacture, with the exception of the General Electric voltage regulator. The 2300-volt oil switches and buses are installed in the inclosure beneath the switchboard gallery, from which they are operated through a system of bell cranks and pull rods. The tub transformers for the three fifteen-lamp series-arc circuits are also located in the sub-gallery space. These arc circuits, which are the only lines on the station grounds employing in part overhead construction, are provided with lightning arresters, although in the case of all the 2300-volt feeder circuits the underground construction has avoided the necessity for such protection.

The engine-room is served by a six-ton hand-operated crane and is amply lighted by eight ceiling groups of six 60-watt tungsten lamps each.

HOT WATER AND STEAM HEATING.

For the direct-radiation heating of the station buildings hot water is used, heated by steam from the plant boilers. From the heaters in the boiler room this hot water is circulated through the supply and return 12-in. tunnel lines by a duplicate pair of 150-hp five-stage Kerr turbines driving D'Olier single-stage centrifugal pumps, each with a capacity of 2300 gal. per minute against 160 ft. head. The exhaust steam from these turbine units is condensed in the exhaust heater and so serves to heat the circulating water of the Evans-Almirall heating system. A Venturi meter in the station, inserted in the main hot-water line, is designed to indicate flows up to 2500 gal, per minute.

In addition to the hot water which is circulated for all direct radiation there is also supplied to each building live steam which supplies the stacks for the ventilating fans, serves for cooking purposes in the galleys and for use in the main laundry of the station, also supplying hot water for bathing and domestic purposes, hot water for the swimming tank, for disinfecting, etc. The hot-water circulating system is that known as the Evans-Almirall system.

WATER SUPPLY

The water supply for the Naval Training Station and associated buildings is obtained from Lake Michigan through an intake pipe 14 in. in diameter, extending out 1200 ft. from shore. Motor-driven centrifugal pumps deliver the water to the filter tank in the purification house near the power plant. From this basin the water passes downward through sand filters and into the filtered storage reservoir, which has a capacity of 400,000 gal. The purification system is designed to treat 200,000 gal. of water per day. A tandem-compound steam-driven service pump, capable of delivering 400 gal. per minute, lifts the purified water through a height of 180 ft. from the storage reservoir to the 40,000-gal. tank in the tower of the administration building. A motor-operated valve in the line leading from this tank tower makes possible in case of fire the instantaneous disconnecting of the tank in the tower, thus

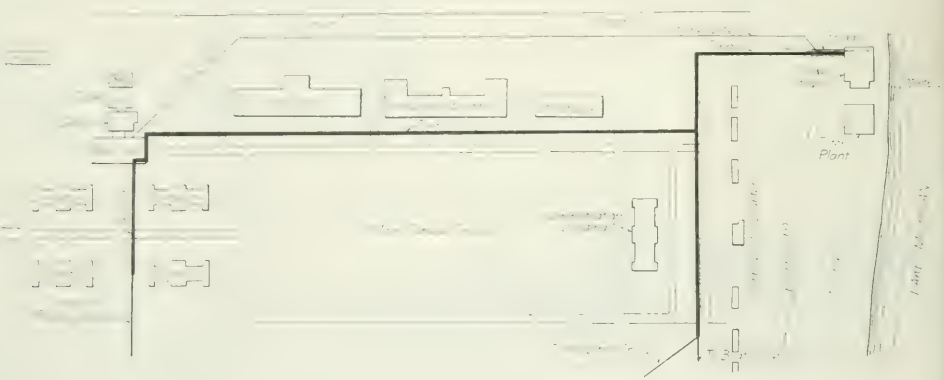


Fig. 2—Plan of Main Plateau, Showing Utility Tunnels and Principal Buildings of the Great Lakes Naval Training Station.

[p]ermitting the fire pumps to increase the pressure by pump[in]g directly into the mains. In the power-house basement, [a]longside the service pump, are also duplicate fire pumps, [e]ach with an ultimate delivery capacity of 400 gal. per [mi]nute. These fire pumps can be arranged to take directly

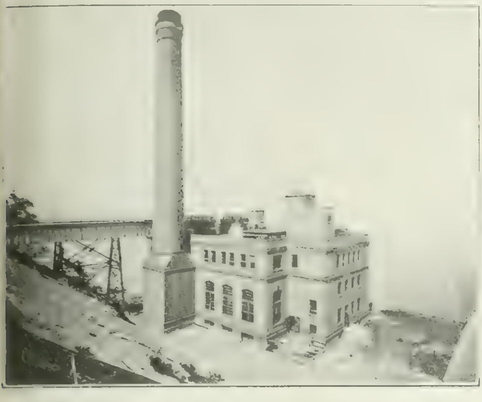


Fig. 3—Central Steam-Heating, Pumping, Refrigerating and Power Plant.

from the lake if necessary, but ordinarily are supplied from the filtered-water tank. They are capable of throwing from four to six fire streams to the top of any building on the station grounds.

ICE-MAKING PLANT.

The ice plant in the basement contains a 30-ton York vertical single-acting double-cylinder ammonia compressor. The expansion of this ammonia cools two independent brine lines, one system being used for freezing ice in the ninety-nine 200-lb. cans installed, while the other brine line is extended through a separate underground trench to the cold boxes in the mess halls. The hospital has its own motor-driven refrigerating apparatus. The brine circulating pumps, impellers, agitators, etc., of the main refrigerating equipment are all electrically driven. A steam-driven air compressor is also installed in the power-plant

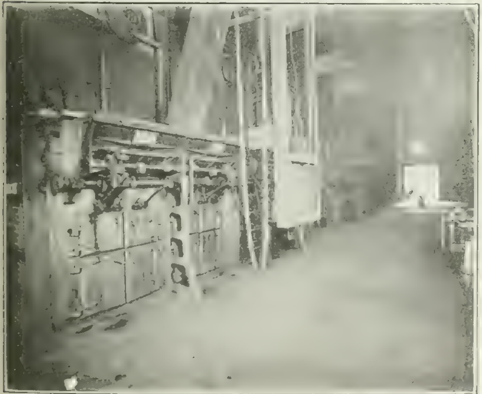


Fig. 4—Automatic Stokers and Boilers, Showing Traveling Weighing Hoppers.

basement, supplying compressed air for various purposes in the power house, including the blowing off of electrical machinery, etc.

MODEL MACHINE SHOP.

A large room on the third-story level of the power station has been fitted up as a model machine shop, which is reached from the main floors by means of an ample electric freight elevator. Individual motor-driven machine tools,

Fig. 5—Interior of Engine-Room in Power Plant at Great Lakes Naval Training Station.

including a shaper, two lathes, drill presses, emery wheels, pipe threaders and benders, etc., are provided, the equipment being sufficient for performing any ordinary job of repairs about the station. The machine shop is also fitted with a modern oxy-actylene welding outfit for which many repair uses are found in a comparatively isolated community like that of the naval station.

UNDERGROUND DISTRIBUTION OF UTILITIES.

The various utilities supplied by the power plant are

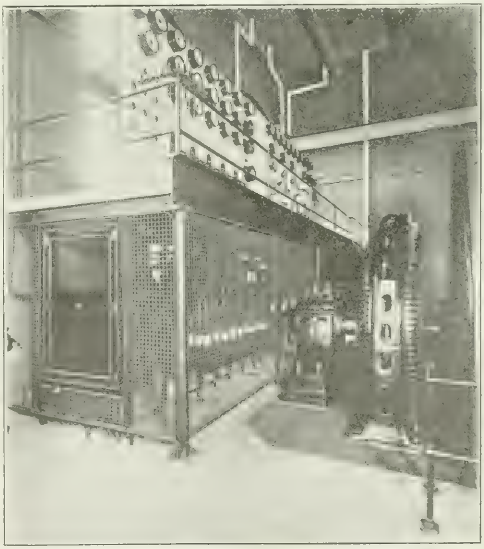


Fig. 6—Switchboard Gallery and High-Tension Buses and Switches.

delivered to the main tunnel under the main plateau over a conduit extension suspended from the coal-track bridge. The main tunnel is 6 ft. square in cross-section and extends

2200 ft. to the mess hall. It contains one 9-in. high-pressure steam pipe, one supply and one return 12-in. hot-water main, one 5-in. vacuum line, five 2300-volt lighting-feeder cables, three arc-circuit cables, the telephone wires and an electric-clock synchronizing circuit. All of the clocks in the various station buildings are controlled electrically from the master clock in the main administration-building tower. The brine lines and the water mains are carried in trenches

Fig. 7—Multiple Arc-Lamp Illumination of Drill Hall.

separate from the tunnels conveying the other utilities. From the main tunnel lateral branches diverge, ranging in size from bores 4 ft. in diameter to mere conduit runs, supplying the various buildings passed.

ELECTRICITY IN BUILDINGS OF MAIN GROUP

The indoor drill hall is one of the notable buildings on the station grounds, both in exterior architecture and in inside construction. It contains a splendid floor, 80 ft. x 400 ft., and free of all supporting columns, which will permit the evolutions of a brigade of 1300 men during bad weather outside. The drill hall is lighted by sixty-six Adams-Bagnall 110-volt multiple inclosed-arc lamps suspended on brass chains from the steel arches which support the reinforced-concrete roof, as shown in Fig. 7. The lamps are hung 25 ft. above the floor and are arranged at intervals of 18 ft. in three rows, 23 ft. apart. All wiring to these lamps is carried in conduit supported on the steel arches and distributed from a panelboard in an anteroom of the drill hall, from which each group of three lamps can be controlled separately.

The grounds about the station are lighted by forty-five series inclosed alternating-current arc lamps mounted on shepherd's-crook posts reached by underground vitrified-conduit construction. All of the arc-lamp circuits on the main plateau are underground, but overhead construction has been employed for reaching a number of the lamps used for lighting the ravine roads in outlying parts of the station grounds. Unlike the 2300-volt lighting feeders all of the arc circuits are protected by lightning arresters at the station.

Electricity has been used to lighten the labors of employees in the mess kitchens and in the station laundry. In the cooks' galley, which is the nautical term applied to the kitchen building, flour is automatically sifted from bins in the cellar and lifted by means of a motor-driven elevator conveyor to a weighing hopper, from which the desired quantity of flour can then be measured and discharged into the large bread mixer. This mixer, together with a cake machine, is driven by a 5-hp motor. The galley is also provided with a Hogberg continuous bake oven, the baking surfaces of which are electrically lighted. The dish-washing department is equipped with a 2-hp motor-driven dish-washer, which surges soapy water over the dishes, later rinsing them with a spray of hot, clean water, from which they emerge and dry automatically by simple evaporation.

The laundry is also equipped with motor-driven washing machines, centrifugal extractors, ironing machines, etc.

ELECTRICAL FEATURES OF HOSPITAL.

On account of the special uses to which it is put, as well as its necessary isolation from the other buildings of the station group, the hospital presents a number of interesting special applications of electricity. Although the main hospital kitchen contains the usual fuel-burning ranges the small ward kitchens are equipped with electric-cooking apparatus, by the aid of which the nurses can prepare special dishes for invalids. A separate motor-driven refrigerating plant is also installed for cooling the ice boxes in this building. Special illumination features have also been worked out with respect to the lighting of the wards, corridors, baths and surgical operating-rooms.

A very complete call-signal system has been provided for the hospital. A patient desiring attention pushes the button in his room, which indicates a call on the annunciator in the nurses' rooms as well as in the hospital superintendent's office. At the same time a white lamp is also lighted in the corridor over the doorway of the room calling, as shown in Fig. 8. To reset these several signals the nurse must actually go to the room in which the call originated and press a clearing-out button there. The call otherwise remains up until reset, which can be done only from the calling station.

A second or special emergency push button is also provided in case a nurse requires assistance in dealing with a delirious patient. Pressing this button lights a red lamp over the door of the room and operates emergency alarms in the various nurses' quarters, superintendent's office, etc., bringing assistance in haste, while at the same time the red lamp in the corridor summons any one chancing to be passing to enter the room and give immediate aid.

The present lighting equipment of the Naval Training Station comprises approximately 8000 incandescent lamps and 140 arc lamps, 100 of the latter being of the 110-volt multiple type used for illuminating the interiors of buildings. The series lamps are employed for outdoor illumination of the grounds. In the various buildings of the station there are also now installed 350 hp of motors.

Fig. 8—Corridor in Hospital, Showing Alarm Signal Lamps.

Rear Admiral Albert Ross, U. S. N., has been commandant of the Great Lakes Naval Training Station since its inception. Capt. George A. McKay, civil engineer, U. S. N., was responsible for the design and had charge of the construction until a year ago, when he was succeeded by Mr. C. D. Thurber, civil engineer, U. S. N.

THE DESIGN OF COMBINATION ICE AND ELECTRIC PLANTS.

By James R. Cravath.

IN view of the present interest in ice manufacture in connection with central electric-light and power stations it is in order to point out some of the important things to be considered in the design of such combination plants. Up to the present time the majority of combination ice and electric plants have been put together by simply adding to an electric-light and power plant a plant for the manufacture of ice, the ice plant being built along the same lines as if it were altogether independent of the electric plant, except as to boiler-room. In other words, there has been insufficient thought given to the most economical working together of these two industries. This has doubtless been due to the ignorance of electrical men as to ice manufacture and to the ignorance of ice men as to electric-power production. The most profitable combination ice and electric plants of the future will be plants designed with a full knowledge of the peculiarities and possibilities of both of these industries.

The electric-service company which goes into ice manufacture has before it such a variety of possible combinations that the number is confusing to those considering the subject for the first time. A brief examination of the ice-machine situation shows that there are no less than eight general types of ice-making plants from which the central-station man should choose. This does not take into account any of the minor modifications of the ice-making apparatus introduced by different manufacturers, but covers simply the general divisions. The opportunities for making important mistakes in the selection of the type of plant for any given condition are, therefore, many, because there are certain local plant conditions which make some one of these eight general types the best for any particular case. The selection of the wrong system may either make unnecessarily high investment and fixed charges or unnecessary operating expenses. It is not the purpose of this article to go into this subject thoroughly by any means, but only to show in a general way the principal types of ice-making machinery available and the special field for each.

Ice-making plants may first be divided into two general classifications: (a) Compression plants, in which the ammonia gas used for refrigeration is raised in temperature and pressure by means of a compressor; (b) absorption plants, in which ammonia gas is raised to the necessary temperature and pressure by boiling it off from aqua ammonia, this gas being afterward absorbed back into the weak ammonia liquor. The further subdivision of these two general classifications is indicated in the next column. This classification might be carried out still further, but, as said before, only general types of plants will be dealt with in this article, leaving aside minor modifications.

Compression plants may have the compressor driven either by a steam engine, as has been the usual practice in the past, or by an electric motor. The absorption plants may be divided into those using live steam for boiling the aqua ammonia and those using exhaust steam. We have, therefore, so far in our classification four types of plants. Going still further, we learn that it is possible to operate any one of these types either with distilled water or with raw water which has not been distilled. There are several ways of successfully operating raw-water ice plants, which further add to the number of types from which the ice-plant investor has to select. There is no lack of controversy among ice-machine manufacturers at the present time as to the relative merits of absorption and compression systems and the various methods of obtaining good ice from raw water. Without entering into the finer points of ice manufacture about which these controversies rage, it may be safe to point out some of the strong points of the various plants and the particular conditions favorable to the different kinds.

The majority of small ice plants in this country are of the compression type having steam-engine-driven compressors, and in plants of from 10 tons to 25 tons daily capacity the exhaust steam from the engines driving the compressor and other necessary pumps is just about sufficient to supply the necessary distilled water for the daily tonnage of ice manufactured. As the freezing of distilled water into marketable ice involves fewer complications than the freezing of raw water into marketable ice, the natural course has been to condense the engine exhaust and make distilled-water ice. There is the added advantage that distilled-water ice is looked upon with more favor by the consumers than is raw-water ice. Ice when frozen from raw water, if simply allowed to freeze in the cans without agitation, is so white and spongy because of the gas and air bubbles given off during the cooling and freezing of the water that it is unmarketable, not only on account of its appearance, but because it does not keep or stand handling well. For the successful manufacture of ice from raw water agitation during freezing is necessary. The commonest method of furnishing this agitation is by forcing air through the water, the bubbles causing the agitation. This complicates the freezing process. The methods used will not be gone over in detail. The ice itself, as far as appearance, clearness and solidity go, is practically equal to distilled-water ice. The impurities in the water will not freeze into the ice if they can by any means get away.

CLASSIFICATION OF ICE PLANTS.

Compression	Steam-driven	Raw water
		Distilled water
	Motor-driven	Raw water
		Distilled water
Absorption	Live steam	Raw water
		Distilled water
	Exhaust steam	Raw water
		Distilled water

There is evidently no particular object in going to the complication of making raw-water ice as long as there is plenty of exhaust steam available for making distilled water. Where, however, exhaust steam is not available there is a strong incentive to make raw-water ice. With this in view we can make a preliminary general classification of the conditions where a raw-water plant should be considered. The first of these is evidently where hydro-electric power is obtainable; the second is where power is obtained from gas engines; the third is where power is obtained from large condensing steam plants located at a distance from the ice plant. Under all of these conditions there is no exhaust steam available for making distilled water. The obvious course is to install a motor-driven compression plant.

When we come to a more common set of conditions found among smaller central stations, however, the course to pursue is not always so obvious. The conditions most commonly found are those of a small steam plant making plenty of exhaust steam for distilled water, most frequently operating non-condensing, but occasionally operating condensing. If the plant is operating condensing and has jet condensers the exhaust steam from the electric plant is not available as distilled water. If it has surface condensers the exhaust steam may be so available, although, of course, at the expense of more impure feed water than

if the condensed water could be used over again in the boilers. Taking up first the most common set of conditions, namely, an electric plant having non-condensing engines, a selection must be made between a steam-driven compression system, a motor-driven compression system, an exhaust-steam absorption system and a live-steam absorption system. From the standpoint of theoretical economy there can be little doubt that an absorption system operating with the exhaust steam from the electric-power plant is the most economical. Certain conditions, however, may render this system impracticable, while for other conditions it approaches the ideal. Of the total number of heat units in each pound of steam at an operating boiler pressure of 100 lb. 87 per cent is used in simply converting the water into steam from water at 212 deg. Fahr. After passing the steam through the engine, which is practically a kind of reducing valve, this large percentage of the total heat units in the steam still remains, to be given out only as the steam is condensed. It is this heat that is utilized in exhaust-steam heating or in boiling the aqua ammonia in an ammonia-absorption plant. Indeed, for supplying the necessary heat to the ammonia boilers considerably less exhaust steam is required than is needed for supplying the necessary tonnage of ice.

An exhaust-steam absorption system requires for its successful operation a greater amount and a lower temperature of cooling water for condensing the ammonia after it is compressed than an ice plant of similar capacity using an ammonia compressor. This cooling water takes away heat units from the compressed ammonia. The drawing back of these heat units into the ammonia as it expands, of course, produces the refrigerating effect.

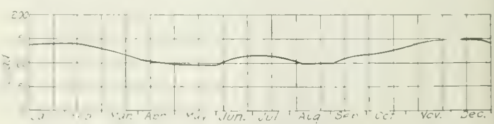
The first cost of an ammonia-absorption ice plant is greater than that for a simple-sized compression plant by an amount over which there appears to be some controversy, but it is probably between 20 per cent and 50 per cent. In general, then, the conditions favorable to the exhaust-steam absorption system are an ample supply of cooling water and a demand for ice enough days per year to justify the extra investment. The amount of cooling water required by an exhaust-steam absorption system operating with not over 5 lb. back pressure on the engines is apparently about double that required for a compression system.

When cooling water is not available at temperatures under 70 deg. it becomes necessary to operate the ammonia boiler at such a high temperature in order to get the necessary ammonia pressure that there soon comes a point where it is not economical to operate the electric-power plant engines at the high back pressure necessary to give this temperature. When this point is reached advocates of the absorption system sometimes recommend that the various pumps needed around the electric and ice plant be operated by steam at a high enough back pressure to give the necessary heat in the ammonia boiler. Since a comparatively small amount of steam is required to operate the ammonia boiler on a good-sized ice plant, this plan is frequently feasible. Another way of overcoming the difficulty is to operate the ammonia boiler with live steam, thus making the installation a straight live-steam absorption system.

The more limited the cooling water or the higher its temperature the more favorable the situation for a compression plant. The controversy as to the merits of absorption and compression systems must of necessity be most active in connection with plants where the amount of cooling water available is limited or of high temperature, or both. An ample supply of cold cooling water is by no means as easy to obtain in many cases as may be thought offhand. An ammonia-absorption exhaust-steam plant operating under economical conditions should have at least 4.5 gal. of water per minute at a temperature of 60 deg. per ton of daily ice-making capacity. The compression plant working with the same water temperature will require about half as much as this, or 2.25 gal. per minute per ton of daily ice-making capacity. There are plenty of places where a deep well cannot be obtained to yield even the latter amount of water if the water is to be thrown away after it leaves the cooling and condensing apparatus of the ice plant. If no pond or stream is available this means that artificial water-cooling towers must be built. The temperature of water available from such towers is necessarily high, being usually from 90 deg. to 105 deg. If, on the other hand, river or pond water is available in a latitude where ice-making is a profitable business the temperature of such water is considerably above that of well water, ranging from 65 deg. to 80 deg. No attempt will be made here to show at what point an absorption plant becomes more costly than a compression plant.

Assuming that the temperature and quantity of water are such that a compression plant is desirable, it becomes an interesting question to decide whether the compression plant should be steam-engine-driven or motor-driven. One of the deciding factors in this problem is the size of the ice plant relative to the electric plant. If the ice plant is so large that additional electric-generating capacity would have to be installed in order to motor-drive the ice plant, the investment becomes excessive for the motor drive as compared to driving the compressors and other pumps direct with steam. Motor-driving the compressor under such circumstances would mean that the necessary investment in motor and generator capacity would have to be made in addition to the engine capacity needed to drive the compressor. Assuming that the engine capacity needed to drive the compressor would cost about the same in either case, the extra investment would be represented by the amount of the cost of the electric generator and motor capacity.

In many cases, however, the size of the ice plant is such that it can be taken care of as an off-peak load by the existing electric-generating capacity of the station. This does not mean that the ice plant is to be shut down every evening in the summer during the evening peak; it simply means that in many cases the summer peak of the central station is enough lower than the winter peak for the ice machine to be operated twenty-four hours per day in the summer without putting a greater load on the plant than is imposed by the lighting and power load alone during the December peak of the station. In order to determine this point in one typical case the writer has had plotted the weekly peak loads for a year of a certain central station about the latitude of St. Louis. The general results are shown in the illustration. These peaks vary con-



Curve Showing General Variation of Loss by Months.

siderably from day to day, but the curve shows only the general variation from month to month. It will be seen that with a maximum load of 150 in the winter the peak is only 100 in the summer. The peak loads in excess of 100 in June and July were caused by the operation of water-works pumps, which, under existing conditions, could be shut off during the peak if desired. A 10-ton ice plant is operated in connection with this central station. It is of the compression type and steam-engine-driven. The capacity of the electric plant is such that it could easily carry the ice-plant load twenty-four

[h]ours per day during the summer season, when the full [c]apacity of the ice plant is needed, if the ice plant were [m]otor-driven. Under the particular conditions in this case [bo]th the ice and electric plants are somewhat small for the [co]mmunity served, so that the same ratio would apply if [bo]th plants were enlarged. If the ice plant were motor-[d]riven the critical time would be during the month of [S]eptember, when the electric peak load is increasing [a]nd the demand for ice is considerable. During the [s]pring and fall months, when the full capacity of the ice [p]lant is not required, the ice-plant motor could be shut [d]own during the electric-plant peaks. Of course, this re[d]uces the ice-making capacity of the plant by an amount [p]roportionate to at least double the amount of time shut [d]own, but this is fully made up for by the other advantages.

The particular advantage which would be obtained by [m]otor-driving the ice machinery in this specific case would [b]e that the electric-power-plant engine, which now car[r]ies the day load and operates in a very much underloaded [c]ondition eighteen hours out of every twenty-four, could [b]e given enough load so that it would operate more eco[n]omically. To state the case in another way: With motor-[d]rive of the ice machine there would be but one set of [e]ngine losses instead of two, as is the case now. This would probably more than counterbalance the extra loss [i]n power transmission by the electric drive.

From this it is not to be assumed that motor-drive is the best for all compression plants. It is the best only when it eliminates a double set of engine losses and involves no extra electric generating-plant investment. One plan which may suggest itself is that of installing a large enough ice plant so that the desired daily capacity may be obtained by operating only eighteen or twenty hours per day, letting the plant lie idle during the peak load. This is likely to involve an ice-plant investment which is so much greater than the usual plan that it is not justified by the saving in electric-plant investment. Assume, for example, that the ice plant costs the common figure of \$1,000 per ton of daily capacity. If we must shut this plant down three hours each day during the peak on the electric plant we must operate the plant three hours after shutting down to bring it back to the point at which it was before the shutdown. In other words, we have reduced the capacity of our plant by six hours out of each twenty-four, or 25 per cent. In order to have an ice plant which will give the same capacity with three hours' shutdown every day as one which operates twenty-four hours each day we must increase the rated daily capacity and consequent investment in a ratio of 75:100, or from \$1,000 per ton of daily capacity to \$1,333 per ton—an increase of 33.3 per cent in our investment. Now, this \$333 increase per ton of daily ice-making capacity is much more than the cost of the extra electric power-station capacity which would be needed to carry the ice plant straight through the twenty-four hours per day.

If the electric-plant capacity is insufficient to carry the motor-driven ice plant over the summer evening peak-load periods, it is better to install a steam-driven compressor than to make the extra investment in electric generating capacity for the sake of the small saving possible with motor operation. In such an event the only extra capacity which is needed in the electric plant is in the boiler-room.

A substitute for motor driving of compressors which may work out well under certain conditions is to belt the compressor to the engine which is used to carry the electric-light and motor load twenty-four hours per day. This gives nearly all the practical advantages of the motor drive by eliminating one set of engine losses and giving the all-day engine of the electric plant a good load.

ICE STORAGE

Another nice question to decide in the design of combination plants is how far it is best to go in the matter of manufacturing and storing ice in the spring before the heavy ice consumption begins. An ice plant, like an electric plant, should be worked at as good a load-factor as possible. The investment should be made to earn money as many hours per year as possible. It is important to decide whether it is better to put in a plant of 10 tons daily capacity and store enough ice to supply a possible demand of 30 tons maximum during the hottest weather, or to put in a plant with a maximum capacity of 30 tons per day. The first cost of the plant which can make 30 tons per day may be higher than the first cost of the smaller plant plus storage, although that would depend somewhat on the kind of storage house erected. If ice is stored, however, there comes the question of the cost of its refrigeration when in storage to prevent excessive loss, and the cost of handling in and out of storage. Ice-plant practice in the past has been mainly in the direction of very small storage capacity and enough daily tonnage manufacturing capacity to supply the demands. It does not always follow that this is the best practice when operating in connection with an electric light and motor plant. The electric light and motor plant must be operated 365 days per year in any event. The additional cost of operating the ice plant for refrigeration of the ice storage will be less than if the ice plant were operated independentely and a crew of men had to be kept especially on duty simply for maintaining the refrigeration of the ice storage. None of these questions can be decided offhand. Each must be gone into carefully, like any other engineering question.

This article has only touched upon the main points of combination-plant design of this kind. In fact, such an infinite variety of local conditions are encountered that each case must be thoroughly studied by itself in detail.

COMMERCIAL METHODS OF DETERMINING SHORT-CIRCUITED TURNS IN WOUND COILS.

By J. P. Raymond.

In the commercial manufacture of certain types of apparatus containing coils of insulated wire it is often necessary to maintain the impedance of the coils within certain definite limits to insure satisfactory working of the apparatus. This is perhaps particularly true in the manufacture of telephone apparatus, where the impedance is at times extremely important, affecting as it does the transmission of speech as well as the transmission of signals where extremely weak currents are involved.

The same tests are also frequently necessary in the manufacture of generators or motors where short-circuited turns would be extremely detrimental in an armature coil or in a field coil, particularly when used with alternating current.

The three methods of testing which are described below have been developed after considerable study of the matter and have been found to be thoroughly commercial. The tests may be made rapidly and with a fair degree of accuracy even with inexperienced operators.

In this connection it may be mentioned that the impedance of similarly wound coils is affected proportionately by the number of short-circuited turns contained in each coil—that is, under ordinary conditions as the number of short-circuited turns increases the impedance decreases. For this reason the terms "impedance" and "short-circuited turns" are used to a certain extent interchangeably in this article.

RECEIVER METHOD.

One of the methods that may be employed to make the impedance test is the receiver method. This method is

applicable to small coils of almost any description wherein it is essential that the short-circuited turns be kept within certain limits, such as an induction coil and magnet coils. As shown in Fig. 1, this circuit consists of a bridge arrangement having two equal resistance-ratio arms wound non-

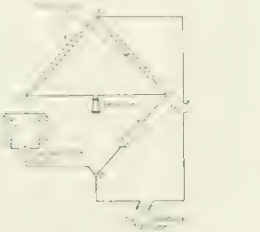


Fig. 1—Connections for Receiver Record.

inductively and joined together at the point marked *a*. A standard coil *S*, similar to the one under construction and having presumably no short-circuited turns, is then connected between the points *b* and *c*. This standard coil is very carefully wound, particular care being taken to insure that no turns are short-circuited. A check coil S_1, having the maximum number of short-circuited turns, completes the local circuit. This coil should be selected so that its impedance is equal to that of the standard coil. A number of turns equal to the allowable number of short-circuited turns is then unwound and a tap brought out so that the turns may be mechanically short-circuited. This coil will then represent the worst condition allowable.

When a high-frequency current is impressed across the terminals *a* and *b* and a telephone receiver is connected between the points *c* and *d*, a tone may be detected in the receiver due to the unbalanced inductance between the coils *S* and S_1 resulting from the mechanically short-circuited turns in S_1. The coil under test, *T*, is then substituted for the check coil and the resultant tone compared with the tone obtained by the previous combination. The tone from the test coil should be approximately the same as the tone from the check coil if the impedance of the coil under test is within the specified limits.

By means of a switch with connections such as shown in Fig. 1 a circuit can be arranged to compare the standard coil with either the test coil or the check coil, as desired, by the operation of a key.

The high-frequency current which is used for the above test is taken up in detail later.

GALVANOMETER METHOD

The galvanometer method is an improvement of the receiver method and uses the same high-frequency current mentioned in connection with the previous test. This method eliminates the necessity of judging by their tone the correctness of coils as compared with a standard. The essential feature of this test consists in the use of a special portable galvanometer having a central zero scale. The galvanometer has two stationary coils, *A* and A_1, and one movable coil, *B*. A needle is fastened to the movable coil so as to move over a scale when the movable coil is acted upon by magnetic forces from the other two coils. As seen from Fig. 2, the circuit is practically a Wheatstone bridge circuit with the two stationary coils of the galvanometer movable coil being connected as shown. The standard coil used in this case is the same as the check coil used in the receiver method. A switch arrangement *c* is used to compare either a test or a check coil with the standard coil. With this switch open, by pressing the operating key *d* and the galvanometer key *e* current is allowed to flow through the unbalanced circuit and deflect the galvanometer very strongly in one direction, which, for convenience, will be designated as the right-hand direction. This determines the direction the galvanometer would take if the test coil under consideration were open or had an

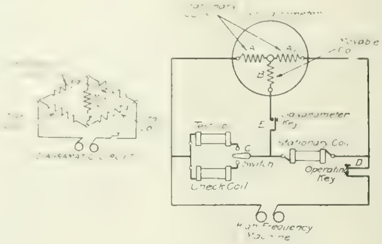


Fig. 2—Connections for Galvanometer.

infinite impedance. It is very evident that a short-circuited coil would strongly deflect the galvanometer in the opposite direction since its impedance is practically zero.

With the relative deflections thus determined, if the test coil is as good as or better than the standard, the deflection will be either zero or to the right. If the winding of the test coil is not as good—that is, has more short-circuited turns, and hence lower impedance, than the standard coil—the deflection will be to the left. Thus it may readily be seen that by the operation of a key the condition of the test coil as compared with the standard coil may be determined by simply watching the direction of the galvanometer deflection. Arrangement has been made by which another standard coil may be switched into circuit to be used as a check coil in order to determine whether the instrument is in calibration. For convenience the operating key and the galvanometer key may be combined so that the connections are made in the proper sequence by a single operation. Spring clips or jigs may be designed to hold the terminals of the coils to be tested so that they may be connected for test with ease and rapidity.

INDUCTION METHOD.

This method is particularly applicable for testing field coils for motors and generators as well as any coil wound without a core and which has a hole of sufficient size in the center. Field coils for fan motors and other similar small machines may be tested with a considerable degree of accuracy for a number of turns, for short-circuited

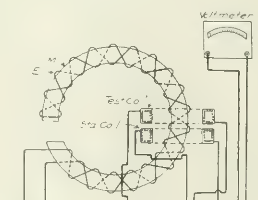


Fig. 3—Connections for Induction Method.

turns and for open circuits. Other coils, including large-size field coils, formed armature coils and other miscellaneous coils of almost any size or shape, may be tested for short-circuit and for open circuits. The apparatus and connections necessary are shown in Fig. 3.

The iron core M is made up of soft-annealed iron wire or punchings and is wound with a carefully insulated exciting winding E. This exciting winding is furnished with alternating current from an alternator of ordinary frequency, usually about 60 cycles per second, some means of easily and accurately adjusting the voltage being introduced either in the local circuit or in the exciting circuit of the alternator, or both. An alternating-current voltmeter and operating key, as shown, should be provided and connected to three spring clips A, B and C.

OPERATION.

A coil of the type which is to be tested should be carefully selected as a standard. It should be slipped over the ring to a position, as shown, and the ends inserted in the clips B and C.

It then acts as the secondary of a transformer generating an emf which will be recorded by the voltmeter. The primary voltage may be varied until the needle of the voltmeter stands at any desired point.

If, now, a coil to be tested is slipped on over the core in the same manner as was previously done with the standard coil it will have no effect on the voltage generated as shown by the voltmeter if the coil is in proper condition. If, however, the coil under test contains short-circuited turns it will exert a damping effect which will decrease the voltage generated in the other coil by a greater or less amount, depending upon the extent of the trouble. If it is desirable to allow a certain number of such short-circuited turns to provide for commercial-winding conditions this may be cared for by determining the corresponding drop in voltage which may be allowed, as shown on the voltmeter.

If the coil satisfactorily passes this first test it is allowed to rest on top of the standard coil. The ends may now be touched together and if the coil is not open this act will cause the voltmeter needle to deflect as already described in the case of a short-circuit, thus giving the test for open circuits.

To test for the number of turns, the ends of the coil winding are inserted in the spring clips A and B, as shown in the diagram. Then by pressing the operating key the coil under test will be substituted for the standard coil in connection with the voltmeter. If the number of turns is correct the voltmeter reading will be the same for each coil; if the number of turns is low the voltmeter reading will be low, and vice versa.

In order to make allowance for commercial variations in winding, the standard coil may be wound to the maximum allowable turns with a tap taken out at the minimum number of turns which may be used for obtaining the passing points on the voltmeter reading.

For testing miscellaneous coils, including armature coils, transformer coils, etc., for short-circuits and opens, any convenient standard coil may be used, as a definite reading of the meter is not necessary for these two tests. The writer has seen this test applied to formed armature coils as large as 4.5 ft. long by 2 ft. wide before the coils were inserted into an armature or alternator. It has also been used on large field coils; in fact, almost anything that can be forced on to the ring can be tested.

DETAIL OF CONSTRUCTION.

The core M may be made up to suit local conditions as to size and material. For miscellaneous work probably the most satisfactory core can be made by using soft-annealed iron wire of approximately No. 20 gage wound up into a coil about 15 in. in diameter, the cross-section being about 0.75 in. to 1 in. in diameter. After being formed into shape it should be tightly taped to hold it in shape and to insulate it thoroughly. After this an exciting winding is added covering the entire length except a short space. This winding may also be adapted to local conditions, an approximation being two or three layers of about No. 18 wire. The core, after being wound and carefully insulated, should be cut squarely in two, as shown, and mounted in a wooden frame to hold it upright. This type of core is so flexible that an end may be sprung to one side to facilitate insertion of the test coils. If the core is made of punchings it may be necessary to cut out a longer section and make a removable wedge which can be inserted to complete the magnetic circuit when accurate tests are being made.

After becoming familiar with operation and requirements an operator can readily test a large number of coils with considerable speed and sufficient accuracy for commercial purposes by this method.

THEORY OF OPERATION.

In order to understand more fully the operation of the apparatus described in the first two methods it will be necessary to touch lightly upon the theory involved.

It will be noticed that in each case the basic principle is that of the Wheatstone bridge, the operation of which with direct current is very familiar. If the ordinary bridge tests were applied to coils a difference in only the ohmic resistance could be detected, but this difference might be due to difference in number of turns, variations in diameter of wire or short-circuited turns. When a low-frequency alternating current is substituted for the direct current previously used the conditions are not appreciably altered. The inductance would, of course, enter into the measurement, causing the impedance which is now being measured to vary slightly from the ohmic resistance previously obtained, but as the frequency is low the reactance is low and hence the difference slight. As the frequency is increased to a very high value the reactance, which is expressed by the familiar formula $2\pi fL$, rapidly increases until its value becomes exceedingly large as compared with the ohmic resistance. Under these conditions the relations previously described are directly reversed and the impedance is now approximately equal to the reactance, and the ohmic resistance component may be ignored. Hence the factors due to variation in size of wire and other things affecting the ohmic resistance no longer are taken into consideration in the reading which is obtained, but the comparison is affected practically only by changes in the inductance of the coils.

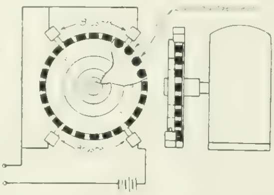


Fig. 4—Details of High-Frequency Interruption.

The inductance is affected inversely as the number of short-circuited turns in the coil, and since, as stated above, the inductive reactance is practically the same as the impedance at the high frequency used it is readily seen that the tests in question do actually compare the impedance of the coil under test with that of the standard coil and hence also the short-circuited turns of the coils.

In practice a frequency of from 800 cycles to 1000 cycles per second has been found sufficiently high for commercial work. This frequency, which should be uniform and steady, may be obtained by various types of apparatus, only one of which will be described in this article. This type is selected on account of its simplicity and cheapness.

SOURCE OF CURRENT

The high-frequency current which is used for the above tests may be obtained by means of an apparatus illustrated in Fig. 4. This arrangement, which is a device for interrupting current from a storage battery, consists of a small motor on the shaft of which is mounted a disk. The

periphery of the disk is slotted at regular intervals in such a manner that insulating segments may be inserted and held securely in place so as to interrupt the current each time the brushes bear upon them. The number of these insulating segments is such that a frequency of from 800 cycles to 1000 cycles per second is obtained when the motor is run at its normal speed. Three brushes connected in parallel are placed in the positions shown in the plate so as to make contact with the rim of the disk. The fourth brush is then placed so as to make contact with a solid slip-ring. Thus, when the plate revolves the three brushes connected in parallel complete the circuit with the battery every time a brass segment passes under them. The three brushes are used in parallel in order to reduce the sparking which is likely to occur. If necessary, a small transformer may be used in connection with this interruption device.

The above methods not only act as a test by which the impedance coils may be checked with that of a standard, but they also act as a test for "open circuits" and "crosses." The methods are not laboratory methods, but may be made strictly commercial, and by applying a little thought as to local conditions the results obtained by their use will be found very satisfactory as regards accuracy, efficiency and speed.

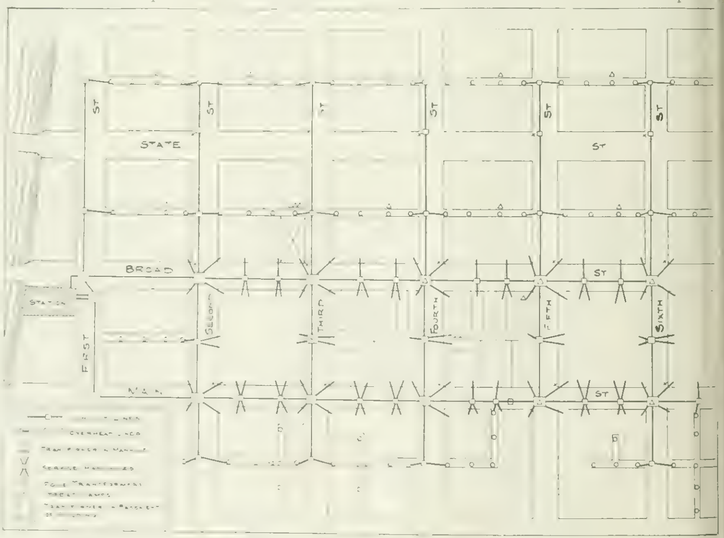
UNDERGROUND DISTRIBUTION IN MEDIUM-SIZED CITIES.

MR. H. B. GEAR, of the Commonwealth Edison Company, Chicago, presented valuable information on underground distribution in medium-sized cities at the recent Iowa Electrical Association convention at Davenport. He first pointed out that the public desire to have pole lines removed from important streets arises in some cases from the large amount of equipment carried on such lines, in other cases from the lack of care in keeping lines in neat condition, and in still other cases from the presence of pole lines of telephone and electric-light companies on the same streets so as to occupy all the available space and badly obstruct the landscape. He, therefore, called attention to some things which could be done to forestall agitation in favor of the removal of overhead lines on public streets. Heavily loaded pole lines can sometimes be avoided by routing feeders which are not required on a business street by way of side streets, leaving nothing in the important streets except the distributing wires actually required in that locality. After minimizing the number of lines, service drops should be maintained neatly and service wires to large consumers of 20 kw or over should be run down the pole in iron conduit to the basement. Only one service line should be installed for each building if it is possible to make one do the work. Where there are several tenants they should be required to bring their wiring to a common point. If the telephone and electric lines are on opposite sides of the street, an improvement in safety and appearance can be made by consolidating the pole lines, placing the electric-light equipment at the top of the pole and the telephone equipment below. Where the system of alleys is such that lines can be routed so as to keep them off the important streets this should be done. Carrying out the foregoing suggestions will often serve to postpone the agitation for underground construction for a number of years.

Mr. Gear then suggested the following three plans for combination overhead and underground or complete underground systems: (1) The removal of lines from streets to alleys with some sort of underground work where needed for street lighting or where the alley system is not continuous. (2) An underground system for the feeders and the principal parts of the primary mains, but with the transformers, secondary mains and service lines overhead in the alleys. (3) Alley construction not permissible and both primary and secondary distribution underground.

The illustration shows a section of city where all construction must be underground. There are continuous alleys on each side of State Street, thus permitting the transformers, secondaries and service wires to be overhead. The alleys could be used as through routes of overhead feeders going to residence territory beyond. If streets could not be crossed with overhead wires it would be necessary to extend the feeders through the Broad Street or Main Street conduit lines to the boundary of the underground district at Sixth Street, and take them overhead into the alleys at that point. The feeder supplying energy to the underground district would be extended along Broad Street with branches at Second, Fourth and Fifth Streets. This would permit the alley in each block to receive energy from the underground line at one end.

If there were no alleys, as between Broad and Main Streets, a complete underground system would be required. This would include transformers in the manholes at street corners with handholes and laterals at intermediate points



Map Showing Underground System.

in sufficient number to permit all buildings to be served without excessive lengths of sub-sidewalk or basement wiring. Where sidewalks are excavated out to the curb line it is usually possible to make one line serve for the building in which it enters and the building immediately adjoining. A possible arrangement of laterals and handholes is indicated for two of the blocks. The secondary system would become a network supplying energy for each street in the section by a transformer. Large cus-

tomers, that is, those requiring 50 kw or more, should preferably be served by transformers located in a fireproof vault under the sidewalk or in the basement of their building, as shown at the southeast corner of Fourth and Broad Streets. If the lines were overhead this would be done by hanging extra transformer equipment in the rear, as shown at the northwest corner of Third and Broad Streets.

If motor service is given from the ordinary system for elevator service or other purposes which require installations of 10 kw and upward, space must be provided in a separate manhole or in the basement of the building for the motor-service transformers. If motor service is supplied by 500-volt direct current, extra ducts and service laterals must be provided for the circuits. If the street-lighting service is operated on a series circuit provision must be made for extra laterals running to lamp-posts. These laterals may extend from the alley out to the street corner in some cases, as shown at Third and State and Fifth and State Streets.

The number of ducts required in the main lines will be determined, of course, by the number of different kinds of service lines and the number of feeders of each kind. In building conduit lines from 50 per cent to 100 per cent reserve should be allowed in the main conduit, as the extra expense of spare ducts while the conduit is being laid is small compared with the expense of laying additional ducts later on as may be required. In general, if two ducts are to be occupied from the start at least four ducts should be laid, and if four ducts are to be occupied six or nine should be laid. Where more than one duct line is laid part of the through line should be routed in each, and the separation of important circuits should be carried out as far as possible.

UNIT COSTS.

As to the expense of installation, general values cannot be given, but there are some unit costs which are fairly standard.

Four-duct or six-duct conduit lines can be built for about 25 cents per duct-foot, or $1 per running foot for a four-duct line and $1.50 per running foot for a six-duct line. A nine-duct line would cost somewhat less than this per duct.

Service handholes can be built at from $35 to $45 each. Intersection manholes, which must be big enough for transformer or junction boxes, will cost from $125 to $200 each. Iron-pipe laterals from handholes to buildings cost, complete, about 40 cents per running foot.

In the particular case illustrated the investment required to serve a load of 600 kw in the twenty blocks from an all-overhead system in the alleys (assuming the alley system to be general) have been estimated to be approximately $10,000.

With the feeders and principal mains underground and the transformer and service distribution lines overhead the total investment would be approximately $24,000, of which about $16,000 would be the cost of underground equipment.

If the entire supply system were underground, no overhead lines being permitted, the investment would be $50,000.

These figures do not include any street-lighting service lines or separate motor circuits. The investment per kilowatt with overhead lines would amount to $16.66. With the principal mains underground and transformers and service lines overhead the investment would be $30 per kilowatt. With an entirely underground system the investment would be approximately $83.33 per kilowatt. Thus an all-underground system is about five times as expensive as an all-overhead system.

The superintendent whose experience is confined to operating overhead lines is fearful of the difficulty of maintaining underground circuits. The introduction of reliable disconnection switches during the last few years permits cable branches to be readily cut off so as to leave only a small section out of service while repairs are being made. Cable terminals on poles may end at a disconnecting pothead, which may be opened, leaving the cable dead while other parts of the circuit are fed with energy from another point during repairs. With underground circuits equipped in this manner it is possible to remedy trouble promptly without seriously interfering with the service of any considerable portion of the city.

The experience of the author for five years with cable properly installed and equipped with suitable terminals where they connect to overhead lines, he said, showed the underground system to be more reliable than an overhead system. The author remarked that a system by which the main lines are placed underground and the distributing lines and transformers are kept above ground is the cheapest solution of the problem of removing lines from public streets where the arrangement of alleys permits this to be done. Where the load is such that transformers of more than 50 kw are required in each manhole the difficulty of securing the necessary space increases and it is usually necessary to adopt some form of low-tension distribution after the density of the load reaches this point. Such distribution is more expensive than a system employing transformers near the load, and is adopted only where loads become so large that sufficient space cannot be secured in the streets for the necessary transformer equipments.

In answering a question as to the position of electric-light and telephone wires on combination-pole lines, Mr. Gear said that the lighting wires should always be placed on top, for reasons of safety, as a No. 6 electric-light wire is much less likely to break than is a telephone wire. There is a distance of 5 ft. between electric-light and telephone lines. Answering a question as to the relative merits of tile and cement pipes for conduits, he said that his company uses both. The cement pipe is of longer length, which is an advantage in one way, but makes handling more difficult. Cement pipe requires ninety days' seasoning to be strong enough for laying. The company uses considerable single-tile duct conduit, mainly for the reason that it gives more tile wall between 9000-volt cables than does multiple-duct tile. Steel-clad cable buried directly in the ground in parkways and lawns makes good construction where it can easily be dug up, but is not good in paved streets.

As to lightning protection at junctions of overhead and underground lines Mr. Gear's practice is to place arresters at the pole adjacent to the cable pole. Statistics in Chicago show that the company loses 0.5 per cent of its transformers per year by lightning. According to this it could be figured out mathematically that it would pay to put in one lightning arrester at each 50-kw transformer or for every group aggregating 50 kw provided the arresters could be located so as to protect the entire group. As smaller transformers are too much scattered to make this plan feasible, the problem is not easy to solve for the small transformers. His company's practice has been to place arresters from 2000 ft. to 1500 ft. apart. On the other hand, those who have investigated the theory and behavior of lightning show that it will travel only a short distance along a pole line.

He considered it inevitable that a certain number of lightning arresters should be destroyed because the building of one arrester which would take care of all kinds of lightning discharges would be equivalent to putting a safety valve on a 1-hp boiler which would be good for a 200-hp boiler. If it were large enough to take the largest discharges, it would create too much disturbance on taking a small discharge.

In answering a question as to the kind of ground connection used in Chicago, Mr. Gear stated this to be a length

of 0.5-in. galvanized-iron pipe, with a cap of malleable iron to serve the double purpose of making the wire connection and protecting the end of the pipe while it is being driven.

SELF-IGNITING OIL ENGINES IN LIGHTING PLANT AT CLEBURNE, TEX.

On Jan. 19, 1911, the new electric generating station of the Cleburne (Tex.) Gas & Electric Company was started up, and since then this plant, with two 225-hp Diesel engine-driven sets, has been in almost continuous operation, carrying the local commercial and street-lighting and railway load and regularly sustaining during the peak periods overloads of 10 per cent and more. The Cleburne company is controlled by the same interests which operate the highly successful and efficient Diesel-engine-driven station at Sherman, Tex., and as a result of the fuel saving and satisfactory operation of this earlier installation a similar but improved type of self-igniting oil engine has been used in the new plant. During the construction of the Cleburne station 6 miles of electric street railway were completed and put into operation in the town, absorbing the power reserve intended to be maintained and necessitating in the immediate future the addition of the third oil-engine unit for which the station is designed.

The fuel used at Cleburne is crude Texas petroleum, which has been previously desulphurized. This oil contains about 18,000 heat units per pound, and in the storage tanks at the plant costs $1.20 per barrel, each barrel containing 42 gal. This fuel is stored in two 9000-gal. tanks buried in pits outside the plant and suitably ventilated for the release of the gases formed during warm weather.

Perhaps no more striking illustration could be given of the small fuel consumption of these engines than the means provided for supplying them with their fuel oil. From the outside storage tanks the oil is pumped by hand into the pair of small 38-gal. steel tanks arranged with level gages, as shown in Fig. 1. During each twelve-hour shift these tanks must be filled several times by means of the small crank-driven centrifugal pump. About 250 gal. of oil is now being used daily, requiring that the tanks

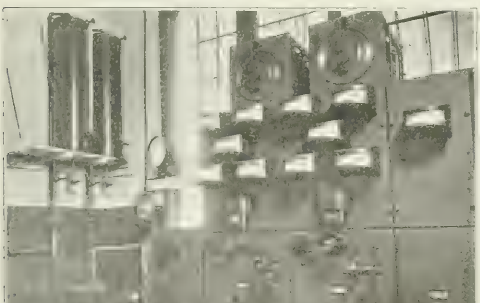


Fig. 1—Fuel-Oil Tank and Switchboard in Cleburne Station

be pumped up at least twice each shift. This arrangement of fuel supply requires the minimum quantity of oil inside the station and keeps the immediate supply under the close supervision of the engineer. The small quantity of fuel taken by these engines is more graphically expressed by the estimate that each unit requires about a teaspoonful of oil per stroke.

Each engine is supplied from its corresponding tank, shown in Fig. 1, provision being made for a third tank for the additional unit. Arrangements are also being made for

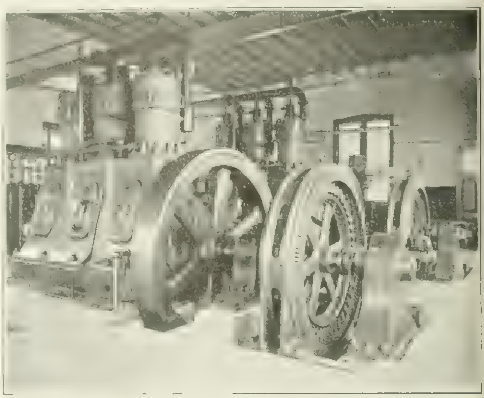


Fig. 2—Interior of Diesel Engine Lighting Plant at Cleburne.

feeding any or all of the engines from any tank by manipulating the proper valves.

The engines, which are shown in Figs. 2 and 3, have three 16-in. x 24-in. vertical cylinders, each engine being direct-connected to drive at 164 r.p.m. a 187-kw, 2300-volt, 60-cycle, three-phase General Electric alternator. On each shaft between the engine and generator is mounted a 14,000-lb., 8-ft. flywheel to assist the regulation of the shaft's angular rotation.

The Cleburne engines are unusual among Diesel installations in having their air compressors direct-driven from the main engine shaft by means of flexible couplings. These couplings, each of which transmits about 20 hp, comprise pairs of intermeshing quills, the fingers of which are linked together by piles of belt-leather links having eyes cut in each end. The compressors, which supply air at pressures up to 75 atmospheres, or about 1125 lb. per square inch, for use in feeding the fuel oil and for starting the engines from rest, are of the Ingersoll-Rand three-stage type, with cylinders respectively 8 in., 5 in. and 2⅜ in. in diameter and 8 in. in stroke. They are capable of compressing about 25 cu. ft. of free air per minute to the pressure named. Between each successive compression the air is cooled by circulating water.

Storage for the compressed air at these high pressures is provided by six drawn-steel tanks or "bottles" with which each engine is equipped. Two of these bottles normally "float" on the compressed-air line feeding oil into the engine cylinders, while the others are held in reserve as storage tanks for starting the engines.

Preliminary to starting a mark on the flywheel of the engine must be brought opposite to a steel pointer on the frame. Only one cylinder of each engine is equipped for compressed-air starting duty on account of the several additional parts required which complicate the construction. Either engine will start easily on about one-third of the compressed air reserved for it, and in case of exhaustion of its own supply the reservoir of the other unit can be drawn upon by opening cross-connecting valves. If all the compressed air in the station should be lost one of the compressors might be separately driven to restore the charge or a flask of carbon dioxide from a bottling works near the Cleburne plant could be pressed into service. With an assistant the engineer of the station declares that

he can put a unit into service in less than thirty seconds.

The exhaust from the engine ports, at about 35 lb. back pressure and 750 deg. Fahr., is led through a 14-in. pipe and down into a 6-ft. x 24-in. cylindrical tank outside the building. From this a 12-in. outlet pipe rises 6 ft. above the

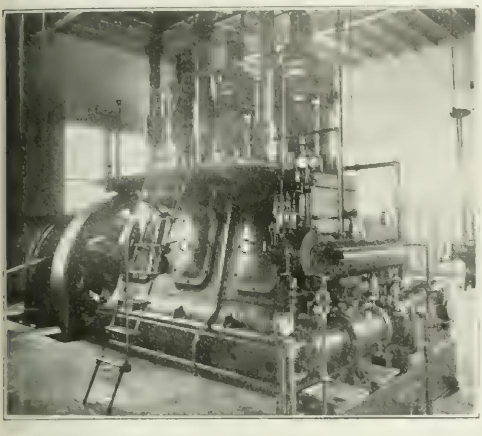


Fig. 3—225-hp Diesel Unit, Showing Valve Mechanism, Direct-Connected Compressor, etc.

roof of the building opening to the atmosphere. The installation is practically noiseless when in operation. The engine cylinders are cooled by circulating water at about 100 deg. Fahr., obtained from a source near the station, where it has already been employed to do useful cooling work before entering the Diesel cylinder jackets.

For supplying the 550-volt direct current for the 6 miles of local trolley line on which three cars are now operated a 100-kw, self-starting synchronous motor-generator set is installed in the station. A constant-current transformer also supplies in suitable form the energy for fifty-six 6.6-amp series inclosed-arc lamps. The black-slate General Electric switchboard is fully provided with panels, switches and meters for the various machines and outgoing lines, and is equipped with a Tirrill regulator which holds the lighting pressure very nearly uniform in spite of the peaks of trolley demand.

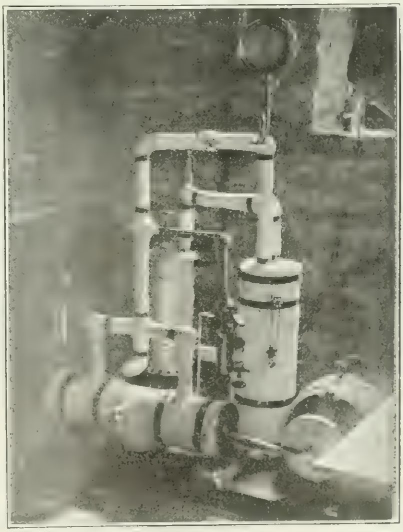
At the present time the Cleburne plant is producing about 9 kw-hours per gallon of fuel oil. On a recent date when the station output was 2030 kw-hours 236 gal. of oil were required, and again with an output of 2290 kw-hours 251 gal. of oil were consumed. The load conditions under which these results were obtained are characteristic of a small plant carrying mixed railway and lighting load. The plant load is less than one-quarter during six hours, half-rating during twelve hours, rising to full load the remainder of the time, during about three hours of which it reaches 10 per cent overload. This overload is regularly carried by the internal-combustion engines without difficulty. In fact, 25 per cent overload has been carried by the station for fifteen minutes at a time, but during a recent unexpected peak of demand when the load reached 150 per cent the operation of the plant was interrupted for two or three minutes until service could be restored by starting up the engines again. The present overload conditions will be relieved and a suitable margin of reserve capacity restored as soon as the third unit can be installed.

The Cleburne Electric & Gas Company, which operates this station, has 1000 local lighting customers and about 275 hp connected load in motors, besides its railway service. The company is controlled by the Dallas Security Company, of Dallas, of which Mr. R. B. Stichter is general manager. Mr. Thomas Cook is local superintendent at Cleburne and Mr. C. G. Campbell is chief engineer.

CYLINDER AND BEARING LUBRICATION TESTS.

For the purpose of determining the friction and lubrication obtained in bearings and steam cylinders under various conditions of speed, temperature, pressure, design, fit, etc., Prof. E. A. Flowers, of the electrical department of the University of Missouri, has conducted a number of tests at the university experiment station, reproducing so far as possible the actual conditions of bearing and cylinder lubrication.

The bearing test was made on an oil-ring bearing, specially mounted, the shaft being driven by a small electric motor. Measuring the power taken by this motor and subtracting its own losses enabled the power absorbed in the bearings to be computed. With the bearing tested it was found that one oil-ring worked not so well as two, in spite of manufacturers' advice against adding the second ring, predicting interference troubles. This second ring improved the lubrication when the two rings were kinked or bent out of flat planes, so as to keep free of each other. Long runs made with a given lubricant showed that in a mechanical sense there is no "wearing out" of oil due to use, even when a great deal of metal has been worn away. Of course, the oil may gum, due to a chemical change, but when freed of this material, together with the dirt, etc., the remaining liquid has precisely the same lubrication constants as ever. At the recent convention of the Missouri Electrical Association Professor Flowers also pointed out that in the average bearing most of the wear occurs during the periods of starting, before the oiling devices, rings or other means have brought up sufficient lubrication. This is best illustrated by comparison of the wear in the case of machines frequently stopped and started, and others, like turbines, which run almost continuously under adequate lubrication and show tool marks after long operation. The friction in a bearing is that of the lubricant itself, and is entirely independent of the material of the surfaces, which do not make contact in a properly oiled bearing. For friction-reduction purposes the special bearing materials used in bearings are actually thus available only during the starting periods, although, of course, there are many other considerations requiring the use of such material.



Apparatus for Measuring Steam-Cylinder Piston Friction.

For testing the lubrication of steam cylinders under

actual conditions Professor Flowers arranged the motor-driven piston apparatus illustrated. A tandem pair of pistons, linked by a connecting rod, is provided to be reciprocated in the long cylinder shown. The steam, oiled by engine-type lubricators, is admitted to the intermediate space between the two pistons through the lagged pipes shown, the condensation being withdrawn from the cylinder by a drain and tap below. As the pressure in the cylinder is exerted oppositely on both pistons it has no tendency to produce motion, the pistons being crank-driven by the motor. The input of this motor, after subtracting its losses, besides other minor corrections, is taken to be the friction loss of the apparatus. Tests were made under various temperatures, pressures and piston conditions, and the results obtained, although somewhat surprising, were definitely reproducible time after time. For example, keeping the cylinder contents at atmospheric pressure, it was found that the piston friction varied inversely with the increase of temperature, doubtless due to the decreasing viscosity of the oil at the higher temperatures. But on raising both temperature and pressure above the atmospheric boiling point, 212 deg. Fahr., the friction was found to increase with the increased pressure and temperature up to a steam pressure of 20 lb. per square inch, beyond which the experiments have not yet been completed. The experiments were also varied by using different piston speeds, piston-ring pressures, etc.

In discussing his experiments, which are considered to be only fairly begun, Professor Flowers described the qualifications of proper lubricants for different uses, and outlined their general purpose to reduce wear, temperature rise and energy losses between moving surfaces. Friction, he remarked, is an inverse function of the viscosity of an oil, and, although different oils have different viscosities at ordinary temperatures, they all reach approximately the same viscosity at a temperature above 600 deg. The increase of piston friction with rise in pressure, overbalancing the expected tendency to decrease due to the accompanying temperature rise, suggests that possibly unexpected friction losses may take place in high-pressure cylinders, as was pointed out in the discussion of Professor Flowers' paper. Mr. W. W. Humphrey, of St. Louis, remarked that in some tests undertaken to find the effect of a flow of current through a lubricated bearing on the friction of the bearing it seemed impossible to formulate any definite law connecting the friction with the current strength.

ICE-PLANT DISCUSSION AT IOWA CONVENTION.

Mr. G. W. Dumont, of Omaha, Neb., read a paper entitled "Refrigerating Advantages and Disadvantages" at the recent Iowa electrical convention at Davenport. He treated the subject under two heads: First, the installation of an ice-making plant in connection with the central station, and, second, the supply of electric power for refrigerating machines owned by various consumers.

Speaking of central-station ice-making plants for small towns with plants of a daily capacity of from 3 tons to 10 tons, he said it was generally better to use electric motors than to install a separate engine to drive the compressor for the ice plant. As to the electrical energy required for driving ice plants he referred to the figure of 68 kw-hours per ton of ice, said to have come from the Commonwealth Edison Company of Chicago. He declared this excessive and said that 48 kw-hours per ton of ice made was an ample allowance. At Norfolk, Neb., a plant is being operated on 32 kw-hours per ton, and a plant has recently been contracted for at Shenandoah, Ia., in connection with which there is a manufacturer's guarantee of 37.5 kw-hours per ton.

The ice made can either be sold to an ice dealer or retailed direct by the company. He favored the latter course as giving the company better control of the market.

Taking up refrigerating machines for consumers, the field for these was among meat markets, ice-cream factories, produce dealers, etc. He criticised severely the lack of readiness of some central-station men to quote rates on this kind of business. He told of some experiences of his where he had the contract almost closed for an ice machine, and went with the customer to the electric-light company's office to get the company's rate. No one seemed to be ready to give the rate and they were referred from one clerk to another until finally they were told they would have to wait until Mr. So and So came back, as he handled all the motor business. He urged central-station men to get their rates printed so that they can be quoted on application by any employee. In answer to a question as to what rates would be satisfactory for this class of business he said that any rate not over 4 cents per kw-hour would be satisfactory. The point he wanted to make was that the central station must have something definite to offer when asked for rates rather than leave the whole matter indefinite and thereby lose the business. As to the competition between natural and artificial ice he said that the demand is undoubtedly for artificial ice, consumers apparently holding it to be superior to the natural product.

Mr. Austin Burt, of Waterloo, in discussing this paper, emphasized the importance of contracts for off-peak loads. At Waterloo, where many such contracts have been taken, it is provided in the contract that the consumer will when requested shut off his motors during specified peak-load hours. If he does not do this the company has the right to cancel the contract. The company makes use of this option only in case its usual reserve capacity is insufficient to carry the peak loads, because of one generating unit being shut down for repairs or for some other reason.

Mr. R. E. Lee, of Clarinda, Ia., did not agree with Mr. Dumont that the motor-driven compressor was better than the engine-driven. His principal objection to motor drive seemed to be the lack of flexibility in speed control of the compressor. He also objected to taking up the capacity of the electric plant with motor drive for the ice machines. His company has two engine-driven ice-machine compressors, careful consideration having been given to motor drive before the installation of each. He finds it desirable to vary the speed of the ice machines from day to day and hour to hour. The cost of ice manufacture depends on the output of the plant. One year when his plant ran its full capacity the cost was $1.56 per ton; another year, when less ice was made, the cost went up nearly to $2 per ton.

Mr. Dumont called attention to the fact that Mr. Lee's conditions at Clarinda are rather unusual in that he has so large a day load that the capacity of the electric plant could not be spared for motor-driven ice machines. His remarks as to motor drive being better for small plants, he said, applied to those having but little day load, which is a condition usually met.

FURNACE DESIGN FOR NATURAL-GAS COMBUSTION.

An unusual arrangement and number of burners has been employed in the case of two 1016-hp batteries of boilers recently installed in the plant of the Oklahoma City Gas & Electric Company. Under each 508-hp unit twenty-nine burners are used, supplied from two sets of gas headers. The burners are set roughly parallel with the slant of the boiler tubes, giving their flames a huge sweep against the rear wall before curving back and traversing the three boiler passes. The brick checkerwork construction which is commonly used with gas-burning furnaces has been replaced by a double row of brick piers, having

...he diagonals set parallel to the furnace walls. The ...er flame is thoroughly broken up in passing through ...around these piers, which are expected to stand up ...r than the usual checkerwork construction. Each of the twenty-nine burners used is rated at 2 hp under 4-oz. ...pressure, and with 8-oz. pressure employed will prob... average 50 hp per burner, enabling the 508-hp boil... to be operated at considerable overload when desired.

...E COOPER'S CREEK TOWERS OF THE PUBLIC ...ERVICE ELECTRIC COMPANY, CAMDEN, N. J.

By R. D. Coombs.

...e Public Service Electric Company's power house at C...den, N. J., is situated near Cooper's Creek. All the el...tric circuits originally crossed the creek in submarine ...es, but owing to the shallow channel it was found that th... river traffic interfered with the continuous service of th... cables. In addition, since the number of circuits is ...tively very large, the original arrester houses at the ...k became inadequate for the heavy service.

...he general experience of transmission-line construction is ...hat aerial lines are much less expensive in first cost ...n underground lines and in many instances more ...nomical in maintenance. This fact was further em...sized by the local conditions, and it was decided to ...lace the submarine cables by aerial wires, particularly th... high-tension transmission circuits.

...n the neighborhood of the crossing the ground is a low-ly...g, tidal swamp, with the surface of the ground at ap-p...ximately high-water level. It was therefore necessary t... use pile foundations under the towers, but it was possi-b... to reduce the depth of the concrete base by allowing

Span Over Cooper's Creek, Camden, N. J.

...e cut-off of the piles to be only 3½ ft. below the ground ...vel.

In the case of the south tower, the position of a city ...reet, although for some years to come only a paper ...reet, brought that foundation near the bank of the creek. ...ith the possibility of governmental improvement of the ...aterway it was thought advisable to protect the founda-...on by a pile bulkhead. This bulkhead is not visible in the ...otograph, as its top is at the ground level. As a measure ... economy the foundations for two future towers were ...ilt during the present construction, the anchor bolts set ...d incased to protect the projecting parts from corrosion.

Cooper's Creek is a navigable stream entering the Delaware River, and jurisdiction over crossings lies with the United States War Department, whose requirement was a minimum overhead clearance of 130 ft. above high water. The calculated clear height of the bottom wire of the proposed installation during its maximum summer sag is 135 ft. above high water, the total height of the towers being 156 ft. above the foundations. With the exception of the Hackensack River towers, designed by the writer and described in the *Electrical World*, Dec. 14, 1907, this is understood to be the highest transmission crossing in this country.

The crossing span is 270 ft. and the next adjoining spans 150 ft., the wires rising abruptly from the heavy double poles of the wooden-pole line to the steel towers. A few years ago this arrangement would have been considered a rather radical departure from the usual methods and, in fact, there are to-day only a few examples of this construction. The improvement in recent years in the class of insulators available has made the abrupt rise of a line of wires entirely practicable. Its advantages are obvious, when the relatively short wooden poles adjoining the towers are noted.

The total wire-carrrying capacity of the towers is 36,250,000 circ. mil hard-drawn stranded, copper cables, arranged with one three-phase circuit on each end of each cross-arm, or a total of six wires per arm. In order to provide an adequate separation of phases of the 13,000-volt line wires, the horizontal and vertical spacing between wires was made 3 ft. This spacing, in conjunction with the sag at which the wires were strung will, it is assumed, prevent swinging into contact. As all wires are of the same size and strung at the same sag, the general tendency toward synchronous movement should prevent contact between adjacent wires.

The attachment of the wires to the towers and to the next adjoining wooden bents was made by means of a dead-ending device using strain insulators and specially arranged clamps. All the connecting bolts and rods of the clamping devices are doubly galvanized as a protection against corrosion, the parts in contact with the copper wires being either of bronze or provided with copper bushings. The insulators have a guaranteed mechanical tension of 2.6 times the maximum tension in the wires, and a wet flash-over test in the inclined position of three times the line voltage. In the design the wires were assumed to be loaded with a uniform coating of sleet ½ in. thick and to be then subjected to the wind pressure resulting from a gale of 70 miles per hour. Under these circumstances the wires have a stress of only one-half their breaking strength. It is, therefore, practically impossible for any wire to break mechanically unless it contains a faulty splice or an injured spot. As new wire was used throughout this portion of the line and strung with care, using snatch blocks to prevent chafing the strands, it is not considered probable that any flaws exist. In erecting the towers the material was delivered near the site by lighter and the individual members erected by a gin pole carried upward on the structure. Although the work was done during the winter months and in a swamp, only nine days were required to erect each tower. The construction of the wooden-pole line and the line work was done by the

Public Service Electric Company; the crossing was designed by the writer as consulting engineer; the towers and foundations were built by Fitzpatrick & Coombs, Inc., of New York, and the entire project was under the supervision of Mr. Farley Osgood, general superintendent of the Public Service Electric Company.

ARRANGEMENT OF WATERWHEEL GOVERNOR TO GIVE HIGH EFFICIENCIES UNDER REDUCED LOADS AND WATER SUPPLY.

When the water supply of a hydroelectric power plant is running at its lowest, and is hence most needed, a very low efficiency of utilization will be the result if an attempt is made to operate the full waterwheel equipment at half gate or less under light loads. The waterwheel and governor equipment should be so designed and installed that when such conditions obtain part of the unit can be shut off and the remainder run at nearly full gate and at relatively high hydraulic efficiency with the water that is available.

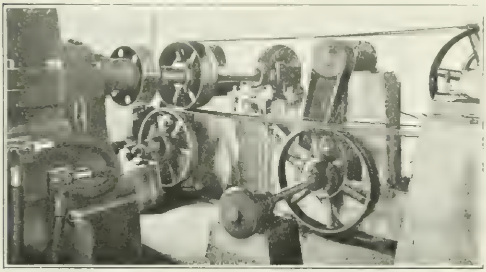


Fig. 1—Cable Sheave Wheel and Gate Mechanism of Park Rapids Plant.

The electric plant at Park Rapids, Minn., of which Mr. L. H. Rice is owner, employs an ingenious governor and waterwheel arrangement by which a single governor can be applied to control any part of the equipment that is in service.

The waterwheel apparatus comprises one 200-hp twin 24-in. S. Morgan Smith turbine, with two gate shafts, and one 250-hp twin 30-in. runner turbine of the same manufacture, with one gate shaft. These are direct-connected to two 220-volt Fort Wayne direct-current generators of corresponding ratings.

A countershaft is mounted midway between the two generator shafts, its pulley being arranged for belt drive from the wheel shaft of either unit. A second pulley on this countershaft drives a Woodward type "C" mechanical governor. The gate-control mechanism of this governor operates a steel cable which is carried to and given a few turns around each of the sheave wheels which control the wheel gates through pinions and sectors, each sector being keyed to its respective gate shaft. As above noted, the 250-hp double-runner wheel has one gate shaft and the 200-hp double-runner wheel has two gate shafts, all three being manipulated, if desired, from the control cable connected to the governor shaft.

The sheaves are mounted on the countershafts carrying the pinions that operate the gates and can be thrown in and out by pin clutches, so that by removing its pin any sheave can be made loose from its shaft, allowing the cable to act without affecting its pinion and gate arm. Then, by means of a hand lever, this gate can be closed by hand, and locked, shutting the water off from this particular runner.

By the arrangement described, therefore, the governor can be driven from the shaft of either of the two waterwheel units, meanwhile, it being made to control, independently or simultaneously, any of the three waterwheel gate shafts, one on the larger unit and two on the smaller.

For example, with plenty of water available and a heavy load, the governor may be run from the shaft of either unit and arranged to control all three gate shafts. If the flow or load decreases so that it becomes desirable to operate only the smaller unit, the pin clutch on the larger single-gate shaft unit is disconnected and its gates closed by hand, leaving the cable wheel free upon its respective countershaft. Later, with such a diminished load or stream flow that the two runners of the double-gate shaft unit are running at less than half gate, and at very low hydraulic efficiency, the gates of one runner can be shut off and the other used to drive the generator. This is done by unclutching its respective cable wheel, as before, closing the gate by hand. At the same time an air valve is opened, admitting atmospheric pressure to the wheel casing shut down, clearing it of water, so that the idle wheel rotates in dead air. This leaves but one of the four runners actually in service, allowing the water that would otherwise be wasted in running the wheels at less than half gate to accumulate in the pondage provided and be used later on to carry them safely over their peak loads. The loss in mechanical efficiency due to rotating the one idle runner in air is greatly overbalanced by the gain in hydraulic efficiency running the wheels at above half gate. The newer types of waterwheels, built for high speeds and increased capacities, show low hydraulic efficiency when the gates are closed below the half-water openings.

On the other hand, if it is desired to shut down the two-gate unit, the governor-driving belt has only to be transferred from this wheel shaft to the other, and the corresponding cable wheels clutched, as before described.

The 220-volt direct-current energy developed by the plant just described is used for lighting Park Rapids, for pumping the city water, and also to operate the flour mill and elevators belonging to Mr. Rice. The 17-ft. head is obtained from an old timber dam, the water entering the wheel chambers through a new, reinforced-concrete flume 60 ft. long by 16 ft. wide. The wheels are protected by steel trash racks and modern head-gate hoists. The powerhouse building is constructed of concrete blocks. This complete plant, including the governing features described, was designed and its construction supervised by Messrs. A. L. Bogart and J. W. Shuman, of the Power Engineering Company, hydroelectric and hydraulic engineers, Minneapolis, Minn.

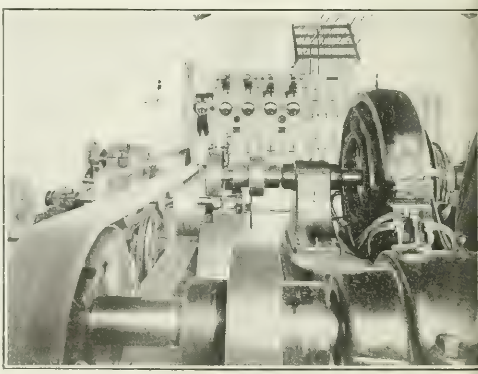


Fig. 2—Interior of Station, Showing Governor Belts and Gate-Controlling Cables.

UCCESSFUL OPERATION OF A SMALL TEXAS LIGNITE PLANT.

The Blooming Grove (Tex.) Ice & Electric Company s had a 60-hp lignite producer-engine plant in operation ring the last two years. The early experiences with this nite equipment were quite disappointing, and for a time e local plant was almost admittedly a failure, minor misljustments or broken parts resulting in refusals to start run, the causes of which were often apparently undiserable. About this time the plant ownership changed, d with it men of good mechanical experience, though w to producer-plant operation, were placed in charge the equipment. For a time the difficulties with the plant ntinued, but persistency in application soon mastered the tails of successful producer operation, and for the last months this lignite plant has been working to the ene satisfaction of its owners and operators. Mr. J. A. allace, local manager, now expresses himself as well eased with the lignite producer, declaring that in his own stance it makes possible electric-lighting service in a mmunity too small to support an electric plant using y other kind of prime mover.

Blooming Grove is a town of about 1000 population, a w miles west of Corsicana. Night electric lighting serve for 100 customers and the town water supply are furshed by the producer engine, the water-works pumps ing run during the night hours after the evening peak s been passed.

The plant equipment comprises a 60-hp Smith gas producer, providing fuel gas for a vertical, double 12-in. x -in. cylinder Rathburn-Jones engine running at 290 r.p.m. 35-kw, 2200-volt, 60-cycle, single-phase Allis-Chalmers ternator is belted to the engine flywheel, and from clutchiven extensions of the engine shaft the air-lift compresr and high-duty water pumps are driven.

Lignite from the Beargrass (Tex.) field has been used the producer. This fuel costs about $1 a ton at the ine and $2.10 a ton laid down at the plant when conacted for in quantities. In future Malacoff lignite from nearer and newly developed field is to be used at Bloomg Grove, costing $1.40 per ton laid down. The plant reires about 1500 lb. of lignite per twelve to fourteen-hour ight's run and about twenty carloads are used per year. uring four to five months of the summer the plant is un twenty-four hours per day for supplying fan service uring the daytime.

The producer-plant outfit is started up by means of an uxiliary 5-hp gasoline engine belted to a compressor and fan blower. The compressor pumps air into a tank for tarting the producer engine as a compressed-air engine, hile the blower creates an auxiliary draft through the roducer bed of coals, delivering fuel gas to the enginepply pipe, so that a rich supply fuel is available for the engine on starting. After the prime-mover engine has been tarted up the blower-engine valves are closed and the roducer engine, which is of the suction type, creates its wn draft. The lignite is charged from a platform 10 ft. bove the floor level, the fuel supply being replenished at o p. m. and 4 a. m. during each night's operation. The shes produced drop into the water seal which incloses the ase of the producer and are raked out by means of a pecial hoe-like utensil. The clinker, which, as a result of he high temperature, collects in the center of the fuel bed, s removed by a hook tool at approximately the same interals as the fuel is charged. From the producer the gas asses through the scrubbers, where it is cleaned, and is hence led to the engine. The steam required by the producer is generated in a superheater installed in the exhaust ine of the engine, saving fuel and utilizing the waste heat. n general, the plant is operated from 5 p. m. to 7 a. m. laily during the winter months, while in the heated sumner season service is supplied twenty-four hours per day for the benefit of fan patrons. The 2200-volt, 60-cycle, single-phase alternator has a full-load capacity of 17 amp, but during its nightly operation carries an average load of 4 amp. The plant can be started up in from twenty to twenty-five minutes or less, with the producer banked, as it is normally maintained during the daytime.

In addition to the electrical load an extension on the engine shaft drives a clutch through which a belted 30-hp Ingersoll-Rand air compressor and a 5¾-in. x 6-in. high-duty water pump are operated. The air compressor delivers air at 70 lb. to 95 lb. pressure to lift 20,000 gal. of water per twenty-four hours out of the wells which supply the town, while the high-duty pump raises this water to a tank 100 ft. above the ground. The water-pumping equipment is not loaded onto the engine until the peak of the lighting load has passed. Beginning at 9 p. m. or 10 p. m. the pumps are run the remainder of the night if needed. Nearly one-half of the total quantity of water pumped is required for cooling and scrubbing purposes in the producer plant itself.

The Blooming Grove combination plant supplies service to about 100 electric and 100 water consumers in its little town of 1000 population. The income from the electrical customers, who are largely on a flat-rate basis, is about $400 per month. The cost of the combination plant was $25,000, of which $7,000 was due to the producer and engine. Mr. W. H. Jones is engineer of the Blooming Grove Ice & Electric Company and Mr. J. A. Wallace is general manager.

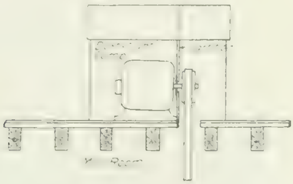
AN ELECTRICAL METHOD OF PRODUCING AND EVIDENCING RIPPLES.

The *Physical Review* for March publishes an interesting short article by Mr. A. H. Pfund on a new method of producing ripples, which is so simple that it deserves to be widely recognized. It is not a very difficult thing to produce ripples on the surface of a basin of water. We all know that ripples can be set up on such a surface in various ways, such as by rhythmic impacts, vibrations or mechanical disturbances. But when the ripples have been set up they move so fast that it is hard to observe them closely. Consequently, the experimental difficulty is not to produce ripples, but to produce ripples that can be readily submitted to careful observation. In the case considered the basin of water is a flat dish of hard rubber. At the center of the water surface a thin copper wire dips down so as just to touch the surface. A good contact with the water is made by a deeply dipping wire near the edge of the dish. The two wires are taken to the high-tension side of a 2000-volt to 110-volt transformer, through a small helium vacuum tube. The low-tension side of the transformer is excited from 110-volt, 60-cycle mains through a 32-cp carbon filament lamp. The result of this arrangement is that the central wire is electrified to about 2800 volts, + or —, 120 times per second, and the electrostatic force thereby exerted on the water sets up a ripple stream emanating radially from the wire. These ripples run out with the usual high velocity and would be hard to observe closely but that they are illuminated by the light of the helium lamp in the secondary circuit. This light is flickering with twice the frequency of the alternating-current supply, so that the ripples appear stationary to the eye. With the aid of a condensing lens the helium-tube light can be made strong enough to make photographic pictures of these seemingly stationary ripples. The flickering of light emitted from alternating-current arc lamps is sometimes a source of annoyance to engineers, so that it is comforting to find occasional instances in which the flickering can be utilized. The above instance is, of course, not the only case of such utilization. Speed and frequency measurements can also be readily obtained from the flickering, as is well known.

LETTERS ON PRACTICAL SUBJECTS

INSTALLING MOTORS UNDER SEVERE DUST CONDITIONS.

In installing a number of motors in a stone grinding mill where fertilizer material is manufactured the writer was required to take unusual precautions in protecting the motors against the thick dust continually present. Even



Motor Protected from Dust.

using induction motors it was found to be out of the question to install the machines in the same rooms as the mills on account of the dust affecting the bearings and lubricating systems. The motors were therefore located in "doghouses" erected on the roofs of the buildings and from their pulleys belts were brought down to the machines to be driven. Each motor proper was entirely inclosed in its doghouse, a partition extending down between its frame and the overhanging pulley. The space between the partition and shaft was then closed by heavy felt wipers bearing on the shaft and rendering it impossible for any dust to enter the motor compartment. A year's experience with this inclosed construction has proved its practicability, and now in the same plant other machines are being similarly equipped.

Memphis, Tenn. Norris H. Cicero.

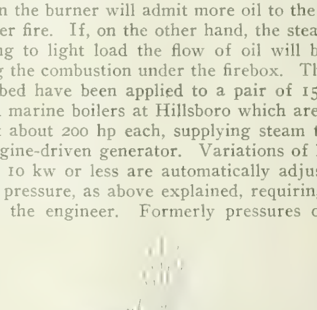
REINFORCING IN CONCRETE.

One should bear in mind when using or planning to use concrete for generator or engine foundations or to carry shafting or any other load that there is no use of reinforcing where the concrete is to carry a dead vertical load with only downward strain. Therefore, there is no need of reinforcing a generator foundation which has only to lie on the ground and carry the weight of the machine. Reinforcing must be applied to concrete only when that material is to be subjected to a pull, a bend or a shear. When the concrete foundation is built very tall it becomes a column and there is a strong tendency for the material to get away from the work by buckling sidewise. Here reinforcing will be necessary for the reason that as one side of the tall foundation bends outward it is subjected to tensile stress, therefore the need of some steel to carry that stress. Concrete can carry a certain amount of strain when applied as a pull, a bend or a shear, but the engineer does not take this strength into account when calculating concrete work. He takes no notice whatever of whatever tensile or other strength there may be in concrete except that of compression. What strength there may be is permitted to augment the factor of safety and the engineer puts in the full amount of steel necessary to carry the calculated load—and then he puts in from five to ten times as much more as a factor of safety. Foundations, as a general rule, require no reinforcing except when it is necessary to bridge over soft spots in the earth or where it is found cheaper to secure adequate footings by light reinforced concrete instead of heavy masses stepped back to the load line. Tall foundations or posts and all column work require bars or hoops encircling them horizontally, as well as leng wise with the stress, for the reason that the stress tends split the posts and the vertical reinforcing will not sa them unless they are laterally reinforced. But, in a instance, the reinforcing must carry all the stresses no above except that of compression.

Scranton, Pa. John Scott

AUTOMATIC REGULATING OIL BURNER FOR BOILERS.

The sketch herewith shows an improved oil burn which Mr. J. B. Baltimore, engineer of the Hillsboro (Te electric-light plant, has improvised from pipe fittings his two 150-hp boilers. The feature of this burner is inherent regulation, tending to admit an increased quant of oil to the flame in the event of a fall in steam pressu due to sudden loads. The construction of the burner best shown in the sketch, the flame tip being a piece 1-in. pipe flattened and notched as illustrated. Air is mitted to the line by a 1¼-in. pipe, while the steam and pipes are themselves ½ in. in diameter. The oil from fuel pump before being led to the burner is pas through a warming coil extending across the flue b When thus warmed to about 150 deg. the oil is found atomize more readily in the burner than if admitted co The oil pump, which is arranged with a by-pass, is set maintain the oil pressure at from 10 lb. to 20 lb. per squa inch, depending on the load. The steam is tapped from 130-lb. boiler header, being throttled down and admit to the burner at approximately the same pressure as oil, which it serves to atomize. Should the pressure di in the boiler due to an increased load, the decreased ste pressure in the burner will admit more oil to the flame, g ing a hotter fire. If, on the other hand, the steam pressu rises owing to light load the flow of oil will be arrest decreasing the combustion under the firebox. The oil bu ers described have been applied to a pair of 150-hp int nally fired marine boilers at Hillsboro which are commo worked at about 200 hp each, supplying steam to a 190- Corliss-engine-driven generator. Variations of load on station of 10 kw or less are automatically adjusted for the boiler pressure, as above explained, requiring no att tion from the engineer. Formerly pressures of from



Oil Burner for Boiler.

lb. to 60 lb. were required on the old-style burners, and valves had to be regulated closely in order to keep an e steam-pressure chart. Much of this labor is now avoi and the boilers are giving better service. The fuel use a crude Texas petroleum residue, the remainder after lighter oils have been removed by distillation. From lb. to 5.3 lb. of this oil are used per kw-hour produ without crediting the boilers for live steam taken by nearby steam laundry.

Dallas, Tex. Leslie Kunt

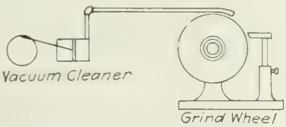
CEMENT DUST AND ELECTRICAL CONTACTS.

Too much stress cannot be laid upon the annoyance and trouble which concrete floors may cause when installed in rooms in which electrical contacts are broken and appreciable arcs are formed. After a few months' use, dust set free from these floors rises in the room and settles on the contacts. Here it lodges, and in the ensuing sparks is vitrified or converted into a virtual glass so hard that an emery wheel is required to free the contact points of their insulating coating. Trouble from this cause, while persistent and annoying, is often obscure, and the concrete floor is not charged with the responsibility for the difficulty. In rooms containing electrical-contact apparatus carrying low potentials it is quite important, therefore, that some dustless surfacing material be provided for the concrete floors now popular with builders.

Indianapolis, Ind. JAMES MARSH.

VACUUM CLEANER TO REMOVE GRINDING DUST.

A novel but effective use is made of a vacuum cleaner in the Erie, Pa., plant of the Burke Electric Company, where the suction line is brought opposite the grinding rest of an emery wheel, removing from the air of the room all fine dust and grit produced during grinding. The emery wheel can thus be conveniently placed in a room



Vacuum Cleaner Arranged to Remove Dust from Grindstone.

with other workmen and machining processes as it gives rise to no dirt annoyance. The cleaner motor is connected across the same switch as that driving the emery wheel, so that both pieces of apparatus are automatically started at the same time. The convenient location of the grinding wheel made possible by the suction arrangement in this case more than offsets the slightly increased cost of the additional machine.

Erie, Pa. JOHN L. BROWN.

COMMUTATOR AND SLIP-RING TROUBLES.

To one acquainted with the troubles incident to sparking and flash-overs of commutators this communication may appeal with particular force inasmuch as it may add a few more ideas to his probably great store of experience. We have a 7½-kw exciter overhung on the generator shaft. It is provided with four sets of brushes of the reaction type. The brush holders were not machined and made to fit securely in place, but were fastened by means of bolts in slots cut in the end of a spider. This, of course, allowed considerable adjustment of the individual brush holders. The spider frame could be shifted either way about 1 in., so as to permit the finding of the commutating point. As it happened the direction of rotation of the exciter installed was opposite to that which the manufacturer's diagram indicated. The brushes were left undisturbed, but the connections were properly changed. To those ignorant of the fact it may be well to state that in the reaction type of brushes the commutator surface rotates against the point of the brushes. The reason that the brushes were not also changed was that it seemed proper at the time in accordance with ordinary practice. How such a course was justified will be seen later. Upon starting there was noticeable a slight vibration of the commutator due to some unbalanced part, as the generator was direct-connected to the water turbine. The exciter was with difficulty made to generate, although there was plenty of residual magnetism in the pole-pieces. The solution of that difficulty made itself apparent when, in removing a brush from its holder, it was accidentally allowed to strike the commutator. Immediately there was a flash and the exciter picked up. Careful examination of the spacing of the brushes disclosed the fact that there was a considerable variation. When properly spaced the exciter commenced to generate within a very short time. After a few days' operation the commutator began to grow troublesome. Four dark spaces appeared on the surface, each a quadrant apart from the next. Beginning with only one bar the spots soon spread to five and six. This necessitated the use of sandpaper in order to prevent bad sparking. The remedy proved to be only temporary, for the same thing occurred again in a few days, and a similar operation was performed. Shifting the brushes a trifle helped some, but it was not lasting. It was now noticed that the brushes covered three bars instead of, as is usual, only two. The tips of the brushes were according filed, leaving the end narrower, thus covering two bars. For one whole month no trouble whatever happened, the sparking had ceased and the commutator acquired a smooth, glossy brown appearance. At the end of this period the sparking recommenced, and so severely that it was realized something more permanent in results had to be done and that quickly. All the former devices were again tried and, in addition, the pole clearances were made more nearly equal. A new set of brushes replaced the old ones, for what with the sparking and truing they had worn down; the connections were gone over, and the commutator was tested for grounds. There was some relief, but the cure was still out of sight. This time the brushes were allowed to cover three bars. In the meantime the vibration of the commutator had been increasing. The black equidistant spacings reappeared, so that sandpaper and crocus cloth had again to be resorted to in order to secure sparkless operation. Finding that nothing that had been done was doing any permanent good, it was decided to reverse the brushes, thus making the rotation of the commutator against the point of the brushes. This, while not doing away entirely with the sparking, reduced its intensity and the alarming popping and spitting of fire. We now had just one recourse left, every other possible method having been tried. We must true up the commutator. Therefore, sliding the frame to one side, we rigged up a wooden table and fastened upon it the cross-carriage of a small foot lathe to hold the cutting tool. Power was obtained from the turbine itself. Upon reassembling everything was gone over carefully to see that every possible precaution was taken advantage of. The machine has been in operation some time now, but there are no dark spots, and, while a slight vibration is still perceptible, the commutation is perfectly sparkless and the operation is very satisfactory.

The slip-rings on the generator had given us considerable worry and anxiety for some time until the source of trouble was discovered and remedied. One night at a time of our maximum load the writer was very urgently called to the power house to attend to trouble. Upon arriving I found that a blue, sizzling flame was encircling one of the slip-rings. Pressing upon the brushes with the fingers stopped the fireworks immediately, but the spluttering recommenced as soon as I removed them. Increasing the tension of the spring accomplished the same purpose. This worked well for a few hours, when sparking commenced again and no pressure was able to stop it. We could not close down the machine then, so we had to continue operating as best we could. Upon stopping it was found that the sparking (it really was arcing) had eaten into one side of the ring so much as to cause a flat spot and the slip-ring had to be turned true again. Prior to this at some time or other the fiber ring separating the two slip-rings had cracked radially, leaving a space of about ¼ in. It was thought that copper dust had accumulated in this space, causing a partial short-circuit. On this assumption it was thoroughly cleaned out and upon starting we found there

[illegible] the same thing happened again. The brush holders were removed, circuits tested, the space cleaned out again, the brush holders replaced, and for a second time we had peace. But the uncertainty was causing us worry, fearful lest at any moment there would be a repetition and probably that at a very inopportune moment. However, it came again as expected, the third time and also the last. It happened in the morning when the load was light and we immediately proceeded to discover the root of the trouble. Holding the finger on the brush there was felt no vibration or rubbing whatsoever. Touching the other (there were a pair on each side) the same was true. Trying the other pair a slight vibration made itself felt. It immediately dawned upon me that probably there was no contact on one side. Upon examination it was disclosed that the screw holding the flexible copper strap to the brush had struck the bottom of the slot of the brush holder, in which it moved, thus preventing it from going down far enough. Bringing the brush holders in a lower position gave the brushes contact, when the sparking ceased immediately. Such was the solution. The cessation of previous troubles can be accounted for by the fact that each time the brush rigging had been loosened and upon replacement put into a lower position.

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THE PUNCH PRESS IN SMALL MOTOR CONSTRUCTION.

Until recently, outside of its conventional use for punching armature disks, the punch press has hardly been given the place it deserves in small-motor construction, and the writer was recently in a factory where it did not even receive that recognition, 5-hp armature disks being squared out, mounted on a sleeve with paper between each disk, put in a lathe and turned off round, then placed in a milling machine and the slots milled out, the armature disassembled, the burrs removed and the armature then reassembled. The engineer complained that it was hard to meet competition. The insistent demand by manufacturers of vacuum-cleaning devices, office accessories, etc., for a motor of minimum weight and maximum output at a reasonable cost has given the small-motor manufacturer food for thought and led him to realize that both cheapness and lightness are to be obtained by giving the punch press the position it deserves in the production of his goods. As a result some of the motors on the market to-day are, with the exception of the windings, practically all produced on the punch press. The accompanying illustrations show how some of the motor parts may be cheapened and lightened where a manufacturer does not care to discard his cast-iron or cast-steel field frame. Fig. 1 illustrates a line of commutators for ¼-hp, ⅛-hp and 1/16-hp motors which can be wholly produced, with the exception of the assembling, by press work. The center tube of steel is rolled over on the ends and the whole thing drawn up under about ½-ton pressure. As with commutators as small as these it is not thought good practice to attempt repairs, but rather substitute a new one, the question of taking the commutators apart easily need not be considered. In this line of commutators the micanite end rings were made up by press work. The rings were first punched out in washer form. The washers were then warmed so that they became flexible, and when pressed under a forming die readily took shape and the chill of the die set them. Fig. 2 illustrates brush holders that are extremely simple to produce with dies, and replace cast brush holders that weigh much more, require several times the number of operations to turn out and are much harder to finish in a presentable manner. These struck-up holders are very rigid and when given a bright dip have a very attractive appearance, as the forming operations leave them quite smooth. The brush holder shown in the lower left-hand corner is suitable for fan motors, giving them a square brush with consequent advantages in contact area and commutation over the round brush, and is also suitable for small power motors up to ⅛ hp. The other is a suitable type for motors of ¼ hp and larger, and the details shown by the front and rear view render further description unnecessary. Fig. 3 illustrates the use of a punch-press product as an end bracket. End brackets of this description materially lighten the motor and also, due to the superior ventilation obtained, secure much cooler operation at the same load, or admit of rating the motor slightly higher. The small cast-iron support for the bearing sleeve adds rigidity to the structure and is easily applied as rivet spinning machines can be secured that head a small rivet every second. The brush holder, of a type shown in Fig. 2, may be fastened through the small round holes shown on each side of ventilating openings and brush wear observed through the opening. Inclosed motors may be produced by punching brackets for brush holders only. The foregoing descriptions are only a few among the many ways in which the punch press may be utilized for the work, and a study of the problem is sure to be both interesting and profitable.

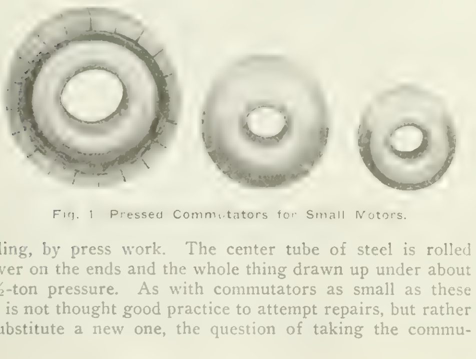


Fig. 1—Pressed Commutators for Small Motors.

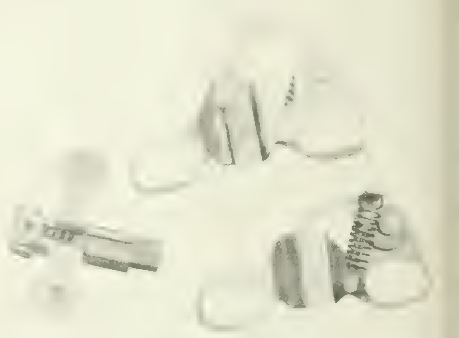


Fig. 2—Brush Holders.

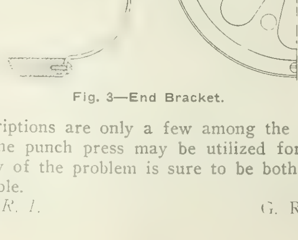


Fig. 3—End Bracket.

Warren, R. I. G. R. ALLEN.

OPEN DELTA TRANSFORMER CONNECTION FOR STATION LAMPS AND MOTORS.

When we got ready to put in our station transformers to supply the house lamps and several auxiliary motors in the plant, I found that only two transformer units were available, and to make the best of this situation for supplying three-phase energy these transformers had to be connected up in open delta. The motors in use were of both the three-phase and single-phase types, several of them being run for longer or shorter periods for the operation of brine pumps, impellers, air lifts, etc. The operation of these motors considerably affected the regulation of the lamps, in the way that the latter were first connected up across the open delta as a 220-volt, three-wire system. We then resorted to the arrangement shown in the sketch, applying the 110-volt lighting pair to the middle points of the trans-

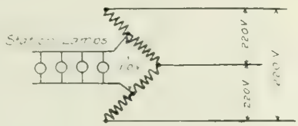


Diagram of Connections.

former secondaries, thus making a half-pressure, or 110-volt, open delta. Any disturbance in either of the 220-volt coils is thus only partially felt in the lighting line and the starting and running of the motors show little effect on the lamps.

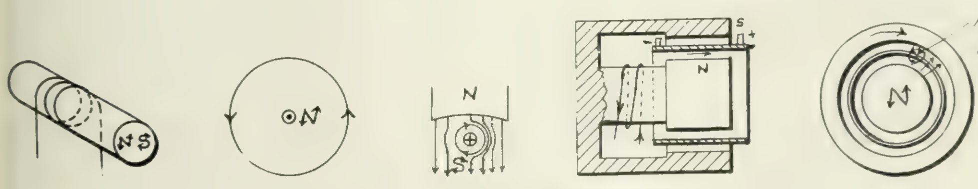
Birmingham, Ala. WILLIAM HAMPTON.

METHOD OF DETERMINING POLARITY.

In connection with the subject of coil polarity, I wish to call attention to a method of determining the relation between the direction of current and flux which I have never seen in print, and which is the simplest and most easily remembered that I know.

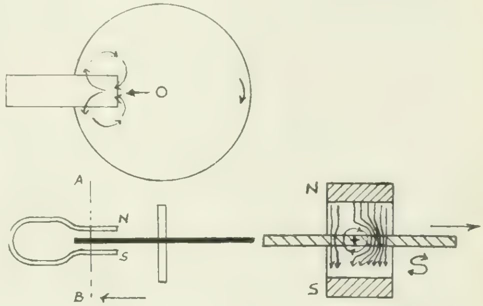
Face the end of an electromagnet or solenoid and write on it the letters "N" and "S," putting arrowheads on the letters, as shown in Fig. 1. If the current flows around the coil in the direction indicated by the arrows on "N" the pole is north and if in the direction of the arrows on "S" the pole is south.

The same device may be extended to determine the direction of the flux around a wire by remembering that in a magnet the flux direction is from the south to the north pole in the metal, and assuming the same letters to designate the same direction of current in the wire. Thus in Fig. 2 suppose that the current is flowing out of the paper, as indicated by the point of the arrow. This may then be called the north pole of the wire and the flux will travel around the wire counter-clockwise, as indicated by the arrows on "N."



Figs. 1, 2, 3, 4 and 5—Method of Determining Polarity.

To determine the direction of rotation of a motor or generator it is necessary to remember that the field from the poles is distorted by the field from the armature conductors being "condensed" on one side of the conductor and "rarefied" on the other, and that in a motor the conductor rotates away from the "condensation" and in a generator is rotated toward the "condensation." Referring to Fig. 3, the application of the above will be seen. A conductor in which the current is flowing into the paper is shown in front of a north pole. The visible end of the conductor will be "S," and the arrows indicate that the



Figs. 6, 7 and 8—Application of Method for Determining Polarity.

flux will be in a clockwise direction around the conductor, condensing the field to the right of the conductor. If the machine is a motor, therefore, the conductor will move to the left, and if a generator the conductor will be moving to the right.

Consider the case of a homopolar generator, shown in Figs. 4 and 5. When current flows around the central core in the direction shown the arrows on "N" in Fig. 5 follow the direction of the current, and the central pole is north, hence the flux in the air-gap is outward, from the central pole to the annular pole. Suppose that the rotor is turned in a clockwise direction, then the current in any element *A* of the rotor must "condense" the flux ahead of it, and this can be the case only if the flux around the element is counter-clockwise. This corresponds to the arrows on "N," and the current is, therefore, out of the paper in Fig. 5 and to the right in the rotor element in Fig. 4.

The case of a disk rotating between the poles of a magnet is similar to the above. Figs. 6 and 7 are a plan and elevation of such an arrangement, and Fig. 8 is a section on the line *A-B*, Fig. 7, looking in the direction of the arrow. Suppose that the magnet pole above the disk is north and that the disk is being turned clockwise, i.e., the segment visible in Fig. 8 is moving to the right. The direction of the flux across the air-gap then is downward and the current in any radial element of the disk between the magnet poles must produce a "condensation" to the right of the element. The flux around the element must, therefore, be in a clockwise direction (Fig. 8), and the visible end of the element, i. e., the end toward the shaft, must be "S." The eddy currents in the disk, therefore, flow from the center toward the edge of the disk under the magnet and return outside the magnet, as indicated.

QUESTIONS AND ANSWERS

[illegible] substations [illegible] cities? S. H.

Presuming that you refer to alternating-current generating stations feeding substations containing converting apparatus, the maximum drop is approximately 12 per cent. Less than this should be provided so that sudden overloads would not cause the synchronous converters to flash over by increasing the drop to over the amount specified.

How are breaks in series arc circuits usually located? I. P.

A method of locating a break in a direct-current series-arc circuit is to ground one terminal of the arc generator and connect the other to one side of the external circuit. A lineman then "flashes" from various points in the circuit to ground until the break is located. Caution must be used in applying this test, as the lineman is subjected to danger of shock from high-voltage current.

Do the Underwriters require screws to be used for fastening all cleats and knobs which are arranged to grip the wire? W. I.

According to the latest ruling of the Underwriters knobs or cleats which are arranged to grip the wire may be fastened by either screws or nails. If nails are used they must be long enough to penetrate the woodwork not less than one-half the length of the knob and fully the thickness of the cleat; washers must be employed to prevent under reasonable usage any injury to the knob or cleat.

Is there a limit of size in induction motor-generator sets? That is, is it common practice to use a different type of motor when the set is of a certain size? S. C. M.

The motor of a motor-generator set rated at 100 kw or over is invariably a synchronous motor, an induction motor being rarely used in motor-generator sets of this size. It has become almost standard practice to use synchronous motor-generator sets in all sizes except where the output is too small for a standard synchronous motor. Large induction motor-generator sets are to be found, however.

In transmission systems is the use of high-tension star-connected transformers preferable to delta-connected transformers? C. P.

Either system if properly installed and carefully operated will give satisfaction. The choice between the two is governed largely by service requirements. The desire to obtain immunity from shutdown due to the failure of one transformer has led to the extensive use of the delta-connected transformers, especially on the low-potential delivery side, where this connection is almost standard. Excellent examples of both systems may be had, but the high-tension delta connection is much more common than the star.

In large generating systems is it usual to install automatic circuit-breakers on the generators, or are the attendants relied on to use discretion in disconnecting the machines? T. D. D.

In many stations, especially those feeding railway systems, it has not been found desirable to employ automatic circuit-breakers in connection with the main generators, the attendants disconnecting the machines by hand operation of oil switches or other switches whenever conditions so warrant. Oftentimes an overload relay operating signal lamp is installed to guide the switchboard attendant. This relay is without time limit. On important systems every effort is made to keep the circuits alive and short-circuits are permitted to burn themselves free. Thus only a small portion of the system is affected by mishaps of this kind. The operating man's first rule is to keep the lines alive at any cost.

What rule is used to determine the size of the instrument to be used on switchboards? A. N. B.

The relations between the smallest load which it is desired to read and the peak are usually taken into consideration in determining the size of the switchboard instruments. On railway boards it is generally considered advisable to allow considerable overload capacity and little attention is paid to light-load periods. On lighting boards the overload is not considered to be as important as on railway circuits and more attention is given to light loads. Usually it is best to select instruments of such size that under normal working conditions the needle of the instrument will rest between half scale and two-thirds scale. This allows for overloads and growth and permits sufficient accuracy during light-load periods. Watt-hour meters should be fully loaded under normal working conditions, as they possess an inherent overload capacity not possessed by indicating instruments.

A solenoid is wound with 3400 turns of No. 17 magnet wire. The voltage is 250. What will be the increase in strength of pull if 300 more turns are added to the solenoid? E. W. C.

We assume that the solenoid mentioned is to be operated upon direct current at a constant emf of 250 volts. If a solenoid now wound with 3400 turns is provided with 300 additional turns the increased pull might be only slightly less than 9 per cent if the same current strength were maintained in the coil as formerly. However, it is very probable that even the same current strength would not produce a proportionately increased magnetism on account of the saturation of the iron. Quite independent of the fact just discussed, an increase in the number of turns, leaving the wire the same size and each turn of the same length, would have no effect whatsoever upon the strength of the solenoid. This statement is based on the fact that simultaneously with the increase in the number of turns there is an exactly equal proportional increase in the resistance of the solenoid winding accompanied by a proportional decrease in the amount of current, so that the number of ampere-turns remains exactly the same as formerly.

A generator having a solid steel armature core has been rewound but refuses to generate. The machine is about seven or eight years old and of Norwegian manufacture. The yoke and field structure are of cast iron, and although the steel core is not exactly modern practice, if the machine generated once why does it not do so again? T. G. McG.

In view of the fact that your generator refuses now to excite itself when formerly it generated properly, it is evident that conditions are not now identical with what they were previously. Not being able to examine the machine, we can only guess at what may be the trouble. Assuming that you employed the same number of turns in rewinding the generator as were used with the generator previously it is possible that the connections have been carried out, say, left-handed instead of right-handed. If such is the case it will be necessary to reverse the field terminals of the generator before the machine will excite itself. Again, it is possible that the points of connection to the commutator are not located exactly as they were previously, so that in order to have the machine generate it would be necessary to shift the brushes into a new position as compared with the position used formerly. We would suggest that the best plan of determining just what is the trouble with your generator is to excite the field coils from a separate source of the proper voltage, drive the armature at a requisite speed and measure the voltage across the commutator. If the machine has been properly connected and the brushes are in the correct position, the voltage should be somewhat in excess of the voltage used to excite the field coils. The field coils should then be connected to the brushes so that the positive terminal will be connected to the positive brush and the negative terminal to the negative brush. If when the machine is separately excited the voltage generated at the commutator is less than the voltage used in exciting the machine it will be impossible to render the machine self-exciting without proportionately increasing the speed of rotation.

Central Station
Management, Policies and Commercial Methods

IRONING ON THE PORCH.

Housewives who do their own work are interested in [t]he hot-weather possibilities of the electric flatiron in [e]nabling them to do their ironing on the back porch or [i]n any other part of the house which is cool and pleasant [a]nd supplied with a near by electric outlet. This fact is [p]ointed out in an attractive newspaper advertisement pub[li]shed by the Commonwealth Edison Company of Chicago, [w]hich is reproduced herewith. The electric flatiron has [p]roved one of the greatest attractions of electric-serv[ice] companies, not only in increasing the day load, but in [de]monstrating to the women of the country the real advan[ta]ge of electrical conveniences.

[A]dvertisement Published by the Commonwealth Edison Company.

PROMPT PAYMENT OF BILLS.

In explaining its discount plan for prompt payment for [b]ills for electric service, the Red River Power Company, of [G]rand Forks, N. D., prints a display advertisement in the [lo]cal papers in which it argues as follows: "Most of the [m]any items entering into the cost of electric and gas opera[ti]on are on a monthly payment basis. By meeting our ob[li]gations promptly each month we often save money, besides [st]rengthening our credit. Economy of this kind results in [b]enefit to our customers by improved service and reduced [ra]tes from time to time as conditions warrant. We cannot [f]ollow this method unless accounts due for service are [p]aid promptly on or before the tenth day of the month. Therefore, we provide our discount plan, which enables a saving of 10 per cent to customers. Do not be a delinquent." The Red River company is one of the Byllesby organizations, and this advertisement is one of a series which have attracted considerable attention.

DISTRICT HEATING FOR THE SMALL CENTRAL STATION.

The cost of steam heat to the central-station customer will be less than that of any equally adequate and constand method of heating his premises. This fact has been repeatedly demonstrated from the experience of district-heating plants installed in both large and small cities. The further advantages to the customer are the avoidance of handling coal, ashes, boilers, furnaces, etc.; the increase in real-estate values, safety, cleanliness, healthfulness and useful life of heating apparatus; and the abatement or reduction of the fire risk, insurance premiums, smoke nuisance, etc. The supply of heat is at all times ample, and the service is much more satisfactory than from any isolated plant.

To the central station the importance of district steam heating as an entering wedge in attacking isolated plants was also pointed out by Mr. Hal C. Kimbrough, Chicago manager for the American District Steam Company, in a paper read before the Missouri Electrical Association recently. Readiness to furnish such steam-heating service will render accessible the positions of many isolated plants, for such prospective customers demand that not only their electric burdens, but their heating—coal, ashes, smoke dirt, smoke and fire hazard—be lifted from their shoulders. Not only is steam heating thus advisable from an electrical-service standpoint, but a heating business is highly profitable, as results cited by Mr. Kimbrough in his paper showed.

In a city of 10,000 population, for example, the annual steam receipts were $35,053, while the electric revenue was $43,359.

The results of another company for three successive years, operating a combination electric and steam-heating plant, were as follows:

[illegible]		[illegible]
[illegible]		[illegible]
Steam receipts	$51,785.23	
Total cost of fuel, water, labor, supplies, etc.	48,174.48	
[illegible]		[illegible]
[illegible]		[illegible]
Steam receipts	59,355.16	
Total cost of fuel, water, labor, supplies, etc.	[illegible]	
Fuel burned during heating season 1908-9	....	[illegible]
Electricity generated, same period	......	[illegible]
Steam receipts	65,972.52	
Total cost of fuel, water, labor, supplies, etc.	44,178.90	

In answering a question by Prof. H. B. Shaw as to the pipe investment required, Mr. Kimbrough declared that this depends, of course, on the location of the plant with respect to its heating load. In Easton, Pa., he said, a 16-in. main is carried a distance of 2675 ft. at a first cost of $32,000 before the first customer is reached, but the profitable district which is served by a further investment of $10,000 in piping at the end of the feeder line justifies the entire outlay.

Discussing the distribution of district heating plants among small central stations, Mr. Kimbrough declared that there are twenty-one such stations in Illinois towns of less than 7500, and two in towns of less than 1000. By far the greatest number of plants are in cities under 30,000 inhabitants.

Professor Shaw suggested the advantages of smaller feeder pipe that might be used with high-pressure steam distribution, especially when large pressure drops are permitted, to convey the steam at high velocity to the low-pressure distributing mains.

COST OF ARC LIGHTING.

In a paper read by Mr. W. Edgar Reed, consulting engineer, before the Pittsburgh Section of the American Institute of Electrical Engineers on May 9 many interesting facts relating to the estimated cost of operating an arc lamp were presented.

The speaker dealt with the subject from the point of view of the engineer endeavoring to ascertain the actual cost to a municipality operating an arc lamp per year. These costs as generally given are very vague, because they are not based on any scientific investigation, but are usually the result of various local conditions, such as prices in adjacent cities, competitive bids and similar causes.

There are many items that enter into the cost of operating an arc lamp per year, and the question should be very thoroughly studied and analyzed before the price is made. Often municipalities, instead of paying a small fee for the services of a competent engineer, make no attempt to get one at a fair price, but simply advertise for bids and try to get the service at as low a cost as possible. Municipal plants often give service that would not be tolerated for a moment by private plants. The contracts generally specify the number of amperes and the watts, but almost never the illumination, which, of course, is the desideratum. The price is usually specified in dollars per year for the arc lamps and cents per kw-hour for incandescent lighting. When a contract is to be let it is usual to make inquiries as to surrounding plants, or some similarly located plant, and get the opinions of many people, some of whom are salesmen of apparatus for lighting. These are, of course, of little use in arriving at an accurate estimate. A careful investigation should be made of costs under actual conditions prevalent in the city to be lighted. Prices quoted from different cities vary very greatly, running from $45 to over $100 per lamp-year, so that it is impossible to base any reliance on an average figure.

The price should be based on costs of installation, fixed charges, interest and depreciation, operating expenses, including legal, office, accidents and extraordinary expenses and cost of producing energy. Erection costs vary from time to time and no data are available that are accurate for any locality. The question of outage is an important one and should be carefully considered. Numerous methods are in vogue, such as deducting so much per lamp-hour from the amount paid, but no standard has been arrived at.

Other factors affecting the cost of arc lighting which are frequently not considered by municipalities in estimating their costs are the following:

Tax on poles, usually $0.50 to $1 per pole; fire, accident and boiler insuring taxes; federal tax on corporations of over $5,000 capitalization; free lighting of public buildings; free telephones, and similar expenses.

The city does not usually count on any profit which a private company is justly entitled to.

Depreciation, a most important item, is generally overlooked entirely. It is important because the effect is not usually present until after a lapse of some years. It is a diminution in value due to various causes which cannot be overcome by current maintenance charges. It is a broad question and should be very carefully considered; it may be determined as the first cost less the salvage divided by the useful life in years. Care should be taken that the salvage is not negative—that is, that the cost of removing the apparatus is more than the scrap value. In this case this expense must be added to first cost.

Mr. Reed showed figures and made an interesting analysis of the costs of arc lighting as given by the borough of Sharpsburg, Pa. This municipality recently submitted figures to the federal government indicating remarkably low costs. Mr. Reed showed that by considering all the factors the cost was approximately $65 per lamp per year instead of about $40 per year as reported by the officials of the municipality.

ELECTRICITY AT THE FALL RIVER COTTON CENTENNIAL.

The centenary of the establishment of the first cotton mill in Fall River, Mass., was celebrated in the week of June 19-24 in that city by a protracted carnival whose schedule included a visit by President Taft, various mercantile, transportation and trade processions and an extensive exhibit of textile processes and products in the local textile school and State armory. Electricity was extensively pressed into service in connection with the decoration of the principal streets, both the Old Colony Street Railway Company and the Fall River Electric Light Company taking a leading part in the work. About 13,000 extra incandescent lamps were installed, including decorative lamps in the armory, where the Fall River Electric Light Company maintained one of the largest and most conspicuous exhibits in the building, and all the displays of moving machinery were driven by electric motors.

Electric signs welcoming visitors to the city on behalf of the centennial were erected at important points, and an elaborate use of bunting and flags was supplemented in many cases by festoons of colored incandescent lamps carried across the streets or parallel to the sidewalks in front of private residences, clubs and mercantile structures. About 6000 plain and colored incandescents were installed for decorative service by the Old Colony Street Railway Company, including circles of multi-colored lamps at various points on the overhead system and an extensive use of the national colors at trolley poles. In the City Hall district a triumphal arch was erected, with an electrically illuminated centennial sign in the center, and from the arch on each side of the principal street fourteen columns were attached to it by looping ropes of laurel, each column being encircled by incandescent lamps and surmounted by American flags set in urns. Six hundred incandescents were used on the arch proper and 140 lamps on the columns, the bases of the latter being painted in Venetian-marble style.

The Fall River Electric Light Company's exhibit at the armory included the general lighting of the main display hall by about 100 tungsten lamps of 100 watts rating, and an extensive display of useful and ornamental electrical equipment in five booths roofed over by an attractively decorated pergola. The main hall lamps were hung from galvanized-iron wire carriers run across the hall in longitudinal and transverse directions, the intersection points being attached to provide additional stiffening. The conducting leads for these lamp circuits thus were run without other strain than their own weight, between lamps, and the elevation of the lamps about 10 ft. above the floor resulted in a highly effective and satisfactory illumination, with a noticeable absence of dark corners in and around the exhibits. Electricity was selected for the central display of the armory by the superintendent of exhibits on account of its great flexibility and safety, wit

the maximum artistic possibilities, as compared with gas.

The central booth of the lighting company contained an electric fountain, electrically lighted artificial flowers and fruits and tasteful decorations in greenery and colored lamps of miniature size throughout the roof structure. Picture post cards of the company's waterside turbine station were given away to visitors, and in a second booth a complete line of electric heating devices was shown. A third booth was devoted to the display of small motors, direct connected machine tools, sewing-machine and vibrator equipments, grinders, glue pots and fans. A fourth booth contained a display of domestic power applications, including also a model sawmill and miniature machine shop, each driven by an 8-in. fan motor, washers, ice-cream freezers, electric flatirons, multiple-tool outfits and a meter connected to a 2-hp induction motor equipped with a friction brake. The speed of the meter corresponded to the amount of power absorbed by the motor. A vacuum-cleaner exhibit occupied the fifth booth, the apparatus being provided by the McCrum-Howell Company, New York. All the equipment was wired for demonstration on the premises, 110-volt and 220-volt alternating current being supplied to the armory by the lighting company, which also exhibited a 1.5-ton electric truck in a trades parade.

COMBINATION RATES FOR STEAM-HEATING AND ELECTRIC SERVICE.

In a paper presented by Mr. R. D. DeWolf, assistant mechanical engineer of the Rochester (N. Y.) Railway & Light Company, before the convention of the National District Heating Association at Pittsburgh, Pa., on June 8, Mr. DeWolf considered the three-charge system of rates applied to steam service, and also a rational schedule of charges to be employed where a customer receives both steam heat and electric service from the same plant. A consumer of this class requires a certain amount of electrical energy and a certain amount of steam for heating. In operating his own plant when the exhaust steam furnished by the prime movers is just sufficient to meet his heating demand, there will be no waste to the atmosphere, and his operating conditions will be the most economical which he can attain. When the energy demand exceeds the heating demand considerable quantities of exhaust steam will be wasted in the atmosphere, and, on the other hand, when the heating demand exceeds the energy demand considerable live steam will have to be furnished from the boilers in order to make up the deficiency in exhaust steam. Under either of these conditions the cost of operating the plant will be higher than when the energy and heating demands are equal.

The rate system, must, therefore, take the ratio between the energy demand and the heating demand into consideration, and must so modify the rate that the consumer who has an advantageous ratio of energy and heating demands will receive a better rate than the consumer whose ratio is not such an economical one.

The simplest practicable method available consists in metering the quantity of energy furnished and metering the condensation returns from the heating system. The energy furnished can be charged for under the electric rate. The charge for exhaust steam will then be the charge which would be rendered under the system shown for the non-condensing generating station for both energy and heat, crediting to this the rates charged for the energy for such portion of the steam required for heating as would be furnished by a non-condensing station, plus a charge based on the live-steam rate for any additional steam.

The three-charge schedule automatically gives the long-hour user a lower unit rate than the short-hour user of the same demand. By varying the demand element of the charge during different months of the year, a seasonal variation in the total service charge can also be introduced, for imposing proper costs on consumers with short-season demands, either winter or summer. The system may be made still more flexible by varying the numerical figure used representing the pounds of steam required by the non-condensing station to generate 1 kw-hour. The small consumer who would require only a small-sized installation if he were operating his own private plant would be using machinery whose water rate would be higher than in the case of a larger plant. It is evident that allowance can be made in the rate system for this variation.

In a well-designed and operated plant for every 1000 lb. of steam delivered by the boiler there will be a loss of about 15 per cent of the steam passing through the engine.

In supplying a consumer with energy and heat, the consumer's demand will be measured in kilowatts and 1000 lb. of steam per hour and his consumption in kw-hours and 1000 lb. of condensation. If the two were just equal, then the rate for the combined service would be correctly expressed by the non-condensing generating rate. If this condition does not exist, the total cost will have to be expressed through a combination of the different rates.

For every kilowatt of demand the consumer is entitled to 850 lb. per hour demand of exhaust steam, and for every kw-hour used he is entitled to 850 lb. of exhaust steam. It is then evident that he can be billed for his electricity under the energy rate and for his steam under an exhaust-steam rate, which rate will take into account the relation between the exhaust steam which would be furnished by the exhaust from a private plant supplying the necessary amount of energy and the live steam required, in addition to this, to meet the total steam demand.

The consumer being billed for the electricity on the energy rate, his steam charge will be determined by correcting the live-steam rate for the amount of exhaust steam furnished by a non-condensing generating plant.

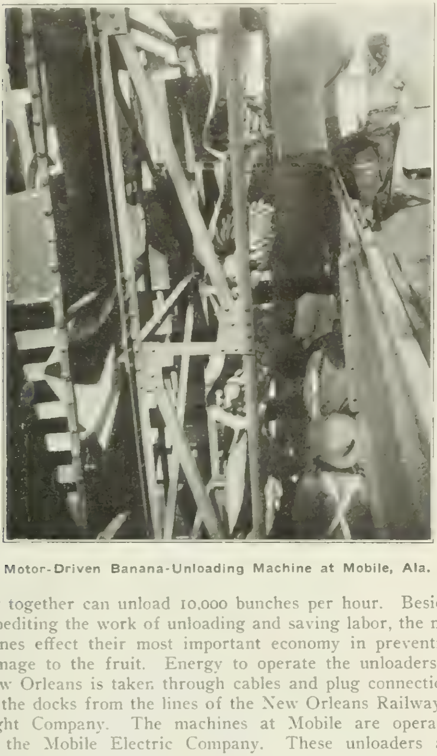
ELECTRIC CONVEYORS FOR UNLOADING BANANA CARGOES.

At New Orleans and Mobile the United Fruit Company makes use of motor-driven machines of the marine-leg type for unloading bunches of bananas from the holds of its vessels, saving much time, labor and damage to the fruit that was formerly occasioned by hand unloading.

From an extension boom projecting over the water's edge a 35-ft. vertical marine leg is dropped into the hatch of the vessel drawn up to the wharf. Sprocket wheels on the marine leg and stationary portions of the unloader carry a pair of chains 4 ft. apart, between which, on cross-bars, is attached a canvas strip so arranged with slack as to form pockets at 3-ft. intervals. The four machines at New Orleans have ninety-two-pocket belts and each is driven by its own 15-hp induction motor. These machines have individual equipments for unloading 2500 bunches of bananas per hour, the bunches weighing from 60 lb. to 120 lb. each. In the hold of the vessel the conveyors are filled from three levels, each level loading into every third pocket of the conveyor, the speed of which is, of course, too high to permit filling successive pockets from a single position. After reaching the back or dock end of the conveyor the pocket-chain passes over a flat roller which gently discharges the bananas onto a moving belt running back to the cars where the fruit is loaded for shipment by rail.

At New Orleans the Mississippi River level varies periodically by about 14 ft., and the unloaders must accommodate this variation as well as be able to reach the hatches of any ordinary vessel. The suspended marine leg is supported from an auxiliary boom hinged to the main boom, so that by making a jack-knife bend practically any hatch

level at distance from the chart [illegible] negotiated. The manipulation of the booms and hoists and the side travel of the huge machine along the dock front are all operated from friction clutches on the main conveyor-motor shaft. Within three to five minutes after the vessel's hatches are made ready the machines can be located in position and unloading begun. Ships are unloaded in from ninety minutes to seven hours, depending, of course, on the size of their cargo. The four machines at New Orleans working together can unload 10,000 bunches per hour. Besides expediting the work of unloading and saving labor, the machines effect their most important economy in preventing damage to the fruit. Energy to operate the unloaders at New Orleans is taken through cables and plug connections on the docks from the lines of the New Orleans Railway & Light Company. The machines at Mobile are operated by the Mobile Electric Company. These unloaders are the only two installations of the kind in the country, the fruit being handled by manual labor at all other ports.



Motor-Driven Banana-Unloading Machine at Mobile, Ala.

FLAT RATES FOR SMALL CONSUMERS.

Prof. A. H. Ford, of Iowa State University, gave an analysis of the above subject in a paper before the Iowa Electrical Association convention held in Davenport recently. The analysis of the cost of supplying energy to different consumers shows it to be made up of several elements, namely, consumer's cost, meter cost, demand cost and kw-hour output cost. The fixed cost per kilowatt of station equipment increases as the demand per consumer increases. When the consumer's load is small and of short duration the fixed cost may be larger than the variable cost, and this condition may make a flat rate more desirable than a meter rate. Since the meter cost for small-demand consumers is a large proportion of the total cost, the elimination of this item by the use of flat rates makes possible the supply of small-demand consumers at a lower rate than previously.

If a flat rate is made at so much per lamp the consumer will limit the number of lamps and will not use electric light, because it is inconvenient. If he is charged for a certain proportion of his connected load he will probably use more lamps at a time than agreed upon. Both of these methods require frequent inspection to see that the connected load has not been changed. These difficulties can be met by using a demand limiter which will dim the light or cause a flicker when the demand contracted for is exceeded. A reliable and cheap demand limiter is necessary for the profitable introduction of flat rates. Another necessity is a lamp of high efficiency and high cost, so that the cost of renewals is high in comparison with the cost of service. This is provided in the tungsten lamp.

Professor Ford then made an analysis of cost and revenue for certain classes of small consumers, taking as a basis residence consumers of the Madison Gas & Electric Company as reported in the recent Wisconsin Railroad Commission decision on the rates of that company. Meter costs were taken from figures submitted from Boston to the Massachusetts Gas and Electric Commission. The following unit prices were used in his calculations: Cost of plant, $220 per kilowatt; cost of demand limiter, $6; consumer's cost, $6 a year; meter-maintenance cost, $6 a year; demand-limiter maintenance cost, $0.75 a year; demand cost, $24 a year per kilowatt; energy cost, 4.5 cents per kw-hour.

With these figures as a basis, Professor Ford obtained curves from which the following conclusions were drawn: The fixed cost of service per kilowatt of maximum demand decreases as the demand increases until it reaches a minimum limit at $24 a year per kilowatt of demand. Where consumers have a maximum demand of 125 watts the cost of service is always more than the income on the meter basis. With a flat rate of 1.25 cents a month per watt of maximum demand the income is greater than the cost, unless the maximum demand is used more than 4.5 hours a day. At a 1-cent flat rate per watt of demand the income is greater than the cost unless the demand is used more than 2.5 hours a day.

Where consumers have a maximum demand of 250 watts each the cost of service is greater than the income on a meter basis for the use of the maximum up to 8.5 hours a day. With a flat rate of 1.25 cents a month per watt of maximum demand such consumers can be supplied with energy at a profit if the use of the maximum demand is not greater than six hours a day, and at 1 cent per watt where the use is not more than four hours a day.

Where consumers have a maximum demand of 500 watts the cost of service is greater than the income on a meter basis for the use of the maximum demand up to 1.8 hours a day. With a flat rate of 1 cent a month per watt of maximum demand such consumers can be supplied with energy at a profit if the use of the maximum demand is not greater than 5.5 hours a day. The cost of supplying energy to each consumer having 250 watts demand is $24.50 a year with a watt-hour meter and $19.29 with a demand limiter. The income in the two cases is $17 on a meter basis and $30 on a flat-rate basis. There is a loss of $17.54 in the first case and a profit of $10.71 in the second. The plan will not answer for mixed lighting and heating load or for lighting with carbon lamps. Where only one heating device, such as an iron, is required it may be run from a separate circuit back of the demand limiter and a flat rate made for its use. Where more light is required on special occasions the demand limiter may be cut out for that time and an extra charge made for this service.

DISCUSSION.

Mr. A. W. Zahm, of Mason City, said that he understood that the flat-rate plan once extensively used at Hartford, Conn., is being abandoned and such customers transferred to meters. The flat-rate plan is prohibitive for consumers having large demands.

Mr. Young reported having introduced the plan at Cedar Rapids for consumers having from 100 watts to 300 watts demand. He considers it mainly as a means of educating

consumers to electric service. The small consumer will take service at a flat rate because of knowing the price in advance. After trying the plan for a while he will become exasperated at being limited in his demand and will order meter service. Mr. Burt, of Waterloo, said that he is opposed to the theory of flat rates. He also said that the device used for limiting the demand is not always a mechanical success. A grocer measures the groceries he sells and the electric company should measure its output.

Professor Ford called attention to telephone service as being a prominent example of a large public service carried on at flat rates.

Mr. H. B. Gear, of Chicago, spoke of the concern or anxiety which once existed as to whether the large number of small apartments which were consumers of the Commonwealth Edison Company were profitable. This led to a study of demand and diversity factors. In a certain block there were 189 consumers, with loads aggregating 103 kw. The average was eleven lamps per consumer, or 550 watts connected. The actual maximum demand for a consumer measured by a maximum-demand meter averaged 300 watts. The average revenue per consumer was from $25 to $30 per year. The maximum demand on the transformer supplying energy to that block with its 103 kw of connected load was only 18 kw. The load-factor at the secondary terminals of this transfomer was 23 per cent. By taking into account the generating equipment reduction due to the diversity of load the small-apartment-house consumers appeared much more profitable than had formerly been assumed to be the case. The meter investment with such consumers is, of course, high, amounting to as much as the generating plant necessary to supply energy to those consumers.

Mr. J. R. Cravath, of Chicago, reported having introduced the controlled flat-rate system in a small way among consumers at Harrisburg, Ill., where an absurdly low uncontrolled flat rate had formerly been in vogue. Old flat-rate consumers are being partly changed to meters and partly to controlled flat rate, at their option. In his opinion the controlled flat-rate system is applicable only to very small consumers, where there is nothing but lighting load. The success depends on the rate being made high enough to force the use of the tungsten lamp in order to get the lighting service at a reasonable rate. With an expensive lamp the consumer turns off the lamp to save renewals.

Mr. Gear pointed out that with flat rates the large diversity factor which he had cited would be much reduced, hence some of the apparent difference in profits pointed out between the flat rate and the meter system would be reduced. Professor Ford said that the consumer cost, which is independent of the maximum demand, is 40 per cent of the total cost for the kind of consumer under consideration. Reducing the diversity factor cannot change the consumer cost.

ENGINE AND BOILER-ROOM RECORDS FOR SMALL PLANTS.

The important items to be recorded in the engine-room and boiler-room of a small plant are as follows: Coal, ashes, water, oil and sundries, the last item including packing, waste, rags, boiler compounds, tools, etc., besides labor and material used in making repairs. To produce the best results in any station, said Mr. Eugene Holcomb, in an address on this subject before the St. Paul convention of the Minnesota Electrical Association, it is essential to know the cost of producing the output.

All coal should be weighed as fired, and for this purpose in small plants it will be found convenient to use a scale with platform set flush with the floor, large enough to hold a wheelbarrow. The number of pounds in each wheelbarrow load should be recorded on a single sheet of paper, ruled in columns for three figures. A record should be kept of the number of pounds of water used for steam-making, for the purpose of checking the furnace and boiler performance. A simple method of measuring this water is to calibrate the feed pumps from time to time and use a stroke counter. A reading of this counter each twenty-four hours will give the quantity used, very closely. The ashes should be weighed as a check on the quality of coal.

The amount of cylinder and engine oil used should be measured and recorded each day. The temperature of boiler-feed water and, in condensing stations, the vacuum should be read and recorded, say, four times per day. The number of pounds of waste or rags, the amount of packing and the amount of boiler compound, if any, should be recorded each day. All labor and material used in making repairs to any part of the generating equipment should be kept separate from the regular operating items and should be recorded each day. The time put in by the regular men in replacing a few bricks in the furnace or the packing or adjustment of a pump or engine, however, need not be recorded as labor on repairs in such case. The above practically covers the cost items that should be recorded in the engine and boiler-room.

In order to determine the unit costs, it is essential that the switchboard be equipped with meter for measuring the total output of the station. Such meters are not very expensive and no station should be without them, even for constant-current arc circuits, although the output on such circuits can be estimated very closely where the number of lamps is constant and the hours' run is known. Volt and ammeter readings are misleading in alternating-current stations because the power-factor is usually unknown and is always changing. Ammeter and wattmeter readings at fifteen-minute or thirty-minute intervals should be made occasionally, however, for the purpose of plotting the output curve and checking the power-factor, as it is essential to know the character as well as the total of the load. With the above switchboard instruments it is an easy matter to record the wattmeter readings each twenty-four hours. It is also important to record the time of starting and stopping each unit, and also any interruptions or stoppages due to accidental break-downs.

While there are nearly as many forms or blanks for keeping these records as there are stations, the form is not as important as the data recorded. No system will work by itself, and almost any blank form will serve as a reminder to the operating men of things to be done.

In large stations these principal items are subdivided into many parts, and records are kept in great detail, but for stations of 250 kw and under, to which these suggestions are addressed, where there are few hands to do the work, these records must be as simple as possible, and, of course, should be made to supply the necessary data to fit into a uniform system of accounting. The principal data that should be recorded are as follows:

STATION REPORT FOR 24 HOURS, ENDING.

Amount of coal on hand . . . .
Amount of coal used. . . . .
Pounds of feed water used . . . .
Pounds of water evaporated per pound of coal. . . . .
Boilers in use from. . . . . .to. . . . . .
Engines and generators in use from. . . . . .to.
Cylinder oil used. . . . . .pints, $. . . .
Engine oil used . . . . .pints, $
Pounds of waste or rags used. . . . ., $.
Pounds of packing used. . . . ., $. . .
[illegible]
[illegible]
Total output in kw-hours. . . . .
Pounds of coal per kw-hour . . . .
Remarks

A convenient form of keeping these records is to have printed blanks, on letter-size paper, bound in books with duplicate sheets and perforated so that one copy may be easily torn out and the office copy punched for binding in a loose-leaf folder.

HANDLING DISTRICT STEAM-HEATING CUSTOMERS.

An interesting paper discussing the broader policies involved in handling customers of district steam-heating systems was presented by Mr. George W. Wright, manager of the Baltimore Refrigerating & Heating Company, of Baltimore, Md., at the convention of the National District Heating Association at Pittsburgh June 8. As Mr. Wright pointed out, the subject of satisfying customers is a most important one to managers of central-station heating plants, for since the number of prospective customers is limited to the territory covered by the heating mains, the loss of any of them is a serious matter.

The best way to keep a customer satisfied with the service and its cost, said the speaker, is to teach him to use the heat with economy, and to make him acquainted with the principles of central-station heating. The service is so much more prompt and effective than the isolated-plant system that the ordinary customer does not realize how much heat he is using until the first bill comes in. If careful attention is given to the operation of the customer's heating system by the heating-plant employees for the first month or two of service, the cost can be kept within satisfactory limits and a permanent customer be made, but if the customer is allowed to use the heat without proper regulation a serious waste often results and dissatisfaction ensues.

Many customers depend upon the least intelligent employee in the building for the management of the heating service and usually with unsatisfactory results. Every heating-plant manager is familiar with the great variation in the use of heat in buildings of exactly the same cubic contents and hours of service, which, in most cases, is largely due to differences of control. It is good practice to advise the customer to have his employee report to him each day the quantity of steam used and thus keep in touch with this running expense of his business. The customer should be given the fullest information as to the operation of the heating system with regard to its efficiency and economy.

ADVICE TO CUSTOMERS.

It is advisable to give each customer a pamphlet explanatory of central-station heating, how the heat is generated and distributed, how the condensation in the mains is taken care of so that it does not enter the customer's heating system, the use of heat recorded (where the meter system of charges is used) and a full description of the meter and instructions for reading same.

The customer should also be cautioned as to the advisability of having all steam piping covered where heat is not required; the keeping of windows and doors closed, especially near radiators; the closing of elevator shafts and stairways; the installation of temperature controllers and reducing valves; the shutting off of the heat at the main service valve, etc. A good plan is to print these suggestions on the back of the heating bills, which presents them to the customer once a month.

The greatest care should be exercised with new customers to see that they do not waste the heat, as very few of them know anything at all about the principles of heating. The meters of such customers should be read at frequent intervals, and advice for the attainment of more economical results given if needed. This attention will be appreciated. It is a mistake for any manager to take on a customer when he knows that the system installed in his building is not properly arranged for economic and efficient results.

The necessary changes should be pointed out and completed before connection is made to the central-station system or else there will be either failure to get a proper return for the heat used or inordinate bills for the service rendered, either of which will be likely to result in the loss of the customer. It will be too late to point out these defects after service has once begun, as the manager will then be in a very uncomfortable position.

ESTIMATION OF COST OF HEATING.

Another cause for loss of customers is the estimation of the cost of heating on a meter-rate basis. To secure the customer the manager is tempted to make this estimate too low or to base his estimate on some similar building which he is heating. The personal element enters so largely into the result that any manager who gives such an estimate is generally very much above or below the actual result. The hours of use, the attention and care exercised, the exposure of the building and the nature of the business therein conducted will cause a variation in the heat used, and it is therefore unwise to make such estimates. The better plan is to refer the prospective customer to several other customers with buildings of about the same size and character and allow him to form his own conclusions and make his own estimates. The maximum, minimum and mean consumption for the buildings of like size and character that are heated by the manager's company may be given, with the frank statement that it is impossible to foretell which result will be obtained owing to the personal element. If an estimate should be given and the result exceeds it, the manager will be expected to refund the difference, and if it falls below the estimate the manager will have proved to the customer's satisfaction that he knows nothing about the business anyhow.

COMPLAINTS AND RECORDS.

All complaints, of whatever character, should receive prompt attention and investigation. The longer the customer is allowed to brood over his grievance the more difficult it becomes to placate him. Prompt attention shows a desire to please, which is usually appreciated. Many complaints are trivial and due to lack of intelligent knowledge of heating, but they should be attended to just as promptly as the most important ones. A book for recording all complaints, giving date, location and nature thereof, by whom and how disposed of, should be kept for recording them as they come in by telephone or mail, so that all shall have careful attention.

A daily record of the outside temperature and wind velocity should be kept by each manager. It will be found astonishing how little accurate observation of temperature conditions prevails among heating-plant customers. A few warm days in a winter month will be clearly remembered and the cold ones entirely forgotten, with the consequent impression left that the month was comparatively warm. When the bill for the month's heating is received there is usually a complaint, which the temperature records will prove to be without foundation. Very few customers realize the effect of the outside temperature, and especially the wind velocity, upon the consumption of heat, and many of them have an idea that their bills for the three winter months should be practically uniform, although there is often a wide variance in the temperature conditions.

METER READING.

With a meter system of charges there should be frequent readings of the customers' meters and duplicates of these readings kept for furnishing to the customer in cases of disputed bills. Loose-leaf blanks are best for this purpose, and the meter readers should be required to transcribe their readings daily onto the duplicate sheets kept in the office. Daily readings have proved a paying proposition in many cases that have come to the author's attention. For example, once during December a large customer, using an average of 13,000 lb. of steam daily, complained because his bill was rendered for three estimated days' consumption, insisting that no steam was used in his building on those three days. The daily visit of the meter reader disclosed the fact that steam was being used, and the report of the repair man who replaced the defective meter with a new one confirmed it. The days when the meter did not record the steam used were just as cold as

ny other days in the month, as was shown by the daily temperature records, and there was no other means of heating the building except from the central-station service. Payment for estimated days was insisted upon and finally made, but if there had been no daily visit of the meter reader the fact that the meter was not recording would not have been discovered, nor would the further fact that steam was used on those days have been capable of substantiation to the satisfaction of the customer. Consequently there would have been a loss of revenue in those three days sufficient in amount to pay the cost of a meter reader for fourteen days. The cost of daily readings from Nov. 1 to April 1 (the consumption during the other months being so small that daily readings are not necessary) has been found to be three-quarters of 1 per cent of the gross receipts for that period, and is more than offset by the increase of gross revenue that results.

When a meter is found recording improperly a notice should be left with the consumer immediately so that he will be prepared for an estimate at the end of the month. Meters should be taken out at the end of each heating season, cleaned, repaired and tested, and a record of the test kept for submission to the public service commission or other authority in the event of the accuracy of the meter being disputed.

LOSS OF REVENUE.

Owing to the changes of customers from year to year it will be found advisable to maintain records of each building heated, showing the radiation and cubic feet of space on each floor, exposed piping, size of meter and trap, location of sewer connection, proportion between radiation installed and space heated, and the proportion of cooling coil installed, as well as any unusual or bad conditions existing. This record should also show the consumption of steam per season and the cost thereof per cubic foot of space, etc. Such data will be found useful in advising prospective tenants as to the cost of heating their own buildings, in this way giving actual results and not estimates. The data will also show the manager where revenue losses are occurring. As an instance of the value of such data, a building which for four seasons had used 75,000 lb. of steam in November showed only 19,500 lb. consumption the next November. It had been noticed during the month that very little steam was being recorded by the meter, which was first attributed to a change in the attendant in the building who claimed that he was taking unusual care in the control of the steam. The difference was so marked, however, that at the end of the month the customer was notified that there was something radically wrong, that an investigation had been ordered and that when the defect was discovered it would be reported to him and an estimate of the steam lost would be billed. The inspector was then sent to the building with instructions to stay there until the cause of the low meter registration had been found. The trouble was located, however, on the first day where the return line was connected to the sewer discharge from the unused heating boilers. A valve supposed to prevent the return water from entering the boilers and flowing thence to the sewer was, though closed and sealed, found to be leaking nearly all of this condensation, very little of which was passing through the meter. The consumer was notified, his estimated bill paid, and the revenue from the building was increased 10 per cent over any other year that it had been heated. All buildings having heating boilers connected to the return were afterward examined, and small leaks were found in several cases.

Another cause for loss has been found in covered return pipes, especially when laid under concrete floors. The concrete and confined heat have a very serious corroding effect on the iron pipe, causing leaks to develop which cannot be found because they do not show on the surface, as the water percolates through the ground.

Another possible cause of loss of revenue is the filling up of the return mains, especially seals in feeds or returns, with mill scale, rust, etc., retarding the flow of steam and thus preventing the customer from getting satisfactory service, and at the same time reducing the revenue of the heating company. This scale also clogs the steam trap, often causing it to blow steam directly into the sewer through the meter without being recorded. These traps should have the same care and attention as the meters.

In general, said Mr. Wright in conclusion, the majority of customers aim to be strictly fair in their dealings and are willing to pay any bill, no matter how large it may be, for which a good and sufficient explanation can be given.

DISCUSSION.

In answer to a question by Mr. Cadwallader Evans, of Pittsburgh, Mr. Wright said his contracts include a clause providing that when meters fail to register adjoining days are to be used in estimating the steam consumed during the non-registration period, and added that his company experienced no difficulty in getting such contracts signed. Mr. J. A. Donnelly, of New York, described the use of recording thermometers to register heating service in place of steam meters. The area between the curves drawn by one such thermometer outdoors and another inside the customer's premises is obviously proportional to the heat supplied to the building. The latter's cubical constant must, however, be known, as well as its cooling and heating curves, which are affected by the proportion of glass windows, air leaks, etc. The use of such thermometers also carries a check on the night temperatures in the buildings, which usually run much higher than the owner suspects, due to the closing of doors and windows that have been open during the day. Mr. A. S. Armguac, of New York, informed the convention that the United States Weather Bureau issues monthly charts showing maximum and minimum temperatures at its stations in the principal cities, and also annual reports showing mean-temperature curves for the year, besides periods of sunshine, rainfall, wind, etc.

Mr. R. D. De Wolf, of Rochester, N. Y., recounted his successful application of a recording thermometer when converting a large customer's installation over onto a meter basis. The first metered month's bill had aroused the customer, but by the thermometer demonstration his consumption was cut 40 per cent and he continued well pleased as before. The Rochester company now plans to install such instruments (which cost about $28 each) at its own expense in all its large consumers' premises. Mr. W. H. Shott, of Chicago, told of some results accomplished by daily meter reading.

Mr. A. D. Spencer, of Detroit, said that it is his company's policy to keep its customers satisfied with the service, maintaining a patrol system for the prompt answering of trouble calls. Only the cost of material used is charged for such repairs. Meters are always tested in position on the premises without disturbing, if possible, the identical conditions of service. When meters are found slow no attempts to collect for back consumption is made, but in case of fast registration proportionate rebate is made. The Detroit company, said Mr. Spencer, made one such rebate to a former customer who has since moved to California, and the man was so pleased and surprised by the company's action that he forwarded the correspondence to the Detroit papers, which printed the facts, occasioning much complimentary comment for the company. Mr. Spencer also spoke of the need of detecting thefts and unauthorized use of steam heat. Mr. A. C. Rogers, of Toledo, Ohio, approved several points in Mr. Wright's paper, and told of his own local corps of inspectors who investigate steam-line conditions.

Mr. S. C. Garnar recounted the incidents of several of his customers who were discovered to have increased their consumption and radiation beyond their original contracts, but refused to increase their payments accordingly. The company's directors were very loath to drop these cus-

tomers, as the heating system was in a precarious financial condition and they disliked to lose any revenue, however small. Finally, the unprofitable customers were dropped, and have since never returned, but at the end of the next season the plant showed a good balance and for the first time paid a dividend. Mr. Garner also told of his flat-rate system, in which different schedules are made for services in congested districts, corner houses and dwellings.

Wiring and Illumination

DAYLIGHT ILLUMINATION.

At the noon luncheon of the Chicago Section of the Illuminating Engineering Society June 15 Mr. W. D. Bradley, of the American Luxfer Prism Company, read a paper on the subject of "Natural Daylight Illumination," in which he pointed out how natural light can be controlled and projected into poorly lighted interiors by the proper arrangement of prismatic glass. Mr. Bradley described the construction of the standard prismatic-glass reflectors used for this purpose, and referred to the several special types in which they are made to suit various conditions. He also outlined particular applications of prismatic reflectors for improving the lighting of interiors, offices, factories, schoolrooms and church windows, showing that the contents and arrangement of objects within the room and the direction and amount of incident light are among the important considerations in designing the light-reflecting screens. These screens are easily kept clean by washing with ammonia and water, although soap, if used, collects in the crevices and interferes with light transmission.

TEST OF A RESTAURANT LIGHTING INSTALLATION.

By Roscoe Scott.

The system of restaurant illumination on which the test to be described was made has been called the "Childs" system because its general adoption by the Childs Company entitles it to such designation, but it is applicable to many classes of interior lighting and can be more accurately designated as the "glass reflector-ball" system.

Large and growing business concerns do not, as a rule, adopt any one type of physical equipment as standard until they have sufficiently investigated all the important competing types—a process which may take weeks, months or even years—although such concerns generally do make it a policy to standardize their equipment ultimately. Economy demands standardization, but true economy recognizes that "haste makes waste." The Childs Company, a syndicate operating more than seventy restaurants in fifteen cities, has standardized to a greater or less extent its service, menu cards, paying system, furniture and architecture, and for some time past has been working out a standard system of illumination. For a number of years the inclosed-carbon arc had been the accepted illuminant in the Childs restaurants, but the reflector-ball system, using metal-filament incandescent lamps, is now displacing the arc, at least for interior use. Eight of these

Fig. 2—Childs Restaurant-Lighting System.

restaurants—in Boston, New York City, Chicago, Syracuse, Baltimore and Montreal—are already equipped with the new class of lighting. The results of an illumination survey of a typical reflector-ball installation will, it is believed, be found of interest.

The test was performed by Messrs. H. J. Tait and H. S. Whiting on the second floor of an "all-night" restaurant in New York City. This restaurant is finished in white, white tile being used for the walls and ceilings, white marble for the table tops and white mosaic for the floors. The second floor is lighted by fourteen units spaced in two parallel rows 10 ft. apart, a pair of units being located every 15 ft., as shown in Fig. 1. The height of the ceiling is 12 ft. 2 in., and the units are hung so that the bottom of each lamp is 9 ft. 2 in. above the floor. Each unit consists of a reflector ball like that illustrated in Fig. 3, suspended by a single-chain fixture and containing a 250-watt clear metal-filament lamp.

The globe is 12 in. in diameter and has a 6-in. holder. It is made in two parts, a blown-glass ball, the lower half of which is satin-finished, and a prismatic-glass reflector, which fit snugly together. It should be noted that the distribution of light from such a unit may be varied within rather wide limits by changing the relative positions of the lamp and the globe. The higher the lamp is placed the greater the concentrating effect and vice versa. In this installation the holders are so designed that the light center of the lamp is approximately 3 in. above the geometrical

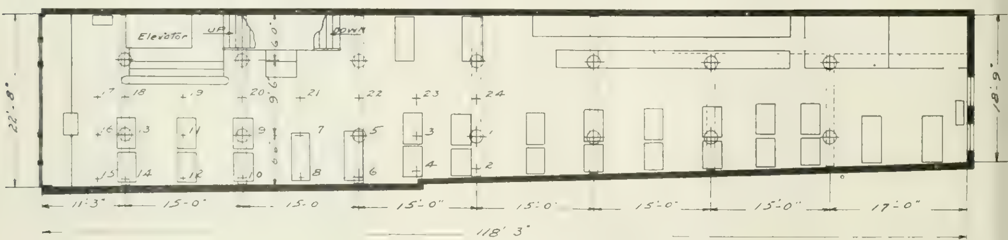


Fig. 1—Second-Floor Plan of Restaurant, Showing Location of Lamps.

center of the globe. This results in an "intensive" distribution of light from the unit.

The instruments used in the test were a portable illuminometer, a set of dry batteries, an ammeter and a voltmeter. The comparison lamp in the illuminometer was checked both before and after the test, so that any serious change in its candle-power at rated voltage might be noted and corrected. All of the readings were taken by one observer.

At the time this test was run the installation had been in constant service for several months so that the lamps

Fig. 3.—Typical Glass Reflector Ball.

were unquestionably well past their respective peaks in candle-power. The units were not specially cleaned for the occasion, as it was desired to have the test represent average service conditions.

Fig. 1 indicates by means of crosses the location of the various stations at which illumination readings were taken, and by means of circles the location of the lighting units. The observations were taken on a plane 36 in. above the floor, from three to five readings being taken at each test station. The average results, shown in the following table, have been corrected to normal voltage, as the lamps were subjected during the test to a voltage slightly higher than their rating:

Station.	Foot-Candles.	Station.	Foot-Candles.	Station.	Foot-Candles.
1*	12.7	9*	8.8	17	6.3
2	7.8	10	5.0	18	8.9
3	6.0	11	5.6	19	5.9
4	5.1	12	4.2	20	7.2
5*	10.5	13*	11.8	21	5.4
6	5.5	14	4.8	22	7.1
7	5.6	15	4.0	23	6.0
8	4.2	16	5.7	24	[illegible]

*Stations that were directly under lamps.

The test indicates that the average illumination of the space investigated is 6.8 ft.-candles, varying from a minimum of 4.0 to a maximum of 12.7 The average intensity at the four stations directly under the lamps is 10.9 ft.-candles. The area lighted by one unit is 162 sq. ft.; the lumens per lamp effective in producing this illumination are, therefore, the product of 6.8 and 162, or 1102 lumens. The total light-flux given by a 250-watt lamp of the make in question operated at its rated initial specific consumption of 1.13 watts per candle is 2168 lumens. Hence the "illumination constant" or efficiency of the system under test conditions is the quotient of 1102 and 2168, or 51 per cent. The lumens effective per watt are 4.4, a high value for diffusing globes even when used with high-efficiency lamps in light-colored rooms. The fact that the globes absorb very little light and the fact that they embody a reflecting device both contribute toward the efficiency of the illumination.

As is well known, no system of illumination will give satisfactory results if the lamps and reflectors are covered with dust. The time necessary to keep arc lamps or incandescent lamps clean is well spent when the improvement in appearance and increase in illumination are considered. In the installation here described the total time required for cleaning the lighting units amounts to approximately one-half hour per unit per month. The reflector balls are dusted with a dry cloth once a week, while once a month each unit is thoroughly washed. The fixtures also are cleaned and polished once a week. Here the efficiency maintenance of lighting units is doubtless brought to the highest practical standard, for absolute cleanliness is characteristic of these establishments.

Efficiency is only one of several qualifications which a satisfactory system of restaurant illumination should possess. The physiological effect on the eyes of patrons should be considered carefully, and this brings up the questions of steadiness and diffusion. As regards the former, the electric-incandescent system leaves nothing to be desired. As regards the latter, the system tested affords sufficient diffusion for eye comfort. The reflector balls are an example of the "satin-finished glass" as distinguished from the "opal-glass" type of diffusion. One sees no image of the lamp filament, but the globe surface appears to the observer to be slightly more luminous near the middle than close to the periphery.

LIFE OF UPRIGHT TUNGSTEN LAMPS.

When tungsten lamps were first introduced it was with considerable misgiving that some began to install them in an upright position. It was feared that placing them upright might have a detrimental effect on the life, as did the horizontal placing of some earlier lamps. Nevertheless many lamps have been used in an upright position the last three years, especially on ornamental lamp-posts for street lighting and on indirect-lighting fixtures for interior lighting. As a general rule, no comparison of the life obtained from these lamps could be made with lamps in the pendent position. Some tests recently completed, however, the conditions of which are not free for publication, indicate that if anything better life can be expected from large tungsten lamps in an upright position than from lamps under identically similar local surroundings in a pendent position. There seems to be some good reason for this. The filament is more flexibly supported with the lamp in an upright position, as tungsten lamps have been constructed in the past, than with the lamp in the pendent position. With lamps in the pendent position the filament hangs from rigid anchors and is especially subject to breakage because of the rigidity of support. This is not so true in more recent designs of lamps. This question is one which becomes of decreasing interest as the earlier types of lamps are replaced by new lamps, but it is nevertheless interesting to note that what was once thought to be the doubtful practice of placing lamps upright gives results as good as and probably better than the pendent position.

A NEW IDEA IN ALTERNATING-CURRENT UNDERGROUND DISTRIBUTION.

A number of prominent business men in Decatur, Ill., purchased a block of ground recently and erected on it several fine residences for themselves with space remaining in the tract for several other houses of like character. These homes are handsome specimens of domestic architecture, and of course the owners desired the conveniences of electrical energy, both in their houses and the garages in the rear. Four of these modern residences facing a private driveway to the south, with accompanying garages, were completed last fall, and their location is shown by Fig. 1 of the accompanying illustrations. The owners of the property did not desire any poles or overhead wires in their grounds, and the question arose how to secure a practicable underground distribution from a near-by overhead alternating-current circuit.

Underground distribution was required primarily on account of the unsightliness of overhead poles and wires in such a high-class residence neighborhood as it was desired to make of this tract, and secondly because the overhead wires could not be strung without marring the beauty of some fine old trees on the property. Various methods of meeting the situation were discussed, and finally Mr. F. J. P. Seuel, of Chicago, a personal friend of one of the gentlemen interested, was called into consultation, and he devised the plan which was installed and which is described herewith. Mr. Seuel has had many years' practical experience with the underground department of the Commonwealth Edison Company, and was therefore particularly well fitted to plan an installation of this kind.

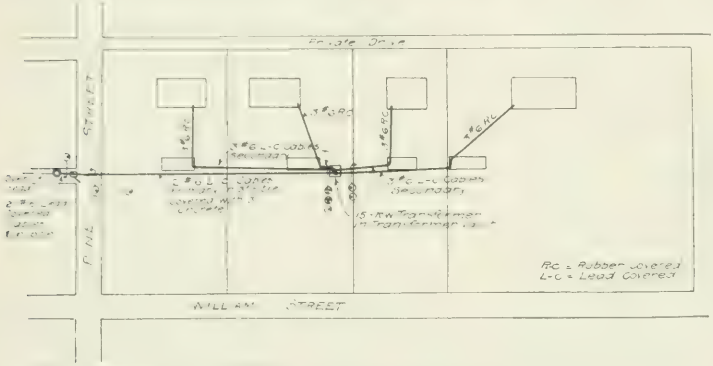


Fig. 1—General Plan of Wiring for Alternating-Current Underground Distribution on Residence Property.

Fig. 1 is a plan of the property served, showing the method of distribution adopted. The overhead circuit runs to a cable pole on the east side of Pine Street, indicated in the drawing. From there two underground lead-covered cables run west to a transformer house of artistic design located near the center of the property, and from this point underground lead-covered secondary cables lead to the four gárages, from which, in turn, rubber-covered underground cables lead to the four houses at present served. The layout, however, is such that an equal number of houses and garages fronting on William Street, on the north side of the property, can be served from the same center of distribution. All of the primary and secondary lead-covered cables are installed in 3-in. fiber ducts laid 26 in. below the surface of the ground and protected on top by 3 in. of concrete. In addition to the electric-service cables laid in this trench, the two competing telephone companies operating in Decatur took advantage of the occasion to install their distributing cables in the same trench. There are thus no overhead wires on the property, either electric light or telephone.


Fig. 2—Exterior of Transformer House.

Fig. 2 shows the appearance of the transformer house, while Fig. 3 is a drawing giving an elevation inside the transformer house, showing the electrical connections. This transformer house is built of brick with stone trimmings, and is designed to harmonize with the architecture of the residences and garages. The windows and a glass panel in the door are provided with wire glass, and the whole structure is fireproof. The roof of this attractive building projects beyond the walls and is elevated from the masonry structure by massive beams, the opening thus secured being used to give ample ventilation. To enhance the ornamental appearance of the structure, a small porchlike addition is provided, as shown in the illustration, giving space for flower boxes.

The transformer and its connections are installed on the north wall of the interior of the transformer house, in the manner shown in Fig. 3. The frame of the transformer and the neutral wires are grounded, and there is also a drainage connection to the sewer, as indicated. The 2300-volt incoming primary wires pass through potheads and insulator-type cut-outs before going to the transformer, which is rated at 15 kw. The secondary circuits are provided by three wires carrying 110-220 volts.

The overhead circuit at Pine Street passes through a lightning arrester on one pole before proceeding to the cut-outs and potheads leading to the upright iron pipe on the near-by cable pole. The details of the equipment on these poles are shown in Fig. 4.

All material used in connection with this installation was supplied by the owners except the transformer, cut-outs, potheads and lightning arresters, which were supplied by the Decatur Railway & Light Company, which furnishes the electrical energy. The central-station company also did the construction work. By this arrangement of sharing the expenses the property owners are convinced that they have secured an exceptional installation for comparatively little money. The commendatory features of the plan are its simplicity, safety and ready accessibility. There can be no transformer trouble due to moisture or water, which is the great objection to underground transformer installations. Although the transformer is installed

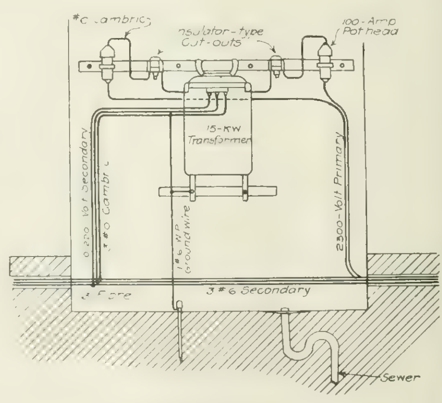


Fig. 3—Transformer Connections..

several feet above grade, drainage is provided as additional precaution, as shown in Fig. 3. The ventilation provided for the transformer house is more than sufficient, and the door to the attractive little building housing the trans-

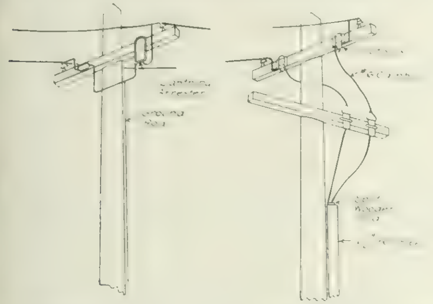


Fig. 4—Details of Poles Carrying Overhead Circuit for Underground Distribution on Residence Property.

former is kept securely locked, only the central-station company and one of the owners having keys. The wire glass will prevent missiles from the hands of mischievous boys reaching the interior.

WIRING AND FUSING OF INDUCTION MOTORS.

At the recent biennial meeting of the electrical committee of the Underwriters' National Electric Association, now the National Fire Protection Association, the following changes were made in the National Electrical Code rules governing the wiring and fusing of induction motors: The first paragraph of Rule 8-*c* (Motors) now reads: "Each motor and resistance box must be protected by a cut-out and controlled by a switch (see No. 17-*a*), said switch plainly indicating whether "on" or "off" (except as provided for electric cranes, see 34 *A-c*). Small motors may be grouped under the protection of a single set of fuses, provided the rated capacity of the fuses does not exceed 6 amp. With motors of ¼ hp or less on circuits where the voltage does not exceed 300, single-pole switches may be used as allowed in No. 22-*c*," etc.

Changes were made in Rule 21-*d* (Fuses and Circuit-Breakers), third paragraph, as follows: "The above shall not apply to motors, except that small motors may be grouped under the protection of a single set of fuses, provided the rated capacity of the fuses does not exceed 6 amp."

The fourth paragraph under the same rule has been revised to read: "The fuses in the branch cut-outs, except for motors as noted above, must not have a rated capacity greater than 6 amp on 110-volt systems, and 3 amp on 220-volt systems."

The first paragraph of Rule 21-*e* has been amended as follows: "The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given in No. 16. Circuit-breakers must not be set more than 30 per cent above allowable carrying capacity of the wire unless a fusible cut-out is also installed on a circuit. Where rubber-covered wire is used for the leads or branches of alternating-current motors of the types requiring large starting currents, the wire may be protected in accordance with Table B of No. 16, except when circuit-breakers are installed which are equipped with time-element devices."

Rule 21-*f* has been slightly changed by substituting for the word "phase" the word "wire," so that it now reads: "Each wire of motor circuits, except on main switchboard or when otherwise subject to competent supervision, must be protected by an approved fuse, whether automatic overload circuit-breakers are installed or not," etc.

LETTER TO THE EDITOR.

Limits of Greater Electrical Networks.

To the Editor of Electrical World:

SIR:—In the discussion of electrical distribution on a large scale from a great central plant, there are several factors to which due weight does not appear to be given. Several of the larger central stations of the country have gone into an extensive distribution outside their immediate urban territory and have obtained excellent results in so doing; yet this success does not prove that they can economically keep on with the policy of extension to an indefinite distance.

There is a period in the expansion of any area when the losses incurred in transmission and the larger expense entailed by increasing distance from the generating station make necessary the establishment of one or several additional stations to take care of the load remote as concerns the main plant. When this state of affairs is reached it is at least an open question whether the additional generating stations cannot do their work just as cheaply and effectively under some other management than the original one. The time comes when increase in size of station and in output ceases to win economies large enough to cover transmission losses. When one is dealing with hydroelectric plants in which there is extremely cheap power production one can stand heavy transmission losses and still keep above the cost of locally generating power. This margin, however, becomes small when the comparison is between, let us say, a 50,000-kw steam plant and a 10,000-kw steam plant, both equipped with modern apparatus.

The advent of the steam turbine, which has had so marked an effect in the economies of power production, tends to lessen the difference in cost between a large plant and a colossal one, and hence to lessen the economical limit of transmitted power received from the latter. Similarly, the gains due to diversity factor become less and less important as the transmission losses become heavier, until at last a distance will be reached at which no practical change in diversity factor would overcome the losses, of one kind and another, chargeable to distance. It does not follow that because there have been some notably successful examples of great hydroelectric networks similar networks operated chiefly or wholly from steam plants will pay. Their economic limits are certainly different from those met in the case of hydroelectric systems and may be much shorter.

There is strong probability that in a considerable number of cases the economic size of plant has already been passed—that is, there are undoubtedly some systems in which the transmission losses more than overbalance any saving obtained by generating in one rather than in several places. The saving of cost by centralized management would be in many cases of larger networks somewhat dubious. There is a point at which centralization defeats its own ends, and this has been in a measure found more than once in large companies. The chance of providing rural and suburban service that could not be reached by a local central station is attractive, but it depends on a condition not always met in transmission systems. If the company owning a big network would agree to retail power to all the communities it touched not already supplied, the plan would have considerable advantages, but the tendency of modern big networks is to sell power wholesale and they are not always freely permitted to do retail business.

Broadly, from the engineering standpoint, there are limits to economical transmission from steam-driven stations which cannot be neglected, and these limits are not infrequently passed. From the financial standpoint it may be desirable to extend service even well up to this limit, but the

big gains in the development of networks have been made through the utilization of hydraulic power. When the territory covered is so large as to necessitate a number of large generating stations, the question of the separate or unified ownership of the various segments of the network becomes of practically very little importance from the standpoint of the engineer. If a great network is to be formed with a view of working out the utmost possible economies in installation and operation, interconnection of all its parts and unified ownership possess advantages. If, however, the organization is made all-inclusive merely to facilitate the issuing of securities, the work is of dubious public benefit. In practice, the matter will work itself out rather easily. Each central station will find its own limits for its economical expansion judged from the engineering standpoint. When these are passed and the realm of high finance is entered, one cannot be over-enthusiastic about the results. It should be added that this discussion does not apply to the case of a central steam-generating plant which would supply electrical energy within a district containing numerous small central-station companies now manufacturing their supply under uneconomical conditions.

Charles L. Warner.

New York.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Checking of Connection Diagrams of Three-Phase Machines.—H. C. Specht.—The author describes how to check connection diagrams of three-phase machines. If the winding of a complete star-connected stator, for example, is to be checked, the respective phases would be excited by low-voltage direct current applied across the terminals of the three-phase machine connected together, and the neutral point and the polarity of the winding explored by means of a compass or magnetized needle held within the stator near the face of the iron. Then there should be three times as many poles as the rated number of poles of the machine, reversing alternately and spaced equally, provided the machine has a balanced winding. In the case of a delta-connected winding it would be necessary simply to open the delta at any convenient point, such as at the point of connection of one of the terminals and connect the two free ends to the source of power.—*Elec. Jour.*, June.

Partial-Slot Windings for Polyphase Generators.—M. Seidner.—The translation of his recent German paper on the theory and construction of partial-slot windings for polyphase generators. An account is given of a graphical method of developing the windings on various types of polyphase machines. This is designed to act as a useful aid in the construction of such windings as are employed in practice. The theory is applied to a number of different types of commercial machines.—Lond. *Electrician*, June 9.

Lamps and Lighting.

Photometric Units.—H. T. Harrison.—An article on the nomenclature of primary and secondary sources of light with special reference to a recent article by Trotter. The author emphasizes that illumination, as defined by the terms at our disposal, does not differentiate between the class of illumination which will make visible the details of solid objects and that which will not. If illumination is the quality and quantity which stimulate the eye in discrimination of outlines and perception of colors, then in order to know the extent to which it is likely to assist in the discrimination of outlines it is necessary to know the area of the source from which the light emanates and also the direction. A monochromatic solid object, like statuary, for instance, demands that every curve or angle must reflect varying degrees of light back to the eye in order that it can be seen in detail, and this applies in varying degree to all objects, except plain artificial ones, such as pictures where the artist has done what the varying degree of illumination has to do in the case of a solid object. Therefore, if an illuminating engineer specifies only the degree of illumination in foot-candles, or any other terms at present in use, he must not be surprised if the result is not satisfactory. In cases where the light is radiated from one or more sources the effect of light and shade will be produced, whereas if it emanates from all directions, being reflected by the luminosity of the surrounding surfaces, the opposite effect will be the result. Therefore, if the term luminosity is to be used to indicate the reflecting value of these surfaces, he suggested that "lumens" should be allotted to light flux obtained by reflection. The objection to this appears to be that the term "lumens" has already been appropriated. Therefore, it would perhaps be advisable to coin a new term for the light-emitting power of a secondary source, and a new unit to describe the value of the illumination derived. The physical value of illumination is not always equal to surface radiation per square centimeter multiplied by the area of the light source. Therefore, the unit required is that which distinguishes between the light flux which produces contrasts and that which does not. It would, then, be possible to judge the true physical value of the resulting illumination. An illumination derived from a source of comparatively small area will accentuate contrasts of light and shade, and that derived from a relatively large area will reduce them. So, mathematically, the unit is required to describe the degree of divergence from the $i = cp \div D^2$ formula, where candle-power is taken as emanating from a point source; in other words, a factor which reaches unity when illumination is derived equally from all directions and a maximum when illumination is derived from one infinitely small point. For example, if 1 cp gives 0.01 ft.-candle at a distance of 10 ft., it will give x ft.-candles measured 5 ft. from an albedo plain surface of practically infinite area illuminated by a 1-cp light at a distance of 5 ft. Thus the new unit would denote a shadow-giving efficiency of $0.01 \div x$, and could be measured by an ordinary illumination photometer by measuring the illumination on the light and dark side of an object. The difference would give the relative shadow value of direct and indirect lighting, which would be the maximum if all the lighting were obtained from a point source and the minimum when the light is obtained equally from all directions.—Lond. *Electrician*, May 26.

A Light Filter and Definition of Light Intensity.—R. A. Houstoun.—A note on a recent paper presented before the Royal Society in London. The author stated that a thermopile could not be used for the measurement of candle-power because it gave the same value to the energy of every wave-length, invisible as well as visible. The author, however, had found by spectro-photometric investigation in the ultra-violet, visible and infra-red parts of the spectrum that if a filter consisting of aqueous solutions of copper sulphate and potassium bichromate of a particular strength in glass cells be placed before the thermopile, then this filter stopped the ultra-violet and infra-red entirely and let through a fraction of each wave-length in the visible spectrum proportional to its visibility. In other words, it weighted each radiation according to its visibility. The voltage of a tantalum lamp was varied over a wide range, and its candle-power as read by thermopile and filters

greed well with the readings of a photometer. Owing to the high sensitiveness of the galvanometer required the method was not suitable for commercial application, except perhaps for integration photometry, when a number of thermopiles might be connected in series with the one galvanometer. The importance of the method lay in the fact that it provided a satisfactory basis for heterochromatic photometry independent of the Purkinje phenomenon at intensities. The author, therefore, proposed to use it for defining the unit of light intensity. He would define the latter as that source the total intensity of radiation from which at a distance of 1 m after passing through his filters would be x ergs per square centimeter per second. For the standard candle x should be about 0.8.—Lond. *Electrician*, May 26.

Lamp Specific Consumptions.—B. F. Fisher.—The author gives curves showing the most economical specific consumptions of 50-watt carbon-filament lamps and of 40-watt

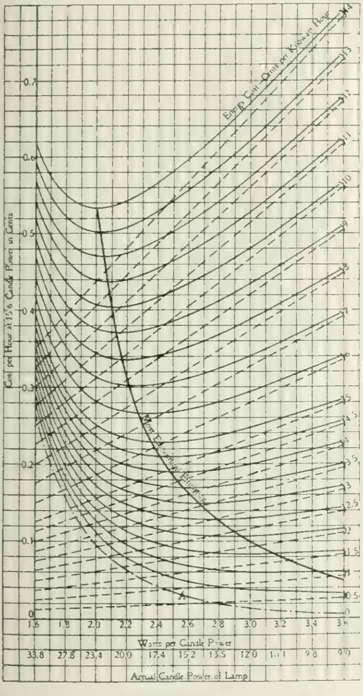


Fig. 1—Curve Showing Most Economical Efficiency of 40-Watt Metallized Filament.

"metallized"-filament lamps (Fig. 1) for different prices of energy (the cost of the kw-hour in cents being given on the right hand). The curves reproduced here refer to a "metallized"-filament lamp consuming 2.56 watts per candle per candle-power in normal operation, with a candle-power of 15.6 and a life of 600 hours, the cost being 23 cents less 20 per cent = 18.4 cents. The solid, drawn-out lines show the total cost. The curves made up of dashes give the energy cost and the curves made up of dashes and points give the first cost and renewals of lamps. As shown in the illustration, at 1 cent per kw-hour the most economical specific consumption is 3.4 watts per candle (which is materially below the value for commercial metallized-filament lamps). At 2.5 cents per kw-hour the most economical consumption is 2.8 watts per candle (which is above 2.83 watts per candle, the low operating consumption of the commercial metallized-filament lamps). At 3 cents per kw-hour the most economical consumption is 2.65 watts per candle (which is the "medium operating consumption" for commercial lamps), and at 7 cents per kw-hour, the average cost for energy, the most economical consumption is 2.22 watts per

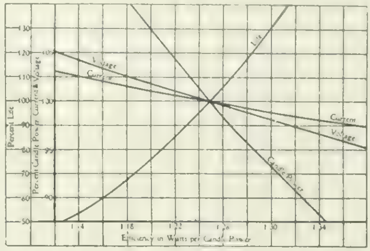


Fig. 2—Characteristic Curves of Tungsten Lamp.

candle (which is to-day above the highest commercial consumption for metallized-filament lamps) and might occasion a slight amount of annoyance on account of the frequent renewals.—*Elec. Jour.*, June.

Tungsten Lamps.—J. F. Meyer.—An article discussing some characteristics of tungsten lamps. Curves are given showing the change of resistance in current with varying voltage. Fig. 2 gives the characteristic curves of a 60-watt, 114-volt tungsten lamp giving the variations of voltage, current, candle-power and life as functions of the specific consumption in watts per candle-power. Curves showing the horizontal and vertical candle-power distribution of the tungsten lamps are also given.—*Elec. Jour.*, June.

Arc Lamp.—A note on an arc lamp of British make de-

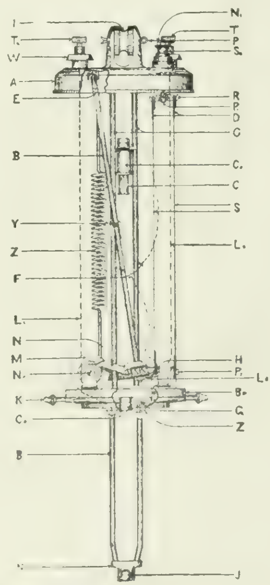


Fig. 3—View Showing Mechanism of Arc Lamp.

signed to work with frequencies from 25 to 40. This has been found possible by constructing on the hot-wire principle, a strip of special alloy being used to operate the chief working parts. Fig. 3 shows the operation of the mechanism. The circuit of the current starts at terminal T_1 and

flows down L_1 to the strip S, from which it passes to the top of electrode holder by the flexible cord F_1. The action of the current in expanding the strip S causes the disk M to rotate and lift a clutch C, thus striking the arc. The reverse of this takes place if the arc lengthens or breaks. In this lamp the dash-pot is absent, and there is also no self-induction, so that a high power-factor is maintained. On 200-440 volts it is advisable to operate the lamps in series parallel with a transformer, so that each lamp is independent in the circuit and the substitutional resistance and cut-out can be dispensed with.—Lond. *Elec. Eng'ing*, June 8.

Measuring Luminosity of the Spectrum.—F. ALLEN.—A description of a new method for measuring directly the luminosity of the spectrum. It is based on the principle of the flicker photometer.—*Phil Mag.*, May.

Generation, Transmission and Distribution.

Water Power in Spain.—M. NEUSTAETTER.—The first part of an illustrated description of the high-tension transmission plant of the Hidroelectrica Española. It furnishes energy to the cities of Madrid, Valencia, Cartagena and others. The water-power plant is located at the Jucar River, and its distance from the city of Madrid is 254 km (152 miles) and its distance from Cartagena is 180 km (108 miles). This is the first system in which a voltage higher than 50,000 has been used in Europe for energy transmission. At present the voltage of transmission is 67,000; this will be raised later to 70,000. In the present instalment the hydroelectric equipment is described.—*Elek. Zeit.*, June 1.

Electric Equipment of Printing Office.—An illustrated description of the electric equipment of a new printing plant in London. It is in a large four-floored reinforced-concrete building, with special features as regards heating, ventilating and fire protection. It contains a full equipment of electrically driven machinery, including a large number of rotary and flat-bed presses in great variety of size and design, special folding, gathering, stitching, wrapping and cutting machinery, complete electrotyping and stereotyping plant, comprising machines, etc. Electric drive by individual direct-current motors is employed throughout, and the lighting is entirely by means of metallic-filament lamps. There is also an illustrated article by F. Broadbent, who discusses the advantages of electric-motor service and lighting in printing establishments on the score of economy and convenience, and describes the special facilities which electric driving offers in the way of easy and accurate control of printing machines.—Lond. *Elec. Eng'ing*, May 25.

Motor Service in Factories.—H. H. HOLDING.—An illustrated article giving notes on factory motor service costs with respect to transmission and the source of energy. The load-factor is the important condition which determines the advantage to be gained both in transmission of energy in the factory and in the source of energy for an electric drive. The lower the load-factor the greater the advantage of electric drive over other methods of transmission. The higher the load-factor the cheaper the rate per unit of energy whether the energy be produced by a private plant or purchased on a demand basis. As the factory manager becomes better advised as to his operating conditions with respect to load-factor it is easier for the central station to show him the advantages of purchased energy.—*Elec. Jour.*, June.

Gas Producers.—J. E. DOWSON.—A paper read before the (British) Institution of Mechanical Engineers. A brief survey is made here of certain types of gas producers, the theory of their action and the composition of the gas produced being given. A comparison is also made between suction plants and pressure plants, and the effect of varying loads, etc., is discussed.—Lond. *Electrician*, June 2.

Elevators.—F. HYMANS.—An illustrated article on direct-traction electric elevators in the Oliver Building in Pittsburgh.—*Elec. Jour.*, June.

Traction.

Tramway Progress in Berlin.—The Great Berlin Stre Railway Company for the year 1910 declared a dividend 8.5 per cent on a capital of $25,000,000. The rolling stoc now consists of 675 double-truck motor cars, 917 singl truck motor cars and 1036 trailers. The last-mention have seats for twenty-four passengers and standing roo for sixteen on the end platform. The number of passe gers carried during 1910 was 427,700,000, as against 39 610,000 in 1909. The gross earnings were $10,192,8 in 1910 and $9,444,820 in 1909. The distances ru were 60,281,160 car-miles in 1910 and 55,823,700 1909, the earnings being 16.8 cents and 16.6 cents per ca mile respectively. The operating expenses were 55.58 p cent of the gross earnings in 1910, as against 54.82 per ce in 1909; 7.04 passengers were carried per car-mile. Th length of track is now 331.4 miles. One hundred an twenty-five thousand dollars was placed to the road depr ciation account and $131,250 to the account for renewal rolling stock. Under the agreement with Berlin and th neighboring municipalities the company paid over $696,6 of its gross earnings to the local authorities.—Lond. *Ele trician*, June 2.

Electric Traction in Prussia.—A review of the work do from 1900 to 1910 by the government department of Pru sia, which has in charge the German railways, with da on the use of the single-phase system and of storage-batte cars on German railways. Figures and curves are give showing the increase of tariff. The receipts from suburb passenger traffic in Berlin increased from $2,500,000 1899 to $5,500,000 in 1909.—*Elek. Zeit.*, May 11.

Installations, Systems and Appliances.

Motor Starting Device.—A note on a recent Briti patent (11,186, June 1, 1911) of the Adams Manufacturi Company (Cutler-Hammer Manufacturing Company of th country) for an improvement on the electrically operat step-by-step mechanism which now rotates a contact dru gradually to cut out resistance from the motor circu The electrically operated mechanism is controlled by relay device which, when energized, establishes a circu causing the step-by-step mechanism to operate, and when d energized produces a circuit allowing the mechanism operate as soon as the current is restored, when the conta drum is moved and the whole of the resistance is in th motor circuit ready for starting. An auxiliary contact se ment is provided and operated simultaneously with the co tact drum, the segment controlling the circuit through solenoid, which operates the main switch in the motor ci cuit. The segment also opens the circuit through a soleno operating the step-by-step mechanism, when all the resis ance is either out or in the motor circuit.—Lond. *Ele Eng'ing*, June 8.

Double Energy Rate.—A. MOHL.—The author discuss some criticisms which have been raised against the ra formerly proposed by him which is a simple double ra so that when a certain current limit is exceeded a high price is charged. The consumer is not obliged to consun a certain amount of energy per year. The working of th rate is explained and it is emphasized that a simple seri relay can be used. The author thinks that this rate e courages the use of electricity for domestic purposes an a greater utilization of electricity in installations wi motor connections which would otherwise be used only f short periods.—*Elek. Zeit.*, May 11.

Wires, Wiring and Conduits.

Telescopic Mast.—An illustrated description of a tel scopic mast of British make. The mast consists of a seri of welded steel tubes of gradually decreasing diameter an thickness, which are adapted to slide telescopically with one another. The novelty of the design lies in the meth employed for extending the mast, for which purpose untempered perforated steel band is employed. By mea

a winch the steel band is rolled out and extends the ast.—Lond. *Electrician*, June 2.

Electrophysics and Magnetism.

Incandescent Lime Cathodes.—R. S. Willows and T. icton.—An abstract of a (British) Physical Society aper on the behavior of incandescent lime cathodes. Vehnelt has shown that incandescent lime emits a large umber of negative ions; if, therefore, hot lime is used s the cathode a discharge may be obtained in a vacuum ibe with potential differences as low as 30 volts. The lteration with time of these cathodes, under continued se, has been investigated and the following results obtained: (1) When lime is heated on a platinum foil, so ar from showing fatigue it actually increases in activity. Vith potential differences greater than the saturation voltge this increase may be ninefold. At lower voltages a low but steady increase up to 100 per cent has been found. The steady activity falls when the lime is cold; the initial ctivity may greatly increase. (2) When the lime is heated n nickel foil, if the tube carries a heavy discharge, the urrent increases to a maximum and then decreases. A greatly increased activity is frequently shown after the ime has been cold for some hours. At the lower voltages he same general variations are shown as with platinum. 3) Great irregularity is frequently shown when the current is first started; at this stage other causes than temperature, such as mechanical vibrations, greatly influence the mission of ions.—Lond. *Electrician*, May 19.

Discharge from Hot Calcium Oxide.—C. D. Child.—When the potential difference between the electrodes is ncreased the discharge in a vacuum from hot calcium oxide passes through a critical condition, the current being very much greater after the critical point is passed and the discharge becomes luminous. It has been suggested by Mr. J. J. Thomson that this sudden change is caused by the molecules having been hit so often by the electrons that many of them are in a state of unstable equilibrium, and that when in this state only a small increase in the electric force is needed to cause ionization. The author offers some reasons why he thinks that this is not the correct explanation, and he suggests that the phenomena may be explained by assuming that ionization is produced at the cathode by the bombardment of its surface by positive ions and that such ionization occurs very much more easily with a very hot cathode than with one which is cold. The potential difference between the beginning and end of a striation was found to increase as the pressure of the gas increased and to decrease slightly when the current was increased. It was in certain cases as low as 10 volts. Because of the similarity between this form of discharge and the electric arc it is reasonable to assume that the electrons at the cathode of the arc are also produced by bombardment of the cathode by the positive ions which come from the gas, and that they are not to any great extent emitted from within the cathode because of its high temperature. Such an explanation accounts for certain difficulties which may be raised against any other explanation.—*Phys. Review*, May.

Lecher System of Free Vibrations.—F. C. Blake and E. A. Ruppersberg.—An account of an experimental investigation in which it is shown how it is possible to obtain on a set of parallel Lecher wires a system of free vibrations uncontaminated by oscillator influence except that of coupling. It is found that the unmodified theory fits even the case of close coupling to a first approximation. The manner in which the theory has to be modified for a second approximation is pointed out. The conditions for freedom from contamination are found to be two—the introduction of suitable air-gaps into the oscillator circuit and suitable water resistance between the induction coil and oscillator. The results of varying these conditions are studied. A ratio between fundamental maximum and minimum equal to 125 to 1 is experimentally obtained, and it is thought that this ratio can be materially increased by observing the best conditions for controlling the various factors that enter into the problem. The ratio between Lecher wire-length and wave-length is found to be 2.07 and the difference between this value and the theoretical value 2.00 is shown to be due to an "end-correction" which is necessarily always present.—*Phys. Review*, May.

Ions in Flames.—H. A. Wilson.—A discussion of the measurement of the velocity of the ions of alkali salt vapors in flames. The author concludes that the positive ions of alkali salts in flames are probably single atoms of the metal, and that the negative ions are electrons.—*Phil. Mag.*, June.

Units, Measurements and Instruments.

Analysis of the Harmonics in an Alternating Current.—H. Smith.—The author utilized the principle of resonance for the examination of the harmonics present in an alternating-current supply. The method is simple and sensitive. If a circuit (Fig. 4) consists of an inductance L and a

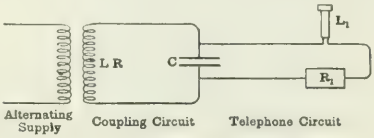


Fig. 4—Diagram of Connections.

capacity C, we can produce an oscillating circuit of low frequency, which can be coupled with the alternating supply which is to be examined. By alternating the value of C we can give to the circuit the same period as any of the harmonics. To test when the circuit is in resonance with any particular harmonic a telephone is joined across the condenser and a note is heard which has the same pitch as the frequency of the circuit. It is necessary that a fairly large resistance (10,000 ohms or more) should be placed in series with the telephone. As C is varied from zero upward, all the harmonics are heard in turn in the telephone, each harmonic producing a note which rises to a maximum with a certain value of the capacity. To find what harmonic has been reinforced by resonance all that is necessary is to find the pitch of the whole note with a sonometer and divide by the frequency of the fundamental; or, if L and C are known, the frequency of the circuit divided by the frequency of the fundamental will give the harmonic. Moreover, since the pitch of the note is the frequency of the circuit, if C is known and L unknown, the value of L may be calculated from the formula $2\pi n\sqrt{LC} = 1$, where n is the pitch of the note. As C is varied till a particular note in the telephone reaches a maximum intensity the current through the telephone due to any particular harmonic must also be a maximum.—Lond. *Electrician*, June 2.

Electricity Meters.—A note on a recent British patent (1930, May 18, 1911) of Allg. Elek. Ges. This relates to meters where the consumption above a certain amount of energy is registered by means of parts which rotate in the same direction and are driven respectively by the meter and by a constant force corresponding to a determined maximum energy. In the improved meter two registering counting mechanisms are provided, one of which continually registers by an amount corresponding to the determined maximum energy, while the second increases by this amount only when the consumption is below the maximum energy, whereas on exceeding this the total consumption is registered, so that the difference of the results of the counting mechanisms shows the amount in excess of the determined maximum energy.—Lond. *Elec. Eng'ing*, May 25.

Insulating Material.—A note on a recent British patent (9858, May 11) of Mr. W. J. Reid. The method consists in treating with paraffine wax a mixture of from forty to sixty parts of finely powdered cork and from sixty to forty parts by weight of linseed oil, which has been subjected to a temperature usual in preparing boiled oil for painters'

use for such a time that it becomes viscid and will draw into threads when cool. This mass can be molded while hot into any shape, and when hardened can be exposed to the air at a temperature of 100 deg. Fahr.—Lond. *Elec. Eng'ing*, May 18.

Units and Notations.—Four committee reports by Messrs. C. L. Weber, L. Fleischmann, Thomaelen and G. Dettmar on electrical units and uniform notation, presented to the Berlin Electrical Society.—*Elek. Zeit.*, May 11 and 18.

Telegraphy, Telephony and Signals.

Determining the Characteristic Constants of Telephone Lines.—Devaux Charbonnet.—A mathematical article on the determination of the damping coefficient of a long telephone line and its characteristic impedance on which the reflections at joints of two telephone lines of different specifications essentially depend. The author closes the telephone line to be tested at its end through an impedance equal to the characteristic impedance of the line. In this case there are no longer reflections and the experimental determinations are easy.—*La Lumière Elec.*, May 13.

Miscellaneous.

Compulsory Accident Insurance in Germany.—On Oct. 1, 1910, there was the twenty-fifth anniversary of compulsory accident insurance in Germany. Mr. K. Hartmann in analyzing the results, with special reference to electrical engineering, reaches the conclusion that the increased efforts made to prevent accidents have met with great success.—*Elek. Zeit.*, May 11.

Book Review.

Electrical Nature of Matter and Radioactivity. By Harry C. Jones. New York: D. Van Nostrand Company. 210 pages. Price, $2.

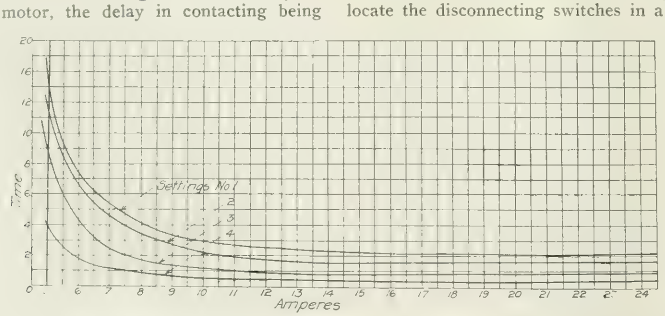
This is the second edition of a very interesting elementary treatise upon a most fascinating topic. The writer presents a very comprehensive view of the electronic theory and experimental support, including the latest developments prior to the printing of the second edition. The language is clear and mathematics is avoided. The book is undoubtedly one of the clearest elementary expositions of the electronic theory in the English language.

New Apparatus and Appliances

TIME-LIMIT RELAY.

Of the two well-known types of time-limit relays, the "inverse" and the "definite," both possess advantages and disadvantages when used in a large supply system. When the inverse-time-limit type is used several relays in series do not act selectively under short-circuit conditions, so that a short-circuit on any part of the system interrupts the whole supply. The definite-time-limit type acts selectively, but fails to protect the system against damage due to direct short-circuit. A relay being placed on the market by the Condit Electrical Company, Boston, it is claimed possesses simultaneously the selectivity of the definite-time-limit type.

The relay consists of a contracting device driven by an alternating-current motor, the delay in contacting being determined by the amount of time consumed by the motor in bringing the contact points together. The amount of the delay can be varied by simply changing the arc through which the contact device must travel in order to close the relay circuit. It is stated that when once set to operate with a certain delay in time the relay will not vary therefrom subsequently.



Time Required for Operating Relays as Affected by Current in Circuit.

Curves showing the time required for operation of four different settings as affected by the current in circuit are shown herewith. The action is seen to be "inverse" for low current values, but "definite" for high currents. The individual settings are separated by a definite interval of time, no matter how heavy the short-circuit current may be, so that the relays may be set to operate selectively, but the "inverse" action is said to be sufficient to obviate damage to the apparatus by a continued short-circuit.

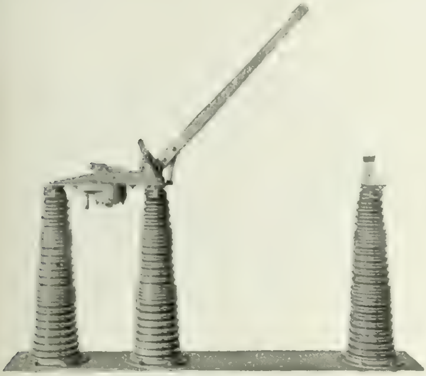
PNEUMATICALLY OPERATED DISCONNECTING SWITCHES.

Bus isolating or disconnecting switches are usually opened or closed by means of a wooden rod having at one end a hook to engage with the hole in the switch blade. Ordinarily this is quite satisfactory. In many cases, however, to simplify the wiring layout, to save in length of large cables, for convenience or for safety, it is advisable to locate the disconnecting switches in a position where they cannot be easily reached by the station operator. It is in such connection that pneumatically operated disconnecting switches find useful application. The switches of this type made by the General Electric Company are clearly shown in the accompanying illustrations. They can be located at any height and can be controlled by an air-control valve or switch located at the switchboard or other convenient point.

These switches are simple and substantial in construction, being similar to the hand-operated switches, and introduce no complications in wiring. They are mounted on post-type insulators fastened to steel bases, the insulators

varying in size acording to the voltage. The switches are made up in single-pole, single-throw form only, but can be opened and closed singly, or any number of poles can be operated in unison. Also, one or more sets can be operated simultaneously by a single air-control valve or pull-button switch. This gives great flexibility of operation.

Pneumatically operated disconnecting switches are espe-



Switch Open.

cially adapted for use in stations employing air-operated oil switches, but can, of course, be used in any case where an air supply is available.

When the disconnecting switch is controlled from a distance the valves in the air connections to the diaphragm are operated electrically—usually from the lighting or exciter circuit.

These switches are made in voltages from 35,000 to 110,000 and for currents of from 100 amp to 300 amp.

IMPROVED LIGHTING TRANSFORMERS.

The general design of lighting transformers has been well established for many years, but occasionally marked improvements in details have been made which have greatly increased the practical value of this type of electrical apparatus. A new line of lighting transformers which the Allis-Chalmers Company is now placing on the market includes a number of departures from older designs. Among these are means whereby the heat is conducted to the air from the coils in a much more rapid manner than is usually the case, thus insuring a transformer with an exceedingly low temperature rise. The greatest visible change in these transformers is a provision, in the larger sizes, of three cooling surfaces instead of the single surface in the ordinary plain-case transformer. This is accomplished by encircling the main case with a jacket and providing for the circulation of oil between the two. Both the tank and the jacket are made of boiler plate, and are connected at top and bottom by short tubes leaving an air space between the two. All joints are welded, making both the tank and jacket seamless, and thus preventing the chance of leakage. In addition to the three radiating surfaces provided, the space between the jacket and the tank forms a flue through which currents of air ascend at a considerable velocity, thereby exerting a scrubbing action on the surface which greatly facilitates heat dissipation. This style of tank is used on all lighting transformers from 20 kw to 50 kw. The tubes connecting the top and bottom of the tank and jacket provide for a continuous and positive circulation of the oil. Tests made show that this circulation is rapid and that heat is quickly conducted from the transformer through the oil to the surface of the tank and jacket and thence to the air.

An entirely new departure has also been made in the 40-kw and 50-kw sizes by so arranging the coils that there is a ventilating space between them which allows full and free circulation of the oil. These sizes are wound with two low-voltage and one high-voltage coil, the latter being placed between the other two. The coils are separated from each other and the space between them provides ventilating ducts on each side of the high-voltage coil through which the oil can readily circulate. This venti-

Transformer for Lamp Circuits.

lating feature helps to make a transformer that is extremely cool in operation.

All these transformers are supplied with 5 per cent and 10 per cent taps, which are connected near each end of the primary winding and enable a normal secondary voltage to be secured, even if the voltage supplied the primary coil is 5 per cent or 10 per cent below normal. These transformers are designed for use on 2200-volt or 1100-volt lines. The use of the taps makes it possible to step down from 2200 volts in nine different ratios and from 1100 volts in six different ratios.

ADJUSTABLE ELECTRIC-LAMP BRACKET.

The Patterson Tool & Supply Company, Dayton, Ohio, has brought out a new type of electric-lamp bracket which can be adjusted for use on all classes of machines. The brackets are made of sheet metal and the joints operate on leather frictions between two disks and a strong rivet. Hard-fiber insulation is inserted in the joint to which the lamp holder is attached. The base of the bench bracket

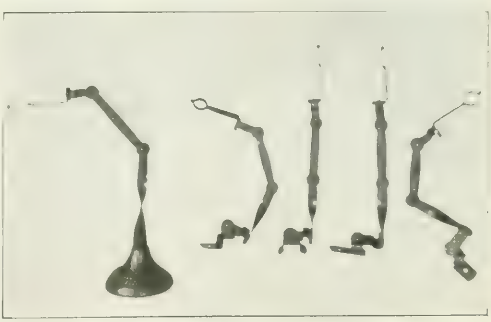


Fig. 1—Adjustable Electric-Lamp Brackets.

is of cast iron, while that of the machine bracket has a hole to take a ½-in. bolt, thus making it convenient for attachment to a machine having T-slots for bolts. For locating the brackets permanently four screw holes are also furnished. A screw clamp or spring clip is used to hold the

lamp in place. The height of the bench bracket is 23 in. and when a right-angle bend is made at the first joint there is a 16-in. reach from the center of the stand to the lamp. At the second joint the machine bracket has a reach of 21 in. from the center of the base to the lamp and will cover

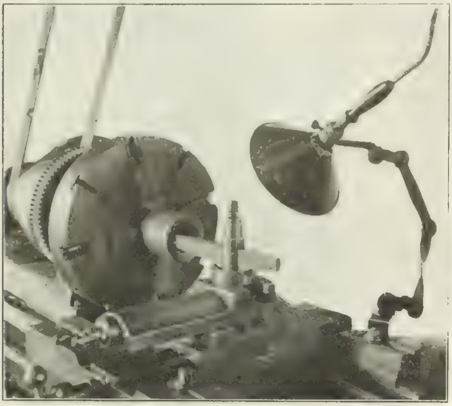


Fig. 2—The Machine Bracket Attached to a Lathe.

a radius of 42 in. The special advantages claimed for the brackets are that they can be operated at any point, a great saving in the number of lamps broken is effected by their use, and an increase in the output of the machines due to better light is secured. The bench bracket may be set for-

Fig. 3—The Bench Type of Bracket.

ward so as to direct the light on the work or it can be reversed so as to direct the light through the opening in the work.

THREE-WIRE GENERATOR.

Many changes have occurred in central-station apparatus since the original three-wire system of distribution of electrical energy was invented. These changes have included many forms of three-wire machines and methods of obtaining the neutral necessary for three-wire distribution. The latest improvement in this direction is the three-wire generator of the Burke type, which is being marketed by the Crocker-Wheeler Company, Ampere, N. J. Unlike the three-wire generators in which the neutral is obtained by transformation, the neutral in this machine is obtained by a generating winding, which, by its combination with the main windings of the machine, generates a voltage which is at every instant exactly one-half the voltage of the main generator windings and therefore gives under all conditions a true neutral. This neutral winding is located in the same armature slots as the main winding of the generator. For convenience of location it is usually placed in the bottom of the slot and contains just one-half the number of turns that are in the main winding between brushes. This neutral winding has one end tapped from the main generator winding and the other end goes to a collector ring located preferably at the front of the commutator in such a way that the brush holders for the neutral winding may be carried conveniently from the main brush rigging of the generator. It is apparent that if an auxiliary wind-

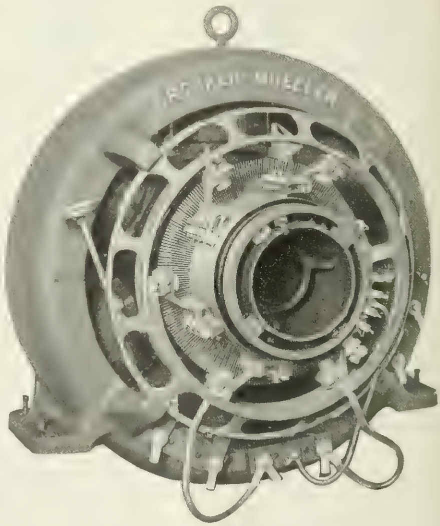


Fig. 1—Three-Wire Generator.

ing is placed on an armature in parallel with the main winding of the armature, but having just one-half the number of turns of the main winding from which it is tapped, then the voltage generated in this neutral winding, when the armature in its rotation brings the tapped point opposite a brush on the commutator, will be just one-half the voltage of the main winding between brushes. At the next moment, when the armature has revolved to some position where the tap is opposite a point somewhere between the positive and negative brush studs on the commutator, it will be seen that the neutral winding is in series with certain turns of the main winding between the point at which it is tapped from the main winding and the brushes. The voltage generated at this instant in the neutral winding is then added to the voltage generated in the main winding between the point of tap and the brushes. Of course, it is obvious that if this neutral winding is concentrated in one section of the armature any variation in air-gap or other causes which would vary the uniformity of the flux of the generator would cause a fluctuating voltage to occur in this winding. To overcome this the winding is properly distributed around the armature in such a way that uni-

ormity of voltage is obtained. A single winding tapped rom only one point of the main winding is inefficient. Such a single winding might be referred to as a single-phase winding. The form of winding used in these generators consists of multiple circuits tapped from different points of the main winding and is a polyphase winding; such polyphase windings all have one end connected to a single collector ring, the other end being connected at proper points to the main winding. Any two of these neutral windings in series will then parallel with a section of the main winding, and since each one of these neutral windings generates a voltage equal to one-half the corresponding generator winding the two in series will generate a voltage equal to the voltage in the main windings between the points from which they are tapped. They are therefore effective in carrying their share of the main two-wire current of the generator, so that even when there is no unbalance in the three-wire system these neutral windings are effective in carrying their share of the generator load in proportion to their capacity. This the manufacturer claims is a very important point, since it means that the same efficiency can be obtained on a three-wire generator as is obtained on a two-wire generator. The advantages claimed for this type of machine are: High efficiency, since there is at no time any exciting current required by the neutral windings and the neutral windings are effective in carrying their share of the main two-wire load of the generator; simplicity, because there is only one collector ring, less wiring, and no transformers, either static or rotating; overload capacity, because the capacity of the two-wire windings is increased by having in parallel with them the effective generating neutral windings.

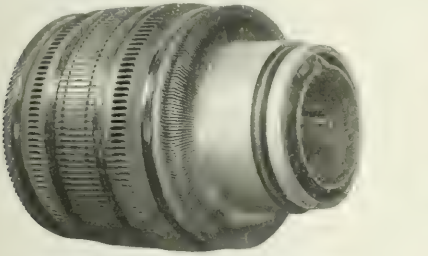


Fig. 2—Armature of Three-Wire Generator.

MOTOR-GENERATOR SETS FOR CHARGING AUTOMOBILE BATTERIES.

The charging of electric-automobile batteries requires for its best accomplishment the use of special machinery, because almost all present-day automobile batteries take a voltage which is entirely different from that on any standard distributing system. Another feature which introduces difficulties into the problem is the fact that the voltage of the battery changes as the charge advances. This change is as much as 20 per cent under certain conditions. The common way of charging automobile batteries in the usual garage is to feed directly from a 110-volt system and consume in resistance the difference between the line voltage and the voltage needed by the battery. This necessitates, of course, the use of a resistance which can be varied and also introduces a much greater drawback in that all the energy consumed by the resistance is wasted. Thus with the usual twenty-four-cell, twenty-six-cell or twenty-eight-cell lead battery the loss in charging from a 110-volt system is approximately 45 per cent. All cars manufactured at the present time can be charged, however, with practically no loss in resistance from two circuits, one of 75 volts and the other of 111 volts. Thus the 75-volt system would charge the twenty-four-cell, twenty-six-cell or twenty-eight-cell lead batteries and the forty-cell nickel battery with very little loss in resistance, and the 111-volt system would charge the thirty-eight-cell, forty-cell and forty-two-cell lead batteries and the sixty-cell nickel battery with very little loss in resistance. The Lincoln Electric Company, of Cleveland, Ohio, has developed two types of charging apparatus for garage works, one used when the supply is alternating and the other when the supply is direct.

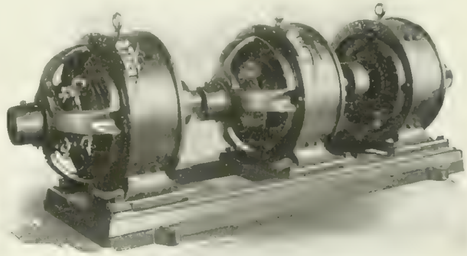


Fig. 1—Three-Machine Balance Set for Direct-Current Supply.

The alternating-current system comprises a motor-generator set, the motor being wound to take up alternating-current supply and designed for efficient operation on light loads, since these sets are operated under this condition to a very great extent. The generator is of the double-voltage type, furnishing generally 75 volts and 111 volts. If the supply is three-wire direct current a balancer set is recommended which will divide the 220 volts into three separate and equal parts, so that under this condition a garage in operation will have a four-wire system, which will give three circuits of 73 volts each and two other circuits of 110 volts each. In case the supply voltage is 110 it can be again split up into three equal parts and the system balanced by properly placing the cars on charge. By the use of these systems and several variations of them it is possible to reduce very greatly the energy necessary for doing a certain amount of charging. This saving the manufacturer claims has in some cases been as much as 60 per cent, and in all cases in excess of 25 per cent in places where charging is done from a standard voltage.

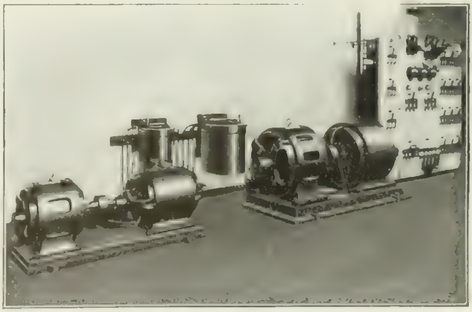


Fig. 2—Installation of Three-Wire Motor-Generator Set for Alternating-Current Supply.

AN ELECTRICAL METHOD OF STUDYING RECALESCENCE.

The study of the behavior of steel under heat has been rendered particularly easy by the application of well-known electrical principles, and the production of permanent recalescence curves is now effected by a special form of curve-tracer which has been developed by Mr. Harry Brear-

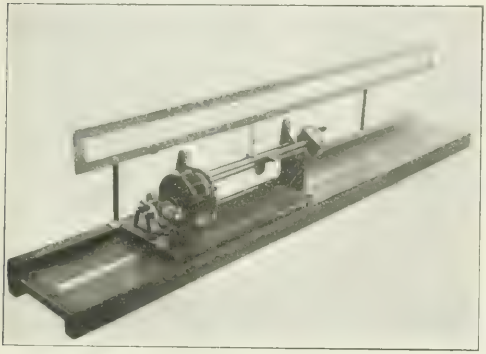


Fig. 1—First Instrument for Making Recalescence Curves.

ley, of Firth College, Sheffield. Its original object was to obtain recalescence curves on a very open scale with rectangular co-ordinates, but, as made by the Cambridge Scientific Instrument Company, Limited, of Cambridge, England, it is not limited to this purpose, but may be used for tracing any curve in which the deflections of a galvanometer can be co-ordinated with time. It is semi-automatic in action, so that the curves are obtained with a minimum of trouble. The accompanying illustration, Fig. 1, shows the first model which was made, complete with all the necessary accessories for obtaining curves. It will serve to give a general idea of the apparatus, although the newer models are improved in design, and the photographic reproduction is therefore not quite correct in detail.

The apparatus is used in conjunction with a thermocouple and reflecting galvanometer. The galvanometer used

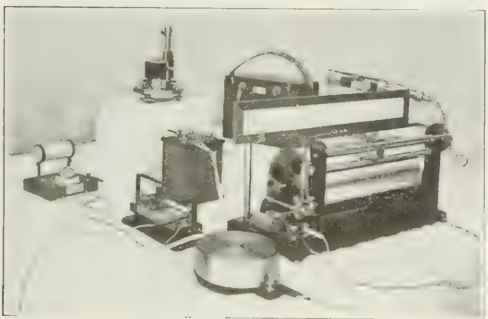


Fig. 2—Arrangement of Apparatus.

is of a standard Ayrton-Mather pattern except that the suspension strip is stronger than usual in order to give a more steady zero reading. The principle made use of consists in fixing a rotating drum underneath the galvanometer scale and providing means to keep a pointer coincident with the moving spot of light. A pencil is attached to the under side of this pointer and is in continuous contact with a chart on the rotating drum. The curve traced out on the chart, therefore, co-ordinates the galvanometer deflections with time.

Referring to the illustration, the thermo-couple is connected to the resistance box, which has attached to it conductors insulated in small porcelain tubes, while to the left of the picture is seen a small electrical tube furnace for heating the sample of steel under test. The galvanometer is seen in the background and a resistance box is used in series with the galvanometer in order to adjust its sensitivity to the required value. To the right is seen a telescope containing a Nernst lamp for projecting a beam of light onto the galvanometer, and in the foreground is the galvanometer scale. This scale is shown mounted on a Brearley curve-tracer in which is a rotating drum and attached to which is a sliding carriage carrying a pointer capable of being moved along the scale of the tracer. The sliding carriage can be moved in a direction parallel to the scale and drum by means of an accurately constructed screw which can be turned by hand from the handle at the right-hand end. Thus, by turning this handle backward or forward, the pointer can be moved up or down the scale and kept coincident with the line down the center of the galvanometer spot of light. Underneath this pointer a pencil or pen is fitted, and this rests continuously on a chart wound round the drum. The drum is 360 mm in circumference by 300 mm wide, and, by means of change-speed gears, it can be made to give one complete revolution in either ten or thirty minutes.

In the apparatus illustrated in Fig. 1 a scale 50 cm long is shown, but in the newer model now used and which is shown in Fig. 2 a special scale 1.5 m long is employed. This scale is mounted on a suitable platform and is used at 2-m working distance from the galvanometer. The resistance box supplied makes the range taken by the instrument capable of recording from 0 deg. C. to 1500 deg. C., with platinum-rhodium thermocouples, for a full scale deflection of 1½ m. The curve-tracer itself is independent of the scale and it can be moved up or down the platform so that the record taken on the drum can be made to correspond with any 300 mm of the scale. By altering the connections on the resistance box a more contracted scale can be obtained in which a temperature range of from 0 deg. C. to 1000 deg. C. on the full width of the drum, or 300 mm, can be obtained. It will be seen that the apparatus enables accurate and open curves to be traced in a very short time and with a minimum of fatigue. The application of the

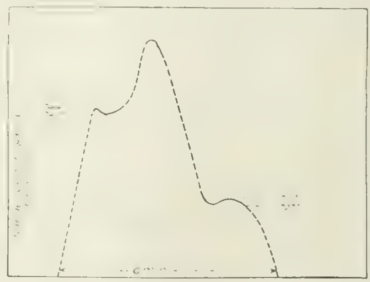
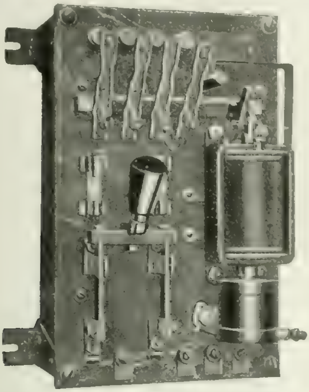


Fig. 3—Curve Obtained with a Brearley Tracer.

rectangular co-ordinates and the use of such an open scale enables the most delicate temperature changes to be observed, as will be seen from Fig. 3, which reproduces on a small scale the actual curve obtained with one of the Brearley tracers.

MOTOR SELF-STARTER.

The Cutler Hammer Manufacturing Company, of Milaukee, has added a new type of self starter to its line. his apparatus, shown in the accompanying illustration, is a new method of operation, which is claimed to elimiate sliding contacts entirely. A solenoid controlled by an



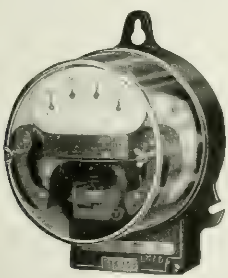
Motor Starter.

r dash-pot operates four contact arms by means of a volving shaft, and the time of acceleration can be varied s desired.

This type of self-starter is particularly adapted for autonatic or remote control of motor-driven pumps and similar nachinery. The control can be arranged by means of float witch, where pumping into an open tank, or by a pressure egulator where used with a compression or closed tank systems. No relay circuit is required. With vacuumcleaner systems the vacuum pump can be started or stopped rom different floors by means of push-buttons. These selfstarters are made for 110-220 volts and 550 volts direct current, and in capacities from ¼ hp to 3 hp, for two-wire and three-wire control, with and without knife switch and fuses.

INDUCTIVE LOAD COMPENSATION OF INDUCTION WATTHOUR METERS.

The increasing use of energy-consuming devices of a nore or less inductive nature necessitates the employment of meters which will accurately record the energy con-



Watt-Hour Meter Compensated for Induction Load.

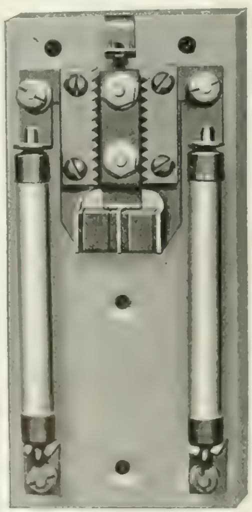
sumption regardless of power-factor, and various methods of securing this compensation have been resorted to by meter designers. A simple and accurate method consists of placing a short-circuited turn or secondary around the shunt magnet pole, thus producing an induced magnetic field acting with the shunt magnetic field and producing a resultant field lagging 90 deg. behind the field of the series coils.

This is the method of inductive load compensation employed in the Sangamo meter of type "H" design, and meters so equipped are now supplied in all capacities by the Sangamo Electric Company, Springfield, Ill. As a result, the station manager can indiscriminately place meters in service without taking into account the character of load, thus avoiding selecting meters for each service such as would be necessary if uncompensated meters were employed. The addition of inductive load compensation in no way affects the regular adjustments of the meter, which still retains its characteristically simple light and full-load adjustments.

TELEPHONE LIGHTNING ARRESTER.

The lightning arrester shown herewith, which is being introduced by the L. S. Brach Supply Company, 143 Liberty Street, New York, involves, it is claimed, a new electrical principle in lightning protection, being a combination of the non-air-gap lightning arrester with a standard telephone type. Instead of the arc passing across an air-gap, causing the metals or carbons to fuse, the discharge is absorbed by a high-resistance block between the line and ground. The block, which is of a special material of great ohmic resistance, will not, it is stated, fuse or permit any leakage of current. The air-gap provided is such as to allow a potential of 500 volts or over to break down and ground, thereby protecting the line from crosses with trolley wires or other high-potential circuits.

The arrester is extremely simple and neat and there is no part about it that should give any trouble. The manufacturers state that many thousands are now in successful service in all parts of the country on signal, telephone and telegraph lines owned by the principal railway systems.



Telephone Lightning Arrester.

The device is built to conform with the requirements of the National Board of Fire Underwriters and every arrester is tested for efficiency. The capacity of discharge is stated to be very great, and the device to be more sensitive than any air-gap type, as the resistance blocks themselves are capable of shunting an arc from an air-gap of 4 mils.

Industrial and Commercial News

THE WEEK IN TRADE.

GENERAL business has not advanced appreciably this week in either volume or tone, and the turn-over is well below normal for the season of the year. The rate of gain shown in the past few weeks has decreased, apparently as a result of present uncertainties of tariff legislation, government investigations and hesitancy engendered by crop reports. The latter are in abundance, as is customary at this time, and not a few have caused a slowing down of the trade revival by unfounded expressions of serious damage in the agricultural districts. While some impairment has undoubtedly taken place in a section of the growing wheat area owing to the prolonged absence of ample rains, the outlook for returns equal to, if not in excess of, those of last year continues to be bright. The conditions in many lines are no worse than they have been in recent weeks. Iron and steel trades are feeling the benefit of the price reduction, and prospects for new business are held to be good. Further reductions have taken place in prices of wire and wire products, and the statement made during the week showing that the operations of the Steel Corporation have increased from 63 per cent of capacity at the beginning of the month to 68 per cent at this time was a source of favorable comment. Business for the coke companies is on an increasing scale. Retail lines continue to do a fair summer business, while in other fields sales are largely for present needs, with the volume of future business increasing but slightly. The continuation of this mode of buying is counted upon to cause early stimulation in nearly all lines, on the assumption that stocks must be low at present and will need replenishment for the buying movement which it is hoped will begin when harvests assume a tangible form. Increased bank clearings are considered an indication that trade is advancing and that the dullness of the week is but temporary. Business failures for the week ended June 22, as reported by *Bradstreet's*, were 222, as compared with 212 for last week, 187 for the same week in 1910, 223 in 1909, 258 in 1908, and 150 in 1907.

THE COPPER MARKET.

SALES last week were in smaller volume owing to practical cessation of London business in the coronation holidays. The lull abroad was responsible in part for retarding the movement to place electrolytic on a 13-cent basis. Revival of the movement is expected in the current week. Domestic consumption is reported on a slightly larger scale in the past week, with sales of electrolytic at 12¾ cents delivered, thirty days, with July, August and September shipments bringing 12⅝ cents cash. A few sales of electrolytic at 12⅞ cents are said to have been made. Many consuming interests, though aware of the prospects for higher prices, have remained out of the buying at the higher levels, in view of rumors that some selling interests, to make sales, are willing to cut prices. Surplus stocks and excess production still characterize the trade, despite manipulative reports to the contrary, and, although the report of the Copper Producers' Association for June may show a slight decrease in

Standard Copper	Bid.	Asked.	Settling Price.
Spot	12.25	12.30	....
June	12.25	12.30	12.27½
July	12.25	12.30	12.27½
August	12.25	12.30	12.27½
September	12.25	12.30	12.27½

The London market, June 26, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	57 10 0	58 [illegible] 6
Standard copper, futures	57 10 0	58 1 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 6 3	£53 7 6
London, futures	58 0 0	54 0 0
Best selected	[illegible] 0 0	57 5 0

surplus, as compared with the figures for May, the fact that June is a short month is not to be disregarded, so that net improvement in the condition of supply and demand will not be as large as may be indicated. One of the large consumers of copper voiced the sentiment throughout the consuming element by expressing a desire to see a reduction in the visible supply of copper to a point where the demand for the metal will be o sufficient magnitude to form a basis for future production an still make a decided inroad upon the excess. Exports for th month, including June 26, were 24,119 tons. The daily call o the Metal Exchange, June 26, quoted copper as per the accom panying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Huge Railway and Light Company to Be Formed.—Prominent interests are endeavoring to obtain options on th stock of some twenty-eight public-utility companies, operatin electric-light, power, gas, and traction systems, with a view t forming a $17,500,000 company, which shall control these prop erties. It is stated that the board of directors of the new com pany, which will probably be known as the Republic Railwa & Light Company, will be: Samuel McRoberts, vice-presiden National City Bank, New York; Myron T. Herrick, presiden Society for Savings, Cleveland; Anson W. Burchard, assistan to president General Electric Company; R. E. Reed, presiden American Gas & Electric Company; Henry H. Wehrhane, Hal garten & Company, bankers and executive committee America Gas & Electric Company; James Parmlee, president Clevelan Electric Illuminating Company; Ray Morris, White, Weld Company, bankers; Harrison Williams, president Springfiel Railway & Light Company; Thomas A. Reynolds, National Cit Bank; J. J. Bodell, of Bodell & Company, bankers, and directo American Textile Company, and Parmely W. Herrick, a direc tor of the Cleveland Electric Illuminating Company. Th companies control of which the foregoing are making plans t secure are given as follows: Mahoning & Shenango Railwa & Light Company, Youngstown-Sharon Railway & Light Com pany, the Sharon & New Castle Railways Company, Pennsy vania & Mahoning Valley Railway Company, New Castle Trac tion Company, the New Castle Electric Company, the Lawrenc Gas Company, the Mahoning Valley Railway Company, th Mahoning Valley South Eastern Railway Company, the Ne Castle & Lowell Railway Company, New Castle & Lowell Realt Company, Wheatland Street Railway Company, the Youngstow Park & Falls Street Railway Company, New Castle Electr Street Railway Company, New Castle & Mahoningtown Stree Railway Company, the Trumbull Electric Railroad Compan the Mineral Ridge & Niles Traction Company, the Youngstow Consolidated Gas & Electric Company, the Merchants' Ligh Heat & Power Company, the Youngstown & Sharon Stree Railway Company, the Shenango Valley Electric Light Com pany, Sharpsville Electric Light Company, Sharon Gas & Wate Company, the Sharon & Wheatland Street Railway Compan the Shenango Valley Street Railway Company, the Valley Stree Railway Company, Sharon & New Castle Street Railway Com pany (Pa.), Sharon & New Castle Railway Company (Ohio).

Byllesby Interests in Colorado.—The report of the pur chase of the Pueblo & Suburban Traction & Lighting Compan and allied interests of Pueblo, Col., by H. M. Byllesby Company, of Chicago, mentioned in the issue of June 22, confirmed. The property was taken over on June 14. Th Pueblo & Suburban Traction & Lighting Company operate the street-railway system of Pueblo and supplies electric energy to that city and the Cripple Creek gold-mining distric including the cities of Cripple Creek, Victor and Goldfiel The towns of La Junta and Rockyford are served with elec tricity by subsidiary corporations. A steam-driven generatin station of 4135 kw at Pueblo and a hydroelectric plant c 1600 kw at Skaguay are operated. It is proposed to increas the size of the steam station at Pueblo and to extend the tran mission lines to serve additional cities and towns. Extensior to the hydroelectric system are also planned. W. F. Raber in charge of these properties for Byllesby & Company.

New Building for New York Edison Company.—Plar are being drawn by D. H. Burnham & Co. for an eight-stor building to be erected by the New York Edison Company at 1 West Forty-second Street, New York. This new building wi have a large showroom and modern offices, and will be reac for occupancy in about one year. On July 1 the branch offic which the company has had in the old building on the abov site will be transferred to 245 West Forty-second street.

Electrical Trade of the United Kingdom.—The imports of electrical goods and apparatus (other than machinery and telegraph and telephone wire) into the United Kingdom for the eleven months ended Nov. 30, 1910, were valued at $7,-230,884, against $5,713,052 for the same period in 1909; for electrical machinery the figures are $2,531,991 and $2,343,122, respectively. The exports of British electrical goods and apparatus for the same period amounted to $17,093,882 for 1910 and $9,495,299 for 1909, and for electrical machinery, $7,-888,592 and $6,358,597, respectively. Reviewing the electrical trade of the United Kingdom for 1910, the London Chamber of Commerce *Journal* states: "The electrical supply undertakings have benefited through the increasing use of electric driving, which is materially assisted by the reduction in first cost of motors and appliances. The supply undertakings are still suffering loss of output through the change from carbon to metal-filament lamps, but the decreased cost of lighting with the metal lamp is rendering it easier to secure new business. Progress is being made with the electrification of mines and steel works, although this has been somewhat retarded by labor troubles, arising out of the discontent following the eight-hour act first in the northern coal fields and then in the South Wales district. Owing to the increased use of electricity in mines, the Home Secretary appointed a departmental committee in December last to report on the regulations relating to the use of electricity in mines."

Handicap to American Foreign Trade.—Hon. William C. Redfield, member of Congress and vice-president of the American Blower Company, Detroit, who recently returned from a trip part way around the world, was forcibly impressed by the rarity with which the American flag was seen on shipping. It is, he said, a fact that, while he saw two steamers with the flag of Sarawak and twenty with that of Portugal, he had not, since leaving Japan, seen an American flag. When he sold an engine in Rangoon he was told there was a three weeks' handicap in time against the United States as compared with England, and that his engine would have to go to Birkenhead and be transferred there. There were no American ships regularly sailing to Rangoon and no way in which one could avoid the handicap of three weeks' time and an extra freight charge. Fortunately, he said, the excellence of the engine got the order, but a similar handicap ties itself to a greater or less degree to every quotation made abroad by every American manufacturer. Mr. Redfield believes we should be patriotic and wise enough to drop this, that or the other preference, as to relief, and agree on something that will give to our manufacturers and their workmen the share of the world's trade to which they are entitled. This, he said, would be a righteous and a reasonable protection. A letter from Mr. Redfield, while in Calcutta, outlining other phases of American trade abroad was given in the *Electrical World* April 27.

Westinghouse Equipment.—The Allegheny County Light Company, of Pittsburgh, Pa., placed an order with the Westinghouse Electric & Manufacturing Company for ten 250-kva and two 200-kva transformers of the oil-insulated, self-cooling type. The Desert Power & Water Company, of Kingman, Ariz., has ordered four 600-kva oil-insulated water-cooled transformers. The New York Edison Company has placed an order for a 1000-kva oil-insulated, self-cooling transformer of the tubular type, a duplicate of an order placed with the Westinghouse company last year. The Great Western Power Company, San Francisco, Cal., has ordered six 300-kva oil-insulated, self-cooling transformers. The New York, New Haven & Hartford Railroad Company has placed with the Westinghouse Electric & Manufacturing Company an order for fourteen articulated-truck switching locomotives. Each locomotive is to be provided with a quadruple equipment of No. 410 motors and type HB unit-switch control. The People's Street Railway, Nanticoke, Pa., has ordered two quadruple equipments of No. 101-B-2 motors with type K-28-B control. The Westinghouse company is in receipt of an order from the Electrisk Bureau för Holmenkollenbanen, Norway, for a quadruple equipment of motors aggregating 89 hp. The Westinghouse company has also recently shipped twenty-five double equipments of interpole railway motors to South America.

Possible Telephone Competition in Brooklyn.—An option on four-fifths of the stock of the American District Telegraph Company of Brooklyn, which has a charter permitting the company to operate throughout the State of New York, covering both telephone and telegraph service, has been obtained by F. M. Delano, a Detroit promoter. It is thought that the option has been secured for Western interests who plan to take advantage of the unused telephone proviso in this charter as a means of entering into telephone competition with the local company. Henry W. Kilbourne, secretary and treasurer of the American District Telegraph Company of Brooklyn, which has confined its operations to messenger, burglar alarm and patrol service, states that $80,000 has been offered for the 4000 shares of the stock of the company, and that options on 3200 shares at 80 per cent of the par value have been granted. Tunis J. Powell, president of the American District Telegraph Company of Brooklyn, stated on Monday, June 26, that he did not know whether or not Mr. Delano represents J. Ogden Armour, of Chicago, as has been rumored.

Flaming Arcs in Construction Work.—In order to make every effort toward completion of the new Polo Grounds amphitheater, in New York City, so that the ball park may be used by the end of June, the contractors have been working twenty-four hours per day. Flaming-arc lamps, operating in multiple with an auto coil, on a 60-cycle, 110-volt alternating current, have been installed on poles at advantageous points, and the contractors say that the illumination furnished makes working conditions at night equal to those of daylight. A motor-generator unit was installed on the grounds for furnishing direct current to electric drills used for boring holes in concrete in which to set the expansion bolts that will support the tiers of benches, and a motor has been set in operation to drive saws used in cutting timber used on the job. The current is supplied by the United Electric Light & Power Company, and the arc lamps are furnished by the Western Electric Company.

Manufacturers' Catalogue Files for Consular Use.—In a recent speech before Congress, Representative Benj. K. Focht spoke in high terms of the work of the Commercial Bureau Company, 50 Church Street, New York, which, through an arrangement with the State Department, equips American consulates with a system of card-index files containing a digest of the catalogs of manufacturers, the condition being that no preference be shown and that no fee be charged to the manufacturer. Mr. Focht said that the broad policy of the Department of State in permitting a private organization to render this service to the consulates is to be commended, not only from the standpoint of broad-minded statesmanship, but from business considerations.

No Increase to Be Made in Salt Lake Telephone Rates.—H. Vance Lane, president of the Rocky Mountain Bell Telephone Company, in an announcement to subscribers in Salt Lake City, states that the rate schedule will not be increased as had been rumored as a consequence of the purchase of the Utah Independent Telephone Company by the Rocky Mountain Company. Mr. Vance says further that some little time will be required, necessarily, to arrive at a basis which will be fair alike to both the public and the telephone company, but that the engineers of the company have progressed far enough in their work of arranging the physical consolidation of the two plants to warrant the statement that rates will not be advanced.

Long Acre Electric Light & Power Company.—President Shaw, of the Long Acre Electric Light & Power Company, says that as soon as the company is advised as to the amount of securities which the Public Service Commission for the First District of New York will authorize it to issue plans will be completed for the active sale of electrical energy in New York City. Mr. Shaw says further that the company is arranging for the erection of a plant in Pennsylvania for the generation of energy to be transmitted at high tension to New York, and that it is expected to complete this plant within a year. Further details, he said, will be made public following the action of the Public Service Commission.

Ohio Sterling Electric Company.—The plant of the Ohio Sterling Electric Company, in East Dayton, Ohio, formerly the Sterling Electric Motor Company, has been sold to Andrew Strohm, of the Pneumatic Tool Company, for $85,000. Mr. Strohm has not made known the names of his associates in the deal, if there are any.

Chicago Men to Visit South American Markets.—Members of the Chicago Association of Commerce are preparing to take an eighty-day trip to South American points with a view to extending the sale of American goods in these districts. This will be the first of a series of business-getting trips which have been planned by the foreign trade committee of the association.

Financial.

THE WEEK IN WALL STREET.

DULLNESS, with reaction in prices, prevailed upon the New York Stock Exchange throughout the greater part of the week, with a rally taking place on Saturday and lasting partly into Monday. This was caused by announcement that the case of the government against the Harriman lines, questioning the legality of the agreement whereby the stock of the Southern Pacific is controlled by the Union Pacific, had been decided in favor of the railroads. The fact that the decision was known before the opening of the market on Saturday resulted in an opening advance of two points in the shares of the two roads, accompanied by smaller gains in many other stocks. The nature of the decision is regarded as most favorable, not solely by reason of the benefit accruing therefrom to the railroads and to the stock market, but for the fact that it is a satisfactory interpretation of the recent Supreme Court rulings on the Sherman law. It is doubly important, having been rendered so soon after the decree declaring the Du Pont Powder Company in restraint of trade and ordering its dissolution. In addition to being influenced by the interest of the government in the affairs of the leading industries of the country, the stock market lagged somewhat from disturbing rumors in connection with the reciprocity situation, from the quietness in foreign markets during the coronation period, and chiefly from conflicting crop reports. Sales of the week were 1,763,980 shares, as compared with 2,494,178 for the preceding week, the figures showing a continuation of the downward trend and indicating the staleness of the market. The bond market was firm during the week, with buying of the Panama Canal issue at advances over assignment prices the leading feature. Money is quiet, and rates in the money market June 26 were: Call, 2¼@2½ per cent; ninety days, 2½@2¾ per cent. The quotations in the table are those of the close June 26.

NEW YORK.

	June 19.	June 26.	Shares Sold.		June 19.	June 26.	Shares Sold.
All. Ch.	[illegible]	9*	100	Int. Met., pf.	[illegible]	[illegible]	[illegible]
All. Ch., pf.	31*	[illegible]	[illegible]	Mackay Cos.	[illegible]	[illegible]	200
Amal. Cop.	[illegible]	[illegible]	62,550	Mackay C., pf.	74⅞	[illegible]	200
Am. D. T.	[illegible]	[illegible]	———	Man. Elev.	139*	[illegible]	210
Am. Loco.	[illegible]	[illegible]	400	Met. St. Ry.	15*	[illegible]	———
Am. Loco., pf.	[illegible]	[illegible]		N. Y., N. H. & H.	[illegible]	[illegible]	—
Am. Tel. & C.	83*	[illegible]	90	Steel, com.	79	[illegible]	[illegible]
Am. T. & T.	[illegible]	[illegible]	56,182	Steel, pfd.	119	[illegible]	6,131
B. R. T.	[illegible]	[illegible]	5,840	W. U. T.	80¼	[illegible]	3,945
Gen. Elec.	[illegible]	162	[illegible]	West'h, com.	[illegible]	76	10,110
Int. Met.	[illegible]	[illegible]	3,697	West'h, pfd.	118⅞*	119	200

PHILADELPHIA.

	June 19.	June 26.		June 19.	June 26.
Am. Rys.	[illegible]	44	Phila. R. T.	[illegible]	[illegible]
El. Co. of A.	[illegible]	[illegible]	Phila. Elec.	17	17⅜
Elec. S. Bt'y.	56	[illegible]	Phila. Trac.	87½*	86½
Elec. St. Bt'y., pfd.	[illegible]	30*	Union Trac.	[illegible]	49

CHICAGO.

	June 19.	June 26.		June 19.	June 26.
Chi. City Ry.	186*	186*	Chi. Tel. Co.	123*	124½
Chi. Rs., Ser. 1	80*	80*	Met. El. Co.	26*	[illegible]
Chi. Rs., Ser. 2	22*	22	Met. El., pfd.	[illegible]	73½
Com. Edison	129	129½*	Nat'l Car	120*	120*
Chi. Subways	4	[illegible]	Nat'l Car, pfd.	[illegible]	118½*

BOSTON.

	June 19.	June 26.		June 19.	June 26.
Am. T. & T.	151¾*	149	Mex. Tel.	4*	4½
Cum. Tel.	159½*	156¾*	Mex. Tel., pfd.	6¾*	6¾*
Edison E. Ill.	285*	285*	N. E. Tel.	150¼*	147
Gen. Elec.	[illegible]	163	W. T. & T.	20*	20*
Mass. E. Ry.	[illegible]	22½	W. T. & T., pfd.	96*	96½
Mass. E. Ry., pf.	[illegible]	[illegible]			

*Last price quoted.
Shares sold for the week, June 19 to June 24.

FINANCIAL NOTES.

American Telephone & Telegraph Listed on Paris Bourse.—On June 20 300,000 shares of the capital stock of the American Telephone & Telegraph Company were listed on the Paris Bourse. Negotiations to this end had been in progress since November, 1910, and the event was characterized by the fact that this stock is the first American industrial stock to be listed on the French Exchange. The American bankers in the project were Kidder, Peabody & Company, of Boston, and the French banking interests were the Banque de Paris et des Pays-Bas, L. Hirsch & Cie, Thamann Bros., and Dupont & Furland. The fact that the Banque de Paris et des Pays-Bas, in addition to being at the head of the syndicate, is the representative of the American Telephone & Telegraph Company, authorized to act as agent between the company and the French authorities in connection with the listing, is significant of the high plane upon which the security has been introduced. The opening transaction was at 790 francs, closing at 783. On the same day upon which the stock was listed abroad the directors of the American Telephone & Telegraph Company authorized an issue of $50,000,000 new capital stock, which makes the amount outstanding $319,840,500, as against $269,840,500, while the total authorized capital stock is $500,000,000. The new issue may be subscribed for at par by stockholders in the ratio of one share of new stock for each five shares now held. Payments on account of the new issue may be made either in full or in four equal instalments, payable November 1, 1911; February 1, 1912; May 1, 1912, and August 1, 1912. This issue is the one referred to in the *Electrical World* June 22, as being forthcoming for financing new construction and betterments in 1912 and thereafter. In this connection an official statement says in part: "The proceeds of this issue of capital stock will be mainly used to provide the associated companies of the Bell system outside of the State of New York with funds for current and ordinary construction and extension of plant, and will be represented in the treasury of the American Telephone & Telegraph Company by the share capital or the capital advance notes of such companies. A part will be used for extensions to plant (long-distance service) of the American Telephone & Telegraph Company outside the State of New York, and a part to maintain the cash balances now being drawn upon for all the above purposes. The charges of this proposed issue on this year's revenue will be hardly appreciable—as a matter of fact, the usual yearly dividend on the whole amount could be met out of this year's revenue and still leave a surplus. The business of the current six months of this year will show a continuation of increases in gross and net, although the toll and long distance business, as usual, shows the effect of business depression." Announcement of the new issue caused a flurry on the Paris Bourse, and the Banque de Paris et des Pays-Bas offered to cancel the transactions of June 20 relating to the American Telephone stock.

Federal Sign System (Electric).—In his annual report for the year ended March 25, 1911, recently issued, President John H. Goehst, of the Federal Sign System (Electric), notes that during the year the company has established a new office in Baltimore and has also made long-term contracts with electric-service companies in a number of cities to extend its sign-rental service under a plan by which the Federal company furnishes the selling experience and the investment, and the local central-station company does the operating. This arrangement has been made and signs installed in the following cities: Johnstown, Pa., Hattiesburg, La., Jackson, Miss., Enid, Okla., Pontiac, Mich., Ann Arbor, Mich. Mount Clemens, Mich., El Reno, Okla., and Springfield, Ohio. The gross earnings for the year were $663,099 and the net earnings $105,264. Of the latter amount, $92,509 was available for dividends after setting aside a reserve for absorption of development expenses of the branches. The dividends paid amounted to $30,774, and the balance carried to surplus was $61,735. A satisfactory feature of the year's business was the growth in merchandise sales, this branch of the business having shown a decided increase over the preceding year. During the year the directors sold $370,550 of the company's preferred stock, and a voting trust was formed for the common stock. Messrs. Samuel Insull, John H. Goehst and John F. Gilchrist are trustees of this voting trust for a period of five years from Dec. 12, 1910.

Central Hudson Gas & Electric Bond Issue.—An application has been made to the Public Service Commission for the Second District of New York by the Central Hudson Gas & Electric Company for approval of a refunding mortgage to the Knickerbocker Trust Company, and to issue under this $5,000,000 in bonds. Of this amount $1,400,000 is to offset an equal amount of underlying bonds, and the balance of $3,600,000 is to be issued hereafter only with the consent of the Public Service Commission. Permission to issue $600,000 in bonds to finance improvements and extensions is also requested in this application. Reference to the formation of the Central Hudson was made in the *Electrical World* of April 20.

Colorado Telephone Company Consolidation.—Stockholders of the Colorado Telephone Company will meet in Denver, July 17, to vote upon a plan for consolidating the Colorado Telephone Company and the Tri-State Telephone & Telegraph Company. The latter, which operates in northern New Mexico, was organized about a year ago and has been a subsidiary of the Colorado Telephone Company since that time.

Reorganization of Cincinnati Public Utility Property.—The executive committee of the Columbia Gas & Electric Company, of Cincinnati, Ohio, is completing plans for a complete reorganization of the operation of the several affiliated properties. The plan includes the division of the management of the properties into departments as follows: Producing and operating, selling and commercial, auditing and clerical work and financial detail. James C. Ernst, vice-president of the Columbia Gas & Electric Company and head of the Cincinnati, Newport & Covington Light & Traction Company, will be the general manager of the operating and producing department, and will have complete control of the gas and electric plants, the distributing system, the street railway lines and their power houses. He will begin at once a study of the properties with a view to economical operation, and it is probable that all the energy for the operation of the railway lines and the lighting and power business in Covington and Newport, Ky., will be furnished by the Cincinnati plant ultimately. The active management of the Cincinnati, Newport & Covington Light & Traction Company will be turned over to Clarence McCabe, who has been the general superintendent for about two years. He will make his reports to Mr. Ernst, as will the men who have charge of the various properties and plants of the controlling company. This will bring the railway company into closer touch with the Union Gas & Electric Company and subsidiaries of the Columbia, something which President White has desired for some time. Rollin W. White, brother of the president, A. S. White, and acting president of the Union Gas & Electric Company, will become the manager of the selling and commercial department. The auditing and clerical departments for all the companies will be in the hands of Theodore Clauss, now secretary of the Union Gas & Electric Company. W. T. Hunter, secretary of the Columbia Gas & Electric Company, will handle the department of financial detail, such as records of capitalization, interest, dividends, earnings and other things of this nature. Property on Gano Alley has been purchased for a substation in the downtown district on which a plant will be erected at an estimated cost of $150,000. The workshop of the gas plant will also be rearranged and material stations will be established to lessen the amount of hauling and the number of horses to be used.

Baltimore United Railways to Issue $3,125,000 in Bonds.—The United Railways & Electric Company of Baltimore has made application to the Maryland Public Service Commission for the authorization of $3,125,000 three-year 5 per cent secured convertible coupon notes, in order to provide funds for the payment of $2,000,000 Baltimore City Passenger Railway Company first-mortgage 5 per cent bonds, which are underlying bonds, maturing Nov. 2, 1911, and $500,000 of the 4½ per cent certificates of indebtedness of the same company, which will mature on the same day, and to redeem $535,000 series "B" and "C" car trust certificates outstanding after Oct. 1, 1911. The notes will be convertible into United Railways & Electric Company stock at $25 a share at any time before maturity, provided the notes shall not have been redeemed. The stock of the company is now selling on the market at about $18 a share. The notes will be secured by deposit with a trust company as collateral of $2,500,000 United Railways & Electric Company first-mortgage 4 per cent bonds and by a total amount of the company's stock sufficient to meet the conversion rights referred to above. The collateral back of the $3,125,000 notes has a present market value of $4,375,000. The notes will be redeemable by the company at par upon sixty days' notice. Every subscribing stockholder will receive an allotment of $100 of notes or multiples thereof for every ten full shares of stock or multiples thereof standing in the name of such stockholder on the books of the company on an agreed date.

New England Telephone & Telegraph Company.—A wide reduction in rates applicable to all exchanges outside the Boston and suburban districts is to be made by the New England Telephone & Telegraph Company. This follows the recent decision of the Massachusetts Highway Commission regarding rates in the Boston and suburban districts which reduced the annual revenue of the company by some $3,000,000. Officials of the company believe that these new reductions, which will mean a further decrease of $200,000 in revenue, will be compensated by returns from new business induced by lower rates. The dividend rate was increased from 6 per cent to 7 per cent per annum at the directors' meeting held last week. Commenting upon the increase in rate of dividend, President Keller stated: "The average dividend during the life of the company has been less than 5 per cent. Although the company has been for several years in position to change its dividend rate, action was deferred until completion of recent readjustments. It is now practically certain that these will reduce net revenue between $500,000 and $600,000 per year, and recent wage increases will absorb over $200,000 more. It is expected that additional business as a result of lower rates will in another year begin to make itself felt and insure a fair margin of safety over charges."

Washington, Potomac & Chesapeake Railway to Increase Capital Stock.—The Maryland Public Service Commission has received a petition from the Washington, Potomac & Chesapeake Railway Company for authority to increase its capital stock from $500,000 to $2,000,000 and its bonded indebtedness in a like amount. The company states in its petition that it proposes to extend its line from Brandywine, in Prince George's County, to Benning, in the District of Columbia, and from Mechanicsville to Cedar Point, on Chesapeake Bay, and Point Lookout. It is stated that the estimated cost of construction will be in excess of $2,000,000.

Indianapolis Plant to be Sold.—The Security Trust Company, receiver for the Jenney Electric Manufacturing Company, with plants in Indianapolis and in Anderson, Ind., has asked the court for permission to sell the Anderson plant for $135,000. The receiver alleges that the company can no longer carry on the business at a profit or meet expenses. The indebtedness amounts to more than $100,000. The court has ordered that the Anderson plant be sold at private sale on June 27 for the above price.

DIVIDENDS.

American Power & Light Company, quarterly, preferred, 1½ per cent, payable July 1.

American Telephone & Telegraph Company, quarterly, $2.00 per share, payable July 15.

Bell Telephone Company of Canada, quarterly, 2 per cent, payable July 15.

Canadian Westinghouse Company, quarterly, 1½ per cent, and extra dividend on capital stock, ½ of 1 per cent, payable July 10.

Carolina Power & Light Company, quarterly, preferred, 1¾ per cent, payable July 3.

Cities Service, monthly, preferred, ½ of 1 per cent; common, ¼ of 1 per cent, payable July 1.

El Paso Electric Company, semi-annual, preferred, $3.00 per share, payable July 10.

Electric Storage Battery Company, preferred and common, 1 per cent, payable July 1.

Halifax Electric Tramway Company, Ltd., quarterly, 2 per cent, payable July 3.

Lowell Electric Light Corporation, semi-annual, $2.00 per share, payable Aug. 1.

New Orleans Railway & Light Company, quarterly, preferred, 1¼ per cent, payable July 15.

Puget Sound Electric Railway Company, semi-annual, preferred, $3.00 per share, payable July 1.

United States Light & Heating Company, semi-annual, preferred, 3½ per cent, payable July 20.

Westinghouse Electric & Manufacturing Company, quarterly, preferred, 1¾ per cent, payable July 15.

REPORTS OF EARNINGS.

Period	Gross Earnings	Operating Expenses	Net Earnings	Fixed Charges	Net Surplus
AMERICAN LIGHT & TRACTION COMPANY.					
May, 1911	[illegible]	[illegible]	$299,702	....	....
" 1910	[illegible]	[illegible]	264,046	....	....
5m., May '11	[illegible]	47,056	[illegible]	....	....
" " '10	[illegible]	45,629	1,468,193	..	
CANTON ELECTRIC COMPANY.					
May, 1911.......	$20,877	$10,393	$10,484	$3,724	$6,760
" 1910.......	19,824	10,620	9,204	3,253	5,951
KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY					
5m., May '11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
" " '10 ..	1,754,154	824,400	[illegible]	[illegible]	[illegible]
MONTREAL STREET RAILWAY COMPANY					
May, 1911.......	[illegible]	$216,730	[illegible]	[illegible]	[illegible]
" 1910.......	370,234	199,617	170,617	48,977	121,640
NORFOLK & PORTSMOUTH TRACTION COMPANY.					
May, 1911.......	$171,813	$104,513	$67,300	$61,342	$5,958
" 1910.......	160,492	93,510	66,982	65,663	1,319
SCRANTON ELECTRIC COMPANY.					
May, 1911.......	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
" 1910.......	50,578	25,070	25,508	10,179	15,329
UNITED RAILWAYS OF ST. LOUIS.					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

General News

Construction News.

TOMBSTONE, ARIZ.—George Noble Todd, a mining engineer of California, is making investigations in the Tombstone district with a view of establishing a hydroelectric plant in this territory.

CLARKSVILLE, ARK.—Plans are being made by the city of Clarksville for the installation of a municipal electric-light plant to cost about $20,000. It is proposed to purchase the distributing system of the plant owned by E. T. McConnell, which was reported to have been destroyed by fire some months ago. John M. Davis is a member of the Board of Commissioners.

COTTER, ARK.—Preparations are being made by E. B. Griswold for the installation of an electric-light plant in Cotter. Mr. Griswold was recently granted a thirty-year franchise by the City Council to operate an electric-light system in this city.

BERKELEY, CAL.—The Oakland Traction Company has engaged E. C. Prather, of Oakland, Cal., engineer, to make a new survey for the proposed scenic electric railway from North Berkeley to Grizzly Peak.

BURLINGAME, CAL.—Application has been made to the Board of Trustees by Ansel M. Easton for a franchise to construct and operate a street railway in Burlingame. Bids will be received by J. R. Murphy until July 24 for same.

EL MODENA, CAL.—The installation of an electric-light and power system in El Modena is under consideration.

EUREKA, CAL.—The Western States Gas & Electric Company has applied to the Board of County Supervisors for a franchise to erect and operate electric transmission lines along the county roads in district No. 3 for the distribution of electricity in that district.

FOWLER, CAL.—Application has been made to the City Council by the Fresno, Hanford & Summit Lake Interurban Railway Company for a franchise to extend its railway through Fowler.

JACKSON, CAL.—Arrangements are being made by the Amador Electric Light & Power Company, of Sutter Creek, Cal., for the erection of a substation at Jackson.

LAKEPORT, CAL.—The Board of County Supervisors has granted the Mount Kenooti Light & Power Company a franchise to erect transmission lines on the public highways and roads of the county for the transmission and distribution of electricity for lamps and motors in Lake County.

LOS ANGELES, CAL.—Preparations are being made by the Glendale & Eagle Rock Railway Company for the construction of an electric railway from its present western terminus at Fourth Street and Grand Boulevard, through Valley View tract, across Los Angeles River into Griffith Park.

LOS ANGELES, CAL.—It is reported that the Southern Pacific and Salt Lake lines are to be merged with the Pacific Electric Railway Company in Long Beach. It is understood that the southern division of the electric railway system is to dominate the united roads. Material for equipping the steam roads for electrical operation is said to have been ordered.

LOS ANGELES, CAL.—The Board of Supervisors is reported to have decided to readvertise for electrical machinery for the Hall of Records Building.

MERCED, CAL.—A petition signed by a large number of voters has been presented to the City Council asking that a special election be held to vote on the proposition to issue bonds to establish a municipal light and water plant in Merced.

OAK PARK, CAL.—The South Sacramento Power Company, which supplies electricity in Oak Park and throughout this county, has changed hands and the following officers have been elected: C. W. Waller, president; Arthur M. Seymour, vice-president, and R. N. Bishop, secretary and manager.

RICHMOND, CAL.—The Western States Gas & Electric Company has filed a mortgage covering its entire holdings to the Girard Trust Company, of Philadelphia, Pa., to secure an issue of $10,000,000 in bonds. The mortgage covers the plant and holdings of the Richmond Light & Power Company, of Richmond, Cal.; the Stockton Gas & Electric Corporation, of Stockton, Cal.; the Humboldt Gas & Electric Company, of Eureka, Cal.; the Sacramento River Electric Company, and the land and water rights in Humboldt, San Joaquin, Calaveras, Sacramento and El Dorado Counties. The proceeds of the bonds will be used to purchase, develop and equip additional properties.

SACRAMENTO, CAL.—The contract for supplying electricity for all purposes to the State Capitol has been awarded to the Great Western Power Company by the State Board of Control. Under the terms of the contract the company is to furnish electricity for all purposes at the capitol, capitol grounds and the printing office, including incandescent lamps, arc lamps and motors for printing office and elevators at the rate of 1⅞ cents per kw-hour. The contract is for a period of three years, beginning July 1, 1911.

SAN BERNARDINO, CAL.—Application has been made to the County Supervisors by Attorney Carneham, of Riverside, Cal., for a franchise to erect transmission lines on the county roads outside of the incorporated cities for a term of fifty years. Bids will be received for the franchise until July 24. It is said that a company is to be organized with a capital stock of $15,000,000, which will take over the properties developed on Bishop Creek, Inyo County, and transmission system across Death Valley. It is said that the new company will secure additional power from the Los Angeles aqueduct and will exchange reservoir rights for valuable water rights held by the electric company in Inyo County. The company, besides supplying electricity in this section, proposes to extend its transmission line into new territory, including the San Jacinto Valley, where there is now no electrical service.

SAN JOSE, CAL.—The citizens have voted to issue $377,000 in bonds for municipal improvements, among which are included the installation of a new fire-alarm system and a police-patrol flashlight system.

SAN LUIS OBISPO, CAL.—Application has been made to the Board of County Supervisors by Walter Gould Lincoln for a franchise to operate an electric railway throughout the county. Mr. Lincoln has also petitioned the City Council for a street railway franchise in the city of San Luis Obispo.

SANTA ROSA, CAL.—The Board of County Supervisors has awarded the contract for construction of power house and laundry to Hoy Brothers, of Santa Rosa, Cal. The cost of the work, exclusive of laundry machinery, is estimated at $14,176.

SUSANVILLE, CAL.—Application has been made to the Board of Supervisors by James Branham for a fifty-year franchise to erect transmission lines for the distribution of electricity on the streets and highways in Susanville. Sealed bids will be received for the above franchise until July 26. R. E. Langham is city clerk.

YREKA, CAL.—Preliminary work has begun for the construction of a dam across the Klamath River by the Siskiyou Electric Power & Light Company. The dam is to be located about 7 miles down the river from Klamath Hot Springs. A large power house wil be erected near the dam. Electricity generated at the plant will be supplied to the farmers to operate pumps for irrigating purposes.

GRAND JUNCTION, COL.—Right-of-way has been secured for the extension of the Grand Junction & Grand River Valley Railway Company's interurban electric railway from Grand Junction to Clifton, 6 miles in length. Later the railway will be extended to Palisades.

PUEBLO, COL.—Preparations are being made by H. M. Byllesby & Company, of Chicago, Ill., who recently purchased the property of the Pueblo & Suburban Traction & Lighting Company, for extensions and improvements to the system, including the erection of additional transmission lines, increasing the output of the steam generating plant and enlarging the hydroelectric developments. The company at present operates a steam-power plant with an output of 4135 kw at Pueblo and a 1600-kw hydroelectric plant at Skaguay.

BRIDGEPORT, CONN.—Work has commenced on the construction of the proposed Bridgeport & Danbury electric railway at the Trumbull line. The Sperry Engineering Company, of New Haven, Conn., has the contract.

NEW HAVEN, CONN.—Plans are being made by the New York, New Haven & Hartford Railroad Company to erect a power house and machine repair shops at New Haven. The company is now erecting a large engine house which will accommodate forty-three steam engines or eighty-six electric locomotives. The new power house will supply electricity for the system when the electric-car service is extended from Stamford to New Haven.

WASHINGTON, D. C.—The construction of an electric railway to extend from Anacostia to Congress Heights is under consideration by the Washington Railway & Light Company.

WASHINGTON, D. C.—Bids will be received by the Secretary of the Department of the Interior, Washington, D. C., until July 3 for the installation of coal and ash-handling machinery in the old post office building, Washington, D. C., in accordance with plans and specifications, copies of which may be obtained upon application to the chief clerk of the department.

WASHINGTON, D. C.—The contract for erecting the large wireless towers at Fort Meyer for use of the United States Navy has been awarded to the Baltimore Bridge Company, of Baltimore, Md., at about $100,000. The contract includes the erection of three towers, one 600 ft. high and two 450 ft. high.

OCALA, FLA.—The Lake Weir, Ocala & Silver Springs Suburban Railway Company, recently organized, is planning to build an electric railway between Lake Weir, Ocala and Silver Springs. The company is capitalized at $500,000 and the officers are: D. S. Woodrow, president; E. W. Davis, secretary and treasurer, and H. A. Kramer, general manager.

PORT ST. LUCIE, FLA.—The installation of an electric-light plant is reported to be under consideration. J. R. Rogers, of Sewalls Point

a., it is understood, can give further information. Port St. [illegible] post office.

ARAGON, GA.—The Georgia Power Company has secured a site Aragon on which it proposes to erect a transformer station. [illegible] ation will receive current from Tullulah Falls by the way of Atlanta, d will be transmitted to Cedartown and Rome.

BAXLEY, GA.—The question of issuing bonds for the construction [illegible] electric-light plant is reported to be under consideration.

CEDARTOWN, GA.—Investigations have been made in Cedartown by e Georgia Electric Company with a view of extending its transmission nes to this place.

SYLVANIA, GA.—The city of Sylvania is installing an electric-light ant and water-works system. J. B. McCrary & Company, of Atlanta, a., have the contract. The city is in the market for inside wiring material and a small amount of line material. L. B. Moore is superintendent t the light and water plant.

WASHINGTON, GA.—At an election to be held July 14 the proposition to issue $30,000 in bonds, the proceeds to be used for reconstruction of the municipal electric plant, will be submitted to a vote. Westinghouse, Church, Kerr & Company, 10 Bridge Street, New York, N. Y., engineers. E. A. Barnett is Mayor.

SPRINGFIELD, ILL.—The Springfield Light, Heat & Power Company s decided to erect an addition 40 ft. x 108 ft., to its power station loe at Tenth Street and Capitol Avenue, to cost about $25,000, conet for which has already been awarded. It is proposed to install adnal boilers and engines in the new extension.

BRAZIL, IND.—The City Council has awarded the contract for eet lighting to the Terre Haute, Indianapolis & Eastern Traction mpany for a term of five years. The contract provides for a minim of 191 lamps, of which about 50 will be tungsten clusters, at the e of $97.50 each per year with an all-night schedule. Arc lamps will supplied at the rate of $67 each per year. The company offered to nish the service on a ten-year contract at $1 less per lamp per year, ch was not accepted by the Council as it is believed that the city install a municipal plant at the expiration of five years. The cont with the Brazil Electric Company expires next April.

SHIRLEY, IND.—The installation of an electric-light and power stem in Shirley is reported to be under consideration. Electricity for erating the plant will probably be secured from the transmission lines t the interurban railway company.

SOUTH BEND, IND.—Plans are being considered by the Indiana & Michigan Electric Company for the construction of a 42-in. intake pipe rom the river to supply water for condensing purposes at the steam lant. The company will also expend about $100,000 for underground onduits, work on which will begin in the near future. F. A. Bryan, f South Bend, Ind., is general manager.

CRESTON, IA.—At an election to be held July 7 the proposition to urchase the local electric-light plant, owned by C. K. Munns, to be wned and operated by the municipality, will be submitted to a vote. he plant has been offered to the city for $15,000.

DAVENPORT, IA.—Notice has been filed with the Secretary of tate by the Davenport & Muscatine Interurban Railroad Company showg an increase in capital stock from $100,000 to $1,000,000.

MOUNT PLEASANT, IA.—Arrangements are being made for the rection of several power stations along the Skunk River. Three dams re being built on the river, one at Augusta, one at Lowell and the ther at Oakland Mills. A transmission line is being erected from Oakand Mills to Mount Pleasant. The company is said to have begun egotiations to supply electricity to the State Hospital for the Insane nd also in this city. Upon completion of the three dams a circuit will e established which will take in Burlington, Mount Pleasant and Vapello, where a dam will be built on the Iowa River. A steam plant will be erected in Mount Pleasant to supplement the water-power during ow-water periods and in case of emergencies.

PAULLINA, IA.—Plans are being considered by the Council for the nstallation of an ornamental street-lighting system in Paullina.

MINNEAPOLIS, KAN.—The installation of a municipal electric-light lant in Minneapolis is under consideration. The proposition to issue onds to the amount of $15,000 will be submitted to a vote. Electrical ervice in the town is now supplied by the Jackman Roller Mills.

RUSSELL, KAN.—It is reported that bonds to the amount of $28,000 have been voted to complete the municipal electric-light plant.

TOPEKA, KAN.—The City Commission has instructed all companies operating wires in Topeka to have all their poles removed on Kansas Avenue within thirty days. This step has been taken to prepare for he installation of an ornamental lighting system, bids for which are now being asked.

LOUISVILLE, KY.—The Kentucky Electric Company has been awarded he contract for supplying electricity for lighting and elevator service in he United States custom house.

MIDWAY, KY.—The City Council has awarded the contract for installing an electric-lighting system in Midway to the Moore-Young Electric Company, of Lexington, Ky., for $3,575. The plant will be installed under the supervision of Prof. A. M. Wilson, of the Engineering Department of the State University.

ALEXANDER CITY, LA.—The Industries Light & Power Company, recently organized, is planning to construct a dam across a nearby stream to utilize the water power to generate electricity. For further information address Benjamin Russell.

BALTIMORE, MD.—A special meeting of the stockholders of the United Railways & Electric Company has been called for July 3 to ratify a resolution authorizing the issue and sale of $3,125,000 coupon notes.

BALTIMORE, MD.—Preparations are being made by the Consolidated Gas, Electric Light & Power Company for the construction of a large addition to its plant at the foot of Leadenhall Street, to cost $100,000. Bids will be asked as soon as plans are completed. The Fidelity & Construction Company has been awarded the contract for the construction of the concrete foundation.

ATTLEBORO, MASS.—The Attleboro Steam & Electric Company has announced a reduction in the price of electricity for lamps from 14 cents to 13 cents per kw-hour, to take effect from July 1.

BOSTON, MASS.—The directors of the American Telephone & Telegraph Company have voted to authorize an issue of approximately $50,000,000 in additional capital stock, the proceeds to be used to provide the associated companies of the Bell system outside of the State of New York with funds for current and ordinary construction and extensions. Part of the funds will be used for extensions to the long-distance service of the American Telephone & Telegraph Company outside of New York State.

BOSTON, MASS.—Double-tracking the line from Malden to Revere Beach will be among the first of the improvements to be made by the Boston & Northern Street Railway Company. Extensive improvements are contemplated by the company, which will involve an expenditure of about $2,000,000.

GARDNER, MASS.—The Board of Selectmen has granted the Gardner Electric Light Company permission to lay underground conduits on Pearl Street from Elm to Glazier Street.

MALDEN, MASS.—The Street and Water Commission has recommended the City Council to enter into a ten-year contract with the Malden Electric Company for street lighting. Under the new contract the company will furnish lamps on an all-night schedule instead of moonlight schedule as at present. The price for arc lamps will be $86.40 each per year, and incandescent street lamps $18.72. The city pays $100 each per year for arc lamps, and $18.75 per year for incandescent lamps under the present contract. The contract contains a provision that it can be terminated at the end of any one year.

PITTSFIELD, MASS.—F. T. Ley & Company, of Springfield, Mass., have been awarded the contract for the erection of a high-tension transmission line from Pittsfield, Mass., to Canaan, Conn., 28 miles in length, for the Berkshire Street Railway Company. Eight miles of this line will be carried on steel towers. The contract includes an addition to the power house at Pittsfield and several transformer stations along the line.

STERLING, MASS.—The Selectmen have fixed the price of electricity for commercial lighting in Sterling at 10 cents per kw-hour. The minimum charge for electrical service is $1 per month. A discount will be made for large quantities consumed.

WORCESTER, MASS.—The County Commissioners are considering the question of abandoning the electric plant at the court house and securing electricity from the Worcester Electric Light Company to light the building and for motors. The present plant cost $20,000 and has been in operation about twenty years.

CARO, MICH.—The plant and holdings of the Caro Light & Power Company, of Caro, Mich., are reported to have been purchased by T. W. Atwood. It is understood that the new owner will install new equipment at the power plant and may also add a motor-driven pump at the water-works station. A power service will be established if sufficient business is guaranteed.

CHARLOTTE, MICH.—William Breitmeyer has awarded the contract for the construction of office building and packing house, together with power house and smokestack, to Frank J. Curtis.

HUBBARDSTON, MICH.—The plant and holdings of the Hubbardston Electric Light & Power Company are reported to have been purchased by Harry Holbrook.

NEGAUNEE, MICH.—The City Council has awarded the contract for new equipment for the municipal electric-light plant to the Allis-Chalmers Company, of Milwaukee, Wis. The improvements will include the installation of a 350-hp Corliss cross-compound engine, to drive a 200-kw alternator, including auxiliaries consisting of a barometic condenser, switchboard panel, feed-water heater and exciter. The cost of the work is estimated at about $15,000.

CANBY, MINN.—The installation of an electric-light system in Canby is reported to be under consideration.

ST. CLOUD, MINN.—The St. Cloud Water & Power Company has filed amendments to its charter increasing its capital stock from $25,000 to $600,000. The company is building a large dam near St. Cloud in connection with its water-power projects.

ST. PAUL, MINN.—The contract for installation of ventilating, heating and electrical apparatus at the Service and Maintenance Building at the City and County Hospital, bids for which were opened June 16, have been awarded as follows: Electrical work to Electrical Construction Company, of St. Paul, Minn., at $3,700; heating and ventilating to

[illegible] Hees Domestic Engineering Company, of St. Paul, Minn., for $5,890.

COFFEEVILLE, MISS.—The installation of an electric-light plant in Coffeeville is reported to be under consideration. P. M. Woodall is [illegible]

TUTWILER, MISS.—It is reported that a company is being organized in Tutwiler for the purpose of establishing an electric-light plant. It is proposed to expend $10,000 for the proposed system. W. D. Corley is interested in the project.

TYLERTOWN, MISS.—Q. D. Sauls, of Tylertown, Miss., is reported to be in the market for one 50-kw, 2300-volt, 60-cycle generator and exciter, second-hand and in good condition.

JEFFERSON CITY, MO.—The Ozark Power & Water Company has filed a notice of increase in capital stock from $5,000 to $875,000 with the Secretary of State. The company was incorporated for the purpose of acquiring and developing water rights and to generate and sell power. R. W. Morrison and Douglas H. Jones are among the directors.

KANSAS CITY, MO.—The Kansas City Electric Light Company has secured a permit to erect a substation to be located at Fortieth Street and State Line. The building will be 40 ft. x 132 ft., and cost about $17,000. This station when completed will be used jointly by the electric light company and the Metropolitan Street Railway Company. Louis H. Egan is general manager of the Kansas City Electric Light Company.

KANSAS CITY, MO.—Bids will be received at the office of the purchasing agent, City Hall, Kansas City, Mo., until July 12, for one direct-current turbo generator, to be delivered at the Quindaro water works of Kansas City, Mo., to supply electricity for lamps and motors in and around the Quindaro water works pumping station. E. B. Harrington is secretary of Board of Fire and Water Commissioners.

KIRKWOOD, MO.—The question of continuing municipal ownership of the electric-light plant is under consideration. If continued extensive improvements will be required, involving an expenditure of from $10,000 to $12,000. Three propositions are under consideration: First, to raise sufficient funds by a bond issue to make the necessary improvements. Second, to purchase current to be delivered at the switchboard from the Suburban Electric Light & Power Company to be distributed by the city. Third, to close down the municipal electric plant and turn the commercial lighting over to the Suburban Light & Power Company and enter into a contract with the company for street lighting. The value of the plant is placed at $25,000, against which there is a bond issue of $25,000.

ST. LOUIS, MO.—It is reported that the Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., is contemplating erecting transmission lines from the hydroelectric plant at Keokuk, Ia., to St. Louis. Electricity will be transmitted at 100,000 volts and stepped down to 6600 volts for distribution. A transformer station will be built in St. Louis County.

WALSH (P. O. POPLAR BLUFF), MO.—The Paul Lumber Company is reported to have awarded a contract for the erection of a sawmill to replace the building recently burned. The company may install an electric-light plant. W. F. Bectel is president.

HELENA, MONT.—The control of the United Missouri River Power Company, which owns the large Hausar Lake and Canyon Ferry dams, has been purchased by the Amalgamated Copper interests. The properties are valued at $15,000,000 and give practically control of water-power development in Montana.

BRAINARD, NEB.—Sealed proposals will be received by the city of Brainard until July 7 for construction of water works system and rebuilding the electric-light plant. Plans and specifications are on file at the office of the village clerk and at the office of the Almo Engine & Supply Company, Omaha, Neb. Copies of plans and specifications can be obtained from the Almo Engine & Supply Company, for which a charge of $5 will be made.

GIBBON, NEB.—The installation of an electric-light plant in Gibbon is reported to be under consideration.

LOUP CITY, NEB.—A. C. Koenig, of Omaha, Neb., engineer, is reported to have completed plans for the construction of a hydroelectric power plant for Loup City. It is estimated that bonds will soon be sold to provide funds for same.

ELKO, NEV.—Bids will be received by Fred C. Voight, clerk of board, Elko, Nev., until July 12 for furnishing and installing electric-light fixtures for the new court house and jail. Plans and specifications are on file at the office of the clerk, Elko, Nev. W. H. Weeks is the architect.

RENO, NEV.—Preparations are being made by the Nevada Power & Transportation Company for the construction of a 4000-hp power plant on the Truckee River, 7 miles east of Reno. The company is now building a large plant near Bishop, Cal. W. E. Caffrey is chief electrician.

KEENE, N. H.—The Connecticut River Transmission Company has entered into a contract with the Keene Gas & Electric Company to supply electricity to operate the latter's system from its plant at Vernon, Vt. Preparations are being made to erect a transmission line from the plant to Keene. The contract calls for a maximum of 1000 hp. The local power plant of the Keene Gas & Electric Company will be closed down.

CAMDEN, N. J.—Sealed proposals will be received at the office of J. J. Albertson, county engineer, Court House, Camden, N. J., until July 10 for construction of pump house, gasoline engine and foundation, gasoline tank, pump and stand pipe in position, generator with foundation and electrical equipment. Plans and specifications may be obtained on application to F. W. George, Court House, Camden, N. J.

PERTH AMBOY, N. J.—The construction of an electric railway between Perth Amboy and Dunellen is under consideration. W. P. Deering, of Perth Amboy, is interested in the project.

SEA ISLE CITY, N. J.—The Supreme Court has set aside two ordinances passed by the Council on the ground that they were not passed in accordance with the statutory requirements, one of which provided for a bond issue of $20,000 for the construction of a lighting plant and the other for an issue of $25,000 in bonds for street improvements and fire apparatus.

KELLY, N. M.—The Gorman Company is reported to be contemplating the installation of an electric hoist at its properties.

ALBANY, N. Y.—The Central Hudson Gas & Electric Company, recently organized, has applied to the Public Service Commission, Second District, for permission to issue $5,000,000 in bonds, of which it is proposed to reserve $1,400,000 to offset an equal amount of underlying bonds and the remaining $3,600,000 to be issued hereafter with the consent of the commission. The company also asks for authority to issue $600,000 in bonds, the proceeds to be used for improvements and extensions. The company was formed by a consolidation of the Poughkeepsie Light, Heat & Power Company, the Newburgh Light, Heat & Power Company and the Hudson Counties Gas & Electric Company.

BARKER, N. Y.—The Village Board has granted the A. L. Swett Electric Light & Power Company, of Medina, N. Y., a fifty-year franchise to construct and operate an electric-light and power system in Barker. The Board also entered into a contract with the company to light the streets of the village for a period of five years, under the terms of which the company is to supply 25-cp tungsten lamps at $30 each per year. Electricity to light the new Union High School is to be furnished free of charge. It is expected to have the transmission line extended to Barker and the system in operation by Oct. 1, 1911.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until July 3 for repairs, alterations and additions to the electric equipment in Public Schools 3, 7, 37 and 38, Borough of Brooklyn. Bids will also be received at the same time and place for installing electric-light equipment in Truant School, Jamaica Avenue, opposite Enfield Street, and Public School 73, McDougal Street and Rockaway Avenue, Borough of Brooklyn.

BUFFALO, N. Y.—The residents of the Twenty-third Ward have presented a petition to the Board of Aldermen asking that electroliers similar to those on Genesee Street, be erected on Elmwood Avenue from Ferry Street to Virginia Street.

BUFFALO, N. Y.—The Buffalo General Electric Company has been granted permission by the Public Service Commission, Second District, to issue $150,000 in bonds, to be sold at not less than 95. The company was authorized to issue $420,000 in bonds last February to purchase property in Buffalo and to erect a building thereon. The amount was found to be insufficient and the company applied for permission to issue the additional bonds granted.

CATSKILL, N. Y.—The Katskill Traction Company has applied to the Public Service Commission for permission to extend its railroad from Leeds to Cairo, a distance of 6.7 miles. The company has also filed a petition asking for authority to issue $160,000 in bonds, the proceeds to be used to build the proposed extension.

EAST CREEK, N. Y.—The East Creek Light & Power Company is reported to have awarded a contract for the construction of a power house at Ingrams, N. Y., to Brown & Lowe, contractors, of Schenectady, N. Y. The building will be 60 ft. x 90 ft., four stories high, and with equipment will cost about $50,000.

ELMIRA, N. Y.—It is reported that the Chase-Hibbard Milling Company is contemplating the construction of an electric plant. It is understood that the company proposes to supply electricity to industrial and manufacturing plants in Elmira.

JOHNSTOWN, N. Y.—The Charles B. Knox Gelatine Company, of Johnstown, N. Y., is reported to have awarded a contract for construction of factory building, 128 x 62 ft., and power house, 40 ft. x 50 ft. to cost about $60,000.

LONG ISLAND CITY, N. Y.—Plans have been approved by Henry S. Thompson, Commissioner Water Supply, Gas and Electricity, and Deputy Commissioner Walsh, of Borough of Queens, for improving the lighting system on Hoffman Boulevard, Thomson and Hillside Avenues, forming the automobile link between Manhattan and Long Island. At present there are 135 electric lamps on these streets; under the new plan there will be 385 lamps, of which 288 will be erected on Thomson Avenue and Hoffman Boulevard and 97 on Hillside Avenue. Orders have been issued to the lighting companies for carrying out the plans.

LONG ISLAND CITY, N. Y.—The Public Service Commission has directed the Queensboro Gas & Electric Company to reduce its rates for gas and electric service as follows: For the first six months beginning July 1 for gas from $1.30 per 1000 cu. ft. to $1.20, and for the succeeding six months, $1.15 and for the year following June 30 electricity is to be furnished at 13 cents per kw-hour instead of 15 cents per kw-hour. The company asked the commission to establish maximum rates and agreed to accept such rates as it might recommend.

MANLIUS, N. Y.—It is reported that S. Cheney & Son, manufacturers of hardware specialties and gray iron founders, of Manlius, N. Y., are contemplating equipping their plant for electric motor drive and to abandon the use of steam power before the end of the year.

MINEOLA, N. Y.—Surveys are being made by the New York & North Shore Railway Company for the construction of an extension up Broadway, Flushing, to Farrington Street, connecting with its line on Prince and Farrington Streets. It is understood that an arrangement has been made with the New York & Queens County Railroad Company to use its tracks from Prince to Main Streets.

MINEOLA, N. Y.—The Long Island Lighting Company has filed a mortgage in favor of the Mercantile Trust Company of New York, N. Y., to secure an issue of $6,000,000 in bonds. The mortgage covers all the property of the company in Suffolk County and in Oyster Bay, Nassau County.

NEW YORK, N. Y.—Bids will be received until July 3 by C. B. J. Snyder, superintendent of schools, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., for repairs, alterations and additions to the electric-light equipment in Public School 20, Rivington and Suffolk Streets, Borough of Manhattan. Bids will also be received at the same time and place for installing electric equipment in Public School 46, located on 196th Street, between Briggs and Bainbridge Avenues, Borough of the Bronx.

NIAGARA FALLS, N. Y.—Work has commenced on double-tracking the Lewiston-Youngstown division of the Niagara Gorge railroad.

SUFFERN, N. Y.—The Public Service Commission, Second District, has authorized the Suffern Railway Company to construct an electric railway from Orange Avenue to Lafayette Avenue in Suffern and has approved an issue of $24,000 in capital stock, the proceeds to be used to pay for same.

WADDINGTON, N. Y.—The Dunn & Rutherford sawmill on the site of the proposed power dam at Waddington has been purchased by I. Wesley Allison, manager of the New York & Ontario Power Company. Negotiations are under way for the purchase of other property in that town. The company claims to have options on all property needed in connection with its proposed water-power development. The company has a contract with the Hydro-Electric Commission of Ontario to supply electricity to the municipalities in eastern Ontario.

WATERVILLE, N. Y.—The construction of an electric railway to connect Vernon, Waterville, Vernon Center, Augusta and Oriskany Falls, 20 miles in length, is under consideration.

GASTONIA, N. C.—Contracts have been awarded by the Piedmont Traction Company for rails for its proposed electric railway from Burlington to Haw River.

GREENSBORO, N. C.—Plans are being considered by the North Carolina Public Service Company for the construction of several extensions to its lines in Greensboro and High Point.

RALEIGH, N. C.—Plans are being considered for the installation of a separate electric-light plant for the Central Hospital for Insane and Epileptics, to cost about $7,000. Dr. James McKee is superintendent.

RALEIGH, N. C.—The installation of an electric-light plant in the State Hospital is reported to be under consideration. S. O. Middleton, of Hallsville, N. C., is a member of the executive committee.

SELMA, N. C.—Plans are being considered for the installation of a municipal electric-light plant in Selma. John A. Mitchell is Mayor.

CINCINNATI, OHIO.—Arrangements are being made by the executive committee of the Columbia Gas & Electric Company, of Cincinnati, Ohio, for the complete reorganization of the operation of its several affiliated properties. It is expected that ultimately electricity for operating all railway lines and for lamps and motors in Covington and Newport, Ky., will be supplied by the Cincinnati plant. The company has purchased property on Gano Alley, on which it will erect a substation to the downtown station, to cost about $150,000. James C. Ernst will be general manager of the operating and producing department and will have complete control of the electric, gas, distributing system and street railway lines.

CLEVELAND, OHIO.—The Cleveland Railway Company will build 22 miles of new track during the summer.

CLEVELAND, OHIO.—The Cleveland Underground Rapid Transit Railroad Company has filed a certificate with the Secretary of State showing an increase in capital stock from $10,000 to $3,500,000. The company has been authorized by the General Assembly to construct a rapid transit subway in Cleveland. The construction of about 20 miles of subway is contemplated and rapid transit entrance to the heart of the city from every suburb is included in the plan.

KENTON, OHIO.—Negotiations have been consummated whereby the property of the Kenton Gas & Electric Company will be taken over by the Hardin-Wyandotte Lighting Company. The consideration is said to be $160,000. It is reported that the company is planning to erect a new plant, at a cost of $60,000, and to supply electricity in Forest, Dunkirk and Upper Sandusky, where the local plants will be dismantled.

EDMOND, OKLA.—It is reported that plans are being considered for improvements and extension to the municipal electric-light plant, for which bonds to the amount of $20,000 have been voted.

SHAWNEE, OKLA.—The power plant of the Shawnee Gas & Electric Company was struck by lightning and burned to the ground on June 19, causing a loss of about $150,000. The plant will be rebuilt immediately; orders have already been placed for equipment. The company is managed by H. M. Byllesby & Company, of Chicago, Ill.

GRANTS PASS, ORE.—The Grants Pass & Rogue River Railroad Company has begun work on the construction of its proposed electric railway to connect Grants Pass, Medford and Ashland. The Pacific Western Company has the contract for the work.

HERMISTON, ORE.—The Hermiston Light & Power Company is reported to be contemplating the construction of a concrete dam to replace the temporary dam now in use.

OAKLAND, ORE.—The proposition to issue $15,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant and to cancel the floating indebtedness of the city, was carried at an election held recently.

BRADFORD, PA.—The capital stock of the Bradford Electric Light & Power Company has been increased from $85,000 to $130,000.

HARRISBURG, PA.—The Fallowfield Telegraph & Telephone Company has filed a notice with the Secretary of State showing an increase in capital stock from $12,000 to $50,000.

JOHNSTOWN, PA.—The Johnstown Telephone Company has filed amendments to its charter increasing its capital stock from $600,000 to $2,000,000.

MILLERSVILLE, PA.—The Lancaster & York Furnace Street Railway Company is building an extension to Mount Nebo, 3 miles in length, where it will connect with the Lancaster & Southern Street Railway. The company is installing two 300-kw rotary converters. E. W. Goss is general manager.

PITTSBURGH, PA.—The Weyman Warehouse in Duquesne Way, near Seventh Street, will be altered and remodeled into a power house at a cost of about $30,000.

WARREN, PA.—The Warren Light & Power Company has increased its capital stock from $10,000 to $300,000.

FAIRVIEW, S. D.—Arrangements are being made by the Sioux Valley Power Company, recently formed, for the construction of a hydro-electric power plant to cost about $100,000. It is proposed to erect a 16-ft. dam and develop about 500 hp, work on which will soon begin. The Fairview Milling Company is interested in the project. The Missouri Valley Engineering Company, of Mitchell, S. D., has charge of the engineering work.

SIOUX FALLS, S. D.—Sealed bids will be received by the Board of Commissioners of the city of Sioux Falls, S. D., until July 11 for the construction of a reinforced concrete wall and motor house for the municipal water works system, plans and specifications for which may be seen at the office of the Superintendent of Water Works, Sioux City, S. D., and at the office of L. P. Wolff, consulting engineer, St. Paul, Minn.

KNOXVILLE, TENN.—Negotiations are under way between the Eastern Tennessee Power Company and the Ocoee Power Company and the Knoxville Railway & Light Company whereby electricity generated at the Parkside plant will be distributed in Knoxville by the local company. If satisfactory arrangements cannot be made the Ocoee Power Company will ask for a franchise to enter the city and supply electricity for power purposes only.

MEMPHIS, TENN.—Plans are being made by the Lake View Traction Company for the construction of an extension from South Memphis to its city terminal at Third Street and Union Avenue, work on which will begin during the summer.

MEMPHIS, TENN.—It is reported that arrangements are being made for the reorganization of the Tennessee Traction Company. It is said that the company has sufficient funds to build the proposed railway. Practically all the right-of-way has been secured and the surveys made. It is understood that the company will make arrangements with the Memphis Street Railway Company by which the Poplar Avenue line will be extended to Aulon and used jointly by the street railway and traction companies.

BROWNSVILLE, TEX.—Bonds to the amount of $145,000 have recently been authorized, of which the proceeds of $15,000 will be used for extensions to the water and light systems.

LIBERTY, TEX.—Preparations are being made by the Liberty Light & Power Company for the installation of an electric-light plant and a 5-ton ice plant, work on which has already commenced. The company will be capitalized at $4,000. R. E. Bowen is president and C. F. Steusoff secretary and treasurer.

WACO, TEX.—Preparations are being made by the Southern Disinfectant Company for the erection of a factory building, 82 ft. x 265 ft., bids for construction of which will be received until Aug. 1. The plant will be equipped for electrical operation throughout.

WACO, TEX.—A proposition has been submitted to the citizens of Waco by J. F. Strickland, of Dallas, president of the Southern Traction Company, in connection with the construction of an interurban electric railway between this city and Waxahachie, a distance of about 65 miles. The people of Waco are asked to subscribe to $150,000 in capital stock and to donate the right-of-way through the country. The cost of building the railway, construction of a bridge across the Brazos River and taking over the local street railway system is estimated at about $5,000,000.

WILLS POINT, TEX.—The electric plant of the Wills Point Electric Light Company was destroyed by fire on June 16.

[illegible] W[illegible] E[illegible] & Manufacturing Company, of Pittsburgh, Pa., it is reported, is preparing plans and estimates for the construction and equipment of an electric railway to connect [illegible].

KINCAID, VA.—The Jackson River Power Company has applied to the Circuit Court of Allegheny County, Va., for permission to erect a dam not exceeding 60 ft. in height across the Jackson River at a point in Allegheny County near Kincaid Station, known as "The Narrows," and also to build at or near the dam a power house to generate electricity.

NATIONAL SOLDIERS' HOME, VA.—Sealed proposals will be received at the office of the treasurer of Southern Branch, National Home Disabled Volunteer Soldiers, National Soldiers' Home, Va., until July 14 for furnishing and installing electric-driven sewage pumps in buildings Nos. 19 and 60, in accordance with plans and specifications, copies of which may be obtained on application to John T. Hume, treasurer.

PULASKI, VA.—Preparations are being made by the Appalachian Power Company, of Richmond, Va., recently incorporated with a capital stock of $23,000,000, for the construction of a dam near Grayson Sulphur Springs, work on which will begin in the near future. The company owns five power sites on New River. It is proposed to build two dams, which will develop about 34,000 hp. Transmission lines will be erected to Pulaski, Bluefield and Pocahontas coal fields in West Virginia, Christiansburg, Salem and Roanoke, Va. The electric plants in Bluefield, Pulaski and several other towns have been purchased. The Appalachian Power Company will absorb the New River Power Company. A. L. Felio, of New York, N. Y., will have charge of the construction work. The company will be managed and operated by H. M. Byllesby & Company, of Chicago, Ill.

RICHMOND, VA.—S. T. Atkinson, Hotel Richmond, Richmond, Va., would like to receive prices on two 250-hp water-tube boilers, two 150-hp, four-valve engines direct-connected to generators, two 100-kw generators, pumps, etc.

RICHMOND, VA.—The Storm Equipment & Supply Company, 209 American National Bank Building, Richmond, Va., it is reported, would like to receive prices for the installation of a complete hydroelectric plant, including pumps, motors, etc.

ROCKY MOUNT, VA.—Plans for the construction of a municipal electric-light plant, water-works and sewer system are being prepared by W. P. Bullock, of Kansas City, Mo., for which bonds to the amount of $50,000 have been voted.

SUFFOLK, VA.—Plans are being made by the Carr Knitting Mills for the construction of a factory building, 40 ft. x 100 ft. The building will be equipped with thirty knitting machines, a steam and electric power plant, etc.

NEWPORT, WASH.—The village of Priest River has granted the Northern Idaho & Montana Power Company a franchise to erect transmission lines on the streets of the village for the distribution of electricity.

NORTH YAKIMA, WASH.—Mayor Schott has vetoed the ordinance calling for an election to be held on July 1 to vote on the proposition to issue $300,000 in bonds for establishing a municipal electric-light plant. The Pacific Power & Light Company has submitted a proposition to the City Council offering to reduce the price of electricity to 12 cents per kw-hour immediately and a further reduction to 10 cents per kw-hour in June, 1912.

OLYMPIA, WASH.—The City Council is reported to have granted a franchise to Dr. H. P. Carlyon to construct a belt line railway around the Carylon fill on the water front.

TENINO, WASH.—The Washington-Oregon Corporation is reported to have purchased the plant and holdings of the Tenino Light & Power Company. It is understood that the Washington-Oregon Corporation proposes to erect a new plant on the Skookumchuck River at once to supply electricity to the plant of the Hercules Sandstone Company.

TULARE, WASH.—Preparations are being made by the Tulare Power Company for the construction of its main canal, which is to carry water from the Tule River, two miles above Springville, returning same to the river near Globe, where the power house is to be erected. The canal will be about 6 miles in length and it is estimated that a 470-ft. head of water will be developed. Work will begin on construction of power house as soon as the canal is finished. Plans are being prepared for substations and for construction of an auxiliary steam plant for use in emergencies by C. H. Holly, chief engineer and promoter.

WALLA WALLA, WASH.—The Pacific Power & Light Company, it is reported, has been granted a franchise to erect a transmission line from Walla Walla to the Columbia County line. Work will begin at once on the erection of the line.

WENATCHEE, WASH.—The City Council has granted the Wenatchee Traction Company a franchise to operate an electric railway in this city. The company has applied to the County Commissioners for a franchise to construct and operate a railway over the county road between Wenatchee and Leavenworth. Franchises will also be asked from the towns of Cashmere and Leavenworth.

ANTIGO, WIS.—The Antigo Electric Company has received authority from the Wisconsin Railway Commission to issue $15,000 in bonds to be sold at not less than $75, the proceeds to be used to pay outstanding indebtedness incurred by extensions and improvements to property.

BOYD, WIS.—The Boyd Lumber & Implement Company has purchased the electric-light plant from Charles Shong & Son. It is understood that the new owners contemplate improvements to the plant and service.

EAU CLAIRE, WIS.—The Wisconsin Railway Commission has authorized the Chippewa Valley Railway, Light & Power Company to issue $150,000 in bonds, the proceeds to be used to pay for 75 per cent of the cost of the property of the Menominee Electric Light & Power Company and outstanding indebtedness incurred in making extensions to the property, including the erection of a transmission line from Eau Claire to Altoona and erecting concrete dams at Birth Lake and Cedar Lake, in Sawyer and Barron Counties, Wis.; increasing the line voltage from 33,000 to 66,000 between Menominee and Red Wing, Minn., for acquiring additional rights, property and equipment, including an additional 2000-kw generator for the Cedar Falls power house.

MENASHA, WIS.—The City Council has voted to enter into a contract with the Northern Hydro-Electric Company, of Oshkosh, Wis., for electricity to operate the municipal electric-light system. It is understood that bonds will be issued to provide funds to cover cost of transmission lines and service connections.

MISHICOT, WIS.—The contract for the construction of an electric-light and power plant in Mishicot has been awarded to the Acker Electrical Company, of Sheboygan, Wis. The plant will be owned by Ira Beyer, of Mishicot, and will cost about $10,000. The water-power of the Nashotah River will be utilized to generate electricity. The plant will have an output of about 100 hp.

WAUSAUKEE, WIS.—The installation of an electric-light plant in Wausaukee is reported to be under consideration. Alexander Dufresne is said to be interested in the project.

VANCOUVER, B. C., CAN.—Plans are being considered by the Board of Trade for the construction of an electric railway from Vancouver to Ladner, a distance of 14 miles.

SPRINGFIELD, MAN., CAN.—Plans are being considered by the municipality of Springfield for the installation of a light, heat and power service and a street-railway system in this town.

WINNIPEG, MAN., CAN.—Bids will be received by the chairman of the Board of Control, Winnipeg, Man., Can., until July 3 for supplying equipment for police-patrol telegraph system.

HARRISTON, ONT., CAN.—The question of securing electricity from the Hydro-Electric Power Commission is under consideration by the town of Harrison and surrounding towns and villages.

TORONTO, ONT., CAN.—Arrangements are being made by the Hydro-Electric Power Commission to extend its transmission line from its power plant to Toronto Island to supply electricity to operate ten pumps in connection with the filtration plant. It has not yet been decided whether the lines will be carried by towers or cables.

WHITBY, ONT., CAN.—Arrangements for securing electricity for operating the municipal electric-light and power system from the Seymour Electric Company, of Campbellford, Ont., have been approved by the ratepayers.

MELFORT, SASK., CAN.—Plans have been submitted to the town officials by T. Aird Murray, of Toronto, Ont., consulting engineer, for the proposed municipal electric-light plant and water-works system.

HAVANA, CUBA.—President Gomez has signed a bill granting a concession to the Cienfuegos, Palmira & Cruces Railway & Power Company to erect transmission lines from Cienfuegos across the Province of Santa Clara to the north coast port of Isabella de Sagua, aggregating a total of 300 miles. The company proposes to build a large dam in the Trinidad Mountains which will impound the waters of two rivers forming a deep lake covering about 5000 acres. It is understood that the company proposes to build electric railways traversing a rich tobacco and sugar region.

VERA CRUZ, MEX.—At the annual meeting of the Vera Cruz Electric Light, Power & Traction Company the erection of a hydroelectric power plant to supply power to operate the system was recommended.

New Industrial Companies.

THE ALLIED MACHINERY COMPANY OF AMERICA, of New York, N. Y., has filed articles of incorporation with a capital stock of $200,000 to manufacture and deal in machinery, etc. The incorporators are: Livingston H. Burger, 36 Summit Street, East Orange, N. J.; Mortimer H. Bradley, 46 West 129th Street, New York, N. Y., and Bertram Stiff, 13 Glenwood Avenue, Jersey City, N. J.

THE BERG STORAGE BATTERY CAR COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $110,000 to manufacture freight, passenger and street cars and parts of same. The incorporators are: C. H. Lee, T. Sturgis, of New York, N. Y., and R. G. Dale, of Plainfield, N. J.

THE CORNELL CONSTRUCTION COMPANY, of Cold Spring, N. Y., has been incorporated by C. P. Howland, L. V. Lockwood and N. B. Beecher, of New York, N. Y. The company is capitalized at $100,000 and proposes to manufacture machinery used in construction and general engineering work and to do general contracting work.

THE GUARANTEE ELECTRIC STORAGE BATTERY COMPANY, St. Louis, Mo., has been incorporated with a capital stock of $2,000 William D. McClain, Arthur D. Weld and D. G. Tutt. The com-.ny proposes to manufacture storage batteries.

F. H. HERRING, INC., of New York, N. Y., has been incorporated ith a capital stock of $15,000 to manufacture and deal in engines, otors, machinery, etc. The incorporators are: F. H. Herring, S. D. erring, 894 Forest Avenue, Bronx; Charles L. Allen, 3 Onondaga lace, Syracuse, N. Y.

Personal.

MR. FREDERICK A. MORNY has retired from the Columbia Metal x Company of New York, of which he was the organizer and the resident for four years.

MR. ALEXANDER DOW received the honorary degree of Doctor of ngineering from the University of Michigan during the commencement xercises at Ann Arbor, June 29.

MR. F. T. WILLIAMS has resigned as sales and contract agent of e Roanoke Railway & Electric Company, of Roanoke, Va., to accept a osition as heating specialist with the General Electric Company at chenectady, N. Y.

PROF. ALBERT A. MICHELSON, head of the department of hysics at the University of Chicago, and retiring president of the merican Association for the Advancement of Science, has been awarded e honorary degree of Doctor of Philosophy by the University of ottingen.

MR. O. B. COLDWELL, general superintendent of the light and wer department of the Portland (Ore.) Railway, Light & Power Comny, who was recently transferred from the grade of associate to member of the American Institute of Electrical Engineers, has been elected resident of the Portland Electric Club and first vice-president of the Oregon Society of Engineers, recently organized.

MR. CALVERT TOWNLEY, who was prominently identified with the lectrification of the New York, New Haven & Hartford Railroad, has esigned as vice-president of the Connecticut Company, which operates the trolley lines owned by the railroad, in order to assist in a special executive apacity Mr. Robert Mather, chairman of the board of directors of the Vestinghouse Electric & Manufacturing Company. Mr. Townley was for ome years connected with the Westinghouse company prior to joining e staff of the New York, New Haven & Hartford Railroad.

MR. GEORGE B. FOSTER has accepted a position in the office of President Samuel Insull of the Commonwealth Edison Company, Chiago. He reports to Mr. John F. Gilchrist, assistant to the president, whose duties have become so numerous and exacting as to indicate the ecessity of a responsible assistant of the caliber and experience of Mr. Foster. The new accession to the staff of the president's office is an experienced and capable electrical man. He had charge of the arc lighting of the grounds and buildings at the Chicago World's Fair of 1893, and ince then has represented several electrical manufacturing companies in Chicago, including the Wagner Electric Manufacturing Company and the Allis-Chalmers Company. Of late years he has been a manufacturers' gent. It is an interesting fact that in re-entering the electric-service eld Mr. Foster returns to his first love, for he was connected with the ld Western Edison Company, predecessor of the Commonwealth Edison Company of to-day, when Mr. H. Ward Leonard was superintendent, some wenty-five years ago. Mr. Foster enjoys a wide acquaintance and is one of the most popular men in Western electrical circles.

MR. CHARLES F. SCOTT has been elected professor of electrical engineering at Sheffield Scientific School by the Yale Corporation. As our readers well know, Mr. Scott is past-president of the American Institute of Electrical Engineers and has long been identified with the Westinghouse Electric & Manufacturing Company, his connection in recent years having been of an advisory nature, during which period he has also come into intimate contact with the leading educational authorities of the country. Mr. Scott graduated at Ohio State University in 1885 and afterward attended Johns Hopkins University. He has always shown a particular adaptability for educational work and has been closely identified with the apprenticeship work at the Westinghouse company as well as that of the Casino School, which is run under the auspices of the company. He is therefore particularly well fitted for his new duties, upon which he will engage at the beginning of the fall term, Sept. 28.

CHARLES F. SCOTT.

MR. ALTEN S. MILLER, president and general manager of the Union Electric Light & Power Company, of St. Louis, who resigned o become associated with Dr. A. C. Humphreys, of Hoboken, N. J., he well-known gas expert, with whom Mr. Miller was connected some years ago, has been the recipient of a number of farewell attentions, nd on the evening of June 24 he was the guest at a dinner given in his honor at Forest Park Highlands by the St. Louis Section of the National Electric Light Association. About 160 members of the section were in attendance, and Mr. Karl H. Hansen acted as toastmaster. Toasts were responded to as follows: "Our Guest," Mr. S. B. Way; "The Local Section," Mr. John Anderson; "The Company," Mr. H. Spoehrer; "Au Revoir," Mr. Alten S. Miller. A pleasant feature of the dinner was the presentation to Mr. Miller by Mr. John Hunter, on behalf of Mr. Spoehrer, Mr. Way, Mr. C. E. Michel, Mr. E. H. Shufro, Mr. L. F. Philo, Mr. F. D. Beardslee and himself, department heads of the Union Electric Light & Power Company, of an album illustrating the history of the company during the two years of Mr Miller's connection with it. At the same time a large cluster of American Beauty roses were sent to Mrs. Miller at her home, with the compliments of the St. Louis Section of the N. E. L. A. Mr Miller responded in fitting terms, and the evening was further enlivened by several entertainment features. A formal banquet in honor of Mr. Miller was given by the St. Louis League of Electrical Interests at the Hamilton Hotel on the evening of June 27. Mr. W. A. Layman, vice-president of the Wagner Electric Manufacturing Company, acted as toastmaster, and, in addition to Mr. Miller, the guests at the banquet were Mr. S. D. Capen, Mr. H. N. Davis and Mr. Breckinridge Jones, St. Louis members of the Union Electric Light & Power Company's board of directors; Mr. J. D. Mortimer, vice-president of the North American Company and also a member of the Union company's board, and the managing editors of the St. Louis daily newspapers. Speeches were made by a number of these gentlemen, and letters of regret were received from Mr. James Campbell, president of the North American Company, and a number of other gentlemen. In his letter, dated June 16, Mr. Campbell made the interesting statement that the board of directors of the Union Electric Light & Power Company had deferred taking any action in the matter of appointing a successor to Mr. Miller, hoping until the last moment that something might occur making it unnecessary for Mr. Miller to sever his connection with the company. Mr. Campbell expressed in the strongest terms the regret of the directors of the Union company that Mr. Miller felt impelled to sever his connection with the company.

Obituary.

MR. ROBERT W. ADAM, treasurer of the Berkshire County Savings Bank for the last forty-five years, and a prominent director of the Pitts field (Mass.) Electric Company, died recently at his home in Pittsfield. He was a graduate of Williams College and a former representative in the Massachusetts Legislature.

MR. CLARENCE A. KNIGHT, president of the Chicago & Oak Park Elevated Railroad Company, and one of the prominent public-utility operators of the Chicago field, died on June 21, following an operation for appendicitis. Mr. Knight, who was fifty-seven years old, was a lawyer by profession, and became interested in public-service corporations first in his capacity as legal counsel. He was an associate of the late Charles T. Yerkes and was connected with much important litigation relating to street railways and elevated railways. He was an effective public speaker and often addressed public bodies on questions relating to public utilities.

WILLIAM RICHARD BRIXEY.—We regret to note the death on June 9, at Seymour, Conn., of Mr. W. R. Brixey, one of the leading manufacturers in the field of insulated wire and cables. Mr. Brixey was born at Southampton, England, May 11, 1851, educated at a well known grammar school there, and then entered the British Mercantile Marine service, commanding his own ship and visiting all the leading ports of the world. He came to this country in 1878, became at once an American citizen, and went into business with his brother-in-law, Mr. A. G. Day, a pioneer in the American rubber industry and the inventor of "Kerite." In 1879 he married Miss Frances N. DeWolfe, daughter of Alva G. DeWolfe, a co-worker of Mr. Day's and also an inventor of some note. The Day plant was at Seymour, Conn., and there Mr. Brixey developed the business with remarkable energy and intelligence, mastering it in every detail and becoming general manager on the death of Mr. Day, and sole proprietor upon the death of his sister, Mrs. Day. Mr. Brixey was not satisfied with the use of his cables in the telegraph and telephone field or with the early indorsement of such men as Morse, but pushed out into larger developments in other fields. Noteworthy among these developments were the supplying and laying of the Alaskan cable, the furnishing of the Panama Zone cable, and furnishing the wires and cables for the Pennsylvania tunnel and terminal connecting the two shores of the Hudson and East Rivers. In 1908 Mr. Brixey incorporated the business as a company and soon after retired, leaving it to the management of his eldest son, Mr. Richard D. Brixey, president of the Kerite Insulated Wire & Cable Company. Mr. Brixey left two other sons, Mr. Reginald W. Brixey, vice-president, and Mr. Austin D. Brixey, secretary of the company. Mr. Brixey was quite active in public life, and was a member

WILLIAM RICHARD BRIXEY

[illegible] at New York City with the rank of captain. He was a member of the American Institute of Electrical Engineers and of the Brooklyn Club and a high-degree Mason. At the time of the terrible subway explosion at Murray Hill, New York, in 1902, he was injured by glass blown into his room at the adjacent hotel. His wonderful constitution, however, pulled him through injuries of a most serious character, though these probably undermined his health, which had previously always been of the best. Mr. Brixey's wife died in 1909 and he is survived only by the three sons above mentioned.

Trade Publications.

MINIATURE INCANDESCENT LAMPS.—The Federal Miniature Lamp Company, Cleveland, Ohio, lists and describes in a profusely illustrated booklet all types and styles of miniature incandescent lamps in general use.

POLYPHASE INDUCTION MOTORS.—The general characteristics, make-up and application of its polyphase induction motors are set forth by the Allis-Chalmers Company, Milwaukee, Wis., in Bulletin No. 1081, just printed.

BELL-RINGER TRANSFORMERS.—"Pittsburgh Bell Ringer Bulletin" No. 1152, just issued by the Pittsburgh Transformer Company, lists two sizes of bell ringers, both transformers having three low voltages. These little transformers do away with the use of dry batteries for the ringing of electric bells.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 471 issued by the Triumph Electric Company, Cincinnati, Ohio, illustrates and describes its line of polyphase apparatus. The claims made for the motors are as follows: High efficiency and overload capacity with starting torque one and one-half to three times rated torque.

AIR COMPRESSORS.—Bulletin No. 1523 issued by the Allis-Chalmers Company, Milwaukee, Wis., illustrates and describes the company's portable and stationary air compressors for industrial purposes. Those shown are motor-driven, and data relative to alternating and direct-current motor-driven outfits for intermittent or continuous service are appended.

ELECTRICITY IN THE SERVICE OF STEAM RAILROADS.—Bulletin No. 4851, just issued by the General Electric Company, is an attractive publication containing data relative to the use of electricity in the service of steam roads. The publication comprises 48 pages which illustrate and describe both station and road equipment of the New York Central & Hudson River Railroad, the Detroit Tunnel of the Michigan Central road, the Cascade Tunnel of the Great Northern Railway, the equipment of the Baltimore & Ohio Railway, the West Jersey & Seashore, the West Shore Railroad, etc.

ELECTRICAL EQUIPMENT OF THE DETROIT RIVER TUNNEL.—The General Electric Company has recently issued Bulletin No. 4834, which comprises an article on the electrical equipment of the Detroit River Tunnel, reprinted from the *Electric Railway Journal*. The article treats the subject in great detail, and the bulletin contains illustrations of exteriors and interiors of converter and transformer substations, showing various methods of construction and insulation, as well as the size of locomotives and location of apparatus; also the construction and size of the tunnels, and the substation wiring.

THE SOOT PROBLEM.—A pamphlet on "Economical Steam Production" has been issued by G. L. Simonds & Company, 64 East Van Buren Street, Chicago. This firm acts as the sales department for the Vulcan Soot Cleaner Company, of Pittsburgh, which manufactures and installs the Vulcan soot cleaner for steam plants. The pamphlet discusses the subject of soot cleaning as applied to all types of water-tube and return tubular boilers, with especial reference to the Vulcan system. Illustrations and diagrams are included, and the publication, which is sent free on request, is of undoubted value to all interested in the fuel economy of steam-power plants.

IDEAL MOTORS.—"Reducing Expenses and Increasing Output of Textile Mills" is the title of a leaflet recently issued by the Ideal Electric & Manufacturing Company, of Mansfield, Ohio. It is a reprint of an article which recently appeared in one of the textile papers describing the motor installation in the mill of the Mansfield Elastic Web Company. As this mill consists of two halves very nearly identical, one being driven by steam and the other by motors, it formed an ideal basis for making a comparison of steam power and belt transmission as compared with individual electric drives. The figures as to the results obtained are rather remarkable in many respects.

NATIONAL ELECTRIC LAMP BULLETINS.—Two bulletins have recently been issued by the engineering department of the National Electric Lamp Association, the one entitled "Economical Operation of Incandescent Lamps" and the other "Mazda Incandescent Street Lighting." The first of these gives a detailed technical discussion of the principles involved and the methods to be used in determining conditions of the most economical operation for incandescent lamps, from the standpoint of both consumer and central station. The text is elucidated by numerous curves and tables. The bulletin on street lighting is a revision of a former bulletin on this subject and gives distribution curves for some of the latest types of reflectors.

BELT-DRIVEN ALTERNATORS.—The lower first cost of belted generators compared with that of direct-connected units is sufficient to create a large demand for such machines where space is not a serious consideration. To meet this demand the General Electric Company has designed a standard line of belt-driven alternating-current generators, known as Form B generators. These are described in Bulletin No. 4847, recently issued by that company. These generators are built in capacities ranging from 50 to 200 kw, and are adapted for three-phase or two-phase winding without change, except in the armature coils and terminal blocks, the exciters and all accessories being the same for both. Designs have been made for 240, 480, 600, 1150 and 2300 volts.

ELECTRICALLY DRIVEN PUMPS.—The inherent superiority of motor drive for the operation of both centrifugal and reciprocating pumps has long been recognized, and the recent notable improvements tending toward high efficiency and greater economy in the operation of electric motors has made their adoption for the driving of all forms of pumping machinery an economical necessity wherever electric current is available. In Bulletin No. 4855 the General Electric Company illustrates and describes various types of motor-driven pumps designed for different purposes. Among the pumps illustrated are those for mine use, pumps for operation in sewage-disposal plants and dry docks, for irrigating purposes and for use in connection with the water supply of houses.

GRAPHIC RECORDING METER.—A recently issued bulletin of the Minerallac Electric Company, 400 South Hoyne Avenue, Chicago, describes briefly the method of operating the graphic recording meter made by that company. This instrument gives a graphic record on a tape of the consumption of electrical energy by large consumers where the rates are based on "one-minute peak." The Chicago printing attachment of this company gives a record printed in plain figures for the actual consumption for intervals of five minutes or greater, but the graphic recording meter gives a record in the form of a curve showing the exact consumption of energy for every minute. A reading in the required units, such as kw-hours, is then derived by the use of a calibrated scale furnished with each instrument.

COLLEGE USE OF HOLOPHANE DATA SHEETS.—Fifty-two new pages of Holophane data sheets will be distributed July 1. Among the colleges making use of these data sheets for reference on illumination in their engineering departments may be mentioned the University of Michigan, Armour Institute of Technology, Cornell University, Harvard College, New York Electrical School, Ohio State University, Purdue University, Yale University, Wellesley College, University of Illinois, State University of Kentucky, Leland Stanford University and Worcester Polytechnic Institute. While not using the Holophane data sheets as class textbooks, the members of the faculties of these and other colleges are stated to find them of value as works of reference, a tribute to the accuracy and lack of commercial bias which characterize the Holophane data. The installation sheets, which form a new section of the Holophane catalog, contain complete data and the results of careful tests on actual installations. The sheets included in the present series describe a typical Childs restaurant in New York City. Not only are all essential data included, but the results of exact photometric tests are tabulated to give the engineer the fullest possible assistance in checking the efficiency and practical utility of Holophane glass.

BUSINESS NOTES.

MESSRS. D. C. & WM. B. JACKSON, engineers, Boston and Chicago, have moved their Chicago office to the twentieth floor of the new Harris Trust Building, 111 West Monroe Street, Chicago, Ill.

LINCOLN ELECTRIC COMPANY OPENS CHICAGO OFFICE.—The Lincoln Electric Company, Cleveland, has opened a Chicago office, with Mr. George A. Arnold in charge. Mr. Arnold had previously been located in the main office in Cleveland.

MR. C. G. RUSH AND MR. H. B. OTIS, well-known electrical men of Chicago, announce that they have formed a partnership and will continue the old business of C. G. Rush & Company under the new firm name of Rush, Otis & Company. The new firm will do business as electrical contracting engineers, with office at 69 West Washington Street, Chicago.

KERITE COMPANY ABSORBS WATSON INSULATED WIRE COMPANY.—The Kerite Insulated Wire & Cable Company has acquired the interests of its Western representative, the Watson Insulated Wire Company, and has established a Western office in the People's Gas Building, Chicago, Ill. Mr. B. L. Winchell, Jr., formerly vice-president of the Watson Company, will be Western manager.

HASKINS-LUCIDA SHADES AND REFLECTORS.—The Haskins Glass Company, Wheeling, Va., is introducing a new line of glass shades and reflectors, known as Haskins-Lucida ware. This ware is especially adapted for use with tungsten lamps, and is made for 25-watt, 40-watt, 60 watt, 100-watt and 250-watt lamps. It is stated that the light-diffusing quality of these shades is extremely soft and luminous, and by a proper selection of ingredients and use of a scientific process all specks and spots are thoroughly eliminated.

ENAMELED WIRE.—The American Enameling Machinery Company has been organized in Philadelphia with a view to the sale of machinery and formula for the manufacture of high-grade enameled wire. Robert W. Withington, secretary and manager of the American Insulating Machinery Company, and Edwin Lentz, of the Quaker City Carpet Cleaning Company, of Philadelphia, and the New York Carpet Cleaning Company of New York, are interested. The office of the company is located at 1127 East Columbia Avenue, Philadelphia.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, G. S. ... N. Royal St., Mobile, Ala. Annual convention in November.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, high University, South Bethlehem, Pa. Next semi-annual meeting at ronto, Canada, September 21-23, 1911.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. W. ... Travell, 27 East 11th St., New York. Next meeting at Philadelphia, ., Sept. 5, 6 and 7, 1911.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, ugene W. Stern, 103 Park Ave., New York City. The Council meets e first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. pe, Engineering Societies Building, 29 West 39th St., New York. leetings, second Friday of each month, excepting June, July, Aug. and pt.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, . E. Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., ctober 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, orman Litchfield, Interborough Rapid Transit Company, New York. ... convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. Thorpe, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, ... Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. ... Drew, 135 Adams St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreu-..., Chicago & Northwestern Railway, Chicago. Next annual meeting Hotel La Salle, Chicago), November 6 to 10, 1911. Semi-annual meeting, Washington, 1911.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. lcox, Lowell, Mass.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, D. Morris, 323 Hagerman Building, Colorado Springs, Col. Annual vention, Glenwood Springs, Col., September 13-15, 1911.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Rob-..., 124 West 42d St., New York. Meetings, fourth Tuesday of each month.

ELECTRIC CLUB, CHICAGO. Secretary, N. F. Obright, 1500 American ...st Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, eo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. rum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and urth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 lichigan Ave., Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. aveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. ose, Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, 911.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, lbert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical ... Association). Secretary, Franz Neilson, 80 Wall St., New York. ...oard of directors meets second Thursday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. . Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. dams, West Palm Beach, Fla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, eoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in ew York, New England, Philadelphia and Chicago. Annual convention, hicago, 1911.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind. Annual meeting, August 23 and 24, 1911.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 16 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, . R. George, Houston, Tex. Next convention at Ryan Hotel, St. Paul, Minn., Sept. 12-15, 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. 21 and 22, 1911.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine. Next meeting at Augusta, Maine, July 27 and 28, 1911.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo.

NATIONAL ARM, PIT & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Niagara Falls, July 19, 1911.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., probably first week in June, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary, Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 39 Boylston St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Joseph B. Ware, Grand Rapids, Mich.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 25-28, 1911.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E., Sanborn, Ohio State University, Columbus, Ohio.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct. 16-18, 1911.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

VERMONT ELECTRICAL ASSOCIATION. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 20, 1911.

995,434. ELECTRICAL COOKING VESSEL; F. Bolling, Oberursel, near Frankfort-on-the-Main, Germany. App. filed Oct. 4, 1910. The combination of a vessel, a heating element, an outer retaining member and a wedge inserted between the latter and the element, for securing the retaining member and the heating element to the vessel.

995,435. ELECTRICAL RESISTANCE; F. Bolling, Oberursel, near Frankfort-on-the-Main, Germany. App. filed Oct. 4, 1910. The resistor comprises an insulated conductor with a covering, a terminal head, a foot plate on which the head is mounted, fusible means for securing the foot plate to the covering and a terminal contact mounted in the terminal head.

995,438. CONTROLLER; H. W. Cheney, Milwaukee, Wis. App. filed Sept. 13, 1909. The controller is of the multiple-voltage type, so arranged that the buffer resistor, after having been cut into circuit, is cut out of circuit as soon as the armature current is decreased to a predetermined value.

995,441. DYNAMO-ELECTRIC MACHINE; W. P. Dandliker, West Allis, Wis. App. filed Oct. 1, 1910. In order to provide means for supporting the projecting end-turns of dynamo-electric machinery, rods are run through loops forming the end-turns, the rods being supported from the frame of this member of the machine of which the winding forms a part.

995,469. INDUCTION MOTOR; E. R. Knight, Norwood, Ohio. App. filed April 30, 1909. In order to secure together the conductor bars and short-circuiting rings of squirrel-cage motors, the bars are made with tubular ends, which are upset after being inserted in holes in the short-circuiting end rings.

995,476. ELECTROLYTIC PROCESS; R. J. McNitt, Niagara Falls, N. Y. App. filed Sept. 30, 1909. For the purpose of circulating the fluid electrode from and to an electrolytic cell, a difference in specific gravity is maintained between the outgoing and incoming electrode substance, the increase in density of the charged electrode being made by removing some or all of the products of electrolysis.

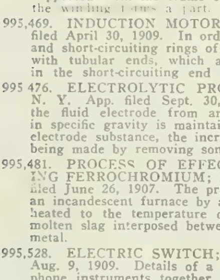
995,481. PROCESS OF EFFECTING REDUCTION AND PRODUCING FERROCHROMIUM; E. F. Price, Niagara Falls, N. Y. App. filed June 26, 1907. The production of ferrochromium is effected in an incandescent furnace by a continuous operation, the charge being heated to the temperature of reduction by an adjacent resistor of molten slag interposed between the charge and the body of reduced metal.

995,528. ELECTRIC SWITCH; H. Fisher, Packerton, Ind. App. filed Aug. 9, 1909. Details of a switch for connecting one or more telephone instruments together to an extension bell, or for cutting in and out different sections of a party line.

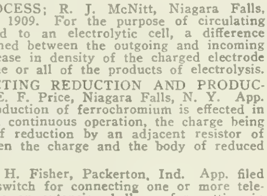
995,588. ELECTRIC WAVE TRANSMISSION; J. H. Cuntz, Hoboken, N. J. App. filed March 11, 1905. Covers a telephone transmission system consisting of a complete metallic circuit, a magnetic core extending substantially throughout the circuit, and windings of the induction coil of the microphone transmitting apparatus disposed about the core.

995,591. ELECTRIC HEATER; T. E. Fogalsang, San Francisco, Cal. App. filed June 27, 1910. The heater is of the immersion type, and is provided with carbon electrodes which differ from metallic electrodes in having no injurious effect upon the water to be heated.

995,599. SWITCH CLIP; G. R. Hebden, Plainville, Conn. App. filed Nov. 19, 1910. Details of a switch clip which provides a yielding contact with the switch blades, and a positive stop to limit the closing movement of the blades.



995,441.—Dynamo Electric Machine.



995,632.—Electric Motor.

995,619. SELECTIVE SIGNALING APPARATUS; I. F. Manny, Milwaukee, Wis. App. filed Aug. 8, 1910. Details of a lockout mechanism for selective signaling telephone systems.

995,621. CATENARY SUSPENSION DEVICE FOR TROLLEY WIRES OF ELECTRIC RAILWAYS; W. A. McCallum, Cincinnati, Ohio. App. filed May 24, 1909. A gripping device for catenary hangers, embodying sister hooks opening in opposite directions, formed integrally with a common shank, provided with bearing supports for a pendulous link.

995,627. METER-TESTING CUT-OUT; T. E. Murray, New York, N. Y. App. filed Oct. 25, 1910. The cut-out is so designed that the circuit to the meter is first opened without breaking circuit between the service and local conductors, then as the device is pushed to its seat, the circuit is closed from a service conductor through the standardizing apparatus and meter.

995,628. ELECTRIC CUT-OUT BOX; T. E. Murray, New York, N. Y. App. filed Nov. 19, 1910. A modification of patent No. 995,627.

995,632. ELECTRIC MOTOR; J. H. Pearce, Helena, Mont. App. filed Nov. 17, 1909. The motor is of the single-phase induction type, provided with a self-contained transformer for producing a field in electrical time-quadrature to the main single-phase field.

995,636. APPARATUS FOR MANUFACTURING IRON AND ITS ALLOYS; M. Ruthenburg, Lockport, N. Y. App. filed June 10 1905. Relates to the constructive features of apparatus to be utilized to effect by one continuous operation the complete reduction to metallic state of any comminuted ore, the reduction being effected by a deoxidizing gas without wasting the heat resultant from the preliminary fritting operation.

995,637. ELECTRIC METER; G. A. Scheeffer, Indianapolis, Ind. App filed Jan. 26, 1910. An improved construction is used for supporting the gearing connected with the movable armature of a watt hour meter.

995,638. BRACE FOR LIGHTNING ROD TOPS; W. C. Shinn, Lincoln Neb. App. filed July 26, 1910. Constructive details.

995,643. SPLICING-SHIELD FOR TROLLEY WIRES; G. Wiedenbeck Alameda, Cal. App. filed March 18, 1911. The splicer is of the mechanical type, in contradistinction to one requiring the use o solder. The strain is resisted by plain surfaced bearings, in contradistinction to devices in which the stress of the pull is wholl taken by toothed dogs.

995,646. MEANS FOR OPERATING ELECTROMAGNETS FROM ALTERNATING-CURRENT SOURCES; G. M. Willis, Chicago, Ill App. filed Nov. 27, 1908. In order to render a direct-current mag net operable on an alternating-current system, a current rectifier i placed in the circuit of the electromagnet, and a non-inductive resist ance is placed in parallel with the magnet winding proper.

995,681. ELECTRIC LAMPLIGHTING DEVICE FOR AUTOMO BILES; H. H. Kanagy, Joliet, Ill. App. filed March 16, 1910. Th igniting device consists of a push button, the alternate depression o which turns on and ignites the gas, and each intermediate depres sion thereof extinguishes the light.

995,685. RAIL BOND; G. W. Knox, Chicago, Ill. App. filed Dec. 1 1905. Details of a bond provided with means by which it may b rigidly secured to the rail.

995,702. FUSE BOX; P. J. McDonald, Rochester, N. Y. App. file March 18, 1908. The box is equipped with a fuse and a groun connection, comprising a plunger held in the circuit-closing positio by the fuse, and means for moving the plunger automatically t break the circuit when the fuse blows out.

995,728. ELECTRICAL CONDENSER; A. K. Sloan, Jr., Brooklyn N. Y. App. filed Nov. 19, 1909. The condenser comprises a plu rality of dielectric members, each containing a conducting fluid, supporting frame for the dielectric members, a conductor bearing o the frame, flexible and removable conductors intermediate to th conductor and dielectric members, and means for adjusting the frame

995,730. MOTOR CONTROLLER; W. C. Stevens, Pittsburgh, Pa. App filed June 1, 1909. The controller is arranged for automaticall slowing down and stopping motors.

995,763. ELECTRIC CIGAR LIGHTER; R. W. Baker, New York N. Y.; V. L. King, Woodridge, N. Y.; H. C. Parker, New York N. Y. App. filed Dec. 29, 1909. The heat necessary to light th cigar is obtained by radiation from a resistor adapted to glow in th air upon the passage of an electric current through it.

995,767. ELECTRIC SWITCH; J. H. Champ, Cleveland, Ohio. App. file March 28, 1910. Details of a pressure-controlled switch.

995,774. ROTARY SWITCH; W. E. Dow, Braintree, Mass. App. file Sept. 13, 1907. The switch is intended for use with an explosiv engine, and is so arranged that the operator can start the engin by actuating the spark plug in connection with the induction coil an battery circuit, and then by simple rotation of the starting switc he can cut out the spark coil and battery circuit and cut in the mag neto and its circuit.

995,797. ELECTRIC CLOCK; C. E. Mathiesen, Chicago, Ill. App. file Nov. 19, 1910. Relates to a contact-making mechanism for operatin an electromagnet, in which a very rapid making and breaking o the circuit is effected in periodical winding operations.

995,838. KNOB FOR ELECTRIC WIRING; F. B. Bower, Penn Yan N. Y. App. filed July 27, 1910. The knob is formed of two ele ments adapted to interlock so that adjustment is possible for differ ent sizes of wire.

995,849. SIGNALING DEVICE FOR TELEPHONE SYSTEMS; A. J Dunton, Ketchikan, Alaska. App. filed July 7, 1910. The system is arranged so that signals may be sent to any distances over which the line is likely to be used for talking purposes.

995,878. INDICATOR FOR SPARK PLUGS; A. R. Lamberson, Al bany, N. Y. App. filed Dec. 1, 1910. The indicator has the genera form of a testing tube, into which the operator may look in orde to ascertain the electrical condition of a spark plug to which th indicator is applied.

995,893. ELECTRIC CONDUIT CONNECTION AND COUPLING O. M. Neitzel, Kingfisher, Okla. App. filed May 3, 1909. Ar rangements are made so that a connection may be established be tween the conduit and outlet box by inserting the end of the condui directly into the box.

995,924. TELEPHONE SYSTEM; J. B. Stemm, Chicago, Ill., and C E. Slade, Brookfield, Mo. App. filed April 11, 1910. The horsesho magnets for operating the diaphragms are directly attached thereto so that a mechanical movement of the diaphragm will cause a move ment of the magnet with reference to its coil, and thereby produce voltage in the telephonic circuit.

995,958. OZONATOR; L. Goldberg, Indianapolis, Ind. App. filed Feb 10, 1911. Details of a device in which the working parts are readi removable from the casing, so as to provide access to the air pa sages.

995,970. INCANDESCENT LAMP SOCKET; E. M. Kemp, Hibbin Minn. App. filed March 21, 1911. The lamp socket is arrange so that it may be quickly connected to a flatiron, percolator, etc and accomplish the same result as an ordinary extension for inca descent lamps.

996,032. PROCESS FOR THE MANUFACTURE OF ALUMINU NITRID; O. Serpek, Paris, France. App. filed June 21, 1910. order to effect the fixation of nitrogen by alumina bauxite, use made of apparatus comprising as an element thereof a rotary co veying cylinder carrying an electric resistor furnace through whi the material treated is passed.

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CONTENTS.

THE INSTITUTE CONVENTION.

The year 1911 is proving a notable one in the matter of electrical conventions. Hardly have the echoes of the great New York meeting of the National Electric Light Association died away before we are called upon to admire and praise the record of the American Institute of Electrical Engineers in Chicago. The Institute convention in the latter city last week was truly a remarkable gathering, not only for its size but for a spirit and enthusiasm unusual in the meetings of a professional society. The registered attendance was 930, which is perhaps even more noteworthy than the record of over 5000 at the recent N. E. L. A. convention, considering the scope and objects of the two organizations and particularly the meager attendance at the Institute annual gathering in recent years. It was very much larger than the attendance at any previous Institute convention and was possibly larger than anybody anticipated. The Chicago convention committee made its preparations on such a liberal scale, however, that the large assemblage was accommodated without difficulty, although it is, of course, true that the total number registered was not present at any one time. The great success of the meeting is an indication of what the Institute may accomplish in other directions under favorable conditions.

Considering the character of the papers presented, one is struck by the attention paid to questions of public policy. Professor Jackson devoted his presidential address to "Electrical Engineers and the Public," saying that while he would not entangle the engineer in "commercialism," he does think that engineers have a special duty as professional men to support right and reason in the dealings between the public and public-service companies. This is something of a departure from the usual presidential address at an engineering convention. Moreover, one entire session, styled the "electric-lighting session," although "public-policy session" would have been a more exact designation, was devoted to the reading and discussion of Mr. Floy's paper on depreciation and Mr. Byllesby's on "The Responsibilities of Electrical Engineers in Making Appraisals." The attention thus paid to matters of political economy is significant of the trend of the times, which was further indicated at a dinner given by the chairman of the entertainment committee, where these problems were vigorously discussed.

An event of more than ordinary interest was the resignation of Mr. Ralph W. Pope, the veteran secretary, who has served the Institute so faithfully and so well for twenty-six years. Fortunately, however, the society will continue to have the benefit of Mr. Pope's counsel and services as honorary secretary, in which capacity he will foster the interests of the Institute sections and branches. Chicago welcomed the convention with open arms. The entertainment features were planned on a lavish scale and carefully carried out. A special word of thanks is due the Electric Club of Chicago for its delightful luncheon. One result of the conspicuous success of the convention will be a possible questioning of the past policy of holding the convention at

summer resorts. A registration of 178 at the White Mountains last year and of 930 at Chicago this year reveals such a great difference in the strength and in the prestige that a convention gives that it is probable that many future conventions will be held in large cities. In the language of the resolutions adopted at the Chicago convention, "The extraordinary success of the Chicago convention, the greatest in the history of the Institute, redounds to the credit of those responsible for its arrangement and attests the suitability of the great metropolis as a convention city."

THE OPERATION OF 100,000-VOLT TRANSMISSION CIRCUITS.

Four papers due to the high-tension transmisssion committee of the American Institute of Electrical Engineers and presented at the recent Chicago convention give a most instructive view of the present state of practice with respect to extremely high-tension lines. There are now, we believe, some half dozen circuits operating at or a little above 100,000 volts, and two of them, that of the Central Colorado Power Company and the Grand Rapids line, have been in successful operation for some time. The present reports pertain to the systems of the Great Western Power, the Southern Power, the Great Falls Power and the Central Colorado Power companies, each of them operating lines exceeding 100 miles of length at approximately 100,000 volts. All have tower lines, with spans from 600 ft. up, and all are equipped with suspension insulators and one or more ground wires, grounded at every tower. All, too, have electrolytic lightning arresters in use. The spanning between the conductors varies considerably, from a little over 8 ft. to 15 ft., and even the shortest distance seems to give entire security so far as insulation is concerned. With regard to the performance of the insulators, it has been uniformly good, break-down of the insulation being an unusual occurrence. The Great Falls plant reports no failures at all, the Great Western Power Company only three or four, and the Southern Power Company only one failure of service during a sleet storm, when some of the insulators gave way mechanically. The first-named plant seems to be particularly fortunate in its insulators, which flash over when wet only at something near 300,000 volts, thus giving a large factor of safety. One of the extraordinary features reported is the very slight coronal effect observed in any of the plants. The secret of the situation is perhaps disclosed by the report from Great Falls, in which case corona was visible on every live part of the system at first, but gradually became less conspicuous as if the points of extreme curvature from which corona would naturally start had been gradually worn away. Possibly, however, something may be charged up to increasing familiarity of the phenomenon, so that discharges which would have been immediately noticed at first failed to attract attention. Certainly at 100,000 volts one must expect coronal discharges, and the reported absence of them in any considerable quantity even on wires as small as No. 6 is a thing which deserves further investigation.

With respect to lightning, the Great Western plant has experienced none, and consequently gives no information. The Southern Power Company's system reports twenty-two shut-downs since Jan. 1, 1910, averaging nearly five minutes of time lost per shut-down. The Great Falls plant reports no shut-downs from lightning, although discharges have taken place over the arresters. Perhaps this immunity may be charged more to good luck and very high line insulation than to anything else, since the lines of the Southern Power Company, which has suffered most, had no less than three stranded ground wires grounded at each tower. The universal experience, however, has been that the 100,000-volt lines suffer no more, and probably less, from lightning than would the ordinary lines at half the voltage. The charging current on these long high-voltage lines is somewhat formidable, running even as high as 6000 kva or 7000 kva. The agreement between the measured and the computed charging currents has proved very satisfactory, so that, although the phenomenon is a very striking one, it is readily prepared for, and on the large systems, which alone can economically use these high voltages, can readily be taken care of by the generators. A plentiful supply of induction motors on the system, of course, tends to neutralize the distributed capacity, so that in the case of the Great Falls Company the power-factor at the generating plant averages 99 per cent. On a large system, therefore, engaged in general energy distribution one may feel reasonably sure that while the charging current looks big, it is unlikely to be an important factor in the practical working of the plant.

Windstorms have caused trouble on only one of these systems so far as the structure of the circuits is concerned. The lines ordinarily do not tend to swing together, so that practically the service has not suffered. As regards regulation, no trouble has been encountered at any of the plants except such as might be expected on a line of any of the ordinary voltages. Looking over the general conditions in all four of these high-voltage systems, it is apparent that the troubles experienced have been not materially greater, perhaps not even so great, as one would ordinarily expect on a line of moderate voltage. Probably the realization of entering a comparatively untried field has caused greater care in factors of safety than would ordinarily be given to a line of lower voltage. Certainly there is nothing in these reports to indicate any particular difficulty in the operation of a transmission service at or about 100,000 volts. It has, in fact, been the universal experience in power transmission that the dangers feared at every material increase in voltage have in large measure vanished upon closer acquaintance with the facts. So long as one keeps up a suitable factor of safety with respect to the voltage employed, and properly increases the distance between the conductors, there is no particular risk incurred in going even so high as 100,000 volts. How much higher it would be feasible to work in commercial practice remains to be seen, but there is assuredly nothing in the experience of the plants now operating at extreme voltage to cause hesitation in pushing on still further when commercial requirements make it desirable.

THE MAGNETIZATION OF TELEPHONE GENERATORS.

One of the most familiar little alternating-current generators in country districts, and one also well known until recent years in cities, is the hand-driven telephone generator for ringing polarized bells. It is closely akin to the

[m]echanically driven generator used for gas ignition in [m]any an automobile engine. Nevertheless, the average [e]lectrical engineer knows less concerning the electric be[h]avior of these familiar and multitudinous little machines [th]an of the fewer large generators used in lighting and [e]nergy transmission. An interesting set of external charac[t]eristics for one of the above-mentioned types of telephone [g]enerators is contributed this week by Mr. H. P. Clausen. [O]wing to the high internal impedance and armature reac[t]ion of such a small machine the internal drop of pressure [u]nder load is relatively considerable, and the terminal volt[a]ge under load is considerably less than the internal volt[a]ge. The generated voltage wave in such a machine is [u]sually very peaked, and with 75 volts root-mean-square [g]enerated the maximum is shown to be about 240. It is no [w]onder, therefore, that the shock capable of being inad[v]ertently received from one of these little generators is [s]ufficient to astonish the recipient.

The principal reason for this remarkably peaked wave is [t]hat the armature pole-faces bridge over from one field-pole [t]o the other and so produce a very sudden rise and collapse [i]n the flux linked with the armature coil at the moments [w]hen the magnetic short-circuits take place. If the armature [w]ere shaped so as to avoid this magnetic short-circuit[i]ng there would be a marked cyclic change in the main-[c]ircuit reluctance and the residual magnetism in the perma[n]ent field magnets would be shaken out much sooner. The [p]henomena of magnetizing the permanent field magnets [a]re well described in the article. The armature has to be [w]ithdrawn during the magnetizing process in order to [a]void a heavy magnetic shunting and reduction in im[p]ressed magnetic potential. A temporary magnetic short-[c]ircuit is then applied to the poles after magnetization until [t]he armature can be inserted permanently. If the newly [m]agnetized field is withdrawn from the energizing without [i]ts armature or equivalent shunt across the air-gap the re[l]uctance in the magnetic circuit at the large air-gap is made [u]nduly great. The passage of the residual magnetic cur[r]ent through this external magnetic resistance sets up, on [t]he same principle as with the electric circuit, a correspond[i]ngly large external back mmf which soon demagnetizes [t]he field system, whereas when a magnetic short-circuit is [a]pplied to the poles, either by means of an external mass [o]f iron or by the armature, the flux encounters only a [f]eeble external resistance and produces only a feeble [d]emagnetizing mmf. All of these phenomena are well [k]nown in connection with the magnetization of permanent-[m]agnet measuring instruments of the D'Arsonval type.

It is curious to see by the curve sheet accompanying the [a]rticle that the external power of the machine reaches a [m]aximum—between 3 watts and 4 watts—approximately at [h]alf the maximum current and half the internal voltage. [T]his is the condition that applies to a small, separately [e]xcited direct-current generator, which is well known to [p]roduce maximum external power when the external re[s]istance is equal to the internal resistance and when half [t]he internal voltage at terminals delivers half the maximum [c]urrent of short-circuit with an electric efficiency of 50 per [c]ent. The conditions in a telephone alternator armature [a]re, however, necessarily more complex, so that this state [o]f affairs is by no means a necessity.

A BRITISH DISTRICT SUPPLY SYSTEM.

It is strong evidence of the effectiveness of electrical energy transmission to find one of the most striking examples of it in the immediate vicinity of Newcastle, England, in the very heart of the coal district. In another column is an account of the new generating station of the Newcastle-upon-Tyne Electric Supply Company, which operates over a territory of over 1000 sq. miles, having a network for general energy distribution fed by seven stations, with still others under construction. All the stations are, of course, operated from coal, except those utilizing waste heat from coke ovens and other sources. The present station at Dunston is near the further end of the Tyne network, and, as will be seen from the description, is a thoroughly modern turbo-generator station containing now three 10,000-kw generators with arrangements for installing an addition of equal size when necessary. The arrangement of the station is not unlike that of several stations in this country. The boiler house is planned to contain four units for each generator, three giving sufficient steam capacity for the machines so that the fourth can be held as a reserve. They are all mechanically fired and are provided with the usual coal-conveying machinery so that the manual labor is reduced to a minimum. The steam pressure and superheating are about as in American practice. In the turbo-generators, however, there is a marked departure, the frequency being 40 cycles per second, which is a little out of the ordinary even in foreign practice. Its obvious advantage is in the facilities it gives for operating large moderate-speed motors, and perhaps for general service it may be consdered a good compromise between the 60 cycles commonly here used for general electric-energy transmission and the 25 cycles employed where synchronous converters form a large part of the load.

In one respect the Dunston station represents a more extreme design than is yet common here. The switch house, in which all the main switch gear is installed, is some 150 yards away from the engine house, all sides of the house being freely accessible for the entrance of cables. Whether this particular feature will prove successful or not depends very much on the care with which the connections from generators to switch house are installed. Several big American stations have been put out of business for considerable periods within the last year or two by reason of wholesale destruction of cables. In order to obtain security against this particular kind of disastrous accident it would seem to be necessary to install protective apparatus close to the generators, and when this is done a degree of complication is reached which probably offsets any imaginable gains from having an isolated switch house. We are glad to note in some American stations a recurrence to simpler methods of operation in which the switch gear is reduced to something like proper proportion of bulk and cost. The Dunston station has emergency switches, it is true, near the generators, but these are really in fact remote-control connections for the main switches in the switch house, so that the added security is perhaps dubious. Altogether, however, the station is a thoroughly modern and well-equipped one and a valuable addition to the resources of the great network which it feeds.

Federal Suits Against Wire Manufacturers.

On June 29 nine indictments were presented by a grand jury to the United States Circuit Court of Appeals for the Southern District of New York, involving eighty-three officers and employees of companies alleged to have entered into combinations and conspiracies in restraint of trade and commerce among the several states. Notice has been served on the defendants to be present in the Federal Court, New York, on July 10. Judge R. W. Archbald, of Scranton, Pa., a judge of the United States Circuit Court of the Middle District of the United States, has been especially assigned to preside at the July term of the criminal court, before which the defendants will be arraigned.

The indictments are against persons named as members of the following associations: Lead-Encased Rubber Cable Association, Weatherproof and Magnet Wire Association, Telephone Cable Association, Underground Power Cable Association, Fine Magnet Wire Association, Bare Copper Wire Association, Rubber-Covered Wire Association, Wire-Rope Manufacturers' Association and Horseshoe Manufacturers' Association. These associations no longer exist, having been dissolved at various times during the past two years.

In various specifications of each of the nine indictments the name appears of Mr. Edwin E. Jackson, Jr., of the law firm of Noble, Jackson & Hubbard, New York, who is also indicted on two counts in each of the nine presentments. Twenty-six companies which manufacture bare or insulated wire are mentioned, but the indictments as filed are against individuals and not against the companies to which they belong. In every case but one officers of the companies mentioned in the presentments are among those indicted. The exception is the General Electric Company, the name of a salesman and of an assistant salesman only being cited as representing that company in the Rubber-Covered Wire Association. Below is a list of the wire companies which figure in the indictments:

American Electrical Works of Rhode Island, American Steel & Wire Company of New Jersey, Ansonia Brass & Copper Company of Connecticut, Ansonia Electrical Company of Connecticut, Belden Manufacturing Company of Illinois, Benedict & Burnham Manufacturing Company of Connecticut, Bishop Gutta Percha Company of New York, Bradford, Kyle & Company of Massachusetts, Coe Brass Manufacturing Company of Connecticut, Crescent Belting & Packing Company of New Jersey, General Electric Company, Habirshaw Wire Company of New York, Hazard Manufacturing Company of Pennsylvania, Indiana Rubber & Insulated Wire Company, Marion Insulated Wire & Rubber Company of Indiana, Alfred F. Moore, Philadelphia; National Conduit & Cable Company of New York, National India Rubber Company of Rhode Island, New England Electrical Works, New Hampshire; New York Insulated Wire Company, Phillips Insulated Wire Company of Rhode Island, John A. Roebling's Sons of New Jersey, Safety Insulated Wire & Cable Company of New Jersey, Simplex Electrical Company of Massachusetts, Standard Underground Cable Company of Pennsylvania, Wire & Telephone Company of America.

The nine indictments vary little in form and statement, and the following abstract of the presentment against the members of the Underground Power Cable Association will serve to represent all the others. After describing the several manufacturing companies represented in this association and stating that these companies produce 95 per cent of the entire amount of underground cable consumed in the United States, the following offenses are charged against the individuals indicted, fifteen in number, including officers, sales agents and salesmen of four manufacturing companies, and also E. E. Jackson, Jr.:

(a) That the defendants named caused and procured their respective corporations to sell the underground power cables to be produced by them at arbitrary, artificial and non-competitive prices, to be fixed by said defendants from time to time, which prices were greatly in excess of the prices which would have been demanded for such underground power cable but for such unlawful combination and conspiracy.

(b) That they caused and procured their respective corporations to limit the amount of underground power cable to be produced by them to a fixed and arbitrary percentage to be determined and agreed upon by defendants from time to time, which would be different from the normal and natural amount they would each otherwise produce but for such unlawful combination and conspiracy.

(c) That they caused and procured their respective corporations so to conduct their respective business, trade and commerce as to destroy and prevent all competition between such corporations in said business, trade and commerce.

(d) That they caused and procured their respective corporations so to conduct their respective business, trade and commerce as to injure and destroy the business, trade and commerce in the United States in underground power cables of all persons or corporations other than those with which said defendants were connected, and so as to destroy and eliminate all competition with their respective corporations by any and all such persons and corporations engaged in the United States in such business, trade and commerce.

Specifications under the above charges are detailed as follows:

First: On the first day of June, 1908, the defendants, in furtherance of and pursuant to said unlawful combination and conspiracy, by written articles of agreement, formed and entered into a voluntary association known to and described by them as "The Underground Power Association," which association was to continue until the first day of May, 1911, without the right of any party thereto to withdraw therefrom. By these articles of association the defendants were to hold regular meetings, once every month in the County and Southern District of New York, and at all such meetings each of the members of the association was to have one vote on all questions to be decided, and the members of said association were to elect an officer to be known as a "supervisor" and such other officers as they might from time to time decide upon.

Second: Immediately upon the formation of the association the defendants elected the defendant Edwin E. Jackson, Jr., to the aforesaid position of supervisor, which position he occupied and the duties of which he thereafter discharged continuously.

Third: Immediately upon the formation of the association the defendants agreed upon, fixed and reduced to writing a set of rules and regulations to be complied with by them and to which they were to cause and procure their respective corporations to comply.

Fourth: Immediately upon the formation of the association the defendants fixed an arbitrary rating for each of the corporations, which rating was established by determining the ratio of the value of the output of the merchandise by each of the corporations to the total value of the output by all during an agreed period of time—the exact period being unknown to the grand jurors—which ratios were known and treated by the defendants as "allotments," which allotments where the percentage bases upon which the corporations were required and compelled to conduct their business.

Fifth: Immediately upon the formation of the association each of the defendants agreed that within ten days after the first day of each month, upon receipt of notice from the defendant Edwin E. Jackson, Jr., as supervisor, to the effect that any of the corporations had taken orders for underground power cable during the previous month in excess of its allotment, the defendants connected with the said corporation would cause such corporation to deposit with Edwin E. Jackson, Jr., 10 per cent

[o]f the value of underground power cable for which orders [h]ad been taken during the said month in excess of its [a]llotment, which sums so deposited should be known as a guarantee deposit," and that if any member of the associa[ti]on should resign, all such sums so deposited by it should [b]e forfeited to the remaining members of the association [a]nd should be distributed by the said Jackson to the [m]embers of the association who were deficient in their re[s]pective allotments.

Sixth: That by the terms of the aforesaid rules and reg[u]lations said defendant Edwin E. Jackson, Jr., was con[t]inuously the treasurer and custodian of the funds of the [s]aid association.

Seventh: That by the terms of the aforesaid rules and [r]egulations the defendants were required, and immediately [u]pon the formation of the association did cause and procure [th]eir respective corporations to deposit with the defendant [E]dwin E. Jackson, Jr., the sum of $5,000, which sum [w]as known and described as a "general deposit," and in the [e]vent that any member of the association should withdraw [o]r fail to perform any of its obligations under the articles [o]f agreement or rules and regulations during the period of [sa]id agreement it was agreed by the defendants that such [s]ums so deposited should be forfeited and be distributed [a]mong the remaining members of the association according [to] their respective allotments.

Eighth: By the terms of the rules and regulations each [o]f the defendants, on the fifteenth day of each month dur[in]g the continuance of the unlawful agreement, was re[q]uired to, and thereafter on the fifteenth day of each month [a]nd including the month of April, 1909, they did cause and [p]rocure their respective corporations aforesaid to pay to [th]e defendant Edwin E. Jackson, Jr., 1 per cent of the [a]ggregate value of the orders for underground power cable [re]ceived by said corporations during the previous month, [w]hich sums so paid in were deposited by the defendant [E]dwin E. Jackson, Jr., in the aforesaid general deposit.

Ninth: That immediately upon the formation of the [a]ssociation the defendants, by the rules and regulations [a]greed upon, established and fixed a schedule of prices at [w]hich their respective corporations should sell the under[g]round power cables thereafter to be produced by them, [a]nd agreed that the defendant Edwin E. Jackson, Jr., [a]s supervisor of the association, should from time to time [f]ix the base price of underground power cable to be applied [t]o said schedules, which prices so fixed should continue in [f]orce until changed by him, and should be observed by the [r]espective corporations and exacted by them and collected [f]rom the purchasers to whom they should make sales of [s]uch product; and that when any such change should be [m]ade by the supervisor prompt notice thereof should be [s]ent by him to all of the defendants and to their respective [c]orporations.

Tenth: Immediately upon the formation of the associa[t]ion, and as a part of its rules and regulations, it was [a]greed among the defendants that each of their respective [c]orporations should daily mail to the defendant Edwin E. Jackson, Jr., a report showing the various orders and [c]ontracts for underground power cable which the corpora[ti]on had received that day for shipment from its factories, [giv]ing the name of the customer, and, in case of contracts, [t]he time of delivery; and from then continuously, every [w]orking day until the first of April, 1909, the defendants [c]aused their respective corporations to make such daily [r]eports to Edwin E. Jackson, Jr.

Eleventh: In compliance with the aforesaid rules and [r]egulations, the defendant Edwin E. Jackson, Jr., from [d]ay to day and every working day continuously from the [f]irst day of June, 1908, to the first day of April, 1909. caused [t]o be made up statements showing the value of the total [o]rders on hand as shown by the aforesaid daily reports [m]ade to him, and sent the same to each of the corporations, [w]hich reports showed the total value of orders received by all of the corporations and the percentage of such orders received by each corporation.

Another article specifies the date of one of the meetings held by the association. The dates of meetings thus specified range for the various associations from Aug. 11, 1908 (Bare Copper Wire Association), to March 2, 1910 (Fine Magnet Wire Association).

The several indictments conclude with the arraignment of the individuals mentioned in the presentment, under two counts. The first count charges them with unlawfully engaging in an unlawful combination and conspiracy in restraint of trade and commerce among the several states. The second count charges them with unlawfully and knowingly attempting to monopolize the business, trade and commerce in the United States in the commodity covered by the association to which they belong.

Amendments to N. E. L. A. Constitution.

The National Electric Light Association has published a number of amendments to the constitution of the body as adopted at the recent New York convention. One of these broadens the scope of the company geographic and national special sections by rendering eligible to membership in these any person interested in the central-station industry who is proposed and recommended by any class A (central-station company) member in the territory in which the applicant resides. Another amendment relates to the executive committee, the membership of which now consists of the president, two vice-presidents, the retiring president and nine elective members, each of whom shall have one vote; in addition, the presidents of geographic sections and chairmen of national special sections shall be entitled to attend all meetings of the committee, the former collectively having two votes and the latter one vote. The object of this amendment is to permit the geographic and national special sections to have their president or chairman attend all meetings of the executive committee and also to insure that the control of the committee shall not be taken away from representatives of class A members. In order to permit the affiliation in the future of electrical associations that may be located in any section of North America an amendment provides that upon application of five class A members, or two-thirds of such members if less than eight, in any geographic section of any country in North America, the executive committee shall authorize the requested organization of a geographic section. Other geographic sections formed may also be admitted by the executive committee.

Convention of Association of Railway Telegraph Superintendents at Boston.

The thirtieth annual convention of the Association of Railway Telegraph Superintendents was held at the Hotel Brunswick, Boston, Mass., from June 26 to 30. Vice-president J. B. Sheldon presided and there was a total attendance of about 130 persons, including nearly fifty ladies. A notable feature of the convention was the welcome extended to the delegates by Mayor Fitzgerald of Boston, which included the singing of "Sweet Adeline" by His Honor amid tumultuous applause. The social program included various automobile trips for the ladies, a special railroad night at the "Pop" concerts of the Boston Symphony Orchestra, and trips to Old Orchard Beach, Maine; Revere Beach, Mass., and Plymouth, Mass. A strenuous business program was also handled, including the following papers:

Some Hints, Insulators, etc., by Mr. W. J. Camp, Canadian Pacific Railway, Montreal, Canada; *Railway Efficiency*, by Mr. R. W. Pope, New York; *Line Conductor Requirements for Telegraph Transmission*, by Mr. Frank F. Fowle, Chicago; *High-Speed Automatic Perforators or Receivers,*

by Mr. William Mauer, Jr., New York; *Co-operation Between Railroad People and Commercial Companies*, by Mr. W. P. Clive, Wilmington, N. C.; *Economy in the Telegraph Department*, by Mr. William Bennett, Chicago; *Some Observations on Telephone Transmission*, by Mr. J. L. McQuarrie, New York; *Current Supply for Selective Telephone Systems*, by Mr. W. E. Harkness, New York; *Development of Telephones for Train Dispatching and Other Railway Purposes*, by Mr. G. K. Heyer, New York.

An important feature of the convention was the presentation and acceptance of the report of the committee on high-tension line crossings, headed by Chairman G. A. Cellar, of the Pennsylvania Lines, West. This report was prepared in conjunction with committees of the National Electric Light Association, American Electric Railway Association and American Institute of Electrical Engineers.

Meeting of Electric Vehicle Club.

At the regular weekly meeting of the Electric Vehicle Club of Boston on June 28 Mr. Day Baker, of the General Vehicle Company, Boston, presided. The committee on signs announced that plans are being drawn by the construction department of the Boston Edison Company for large electric-vehicle signs to be erected at Mattapan and on the Revere Beach Parkway. The location is being considered of a large animated sign which will exhibit alternately a pleasure and commercial vehicle in operation. Agents of various dealers were requested to supply the advertising committee with photographs to be used in the preparation of lantern slides of electric-vehicle development for exhibition in talks before the public. Mr. E. S. Mansfield stated that in the past eight weeks an average of at least one new public charging station per week for electric-vehicle service had been established in the Boston Edison territory.

Mr. W. E. Eldredge, Boston, reported that all the railroad and steamship companies in Boston have now given consent to the use of their docks and terminals by electric vehicles. Gasoline machines are debarred from practically all such installations. It was recommended that all electric vehicles be suitably marked, so that no time would be lost in passing watchmen at docks and terminals. It was announced that Fire Commissioner Daly, of Boston, is making determined efforts to keep gasoline vehicles from being stored in the heart of the business district. Electric vehicles have the complete approval of the commissioner, and can be stored in buildings anywhere in the business center of Boston. Mr. Mansfield distributed a bulletin showing the names and addresses of various prospective electric-vehicle users who have sent inquiries to the company apart from the lists given to the company privately by dealers. The importance of standardizing garage practice was touched upon, and the meeting closed with a short talk by Mr. F. N. Carle, the newly appointed publicity manager of the General Vehicle Company.

German Association for the Promotion of the Use of Electricity.

An undertaking was organized in Berlin the latter part of January which is of the greatest importance for the entire electrotechnical industry, not only for the manufacturers of electrical apparatus, but also for the central stations. It has to do with the establishment of an association for promoting the uses of electricity. This undertaking is patterned after a similar organization for the promotion of the gas industry that was organized in Germany last year and it intends to give the electrical industry wide publicity.

The carrying out of this campaign will require the co-operation of all the branches of the industry, so as to bring out the many advantages of electrical energy, such as convenience, cleanliness and hygienic qualities. Along these lines, naturally, there will be a rivalry with the gas association, the propaganda of which is already attaining marked success. It will lie with the executives of these organizations to adopt a policy with reference to the competition between gas and electricity which will result in no harmful reactions to either.

The duty of this new organization lies not only in instructing the public as to the value of electrical energy for lighting, for heating and for motor service, but it should show ways and means of organizing a suitable propaganda for the manufacturers of electrical apparatus and especially for the central-station manager.

The important points for the association to take up are the rate question and lessening the cost of electrical installations. Even though the operation costs of gas lighting and electric lighting with metallic-filament lamps so nearly approach each other, it is a fact that in small and medium size houses electric lighting has come into very limited use. In all large cities even the smallest houses are piped for gas, only a few of the medium size and large houses being equipped for electric lighting. Even when houses are wired for electricity it is often the case that the tenant is obliged to change the installation in order to answer his special pur-

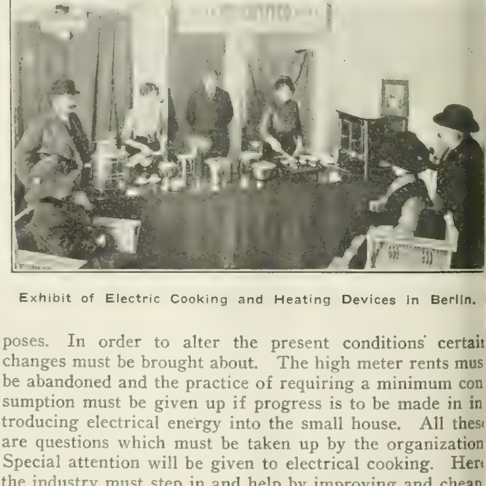

Exhibit of Electric Cooking and Heating Devices in Berlin.

poses. In order to alter the present conditions certain changes must be brought about. The high meter rents must be abandoned and the practice of requiring a minimum consumption must be given up if progress is to be made in introducing electrical energy into the small house. All these are questions which must be taken up by the organization. Special attention will be given to electrical cooking. Here the industry must step in and help by improving and cheapening the electrical cooking apparatus.

As the leader in the movement, choice has fallen on Mr. Einar Wikander, who is known through his articles on the popularizing of electric lighting. He was formerly a director of the Guttenberg central station and later director of the German Incandescent Light Company. He began his duties on Feb. 1, 1911.

In the board the following societies are represented: Vereinigung der Elektricitäts Werke, Der Vorband Deutscher Elektrotechniker, Vereinigung Deutscher Elektricitäts Firmen, Vorband der Elektrotechnischen Installations Firmen in Deutschland, Verein zur Wahrung Gemeinsamer Wirtschaftsinteressen der Deutscher Electrotechnik.

As members of the new organization are eligible owners, central stations, societies and individuals who are interested in the applications of electricity. The headquarters are at present in Berlin—Schöneberg, Salzburgerstrasse 14.

Convention of the Mississippi Electric Association.

The third annual convention of the Mississippi Electric Association was held in the Great Southern Hotel, Gulfport, Miss., June 20, 21 and 22. The meeting was most successful, the total registration of 116 being double that of last year. The sessions, which were held in the Rose Trellis Garden of the hotel, were presided over by Mr. J. Abbott, of Jackson, Miss., the vice-president of the association, President S. W. Greenland, of Columbia, Miss., being unable to be present. At the opening session Judge J. H. Neville, of Gulfport, delivered an address of welcome, eulogizing the city and the manager of the local lighting company. Following the response by the vice-president Mr. A. H. Jones, of McComb, Miss., secretary of the association, announced the entertainment features of the convention as follows: A sight-seeing trip for the ladies in the afternoon and a reception and dance in the evening. On June 21 there were shopping tours arranged for the ladies, and in the afternoon there was a trip to Beauvoir and Biloxi over the lines of the Mississippi Coast Traction Company. In the evening there was a banquet tendered by a number of Southern electrical jobbers to the association and its guests. On June 22 an excursion was provided to Ship Island by boat by the Interstate Electric Company.

The real business of the convention began with the afternoon session on June 20. The first paper on the program was written by Mr. A. B. Paterson, of Meridian, and read in his absence by Mr. Knight.

RELATION OF EMPLOYEES TO THE COMPANY AND PUBLIC.

In his paper Mr. Paterson made an analysis of an employee's duty to his employer and to the public. An employee, he said, should remember that from the company he is receiving his livelihood and that upon its prosperity depends his. If he renders satisfactory service his prospects will be bright. Satisfactory service means loyalty to the company, a thorough knowledge of duties and diligent application to the same, and sufficient interest in the operation of the company to inform other departments of deficiencies. Moreover, there should be no hesitancy in making suggestions having for their object the betterment of the service. Each employee should have a thorough knowledge of the conditions of the company's franchises, of the city code, of what a corporation consists and its proper position with reference to the public. Regarding the second phase of the subject, Mr. Paterson said that employees should not forget that they owe their employment to the public. The company has been granted the privilege to perform an essential service and stockholders eventually expect interest on their investment. The idea that public sentiment can be disregarded or in any manner overlooked has long been outgrown. Some of the important duties which would tend to maintain friendly public relations were given as follows: Pleasant reception of complaints; prompt handling of complaints; satisfactory adjustment of complaints; true statements as to the cause of any deficiencies and when they can be remedied, and polite and intelligent replies to all inquiries. The most valuable man to his employer, Mr. Paterson maintained, is he who places the corporation which he represents in a better light with the public.

The paper was discussed by Messrs. W. F. Gorenflo, Gulfport; J. B. Moorman, Vicksburg; C. Z. Stevens, Hattiesburg; W. G. Clark, Jackson; W. R. Herstein, Memphis, Tenn.; H. Crittenden, Greenville; Percy Stern, New Orleans, La.; I. H. MacArthur, Meridian, and C. E. Reid, Agricultural College. Mr. Gorenflo said his company's affairs were supervised by a railroad commission, but that it welcomes complaints in order to find out defects in its service. Mr. Moorman's company has men on duty to look after complaints, which are given prompt attention. Mr. Stevens said that since the first of the year his company has been under a commission form of government and finds it quite a relief. Mr. Herstein stated that it is the endeavor of his company to instil into the minds of its employees the fact that when complaints arise the customer is not always to blame. It is worse to lose a customer's good will and business, he said, than a few cents in dispute. His company settles a great many claims which it believes are unjust, but it is policy to do so and pays in the long run. He mentioned the plan of a company which gives each employee 1 cent an hour for a period of three months if he is not involved in an accident or trouble of any character. This company has recently distributed $3,500 among its employees and intends to continue the scheme. Mr. Crittenden also felt that his company went farther than it should in settling disputes with the public, but that inasmuch as its revenue was derived from the public no fault could be found.

ELECTRIC-HEATING APPLIANCES.

The second paper to be delivered was prepared by Mr. H. J. Mauger, of the General Electric Company, and was presented by Mr. L. Callender, of the Atlanta (Ga.) office. The author advised an enthusiastic exploitation of heating devices, stating that the bulk of heating-device revenue comes from the residence customer, and will thus develop the residence business. Statistics show that residence business has been neglected; not more than 15 per cent of the residences within reach of central-station service are connected. The author advised house-wiring campaigns on the instalment plan and in co-operation with the electrical contractors, stating instances where such had been very effective. The progressive central-station man realizes, he said, that the more cords by which he can bind the public to him the more indispensable his organization becomes to the community.

As to the amount of money that can be profitably spent for this new-business getting, it was stated that 5 per cent of the gross annual income has often been well spent, half being spent for salaries and commissions to employees and the balance for the various kinds of advertising and publicity. Some central stations spend from $1 to $2 to secure business which will earn $4 gross per year. The author advised selling devices at a profit.

A long discussion followed the reading of the paper in which Messrs. S. M. Jones, Laurel; A. H. Jones, McComb; L. Callender, Atlanta, Ga.; O. A. Acuff, Meridian; W. B. Moorman, Vicksburg; W. F. Gorenflo, Gulfport; J. Abbott, Jackson; A. W. Starliper, New Orleans, La., and others joined. Mr. S. M. Jones stated that his company sells irons at cost, and that in selling heating devices the solicitor should appeal to the women rather than to the men. The increased earnings in small central stations must come from such apparatus as electrical heating devices. The first cost of much of the apparatus he felt was too high. Mr. A. H. Jones, whose company operates in a town of less than 5000 inhabitants, said that about 80 per cent of the company's customers use electric irons. Toasters and coffee percolators are also in use. Two-burner stoves were also introduced and installed at cost, payment being allowed on instalments after a thirty-day trial. At present six stoves are in use, but Mr. Jones believes that he will have from fifty to sixty installations within a year. The prices for ranges are too high, and he felt confident that if the cost were from $30 to $35 for a complete range he could dispose of many of them. The rate on a separate meter for cooking is 5 cents per kw-hour less 10 per cent for prompt payment. The two-disk stoves consume about 1750 watts and, although on a separate meter, the income is only about $1.50 per month, his company is optimistic of results to come. McComb has no gas. Mr. Moorman stated that in Vicksburg almost all of the flatirons sent out on trial remain in service. His company also disposes of a number of sewing-machine motors during the year. Mr. Gorenflo's company pushes flatirons and has been able to install them in every Chinese laundry.

STEAM TURBINE.

Mr. Edmund Dreyfus, of the Westinghouse Machine Company, spoke on the steam turbine in a general way. He referred to the simplicity of the turbine and its economy and possibilities. His paper was not prepared in advance and he spoke from notes serving as an introduction to a general discussion on the subject. Mr. D. D. Ferris, Atlanta, Ga., asked a number of questions, which were answered by Mr. Dreyfus, but other than that there was no discussion on the paper.

NECESSITY OF A COMMERCIAL DEPARTMENT.

A paper on this subject was read by Mr. A. H. Jones, of McComb, who spoke of conditions as they are in Mississippi, where the increases in the use of electricity have not lightened the manager's burdens. Because of this a new-business department is almost unknown. He will take what new business comes to him, but has no time to wage an energetic campaign to get all the business legitimately belonging to the company. This condition exists to-day in nearly all the larger towns in Mississippi. With one or two exceptions it is probably true that no consistent and successful new-business campaigns have ever been undertaken in Mississippi. By this is meant that no such campaigns have been given the sole thought of an able, aggressive commercial man. The possibilities in any community have not been exhausted and it would therefore seem that there should be the courage and conviction to pursue the possibilities until they are captured, for when this is accomplished other opportunities will present themselves, so that an aggressive commercial department need have no fear of ever reaching the saturation point. Some of the latent possibilities that a good commercial department brings into active existence are motors, flatirons, electric signs, cooking and heating appliances, especially where gas is not available. The commercial department enables the influence of the company to grow and creates a new impression of the purpose of the public utility. A review of conditions existing to-day suggests these thoughts to the author of the paper. The original organizations have outgrown their usefulness. The stability of the business demands that additional sources of revenue be provided for two reasons, the enhancement of the earning capacity of the plant and the necessity of rendering to the public generally that service which the company is morally bound to give by virtue of its franchise. With the present organizations overburdened and necessitating changes there remains but to reorganize and in the reorganization create a new department to have charge of all new business and the proper care and handling of the old business.

In the discussion which followed the reading of the paper it was evident that few companies in Mississippi have established new-business departments. Mr. H. Crittenden, Greenville, said his company has just organized such a department. Mr. Moorman, Vicksburg, touched on the necessity of keeping in touch with contractors and architects, stating that his company was gratified with results obtained through maintaining cordial relations with contractors and architects, all new buildings in Vicksburg being equipped with electric wires. Mr. O. A. Acuff, Meridian, gave his experiences with the new-business department in that city and stated that a company can create a better feeling with such a department than in any other way. Solicitors come in contact with customers, hear their complaints and establish friendly relations. Others contributing to the discussion were Messrs. W. F. Gorenflo, S. M. Jones, J. Jumonville, Hammond, La.; E. E. Esslinger, Hattiesburg, and C. Z. Stevens.

A paper on the economy of a 750-kw engine was to have been read at the session on June 21, but the author was unavoidably detained and a lecture by Mr. Karston, of the Holophane Company, was given instead. Owing to the limited time the lecture was greatly curtailed.

EXECUTIVE SESSION.

At the executive session held in the afternoon of June 21 the following officers were elected: President, Mr. Jack Abbott, Jackson; vice-president, Mr. R. B. Claggett, Greenville; secretary-treasurer, Mr. A. H. Jones, McComb; executive committee, the above officers and Messrs. W. F. Gorenflo, Gulfport; W. B. Moorman, Vicksburg; C. Z. Stevens, Hattiesburg, and S. M. Jones, Laurel. Invitations were received from Vicksburg and Hattiesburg for the next convention, but choice of the convention city will not be made until after the first of next year. At the executive session a paper was presented by Mr. J. Abbott on the "Economical Care and Maintenance of Street Cars," and there was a discussion on the Question Box. Notes on both these topics are not available for publication.

Convention of Society for the Promotion of Engineering Education.

The Pittsburgh meeting of the Society for the Promotion of Engineering Education was held June 27, 28 and 29 at Carnegie Technical Schools and the University of Pittsburgh. The attendance was good and a spirit of co-operation and enthusiasm prevailed. On account of the location of the convention in the Pittsburgh district a successful effort was made by the local committee to show the relation of the industries to the education of the young people of the locality. Trips of inspection to a number of manufacturing plants, therefore, formed an important part of the program.

ENGINEERING ENGLISH.

The Tuesday morning session opened with two papers on English, a subject to which the society has properly devoted a great deal of attention. Prof. S. C. Earle, of Tufts College, described original plans which he has used in training engineering students in technical writing. He advocates special drill in English for these students, but he also regards general training in English as an integral part of a technical education. He does not, however, cling to traditional methods of instruction as do some instructors who, in Professor Earle's words, "regard English as the last bit of salvage from the arts course remaining in the engineering school and as the only means of culture in a curriculum otherwise hopelessly practical." The art of clear expression involves clear thinking, especially if the description relates to other than visual images and symbols. Hence, if a student can be taught to write so as to impart accurate information he has been trained in thinking, which is, after all, the real function of a technical education. Following Professor Earle's paper, another of somewhat similar character was presented by Prof. F. N. Raymond, of the University of Kansas, on the preparation of written papers. He emphasized, as the essentials for success in technical writing, (1) accurate and thorough observation, (2) clear perception of other men's viewpoints, (3) correlation of ideas, and (4) good workmanship. By writing reports with these elements in mind an improvement will result whether the instruction is given by the department of English or formally by no department at all. In the discussion following these papers Prof. J. M. Telleen, of Case School, referred to logic as the basis of all work in English and every other subject. He defined rhetoric as "expression with the highest efficiency." Mr. William Kent believed that English can be taught best to engineering students in the engineering school and that engineering reports should be the basis of study of "engineering English."

INDUSTRIAL TRAINING.

Several speakers at the Tuesday and Thursday sessions emphasized the close connection which must exist between theoretical training and practical work. A recent interesting experiment at the University of Missouri was de-

scribed by Profs. H. Wade Hibbard and H. S. Philbrick. They have attempted to teach the principles of scientific shop management by means of the engineering school shops. These shops have been organized as "management laboratories" and work has been put through them in accordance with the modern methods of "efficiency engineering." The experiment is so recent that only preliminary results could be reported, but apparently the students have entered into the spirit of the plan and are profiting by it. A paper based on a wide experience with technical graduates was presented by Mr. E. B. Raymond, vice-president of the Pittsburgh Plate Glass Company, under the title "The Technical Graduate from the Point of View of the Manufacturer." It was appreciated by the society because of the intimate knowledge of human nature which it exhibited. Mr. Raymond said that "it seems to me absurd to expect a college in four years to turn out men freed from their natural weaknesses when one considers the quality of the average human being who enters." Among these weaknesss he mentions laziness, disinclination for practical work, lack of seriousness and ability to assume responsibility, and lack of ability to become a part of a workingman's life. He believes that less "good time" and more "office atmosphere" would improve the college life. He gives as the requisites of success in engineering character health, ambition and specific training.

Messrs. C. F. Scott and C. R. Dooley explained to the society a new plan for adapting technical graduates to the electrical business. The Westinghouse Electric & Manufacturing Company has modified the apprentice plan which has been used for some years by dividing the two years of its apprentice course into two periods. In the one period a more thorough but less extensive shop training will be given and this will be supplemented by classroom instruction. In the other period some one specialty will be taken up and mastered by each apprentice. The University of Pittsburgh is introducing a co-operative plan involving four twelve-week periods per year for four years. The first and last years will be spent in school, but during the second and third years the student will spend alternate periods of three months each in shop and in school. Dean F. L. Bishop hopes by this plan to meet the criticisms of the technical graduate from the standpoint of employers in relation to their immediate adaptability to industrial conditions.

COLLEGE BUILDINGS.

The technical schools of the country are at present very active in securing new buildings and equipment and in improving present facilities. Hence two papers by Prof. J. M. White, of the University of Illinois, dealing with engineering buildings and the college campus, were well received by the society. These papers were supplemented by Director A. L. Williston's description of the buildings of the new Wentworth Institute, a modern trade school in Boston. Professor White discussed "the general considerations which should govern the planning and arrangement of the different types of buildings which are essential for conducting the work of a modern engineering school." He gave the results of a study of the areas required for laboratories, shops and classrooms. He considers the electrical building of the Worcester Polytechnic Institute as the best example in this country of a building well adapted both to its needs and to the architectural requirements imposed by its environment. In the discussion there occurred a lively tilt between the architects and the engineers to decide the relative authority of the architect and the faculty in determining the form of building for engineering instruction.

TEACHING MATHEMATICS.

An important feature of the Pittsburgh meeting was the reception of the report of the committee on the teaching of mathematics to engineering students. This committee was appointed four years ago by the American Mathematical Society and the American Association for the Advancement of Science and it was directed to report to both the American Mathematical Society and the Society for the Promotion of Engineering Education. The first purpose of the committee was to compile statistics regarding mathematical instruction in technical schools, but later the plan was changed to the present one. The report, as presented and, fortunately, accepted, comprises syllabi of the essential elementary mathematical subjects, algebra, trigonometry, geometry, analytical geometry and differential and integral calculus. The plan included a syllabus of "dynamics" or theoretical mechanics, but this was found impracticable for this year on account of lack of time to secure agreement as to the essentials of this subject. The report is an outline of the theorems which every engineering student should know well and which a professor should be justified in assuming as a reasonable mathematical preparation for his work. The committee believes that this is an adequate average preparation, but that if more advanced mathematics is needed in particular courses this should be taught in connection with those courses. Before accepting the report the society debated a number of details, such, for example, as the necessity for including vectors and complex quantities. These subjects were desired by the electrical engineering teachers and others. In accepting the report it was ordered published in the *Proceedings,* where it will be available for general use about Jan. 1, 1912. The report appeared in full in recent numbers of the *Bulletin* of the society.

ENTRANCE REQUIREMENTS AND METHODS OF INSTRUCTION.

The standing committee on entrance requirements presented a revised report with specifications of the several subjects in the required list and a number in the elective list. The discussion preceding the acceptance of the report indicated substantial agreement on essentials and a tendency to limit the number of elective subjects. The members of the society wish to encourage the secondary schools to limit their instruction to what they can teach thoroughly and to give such courses as will fit the graduates for usefulness whether they go to college or not.

Several papers dealing with details of instruction composed the remainder of the program. Mr. H. A. Gehring, civil engineer in the New York State Engineer's department, urged the use of logarithmic diagrams in laboratory work. He believed that much better work can be accomplished by students if they check their results as their experiments proceed. Profs. W. A. Hillebrand and S. B. Charters, of Leland Stanford University, told of their experiences in trying, by means of general lectures, to interest freshmen in the broad field of engineering. They expressed some disappointment that students do not take more interest in the important matters, preferring the "social attractions of a Friday night to a meeting of the San Francisco Section of the Institute." However, the attempt to interest the students in the best things has resulted beneficially to students and faculty alike. Prof. E. B. Paine, of the University of Illinois, gave an extended outline of the methods of electrical engineering instruction employed there. He showed that from a general treatment of the whole subject the instruction becomes more analytical as the work progresses. He lays great stress on mathematical theory, preferring, if necessary, to leave the more practical information to be acquired after graduation. Dean W. G. Raymond, of the University of Iowa, renewed his plea of preceding years for more individual instruction by which each student may advance as rapidly as his ability and industry will allow. Dean Raymond also contended for an all-year session in engineering schools in order that the students may have more time for the increasing demands upon them. He prefers this method of lengthening the course to the five-year plan advocated by many educators. Dean C. H. Benjamin, of Purdue University, and Prof. J. H. James, of the Carnegie Technical Schools, called attention in their papers to the rapidly growing importance of chemical engineering.

The colleges are meeting the demand for instruction in this line, but there is great diversity of practice. Prof. A. H. Blanchard, who is in charge of the new highway engineering courses of Columbia University, outlined the plan and scope of these courses. They are scheduled for the winter season when out-of-door work is impossible. The students will be able to take part in road construction during the summer and fall.

BUSINESS AND SOCIAL FEATURES.

Among the items of business taken up by the Pittsburgh meeting an important one was the decision to continue the publication of the monthly *Bulletin*, which has been issued tentatively for the past year. To permit this required the raising of the membership fee from $3.50 to $4 per year.

The officers elected at the meeting to serve one year are as follows: President, Dean W. G. Raymond, University of Iowa; vice-presidents, Dean G. C. Anthony, Tufts College, and Mr. F. B. Gilbreth, New York City; treasurer, Mr. W. O. Wiley, New York City; secretary, Prof. H. H. Norris, Cornell University. The members of the council elected to serve three years are as follows: Mr. J. E. Boyd, Ohio State University; Dean C. H. Crouch, University of North Dakota; Prof. F. L. Emory, West Virginia University; Prof. C. E. Magnusson, University of Washington; Prof. H. H. Stoek, University of Illinois; Prof. J. A. L. Waddell, Kansas City, Mo.; Prof. A. J. Wood, Pennsylvania State College. The reports of the treasurer and the secretary indicated a thriving condition of the society. The receipts were in excess of the expenditures and the membership increased more than a third during the year.

The social side of the meeting was well looked after by the local committee, comprising Deans C. B. Connelly, F. L. Bishop and J. H. Leete, Prof. W. E. Mott and Mr. C. F. Scott. Inspection trips, advertising and local entertainments were provided. A dinner at the Country Club, given by Director A. A. Hamerschlag and the faculty of the Carnegie Technical Schools, and a luncheon tendered by Chancellor S. B. McCormick and the faculty of the University of Pittsburgh were very enjoyable. While the serious business of the convention was in progress the ladies were entertained by automobile rides and other diversions. A unique feature was an informal reception at the Carnegie Institute, at which Pittsburgh alumni of the various colleges were invited to meet their former teachers. The foyer of the music hall of the Institute resounded with the unaccustomed sound of college yells.

Chicago Convention of American Institute of Electrical Engineers.

The twenty-eighth annual convention of the American Institute of Electrical Engineers in Chicago on June 26 to 30, 1911, was by far the most largely attended convention ever held by the society and probably the most successful also. The final registration was 930, including about 100 ladies. Of the total number about 530 were from Chicago or its suburbs, the remaining 400 being out-of-town members. This attendance is so far in excess of any previous Institute convention as to be remarkable. There were thirty-five papers presented at the session, and as a rule they were of a high order of merit. Parallel sessions were held on two days, and the whole affair was spirited and enthusiastic. Both President Jackson and President-elect Dunn were present, and the convention was the occasion of the resignation of Mr. Ralph W. Pope, the veteran secretary, who has held office since 1885. The entertainment features were lavish and carried out without a hitch, thanks to the local convention and entertainment committees, and there were numerous social gatherings "on the side," some of them very brilliant.

The opening reception of Monday evening, June 26, and the power-station session of Tuesday morning were reported by telegraph in the *Electrical World* last week. Herewith is given a general condensed account of the proceedings from that time, abstracts of papers and discussions appearing in another place in this issue.

CIRCULAR INSPECTION TOUR.

On Tuesday afternoon members and visitors, as guests of the Western Electric Company, were taken on board a special train to the Hawthorne plant of the company, where

President D. C. Jackson.

an appetizing luncheon was served in the large employees' dining-room. During the luncheon music was furnished by the Western Electric band. A short tour of inspection was made through the power house and the cable factory, after which the party reboarded the special train and was taken to the Fisk Street station of the Commonwealth Edison Company. Following an inspection of the great turbine and boiler rooms and the switch houses of this 120,000-kw generating station and its neighbor, the 84,000-kw Quarry Street station, the Institute delegation was conducted to a tent erected on the plant grounds, where refreshments were provided through the courtesy of the central-station company. Each member of the party received a souvenir

President-elect Gano Dunn.

booklet prepared especially for the Institute convention, and a number of the delegates returned downtown by a special boat chartered by the Commonwealth Edison Company.

ELECTRIC-LIGHTING SESSION.

Mr. H. M. Byllesby, of Chicago, opened the Tuesday evening electric-lighting session with his paper on "The Responsibilities of Electrical Engineers in Making Appraisals," in which he declared that to the capitalist, the promoter and the man who is able to influence capital, as

well as to the engineer, proper credit should be given for the accomplishment of these great results. Out of past and present controversies between corporations and the public, he said, a condition of justice, honesty and fair dealing must come.

Mr. Henry Floy, of New York, followed Mr. Byllesby, with an abstract of his paper entitled "Depreciation as Related to Electrical Properties." Mr. Floy urged more general agreement on the terms used in discussing the subject of depreciation, and recommended co-operation among engineers, manufacturers and service corporations for the intelligent collection and correlation of data on which to base estimates of depreciation.

The discussion of the general subject of depreciation was opened by Mr. Bion J. Arnold, of Chicago, who declared it to be his conviction that not only should the public pay to the public-service corporation the cost of the service rendered by it, plus a fair return on the investment, but also an additional amount in return for the early hazards and losses incurred in establishing the business. Mr. W. F. Wells, of Brooklyn, N. Y., said that where property, though not new, is in first-class operating condition, its value should not be depreciated for purposes of rate making. Mr. J. W. Lieb, Jr., of New York, pointed out that in the case of electrical apparatus obsolescence, due to advances in the art, may form as important a part of the loss of value as depreciation due to wear. Dr. S. S. Wheeler, of Ampere, N. J., proposed that all kinds of depreciation be unified as a simplification of the problem. Mr. Emil Leonarz, of Mexico City, Mexico, said that, while rates are often lowered, they are not raised when lines are extended to reach and develop new territory, at great expense to the corporation. Prof. A. H. Ford, of the University of Iowa, suggested that public-service commissions fix the upper and lower limits beyond which, above or below, the commission should take a hand in regulating rates for the benefit of the public or company.

RAILWAY SESSION.

Wednesday morning's session was devoted entirely to the presentation and discussion of railway papers and was a lively and interesting meeting. Mr. E. F. W. Alexanderson, of Schenectady, was called on first to present an abstract of his paper on "Induction Machines for Heavy Single-Phase Motor Service." Following this, Mr. B. F. Wood, of Altoona, Pa., abstracted his paper, entitled "Some Data from the Operation of the Electrified Portion of the West Jersey & Seashore Railroad." Then followed the exhaustive paper by Mr. W. S. Murray, of New Haven, bearing the title "Electrification Analyzed and Its Practical Application to Trunk-Line Roads, Inclusive of Freight and Passenger Operation." This last paper was first presented at the Toronto meeting of the Institute on April 7 last.

Mr. Murray did not attempt to summarize his long paper, but made a general statement in which he said, among other things, that electrical men must be honest with themselves and not talk one system of electrification exclusively. They should get together and possess a real sense of the necessity of standardization on general principles for the use of electricity on heavy trunk-line railroading, including terminal and suburban traffic. The problem of electrifying the yards is very important, and the speaker pointed out the advantages of overhead catenary construction with single-phase operation for this purpose. Mr. Murray's remarks related principally to the experiences of the New York, New Haven & Hartford Railroad with single-phase operation. The speaker said that the first electric freight locomotive on that road weighed 151 tons, but locomotives of greater power are now available weighing only 116 tons. The latter develop from 40,000 lb. to 50,000 lb. of tractive force. Within the next three months 350 miles of the track of the New Haven road will be electrified, of which 250 miles will be operated on the straight single-phase alternating-current system.

Before inviting discussion, President Jackson announced the appointment of a committee on resolutions, consisting of Messrs. D. B. Rushmore, of Schenectady; C. E. Magnusson, of Seattle, and A. S. Langsdorf, of St. Louis.

All three papers were discussed together. The first speaker was Mr. Frank J. Sprague, of New York, who championed the use of direct-current motors for railway operation in his usual animated and vigorous fashion. Others taking part in the discussion were Messrs. E. B. Katte, of New York; L. C. Fritch, of Chicago; J. L. Woodbridge, of Philadelphia; Prof. D. C. Jackson, of Boston; N. W. Storer, of Pittsburg; J. W. Lieb, Jr., of New York, and C. F. Scott, of Pittsburgh. Messrs. Alexanderson, Wood and Murray closed the discussion. Written discussions were submitted by Mr. Philip Dawson, of London, and Mr. W. N. Smith, of New York.

Practically all the gentlemen taking part in the discussion expressed a desire to see a "get-together" spirit on the part of electrical engineers in relation to an approved system of trunk-line electrification. However, the advocates of the direct-current motors and the alternating-current motors appeared to be as fully impressed with the merits of each system as ever. Mr. Fritch, speaking from the viewpoint of a steam railroad engineer, made an especially interesting contribution to the discussion, while Mr. Woodbridge advocated the use of the storage battery. Mr. Storer exhibited drawings of the new 116-ton single-phase freight locomotive to which Mr. Murray referred. Mr. Lieb pointed out the interest of the great electric-service companies in the subject.

ELECTRIC CLUB LUNCHEON.

A pleasant feature of the convention was the luncheon given to the Institute by the Electric Club of Chicago. This was held at the Hotel Sherman immediately following the morning session of Wednesday, and about 500 gentlemen participated, of whom about 150 were members of the club, the others being its guests. At the conclusion of the luncheon Mr. H. E. Niesz, president of the club, extended greetings to the Institute. President D. C. Jackson, of the Institute, returned thanks for that society and commented on the success of the convention and the exceptional attendance. Mr. Gano Dunn, of Ampere, N. J., president-elect of the Institute, in a short speech dwelt on the value of the personal element in conventions. Engineers have the quality of open-mindedness and Chicago is noted as a center of open-mindedness. Mr. Dunn gracefully connected these two facts in his speech.

INDUSTRIAL POWER SESSION.

The industrial power session of Wednesday afternoon was opened with a paper by Mr. Arthur C. Eastwood, of Cleveland, Ohio, on the subject of "Automatic Motor Control for Direct-Current Motors." Mr. Eastwood's paper described a solenoid-switch device having the characteristic by which it remains locked out during the initial rush of motor-starting current, finally closing and cutting out resistance after the running current has fallen to a normal value. This result is accomplished by providing duplicate magnetic return paths for the flux through the core, the more reluctant of which when excited at high flux densities provides a counter attraction which neutralizes the closing action of the core.

Mr. E. J. Murphy, of Schenectady, N. Y., next presented a description and lantern slides of a single-coil starting switch element employing the unequal reluctant path principle similar to that used in the device above mentioned, but arranged with a pivoted armature and roller contacts, which, said the speaker, minimize friction. In this device the normal flux-conducting path of low resistance is fitted with a closed copper band which prevents flux from building up rapidly through this path, when used with a motor the starting current of which rises at a comparatively slow rate.

Mr. L. L. Tatum, of Milwaukee, then read a paper on

"Limitations of Rheostat Control," in which he described the functional limitations inherent to the types of control, those due to characteristics of the rheostat material, and switching-device limitations applying to the method of adjusting the resistance. The paper included a discussion of the application of various types of control to motor-driven machines of special requirements, and closed with a discussion of contact limits as affecting the design and use of control apparatus. There was no discussion on Mr. Tatum's paper.

"The Control of High-Speed Electric Elevators" was the subject of a paper by Mr. T. E. Barnum, of Milwaukee. Two types of electric elevators were discussed—the worm-gear drive with moderate-speed motor and the gearless drive with special slow-speed motor. The application of these types to office-building requirements, with analysis of their control systems, bringing out the principal features of each, made up the text of the author's remarks, which were illustrated with a number of curve-drawing meter records of the power taken for the operation of the cars. Mr. Barnum's paper was discussed by Mr. S. N. Clarkson, of St. Louis, and Mr. F. J. Newman, of Chicago.

"Electrically Driven Rolling Mills" was the subject of a paper by Mr. Wilfred Sykes, of Pittsburgh, who described a system of reversing-roll operation through the means of a motor-generator set coupled to a flywheel for reducing shocks of demand. Mr. Sykes' paper discussed the relative manufacturing advantages of the reversing and non-reversing rolling mills, and discussed the control of roll motors by which it is possible to reverse the mill even more quickly than the material can be handled. The discussion of Mr. Sykes' paper, which turned chiefly upon matters of steel-mill practice, was taken part in by Mr. Carl A. Pauly, of Schenectady, and Mr. R. Tschentscher, of South Chicago, Ill.

TELEGRAPHY AND TELEPHONY.

Four papers were presented at the parallel session of Wednesday afternoon bearing on telegraphy and telephony. Mr. J. G. Wray, of Chicago, presided at this meeting and was accorded a vote of thanks at the conclusion of it. The first paper presented was an unusually interesting one by Major George O. Squier, U. S. A., on "Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires." Mr. S. G. McMeen, of Chicago, who presented the paper, commented on the extremely interesting nature of Major Squier's invention and on the attention it had attracted in the technical and lay press. Mr. McMeen also commented on the fact that the patent covering the Squier system of multiplex telephony and telegraphy has been dedicated by the inventor to the people of the United States.

Those taking part in the discussion were Dr. Frank B. Jewett, of New York, and Messrs. E. F. W. Alexanderson, of Schenectady, and J. B. Taylor, of Schenectady. Mr. McMeen closed the discussion. The gist of the discussion was that, while the invention is a most beautiful and interesting one, it is at present to be regarded more as a fascinating laboratory experiment than a commercial possibility. Mr. McMeen remarked, however, that the important feature of the paper is the hope it holds out for the development of such a system and also that when Prof. Alexander Graham Bell finished his first telephone it also was only a beautiful laboratory experiment.

The paper by Mr. F. F. Fowle, of Chicago, on "Telegraph Transmission" was presented in abstract by Mr. F. H. Reed, of Chicago. Messrs. Bancroft Gherardi, of New York, and Prof. G. D. Shepardson, of Minneapolis, discussed the paper briefly.

Mr. Bancroft Gherardi then presented an abstract of his own paper on "Commercial Loading of Telephone Circuits in the Bell System," Mr. E. H. Bangs, of Indianapolis, Dr. F. B. Jewett, of New York, Mr. E. H. Colpitts, of New York, Mr. E. B. Craft, of New York, Prof. G. D. Shepardson, of Minneapolis, Mr. Allard Smith, of Chicago, and Mr. J. G. Wray, of Chicago, discussed the paper, Mr. Gherardi closing. This paper and its discussion brought out many interesting facts about the loading of telephone circuits not widely known.

Mr. F. P. Valentine, of Boston, presented his paper on "Problems in Telephone Traffic Engineering." Those discussing this paper were Messrs. A. P. Allen, of Chicago, W. Lee Campbell, of Chicago, and Bancroft Gherardi, of New York. Mr. Valentine closed by saying that recent telephone studies have reduced many things thought to be variables to well-known quantities. This work is carried on with increasing intelligence and great advancement has been made in the last four or five years.

BOAT RIDE ON LAKE MICHIGAN.

Nearly 1000 persons, members of the Institute and their guests, enjoyed the boat ride of Wednesday evening on the excursion steamer *United States* along the Chicago water front. By a happy coincidence a brisk, cool north wind had imported a crystal-clear atmosphere from the head of Lake Michigan and the lights of the city stretching for miles along the shore were visible from the vessel's course several miles off the land. Refreshments were provided on board the boat and an orchestra furnished music for those who cared to dance on the broad lower deck.

TRANSMISSION-LINE OSCILLATION.

With Mr. Percy H. Thomas, chairman of the committee on high-tension transmission, presiding, the transmission session of Thursday morning was opened with Mr. G. Faccioli's paper on "Electric Line Oscillations," which was read by Dr. Steinmetz. The author's paper dealt with tests carried out last summer on the 100,000-volt lines of the Great Western Power Company, to obtain information on oscillations and rises of potential due to switching operations. Extensive oscillograph records were secured depicting the conditions existing in the circuits. Twenty-one oscillograph records were reproduced in the paper, showing the effects of various switching operations under different conditions, which were fully described by the author, and explained by Dr. Steinmetz with his characteristic clarity of expression. These records show extremely high frequencies, although an absence of high potentials, thus showing that switching phenomena give rise to frequency impulses against which protection is mainly called for. Mr. Faccioli's paper was discussed by Mr. M. H. Collbohm, of Madison, Wis., Mr. D. B. Rushmore, of Schenectady, N. Y., Mr. P. R. Thomas, of New York, and Dr. Steinmetz.

DIELECTRIC STRENGTH OF AIR.

Dr. J. B. Whitehead, of Baltimore, next read a paper on "The Dielectric Strength of Air," supplementing the results presented in an earlier paper on the subject of the conditions under which air breaks down in the neighborhood of clean, round wires subjected to high voltage. The investigations included a summary of facts bearing on the fundamental relations between diameter and surface intensities, and showed the influence of stranded conductors, of variations in air pressure and of frequency.

Mr. F. W. Peek, of Schenectady, N. Y., followed Dr. Whitehead with a paper on "The Law of Corona and the Dielectric Strength of Air," in which he discussed results obtained by extensive investigations on the laws of corona carried out at Schenectady under the direction of Dr. Steinmetz. Mr. Peek's paper presented an enormous mass of observational data, attesting the elaborate and complete scale of the work undertaken and carried out with the pracically unlimited facilities at the command of the investigators. The paper pointed out that loss of energy does not begin immediately the disruptive gradient is reached at the conductor surface, but only after the disruptive strength of air has been exceeded over an appreciable distance from the conductor. Due, however, to conductor surface inequality, some loss occurs at lower potentials below the disruptive critical voltage. Mr. Peck's paper further disclosed the relation borne by corona loss to frequency, excess

voltage, conductor diameter, conductor distance, air density, humidity, snow, wind, fog, rain, etc.

The discussion of the two preceding papers was opened by Dr. Steinmetz, who was followed by Mr. C. M. Davis, of Schenectady, A. B. Hendricks, of Pittsfield, C. F. Scott, of Pittsburgh, and the authors of the papers.

REPORTS ON TRANSMISSION SYSTEMS.

A summary of the general facts brought out by reports on several large transmission systems of 80,000 volts pressure and above was next presented by Chairman Thomas. The facts stated were in reply to inquiries sent out by the Institute and were responded to by J. P. Jollyman, on behalf of the transmission system of the Great Western Power Company, Mr. W. S. Lee, of the Southern Power Company, Mr. M. Hibgen, of the Great Falls Power Company, and Mr. P. T. Hanscom, of the Central Colorado Power Company. Mr. Thomas observed that the operation of these high-voltage systems is in general as satisfactory as those working at lower potentials. A number of the plants are working near the corona-loss limit, although they are not handicapped in operation at the present potential. The chairman referred particularly to the operation and design of the suspension-type insulator construction and the troubles to be apprehended from the mechanical motions of such suspended wires. Mr. M. H. Collbohm, of Madison, Mr. L. C. Nicholson, of Buffalo, Mr. Paul M. Lincoln, of Pittsburgh, and Mr. N. J. Neall, of Boston, in the discussion presented the benefits of their own experience with high-tension construction, operation and maintenance.

EXCURSION TO GARY STEEL MILLS.

Thursday afternoon was taken up with the excursion to the great works of the Indiana Steel Company at Gary, Ind., 25 miles southeast of Chicago. Through the courtesy of the General Electric Company a special train, stocked with refreshments, was provided for the Institute members. At Gary the 600 visitors went aboard an observation train and were taken about the plant property, visiting the new coke ovens, the power plants, ore unloaders, conveyors, blast furnaces, open hearths and the various mills. Owing to the size of the party no stops were made for inspection of the interiors of any of the buildings, but through the courtesy of the steel-corporation officials, invitations were tendered to the Institute members to visit the plant in small parties for a complete inspection of the processes of steel manufacture at this most modern installation.

CONFERENCE OF SECTION DELEGATES.

At 8:30 Thursday evening a conference of Institute officers and section delegates was held under the chairmanship of Mr. Paul M. Lincoln, of Pittsburgh, who in his opening speech discussed the welfare of the local sections of the Institute, inviting the suggestions of delegates in attendance as to how sections may best work in harmony with local societies.

Prof. George A. Hoadley, of Swarthmore, pointed out that it was the desire of the sections committee that there should be concentration instead of dissipation of energy in the section relations with local engineering societies. He then called upon Prof. A. S. Langsdorf, of St. Louis, who described how local rivalry between societies had been ended in that city by the organization of a joint committee drawn from the various societies. This committee planned a scheme of co-operation, making the Engineers' Club the chief factor, with the national society branches as subordinates. A joint council, said Professor Langsdorf, is in charge of meetings and programs at St. Louis, and the result of the plan has been to stimulate interest and attention at all of the meetings.

Mr. L. L. Tatum, of Milwaukee, said that the Institute section there is the tenant of the Milwaukee Engineers' Society, Institute section members receiving all services for $3 a year, which is less than the Engineers' Society members pay. The average attendance at meetings has been between forty and fifty. On account of the number of young engineers engaged with the large manufacturing companies at Milwaukee effort has been chiefly to bring out and stimulate the interest of these young men.

Mr. N. J. Neall, of Boston, said that in his city the chairman of the Institute section appoints a delegate to serve on a joint committee with those of the three other engineering societies. Three joint meetings are held a year, one under the auspices of each society. A social event of importance is the joint engineering dinner, the attendance of which has reached 400 persons. Mr. Neall pointed out the advantages of a common mailing bureau, equipped with addressograph, etc., for the several engineering societies.

Mr. Earl Wheeler, of Washington, D. C., said that the electrical men in the capital city expect to co-operate with the Washington Society of Engineers, possibly also holding combination meetings with the Baltimore Section of the Institute.

Mr. Ralph W. Pope, secretary of the Institute, said that beginning with the coming season he expects to devote all of his attention to section work, and hence is much interested in the development of section interest. He discussed the various plans of section organization and section dues and pointed out that a local engineering society often exerts more influence on the popular mind than a mere branch section of the national society. However, he urged members of the Institute to form a local section where possible. Mr. Pope also referred to the possibilities of forming sections at Birmingham, Ala., and in New York City. The New York Section, he explained, would permit the discussion of many interesting papers and subjects of a less important nature than it is now possible to bring up at regular meetings of the Institute. Mr. Pope also alluded to the useful service of social sessions and excursions to plants in bringing out many persons to section meetings.

Mr. E. Leonarz, of Mexico City, suggested co-operation between the headquarters of national societies and declared that in such case probably an engineering building might be obtained in Mexico City.

MR. POPE'S RESIGNATION.

President D. C. Jackson then addressed the meeting with relation to the general matters of the Institute, the main object of which, he said, is the stimulation of the engineering spirit among electrical men. The Institute now has nearly 7400 members, having taken on 436 during the last

Secretary Ralph W. Pope.

year, so that the present problem is not to increase the size of the organization, but to assimilate the existing new membership. President Jackson spoke of the national character of the trusteeship and members of the board, which, he pointed out, is made up of delegates from a number of states, although for purposes of obtaining a quorum a number of the board are necessarily chosen from New York City. The American Institute of Electrical Engineers, said President Jackson, is the only institution of similar importance in which no traveling expenses are paid officials for attending meetings. Nevertheless, he added, the organiza-

tion enjoys the most conscientious and exacting attendance of those intrusted with its trusteeship.

The Institute, continued President Jackson, now has clear unencumbered property amounting to \$600,000, the major part of which is a one-third interest in the Engineering Societies Building in New York. Ample funds are in the treasury to offset the existing mortgage against the land on which the building stands and which is owned by the Institute. Of the yearly income of \$97,000 which the Institute enjoys, said the president, \$65,000 is now required for printing proceedings, holding meetings, for office expenses and for other routine matters. The \$35,000 remaining last year was divided into three parts—one going to meet expenses of the various committees, another being applied on the library fund and a third being divided among the several sections of the Institute.

President Jackson next referred with feeling to the loyal services of Secretary Ralph W. Pope, now closing his twenty-sixth year in the service of the organization, during which time upon him more than anyone else had devolved the work of building up the Institute to its present important position among engineering societies. The resignation of Mr. Pope as secretary was announced. President Jackson expressed his own regret that the effort to elect Mr. Pope honorary secretary with a vote on the board had been unsuccessful when presented to the membership, and declared that in affectionate recognition of Mr. Pope's notable services to the Institute the board intends to employ him as honorary secretary, with supervision of section affairs, at the present salary. A committee headed by Mr. Samuel G. McMeen recommended that the amendment relating to the secretary's election be resubmitted to the membership, proposing that on account of the long and faithful service of Mr. Pope he be apopinted honorary secretary for life, at the salary now received by him. A resolution of the section delegates read by Professor Langsdorf also placed on record the high personal esteem and regard in which Mr. Pope is held by the Institute members.

Secretary Pope expressed feelingly his appreciation of the sentiments expressed by the Institute's officers and members, and referred to the high standard of progressiveness which characterizes the American Institute of Electrical Engineers. He referred modestly but with evident pride to his own connection with the growth of the Institute, and said that he felt the best time for him to retire has now come with the Institute's attainment to a position of importance, housed in a great building adequate to its needs. Feeling the weight of advancing years he has tendered his resignation, to take place Aug. 1. This resignation has been regretfully accepted by the board of managers, who propose, however, to re-employ Mr. Pope as honorary secretary in charge of section affairs.

METHODS OF INSTITUTE ELECTIONS.

As the result of a motion introduced by Professor Langsdorf, chairman of the sub-committee on methods of electing Institute officers, an extended discussion occurred on the subject of official nominations and elections. Campaign methods were declared unethical, and objections were made to the board's right to choose its own successors by appointment. Methods were asked which would better recognize numbers and geographical distribution of voters.

President-elect Gano Dunn referred to the predominating interest which the presidential vote attracts over that for other members of the governing body of the Institute. The motion for territorial representation he compared to governmental conditions in this republic, where Senators are chosen by states and Representatives by districts, according to the population. Mr. Dunn also brought forward a method of election proposed by Assistant Secretary Hutchinson by which any nominee securing a petition signed by 50 or 100 members might announce his candidacy for an Institute office. The ballots giving this list of nominees could be accompanied by professional records of the candidates, to aid voters in making their selection. President-elect Dunn also announced the reappointment of Mr. Paul M. Lincoln as chairman of the section committee during the coming year, which provoked hearty applause from the members present.

GENERAL PAPERS OF FRIDAY.

Prof. George F. Sever, of New York, presided at the general session of Friday morning. Six papers were presented, the first being that of Mr. R. Wikander of Pittsburgh, whose subject was "Economical Design of Direct-Current Electromagnets." This was a mathematical treatment of electromagnet design with practical applications of the theory outlined. There was no discussion.

"Electrolytic Corrosion in Reinforced Concrete" was the title of a paper by Prof. C. E. Magnusson, of Seattle, and Mr. G. H. Smith. Professor Magnusson gave an abstract of the paper, which he spoke of as a progress report, showing the results of tests at the University of Washington. Various methods of preventing corrosion were discussed by the authors. Mr. Burton McCollum of the Bureau of Standards, Washington; Mr. E. W. Stevenson, of Wilkes-Barre, Pa.; Prof. George A. Hoadley, of Swarthmore, Pa.; Prof. A. S. Langsdorf, of St. Louis, and Prof. G. D. Shepardson, of Minneapolis, took part in a short general discussion, Professor Magnusson closing. The general opinion seemed to be that there should be no undue alarm over the danger of electrolytic corrosion from iron embedded in concrete. Written contributions to the discussion were received from Messrs. Harry Barker, of New York, and Prof. W. L. Upson, of Burlington, Vt., jointly, and from Mr. Guy F. Shaffer, of New York, and Mr. Maximilian Toch.

Mr. H. Weichsel, of St. Louis, abstracted his paper on "Wave Shape of Currents in an Individual Rotor Conductor of a Single-Phase Induction Motor." Mr. Theodore Hoock, of Wilkinsburg, Pa., discussed the paper briefly and Dr. A. S. McAllister sent in a written communication in which he protested against giving credit incorrectly for developing the method described by Mr. Weichsel in his paper as originally prepared. Chairman Sever asked Mr. Weichsel to consider this point, and the author of the paper said that Dr. McAllister was right and that he wished to correct the error, and indeed had already done so.

A similar paper was that on "The Choice of Rotor Diameter and Performance of Polyphase Induction Motors," written and presented by Mr. Theodore Hoock, of Wilkinsburg, Pa. Messrs. E. F. W. Alexanderson, of Schenectady, C. J. Fechheimer, of Ampere, N. J., and H. Weichsel, of St. Louis, discussed the paper, Mr. Hoock closing.

Mr. J. R. Craighead, of Schenectady, abstracted his paper on "The Aplication of Current Transformers in Three-Phase Circuits." Then Mr. R. W. Atkinson, of Pittsburgh, presented the paper on "The Cost of Transformer Losses" prepared by Mr. E. C. Stone, of Pittsburgh, and himself. These papers were discused at the same time. Mr. A. H. Pikler, of Ampere, N. J., praised the Stone and Atkinson paper. Mr. W. C. Smith, of Pittsfield, Mass., Mr. E. A. Wagner, of Ft. Wayne, Ind., and Mr. H. B. Gear, of Chicago, also took part in the discusssion.

Mr. R. W. Pope, whose resignation as secretary, to take effect on Aug. 1, was announced at a preceding session, spoke briefly, praising those who had made the preparations for the convention, and particularly Mr. George F. Sever, chairman of the committee on meetings and papers.

RESOLUTIONS.

At both of the Friday morning sessions the committee on resolutions, consisting of Messrs. Rushmore, Magnusson and Langsdorf, presented its report, which was adopted without dissent. Thanks were extended to Mr. L. A. Ferguson, chairman, and the members of the convention committee; to Mr. H. M. Byllesby, chairman, and the members

f the entertainment committee; to the Electric Club of Chicago; to the ladies of Chicago, and to the commercial organizations extending courtesies. The report contained this interesting declaration: "The extraordinary success of the Chicago convention, the greatest in the history of the Institute, redounds to the credit of those responsible for its arrangement and attests the suitability of the great metropolis as a convention city."

MECHANICAL CHARACTERISTICS OF TRANSMISSION LINES.

With Mr. D. B. Rushmore, of Schenectady, in the chair, the high-tension transmission meeting of Friday morning (parallel session) opened with a paper on "The Solution of Problems in Sags and Spans," by Mr. W. L. R. Robertson, of Philadelphia. In the paper the author discussed the application of the catenary, rather than the parabola, to the solution of spans of great length and large sag, in which the latter quadratic curve is less accurate than for short spans of small sag. Mr. Robertson's paper discussed the effect of change in temperature and tension on the sag of the span, and presented calculated results and actual measurements of characteristic spans under varying summer and winter conditions. The paper concluded with a discussion of spans supported from different levels, with definitions of sag under these conditions.

"The Mechanical and Electrical Characteristics of Transmission Lines," a paper by Dr. Harold Pender and H. F. Thomson, was read by Mr. Thomson. This paper presented in compact form data and formulas, together with their derivations, required for determining the mechanical and electric characteristics of transmission systems. A set of charts appended with the paper enables various mathematical operations to be accomplished graphically with minimum effort. The authors first discussed the mechanical analysis of spans of various kinds, the second part of the paper being made up of mathematical analyses of the electrical characteristics of transmission systems.

Mr. P. H. Thomas next illustrated graphical methods of making sag calculations for suspended wires, with the aid of curves plotted to show stresses as ordinates and lengths and sags as abscissas. Included in Mr. Thomas' paper were examples of practical calculations using this method, originated by him, together with the theoretical derivation of the curves.

The three preceding papers on transmission-line subjects were discussed by Messrs. D. B. Rushmore, of Schenectady, Paul M. Lincoln, of Pittsburgh, L. C. Nicholson, of Buffalo, N. J. Neall, J. B. Balcomb, of Chicago, W. E. Belcher, of Chicago, and P. H. Thomas, of New York.

Mr. A. O. Austin, of Barberton, Ohio, next read a paper on "The High-Efficiency Suspension Insulator," in which he described tests of this important new piece of transmission apparatus under conditions simulating those of actual operation. The studies included flash-over or arcing tests, and the author exhibited curves showing the surface resistance of the insulators. The paper was chiefly taken up with a study of dielectric, flashing and puncture tests, and closed with an account of the mechanical strength of these insulators. Mr. Austin's paper was discussed by Messrs. E. E. F. Creighton, of Schenectady, Paul M. Lincoln, of Pittsburgh, L. I. Thomas, of Chicago, and N. J. Neall, of Boston.

UNIVERSITY ORGANIZATION.

Prof. A. S. Langsdorf, of St. Louis, presided at the concluding session on Friday afternoon, at which only one paper was presented, that of Mr. Ralph D. Mershon, of New York, entitled "Tentative Scheme of Organization and Administration of a State University." In the absence of the author, Prof. John H. Hunt, of Ohio State University, Columbus, Ohio, read the paper. Prof. A. H. Ford, University of Iowa, Iowa City, opened the discussion, and he was followed by Prof. C. F. Harding, Purdue University, Lafayette, Ind.; Prof. B. B. Brackitt, State College, Brookings, S. D.; Prof. A. S. Langsdorf, Washington University, St. Louis; Prof. G. D. Shepardson, University of Minnesota, Minneapolis, and Prof. M. C. Beebe, University of Wisconsin, Madison. The general trend of opinion appeared to be unfavorable to the proposal outlined by Mr. Mershon, particularly in respect to the plan of having an alumni advisory board associated in the control of university affairs.

In a few closing words Secretary Pope alluded to the size and success of the convention and explained that President Jackson had to leave before the last day in order to catch a steamer to Europe, as he had received an urgent call to England on consultation work on which he is engaged.

Vice-president Paul M. Lincoln, of Pittsburgh, then took the chair and declared the twenty-eighth convention adjourned.

CONVENTION NOTES.

Mr. Louis A. Ferguson gave an enjoyable luncheon to his fellow past-presidents of the Institute at the South Shore Country Club on Thursday at which problems of society development were discussed. The party included Messrs. T. C. Martin, Frank J. Sprague, F. B. Crocker, C. P. Steinmetz, B. J. Arnold, J. W. Lieb, Jr, S. S. Wheeler, D. C. Jackson, Gano Dunn and the host.

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There were several college reunions during the convention, including luncheons for the Boston "Tech" men at Vogelsang's Restaurant on Thursday and for the University of Wisconsin engineering alumni at the Grand Pacific on Friday.

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Following the example of the New York N. E. L. A. convention placards were displayed at each session during parallel sessions showing what paper was being discussed at the other. Calls to the telephone or other messages were displayed silently by stereopticon without interrupting the proceedings.

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President Jackson was forced to leave for the East on Thursday evening. Messrs. Percy H. Thomas, Paul M. Lincoln, D. B. Rushmore, J. G. Wray, George F. Sever and A. S. Langsdorf made acceptable presiding officers in his absence and at parallel sessions.

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The convention arrangements in the hotel were excellent, but owing to the very large attendance it was sometimes difficult to make one's way about in corridors and lobbies.

The daily list of arrivals prepared under the direction of Assistant Secretary Hutchinson was helpful and accurate.

Thanks are due many Chicago members for placing their automobiles at the disposal of delegates.

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Mr. Henry M. Byllesby took advantage of the convention to give an elegantly appointed dinner to about sixty gentlemen at the Chicago Club on Thursday evening, June 29. The table decorations and lighting effects were unique and beautiful. The large table was shaped like an hour-glass with ponds, goldfish, ferns and flowers at each end. A miniature electric railway encircled the ponds, while overhead a miniature aeroplane moved above the guests. There was a miniature "wireless" sending station and many other ingenious novelties. After an invocation by Rev. Dr. Page there were speeches by Mr. Byllesby, Mr. C. G. Dawes, president of the Central Trust Company of Illinois; Prof. D. C. Jackson, of Boston, president of the institute; Mr. George M. Reynolds, president of the Continental and Commercial National Bank; Mr. Samuel Insull, president of the Commonwealth Edison Company; Mr. Gano Dunn of Ampere, N. J., president-elect of the Institute, and Mr. B. J. Arnold, of Chicago. Among the other guests were Messrs. Reginald Belfield, of London; Horace G. Burt, of Chicago; D. B. Rushmore, of Schenectady; E. G. Cowdery, of Chicago; Prof. F. B. Crocker, of New York; Mr. L. A. Ferguson, of

Chicago; Mr. J. B. Forgan, of Chicago; Mr. A. S. Huey, of Chicago; Mr. H. H. Kohlsaat, of Chicago; Mr. T. C. Martin, of New York; Mr. E. W. Rice, Jr., of Schenectady; Mr. Charles F. Scott, of Pittsburgh; Mr. Frank J. Sprague, of New York; Mr. M. B. Starring, of Chicago; Mr. B. E. Sunny, of Chicago; Mr. Hugh M. Wilson, of New York, and Mr. S. S. Wheeler, of Ampere, N. J.

The speeches were in earnest vein, following the example set by the host, and related to the economic and industrial condition of the country. The dinner served also to enable a number of visiting engineers to become acquainted with some of the leading men of affairs of Chicago.

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About fifty members of the Tau Beta Pi fraternity among the delegates to the convention held an informal dinner in the Gray Room of the Hotel Sherman Wednesday evening, June 28. Among the members of the fraternity present at the meeting were President Dugald C. Jackson, of the institute; President-elect Gano Dunn; Past-presidents Charles P. Steinmetz, Bion J. Arnold and John W. Lieb, Jr., and Messrs. P. Junkersfeld, R. F. Schuchardt, W. L. Abbott, A. N. Motter, J. R. Bibbins, Elwood Grissinger, Prof. W. F. M. Goss, of the University of Illinois; Prof. C. F. Harding, of Purdue University; Prof. George D. Shepardson, of the University of Minnesota; Prof. H. V. Carpenter, of Washington State College, and Prof. P. B. Woodworth, of Lewis Institue, Chicago. The dinner was arranged by Mr. Ralph H. Rice, of the board of supervising engineers, Chicago Traction.

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A reception and tour through the galleries of the Chicago Art Institute was arranged for the visiting ladies of the convention on Wednesday afternoon. Following the reception the party was divided into groups, under the direction of persons connected with the Art Institute, who conducted the ladies through the galleries, explaining objects of interest. A 5 o'clock tea followed the gallery tour.

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The ladies of the convention were entertained at luncheon at the South Shore Country Club on Thursday. Automobiles left the Hotel Sherman at 11 a. m., taking the ladies out to the club over the South Park boulevards. An orchestra was provided at the club for the occasion, and during the luncheon Venetian gondoliers dressed in native costume strolled through the dining-room singing boat songs. A handsome menu formed the souvenir of the luncheon. Returning, the party was taken in automobiles for a trip through the West Park system, reaching the Hotel Sherman about 6 p. m. Sixty-five ladies attended the luncheon and reception.

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Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers since 1885, presented his resignation to President Jackson at the convention, as noted elsewhere. Mr. Pope has been a conspicuous figure in the upbuilding of the great national engineering society with which he is connected and in doing so has become very widely known to the electrical engineers of the country. For some time, however, he has been planning to transfer his burden to the shoulders of younger men, and there has been considerable discussion of the manner in which the step should be taken. Mr. Pope's resignation is to take effect Aug. 1, when he will be made honorary secretary, receiving the same salary as at present and will have charge of section affairs under the general direction of the sections committee and the future secretary. By this plan the institute still has the benefit of Mr. Pope's counsel and services while expressing in a substantial way a realization of the value of the work which he has done for the Institute, and, indeed, for the whole industry. Mr. Pope was elected secretary of the Institute on May 19, 1885, succeeding Mr. T. Commerford Martin, who had been appointed acting secretary to fill the vacancy caused by the resignation of Dr. Nathaniel S. Keith, the founder of the American Institute of Electrical Engineers, and its first secretary. Mr. Pope was at that time associate editor of the *Electrician and Electrical Engineer*. During the following two years it became evident that the growth of the electrical industry required that the secretary should devote practically his entire time to the affairs of the Institute and plans to this end went into effect in 1888. Concurrently the first independent office of the Institute was established at 5 Beekman Street. Perhaps the most important improvement introduced at this time was the organization of monthly meetings which appeared necessary in order to keep abreast of a rapidly growing art. This was followed by the publication of the *Proceedings* monthly, and the issuance of an annual volume. In 1893 the establishment of sections was suggested and the entire plan was outlined in a paper presented by Mr. Pope at a meeting of the Institute Oct. 18, 1893. Local meetings were held in Chicago in 1894, the first being fixed for March 21. This was of unusual interest for the reason that it was simultaneous with the New York meeting, and connection by telephone was established between them through the courtesy of Mr. Edwin J. Hall. The question of local meetings languished, however, until 1902, when, under the administration of President Scott, it became a well-recognized development of the policy of the Institute. Mr. Pope's previous experience in journalism, telegraphy and railroad accounting was of great value when devoted to requirements of the secretary's office. He believed that the affairs of the Institute should be conducted on business principles, and this has been an important factor in its numerical growth and financial standing. A committee has been appointed to consider the selection of a temporary secretary.

The St. Louis Public Service Situation.

In a speech made at a dinner given in his honor by the St. Louis Section of the National Electric Light Association on June 24 Mr. Alten S. Miller, retiring president of the Union Electric Light & Power Company, of St. Louis, took occasion to allude to the relations of that company to the city government. He referred to the organization of the company as highly efficient, but said that the stockholders were not receiving a fair return on their investment, owing to the concessions demanded by the Public Service Commission of the city, and also, perhaps, to the policy of a board of directors in having too much confidence in public fairness and gratitude. As reported in the newspapers, Mr. Miller continued:

"The situation is a strange one. The Municipal Assembly has passed an ordinance under authority of a statute which gives power only to fix rates. The ordinance does not fix rates, but regulates the rates and operation of the company. Most of the regulations are reasonable and have been followed by the company for years. The company is willing to make a rate for residences that will average lower than 9½ cents per kw-hour, this rate to be arranged in such a maner as to stimulate business. The company went so far as to have an ordinance prepared that would give the city practically all it asked for, but when this ordinance was presented to the company's counsel he advised that it was subject to the same legal objection as the Municipal Assembly ordinance in that it regulated rates, whereas the city has only the right to fix rates. In the words of 'Pooh Bah,' 'Here's a pretty mess.' As a result of a series of blunders the city has passed an act which we are told by counsel, and believe, cannot be enforced."

In concluding Mr. Milller gave his former associates in the company this advice: "If you do not believe in the honesty and good intentions of the management, you should go elsewhere. You can accomplish little without confidence in your employers and associates. If you are convinced, you must shout it from the housetops. Tell

your neighbors and friends and their friends that the company is fair and reasonable; that it has spent millions and is entitled to a fair return on the money so spent; that it is entitled to some consideration for its good service to the public and to some share of the saving made through economical management. In time the people will realize that you are right."

Street Lighting and Franchise Controversy at Chisholm, Minn.

A pending lawsuit at Chisholm, Minn., in regard to a franchise and street-lighting contract has recently been settled by the passage of a new franchise ordinance for the electric-light and power company. This controversy arose primarily out of alleged failure of the Range Power Company to give adequate electric-light and motor service. The village of Chisholm is a rapidly growing town of about 5000 population in the heart of the famous Mesaba iron-mining district, and is near to several large iron mines. In 1908 the town was practically destroyed by forest fires, and soon after the Range Power Company was given a twenty-seven-year franchise. The company was operating a gas engine and producer previous to the burning of the town with but poor success. After the fire the company continued to operate with gas engines and producers by adding apparatus, but the results remained unsatisfactory. Interruptions to service were frequent and voltage fluctuations and low voltage were common, even during the time the plant was in operation. To make matters worse, the town and the company's business grew so rapidly as to overload the plant, in spite of the poor service, as a rapidly growing mining town demands electric-light service even if it is not of the best. Protests were made by city officials and by mass meetings of citizens against the kind of service which was being rendered, but the company seemed unable to cope with the situation. Frequent serious breakages of gas-engine parts occurred and the overhauling of the machinery seemed only to be followed by further accidents and interruptions.

After two years of poor service the village board cast about to see what relief could be obtained and the company's ordinance as drawn seemed to offer some opportunity for action by the city. This ordinance provided for all-night service except in certain contingencies, such as fire, riot, etc., when the company might be excused temporarily. It also provided that the street arc lamps should be of 1200 cp each (nothing being said as to this being a nominal rating) and that the city had the privilege of hiring an expert to test the candle-power, and if the lamps were found to be less than 1200 cp the expense of the test was to be paid by the company and no money paid by the city for the service. The ordinance also provided that poles and wires be maintained in safe condition. In September, 1910, to conform with the ordinance, the city employed Mr. J. R. Cravath, of Chicago, as expert to conduct a test of the candle-power of street lamps and a forty-day test on the general character of the service rendered, both for street and commercial-lighting purposes. This test covered the candle-power of street arc lamps, interruptions to street-lighting service, street lamps out and in bad order, interruptions to commercial incandescent electric-lighting service, voltage regulation of incandescent service and safety of the company's pole lines and other devices.

In the report of this test, which was rendered to the village board in November, it was first pointed out that actual 1200 cp is a commercial impossibility with the 4-amp magnetite series-arc lamps used. Manufacturers' tests in printed matter showing a maximum of less than 700 cp and National Electric Light Association street-lighting committee reports rating such lamps at 480 cp were quoted. It was shown that to comply with the terms of the ordinance a 6.6-amp magnetite arc should have been installed. Tests made on the lamps in actual service at Chisholm showed poor maintenance conditions. These showed candle-powers at the most favorable angle of from 516 maximum to 84 minimum. A number of lamps were found to be giving very low candle-power, which was presumably due to electrode troubles or dirty globes, as voltage measurements on the dim lamps showed voltages from 65 to 70, as in the case of the best lamps.

As regards the 1200 cp named in the franchise contract, it was pointed out that there was no excuse for ignorance on this subject by those engaged in the electric-light and motor business in 1908, when it was drawn. For several years previous to that time there had been extensive discussion of the old, erroneous readings of arc lamps, both in the conventions of the National Electric Light Association and in the technical press. The tests showed that the current and voltage supplied to the lamps were slightly in excess of that at which the lamps were rated. During the forty days of the test the street-lighting service was off 149 hours, owing to the inability of the station to carry the load during the early evening hours. Records of individual lamps out while arc service was on showed a large number of lamps in bad order.

Interruptions to incandescent-lighting service in the forty days' test totaled twenty-six hours and fifteen minutes during ordinary lighting hours. Voltmeter readings taken by means of recording voltmeters located at different points and by means of a portable voltmeter at a considerable number of points each day showed voltages ranging from 112 to 50, voltages between 80 and 90 being very common on some dates. The report also called attention to the fact that the company's secondary circuits were not grounded as recommended by the American Institute of Electrical Engineers and the National Electric Light Association; that as a precaution for public safety this should be done and that the city should require it and insist on connection being made to the city water mains.

After receiving the engineer's report the village board, acting under legal advice, declared forfeited the street-lighting contract of the company because of lack of fulfilment of its conditions, and also declared void the company's franchise ordinance for lack of fulfillment. Proceedings were immediately begun by the city to bring suit in order to get an order of court confirming these actions by the City Council. The company's representatives admitted the inadequacy of the service which had been rendered, but maintained that the interruptions had been due to causes beyond the company's control. In the fall of 1910 it installed a steam engine of 400 hp with two 150-hp boilers. With the aid of this steam apparatus it was able to give considerably better service. In the hope that municipal purchase and operation would afford relief from the intolerable service the city employed Mr. Charles L. Pillsbury, of Minneapolis, as consulting engineer to make an appraisal of the company's property. Mr. Pillsbury reported a valuation approximately equal to the bonds on the property, and the city offered the company a sum considerably in excess of the appraised valuation. The officers of the company refused this offer.

At the last moment before the case was to be tried an agreement was reached whereby the company received a new ordinance which had been passed by the Council and goes into effect upon acceptance by all of the bondholders. This ordinance gives the company a twenty-five-year franchise and a contract to supply 4-amp magnetite, constant-current luminous-arc lamps, taking 60 volts to 70 volts at the lamp. It is elsewhere specified that these lamps shall give approximately 480 cp from 10 deg. to 15 deg. below the horizontal when in street use. They are to be maintained in service 3650 hours a year. The price is to be $120 per year per lamp. The maximum rate for commercial lighting service is to be 11 cents, with discounts for quantities, instead of 14 cents as before. A minimum service charge of

50 cents per month is allowed. For motors a minimum charge of 50 cents per horse-power per month is provided. Provision is made for revision of the company's rates at certain periods throughout the life of the ordinance, such revision being made by arbitrators appointed in the usual way, one arbitrator by each party and the third by the two so chosen. Provision also is made for purchase by the village of the company's plant at certain stated periods upon notice being served by the city. In such an event the valuation is to be made by arbitrators on the basis of the cost of reproduction of the plant less proper depreciation. The purchase price is to be 10 per cent more than the valuation. The earning capacity, goodwill and franchise are not to be considered in determining the valuation.

From the standpoint of the city this ordinance is an improvement over the old one because of the relief it affords from inadequate service by purchase of the plant by the city. From the standpoint of the company it is an improvement because it does not require arc-lamp candle-powers of impossible realization with the apparatus now installed. The maximum rates are 11 cents per kw-hour in the new ordinance as against 14 cents in the old. The city officials of Chisholm were apparently actuated by no particular desire to have municipal ownership of the plant, but simply by a desire to get adequate service. The whole trouble seems to have arisen from an overestimate on the part of the company of the ability of some of the older types of gas engines and producers to give reliable service. While the experience of the Chisholm company with a gas-producer plant has been disheartening, it should be remembered that gas-engine and producer plants are being successfully operated in numerous cases over the country, and that failure in this case is to be attributed to the particular unfortunate conditions existing in this plant rather than to gas-engine producer plants in general, including failure to recognize that the successful operation of a plant of this kind calls for men skilled in gas-engine and producer operation.

Massachusetts Legislative Notes.

The bill providing for the electrification of steam railroads at Boston subject to the supervision of the Railroad Commission has been referred to the next Legislature by the Senate, the vote being 19 to 13 against the passage of a law requiring electrification by the present Legislature. This action destroys any hope of an electrified suburban service based upon a compulsory act in 1911. There is still some prospect that a bill authorizing the New York, New Haven & Hartford Railroad to build a tunnel under Boston Harbor will be passed at this session, and if this is done, a provision for electrification between Readville and Lynn is regarded as practically certain. With the approval of Chairman Hall, of the Railroad Commission, a bill has been introduced giving mandatory instead of recommendatory powers to the commission, including the power to originate investigations of rates and service.

Massachusetts Commission News.

The Buzzards Bay Electric Company has petitioned the Gas & Electric Light Commission for authority to extend its lines into the towns of Bourne, Barnstable and Sandwich. The Fall River Electric Light Commission has petitioned the commission for the right to issue $200,000 of additional stock, to meet the cost of plant extensions and improvements.

Two new petitions bearing upon the question of rates have been received by the Gas & Electric Light Commission, one coming from consumers of the Natick Gas Light Company's service and requesting a reduction in the price of gas, and the other from residents of Revere, praying for a reduction in the price of electricity.

New Jersey Commission News.

The New Jersey Board of Public Utility Commissioners has recently approved an ordinance of the borough of Penns Grove granting franchises to the People's Rural Telephone Company and has also approved the proposed issue by the West Jersey & Seashore Railroad Company of 5 per cent mortgage bonds to the amount of $1,089,000.

A hearing has been held by the board on the complaint of Cochran, Drugan & Company, manufacturers, whose works are located across the line dividing Hamilton Township from the city of Trenton. The Trenton & Mercer County Traction Company charges a 10-cent fare to this point, which the complainant alleges is more than is charged for greater distances in other directions by the same company, and places it at a disadvantage in the employment of labor. The company contended that the terms of its franchises do not admit of its collecting more than one fare in Hamilton Township, and that if it extended the 5-cent fare zone beyond the boundary line it would be unable to collect an additional fare for a trip of several miles through the township.

New York Commission News.

The New York Public Service Commission, Second District, has received a petition from the Olean Electric Light & Power Company for an order authorizing the issue of $185,000 first-mortgage 5 per cent forty-year gold bonds. The proceeds are to be used for the construction and equipment of a new generating station at Sears and the building of a high-tension transmission line from Sears to the city of Olean and making improvements to its present distributing system in the city of Olean, for an additional distributing line to the city of Allegany, acquiring and installing a new arc-lighting system in the city of Olean, and for the refunding of present mortgage indebtedness.

The village of Hunter, Greene County, has petitioned the commission for an adjustment of certain difficulties that have arisen between it and the Schoharie Light & Power Company because of the expiration on Nov. 1, 1910, of a five-year contract for street lighting which was held by the Schoharie company. The village alleges that it has elected to exercise the right to renew this contract for a further term of five years at the same price, but that the company refuses to accept the renewal and desires an increased rate. Negotiations for a new contract having finally failed, the company shut off the supply of service and the commission is now asked by the village authorities to adjust the matter. The price paid under the old contract was $15 a year for thirty-four incandescent lamps of 32 cp each, the contract further providing that the company should install and maintain without cost to the village one 2000-cp inclosed-arc lamp. As a further cause of complaint against the company the trustees allege that in violation of the conditions of the franchise under which the company operates, the company arbitrarily refused to change the location of several poles in accordance with the request of the municipal authorities. A copy of the complaint has been served upon the company with the direction that answer be made within five days provided the street-lighting service is not at once renewed. In case the company is willing to renew the street-lighting service it may have twenty days in which to make answer.

Maryland Commission News.

The Maryland Public Service Commission has received an application from the Baltimore & Washington Transit Company for permission to reorganize and issue second mortgage 5 per cent bonds to the amount of $50,000, as i

as been unable to redeem the December interest coupons n its outstanding $100,000 bond issue and is in need of iore money with which to extend and complete its system. : is understood that those interested in the project have greed to subscribe to the new bond issue which the comiission is asked to authorize.

The Baltimore city administration filed with the commison its complaints against the rates charged by the Con-›lidated Gas, Electric Light & Power Company for gas nd electricity. City Solicitor Edgar Allan Poe submitted oth complaints to Mayor Preston and the latter promptly pproved them. They were at once filed with the Public ervice Commission. Messrs. Charles M. Cohn, general ıanager of the gas division of the company, and Herbert .. Wagner, general manager of the electric division, actıg under the direction of President J. E. Aldred, of the ›mpany, held a long conference with the members of the ›mmission relative to the procedure to be adopted by the ›mpany in filing its answer to the complaints. The comiissioners were assured by these gentlemen that the comany was both willing and anxious to have the question as › rates threshed out before that body, and, speaking for ıe company and Mr. Aldred, Messrs. Cohn and Wagner ıformed the commission that every assistance would be iven the commission in the examination of the company's ooks and property.

The price of electricity, especially to small consumers, ›ill be investigated by the Public Service Commission. he company charges small consumers 10 cents a kw-hour, ›hich the petitioners declare is unjust and unreasonable. he matters to be examined by the commission, as stated in ıeir resolutions adopted last week, are: First, whether the rices charged by the Consolidated Gas, Electric Light & ower Company for electricity are unjust and unreasonble. Second, whether such charges are unjustly disriminatory or unduly preferential. Third, whether the ommission should determine the reasonable charges to be reafter in force as the maximum for the service.

The Jubilee of the Dynamo.

By Brother Potamian.

Among approaching celebrations is one to be held in ›t in honor of the fiftieth anniversary of the construction f the first commercial-type dynamo by Dr. Antonio acinotti in 1861. In 1860, while a student under his father t the University of Pisa, the young inventor, then in his ineteenth year, had the matter of a direct-current machine ell in mind. He had a clear apprehension of the principles nd mechanism by which such currents could be generated nd utilized. He did not, however, rush into print, but ather delayed public announcement of the work upon which e was engaged until he had settled all details and con-ructed a model that realized his expectations. Three ears later, in 1864, he wrote a full account of his invention nd published it in the columns of the *Nuovo Cimento*, ›gether with an illustration of the little machine itself.

Pacinotti's invention attracted very little attention at ne time; indeed, it was not until 1881 that the originality nd merits of the invention were publicly recognized, and ıen by the award of a diploma of honor at the Paris Ex-›tion of that year.

In his experimental machine Pacinotti used for the first me the ring armature with its symmetrically grouped coils ›nnected to the bars of the commutator, an arrangement ıat was reinvented by Gramme and embodied by him in the ynamo which he gave to the industrial world in 1870.

Pacinotti seems to have resembled Faraday in his prefernce for the field of research rather than for the field of deelopment and exploitation. Having discovered the comıutated-ring armature and satisfied himself of its usefuless as a generator of direct currents, he left to the ingenuy of others the task of converting his laboratory model into a thoroughly practical and commercially efficient machine.

The principle of reversibility did not escape the attention of the young Pisan investigator, for he says in equivalent words that by supplying the machine with current it will work satisfactorily as a motor.

The reversibility of the Gramme machine was first shown by Fontaine at the Vienna Exposition of 1873, where the writer saw two similar Gramme machines connected electrically together and placed some 1600 ft. apart. The generator was driven by a gas engine; on closing circuit the distant machine was set in motion and used in the operation of a pump.

Many years later the writer saw another instance of the principle of reversibility. In this case it was the reversibility of the electrostatic machine, of the Winshurst type, shown by the inventor himself at his home on Clapham Common, London. The generator was a 12-in. machine; the motor, which was about 4 in. in diameter, responded

Antonio Pacinotti.

very well to the energy which was sent through its brushes, and even made its usually calm and phlegmatic inventor wax enthusiastic, for the nonce, over its excellent performance.

The early recognition by Pacinotti of the great principle which renders the electrical transmission of energy possible places him among the pioneers of science and the benefactors of humanity. He is now in his seventy-first year (born June 17, 1841), professor of technological physics in the University of Pisa and Senator of the Kingdom of Italy.

Interesting matter connected with this first chapter in the history of the modern dynamo will be found in the library of the American Institute of Electrical Engineers. No. 1601 of the catalog of the Wheeler gift contains the six pages of the original article, with illustrations, published in the *Nuovo Cimento* in 1864 under the title of "Descrizione di una Macchinetta Elettro-Magnetica." No. 2444 consists of an autograph letter and memoranda, sketches and photographs (of father and son) furnished by Pacinotti to the late Mr. Franklin L. Pope to assist in the preparation of an article from his gifted pen which, under the title "The Genesis of the Modern Dynamo: Antonio Pacinotti," appeared in the *Electrical Engineer* in September and October, 1892.

CURRENT NEWS AND NOTES.

Electrical Engineering at Massachusetts Institute of Technology.—Besides graduating the largest class ever passing from the undergraduate course, the Massachusetts Institute of Technology conferred one degree of doctor of engineering and four degrees of master of science on men taking graduate work in electrical engineering. The applicants for permission to become candidates for advanced degrees in electrical engineering are already more numerous than they were last year, and particularly is this true in respect to graduate students who intend to study the problems of electric railroads, electric transmission of power and the organization and management of publicservice companies.

GROUNDING IN DENVER.—The Denver Gas & Electric Company now has all its secondaries grounded, utilizing the water mains entirely. Its distributing system is also grounded to a city hydrant on each block, and its regulations require that all new interior installations shall have the neutral and the conduit grounded to the largest available water pipe within the building.

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BOSTON EDISON SERVICE ADOPTED BY CARLISLE.—The Edison Electric Illuminating Company of Boston has entered into a ten-year street-lighting contract with the town of Carlisle, Mass., which lies in the outer suburban area at the west of Lexington and Bedford. The town has a population of about 600, a street length of about 37 miles and an area of 16.1 sq. miles. About 4.2 miles of streets will be covered by Edison lighting and power service in the initial installations. The most remote point in the town is about 23.5 miles from the company's generating station in South Boston. It is expected that electricity will be applied extensively in this community for both agricultural and domestic service.

* * *

ELECTRIC-VEHICLE INVESTIGATIONS.—The electrical engineering department of the Massachusetts Institute of Technology has received an appropriation of $3,000 from the Edison Electric Illuminating Company of Boston to be used in an investigation of the relative operating reliability and cost of electric trucks, gasoline trucks and horse trucking, for the purpose of determining to what degree electric trucks are adapted to compete with gas and horse trucks in the city of Boston. This investigation will cover the cost of delivery of goods in the different ways and comprise all questions which concern electric trucks, including the influence of the different kinds of city pavements on cost of delivering goods and the effects of different routings of the vehicles. The investigation will be partly theoretical, but it will be planned to determine practically what it ordinarily costs to deliver goods under city conditions. This part of the investigation will be accompanied by actual observations extended over a period of many months. At least a year will be occupied in this work and Mr. H. F. Thomson has been appointed research associate to carry on the work under the direction of Professor Pender.

* * *

NOVEL ELECTRICAL PARTY AT FALL RIVER, MASS.—A party of officers and employees of the Fall River (Mass.) Electric Light Company, with their wives, was recently given a novel entertainment at the home of Mr. and Mrs. F. S. Root. Invitations were issued to "A Shocking Affair," the cards being decorated by drawings of streaks of lightning. Upon arriving at the house the guests were subjected to a number of so-called shocks, arranged as follows: Shock No. 1 consisted of cartoons of those in attendance thrown upon the screen by means of an electrically illuminated post-card projector. The second shock consisted of the identification of various groups of objects representing some electrical term, the word "in-can-descent" being prepared by a bottle of perfume in a tin can; the word transformers being represented by boxes of cold cream, rouge, puffs, etc., and the word tungstens being indicated by ten shoe tongues. In the third event the guests performed various "stunts," including a game of ring toss in which an incandescent lamp was lighted whenever the ring was successfully thrown over two miniature lighting poles. Another incident was the playing of a game similar to "pit" in which the word "electricity" was used in place of the usual cards. Score cards were in the form of incandescent lamps. Refreshments were served at a table decorated with a model of the company's main generating station, including a pole line wired with miniature lamps with colored bulbs. From the lighted station came the hum of a small motor, and smoke produced by smoldering cott issued from the chimney in a lifelike fashion. Curre was supplied from a dining-room chandelier, the realist wires being concealed by the smoke from the chimne The affair was unanimously voted a great success by tl participants. The host is in charge of the power sal department of the company.

* * *

ILLUMINATING ENGINEERING SOCIETY CONVENTION I CHICAGO.—The date of the forthcoming convention of tl Illuminating Engineering Society to be held in Chica has been fixed for Sept. 25, 26 and 27. Mr. John F. G christ, of the Commonwealth Edison Company, 120 We Adams Street, is serving as chairman of the conventi committee.

* * *

ENGINEERING DEGREES AT UNIVERSITY OF ILLINOIS.—Tl College of Engineering of the University of Illinois at tl commencement exercises on June 14 conferred the bac elor's degree in engineering upon 202 men, the maste degree upon nine men and the professional degrees of ci engineer, mechanical engineer and electrical engineer up eight, four and five men respectively.

* * *

ST. LOUIS N. E. L. A. SECTION.—At a meeting of t St. Louis Section of the National Electric Light Associ tion (Union Electric Light & Power Company) held June 24 officers for the ensuing year were elected as f lows: President, Mr. B. F. Crouch; first vice-preside Mr. E. H. Tenney; second vice-president, Mr. Orrin Hu secretary, Mr. H. G. Kislingbury; treasurer, Mr. D. Scullin.

* * *

OVER 9000 N. E. L. A. MEMBERS.—The successful a ministration of Mr. W. W. Freeman as president of t National Electric Light Association came to a close Ju 30 with a total of no less than 9214 members. He beg his term with a total of 5736, which shows a gain of 34 for the twelve months. This is, of course, unprecedent in the annals of engineering bodies, but it is believed th the coming year under President Gilchrist may see t figures matched, as there is a strong movement on foot all parts of the country toward the formation of compa sections and the affiliation of state associations. There a indications that the membership during the coming ye will easily reach not less than 12,000.

* * *

ANNIVERSARY BOOKLET OF BOSTON EDISON COMPANY. In connection with the twenty-fifth anniversary of t organization of the Edison Electric Illuminating Compa of Boston, Mass., an attractive booklet of forty-three pag has been published, reviewing the history of central-stati development in Boston during the quarter century that h elapsed since the inauguration of service from the origi station near Head Place. The booklet describes the sali events which have occurred during the growth of the co pany from these small beginnings to a system embraci 600 miles of territory, a population of about 1,000,000 a over 1300 employees. The first station contained a 90- engine belted to two Edison dynamos capable of supplyi 500 incandescent lamps, while to-day the company has generating capacity of about 70,000 kw, with maxim units under construction or in contemplation of ab 14,000 kw. Nearly forty municipalities are supplied w the company's service. The booklet contains numer illustrations of the company's generating plants and s stations, a map of the initial and present systems, chronolo of important events in its life, and a valuable table of ca talization, earnings, expenses, dividends, sales of sto customers, connected load segregations, rates and el trical sales by years for the entire period of 1886 to 19

A BRITISH DISTRICT-SUPPLY SYSTEM.

unston Generating Station of the Newcastle-Upon-Tyne Electric Supply Company.

THE Northeast Coast Power System now covers an area of over 1000 square miles, extending from Blyth in the north to Guisboro in the south, and estward from the coast to Consett and Bankfoot, England. .t the present time it is supplying some 150,000 hp of plant, n connection with railways, tramways, collieries, shipyards, ghting, heating, cooking and chemical works.

Its principal generating station is at Carville-on-Tyne, hich is coal-fired, while it generates a large quantity of nergy at stations utilizing waste heat from coke ovens, owing engines, etc. The principal of these are at Blay-n, Newport, Weardale, Bankfoot and Bowden Close. thers are in process of construction at Redcar, Port Clar-nce and elsewhere. The steady growth in the company's usiness has entailed the erection of an additional coal-fired ation which has been recently built at Dunston-on-the-yne and is here described.

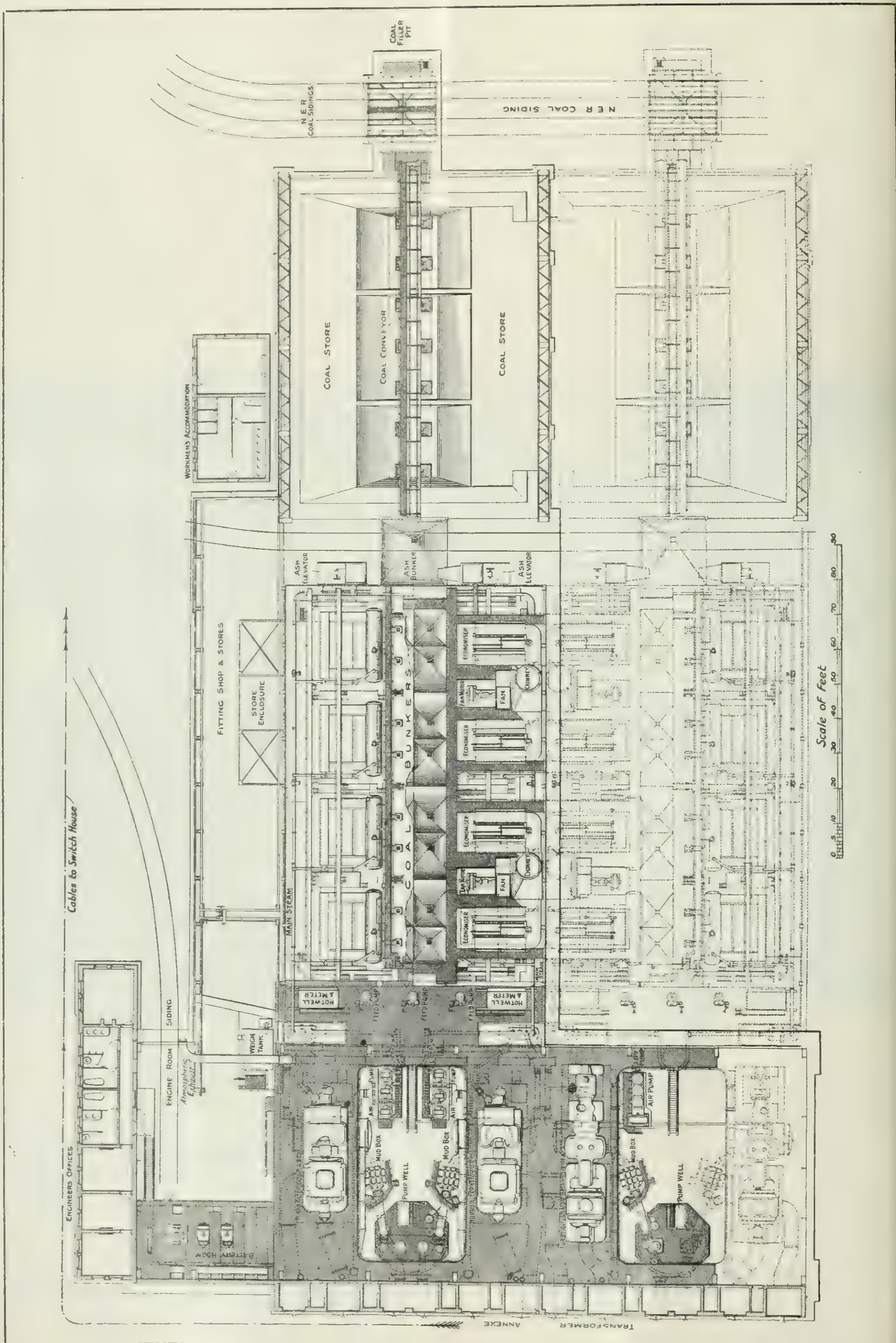
The Dunston power station of the Newcastle-upon-Tyne lectric Supply Company—one of the largest and most re-ntly designed power stations in Europe—contains several ovel features. Its construction was decided upon by the ompany about three years ago in order to provide for the ontinued increase in business, amounting to about 20,000 hp er annum. Although the company has still more spare nd at Carville, it was considered by the engineers to be etter to put the next instalment of generating plant higher p the Tyne. A site of about thirty and one-half acres was btained on the south bank of the Tyne at Dunston, about miles above the High Level Bridge and some 8 miles from Carville. One reason for this course was to obtain in the neighborhood of the station plenty of land for further new processes which are being attracted to the district as a result of the cheap electrical energy. The company is already supplying large electrochemical works near Carville, but the land available for future developments near Carville is not large, whereas at Dunston there is at present plenty of land available for future requirements. Another reason for this policy is that it has resulted in practically doubling the cable capacity of the very heavy cable network which exists on both sides of the Tyne. The Dunston station is situated near one end of the Tyne network and the Carville station is situated toward the other end. The cables are connected together at Carville by means of a tunnel constructed under the river and again higher up the river over the King Edward Bridge and the old High Level Bridge. It will therefore be seen that the erection of the Dunston station improves the position of the company not only from the point of view of generating-station capacity but also to a most important extent from a distribution point of view also.

Fig. 1—Dunston Station of the Newcastle-Upon-Tyne Electric Supply Company.

As the Northeastern Railway has bridges over the Tyne both at Blaydon and at Newcastle, the Dunston power station being about equally situated between the two, coal supplies can be obtained with almost equal facility from either the Durham or the Northumberland coal fields. Condensing water is obtained from the River Tyne by means of suction pipes for each generating unit taken direct to the river.

GENERAL DESIGN.

The station generates three-phase currents at a frequency of forty cycles and a normal potential of 5750 volts. The steam pressure is 200 lb. and the steam is superheated, the total temperature being practically 570 deg. Fahr.


COAL FILLER PIT
N E R COAL SIDINGS
N E R COAL SIDING
COAL STORE
COAL CONVEYOR
COAL STORE
WORKMEN'S ACCOMMODATION
FITTING SHOP & STORES
STORE ENCLOSURE
ASH ELEVATOR
ASH BUNKER
ASH ELEVATOR
COAL BUNKERS
ECONOMISER
FAN MOTOR
FAN
CHIMNEY
MAIN STEAM
HOTWELL & METER
FEED PUMP
WEIGH TANK
Cables to Switch House
SIDING
ENGINE ROOM
Atmospheric Exhaust
ENGINEERS OFFICES
BATTERY ROOM
AIR PUMP
MUD BOX
PUMP WELL
TRANSFORMER ANNEXE
Scale of Feet
0 5 10 20 30 40 50 60 70 80 90

The station is designed to accommodate eventually six generating units, each of 8000 kw normal rating and 10,000 kw maximum rating. If further extensions are necessary it is intended to commence a new engine-room. The engine-room has so far been built for four units, of which there are already three installed.

For every two units there will be a boiler house, or three boiler houses in all. One has so far been completed. On each side of the boiler house there are four boilers, three of which are capable of supplying steam to drive one generating unit at full load, or eight boilers per house, so that eventually there will be twenty-four boilers in the station.

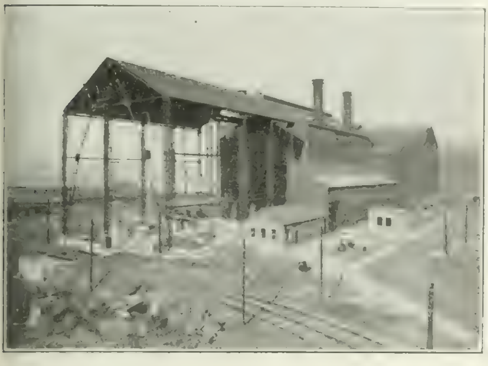


Fig. 3—General View of Station.

Fig. 5—Boiler-Room of Dunston Station.

THE BOILER HOUSE.

The general arrangement of the boiler house consists of a basement 18.5 ft. high in which the ashes are dealt with. Ash bunkers are provided under each boiler capable of storing the accumulation of ashes from fourteen hours' working at full load. This means that at ordinary load-factors each ash bunker need be cleared only once in every twenty-four hours. The ashes are removed by trucks which are hoisted by electric elevators and dump their load into an overhead ash bunker. This ash bunker has a capacity equivalent to from two to three days' working of the boiler house and is arranged over a railway siding so that ashes may be either taken away by rail or taken by railway trucks to the dock and dumped into barges.

The boilers are grouped together in pairs on the first floor, each boiler having its own superheater and economizer, but the gases from each pair of boilers are dealt with by one separately driven 65-hp fan and one chimney, both placed immediately over the corresponding boilers. Between the economizers, which are arranged overhead in pairs, and down the center of the boiler house are bunkers capable of holding a week's supply of coal, assuming the station to be operated at 50 per cent load-factor. The whole boiler installation is designed so that when working at maximum economy the chimney gases are reduced in temperature to below 300 deg. Fahr.

The coal, which is delivered to the receiving hoppers by bottom-dumping cars, passes first through a crusher and is then lifted by means of a Babcock & Wilcox conveyor capable of dealing with 40 tons of coal an hour. Advantage has been taken of the necessity for a conveyor to provide at the end of the boiler house storage for three weeks' supply of coal in addition to that in the bunkers over the boilers themselves. The inclosure is arranged to receive coal from the conveyor which feeds the boiler-house bunkers. Underneath the hoppers there is a tunnel for feeding the same conveyor, so that the one conveyor delivers coal direct to the boiler-house bunkers or delivers it to the storage bins or takes it from the latter to the boiler-house bunkers. The coal from the overhead bunkers is led by vertical gravity chutes direct to the receiving hoppers, whence it is fed into the boilers by Babcock & Wilcox chain-grate stokers, the grate area per boiler being 168 sq. ft. The economizers, of which there is one to each boiler, are

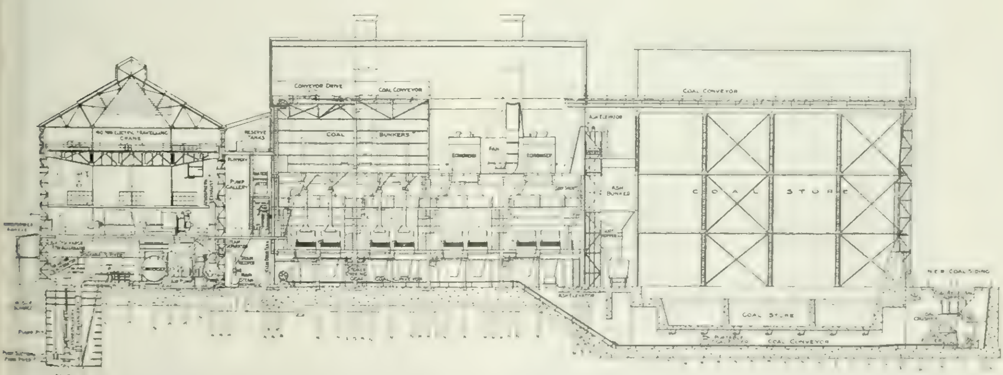


Fig. 4—Elevation of Dunston Station of Newcastle-Upon-Tyne Electric Supply Company.

situated at the top of the building, where the fans are also placed in a well-lighted and roomy economizer house.

The boiler house has a series of galleries at different heights for water tenders and in order to give access to the economizers, fan motors, etc. Each mechanical stoker and each economizer scraper is driven by a separate inclosed electric motor.

GENERAL ARRANGEMENT OF BUILDINGS.

The design provides that eventually there shall be three

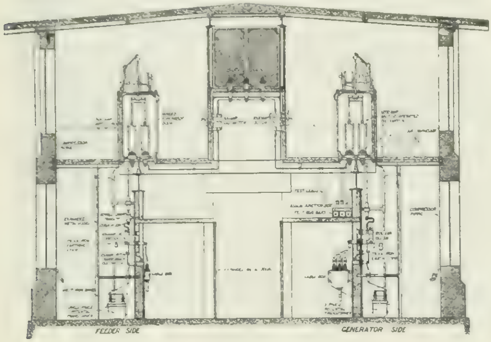


Fig. 6—Section Through Switch House.

end-on boiler houses, each with its own coal storage on the land side of the engine-room. The buildings are all steel frame structures, very little brickwork being used at all. All the main switchgear is arranged in a separate building about 450 ft. away from the engine house, thus allowing not only of a very light and convenient engine-room but of a switchhouse from which cables can be taken in and out on any side, thereby greatly facilitating future extensions.

ARRANGEMENT OF UNITS.

There is one coal-storage, boiler-house and coal-handling plant for each set of eight boilers, and one boiler house to each turbo-alternator unit. There is one main steam pipe, feed-water pipe, hot-well pump and ash-conveying plant for each set of four boilers. There is one economizer and coal

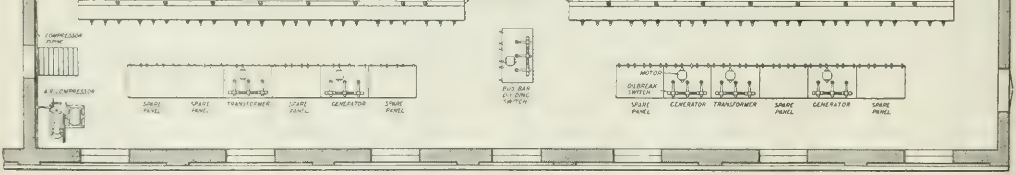


Fig. 7—Plan of High-Tension Switch Room.

chute for each boiler. Each turbo-alternator unit has its own set of engine-room and boiler-house auxiliaries, supplied with energy from an independent "unit" transformer.

TURBINE-ROOM.

The existing turbine-room, which has been built to accommodate four turbines, has a railway siding under a 40-ton overhead crane. Adjacent to the siding is a space at the ground-floor level which can be used for the accommodation of the different parts of a turbo-alternator during repairs or overhaul. This space communicates by means of a smaller overhead crane with the fitting and repair shop erected parallel to the first boiler house. Adjacent to this shop are offices, messroom and lavatories for the mechanical engineers in charge of the station and the engine-room staff.

The designers have aimed to get as compact an arrangement of machines as possible, so as to facilitate their opera-

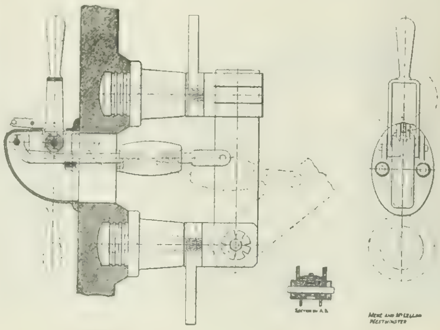


Fig. 8—Operating Gear of Isolating Switch.

tion, but at the same time to have everything, including auxiliary machinery, accessible to the overhead crane. This even applies to the circulating-water sumps, of which there will eventually be three, one for every two units. These circulating-water sumps are situated in the engine-room, midway between each pair of turbines, and go down a depth of 30 ft. below the engine-room floor level. In each circulating-water sump there are two main centrifugal pumps, one for each generating unit, and situated at such a depth that they are under water at all stages of the tide. The pumps have vertical spindles and are driven by 60-hp, three-phase electric motors installed on engine-room floor level. The suction of each circulating pump communicates by a 24-in. cast-iron pipe direct with the intake sumps at the river. The intake sumps are provided with gratings, and additional self-cleaning screens are provided for each condenser. One salt-water pump is also installed in each sump for supplying water for general cleaning purposes.

Contrary to Continental practice, at Dunston the necessary access to the turbines is secured by means of openwork cast-iron floor plates and galleries. The whole appearance of the engine-room, provided as it is with both a monitor

of and large windows running the whole length of the rth side, is light in the extreme. Behind the turbines on e same level and between them and the boiler house are e feed pumps, hot wells, water meters, etc., these being ranged to be operated by the turbine attendants. Be-

Fig. 9—Control-Room in Switch House.

ath the pump gallery are various smaller pumps, etc.; on same basement level are the condensers and electrically iven air pumps. The feed-pump exhausts can be taken ther to the hot-well tanks or to the water softener, or ssed direct to the atmosphere.

TURBO-ALTERNATORS.

Two of the turbine sets at present installed are of the llgemeine Elektricitäts Gesellschaft impulse type, and one of the Parsons-Richardson-Westgarth-Brown-Boveri type. he alternators are designed to stand the severest short-rcuits which are likely to come upon them in practice. e exciters are arranged on the ends of the alternator afts. The ventilating fans are on the alternators themlves, and the air is drawn in through special filters, there ing a separate duct and filter for each alternator. The tlet air ducts from the alternator are so arranged that hot air can either be discharged outside the building or the engine-room, thus making it possible to control the nperature of the engine-room at will.

AUXILIARIES AND STATION SUPPLY.

Three-phase current is used at 440 volts throughout the tion for motive power. The motor-driven auxiliaries beging to each unit are normally fed from a separate o-kw "unit" step-down transformer installed in a fireoof compartment opposite each alternator. The primary the transformer is directly connected, through switches, the main terminals of its own alternator so that the xiliaries are supplied even if the main alternator switch off. In addition to these separate low-tension threease circuits, for each unit, there is a common low-tension ree-phase system fed from the main high-tension busbars the switch house through two 500-kw, three-phase transrmers, which supply a set of busbars placed in an insed gallery in the engine-room. A supply can be given r starting up from these busbars to the auxiliaries benging to each unit. The fields of the exciters can be parately excited. Two 50-kw motor-generators provide supply of direct current at 100 volts for lighting the ation and for charging the station battery, which is kept circuit to insure an absolutely independent supply of lightg. A smaller motor-generator is also used for charging o control batteries used for operating the high-tension vitch gear. There are three batteries in all, the larger r lighting, giving 1000 amp for one hour, the two smaller o amp each. A 250-kw rotary converter supplies the ergy for the electric locomotives.

SWITCH GEAR.

The switch-gear arrangements at Dunston are perhaps the most interesting part of the station, showing, as they do, a distinct advance upon previous practice. Instead of the usual elaborate switchboard, which forms a striking feature of most power-house engine-rooms, the Dunston engine-room contain practically no high-tension switch gear or electrical instruments at all. With the exception of certain unobtrusive high-tension panels of "Ironclad" type controlling the "unit" transformers which supply the auxiliaries belonging to each generating unit, and an indicating wall ammeter for each generator, the high-tension gear and instruments are installed in a separate switch house 450 ft. away from the engine-room.

There is, however, in the engine-room near each generator a set of emergency gear for tripping the main high-tension generator switches in the switch house, with which is interlocked a field switch. Apart from these and the direct-current gear for motor-generators, there are practically no electrical connections or cables visible at all; ducts, etc., for the whole of the main cable wiring having been provided for in advance and so hidden.

SWITCH HOUSE.

The switch house is a building with a concrete roof 135 ft. long and 33 ft. broad by 32 ft. high. It has two floors and is divided into two divisions. The front of the building contains on the ground floor the offices, lavatories, etc., for the control-room engineer. The operating boards are on the first floor. The back part of the building, shut off by iron doors, is devoted to the switch gear itself, the main oil-break switches and busbars being on the upper floor, while the isolating switches, series and shunt transformers, etc., are on the underside of the lower room, in full view and accessible from the lower room with ladders, but absolutely out of reach of accidental contact.

CONTROL-ROOM.

The control-room is a well-lighted apartment, 40 ft. by 30 ft., with part glass roof. It is mainly occupied by the semi-circular operating switchboard (for feeders) and the smaller board for generators. The operating board of black slate is divided into sections, the generator and transformer

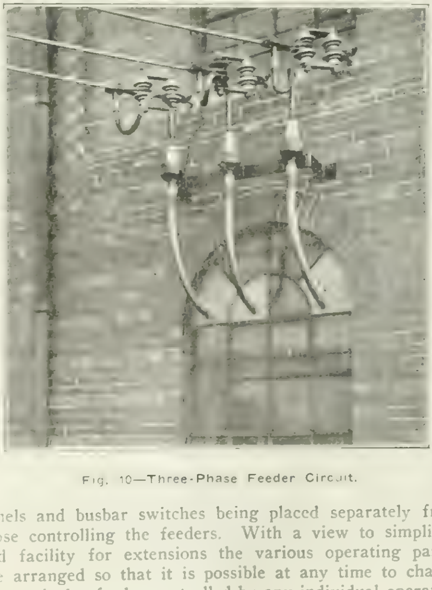


Fig. 10—Three-Phase Feeder Circuit.

panels and busbar switches being placed separately from those controlling the feeders. With a view to simplicity and facility for extensions the various operating panels are arranged so that it is possible at any time to change the particular feeder controlled by any individual operating

panel. The control gear is operated by means of direct current at a pressure of 100 volts from two small batteries specially used for this purpose.

GENERATOR AND FEEDER PANELS.

Each generator panel has a main ammeter and voltmeter, power-factor indicator, indicating wattmeter, field ammeter, watt-hour meter, etc. It also has a switch for controlling the governor of the turbine and a rheostat handwheel in front as well as a telegraph to each generator. At each end of the generator board is a synchronizing panel with a rotary synchronoscope. Each feeder panel on the feeder control board has a separate set of instruments and a set of synchronizing and voltmeter plugs for synchronizing any other generating station with the machines at Dunston. The feeders are protected with Merz-Price protective gear. Both the feeder and generating panels have throw-over control switches arranged to make or break the main oil-break switch immediately contact is made. The position of the main oil-break switch is indicated by the lighting of a red or blue lamp, and the operation last performed is automatically indicated by a small colored pin on the switch handle.

SWITCH-ROOM.

The switch-room itself has two floors. Access is obtained to the upper floor through an iron door leading from the control-room and to the lower floor from the passageway under the control-room. The busbars and main oil-break switches are on the upper floor and the connections and isolating switches and instrument transformers on the lower floor. The cables from separate generators or feeders are brought up through the ground into separate brick cells opening on to the central passageway in the lower chamber by an expanded-metal door. From the three-way dividing boxes the three single connections pass through the wall to a brick cell on the other side, which is accessible, by means of expanded-metal doors, from the outer passages running the length of the lower chamber. Each of these latter cells contains three single-pole main isolating switches as well as isolating switches for the shunt transformers which are placed on the ground below in a small brick cell, protected by sheet-iron doors. From the main isolating switches the three connections are taken up through expansion joints and series transformers to the bottom connections of the main oil-break switch in the ceiling, the switch itself being placed on the upper floor.

On the upper floor three molded stone slabs run parallel to each other along the room, being continuous except for a division of some 6 ft. or 7 ft. in the middle. The main 6000-volt busbars rest upon insulators on the central slab, which is 5 ft. high, and are protected by expanded-metal screens running up to the ceiling, thus forming a cage in which the busbars are placed and are visible for their whole length. The busbars are divided in the middle of the room by means of a main oil-break switch, capable of carrying 20,000 kw continuously. On the two side slabs are fixed the oil-break switches, the left side of the room being entirely devoted to feeders.

The main oil-break switches are of the British Thomson-Houston Company's type. The motors operating the switches are arranged to wind up a spring immediately the switch has operated, so that the make or break is instantaneous on the closing of the control switch. Each oil-break switch can be made "dead" by means of isolating switches, there being one set for isolating it from the busbar and one for isolating it from the incoming cables. The busbar isolating switches are situated under the busbar slab in the ceiling of the lower chamber, but the handles operating them are in the upper chamber on the side of the busbar slab, each one being opposite its own main switch. All the high-tension panels are provided with balanced protective gear.

In addition to the switch gear already described, there are in the engine-room a neutral isolating switch for each generator and a set of emergency tripping gear, by which th main generator oil-break switch in the switch house ca be operated from the engine-room. On the wall of th engine-room opposite each generator there is an indicatin ammeter and each generator also has its own "unit" tran forming set in the transformer annex.

The direct-current switch gear principally consists of 500-volt traction board and a 100-volt board, as well the main lighting distribution fuse board. The main direc current switchboard with the motor-generators is situat in the corner of the engine-room.

A NOVEL METHOD FOR MAGNETIZING TELE PHONE GENERATORS.

By H. P. CLAUSEN.

As indicated by the title, this article is a discussion a novel method for efficiently magnetizing the ste polarizing magnets of a hand-driven, two-pole-arm ture electric generator. Preliminary to this, however, brief discussion appears advisable covering the character tics of the current delivered by such a machine.

In building a generator suitable for use in connecti with telephone apparatus it is the standard practice to co struct the machine so that the armature will be rotate

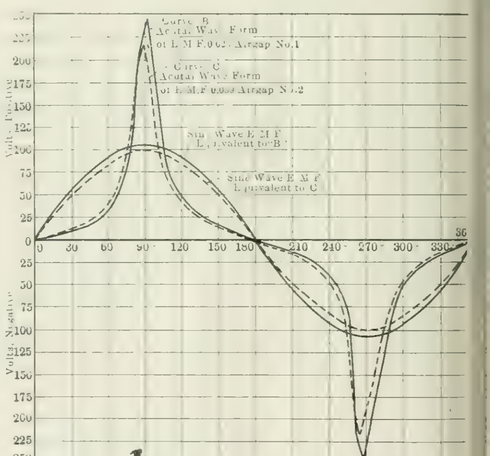


Fig. 1—Curves of Hand-Driven Generators.

approximately, five times for every revolution of the dri ing gear. Therefore, the average operator of the ha generator causes the armature to rotate so that current w be produced at about 20 cycles per second.

In order to secure a proper signaling margin it has be found necessary so to wind the armature that, with a system of permanent magnets applied, the current will delivered at somewhere around 80 volts. Therefore, in t building of a hand-driven generator, it may be assum that, with the armature rotating at the rate of 1000 r.p. and a voltmeter load of 1500 ohms, the current is deliver at about 80 volts.

In order to permit a study of the characteristics of alternating current delivered by a hand-driven generat it will be of interest to note Fig. 1. This diagram sho the current produced by two generators exactly similar so far as magnetic strength and windings are concern with the only difference that curve *B* shows the e wave-form of a generator having an air space of 0.023 between the armature and the pole piece, while curve

shows the form of wave when the same generator is provided with an air-gap of 0.039 in., the former curve being produced by machine No. 1 and the latter curve by machine No. 2.

In reducing the results of the direct measurement of the emf of the No. 1 and No. 2 machines it was found that

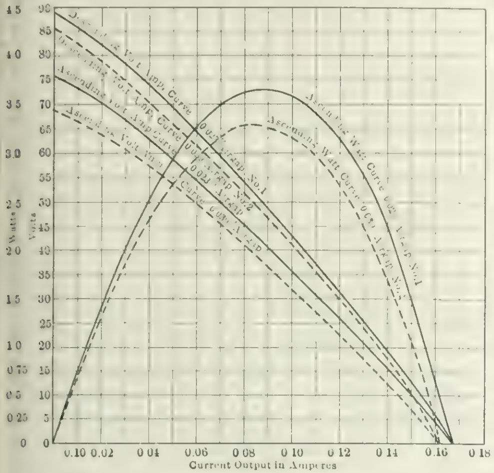


Fig. 2—Current Output of Two Machines.

while these machines are of standard construction, and, therefore, known as the regular 80-volt generator, the No. 1 machine, with the smaller air-gap, delivered about 245 volts at its highest emf, while the No. 2 machine, with the larger air-gap, had a maximum emf of 215 volts. In order to make the voltage measurement it was necessary to provide a contact upon the armature through which the voltage during a given instant could be measured. In order to accomplish the measurement a source of direct current was opposed to the current generated and when absolute balance was had in the potentials of the two sources current ceased to flow from one to the other and the emf of the opposing source of current was accepted as being equal to that generated by the armature at a given position. Upon reducing the emf curve to a sine-wave equivalent machine No. 1 produced the sine-wave B and machine No. 2 the form C.

Before leaving this subject reference may be made to Fig. 2, in which tests of the actual current output of the two machines are shown so as to compare the effect of the difference in the air-gap and the difference in the current delivered by the machines after they have been subjected to the demagnetizing influence of driving the machine with the armature windings completely short-circuited.

Referring to the diagram, it will be observed that machine No. 1, having the smaller air-gap, starts in with a voltage of 89 (the voltage measurements, it should be remembered, were made with a voltmeter having a resistance of 1500 ohms). Gradually increasing the load upon the generator while driving it at 1000 r.p.m., it is observed that as the current delivered increases the voltage drops until we arrive at a total current of slightly over 0.1675 amp. Now, without changing the conditions in any way, the load was gradually removed, with the result that when finally reduced to the voltmeter resistance, generator No. 1 delivered current at something under 76 volts. In other words, after building the generator and subjecting it to the short-circuiting operation, it was found to have dropped something under 15 per cent in the voltage which it was capable of generating.

In order to observe the effects of the larger air-gap machine No. 2 was started off at about 85½ volts and did not quite reach the 0.1675 amp point of machine No. 1, stopping at 0.161 amp, and, upon ascending, the voltage finally rested at slightly under 69, which gave a reduction of 19½ per cent.

From the above tests it will, therefore, appear that since it is impossible to prevent short-circuiting a generator winding while it is being driven, we find that the No. 1 machine at the beginning is about 4 per cent better, from a voltage standpoint, than the No. 2 machine, and that, after having been short-circuited, it is about 9 per cent better. It, therefore, is quite obvious that if an air-gap of 0.023 in. can be maintained efficiently from a mechanical standpoint, it will produce a generator about 9 per cent better than the machine having the larger air-gap. Reducing the voltage and ampere line to a watt curve, we are interested, particularly, in the ascending curve, A showing the No. 1 machine curve and B the No. 2 machine curve, from which it will be observed that the small-air-gap machine is about 11½ per cent better than the machine provided with the larger air-gap.

Upon attacking the problem of producing a generator which, after short-circuiting, might retain a greater percentage of its original emf, or, at any rate, prevent a loss of from 15 per cent to 20 per cent, several interesting experiments were conducted and a method was finally developed which permitted of increasing the initial voltages of the two generators from 15 per cent to 20 per cent; and upon short-circuiting the armature and driving the machine it was found that the drop of potential with machine No. 1 did not fall below 90 volts. This was accomplished by introducing a special method of magnetizing and by observing a few simple precautionary measures.

Referring first to Fig. 3, this shows a ring of iron broken at points a and a^1, provided with a magnetizing coil b.

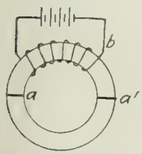


Fig. 3—Broken Ring with Magnetizing Coil.

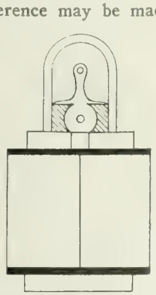


Fig. 4—Magneto Generator.

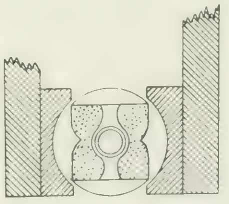


Fig. 5—Detail of Generator Shown in Fig. 4.

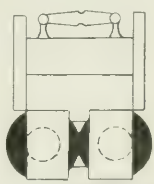


Fig. 6—Method of Short-Circuiting Pole Pieces.

Upon passing current through the winding it is well known that the ring magnet is magnetized and even after the current ceases to flow through the windings of the coil a considerable attraction is still observed between the two halves of the ring, this being due to residual magnetism.

This well-known phenomenon was applied to the magneto

generator shown in Fig. 4. Here we have an electromagnet of suitable power, built with the pole pieces so arranged that the magneto generator will rest upon the projections and permit the magnetic flux to pass through the limbs of the permanent magnet, which is shown more clearly by Fig. 5. The first experiments along this line were not very successful, owing to a large portion of the magnetic flux passing from pole to pole of the generator through the armature. The reason for this is clearly shown by Fig. 5.

Recognizing this as the cause for the failure, the armature was withdrawn from the generator and the magnetic flux resulted in thoroughly saturating the permanent magnets of the generator. While subjecting the machine to the influence of the magnet the armature was placed back into position, and, before interrupting the magnetizing circuit, the pole pieces of the magnet were short-circuited by a large block of iron, whereupon the current was interrupted and the generator removed from the pole pieces. Fig. 6 shows, in a diagrammatic way, the block of iron, mounted so as to permit its being slid up against the pole pieces to short-circuit them.

After removing the generator from the pole pieces the armature bearings were screwed into place, and, upon testing the generator so magnetized, an increase, sometimes as high as 25 per cent, was observed in the magnetism. Upon testing the machine for voltage, after short-circuiting, a drop of approximately 20 per cent was observed, which, however, still left the machine something over 17 per cent better, from a voltage standpoint, than could be brought about through any other known method.

When investigating the method of magnetizing telephone generators the first plan consisted in opening the circuit of the magnetizing coil after the armature of the generator had been placed in position. It was found, however, that a short-circuiting of the pole pieces before opening the circuit very materially increased the residual magnetism. In connection with this method of magnetizing it is necessary to observe the following precautions:

Under no circumstances must the armature be removed from between the pole pieces of the generator after saturation, for doing so will immediately drop the magnetization something like 20 per cent. Obviously, removing the separate magnets from the pole pieces will also result in the same reduction of residual magnetism, evidencing thereby that we have an effect with the permanent magnet exactly similar to that shown in connection with the description of Fig. 3.

As regards the lasting qualities of a generator magnetized according to the new method, the writer, so far as he has been able to determine, finds that it will last for many months, and, so far as the commercial value of the plan is concerned, it need only be suggested that one of the larger telephone manufacturing companies has, during the past six years, gained considerable commercial advantage through being able to produce a machine of a given power at a less expense for magnet steel.

MARTIGNY-ORSIERES SINGLE-PHASE RAILWAY.

One of the new single-phase railways of Switzerland is a line 19.3 km (12 miles) long from the Swiss government railroads at Martigny to Orsières. Its maximum grade is 3.5 deg. The line was built for electric operation with trains of one motor car and one or two trailers, having a maximum weight of 70 metric tons and carrying about 100 passengers at a speed of 30 km to 45 km an hour (18.6 miles per hour to 27.9 miles per hour), and with maximum freight trains made up of a maximum of 80 tons in motor-car weight and 50 tons in trail-car weight for operation at a speed of 15 km to 25 km an hour (9.3 miles per hour to 15.5 miles per hour). The freight motor cars are available for passenger service when required.

Direct current at 2400 volts was first considered for the line voltage, but the final decision was in favor of 8000 volts single phase on the trolley. It was intended to use

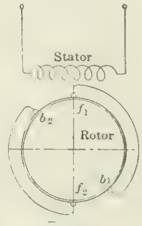


Fig. 1—Circuits of Deri Motor.

25 cycles, but the frequency was changed to 15 cycles to harmonize with the officially recommended frequency limits for the electrification of the trunk lines of Switzerland. Energy for operating the lines is obtained from the station of an electrochemical company.

For reasons of economy catenary construction could not be used for the overhead line except for certain sections where special safety is required. The trolley wire of the entire line consists of hard-drawn round copper wire of 50 sq. mm (No. 0 wire) cross-section. The brackets in open country are carried on wooden poles spaced 35 m (115 ft.). The normal clearance between the trolley wire and the head of the rails is 6 m (19 ft. 8 in.), but rises to 7 m (22 ft. 11 in.) at street crossings and drops to 4.8 m (15 ft. 9 in.) in tunnels. The insulation between the trolley and the brackets is threefold, namely, two trolley insulators of vulcanized rubber and porcelain and one grooved porcelain span insulator. The catenary brackets are furnished with double bell-type porcelain insulators which carry a seventeen-strand steel catenary. The trolley wire on the catenary section is suspended at intervals of 3 m (9 ft. 10 in). The spacing of the poles on the catenary section is 50 m (164 ft.), except at curves and switches. The rails are bonded with Brown's metallic alloy, in addition to which wire bonds are installed about every 100 m (328 ft.).

The present rolling stock consists of two passenger

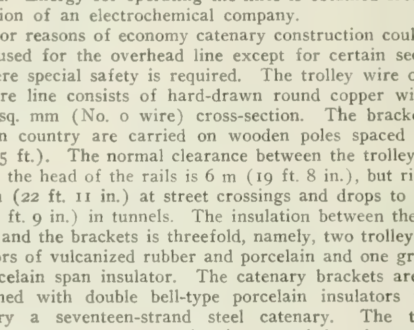


Fig. 2—Speed-Torque Characteristics of Deri Motor at Different Brush Positions.

motor cars, two freight motor cars, three passenger trailers and four ballast cars. All the motor cars have two plate-frame trucks of 2500 mm (8 ft. 2 in.) wheelbase and wheels of 1150 mm (45 in.) diameter. Every car, whether motor or trailer, carries a hand brake, straight air brake and an automatic brake. A separate system of brake levers

is installed at each end of the car to leave the rest of the underbody free for the electrical equipment. A connection is provided between both sets of levers to permit the operation of all brakeshoes from either platform.

The motor cars are of particular interest as they have been equipped with the Déri single-phase commutator motor furnished by Brown, Boveri & Company. This motor is of the repulsion type, and hence has a common

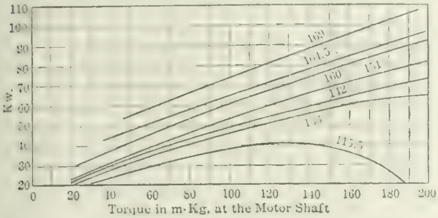


Fig. 3—Variation of Power with Torque for Different Brush Positions.

winding on its stator for compensation and excitation. The stator receives constant voltage and is connected to its rotor only by lines of magnetic force. As shown in the accompanying diagram, the rotor of a two-pole motor has two sets of brushes, *f*-1 and *f*-2, which are fixed permanently in the axis of the stator field, and *b*-1 and *b*-2, which can be turned around the commutator. One brush of the fixed and one of the movable set are connected by flexible cables; the other two brushes are similarly connected. When the motors are at rest both the movable and fixed brushes are in the axis of the stator field. The displacement of the movable brushes from zero position causes the turning of the motor. The rotor revolves in the direction opposite to the movement of the brushes and its speed increases according to the degree of brush displacement from zero position.

This motor has series characteristics, inasmuch as its speed drops with an increase in torque, but it also has shunt characteristics because its speed increases with an increase in the shifting of the brushes. Ordinarily motors of this type which have not been especially dimensioned for heavy starting currents will operate sparklessly with a starting current equal to about 2.5 times the normal output. Good commutation is secured for full-load running within limits varying from 50 per cent to 125 per cent of the synchronous speed.

The regulation of the Déri motor by mechanical brush shifting instead of voltage control constitutes its great

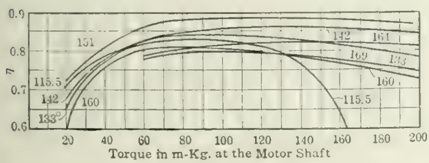


Fig. 4—Efficiencies at Different Brush Positions.

difference from other single-phase commutator motors. The characteristics of this motor may be summarized as follows:

It is always operated at constant voltage, hence the car transformer has only one secondary tap. Regulation does not occur by means of voltage steps, but is continuous, so that this motor really has an infinite number of running positions. No special reversing means are required, as the direction of rotation is changed simply by reversing the direction in which the brushes are turned. As this is a repulsion machine with a rotor independent of external circuits, it is especially suitable for high-voltage lines because the voltage due to induction and speed can be kept very low under all conditions. If desired the motor may be permanently connected in the zero position of the brushes, in which connection it consumes wattless magnetizing current only.

The prejudice against a motor of the brush-shifting type has hitherto prevented its use on railways, although small

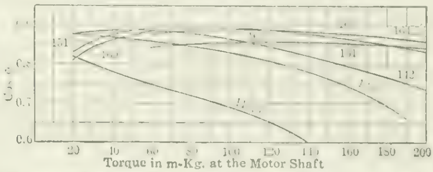


Fig. 5—Curves Showing Power-Factors at Different Brush Positions.

sizes have been built for cranes and mill work. The result of a year's satisfactory experimenting on the Stansstad-Engelberg Railway led to the introduction of this motor on the Martigny line. The manufacturers are now building 800-hp motors of this type for a number of important European lines, including the Dessau-Bitterfeld section of the Prussian-Hessian State Railways, the Bavarian State Railways and the Midi Railway of France.

The Martigny machine is a four-pole motor built for operation at 500 volts, 15 cycles. Its hour rating is 90 hp and its synchronous speed 450 r.p.m. The weight of the motor, gearing and gear case is 2500 kg (5500 lb.). Four motors are carried on each car, but the gear ratios differ in accordance with the speed requirements for passenger and freight service. The accompanying diagrams show the operating characteristics of this motor.

Current is collected at 8000 volts and transformed to 500 volts by transformers on the car. Pneumatically operated stator switches are provided to cut the motors out of circuit entirely without interfering with the transformer connections for the lighting and compressor circuits. The brushes are shifted by a combination of bevel gears, a cen-

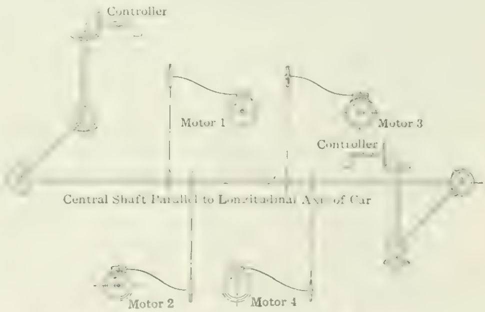


Fig. 6—Mechanism for Shifting the Brushes.

tral shaft parallel to the axis of the car, driving chains and flexible shafting, as shown in the accompanying drawing, Fig. 6. The brushes may be moved from zero to full-load position by no more than six turns of the controller handle. It is stated that the brush shifting is practically synchronous and uniform on all motors, and that the motors have operated successfully even when the line emf has dropped to 4000 volts.

A. I. E. E. PAPERS AND DISCUSSIONS

FOLLOWING are abstracts of a portion of the papers presented last week at the Chicago convention of the American Institute of Electrical Engineers, accompanied with abstracts of the discussions to which they gave rise. Abstracts of the following papers appeared in the issue of July 1, pages 5, 6 and 7: "Development of the Modern Central Station," by Dr. C. P. Steinmetz; "Tests of Oil Circuit-Breakers," by Mr. E. B. Merriam; "The Use of Reactances in Large Central Stations," by Messrs. R. F. S. Schuchardt and E. O. Schweitzer. Similar abstracts of the remainder of the papers and discussions will appear in a following issue. The papers, which are grouped so far as possible by subjects, are not printed in the order in which they were presented. On preceding pages a running report is given of the sessions of the convention, and of social and other events during its period.

DIAMETER OF INDUCTION MOTORS.

In a paper entitled "Choice of Rotor Diameter and Performance of Polyphase Induction Motors," Mr. Theodore Hoock showed from theoretical considerations that there exists for every rating one ratio of rotor diameter to core length for which the performance becomes a maximum. The power-factor, the copper losses, iron losses and overload range have an opposing influence upon this ratio. In order to work the material in the most advantageous manner for each item there would be obtained as many different diameters as there are items. It is not feasible to express all influences in one equation. The author therefore determined the proper ratio of core length to pole-pitch for which each item of the performance will become a maximum or minimum. The introduction of the leakage coefficient, that is, the ratio of the wattless magnetizing current to the ideal locked current, furnishes very simple formulas for practical application. The highest power-factor will always be obtained at an easily determinable ratio of core-length to pole-pitch.

The accompanying table shows the ratio of core-length to pole-pitch at which the power-factor, apparent efficiency and copper loss approach the minimum or maximum values of a certain frame (D^2l_t) where D is the diameter and l_t the core length expressed in inches. The limits vary with the type, length of air-gap, type of winding, slot dimensions and number of poles.

Ratio of Core Length to Pole Pitch.

[illegible]	Best Power-Factor.	Best Apparent Efficiency.	Smallest Copper Weight.
20	0.2 to 0.3	0.5 to 0.8	2 to 3
200	0.4 " 0.8	1.0 " 2.0	3 " 4
2,000	0.8 " 1.4	1.0 " 2.0	3 " 4
10,000	[illegible]	2.0 " 3.0	4 " 5
300,000	1.3 " 1.8	3.0 " 4.0	4 " 6

The field of application or the characteristic of the type usually settles or limits the main dimensions. The peripheral speed, temperature rise, flywheel effect, method of manufacturing, ventilation, available floor space, shipping weight, load-factor, power consumption and factory cost are some of the factors determining the choice of the diameter within small limits and sacrificing certain parts of the performance.

Discussion.

Mr. E. F. W. Alexanderson, of Schenectady, said the value of the paper consisted of the author's methods of dealing with proportions. The motor designer must have a clear conception of the importance of changes in proportions. The leakage coefficient, as referred to in the paper, is the most important of all relations of the induction motor. The name selected is unfortunate, however, as not impressive enough to designate the very important effect involved.

Mr. C. J. Fechheimer, of Ampere, N. J., did not agree with the author's observations on temperature rise. The cost of copper, and therefore of the motor, must be considered by the designer in studying this branch of the subject, particularly in the case of small motors. Too much complication in mathematical calculations should be avoided.

Mr. H. Weichsel, of St. Louis, was glad the author spoke of "leakage coefficient" rather than "leakage reactance." The concluding table in Mr. Hoock's paper is of great value. Mr. Weichsel spoke of the advantage of standard patterns and tools in manufacturing induction motors. The table referred to will be an aid in such standardization.

A written communication was received from Mr. S. Harr, of Schenectady.

Mr. Hoock closed the discussion by saying that the long formulas were not intended to be used actually, but simply to show the development of the method. He made the interesting statement that no formula exists for predetermining objectionable noises, such noise, for instance, as would prohibit the use of an induction motor in a hospital or a hotel. The cut-and-try method is now used for this purpose.

SECONDARY CURRENTS OF THE SINGLE-PHASE INDUCTION MOTOR.

In a mathematical paper dealing with the wave shape of currents in the individual rotor conductors of the single-phase induction motor, Mr. H. Weichsel, of the Wagner Electric Company, discussed the complete cycles throughout which the currents in the secondary of a squirrel-cage induction motor vary. He concluded that the currents in the secondary when acting alone would produce a rotating field traveling in a direction opposite to the motion of the rotor and having a speed which is synchronous with reference to the line frequency. Superposed upon the rotor magnetizing current is the working current, which tends to produce an alternating field which is stationary in space and having an axis coinciding with the axis of the primary poles. In any individual rotor conductor this working current would be approximately unidirectional at a speed approaching synchronism, and at speeds different from synchronism it would have a low frequency, represented by the slip of the rotor from synchronous speed. He concluded that there are three distinct currents flowing in each rotor bar. One of these is the rotor magnetizing current, and the other two are components of the working current. The magnetizing current is of the same frequency as one component of the working current, and the total resulting current, therefore, consists of two different waves, one of which has a frequency equal to the line frequency plus the speed, and the other has a frequency equal to the slip.

ELEVATOR CONTROL.

A paper devoted to the control of elevators for office-building requirements was presented by Mr. T. E. Barnum, of the Cutler-Hammer Manufacturing Company. The author stated that two types of electric elevators have been developed to meet this service. One is the worm-gear drive with moderate-speed motor, and the other is the gearless drive with special low-speed motor. He claimed that the best results have been obtained by using an adjustable-speed motor, with a two-to-one speed range obtained by shunt field

rcuit control. This arrangement gives an economical eed of one-half of the maximum.

By this means the operator is given positive control of the evator speed, so that he can slow down to half speed ickly, regardless of the load. Slower speeds are obtained introducing resistance in series with the armature and by unting the armature with a resistor of low resistance. In is way it is possible to obtain a total effective speed range eight to one. The paper contained a discussion of the tails relating to the constructive features and operating aracteristics of controlling devices for elevators using justable speed motors. The author gave data showing at the energy required to run an elevator cannot be pre-termined with any degree of accuracy unless the service be rendered is fully taken into consideration. Tests made on actual installations showed values ranging from 2.4 to .4 kw-hours per car mile. The maximum value was ob-ined when the car was running with maximum load and ith stops at all floors, while the minimum was obtained ien running with two-thirds load with stops at only the p and bottom.

AUTOMATIC MOTOR CONTROLLERS.

Mr. Arthur C. Eastwood, of the Electric Controller & anufacturing Company, presented a paper entitled "Auto-atic Motor Control for Direct-Current Motors," in which ere described some recent developments in automatic otor control of the current-limit type, which have resulted material simplification of the controller. This new type automatic controller is known as the series current-limit e, in view of the fact that the magnetic switches which ntrol the acceleration are series-wound and their windings connected in series with the motor to be controlled. Use made of a magnetically operated switch which possesses markable characteristics. The switch acts not only for sing the circuit and holding it closed, but also as a cur-nt-limit relay. If the current through the winding of a witch is below a certain critical value, the switch closes stantly, while if the current is above the critical value the witch will refuse to close until the current has been reduced the critical value. The magnet-operating coil of the witch is so designed that the core is acted upon by two rces, one the magnetic pull at its upper end, which tends close the switch, and the other made up of the weight the moving parts plus the downward magnetic pull on e shoulder at the plunger. When the current is below a rtain critical value the upward pull is greater than the ownward pull plus the weight of the moving parts, and e switch will close; when the current is above this critical alue the downward pull plus the weight of the moving arts predominates and the switch cannot close.

The author claimed that the switch is sensitive well ithin 10 per cent; that is to say, if the switch locks out ositively at a given value of current it will close positively hen the current has dropped 10 per cent below that value. his means that the maximum and minimum accelerating urrent values can, with the requisite number of switches, e kept within 5 per cent above and 5 per cent below a hori-ontal line which represents a predetermined accelerating urrent of constant value. Descriptions are given of numer-us controller installations in which the series current-limit-g switch was employed.

Discussion.

Following Mr. Eastwood's paper, Mr. E. J. Murphy, of chenectady, N. Y., described a type of series switch unit mploying a duplicate magnetic path construction similar principle to the device described by Mr. Eastwood, but ntirely differing from it in construction. Mr. Murphy's witch employs a pivoted armature with a rolling contact, ereby minimizing friction. For use with motors in which e starting current rises comparatively slowly, due to in-uctance, the inner or less reluctant magnetic path of the switch has to be inclosed in a copper damping coil. This coil prevents the rapid rise of magnetic flux in the normal path, deflecting the flux to the outer circuit, where it effects an attraction in counterbalancing the action tending to close the contactor.

In closing the discussion Mr. Eastwood said that in his early experiments with pivoted arms it was found that the presence of a conducting shunt or ribbon across the pivot introduced friction or residual forces interfering with the accuracy of the core's operation. In reply to inquiries, Mr. Eastwood also said that experiments have been made toward developing an alternating-current switch unit of similar characteristics, the outlook for which is very promising.

LIMITATIONS OF RHEOSTATIC CONTROL.

In a paper by Messrs. G. R. Radley and L. L. Tatum, of the Cutler-Hammer Manufacturing Company, the limitations of rheostatic control were considered under three heads, namely: Functional, where the limitations are inherent to the type of control; resistor material, where the limitations are due to physical characteristics of the resistor material, and switching devices, where the limitations apply to the method of adjusting resistance.

The authors discussed the fundamental features which determine the permissible variation in the power taken by the motor when controlling apparatus is being adjusted. They showed that, while the coarseness of steps permissible in a rheostat is limited by the requirements of the supply system, there is no functional limit to the fineness of the steps, the fineness being determined by commercial considerations alone.

The limiting features in the resistor relate to getting the electrical energy into the resistor and getting the heat produced out of it. The dissipation of the heat is by radiation, conduction or convection. In most designs of rheostats practically all of the heat must be carried away by the air and hence the highest efficacy is obtained when for a given amount of resistor material the quantity of air passed through the rheostat becomes the maximum. The authors showed that the permissible temperature rise is different in different parts of the rheostat. Thus the part which comes into contact with external objects must operate below a certain temperature, but when the resistor is provided with a frame and with screens to prevent the entrance of foreign combustible material the temperature limit can be much increased. As a rough average of commercial structures with natural ventilation, the surface temperature of an open resistor, such as a cast-iron grid, will be about 350 deg. C., with the air issuing from the top of the frame at a temperature of 175 deg. C.

For very large currents iron is a cheap resistor material, but difficulty is encountered in forming the terminals of iron resistors. The limit of temperature of wrought-iron or steel resistors is the plastic stage. For heavy currents cast grids reach a limit due to terminal features, while with low currents the limit is the ability to obtain sufficiently high resistance.

The limitations of switching parts are the carrying capacity and the commutating capacity, the latter including the ability to make as well as break a circuit. Of the commercially possible contact materials, silver is the best, with copper, brass and carbon following in the order indicated. Carbon has a relatively high specific resistance and a high contact resistance, but it is used very extensively as a material for sliding contacts, because of its freedom from welding and of its ability to withstand local high temperature without injury.

In summarizing a few of the factors which serve as short cuts to the consideration of sizes of rheostats, the authors stated that the maximum energy dissipation in a resistor of adjustable resistance in series with one of fixed resistance

across a given voltage occurs when the adjustable resistance in circuit is equal to the fixed resistance. When the voltage across the rheostat varies as a result of changing its resistance the series connection of steps affords the most efficient use of resistor material. However, when the voltage over the rheostat does not change greatly with the change in its resistance parallel connection of steps affords the best use of both the resistor and contact material.

ELECTRICALLY DRIVEN REVERSING ROLLING MILLS.

Mr. Wilfred Sykes, of the Westinghouse Electric & Manufacturing Company, read a paper reviewing some of the more important points in the design and operation of electrically driven reversing rolling mills. In rolling mills of the non-reversing type the fluctuations in demand upon the motor are minimized by the use of flywheels directly connected to the motor. In rolling mills of the reversing type the flywheel effect must be minimized, and no attempt is made to minimize the fluctuations in demand upon the motor. However, the fluctuations in the demand upon the supply system are properly minimized by the employment of motor-generator sets equipped with flywheels as an intermediate link between the supply system and motor. The motors employed in reversing rolling mills are of the constant-field, variable-voltage, direct-current type, the voltage being varied by means of a regulator in the field circuit of the generator on the flywheel motor-generator set. An automatic regulator for the motor-generator set is so arranged that when the load on the set exceeds the average value the speed of the set is reduced and the flywheel gives up part of the energy stored in it, thereby assisting the motor in driving the generator and eliminating the peak loads on the main supply system. During periods of light loads the flywheel is accelerated, and by properly designing the equipment the input can be maintained fairly constant. The author gave data relating to thirty-two reversing rolling-mill equipments now in service in Europe and three in this country.

The author claimed that in comparison with the three-high non-reversing rolling mills the two-high reversing mill has the following advantages: Where the mill has to roll a large number of different sections and operates for only a short time on one particular class of work the two-high mill is much more convenient than the three-high mill, there being a reduction in the cost of rolls, as well as in the time required for changing the rolls. The economy of the reversing mill with intermittent work is higher than that of the continuously running mill, principally on account of the elimination of the friction load when the mill is not in operation. Moreover, the auxiliary equipment of the reversing mill is somewhat simpler than that of the non-reversing mill, the lifting or tilting table being eliminated. The balancing arrangement of the rolls is also simpler, as only one roll is moved.

The paper contains descriptions of various devices that are employed for controlling the input to the motor of the motor-generator set. The motor is usually of the three-phase induction type, with a coil-wound secondary arranged for the variation of the resistance in the secondary circuit. In order to eliminate complications incident to the use of switch-controlled resistors, during the last few years the liquid type of regulator has come into extended use. The moving electrodes of the liquid regulator are operated by a small induction motor, which is supplied with current through a series transformer in the primary circuit of the main motor. The torque on this motor tends to separate the plates, and at normal load the motor torque plus that of the counter-weight just balances the weight of the moving electrodes.

An outline was given of the electrically operated reversing rolling mill of the Illinois Steel Company. This mill is driven by two direct-current shunt motors, having a total rating of 8000 hp. These machines are of the interpole compensated type with laminated field structure. The moto generator set consists of a 6600-volt, 25-cycle, 1300-hp indu tion motor coupled to a double-commutator shunt-type ge erator of the interpole compensated type. The motor-ge erator set is equipped with two flywheels, each weighi 100,000 lb. The speed of the set is regulated by an aut matic slip regulator, which consists of unit switches operat by two relays, one for dropping out the switches and t other for causing them to close, the different settings repr senting the limiting speeds between which the regulat operates.

Discussion.

In opening the discussion of Mr. Sykes' paper, Mr. K. Pauly, of Schenectady, N. Y., observed that there is fact little difference in the energy consumption of rever ing and three-high mills when operating at full load. T real determining factor, he said, is not alone in ener consumption, but in cheapness of operation, speed and t quality of material produced. Small mill plants often em ploy reversing rolls with greater success. A very lar proportion of the energy required by the rolls may be d entirely to friction. The non-reversing three-high m was introduced before electric drive, although there a some uses for which the reversing two-high mill is n applicable.

Mr. R. Tschentscher, of South Chicago, Ill., declared th the first reversing mill was operated in this country, the South Chicago plant in 1906, being driven by means an improvised motor-generator set. Among the advantag of the two-high mill over the three-high mill, is the po sibility of instant stopping due to shut off; lessened mai tenance due to fewer parts, less weight, and less speed operating parts, making it possible for employees to a ticipate repairs. The three-high mill is limited to a sing kind of finished product, so that durng slack seasons t percentage of salable products is higher with the two-hi mill. The speaker also pointed out that the latter has le roll friction and lower starting demand, requiring less ge erating plant equipment. The steel business, he adde has lately developed the output of alloy steels for the pr duction of which the reversing mill is especially adapt in getting out limited quantities and material for expe mental purposes.

In closing the discussion, the author of the paper r peated that while the reversing mill is not so well adapt for continuous, large output, it has a much greater ma euvering capacity for rolling a variety of shapes. The di ference in energy consumption with high-carbon and lo carbon steels he attributed chiefly to the differences temperatures at which these materials are worked. shutting down an Ilgner motor-generator set the unit frequently shut off and allowed to coast for some minut while use is yet being made of the energy residual in rotating parts.

THE DESIGN OF DIRECT-CURRENT ELECTROMAGNETS.

Mr. R. Wikander, of the Westinghouse Electric & Man facturing Company, presented a paper recording some i vestigations concerning the design of the cheapest, mo compact electromagnet to perform a certain duty. He di cussed four different types of magnets, the continuous excited magnets designed for a certain final pull, the inte mittently excited magnets designed for a certain pull, t continuously excited magnets intended for the performan of a certain amount of work and the intermittently excit magnets designed for the performance of a certain amou of work.

Concerning the first class of magnets the author co cluded that the most economical density is always the o for which the corresponding part of the magnetization cur is a parabola. The absolute value of the density depen upon the permeability of the iron part of the circuit a upon the length of the air-gap, but it is the same wheth

.e magnet is designed for minimum volume, minimum ..ght or minimum cost. The ratio of the core diameter the outside diameter of the winding is independent of the . gap, the flux density and the ampere-turns, but depends .n whether the magnet is to be designed for minimum lume, weight or cost, and upon the relation of the volume . the total magnetic circuit to the core inside of the coil.

In relation to the second class of magnets the author drew . following conclusions: The most economical density is . that part of the magnetization curve which is below the "..." and the value of the density depends upon the mag-...c properties of the iron. The ratio of the core diameter . the outside diameter of the winding is independent of the . -gap, flux density and ampere-turns. He showed that in .der to obtain an economical magnet of the third type the ..ke should be chosen with as great a length as the con-..ons of the case will permit. The section of the core ..l be chosen so as to give a certain definite pull per ..are inch. The necessary ampere-turns per inch of stroke ..nd upon the ratio of diameter of core to length of ..ke.

..he ratio of the outer diameter of the coil to the ..meter of the core is determined by the same conditions .. apply to magnets of the first class. In designing magnets .. the fourth class the stroke should be made as long as con-..ns will permit. The section of the core should be ..sen so as to give a certain definite pull per square inch .. plunger section. The number of ampere-turns per inch .. stroke depends upon the ratio of diameter of core to the ..gth of stroke. The ratio of outside diameter of the wind-.. to the core diameter depends upon the same conditions ..ch apply to magnets of the second class.

SERIES TRANSFORMERS IN THREE-PHASE CIRCUITS.

Mr. J. R. Craighead, of the General Electric Company, ..tlined by means of vector diagrams the operating char-..acteristics of series transformers when used in three-phase ..stems. He showed that certain methods of interconnec-..tion of the secondary circuits of series transformers in three-..ase systems resulted in the transformers carrying equiva-..lent secondary loads which differ decidedly from those ..sulting from the use of the same devices with a plain ..ries secondary connection. The power factor of the effec-..tive secondary load may be leading or even negative in ex-..treme cases. The variations in the equivalent secondary ..ad due to the power factors of the separate loads have a ..eneral tendency to offset one another. That is, when the ..wer factor of one equivalent load is large in the leading ..rection the other is usually large in the lagging direction. ..hen one equivalent load is increased the other is usually ..minished. Therefore, these variations may be neglected .. making approximate estimates of volt-ampere loads. The ..nbalancing of primary currents has a general tendency to ..crease the loads on interconnected series transformers, and ..here the circuit is known to be unbalanced to an unusual ..gree interconnections should be avoided, or the loads con-..nected to the secondaries should be kept considerably below .. amounts which are allowable under balanced condi-..tions.

COST OF TRANSFORMER LOSSES.

..n a paper by Messrs. E. C. Stone and R. W. Atkinson, of .. Standard Underground Cable Company, was recorded an ..vestigation of the losses produced in a system by the dis-..tributing transformers. It was shown that when the total ..cost of the losses due to the transformer is considered as ..100 per cent the various elements will be approximately as ..follows: Iron loss from 40 to 70 per cent; magnetizing cur-..rent loss from 1 per cent to 30 per cent; copper loss from ..3 per cent to 50 per cent; regulation loss from 1 per cent to ..1 per cent. By discussing the general relation of the cost .. the losses to the amount of material in the transformer it ..was shown that for a given amount of material as the ratio of the losses is varied the copper loss of the transformer increases faster than the iron loss decreases, thus making the total loss larger, the larger the ratio of the losses. The amount of material in the transformers increases faster than the losses are decreased when the losses are varied by the varying size of the transformer. For lighting transformers the amount of active material varies at a rate greater than the third power of the loss.

Discussion.

Mr. A. H. Pikler, of Ampere, N. J., remarked the large amount of money invested in transformers and said that the subject of core and copper losses is therefore very important. The paper of Stone and Atkinson will be almost a classic because it goes into the subject of transformer losses so thoroughly and practically. Low-grade transformers can be sold cheaply, but they are dangerous, and this paper points out how high core density is dangerous. Low power-factor in the transformer is not objectionable when accompanied by low core loss. High-grade transformers show their superiority, especially where there are variations of voltage on line circuits.

Mr. W. C. Smith, of Pittsfield, Mass., said the depreciation factor is very important in the selection of distribution transformers. It is probable that the future will see a tendency toward higher operating temperatures. A temperature limit of 90 deg. is a fair estimate for present-day practice, but with the modern coil compounds known as "artificial resins" an ultimate temperature limit of 125 deg. may be reached.

Mr. E. A. Wagner, Ft. Wayne, Ind., said that magnetizing currents in transformers do not increase in proportion to the losses. In modern transformers the magnetizing feature is the "whole thing." The so-called "cheap" transformers may not be so bad as painted.

Mr. H. B. Gear, of Chicago, speaking as an operating man, said that transformer depreciation may loom above core losses and efficiencies. In the Chicago central-station system core losses amount to about 500,000 kw-hours a month, but even this is relatively small compared to the advantage that would be secured by methods adding from three to five years to the life of the transformer. Mr. Gear pointed out the difficulty in specifying transformers, owing to the mixed character of customers' requirements as to load-factor.

Mr. R. W. Atkinson, of Pittsburgh, who presented the Stone and Atkinson paper, closed by saying among other things that the cost of magnetizing current is the most variable factor entering into transformer losses. In buying transformers the requirements of each case must be figured out for themselves. Neither high-grade nor low-grade transformers are necessarily indicated.

HIGH-TENSION TRANSMISSION SYSTEM.

Four of the papers dealt with transmission systems operating at 100,000 volts. Mr. Max Hebgen gave data relating to the system of the Great Falls Power Company. This company operates a total of 282 miles of transmission line at 100,000 volts. The principal line is from Great Falls to Butte, Mont., a distance of 130 miles. Over this distance two separate, single-circuit tower lines are used, a single line being extended from Butte to Anaconda, a distance of 22 miles.

Mr. W. S. Lee submitted operating data in regard to the transmission lines of the Southern Power Company, Charlotte, N. C. This system was described in our issue for March 24, 1910.

Mr. J. P. Jollyman outlined the operating characteristics of the transmission installation of the Great Western Power Company, Oakland, Cal. The equipments of this company were described in our issues for Aug. 26, and Sept. 16, 1909. The main line from the plant on the Feather River to Oak-

land has a length of 153.6 miles. A branch line 1.1 miles long taps the main line 136.5 miles from the generating station. Both the main and the branch lines are of the double-circuit type.

Mr. P. T. Hanscom gave operating data relating to the system of the Central Colorado Power Company. This system was described in our issues for Jan. 27, June 23 and June 30, 1910.

LINE-CONSTRUCTION DETAILS.

On the Southern system the transformers are star-connected with the neutral point grounded. In the other systems the delta-connection is used without grounding. In the Colorado system both the delta and the star connections are used without grounded neutral.

Overhead steel grounded wires are used on all systems, the wires being grounded at each tower.

The standard tower spacing is 750 ft. in the Great Western and 600 ft. in the other systems. The maximum spans are 1600 ft. for the Southern, 3034 ft. for the Great Falls, 2740 ft. for the Great Western, and 2900 ft. for the Colorado. In all systems the three conductors are placed in a single horizontal or vertical plane. In the Southern system the spacing is 8 ft. 4 in. on old towers and 10 ft. 6 in. on new towers. In the Great Western system the spacing is 15 ft. In the Great Falls system the spacing is 10 ft. 4 in. The Southern conductor is No. 2-0, seven-strand cable of aluminum and of copper. The Great Western conductor is No. 3-0 copper cable. The Great Falls and Colorado cables are of No. 0 six-wire copper, with hemp core.

LIGHTNING.

Lightning has never caused any shutdown on the Great Falls system, although several severe storms have occurred since the system was installed. There has been no lightning along the Great Western system. On the Great Falls system there have been twenty-two shutdowns since Jan. 1, 1910, due to lightning damaging the 100,000-volt line or apparatus. On the Colorado system there were ten interruptions from lightning during the season from sixty-three recorded lightning storms along the high-tension lines. Electrolytic lightning arresters are used on all four systems, the operating results obtained from them being considered very satisfactory.

The charging kilovolt-amperes measured 6185 at 88,000 volts on the Southern system, 7330 at 90,000 volts on the Great Western system and 6800 at 100,000 volts on the Great Falls system.

INSULATION.

The insulators used are of the General Electric strain, Locke strain, Thomas strain and suspension types on the Great Western system; all have proved successful. In the Great Falls system the insulators are of the suspension type and consist of six units, 10 in. in diameter, with the under side of each unit corrugated. The caps and pins are cemented to the porcelain with Portland cement. The insulators have an ultimate strength of approximately 10,000 lb. and will flash over wet at somewhat over 300,000 volts. Up to the present time there has not been a single insulator failure, either mechanical or electrical. In the Southern system some hooks have pulled out of the insulators, but no line has been put out of service from this cause except during a sleet storm, when three hooks pulled out. On the Colorado system trouble has been caused by excessive winds shaking the conductors violently and mixing them up generally. It has been found necessary to dead-end the spans, increasing the horizontal stress, and in one span it has been found desirable to increase the spacing of conductors. During spring and fall months sleet and snow has collected on wires at the lower elevations, and in one instance before the line was placed in commission the accumulation of sleet and snow on a No. 0 conductor was found to be 1.9 lb. per linear foot.

The building outlets consist of porcelain bushings set into 5-ft. square slate slabs on the Southern system; plate gl[ass] windows 5 ft. square, without bushings, are used on [the] Great Western system, and oil-filled porcelain roof bushi[ngs] are used on the Great Falls system.

Oil switches are used on the 100,000-volt side of [the] transformers in each system. These switches have giv[en] entire satisfaction.

The Great Falls system has been in operation at 100,[000] volts for six months, and nothing has developed as yet [to] indicate that the operation is more difficult than that o[f a] 50,000-volt system. The Southern system has been in s[er]vice since Oct. 24, 1900. The Great Western system beg[an] service at 100,000 volts on Nov. 1, 1909. The Cent[ral] Colorado system was first placed in operation on July [.] 1909.

Discussion.

In presenting at the high-tension transmission session reports of the transmission systems of the Great West[ern] Power Company, the Southern Power Company, the Gr[eat] Falls Power Company and the Central Colorado Po[wer] Company, Mr. P. H. Thomas, of New York, who occup[ied] the chair, discussed the conclusions of chief interest in th[e] four reports. In general, it was declared, high-poten[tial] systems employing from 80,000 volts to 100,000 volts [are] quite as satisfactory as other plants operating at lower v[olt]ages. Many of such troubles as do occur on these hi[gh-] potential systems are not directly due to the high-tens[ion] employed. Some of these plants are already near [the] corona limit, although at their present normal voltage t[hey] are not handicapped in this regard.

The reports refer with special interest to the operat[ion] and design of lines employing suspension-type insulat[ors], the elasticity and inertia effects of which, it was suspec[ted] might give trouble from mechanical motions of the c[on]ductor wires. Oscillations in the wires progress al[ong] these lines, becoming especially violent at passing points near the ends where the stationary waves set up are [of] double amplitude. Such waves may bring opposi[tely] charged wires within sparking distance of each other. [The] period and radius of swing, Mr. Thomas observed, is [de]pendent upon the length of the suspension insulators, [and] where attempts have been made to allow factors of ins[ula]tion safety by the insertion of additional disks long [sus]pensions have been formed of large swing radius. The d[an]gers of crosses from this source are sometimes overloo[ked] in the design of lines where the insulation strength occu[pies] the chief attention. When an intermediate pole or to[wer] at a lower level is inserted to help carry a long s[pan] tremendous lateral forces may be developed at the poin[t of] central support. The chairman also mentioned the spre[ad]ing effects between conductors, due to short-circuits, [and] cited an instance where wires, after being thrown viole[ntly] apart, were on the return swing twisted about each o[ther] with such violence as to make disentanglement a diffi[cult] task. The maximum span recorded is 3000 ft. and [the] worst sleet conditions reported have been a coating of [.] lb. per linear foot on a No. 0 conductor. Telephone [cir]cuits are operated successfully on transmission-tower l[ines] with the aid of split inductances having their central po[ints] grounded.

Mr. H. M. Collbohm, of Madison, Wis., reported an [in]stance where an aluminum arrester has been three t[imes] blown up during switching operations without the pres[ence] of lightning.

Mr. Paul M. Lincoln, of Pittsburgh, advised the gro[und]ing of the neutral through a resistance, but cited a Wes[tern] case of direct grounding where customers are served si[ngle-]phase high-tension energy over a single wire with [earth] return. Mr. L. C. Nicholson, of Buffalo, declared tha[t the] large current taken by a dead-grounded neutral sets up [dis]turbances in neighboring circuits. He suggested the u[se of] a resistance of about 1000 ohms in a 6000-volt neutral, l[imit]ing the maximum discharge currents to from 35 amp [to 40]

amp. This limited current may be used to control the automatic longitudinal sectionalization of the lines through ground detector relays. These relays have been found quite infallible in operation and permit the easy location of trouble.

THE ELECTRIC STRENGTH OF AIR.

Prof. John B. Whitehead, of Johns Hopkins University, presented a paper in which were recorded the results of recent investigations relating to the electric strength of air. The paper is supplementary to an earlier one presented by the author on the same subject, and deals with the fundamental relation between diameter and critical surface intensity, recording a series of investigations of the influence of stranding a conductor, the variation of atmospheric pressure and of frequency on the critical surface intensity. The term critical surface intensity, as used by the author, refers to the voltage gradient at the surface of a conductor at which the visible corona appears and the ionization of the neighboring air with accompanying conductivity begins.

The author stated that all of the facts and phenomena thus far observed indicate that the state of the air as regards ionization has no influence on the value of the critical surface intensity. He claimed that there is no experimental evidence in support of the contrary contention, and that in the present state of uncertainty as to the conditions controlling the critical voltage and the variation of the loss it appears unwise to confuse the problem by the introduction of an ionization theory.

As a result of the investigations recorded, the author concluded that the relation between critical surface intensity and the diameter of a clean, round conductor may be expressed by the simple law

$$E = 32 + 13.4 \div \sqrt{d}$$

being the surface density in kilovolts per centimeter and being the diameter of the conductor in centimeters.

Stranding a conductor lowers the critical voltage, and the lowering is greater the fewer the number of strands in the outer length. When expressed in terms of the diameter of wire in the same critical voltage the fraction of the over-all diameter of the stranded conductor for three strands is 0.7 and for nine strands is 0.88. With increasing frequency the corona starts at lower values of voltage, the lowering between 25 and 60 cycles being about 2 per cent, and about per cent between 25 and 90 cycles. A linear relation exists between the atmospheric pressure and the corona-forming voltage for the range between 30 and 109 centimeters of mercury. The slope of this relation varies, however, with the size of wire, and the rate of change of critical voltage with the pressure is greater the smaller the diameter of the wire.

INVESTIGATIONS OF CORONA.

A paper by Mr. F. W. Peek, Jr., General Electric Company, contained a report of extensive investigations on the electric strength of air which have been carried on at Schenectady during the past few years. The result of these investigations was to confirm many of the results obtained by others, and to establish certain facts which had not previously been discovered. The author stated that as the voltage of a transmission line is increased until it exceeds a certain value, a loss occurs by dissipation of energy into the air, accompanied by the formation of visible corona. Luminosity of the air surrounding the lamp conductor does not begin at the disruptive critical voltage, but at a higher voltage designated by the author as the visual critical voltage. Visual critical voltage is much higher for small wires than the disruptive critical voltage; it is also higher for large than for small wires, but to a less extent.

While theoretically no loss of energy should occur below the visual voltage, some loss does occur due to irregularities of the wire surface, dirt, etc. Loss of energy does not begin at the voltage at which the disruptive gradient is reached at the conductor surface, but only after the disruptive strength of air has been exceeded over a finite and appreciable distance from the conductor.

Concerning the effects of various atmospheric conditions and storms on the critical voltage and loss, the author stated that humidity has no effect on either the critical voltage or the loss; smoke lowers the critical voltage and increases the loss; heavy wind has no effect on the loss or critical voltage at ordinary commercial frequencies; fog lowers the critical voltage and increases the loss; sleet on the wires or falling sleet lowers the critical voltage and increases the loss; high voltages do not entirely eliminate sleet formations; rainstorms and snowstorms lower the critical voltage and increase the loss.

Discussion.

The discussion of the papers by Messrs. Whitehead and Peek was opened by Dr. Steinmetz, who remarked upon the momentous importance of these contributions in solving the limit of high-tension advances due to corona. Dr. Steinmetz then explained how corona starts, not when the potential gradient at the conductor reaches the breakdown point, but only after a conducting envelope which is formed has progressed an appreciable distance out from the conductor. A definite quantity of energy is thus required to start corona action, as is well known in the case of gaseous conduction. Dr. Steinmetz also complimented the investigators on the identical values of the critical voltages obtained in each case. The data presented shows that while free ionization or free humidity has no effect on corona, the presence of foreign material, such as fog, etc., exerts a profound effect. While Dr. Steinmetz admitted that he is not a believer in the ionic theory, he declared that he could see that this hypothesis permits of an easy explanation of corona production due to ionization by collision.

Mr. C. M. Davis, of Schenectady, explained how in the formation of corona the conducting envelope about the wire enlarges until a condition of equilibrium takes place and corona occurs, unless the wires are so close together that a disruptive discharge has already happened. Mr. Davis also brought out the fact that a point may be reached where disruptive, "puff" and corona discharges occur in succession between the same electrodes.

Mr. A. B. Hendricks, of Pittsfield, commented on the accuracy of the results attained and suggested the possibility of the corona voltmeter, proposed by Professor Ryan, which would make use of the visible and audible corona discharges. Such a device might have an accuracy within ½ per cent and could be used without the possibility of producing short-circuit, being in this respect superior to the needle-gap.

Mr. C. F. Scott, of Pittsburgh, spoke in general of the progress of high-potential transmission, referring in the course of his remarks to the accurate data and tests now available on the subject of long transmission lines and obtained with adequate instruments. These known facts extend the certainties and possibilities of high-tension transmission.

In closing the discussion Dr. Whitehead said that smooth, clean wires show no loss under potentials below visible-corona pressure, and Mr. Peek announced that the experiments which he reported are being continued and that further results are promised.

ELECTRIC-LINE OSCILLATIONS.

Mr. G. Faccioli, of the General Electric Company, presented a paper in which were described some tests performed on the 100,000-volt lines of the Great Western Power Company to obtain information on oscillations and rises of potential due to switching operations. The paper deals with some of the most important and representative records obtained by means of oscillographs. The following tests were performed: Switching in and out an open three-phase line at the generating station by high-tension switches; switching in and out an open three-phase line and step-up, three-phase transformers at the generating station by low-tension switches; switching in and out a three-phase line

connected at the end to an unloaded three-phase step-down transformer by high-tension switches at the generating station; switching in and out a three-phase step-down transformer at the end of an unloaded three-phase line by high-tension switches; switching, by high-tension switches, one of the three-phase lines when unloaded on and off the end of the other three-phase line while carrying its normal full load.

As a result of the experiments performed the author concluded that abnormal high potentials to ground, or between line conductors, or across windings of apparatus, are not to be feared. The maximum over-tension which the records showed was 60 per cent above the normal operating value. On the other hand, although extra high potential was absent, high frequencies were commonly produced. It seems, therefore, that the common method of protecting transmission systems by lightning arresters connected in series with a spark-gap does not answer the purpose effectively in all cases. The switching phenomena call mainly for protection against high-frequency impulses, the existence of which has perhaps not been properly realized in practical operation.

The author claimed that low-tension switching is preferable, when possible, to high-tension switching. There are two methods for energizing a line. According to the first the open line is connected to the generating system and the step-down transformer is thrown on to the end of the live line. According to the second the step-down transformer is connected to the dead line and then the line and the transformer are connected to the generating system. The tests recorded show that the second method is the better one, as it produced only one oscillation, and this oscillation was of the same character as the less severe of the two oscillations which took place in the first method of connection.

Discussion.

Mr. M. H. Collbohm, of Madison, Wis., opened the discussion of Mr. Faccioli's paper by drawing attention to the two principal points set forth therein; first, that the high harmonics present at no load disappear at increased current values, and, second, the production of high-frequency oscillations during switching. Mr. Collbohm cited an example of the occurrence of seventeenth harmonics of 5 per cent magnitude in a 66,000-volt, 25-cycle line, 63 miles in length. These harmonics produced no appreciable increase in the charging current. In view of the conditions pointed out in the paper, Mr. Collbohm said that the smoothness of the generator wave-form seems less important. For use where high-frequency oscillations meet reactances, building up high voltages, the speaker described the European method of applying a dry condenser element, shunted by a choke coil of high reactance, the condenser conducting off the high-frequency current, and the coil discharging the static accumulation. Mr. Collbohm also spoke of the successful application of solid iron conductors for station bus wiring, taking advantage of the high skin effect of these conductors for choking out high-frequency alternations. In the installation referred to a choke coil of Swedish iron is included in the busbar structure. As protection against high frequency at series transformers, electrolytic discharge cells have been connected across the terminals of the instrument apparatus.

Mr. D. B. Rushmore, of Schenectady, said that for years transmission systems have suffered unexplained disturbances and breakdowns at insulators, bushings and transformers, and added that Mr. Faccioli's paper is the first investigation actually to clear up the nature of the phenomena occurring in high-tension lines during switching operations. Insulation on high-tension lines is so strong that disturbances have now become fewer due to the magnitude of the causes themselves being below the factor of safety of the installation. The net result of these improvements is the increasing possibility of delivering uninterrupted supply of energy over long-distance transmission systems.

Mr. Percy H. Thomas pointed out that the facts of the paper form a valuable complementary study to the investigation of static phenomena presented at the Asheville convention. Dr. C. P. Steinmetz closed the discussion by reminding the audience of the tremendous range in the frequency which electrical waves may attain—from those o dying oscillations of 20 cycles per second up to wave frequencies of 20,000,000 cycles, which he estimated to b the frequency of a certain disturbance investigated at Schenectady.

CHARACTERISTICS OF TRANSMISSION LINES.

Three papers relating to the mechanical characteristics o transmission lines were presented as follows: "Solutions t Problems in Sags and Spans," by Mr. W. L. R. Robertson Philadelphia Electric Company; "Sag Calculation for Suspended Wires," by Mr. P. H. Thomas, New York, and "Th Mechanical and Electrical Characteristics of Transmissio Lines," by Messrs. Harold Pender and H. F. Thomson Massachusetts Institute of Technology.

Mr. Robertson reported the results of measurements mad upon a certain 80-ft. span of wire at intervals of 8 ft. alon the length, in order to show the deflection from a straigl line actually existing between the points of support. The measurements were compared with calculations based upc the curve of the circle, the ellipse, the catenary and tl parabola. The result showed that when the sag is small value in comparison to the length of the span it is ii material whether the curve is considered an ellipse, catenary or a parabola, although an appreciable error m be introduced by considering it a circle. With greater sag or when the supports are at different levels, the catena formula most nearly represents the actual conditions. T author concluded that since the catenary formulas are the whole as simple as any, the catenary curve seems to the best to select for transmission-line sag calculations.

He presented in the form of curves the equations relati to the variation of the sag with the length of the arc affected by the difference between the heights of suppo the variation of the sag with the total stress upon the wi and the dependence of the total stress upon the stress j square inch for different commercial sizes of wire.

In the paper by Mr. Thomas a description was given a simplified method for calculating the sags and strains suspended wires. The method is based on the assumpti that the suspended conductor conforms to the catenary, a that the span is reduced in size to 1 ft. in length with changing the shape of the curve. The author stated tl under these conditions the sag will be reduced in dir proportion to the reduction of span, and the stress in wire and length of the wire will be reduced in the sa ratio. He gave curves for showing the relations betw the strain in the wire at the point of support and the in a 1-ft. span with a total load on the wire of 1 lb. per fo From this curve the sag in any span can be found wl the length of span, the total load per foot and the str to be allowed on the wire are given. Dividing the allowa stress in pounds by the span in feet, and by the load per f on the wire, gives the stress at the support on a span 1 long of the same shape having a loading of 1 lb. per The actual sag for the 1-ft. span as found from the cu being multiplied by the length of the span gives the sag the actual span.

In the paper by Messrs. Pender and Thomson there w presented data and formulas, together with their derivati required for the determination of the mechanical and e trical characteristics of transmission lines, together wit set of charts whereby the various mathematical operati involved may be accomplished readily and with the minin of effort. The authors showed methods for determining ratio of the total force acting on the wire to the weigh the wire, and then derived equations for expressing stres

etc., in the wire span. They showed that in all practical cases, except under extreme conditions of loading or for very long spans, the equations of the span wire may be represented with sufficient accuracy by the parabola, although for greater accuracy the catenary must be used. They presented methods for determining the variation in the tension and deflection of a span of wire with changes in temperature and with changes in the mechanical load such as may be produced by sleet and wind pressure.

Under electrical characteristics were discussed the resistance, reactance, capacity, susceptance and leakage of transmission lines, and there were developed approximate equations which are applicable for ordinary transmission lines.

Discussion.

In opening the discussion on the three papers having as their subject high-tension line construction, Chairman D. B. Rushmore directed attention to the unsuspected changes in line construction and design made necessary by advances in transmission practice. Mr. Paul M. Lincoln, of Pittsburgh, pointed out that for short spans of small sag, the parabola may be used for calculation with fair accuracy, although the catenary is, of course, more closely applicable to long spans. Mr. Lincoln also remarked that the stretch in the line due to yielding of supports, especially at angles, is often equal in amount to the elongation in the wire itself. Mr. L. C. Nicholson, of Buffalo, said that the spacing employed between wires should be chosen as much with reference to the length of span, sag, weight and size of wire as to the voltage to be employed. Heavy copper wires may be spaced more closely than lighter aluminum cables, since the latter are put up with more sag and are more likely to swing together. Mr. N. J. Neall, of Boston, observed that an engineer will sometimes experience more difficulty in learning to use a new, even if simpler, method of making transmission-line calculations than in sticking to his own awkward familiar method of computation. Mr. Neall also spoke of the difficulties of getting line-construction crews to follow specifications and dimensions in erecting towers and [illegible].

Mr. J. E. Balcomb, of Chicago, told of his own experience in line construction and operation among Western mountains and on the plains, where lines were subject to seasonable variations ranging from 140 deg. Fahr. in summer to the most severe sleet and wind conditions in winter. Mr. Balcomb said that the maximum sag in a span is found to occur not during the summer, but at times when ice and sleet coat the wire at the highest temperatures in which such coatings will persist. The greatest stress in a span occurs, he also pointed out, at times of high winds during low temperature. Mr. Balcomb suggested that some member of the Institute undertake a report comparing the actual line data reported by transmission companies with the calculated values based on the data which were presented before the convention.

Mr. W. E. Belcher, of Chicago, explained methods of correcting computed values of spans, sags and stresses, and recommended the use of suspension-type insulators for down-hill spans and for construction where the breaking of conductors might introduce large unbalanced forces. Mr. Belcher also recommended the use of spreaders in very long spans to prevent conductors swinging together.

DEVELOPMENT OF THE SUSPENSION INSULATOR.

Mr. A. O. Austin, of the Ohio Insulator Company, described in an instructive manner the characteristics of insulators which resulted in the changes in type and led to the final adoption of the suspension insulator for high-voltage work. He took into consideration the surface resistance, the mechanical shape of the flanges, the dielectric strength of the insulator to carry electrical stress, the distribution of stress in the insulator, the mechanical strength of the parts and the arcing characteristics as affected by dust, moisture, etc. He presented the accompanying table showing the design features and operating characteristics of two different 100,000-volt line insulators, one of which weighs 50 lb. and the other 90 lb. It was shown that the lighter insulator has greater mechanical strength, greater dielectric strength, greater flashover potential and less depreciation due to the loss of one section.

The author claimed that for the same cost the cemented type insulator is much more reliable than any interlocking type, for its connections may be tested, thereby eliminating the personal factor. He remarked that practice has shown that unless the interlocking parts are large the arc punctures may destroy the connections, because the interlocking connections do not always come into contact. Reliability in practice depends on the testing of insulators and connections, in order to eliminate any weak part. High mechanical strength is obtained by making the gripping surfaces effective and developing the full shearing strength of the cement, thus permitting the use of very small metal parts. The electrical advantages of scientific design are greater dielectric strength, higher surface insulation and lower depreciation. The economical advantages are lower cost of production, lower weights and lessened length.

COMPARISON OF 100-KV LINE INSULATORS.

	Type *A*	Type *B*.
[illegible]	[illegible]	[illegible]
Number of shells per section	1	2
[illegible]	10	[illegible]
Length of insulator, inches	[illegible]	41
Mechanical strength, pounds	[illegible]	8,000
[illegible]	[illegible]	[illegible]
Total weight, pounds	50	[illegible]
[illegible]	12	12
[illegible]	[illegible]	Over surface
[illegible]	Through air	Over surface
Total tested dielectric strength, kv	540	140
[illegible] in per cent	16	10.6
Wet flashover	[illegible]	235
Depreciation due to loss of one section, per cent	[illegible]	[illegible]

Discussion.

Mr. E. E. F. Creighton, of Schenectady, N. Y., pointed out that the behavior of an insulator under a gradually applied potential is in no way indicative of its ability to withstand a sudden lightning or static discharge. During the gradual application of the potential the conducting envelope or path which spreads over the insulator surface permits the discharge to flash over the disk of the insulator, whereas the same potential suddenly applied would puncture the insulator. Mr. Creighton illustrated this point by citing the case of one insulator which was flashed over without harm several hundred times as long as the pressure was gradually applied, but which failed instantly by puncturing when submitted to a sudden electrostatic discharge. The speaker also showed how the multi-gap effect, present in suspension-type insulators, leads to spark-overs in case of high-frequency discharges.

Mr. Paul M. Lincoln, of Pittsburgh, said that flash-over tests on insulators show practically the same voltage values for wet as for dry tests, illustrating that while the surface leakage of the wet insulator is of course much greater than in its dry condition, this difference is offset by the superior insulation offered by the capacity effect. Mr. P. H. Thomas compared the multi-gap effect shown by a lightning arrester with the sparking cylinders arranged in the familiar V pattern and in a straight line.

In closing the discussion the author of the paper declared that while there is possibly a fatigue effect in porcelain, it is so slight as to be practically non-observable. Often, however, trouble is caused by poor burning of the porcelain, which is sometimes ascribed to fatigue, but which is in fact due to improper vitrification.

Central Station
Management, Policies and Commercial Methods

ECONOMY OF ELECTRIC TOASTERS IN A RESTAURANT.

Illustrating the advantages of using electric toasters in restaurants, Mr. J. D. A. Cross, heating specialist for the General Electric Company, in an address before the Michigan Electric Association, June 21, cited a striking instance of electric economy over a gas-heated toaster in a restaurant at Pittsfield, Mass. The gas-heated toaster formerly used cost 35 cents a day, using dollar gas; the 3500-watt electric device now employed costs but 10 cents per twenty-four hours, at 8 cents per kw-hour. The new electric toaster can prepare six slices per minute, or 360 per hour, and from it 200 to 250 orders of toast are ordinarily served in twenty-four hours. The consumption averages 10 watt-hours per slice of toast. The proprietor is much pleased with the electric device, declaring that it operates 60 per cent faster and is cleaner, handier and in all ways better than the gas toaster. The central-station income from this particular restaurant toaster ranges between $3 and $10 per month.

ELECTRIC RIPENING OF BANANAS A TWENTY-FOUR-HOUR HEATING LOAD.

The fruit and commission house of Leisman & Company, 102 West Jefferson Street, Louisville, Ky., ripens large numbers of bananas for the local business in basement compartments heated by an electric radiator or air heater. Two years ago this firm occupied a building with a fruit dealer who used gas to heat his ripening cellars. One day the gas exploded, wrecking the building and causing large damage. After suffering from this disaster the Leisman company determined, when it later added a banana department to its lines, to find some safer means of heating for ripening its fruit. Electric radiators were tried and have proved much more satisfactory than the old means.

Electric Heater Used to Ripen Bananas in Louisville Commission House.

The ripening rooms comprise two 8-ft. x 10-ft. compartments, with 6-ft. 6-in. ceilings, which are separated by double partitions with intermediate air spaces from the rest of the cellar. In rows on the ceiling of each room are placed eighty hooks, each capable of supporting a bunch of from 150 to 225 bananas. Such bunches weigh from 60 lb. to 90 lb. each. A Simplex resistance-type air heater, consuming from 1200 watts to 900 watts at its three temperature steps, is placed on a zinc mat on the floor and holds the room temperature at the desired range of 60 deg. to 80 deg. Fahr. For ripening, a process requiring forty-eight hours, a temperature of 75 deg. to 80 deg. Fahr. is needed and for storing the fruit after it has ripened the temperature should be 60 deg. to 70 deg. Fahr. The three-heat switch on the heater enables this regulation to be made nicely. During ripening the bananas give off a great deal of steam and moisture, which sometimes causes trouble by extinguishing the flame where gas is used, leading to explosions of the kind already cited. The electric heater, of course, is proof against such interruption. The chemical processes of ripening of themselves give off an appreciable quantity of heat, which aids in the ripening process.

The heater is operated on its middle temperature step continuously throughout the twenty-four hours during all but the very warm summer months, when the ripening process goes on without artificial heat. During an average month's use the heater recently consumed 495 kw-hours. For this energy, at its 5-cent rate, the Louisville Lighting Company received $24.75. The average monthly consumption and income for the electric company have been about these figures. As will be noted from the foregoing, the equipment provides for ripening about 32,000 bananas every forty-eight hours, although, of course, the local market does not demand this quantity, and during most of the time the fruit is simply held in warm storage pending distribution. Curiously, as above intimated, less artificial heat is required to ripen a room fully filled with bananas than only a few bunches, on account of the quantity of heat given out by the ripening processes themselves. The merchant expresses himself as thoroughly pleased with ripening by electric heat after ten months' experience with the new process.

Such twenty-four-hour large-demand heating uses doubtless exist in every city where bananas are ripened for distribution, and, on account of the continuous long-hour character of such loads, it should be possible to make a very satisfactory rate for energy. The accompanying illustration of the electric radiator in use in the banana cellar is kindly furnished by Mr. A. T. Macdonald, traffic manager of the Louisville Lighting Company and editor of its attractive and popular publication, *Chained Lightning.*

TRANSFORMER PRACTICE AT GRAND RAPIDS, MICH.

All lighting and motor-service transformers on the Grand Rapids-Muskegon Power Company's lines are fused on the primary side. The fuses and fuse boxes, which are made up in the company's shops, were described by Mr. Howard Pett, before the Michigan Electric Association, June 20. The fuse consists of standard fuse wire inclosed in a 3/8-in. glass tube, 12 in. long, equipped with brass clips on the ends. These clips fit into brass terminals mounted on standard porcelain insulators, the whole being inclosed in a box screwed to the cross-arm. The box is made of 7/8-in. pine well filled, and fitted with entrance bushings for the wires. One side of the box is hinged to allow the renewing of the fuses and is provided with a catch to hold it shut. The bottom of the box is left open to allow the escape of gases formed when a fuse blows and is covered with a strong wire screen, with 1/4-in. mesh, to keep out birds.

Every transformer is inspected once a month and samples

oil are drawn out into bottles, labeled with the number of the transformer and sent to the shops of the line department. The oil is tested and results of the test are sent to the foreman. All transformer oil must stand up under an insulation test of 27,000 volts between a spark gap of 0.15 in. If it does not come up to this standard notice is sent to the foreman in charge and the oil is changed.

It is a question at present, said Mr. Pett, whether it is necessary to subject the oil from every transformer to this test as often as once a month. The time may be lengthened except in instances where a transformer is heavily loaded or is working on potentials in excess of 7200 volts, which is used for distribution at Grand Rapids.

An experiment is being tried out in connection with transformer protection in Grand Rapids by inserting choke coils in the primary wires leading in and out of the transformer fuses. This coil is made by giving the wire seven turns around a 5/8-in. bolt. The ends of the wire are then brought back through the coil and pulled up tight. There were many serious electrical storms in western Michigan during the last week in May and the first week in June and the results observed would seem to indicate that these coils afforded considerable protection. In many instances after a storm the fuses were blown and the fuse boxes totally destroyed, but transformers protected by these coils seemed to suffer damage. Outside of the apparent protection that these coils seem to afford the advisability of using them has not been fully decided upon, but will be determined by future tests.

CONCRETE LAMP-POSTS AT ANN ARBOR, MICH.

A number of concrete tungsten-lamp posts have been erected at Ann Arbor, Mich., at a cost of $7.48 per pole. The posts are 25 ft. long, 8 in. in diameter at the base and 6 in. at the top, and are reinforced with four 3/8-in. steel rods, one at each corner. Complete, the posts weigh 1185 lb. each. Six inches from their tops single arms or buck arms are cast into the concrete, 1½-in. x 5/8-in. x 18-in. steel angles being used. These arms are bored for 5/8-in. bolts, which support the insulators carrying the line wires. Nineteen feet from the butt of the pole three ½-in. bolts are cast into the concrete for carrying the lamp bracket.

Fig. 1—Post Loaded for Transfer to Place of Erection.

The posts are set 5 ft. into the ground, bringing the lamp .. ft. above the curb. On each post are stenciled the number of the lamp and its circuit.

The wooden forms required for the construction of these poles cost $200 to build, $155 of which was for lumber and mill work. A concrete mixture of one part Portland cement, two parts sand and four parts ½-in. crushed limestone was used, the cement being mixed wet and poured and troweled in the form. The posts were allowed to set

Fig. 2—Electric Truck Raising Post Into Position.

two days and then to lie on the form base four days longer. after which they were seasoned for ten days before erecting. The cost of 100 poles was made up as follows:

30 tons crushed stone, at $2.60	$78.00
18 tons sand, at $2.75	49.50
47 bbls. cement, at $1.60	75.20
4300 lb. reinforcing steel, at 2.58 cents	110.94
600 lb. cross-arm steel, at 2.20 cents	13.20
Labor	420.00
	$746.84

The average cost per pole was thus about $7.47 each, exclusive of the first cost of the forms. The poles were distributed by loading them onto a carrier drawn by an

Fig. 3—Concrete Tungsten-Lamp Post Complete.

electric truck. On reaching the place of erection the truck was connected to tackle and the pole raised into position by running the truck off at a distance. In a paper on street lighting, read before the Michigan Electric Association, June 20, Mr. R. M. Hemphill, Jr., manager of the Wash-

tenaw Division of the Eastern Michigan Edison Company, expressed himself as well pleased with the appearance and service shown by these poles, the design of which he attributed to Mr. Edward Richards, of the Toronto Hydroelectric Commission.

ELECTRIC-POWER REQUIREMENTS IN A MANUFACTURING PLANT.

A THOROUGH investigation of the conditions in a Western metal-products factory was lately made with the object of determining the actual consumption of electricity by machinery in various departments of the establishment. The tests were carried out with unusual detail and extracts from the data secured are given below.

Iron Foundry, Tumbling Barrels.—Two barrels, on shafting; size of barrel, 36 in. and 48 in. diameter. Usual load is one barrel, but about 25 per cent of the time both are run. Speed of shafting, 196 r.p.m. Shafting required 2.75 hp. running light, and each barrel required an average of 1.55 hp (1.7 hp for larger and 1.4 hp for smaller barrel). Average power demand, 4.3 hp; maximum, 5.8 hp, with both barrels in service. A 5-hp squirrel-cage induction motor is ample for the work.

Iron Foundry, Compressor.—Bury Compressor Company, class BB, 10 in. x 10 in., driven from short jack-shaft. Chain drive could be used if space is available. Heavy service, full-load running test, 17.6 hp. To run compressor with free discharge took 4.1 hp at jack-shaft. Compressor was rated at 136 cu. ft. per minute at 100 lb. pressure. Squirrel-cage induction motor of 20-hp rating satisfactory.

Iron Foundry, Sand Sifter.—Driving pulley, 12 in. diameter, 6-in. face; speed 630 r.p.m. Power consumption of sifter running light, 0.38 hp; momentary maximum load when running with both sides of sifter full, 1.3 hp. Test showed that a 3-hp motor is ample for service, instead of existing 5-hp motor.

Bread-Maker Department.— Total number of machines in department, sixty-five. All machines off, friction drive, 12 hp; ten machines on, 15.3 hp; heavy load, 75 per cent of machines running, 18 hp.

Box Nailer.—Nailer was a No. 8 Morgan, running 300 r.p.m., with 22-in. pulley. Motor in use, an Allis-Chalmers 2-hp, 110-volt outfit, 1150 r.p.m., 5-in. pulley. Running nailer and motor free, 330 watts; driving two nails, 880 watts; driving four nails, 1100 watts; driving five nails (maximum duty), 1210 watts. Test showed that 2-hp motor is ample for work in hand.

Chopper Department.—Department contained about 110 small machine tools, 102 of which were connected to a line shaft driven by a 50-hp General Electric 500-volt motor. Tests showed that shafting friction load was 12.3 hp; 102 machines running and fifty-nine working took about 38 hp, which was normal load. The total length of line shafting was 510 ft., and the shaft diameter 2 7/16 in., with ring oiling bearings in good condition. A very heavy occasional load, with ninety-six machines running, required 42.5 hp.

Percolator-Urn Department.—Number of machines, twenty-seven, including ten spinning lathes. All belts running on loose pulleys, 7.4 hp; all machines running free, 16.6 hp; heavy load, all but three machines running, 18 hp. Test showed that the power required in actual machining was very small in proportion to that consumed in running shafting and machinery apart from load.

Aluminum-Percolator Department.—Equipment consisted of thirty-seven small machines, including four spinning lathes, 96 ft. shafting, one milling machine and small drill press. Running machines free, 12 hp; running shafting only, 5.3 hp; all machines on, usual work, 18 hp. Second test gave usual load of 12.4 hp, and occasional peak o 15.4 hp.

Cleaning Off Urn Buffers.—Equipment consisted o twenty-four buffing lathes and a 35-in. exhauster. Te showed power consumption with everything except e hauster off of 18 hp; all machines running free, 36 hp same as preceding with eighteen men working, 44 hp maximum peak load noted, 50 hp; allowance of 1.8 hp pe buffing lathe on hard work. Another test on buffers an finishers gave 0.4 hp per machine when off the line shaf 0.9 hp per machine when running light and 1.2 hp pe machine on normal finishing work.

Aluminum-Percolator Buffing.—Equipment consisted o 45-in. Sturtevant double exhauster, 700 r.p.m., and eigh double buffers and six smaller single buffers. Line sha running with exhauster and fourteen loose pulleys, 14 hp all wheels running free, 21.3 hp; all buffers working, . hp; maximum load noted, 40 hp; line shaft and blowe required, 8 hp. Unit results: Power per buffer (loos pulleys), 0.47 hp; power per buffer run free, 0.99 hp power per buffer under normal operation, 1.82 hp.

Hardware-Plating Department.—Equipment driven in cluded one 60-in. Sturtevant exhauster, one 1500-amp pla ing dynamo, two plating rolling barrels and four sma brush lathes. Test showed that plating barrels and lathe could be started by 8.1 hp. Exhauster, four lathes an dynamo, running free, required 6 hp; adding the tw plating barrels required 6.7 hp, and operating all the equip ment and supplying 600 amp at 6 volts to the barrels re quired 14.6 hp.

Printing Department.—In this department five small jo presses, one 28-in. paper cutter, one No. 3 Miehle cylinde press, one stitcher, a jig saw, a circular saw, a Whitloc pony cylinder press and a slow-speed exhaust fan wer driven by a 15-hp motor running 1200 r.p.m. The moto pulley was 34 in. in diameter, and it was belted to a lin shaft running 285 r.p.m. With all this equipment off excep the exhauster and flywheel of the paper cutter the depar ment required 2.33 hp. With all machinery in service 5 hp was required. It appeared desirable to install a 10-h motor to insure easy starting.

Stag Room.—In this room were a 45-in. Sturtevant ex hauster running 1200 r.p.m., nineteen small bench tool a small exhauster and thirty stands for hand grindin Twenty stands were connected to the exhauster, givin a total of 250 sq. in. of openings. In the tests the startin power required was 20.6 hp. With all the equipment run ning on loose pulleys, with grinding wheel belts loose, bu exhausters running at full load, the power required wa 13.3 hp. With all machinery running on loose pulleys bu with twenty-one wheel belts on spindles 15.3 hp was neede with all machinery on loose pulleys and twenty-on wheels running free 17.3 hp was required, with an increas of 20 hp when thirteen wheels were manned. The powe required with everything running free and with thirtee wheels manned was 22.6 hp. The average power per whe was 0.53 hp, and 0.2 hp was required to run the whe free in addition to shaft friction.

A test in the fork and handle-finishing departmen showed that 100 polishing and grinding wheels require about ½ hp each. In the cutlery-plating department tes showed that the average power consumption of nick tanks was 0.65 hp each; of silver tanks, 0.68 hp each, an of stripper tanks, 0.70 hp each. For this class of work general allowance was made of 0.7 hp per tank.

Machine-Grinding Department.—Motor drive of thirty four standard knife-grinding machines, two large knif grinders and two hand emery wheels. Power required t run equipment with loose pulleys, 22 hp; with equipmen running free but doing no work, 40 hp; with thirty-fou machines loaded, 86 hp, or an average of 2.53 hp per ma chine when bearings had just been oiled. With thirty four small machines and two large machines in operatic

100 hp was required. To start the equipment required 1.8 hp per machine.

Machine-Glazing Department.—Two groups, or forty-eight total machines, driven by 30-hp General Electric motor. The spindles are run except when temporarily shut down for repairs and are started in the morning with the belts on tight pulleys. The starting power required was 37.7 hp; with forty-eight machines running free there was required 28.5 hp. With forty-eight machines running and forty-four working 38.2 hp was required. With all machines working (100 per cent load-factor) 0.81 hp per machine was demanded. Further machine-glazing service utilized a 75-hp motor driving 100 glazing machines, nine polishing wheels and two small machine tools. The starting duty was so severe that the motor was arranged to start only five lines, or fifty-eight glazing machines, at a time. After full speed is attained the remaining machines are started by shifting belts. When 100 glazing machines and nine polishing wheels were run free the power requirements were 40 hp. With 100 machines running and eighty working, with three of the polishing machines, 70 hp was required, this being an average heavy load. The net power required per glazing machine was 0.67 hp, with 80 per cent of the installation working.

Celluloid Department.—A 30-hp motor drives five variety shapers, four bench tools, one roll, three kneaders, two tube machines, one hydraulic pump and five small speed lathes on one floor, and thirty-five standard polishing and grinding wheels, one sander, eight small bench tools and four exhauster and blower equipments. Power required to start, 34.8 hp; all machinery off except exhausters, [illegible] hp friction load; first floor heavy load, second floor off, [illegible] hp; second floor heavy load, first floor on loose pulleys, [illegible] hp; second floor heavy load, first floor entirely off, 28 hp; both floors on, heavy work, 41 hp. Exhausters take 8 hp.

In the basement of the celluloid department there are driven four double tumblers, one pulverizer, three small drills, one punch, one swage and two small circular saws. In the hallway are a small shear and belted elevator taking [illegible] hp at the peak load, and at the west end of the plant are [illegible] 8-in. single grinding and buffing lathes, with a Sturtevant No. 40 single exhauster with a total opening of 275 sq. in. With the exhauster running at full load and everything else off 8 hp was required; with the first group of machinery running free, 11.3 hp; with all equipment running free, 12.7 hp; with all equipment running free except that used by nine men buffing, 14 hp; with everything running free and both groups working, 12.7 hp; and with normal load, 14 hp. A 23-hp peak was noted on starting the elevator, with the rest of the equipment running.

Pressroom, Hardware Building.—A 35-hp motor drives eight heavy direct blanking presses, six medium blanking and piercing presses, five large Bliss back-geared drawing presses, thirteen medium presses, eleven light punch presses, one sheet-steel shear, six small machines and one elevator for foundry. The friction load, with all machines on loose pulleys, was 9.4 hp; with all flywheels and countershafts running, 16 hp; with preceding service in operation and seventeen men on light work, 22.7 hp maximum; with all machines running, 35 hp.

Coffee Mill and Grinding Machines.—Foundry equipment, one 6-in. x 6-in. air compressor, 85 r.p.m., 55 lb. pressure; one rotary blower, one tumbler (did not run during test); coffee-mill department, eleven medium and nine small special machine tools; grinding-machine department, twenty-two average light machine tools. Coffee department has twelve light machine tools and one elevator. Five men working on tools in coffee department and ten on grinding machinery. With all machines on loose pulleys, 12.7 hp; with compressor and blower on, 16 hp; foundry with coffee-mill present load, 18.7 hp; foundry with present grinding-machine load, 21.3 hp; everything on, present load, 24 hp; with 95 per cent of present machine tools running and fifteen men working, 32 hp.

Brass and Scale Departments.—Machinery driven includes two special cock grinders, four grinding wheels, one Buffalo 35-in. single exhauster, thirty-three small machine tools and twelve dry tumbling barrels and elevator. During test ten men working, frequently fifteen. Scaleroom contained twenty-eight small machine tools and five grinding and buffing lathes, with twelve men working during test. Test showed that with all machinery off on loose pulleys 10 hp was required; running tumblers, 11.3 hp; all tools free in brass department, 16.7 hp; same with ten men working, 18.7 hp; running all scale department free, with thirty-three machines, 16.7 hp; momentary peak, 22 hp; both departments normally running, 20.7 hp average. Elevator starting adds a momentary peak of 5.3 hp.

Drop Department Hardware.—Motor (35 hp) drives five large drops of about 800 lb. each, two light drops of 200 lb. each, four foot drops, one No. 5 R. G. F. blower, two wire cutters, two turret lathes, two bench lathes, eight tumbling barrels and one small circular saw. The test showed that with everything off except the blower 10 hp was required; with eight barrels running 12 hp was needed; with about 1000 lb. drop work under way, 23.3 hp peak; with six large drops working, 37 hp peak, and with all men working in addition, 37 hp peak and 30 hp average.

Carpenter Shop.—Equipment consisted of one 16-in. hand-feed circular saw, one band saw, one grindstone, a sensitive drill and a speed lathe. With all tools off, 2.7 hp; with band saw on 8-in. heavy work, 4.7 hp; with circular saw on 5-in. rip in heavy spruce, 7.4 hp; with both saws on heavy work, 10.7 hp.

Steel Cutting.—Equipment, one medium 8-in. alligator shear at fifty-two strokes per minute and one small 8-in. alligator shear at eighty-three strokes per minute; large shear cutting 5 7/16 in. x 3/16 in. at each stroke, heavy work, and smaller shear two strips, 1¾-in. x 1/16-in. work; with flywheels and shaft running free, 2 hp; with both shears on heavy work, 3.3 hp. In the shafting-room thirty-seven light wood-working machines took 32.4 hp.

Wiring and Illumination

MITERING METAL MOLDING.

By G. A. Harris.

In a recent issue of the *Electrical World* a method of forming turns and elbows in metal molding was described in which the base was cut in two at each bend or elbow. This necessitates the insertion of a "conducting-piece" at each turn or elbow in order that the electrical continuity of the molding may be maintained. If the base is sawed in accordance with the instructions given, the "conducting-piece" may be eliminated. Fig. 1 illustrates how a piece of base is cut to form a right-angle elbow, leaving a portion of one edge intact to afford conductivity. After cut-

Fig. 1—Miter Cuts for Elbow.

ting the two ends of the base are bent together until the two cut faces abut. The two end lengths will then be at right angles to one another. Cappings for such a 90-deg. elbow are mitered, as shown at the bottom of Fig. 1, and are snapped over the base after it has been erected. The completed elbow appears like that shown in the article referred to above.

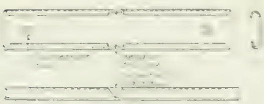


Fig. 2—Miter Cuts for Bend.

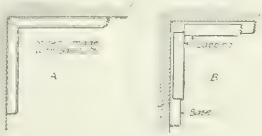


Fig. 3—Mitered Inside Bend.

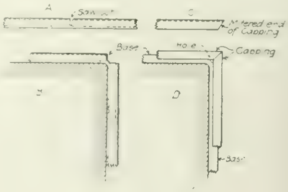


Fig. 4—Mitered Outside Bend.

The base for an internal bend may be cut for a 90-deg. turn, as shown in Fig. 2. In Fig. 3*A* the base, which has been cut as outlined in Fig. 2, is shown in position in the corner, ready to receive the capping, and at *B* it is shown with the capping in position. It will be noticed that it is not necessary to miter the capping, as it completely incloses the slot in the base if pushed into the corner as suggested at Fig. 3*B*.

For an external bend the base is cut with a hacksaw, as shown at *A* (Fig. 4), and is then bent and secured on the corner as outlined at *B*. The capping for an external bend should be mitered as detailed at *C*. When this is done there may be a small hole just at the apex of the angle included within the molding, as shown in the illustration, but this is of no consequence.

Fewer screws are required for the erection of metal molding where "conducting-pieces" are used. Where "conducting-pieces" are used two screws or bolts are required at each turn or elbow to maintain the electrical continuity of the run. Where molding (as herein outlined) is electrically continuous it can often be well supported by screws inserted through the holes punched in the base by its manufacturers. Where this is done the extra labor of drilling additional screw holes and of driving the extra screws is avoided.

INCANDESCENT STREET LIGHTING IN WARREN, OHIO.

BY A. E. LENNOX.

The illumination of the streets of Warren, Ohio, a city of approximately 12,000 inhabitants, furnishes a notable example of a municipality made cheerful and attractive through the efforts of its citizens to secure modern and effective street illumination. The new street lighting in Warren had its beginning two years ago when the contract with the Warren Water & Light Company for street lighting was about to expire. Up to that time the city depended on an open-arc lighting system in which the units, located principally at street intersections, afforded but meager illumination at points removed from the immediate vicinity of the lamps.

The Board of Public Service first directed its attention to the advisability of substituting inclosed arcs for the units then in use, but it was afterward realized that the question of effective light distribution would be still an unsolved problem. When, therefore, an incandescent system was suggested it receive very careful consideration by those who were directly in charge of the matter. It was at this stage that the Warren Water & Light Company was induced to co-operate in the installation of a trial system of tungsten lamps on Park Avenue, in which a staggered arrangement of series lamps was adopted. A little later a second trial demonstration was made with a straight-line arrangement of units on Mahoning Avenue. Both of these installations proved so satisfactory that the citizens were unanimous in their approval of incandescent lighting. All thoughts of having an inclosed-arc lighting system were finally abandoned and specifications were drawn up for lighting with street series tungsten lamps. The Warren Water & Light Company was awarded a contract to cover a period of ten years, during which time, in addition to installing the system, it was to be responsible for its complete operation.

The installation, which is now completed, is divided naturally into two parts, viz., the residential and the downtown systems. In the former there are 355, 90 and 175 6.6-amp street series Mazda lamps of 40, 60 and 80 cp respectively. All the units are equipped with Wheeler radio reflectors and are suspended by gooseneck brackets from wooden poles arranged in a straight line along one side of each residential street. In the spacing of these units one lamp is located at each street intersection and the intervening distance between corner lamps is divided so that the spacing is as uniform as possible. This varies, however, from 100 to 300 ft. on the different streets, depending on the traffic demands and to some extent on the foliage of the shade trees. The height of the lamps above the pavement is 14 ft. and they are suspended 3 ft. beyond the curb line over the road. The illumination in the residential districts is highly satisfactory and is far superior to that furnished by the former open arcs.

Fig. 1—Day View of Mahoning Avenue.

The ornamental lighting of the downtown streets is quite spectacular. Sixty-two three-lamp iron standards supporting two pendent lamps and one upright are employed on the principal business streets, while around the centrally located park 22 single-lamp standards are located. At the entrance of the courthouse, on the north side of the park, two five-lamp standards are situated, one on either side of the approach. All upright lamps are rated at 80-cp, except nineteen 60-cp lamps on the single-lamp standards, and are sur

·ounded by 14-in. Alba globes, while 12-in. globes are used on the 40-cp pendent lamps. The spacing of the three-lamp standards is uniform on each street, but varies from 65 to 75 ft. on different streets; that of the single-lamp standards s from 65 to 85 ft. The corner standards at street inter-

Fig. 2—Day View of Market Street.

·tions are set where the street lines extended meet the ·rb line; thus there are eight of these standards at each intersection.

The ornamental standards were supplied by the Canton Metal Post Company, Canton, Ohio. Each standard is anchored to a 2½-ft. cube of concrete, the center of which is placed 18 in. back from the curb line on the business streets, thus allowing the outside pendent lamp to be hung directly above the face of the curb.

The wiring of the standards is all underground. Where it was necessary to place this under pavement, fiber conduit with 4550 ft. of lead cable was incased in concrete beneath the gutter close to the curb and beneath the street foundation. In park lighting or where lawns were available 3065 ft. of steel-armored cable was placed from 2½ ft. to 3 ft. back of the curb under the lawn. For all underground work No. 8 wire was employed, and No. 6 for over-

Fig. 3—Three-Lamp Standard.

ead wiring in the residential streets. Since the power tation is quite centrally located, no feeder systems are used, ut the several circuits on which lamps are operated are ontrolled from the power house.

An all-night schedule has been adopted for lamps on the residential streets, since it was thought more economical to operate the lamps all night than to duplicate the extensive wiring system necessary throughout this part of the city. In the case of the ornamental system, however, the upright lamps only burn on all-night schedule, while pendent lamps

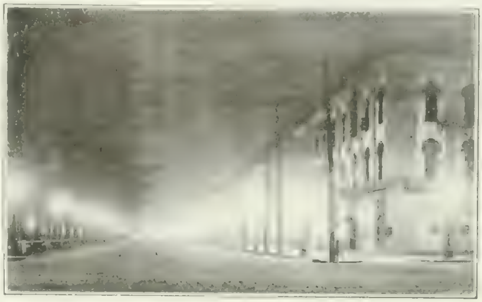


Fig. 4—Night View of Market Street.

are switched off from the power station every night at midnight.

On account of the short time since the system has been in operation, it is impossible to give a full report on the operating expenses. The contract specifies the following prices which must be paid to the lighting company for maintaining the three sizes of lamps in the two systems and under the two operating schedules. The cost of installation is taken care of in these prices:

SCHEDULE OF RATES FOR INCANDESCENT STREET LIGHTING.

Size of Lamp.	Ornamental		Residential
	All Night.	Midnight.	All Night.
[illegible]		$12.00	$13.50
[illegible]	$19.50	14 [illegible]	19.50
[illegible]	23.00	18 00	23.00

Included in the cost of installation, that of the standards, bases, conduits and wire was as follows: Five-lamp standards, $40; three-lamp standards, $36.50; one-lamp standards, $30. These figures are based on one standard of each kind exclusive of lamps, globes, sockets, etc. The 3065 ft. of steel-armored cable cost 36 cents per foot and an additional 5 cents per foot for laying. The lead cable, of which there was 4550 ft., cost 21½ cents per foot, and the bases for the 86 posts were estimated at $3.50 each. The fiber conduit laid cost 51 cents per foot, and the cost of the globes, when freight charges, crating, etc., were paid, was approximately $1 each. Warren is well known as a lamp-manufacturing town and the lamps for the entire system were supplied by one of the prominent lamp companies there.

In the old open-arc lighting system there were 161 units, consuming 500 watts each and operating on 9.6 amp. Seventy-one of these lamps burned on all-night schedule and the remainder till midnight, in the former case the city paying the central station $80 each per annum, and in the latter $55 each a year. It must be understood, however, that the relative operating costs of the arc and incandescent systems are no criterion by which the efficiency of the two should be judged, since the new system covers a much larger terrtiory and also because the lighting conditions have been greatly improved. The spacing of the units and the locations of the ornamental standards have been taken care of by the local city engineer, Mr. Bert C. Smith.

RECENT TELEPHONE PATENTS.

SWITCHBOARD CIRCUIT.

There has been issued to Mr. H. P. Claussen, of Chicago, a patent describing an arrangement of switchboard circuits providing means for connecting battery and magneto-signal lines. Local battery is contemplated for the transmitters at all stations. When dissimilar lines are to be connected a key is operated which inserts a repeating coil in the cord circuit. This permits talking connection but isolates the signaling currents. The patent is assigned to the Stromberg-Carlson Telephone Company.

SELECTIVE PARTY SYSTEM.

Two patents have been granted to Mr. W. M. Bruce, Jr., of Springfield, Ohio, covering a lockout selective system and the apparatus therefor. The apparatus is controlled by impulses sent out upon one or the other side of the line, or both. A vertical bar is arranged to be lifted a step at a time by impulses upon one side of the line. The bars at all stations move synchronously. Each step corresponds to the selective position at one station, and if an impulse be sent upon the other side of the line, the current finds a path through a connecting magnet at that particular station, the various connecting magnet circuits being controlled by the bar. An impulse over both sides of the line simultaneously operates the trip magnets and restores all stations to normal. These patents are assigned to the American Automatic Telephone Company.

REPEATING SYSTEM.

The repeating apparatus patented by Mr. C. G. Ashley, of Chicago, was noted in this column a few weeks since. There has now been issued to him a patent for his "method of propagating telephonic currents." The received current is led into a unipolar generator and there impressed upon the otherwise uniform field in which the conductor is spinning. A reinforced telephone current is set up by the generator.

RECEIVER SUPPORT.

The patent granted to Mr. C. E. Flynn, of Vale, Ore., relates to a receiver holder. The holder proper consists of a bar with a supporting clamp which maintains the receiver in suitable position for use. The bar in turn is mounted upon a sliding sleeve surrounding the stem of a desk stand. The sleeve holds the hook switch lever down, save when grasped in the hand of the user as though to lift the instrument. A latch is provided to release the hook lever in case it becomes inconvenient to continue the lifting effort.

EXCHANGE CIRCUITS.

At times it becomes necessary to operate a hybrid exchange system employing signal lamps operated upon a central-office battery but employing subscriber station equipment equipped with a magneto-generator and for a local transmitter battery. To such a system an invention of Mr. H. P. Claussen applies. Instead of the usual line relay he provides a self-locking relay sensitive to alternating ringing current. A condenser is inserted in one limb of th line. A turn of the magnet crank pulls up the line relay an closes the signal-lamp circuit. The resulting current lock up the relay until cut out by the cut-off relay. This latte responds to the insertion of a plug in the answering jack The patent for this system is assigned to the Stromberg Carlson Company.

SELECTOR MAGNET.

An improved electromagnet for a selector has been pat ented by W. Kaisling, of Chicago, and assigned to the Kel logg Switchboard & Supply Company. The core prope is mounted within a U-shaped return pole piece. The arma ture hangs from the upper leg of the U and confronts th core and lower leg of the U. The upper leg of the U ha a wide notch cut in its end to receive the armature and pin is inserted so that a hinge is formed. The pin move freely in the perforations in the pole piece, but is clampe in a groove in the armature.

LETTERS TO THE EDITOR.

Transmission-Line Supports at Different Elevations

To the Editor of Electrical World:

SIR:—I have read with interest Mr. J. S. Viehe's articl in your issue of June 15 regarding transmission-line sup ports at different elevations. Allow me to call to you attention that this method was described by Mr. Torste Holmgren, of Trollhättan, Sweden, in *Teknisk Tidskrif Elektroteknik*, No. 3, 1910, and in *Mitteilungen den Verein gung der Elektricitätswerke*, Heft 9, 1910. Prior to th date it was used in the construction of the transmission lin between Trollhättan and Gothenburg, which was designe and built by Mr. Holmgren.

New York. KAJ LINDHOLM.

To the Editor of Electrical World:

SIR:—In the interesting paper by Mr. J. S. Viehe c "Transmission-Line Supports at Different Elevations" i the *Electrical World* for June 15, 1911, I note that l apparently deals with the center line of the transmissio line. It should be noted as a practical and an extremel important fact that not only does it sometimes happen th the least clearance is not at the lowest point of wire, bu that in side hill work ample clearance on the center lin may not give suitable clearance on the up-hill side wir this being particularly true on two-circuit lines and c lines having wide phase spacing. In laying out a tower lin it is, in many cases, absolutely essential to have profil under the two extreme side wires, and it is always advisab to have the layout checked in the field before actual co struction begins.

New York. CHARLES RUFUS HART.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Three-Phase Commutator Generator.—R. RÜDENBERG.—If a three-phase commutator machine in which the stator circuit and the rotor circuit are connected together is mechanically driven, experiment shows that under certain conditions a magnetic field is produced which rotates with a certain speed. The author has formerly given the theory of such a generator under simplified assumptions and gives now the theory on more general and more accurate assumptions when the machine is running unloaded. He shows that the self-excitation of the machine is not influenced by the stray field of the machine, while the frequency of the alternating current produced is only slightly influence Simple circular diagrams are given.—*Elek. Zeit.*, May 18.

Induction Motors.—J. REZELMAN.—A continuation of h serial dealing with the reactance of induction motors wi squirrel-cage rotors. The leakage reactance of a two-po 50-hp induction motor is analyzed. The rotor winding found to exert no magnetizing effect upon the end coils the stator winding. The losses on short-circuit are dete mined for various frequencies.—Lond. *Electrician,* June

Lamps and Lighting.

Discrimination of Colors.—F. W. EDRIDGE-GREEN.— paper presented before the Royal Society in London.

definite portion of the spectrum be isolated it appears monochromatic, the size of the monochromatic region varying with the luminosity and wave-length of the light and the color perception of the observer. Lord Rayleigh had expressed the opinion that he could discriminate between the colors in a monochromatic region even to the extent of distinguishing between the colors of the two D lines. The author, however, did not find this possible when special precaution was taken to have a pure spectrum and to avoid the physiological effect of contrast through varying intensities of the areas to be compared. The monochromatic area may be magnified without altering its monochromatic appearance, the intensity of the light source being increased to compensate for the diminished luminosity. The monochromatic area may also be examined through a double-image prism, or be projected by means of a double-image prism upon a screen, so that the violet side of one area would be adjacent to and just touch the red side of the other area. In this way the monochromatic area may be made as large as desired, the intensity of the source of light being increased as required. An arc lamp gives two very bright areas of color. This method is the most favorable for the detection of any difference; the monochromatic areas, however, still remain monochromatic.—Lond. *Electrician,* June 2.

Factory Lighting.—C. E. CLEWELL.—The author discusses the relation of factory-lighting problems to efficient management and classifies the different problems in factory lighting. Reflectors for uniform illumination are discussed and an account is given of a recent typical factory-lighting installation where tungsten lamps are used. The 100-watt lamps seemed the best average size, but at least two intensities were found advisable, one somewhat high for detail and machine work and a lower intensity for general assembly work. Of the various mounting heights tried it was found very desirable to mount the lamps as close to the ceiling as possible, so that glare was reduced to a minimum. While the ratio of spacing distance to mounting height of the lamps called for a concentrating reflector for producing uniform downward light, a distributing reflector was essential for the purpose of providing the necessary side light. An intensity of about 2 ft.-candles on the sides of the machines seemed to be sufficient. Bowl-frosted lamps proved not so desirable as clear lamps, due to the more rapid effect of dust and dirt on the frosting than on clear glass. The effect is, of course, particularly noticeable in factory work. Metallic reflectors were far inferior to glass because of the fact that no light passes through them. Glass reflectors, on the other hand, permit some of the light to pass through the reflectors and to be in turn reflected from the light ceiling and walls. Lamps without reflectors were debarred on account of the glare which resulted when a man looked up from his work. Moreover, since 62 per cent more light on the working surface was produced by lamps equipped with reflectors than with lamps of the same size alone, it was considered a doubly good investment to provide all lamps with reflectors.—*Elec. Jour.,* June.

Street Lighting.—L. CROUCH.—A continuation of his illustrated serial on electric street lighting. The author compares the luminous efficiency of various incandescent and arc lamps and then gives polar candle-power distribution curves for arc lamps. He further gives spherical reduction factors for various lamps and compares the intrinsic brightness of various sources. He then takes up the discussion of Nernst lamps for street lighting.—Lond. *Elec. Review,* June 9.

Lighting of Small Offices.—C. E. CLEWELL.—The author discusses the lighting of small offices under the following heads: Elimination of drop lamps, range of the number of lamps for each office, first cost as a factor, spacing distance of lamps, sizes of lamps available, lighting calculations.—*Elec. Jour.,* June.

Generation, Transmission and Distribution.

[illegible] Results of the [illegible] of the new 5000-kw steam turbo-alternators built for a British company. The turbines are of Westinghouse latest impulse type and are arranged to use high-pressure steam at 175 lb. per square inch pressure and 150 deg. Fahr. superheat, both measured at the stop valve. The conditions specified for carrying out the tests were as follows:

Normal output 5,000 kw, three-phase, 25 cycles, 11,000 volts.

[illegible]

The results of the tests are as follows:

Output in kilowatts	1,346	2,715	3,902	5,066	6,487.5
Speed, r. p. m.	1,500	1,500	1,500	1,500	1,500
Steam pressure, lb.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steam temperature, deg. Fahr.	518	519	542	552	544
Steam superheat, deg. Fahr.	141	141	164	175	167
Vacuum corrected to 30-in. bar.	28.13	28.28	28.58	28.68	28.53
Cir. water inlet temp., deg Fahr.	43.9	43.7	44.0	44.0	43
Cir. water outlet temp., deg. Fahr.	48.0	52.6	57.0	60.0	65.5
Total steam consumption, lb.	24,780	40,130	53,125	65,860	85,880
Steam con., lb. per kw-hour	18.14	14.78	13.61	13.00	13.24

—Lond. *Electrician,* June 2.

Electric Driving of Rolling Mills.—G. J. HOOGHWINKEL AND F. THURSFIELD.—A paper read before the Staffordshire Iron and Steel Institute on the electric driving of light rolling mills. This is an easy problem as compared with heavy reversible mills, since there is no high installation cost and no complicated equalizing plant. The authors point out that from the electric drive of a rolling mill an increased output is obtained as a matter of experience. This is due to two causes—(a) the more even turning moment, resulting in fewer hot bearings, breaking of couplings, etc., and (b) the more uniform speed, permitting the average speed to approach more nearly to the maximum. Both these causes favorably influence the quality of material produced. The different possibilities of the source of power supply are discussed with special reference to the utilization of the low-pressure steam from the puddling furnaces in steam turbines coupled to electric generators, enabling the larger works to produce their own electric energy required for the rolling mills and auxiliary plant. A list of electrical driving mills is given.—Lond. *Electrician,* June 9.

Pumping.—R. H. WILLIS.—A paper dealing in some detail with the use of turbine pumps in collieries, with an account of the discussion which followed the paper before the Association of Mining Electrical Engineers.—Lond. *Electrician,* June 9.

Electric Plows.—K. SIMONS.—An illustrated article in which the author critically reviews the present constructions of electric plows. He does not think that any of those now available fulfils all requirements and emphasizes that the problem of electric plowing should be considered from the viewpoint of the farmer rather than of the electrical engineer.—*Elek. Zeit.,* May 11.

Traction.

Electric Traction on German Railways.—The Prussian Parliament has been asked to grant about $7,000,000 for an extension of the electric railway from Dessau to Bitterfeld and for the erection of a new electric railway in the Silesian mountain district.—*Elek. Zeit.,* May 11.

Electric Traction in Lapland.—A note on the progress of electrification of the Lapland Railway. In spite of an unusually severe Arctic winter, with a tremendous downfall of snow, the work on the Porjus Railway has been energetically proceeded with and the work in connection with the hydroelectric station at Porjus has been commenced. The construction of the power line from Porjus will be taken in hand this month, and part of the line is expected to be finished before the end of the year. The present large steam locomotives haul, as a rule, twenty-eight cars, each with a load of 30 tons. The electric trains will comprise forty cars of the same size, propelled by two electric locomotives, one pulling and one pushing, with an aggregate rating of some 2000 hp, and the average speed will be

about twice that of the present trains. The increased speed will make it possible to dispatch twelve trains in the day instead of the present nine trains, without increasing the number of passing places. The experimental trains had the same weight as the future electric trains—that is, forty cars—but they were each hauled by two locomotives. Negotiations have also been entered into with the Norwegian railway authorities about a possible electrification of the Norwegian section of the line from Riksgransen to Narvik.—Lond. *Eng'ing*, June 9.

Installations, Systems and Appliances.

Rates.—H. Passavant.—The author emphasizes that a uniform rate should be devised covering the supply of electricity for all different purposes. This should be based on the cost of producing the electric energy in the central station. If the fixed costs are assumed to be $68.75 per kilowatt and the cost of operation 1 cent per kw-hour, then the yearly cost of 1 kw is $6875 + N$ cents, where N is the number of hours use for the year during which the electric energy is used. For different numbers of hours for which the energy is used the prices of the yearly kilowatt and the average price of the kw-hour are given in the following table in dollars and cents respectively:

Hours per Year.	Price per Kw per Year. Dollars.	Price per Kw-hour. Cents.
500	73.75	14.75
1,000	78.75	7.88
2,000	88.75	4.45
3,000	98.75	3.3
4,000	108.75	2.73
5,000	118.75	2.38
6,000	128.75	2.15
7,000	138.75	1.98
[illegible]	[illegible]	1.85

In selling energy to small consumers it hardly pays to install a meter and in such cases a flat rate is allowed, assuming that the equipment installed is used for a certain number of hours per year. However, this number of hours is often assumed too low. As a matter of fact, the most intelligent consumers will try to use their connections all the time to the fullest extent. When they are not needed for lighting they will use them for heating water and cooking. This principle has been developed in the most logical way in an article in the *Electrical World*, 1911, Vol. 57, page 45, in conection with the system of the Hartford Electric Lighting Company. Since a consumer will hardly use the connections for all the 8760 hours in the year the author bases his calculations on the assumption of 8000 hours per year and recommends to charge according to the above table for a consumer with connections of 100 watts $15 per year. This gives him three metallic-filament lamps of 25 cp and permits him to prepare all the cooking for three or four persons. If a consumer has connections of 300 watts the yearly charge is $45. This gives him ten metallic-filament lamps of 25 cp and permits him to do all the cooking and water heating. The author proposes to make this the basis of his uniform rate. The fundamental point is not to charge for kw-hours, but for kilowatts, and to encourage as much as possible the fullest utilization of the installation. If $150 is the charge for the yearly kilowatts, the average price of the kw-hours in cents will vary as follows with the number of hours of use:

Hours per year.....	500	1,000	2,000	3,000	4,000	5,000	6,000	8,000
Cents per kw-hour...	30	15	7.5	5	3.75	3	2.5	1.9

This is a fair rate also for the lighting of restaurants. For instance, he assumes for restaurants which are open during the night that the number of hours of lighting are 3000; according to the above table the kw-hour will cost 5 cents, which is less than the usual rate. In pure lighting installations limiting devices should be used to prevent the consumer from consuming more power than contracted for. This could not be done when electricity is used for motor purposes. In this case he recommends metering the excess kw-hours only. In the most general form the rate would therefore be as follows: Electricity is furnished to the consumer on the basis of the kilowatts contracted for at a yearly price of $150 per kilowatt; if more than the power contracted for is used the excess of the energy in kw-hours is charged for at the price of 10 cents per kw-hour. The exact figures may be varied according to the first cost of the station and the cost of raw materials used in operation but the principle would be the same in all cases and the author thinks that the rate based on this principle would not only make electricity more popular with all kinds of consumers, but would considerably increase the load-factor of the station.—*Elek. Zeit.*, May 11.

Wires, Wiring and Conduits.

High-Tension Cables.—L. Lichtenstein.—An English translation of his recent German paper on the present state and future prospects of high-tension cable manufacture.—Lond. *Electrician*, June 2.

Tension and Sag in Wires.—E. Parry.—An article on the determination of tension and sag in overhead wires, giving useful formulas and tables.—Lond. *Elec. Eng'ing*, June 8.

Electrophysics and Magnetism.

Valency in Gaseous Ionization.—R. A. Millikan and H. Fletcher.—The authors studied the act of gaseous ionization through the capture upon oil drops of the products of the ionization. The authors used various methods of producing ionization, namely, primary Röntgen rays, secondary Röntgen rays and the beta and gamma rays of radium. Although the authors entered upon this investigation with the expectation of proving the existence of valency in gaseous ionization, they have instead obtained direct, unmistakable evidence that the act of ionization of air molecules by both primary and secondary Röntgen rays of widely varying degrees of hardness, as well as by beta and gamma rays, uniformly consists, under all conditions which they have been able to investigate, in the detachment from a neutral molecule of one single elementary electrical charge.—*Phil. Mag.*, June.

Radium Emanation.—R. W. Boyle.—An account of experiments on the behavior of radium emanation at low temperatures. The author studied by a new method the process of volatilization of condensed radium emanation at low temperatures.—*Phil. Mag.*, June.

Units, Measurements and Instruments.

Magnetization Curves of Iron.—J. T. Morris and T. L. Langford.—An abstract of a paper read before the Physical Society in London. The authors investigated the differences existing between the magnetization curves for a given sample of iron when determined (1) by the older methods in which the flux is changed suddenly, (2) by a method in which it is changed exceedingly slowly and at a uniform rate. The methods experimentally examined were: 1—Method of constant rate of change of flux. 2—"Slow cyclic" hysteresis loops by method (1). 3—"Step-by-step" magnetization curve. 4—"Step-by-step" hysteresis loops. 5—Method of reversal. 6—Alternating-current magnetization curve. Details are given of the theory and practical working of method (1). In this method the magnetizing current is continuously increased through a primary winding by a specially designed resistance at such a varying rate as to maintain a constant voltage generated in a secondary winding. A certain amount of skill is required in operating the resistance, but an average experimenter may easily acquire this with a little practice. The time required for a complete change of the current varied from one up to five minutes. Tables are given of the magnetization curve determined by the six different methods at a number of values from $H = 0.3$ up to 70, and of the permeability from $B = 500$ up to 17,000. At low values of the magnetizing force the uniformly varying flux method gives results of some 200 lines per square centimeter in excess of the older methods. As regards the time required for determinations by the various methods experimentally examined, ballistic methods are undoubtedly the most tedious. The alternating-current method (method 6) has considerable advantages in this respect, a full set of readings of magnetizing current

and induced voltage occupying a very short time. When, however, it is necessary to take oscillograms at various points in order to plot curves of form-factors, the time required is enormously increased. The method of uniformly varying flux (method 1) is peculiarly adapted for use where time is a consideration and a high degree of accuracy is desired. A complete magnetization curve may be taken in a very few minutes, and the mean of many such curves obtained in, say, one hour, the iron being demagnetized between each test. The method of "uniformly varying flux" appears to possess advantages, both scientific and practical, over the older methods in use for testing of ring samples of magnetic materials. It avoids difficulties due to eddy currents and magnetic viscosity, which effects are themselves due primarily to rapid or irregular changes of flux. Besides rapidity of experiment it also has the advantage of accuracy of repetition under standard or predetermined conditions of magnetic change. The method is, therefore, commended for the carrying out of magnetic tests, especially where great accuracy under definitely known conditions of experiment is essential.—Lond. *Electrician*, May 26.

Electric Thermoregulator.—H. L. Callendar.—At a recent meeting of the Physical Society in London the author gave a demonstration of the action of the thermoregulator designed by him in 1897 for experiments by the continuous electric method on the specific heat of water. The expansion of liquid in a bulb causes a thread of mercury to make contact with a platinum wire actuating a relay which puts a 16-cp lamp in series with a 32-cp lamp in the regulator tank. If the wire is fixed, hunting occurs owing to the mercury sticking to the wire and to lag of the regulator bulb. This is prevented either by causing the wire to move up and down continually through a distance of about 1 mm with a period of 5 to 10 seconds or by fixing the lamp bulb close to the regulator bulb. The hunting was demonstrated by means of a platinum thermometer reading to 0.001 deg. C. Other details of construction were also explained. The same type of regulator is now being employed for measurements of the variation of the specific heat of water by a new method in which two steady currents at different temperatures are allowed to mix, or share their heat, the resulting temperature being observed.—Lond. *Electrician*, May 26.

Measurement of Logarithmic Decrement of an Oscillation Circuit.—A. Petrowski.—The measurement of the logarithmic decrement of a circuit by the resonance method gives in reality the sum of two logarithmic decrements, namely, that of the oscillating circuit under test and that of the wave meter which is used for measurement. It is, therefore, necessary to know the latter. The author shows that the simplest way to overcome all difficulties is to use two wave meters and make three measurements whereby the logarithmic decrements of the two wave meters can be easily eliminated.—*La Lumière Elec.*, May 20.

Telegraphy, Telephony and Signals.

Wireless Telegraphy for Time Signals.—M. Tissot.—The author first deals with the experiments made in Paris to utilize the Eiffel Tower wireless telegraph station for the transmission of time signals. The trials consisted in obtaining by the aid of "dots" sent from the tower the comparison of chronometers of known rates, placed at each of these stations. Very concordant values were obtained, agreeing to 0.5 second—an approximation amply sufficient for ships. As a result of these experiments a service of regular time signals was commenced in May, 1910. The signal consists of a "dot" emitted at midnight—Paris mean time—preceded by a *call* signal. This is repeated at two minutes and four minutes past midnight. The emission from the tower necessitates the making and breaking of a current of 50 amp by means of a device actuated by a relay controlled by the observatory. This is done by a mercury-jet interrupter designed by Ferrie. A small turbine forces mercury under pressure through a tube pivoted on a horizontal axis O (Fig. 1). By means of a spring R this tube is normally directed toward the fixed part N of the turbine. On closing the key K a current in the coil E attracts a plunger causing the tube to turn so that the stream of mercury impinges on an amalgamated copper disk keyed to the

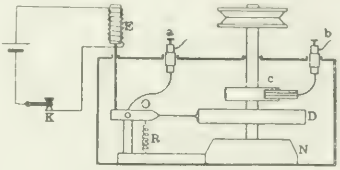


Fig. 1—Mercury-Jet Interrupter.

axis of the turbine. The main circuit is thus closed through the mercury jet. On opening K the jet falls and the current is broken without the production of an arc. To secure a quick break it should be produced in a liquid dielectric by filling the turbine with paraffin or alcohol. A simple receiver suitable for small ships consists of a Oudin resonator (Fig. 2) of rectangular form, the secondary of which is fixed and constitutes, with a condenser C, also invariable, a resonating circuit, tuned once for all to the period of the waves emitted from the Eiffel Tower. A detector is inserted in this circuit with a telephone across its terminals. The primary is inserted between the antenna and the earth and consists of the part of this solenoid between M and the sliding contact A. This sliding contact is moved until the sound in the telephone is a maximum. The detector, which is of the solid-contact type and requires no auxiliary battery, consists of a fixed electrode, which is a small piece of sulphide of copper or galena, and an adjustable electrode consisting of a fragment of zinc oxide, the whole being inclosed in a protecting brass cylinder. The observation of a single "dot" is not sufficient to fix the precise value of a difference of longitude. In order to use the method of coincidence a series of periodic signals is necessary. For this purpose Claude has adapted the Lippmann pendulum, electromagnetically maintained, in the following manner. Two silver-wire circles a and b (Fig. 3) are fixed to supports m and n, and are inserted in the circuit containing the cell P and relay R. A small piece of silver carried by the pendulum closes the circuit as the pendulum passes through the vertical. The duration of contact is long enough to secure the working of the relay; this can be regulated by micrometer screws which allow the

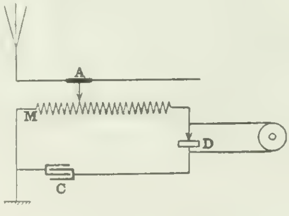


Fig. 2—Oudin Resonator.

supports m and n to be displaced. At each beat of the pendulum the relay is actuated and closes the circuit E (Fig. 1) so that a spark is produced. The successive beats thus give rise in the receiving telephone to a series of ticks. It is then easy to compare two pendulums placed at any two stations, A and B, by using as intermediary a pendulum at a third station C. In order to apply the method of coin-

cidence the length of the pendulum at C is adjusted so that its time of vibration is slightly greater than that of either of the pendulums to be compared. This method has been applied to the determination of the difference of longitude between Paris and Brest, the pendulum C being at the Eiffel Tower, A and B at the observatory at Montsouris and the radiotelegraphic station at Brest respectively. By the

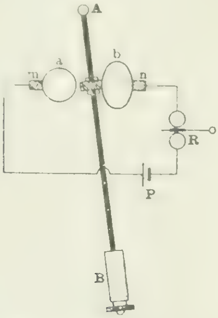


Fig. 3—Lippmann Pendulum.

aid of a microphone the beats of a local chronometer were observed in the receiving telephone, together with the signals from C. The microphone is inserted in the primary of an induction coil, the secondary of which is connected to the receiving telephone. Adjustable resistances in both the primary and the secondary make it possible to equalize the intensity of the beats from the chronometer with that of the signals transmitted by wireless telegraphy.—Lond. *Electrician,* June 9.

Telephone Meter.—A note on a recent British patent (11,048, June 1, 1911) of A. J. Boult (International Telechronometer Company, New York). This invention provides a metering apparatus which is installed at a telephone subscriber's station (in conjunction with the telephone set) to register the number of calls and also the length of time the call takes. Each of the mechanisms comprises an operating electromagnet. A normally open-shunt circuit round the electromagnet, which can be closed by contacts under control, is arranged to remove the impedance of the operation from the circuit. For recording a number of messages and also the length of time the line is in use, the operating electromagnet and the shunt-controlling magnet are oppositely polarized so that one responds to current flowing in one direction and the other magnet responds only to current in the opposite direction. Two circuits are provided for impressing currents of opposite polarity on the subscriber's circuit with the necessary arrangement whereby the message meter and the time-recording device are not operated until the call has been answered by the removal of the receiver, when the circuit is complete.—Lond. *Elec. Eng'ing,* June 8.

Automatic Telephony.—W. Aitken.—A paper read before the (British) Institution of Electrical Engineers on automatic-telephone exchanges. He dealt with the subject in considerable detail, and expressed himself strongly in favor of the automatic switchboard, quoting American results to show its efficacy and economy. In the discussion J. E. Kingsbury, F. Gill and M. S. Connor all considered that sufficient cause had not been shown for the abandonment of the manual board in favor of the automatic. A. W. Whalley, however, thought that, whatever the expense, the saving in time in obtaining connections and clearing should justify the erection of an automatic-exchange system in London, and R. Scruby related the favorable impression he had obtained from his examination of automatic exchanges in America. In the first part of his paper Aitken also described the recent adoption of keyless ringing on the incoming junction boards of the ordinary common-battery exchanges, and explained an arrangement for automatic clearing which the British Insulated & Helsby Cables have recently introduced for private-branch exchanges too small to have a regular operator.—Lond. *Elec. Eng'ing,* May 25.

Miscellaneous.

Electric Cooking.—An article on special electric-cooking demonstrations recently held at the showrooms of the Hampstead municipal electric station in London. A description is given of the particular electric ovens used, and it is pointed out that a great feature of electric cooking in addition to the improved flavor of the food is the considerable saving in meat. The following comparative figures are given as results of tests with an electric oven and a coal range. The joint was a top side of beef.

	Coal.	Electric.
[illegible]	5 lb. 4 oz.	4 lb. 0 oz.
[illegible]	3 lb. 6 oz.	3 lb. 8 oz.
[illegible]	[illegible]	11.5

This indicates that with electric cooking a 4-lb. joint is equivalent to a 4.25-lb. joint where an ordinary oven is used.—Lond. *Electrician,* June 9.

Danger of Fire.—A comparison is made of the danger of fire from electricity, gas and kerosene, with statistical data on the causes of fires in 1908 in Germany. The conclusion is drawn that the electric light is the safest of all methods of lighting.—*Elek. Zeit.,* May 11.

Book Reviews.

The Steel Workers. By John A. Fitch. New York: Charities Publication Committee. 380 pages, illus. Price, $1.50.

Virtually a report to the Russell Sage Foundation concerning the social, economic and industrial conditions of the steel workers in the mills of Allegheny County, Pa. There is much information in the book of a character that bespeaks care and earnestness in its collection. Nevertheless the book seems to carry a brief as well as evidence. The force of the evidence would be greater if the brief were omitted or relegated to a separate section.

Homestead. By Margaret F. Byington. New York: Charities Publication Committee. 292 pages, illus. Price, $1.50.

Virtually a report of nearly 300 printed pages, with photographs, from a social-service worker to the Russell Sage Foundation, concerning the households, lives, habits, economics and social status of the workers in the steel mills at Homestead, Pa. The book is one of a series of six volumes entitled "The Pittsburgh Survey." The book is well printed and prepared. It seems to be written in a fair and truthful attitude of mind. There is a large mass of material presented, and much that is satisfactory appears hand-in-hand with what might be better amended.

Engineering Chemistry. By Thomas B. Stillman. Fourth edition. Easton, Pa.: Chemical Publishing Company. 744 pages, 174 illus. Price, $5.

The fourth edition of an excellent and carefully prepared textbook and reference book on engineering chemistry. It deals mainly with the chemistry of fuels, solid, liquid and gaseous. The illustrations of apparatus are very good and the description is clear. Much of the chemical computation is in the metric system, but, unfortunately, the pages are marred by constant bewildering reference to English units. We hope these will be largely cut out in subsequent editions, as metric methods are far the simplest and safest for the engineer. The book will be of great value to all engineers who deal with fuels and have occasion to analyze them without being chemists.

E[illegible]menti di Metallurgia. By Alfonso Greco. Leghorn Raffaello Giusti. 102 pages, 27 illus.

A pocket textbook on a particular branch of metallurgy, namely, the furnace production of iron and steel. Commencing with a brief historical statement concerning the development of iron and steel in civilization, the author proceeds to discuss the production of pig iron, the nature of the operations taking place in the blast furnace, the production of steel by various methods, the theory and practice of tempering steels and the classification of steels and makes a very brief reference to electric-furnace steel. The book is a handy pocket guide to industrial processes for the furnace production of steels and will be found useful by metallurgical students and others.

New Apparatus and Appliances

PACKING GOODS FOR EXPORT.

By A. C. Jewett.

This article has to do with the poor packing, and insufficient and illegible marking on cases, of American machinery exported abroad, and with the bad advertising it gives to American machinery and appliances, due to consequent loss and damage during transport.

In addition to this, the customer is often put to any amount of annoyance, and expensive delays are caused by the failure of the exporter to follow shipping instructions and to supply the requisite number of negotiable and non-negotiable bills of lading, together with priced and detailed memoranda of shipments often required by foreign governments for statistical and customs purposes and which must

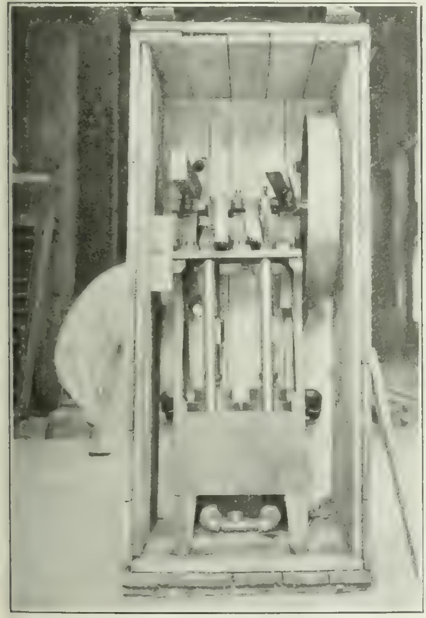


Fig. 1—Packing Showing Unnecessary Space at Top.

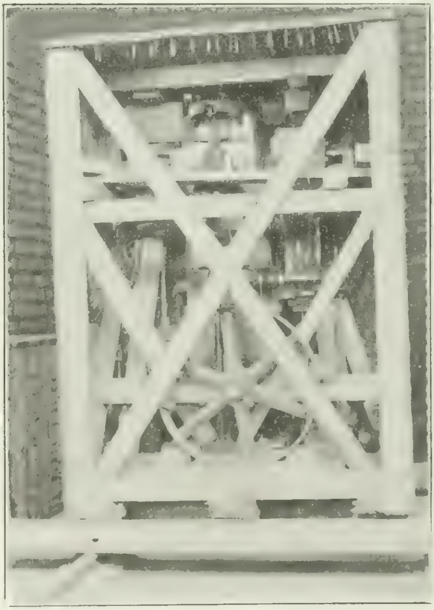


Fig. 2—Properly Packed Case.

be supplied before the customs will release consignments.

The head of a department in a large American firm which does a considerable export business was heard to say recently: "Our foreign business is made a football of. When our factories are full with work here at home and times are good we neglect it. When times are dull and there is not enough to keep us going at home we go after foreign business again, but it cannot be continually dropped and picked up," which is quite true. Some day we may want it very much and find it has gone elsewhere. The Germans and others keep what they get and they are always after more; also they study the requirements of their foreign trade and conform to them.

The writer has been abroad since 1900 on construction work in Asia and South America, and has handled electrical, hydraulic and mining machinery—American, English and German—principally American electrical apparatus, and has had considerable experience with and opportunity to observe cause and effect in connection with poorly packed apparatus from the customer's point of view.

The Scotch manager of a mining property in South America, who had several times ordered apparatus from an American firm, said to me one day: "I like their apparatus and their price is all right, but they will never get another order from me, for I cannot get them to follow shipping instructions and it causes me too much expense and delay." Nor did they. The next order went to England.

The American consuls in foreign ports have this same story, and a year or two ago the writer met Mr. Charles M. Pepper, of the United States Department of Commerce and Labor, in Asia. He had found the same complaint everywhere—failure of American firms to follow shipping instructions and to pack properly—and he urged writing an article on the subject.

Packages are handled from fifteen to twenty times on for-

eign shipments—carted, freighted, lightered, stowed on steamers, transshipped to other steamers, lightered and carried on railways again, passed through customs and other warehouses and finally carted again. Often they have to be handled without proper appliances and receive very rough usage.

Some of the things that have been wrong will be touched on first, and this will be followed with a few suggestions. For purposes of illustration and contrast we will take two cases that were shipped to the interior of Asia by two different American firms.

The first case (see Fig. 1) contained a vacuum pump. Dimensions of case, 33 in. x 33 in. x 73 in.; gross weight, 1000 lb.; net, 700 lb. Bearing in mind that 2240 lb., or 40 cu. ft., equal a ton, ship's option, this case measured over a ton. Note waste space between pulley and top of case. This pulley could have been easily removed and placed behind the pump where there was ample room, and the case shortened and a saving of 11.3 cu. ft. made—over ¼ ton. With $10 a ton for ocean freight this would amount to $2.50.

The pump might have been secured by lag screws to the bottom of the case, using the lugs on the base supplies for anchoring the pump, but it was not. The blocks of wood used for chocking, and which show in the photo, were inadequate and not properly secured and came loose in the case. The key which secured the pulley projected beyond the end of the shaft and gouged into the side of the case. When the case was inverted the weight of the pump was consequently thrown on the end of the crank shaft, bending it in the center of the bearing. The labor to straighten this cost the customer $3. The case arrived at destination in perfect condition, and with no extra cost to the exporter the customer might very easily have been saved $6.

The writer could cite a hundred similar cases and within the month saw three crated, oval iron tanks being loaded for South Africa. Each crate took up 1¾ tons absolutely unnecessary space weight. On the three crates this would amount to $65 ocean freight that the customer would pay for somebody's stupidity. But this sort of thing, in lesser degree, happens right along. The shipper has certain stock sizes of packing cases on hand and takes the nearest to a fit; it may be 50 per cent too large, but the customer pays for the extra space freight. Very often the shipper saves himself cents at the expense of dollars to the customer.

Fig. 2 shows a thoroughly well-packed case, and the contents—a waterwheel governor—heavier and much more difficult to pack than the pump. Dimensions of case, 52 in. x 46 in. x 64 in.; gross weight, 2509 lb.; net, 1670 lb. Note all four sides of case braced inside, the braces being cut to fit and secured in place. The governor is securely braced from every point and packed to ride any side up. The base is bolted to 2 x 6's, which are again bolted through to the outside skids. The pulley is removed and secured in place by a cleat and by strips of belting nailed thereto. This case and contents arrived at destination in good condition and form an example of good packing.

The writer saw a case being transshipped from one railway to another in South Africa. It was marked "This Side Up—Handle with Care" in English. The humor of this ought to be apparent. Where such directions are necessary they should be stenciled on the case in the several languages of the countries through which it has to pass. Some firms have learned to do this. The contents of the case were damaged to the extent of about $50.

In all cases where possible packages should be packed to ride "any side up," for such directions are apt to receive little or no notice from steamship and railway companies.

More trouble has been experienced with damage to high-tension transformers during shipment than with any other kind of apparatus, and in all cases it might have been avoided by intelligent packing and with very little additional expense. Some types of transformers can be shipp[ed] safely only if kept in an upright position, and it is hard[ly] possible to insure their being so kept when shipped to so[me] parts of the world. For this and for the further reas[on] that they are often beyond the limit of weight that can [be] carted in foreign countries it is necessary to ship the[m] knocked down.

Coils have been received with the insulation chafed t[ill] the copper not only showed bare, but with the windin[gs] rubbed together till they looked like a sheet of copper, an[d] again, jagged with nails and with the leads broken sh[ort] off at the coil; and where the assembled iron cores or le[gs] were shipped separately the iron and insulation would [be] in such shape that the iron would have to be relaid, press[ed] and reinsulated. It is an expensive and time-taking oper[a]tion to rebuild transformers in a foreign country with u[n]skilled labor and no appliances.

As an indication of how expensive poor packing can [be] on one foreign installation breakage, damage and cons[e]quent extra labor entailed amounted to nearly $7,000. [If] the shipper paid for all of this the customer would still [be] subject to the annoyance and delays, which have a mon[ey] value as well. Five per cent of this amount spent on t[he] packing, together with a little intelligent supervision, wou[ld] have saved it all.

When this same installation was completed the forwar[d]ing agents at the port of entry wrote that they had twent[y]-one unidentified pieces of all sorts, with no marks on the[m] but which they believed must belong to the shipment r[e]ferred to. Most of them did. There was a case or tw[o] consisting of pieces of the crane "I" beams, piping, et[c.], all of which had been reordered and replaced long befo[re].

This leads up to the marking of packages. Packag[es] should never have the marks painted on by hand. Ve[ry] often the letters and figures are poor, and people unfamili[ar] with the language cannot decipher the marks. Again, th[is] sort of marking is made illegible or obliterated by a scra[pe] or rubbing much quicker than stenciled lettering. Agai[n] cases are shipped with all sorts of lettering on them, su[ch] as shop-order numbers, requisition numbers, catalog nu[m]bers, drawing numbers, etc. They will have infinitely mo[re] and better marking for convenience of passing the[m] through the factory to the shipping clerk than is put [on] them to get them half round the world and by several tran[s]shipments. Superfluous marking on packages should [be] avoided as it leads to mistakes and confusion.

Marking Packages.

Cases should be distinctly marked with stencil.

The final destination should be inclosed in a diamond [or] square, with the port just over or under.

The serial number of the case should be in 3-in. lette[rs] and, together with the destination marking, appear on tw[o] sides of the case.

Castings, I-beams and the like should be marked wi[th] white paint, and the markings should be placed where th[ey] cannot be scraped off in transit.

Iron pipes, rods, etc., of too small diameter to put mar[ks] on should have metal tags fastened securely to them [by] wire with marking stamped on the tags. Paper or clo[th] tags are hopeless, as they are torn off or the marks becom[e] obliterated by oil or water during transit.

The serial number and distinctive marking should appe[ar] on two sides of each case. If one marking is scraped o[ff] the other remains for identification. Again, if the case li[es] with one marking on the bottom the other can be see[n]. This saves a lot of extra handling and knocking about [of] cases.

Packing.

Good, strong cases or crates should be used, and t[he] cases should be packed to ride "any side up" where possibl[e]. It cannot be expected that cases will be kept right side [up] on foreign shipments. Often cases are quite strong enoug[h] but the contents are not secured or securely packed a[nd]

rive broken or damaged because they have banged together or against the sides of the case. With heavy articles, such as small castings, large porcelain insulators for ansformers and the like, simply packing them in excelsior not good enough. There should be wooden partitions in

g. 3—Hauling 4-Ton Piece of Machinery Through Interior of Brazil.

e case, or, in the case of porcelains or the like, each ece should be bundled in excelsior and tied up in a wrapng of paper or cloth. This will keep it from working rough the excelsior.

Cases that contain heavy material should be bound with oop iron—not wire—and hoop iron is best in any case. lts, rivets, insulator pins and such material should not packed in unreinforced nail kegs or barrels, as, after a w handlings, they go to pieces. Tons of material so acked have arrived at their destination entirely loose, using any amount of trouble to check and repack. Barrels e not good to use for light material anyway, as the ships ow only four to the ton. Crates for heavy pieces should ot be made of ⅞-in. lumber. Good, thick planking from ¾ in. up should be used, and all heavy pieces, whether in rates or cases, should have skids, and, where possible, astings and machinery should be bolted through to the ids.

As a rule, heavy pieces, say, from 2 tons up, are given ore attention by shippers. It is the odds and ends and nclassified articles that need more attention, such as mahine parts. These get broken and cause expensive delays nd much annoyance. Care should be taken to make cases

g. 4—Transport of Electrical Machinery on Jhalum Valley Road, Kashmir, India.

vaterproof when contents will be injured by water or lamp. Polished and moving parts of machines should be arefully slushed with grease to prevent rust.

No shafting, whether shipped separate or with the vheel, armature or other revolving parts, should ever be upported on chocks where the bearing surface comes, for if the wood is damp or moisture gets in—as it is almost sure to do—the bearing surfaces get rusted and pitted and cause trouble. Bearing surfaces of shafts should be painted with white lead that will dry hard and not rub off, and further protected from mechanical injury by having a canvas covering and wood slats bound with wire around the bearing. The shaft must be cased as well.

Packing should not be made too expensive nor should there be unnecessary tare for the customer to pay freight on. Shipments to some parts of the world have to be taken better care of than others.

Exporters should in all cases make it their business to find out the conditions of transport from the customer and pack accordingly. Often material has to be transported from rail end into the interior by pack animals, mules or camels—sometimes part by pack animals and part by cart. When this is the case anything that can be put in cases of such weight and size that they can be carried on pack animals will reduce the cost of carriage very much. When it is remembered that the cost of transport from rail-end to site of erection is often more than the total cost of ocean and railway transport combined it will be seen that this is something to be taken into consideration. The writer has known of instances where the final haul from rail-end cost from $25 to $90 a ton.

Special shipping instructions should be issued for special

Fig. 5—Transport of Electrical Machinery in Mysore State, India.

cases and the management should see that they are carried out by the shipping department.

Exporters complain that marking and packing that differ from their established routine make them extra trouble and cost more. This seems absurd, especially if shipments are so made that the customer is put to ten times the trouble and expense.

Not all American packing is bad by any means. Some of it is as good as the best, and in most cases there is sufficient material used if it were used to advantage. What is needed is a little more intelligence put into the actual packing, or, maybe, better supervision.

BALL-BEARING MOUNTINGS FOR ELECTRIC MOTORS WITH VERTICAL ARMATURE SHAFTS.

The demand for higher efficiency in electrical machinery has caused ball bearings to be seriously considered of late years for many applications where a few years ago they would have been thought superfluous. Bearings which were first adopted in automobiles simply as a means of increasing the maximum speed of those machines have proved themselves to be not simply reducers of friction, but preventers of wear and tear, and it is for both these qualities that they are now being applied in the electrical field.

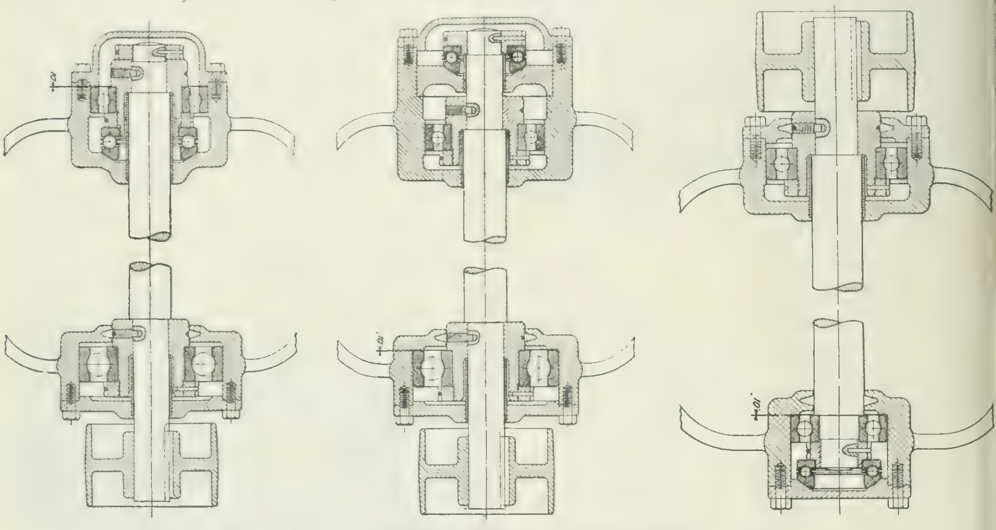
A high-grade annular ball bearing which is properly mounted and not overloaded has an almost negligible coefficient of friction and thus has no sensible wear. Consequently there is a direct saving of friction in the armature bearings and, even more important, a reduction of the air-gap is rendered possible. The accompanying illustrations show mountings recommended by the Hess-Bright Manufacturing Company for use with its type of ball bearings in motors having vertical shafts with the pulley either above or below the motor.

In Fig. 1 the pulley is underneath and the weight of the armature is carried by a thrust bearing under the upper radial bearing. To guard against differences in alignment the thrust bearing has a ball seat, which allows it to select its own position and distribute the load evenly among all the balls. The upper annular bearing is a light press fit on a collar and is clamped solidly by the nut and spring wire shown. This nut is carefully machined and rests on the thrust bearing. The outer race of the annular bearing is a sucking fit in its housing and is unconfined endwise. This permits the outer race to creep slowly around, thereby distributing such minute wear as occurs.

The collar on which the inner race is mounted is itself a press fit on the upper end of the armature shaft, and is secured by the nut and set screw shown. Both nut and set screw are locked by spring wire rings. Oil is retained in this upper ball housing by means of the tube, which is pressed into the base of the housing and extends up around the shaft nearly to the top of the ball bearing. This arrangement is permanently effective, whereas a stuffing box would require occasional attention, besides causing friction. The lower annular bearing is large, to carry the maximum belt pull. It is clamped on a collar, as above described, and its outer race is a sucking fit and unconfined endwise, thereby eliminating the possibility of destructive endwise cramping. The oil-retaining tube is similar to that already mentioned. The oil closure is of the familiar groove and lip type, the lips being at least 3/32 in. wide and bored 1/64 in. larger than the collar which they surround. Capillary action prevents the oil from working out beyond the second lip.

The arrangement of Fig. 2 is similar to that already described, except that the positions of the upper radial and thrust bearings are reversed. The details are identical in principle with those described in connection with Fig. 1. The nut at the top end of the shaft, which rests on the thrust collar, is turned a little smaller in diameter than the hardened ball-bearing ring on which it rests, thereby allowing both ring and nut to assume unconstrained positions in the event of slight errors of machine work existing.

In Fig. 3 the pulley is at the top of the shaft. The armature is supported by a thrust bearing at the bottom of the shaft, and this bearing may be considerably smaller than in the preceding two cases, since the shaft may be safely reduced in diameter at the end. The same clamping nut which holds the lower radial bearing is turned to form a step resting on the thrust bearing. Here again, as in Fig. 2 the nut is turned a little smaller than the inner diameter of the thrust ring to allow slight lateral play. The upper bearing is mounted on a collar with lipped and grooved closure and oil retaining tube of form already described.



Figs. 1, 2 and 3—Ball-Bearing Mountings for Vertical Armature Shafts.

By a slight modification of the above design interchangeable patterns could be made, enabling the same motor to be built with only detailed changes of the housing at the upper and lower ends of the shafts, thus simplifying machine work and rendering it easy to carry a stock on hand or nearly finished.

ELECTRIC SIGN PROJECTOR.

A novel application of electric light for store or other advertising employs the familiar principle of the magic lantern to project the image of the legend in letters of light on the sidewalk or other blank surface. The specially constructed projector comprises a 125-watt high-efficiency glower behind the stencil in which the sign is cut, the light through the openings traversing a set of condensing lenses which bring it to a sharp focus at the plane of the sidewalk. The whole device is contained in a polished-metal tube, 14 in. long and 2⅝ in. in diameter supported by a tripod base for ceiling, wall or shelf mounting. The glower produces 100 cp and is inclosed in a translucent globe which permits the lateral rays of light to illuminate the show window or doorway in which the projector is mounted. The projector barrel may be adjusted at any angle desired to reach the sidewalk with the image and the device itself can be mounted in the show-window ceiling or in the doorway vestibule, as is most convenient

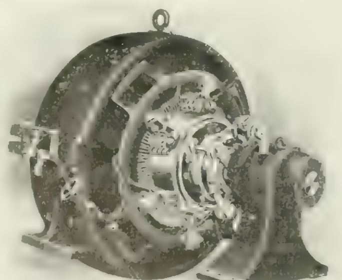
The effect of the illuminated sidewalk sign is a novel one which, in contrast to the blank space of the sidewalk, attracts the attention of pedestrians probably more than an equivalent wall sign or other publicity device consuming the same wattage. The image produced is about 3 ft. in

Electric Sign Projector.

diameter, and while the projector is primarily intended for sidewalk use, it has also been applied to showing signs on walls. Department stores have used the projectors to announce special sales, etc. The projector is made by the Pittsburgh Electric Specialties Company, 927 French Street, Pittsburgh, Pa., a new company organized to market this and other electrical specialties.

THREE-WIRE GENERATOR.

For the operation of direct-current arc and incandescent lamps the use of 110 volts is practically universal, while for the operation of motors above 1 hp or 2 hp the use of 220 volts is almost as thoroughly standardized. The lower voltage is employed for lighting, due to the fact that lamps for this voltage have higher efficiency and longer life, while the higher voltage is employed for motors, mainly on account of the smaller size of the copper wire needed to transmit the current, although there is also some considerable saving in the cost of the motors for this voltage. The ideal system is, therefore, one in which the current is transmitted at the higher voltage and delivered to the lamps at the lower voltage. Such a condition is secured by the use of the three-wire system, which employs two outside mains, carrying the higher voltage current, and a neutral lead between which and either of the mains apparatus requiring one-half the main line voltage may be installed. By the use of this system the output of a given generator may be distributed with three-eighths of the amount of copper that would be required to make the same installation on a two-wire system of the lower voltage. If the load on one side of the neutral lead should always equal that on the other side, the system would be self-balancing and a standard 250-volt generator could be used for the operation of a 125/250-volt three-wire system. Such an ideal condition, however, is not obtainable in ordinary practice, as the load on one side of the system will invariably differ from that on the other side, although in a well-planned installation, with all of the motors on the 250-volt mains, this difference will seldom, if ever, equal 25 per cent of the capacity of the generator. To take care of this unbalanced load numerous methods have been employed. The earliest was the use of two 125-volt generators in series, with the neutral connection between the two machines. This system involved the constant operation of two machines and it was difficult to obtain the desired voltage regulation of the two sides. A later development of the three-wire system came with the introduction of a rotary balancer connected across the mains of a single 250-volt generator. This balancer consists of two 125-volt units so connected that either will automatically act as a generator and supply energy to the unbalanced side of the system, the other unit acting as a motor to operate the generator end. The size of the units of this balancer is usually only that required to maintain an unbalanced current in the neutral of 20 per cent to 25 per cent of the ampere capacity of the generator. This system operates very satisfactorily as regards voltage regulation, but requires an auxiliary rotating machine and if this auxiliary machine meets with disaster the entire system is rendered inoperative. Another means is found in the use of the three-wire generator. The type of three-wire generator described herein is simply a two-wire dynamo equipped with collector rings and an auto-transformer, or compensator, which is essentially a single coil of wire wound on an iron core. This compensator is supplied by means of the collector rings with alternating current from the generator armature. The middle point of the compensator winding has a potential midway between that of the two main wires, and is, therefore, the neutral point of the system. From this point the neutral lead is brought out and the lamps are connected between this neutral and either of the two mains. The standard three-wire generators will carry continuously an unbalanced load, demanding in the neutral wire 25 per cent of the full-load current of the generator, with the voltage on either side of the neutral not varying over 2 per cent from one-half of the line voltage. This regulation of voltage renders three-wire generators satisfactory for meeting the most exacting demands. While any two-wire generator may be equipped in this manner and thus adapted to the three-wire system, it is essential that a thoroughly reliable two-wire machine be employed to start with. Granted that the generator itself is inherently good, its adoption as a three-wire machine cannot but prove satisfactory, as the



Three-Wire Generator.

compensator is in itself one of the simplest pieces of electrical machinery manufactured and, once installed, requires no attention whatever. The machine illustrated herewith is built by the Sprague Electric Works of the General Electric Company, New York City.

Industrial and Commercial News

THE WEEK IN WALL STREET.

PROGRESS in enlarging the scale of operations was not especially marked during the week, and the usual summer dullness prevailed. Sentiment, however, was vastly improved, based upon the many favorable indications for good business in the second half of the year. More advancement has been made recently in the iron and steel trades, perhaps, than in other industries. The volume of orders received in the past few months has been on an increasing scale, and the prospects for curtailing the usual mid-summer slackness at the mills are considered especially bright. In fact, it is stated that the business carried by the steel trade into the second half of the year is better than in 1910. Demand for wire for export has increased as a result of price reductions, and the sheet mills are reported to be turning out their product in the greatest amounts since March. The outlook in the trade is brightened by the heavier inquiries for steel cars, rails and various railroad equipment, necessitated by supposedly low stocks and by the imminence of crop transportation. A favorable incident of recent date was the disposal by the Erie Railroad Company of $6,000,000 equipment trust certificates, the proceeds of which are to be used in payment for some 300 freight cars and other rolling stock. In view of the fact that the report of low stocks is not confined solely to the railroads, but is believed to be the condition in many branches of trade, it is hoped that the improvements of the past month will culminate in July in a general buying movement, increasing with the successful outcome of this year's crops. So widespread is the influence of the crop situation that, in spite of removal of many of the obstacles that stood in the way of trade revival in the first part of the year, the waiting attitude is still apparent. Necessary moisture was received in the agricultural sections last week, and the outlook for excellent harvests is little changed. Business failures for the week ended June 29, as reported by *Bradstreet's*, were 227, as compared with 222 for the last week, 197 for the same week in 1910, 213 in 1909, 236 in 1908 and 135 in 1907.

THE COPPER MARKET.

LIGHTER demand for domestic copper was noticed in the past week, accompanied by a weaker tone both here and abroad. Prices were not greatly affected, and quotations of 12⅝ cents and 12¾ cents are general throughout the trade, with good prospects for 13-cent copper before long. Most of the efforts to sell were made by the smaller interests, who were said to be willing to shade slightly to dispose of material. Prices abroad advanced early in the week, but reacted later, with very little business reaching this country from the other side. Liquidation of standard contracts by speculators abroad was probably the chief feature of interest in the copper trade during the week. Consumers are believed

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.25	12.35	.....
July	12.25	12.35	12.30
August	12.25	12.35	12.30
September	12.25	12.35	12.30
October	12.25	12.35	12.30

The London market, June 30, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	57 2 6	57 0 0
Standard copper, futures	57 13 9	57 11 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	52 2 6	54 0 0
Best selected	61 10 0	57 5 0

to be supplied for immediate needs, but not for any length of time, and increase in the buying movement is expected to follow the June report of the Copper Producers' Association. In any event, it is hoped that the report will show a better relation between consumption and production than has been in evidence during the year, for the reports of necessity for further enlargement of capacity at the mines do not seem consistent with the meager statistics showing the great excess of production over consumption at this time. Exports for the month of June were about 27,408 tons. The daily call on the Metal Exchange, June 30, quoted copper as per th accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Diesel Oil Engines.—Small central stations, refrigeratin plants, and many industrial lines are finding oil-engine uni useful for meeting their power requirements, as shown by t following sales of Diesel oil-engines: Two 225-hp engines ha been purchased by the Hershey Chocolate Company, Hershe Pa., and are now being installed; the Municipal Lighting Plan of Thibodaux, La., which was recently equipped with tw 120-hp engines, was placed in operation a few weeks ago; t Ennis Ice, Light & Power Company, of Ennis, Tex., which h one 225-hp oil engine in operation, has added another rated 170 hp; the Anheuser-Busch Brewing Association, of St. Lou has just completed the installation of two 225-hp Diesel engines; the Arkansas Cold Storage Company, of Little Roc Ark., has placed an order for two 120-hp oil engines; the ne power station of the General Phosphate Company of Flori equipped with oil engines, is nearing completion; the Clebur Gas & Electric Company, of Cleburne, Tex., has placed order for a third 225-hp oil-engine; a 225-hp oil-engine h been installed in the shops at the United States Naval Torpe Station, at Newport, R. I.; the Municipal Lighting Plant Mansfield, Mass., has ordered a 225-hp engine, making t fourth oil-engine unit in this station; the Plant Ice & Pow Company of Plant City, Florida, has placed an order for 120-hp engine; the Granite Falls Electric Works of Grani Falls, Minn., has ordered a 170-hp oil engine to be used as auxiliary in the hydroelectric plant; the Corpus Christi Ice Electric Company of Corpus Christi, Tex., has ordered a 22 hp oil engine.

Crocker-Wheeler Equipment.—Among sales recent booked by the Crocker-Wheeler Company are the followin Generating equipment and motors for the Angel Guardi German Catholic Orphan Society of Chicago, including gener tor, balancer and eight motors of various sizes; Cuban Tradi Company, of Havana, Cuba, generating equipment, twenty m tors of various sizes, switchboard equipment and installation Remek transformers; Maris Brothers, Philadelphia, consig ment of motors, including twenty-four crane motors; additio equipment for the Postal Telegraph Cable Company of Tex including sixteen small motor-generator sets; Hashaw, Full & Goodwin Company, Elyria, Ohio, generating equipment, i cluding three generators and ten motors of various sizes; Hue fano Coal Company, Denver, Colo., equipment including o 250-kva alternator, motors and Remek transformers; additio equipment for the Capac Paper Company, Capac, Mich., i cluding one 200-kw generator; additional equipment for t Illinois Steel Company, Gary, Ind., including six steel mill m tors; three motor-generator sets for wireless telegraph servi for the Telefunken Wireless Telegraph Company of New Yo City; motor-generator equipment for the Savannah Elect Company, Savannah, Ga.; several annual contracts for Rem transformers, and orders for fifty-five induction motors f mill service.

General Electric Orders.—The General Electric Co pany has recently received an order from the Clinchfield C Corporation, Dante, Va., for six 6-ton gathering locomoti and four 10-ton mine haulage locomotives. One of the 10-t locomotives and five of the 6-ton locomotives will be instal at the mines at Dante, Va., while the remaining one 6-ton a the three 10-ton locomotives will be installed at Hurricane, Va. The French River Textile Company of Mechanicvi Conn., has placed an order for one 500-kw turbine, one 200- generator and one 20-hp induction motor. This apparatus for the joint use of the French River Textile Company a the Putnam Light & Power Company.

Canadian Pacific's Telephone Dispatching.—The te graph department of the Canadian Pacific Railroad has co pleted statistics which show that the number of miles on t system equipped with telephone train dispatching circuits 3055, which represents 71 miles more than upon the Sa Fé, its nearest competitor.

Keokuk Electrical Properties.—The Stone & Webster Engineering Corporation, of Boston, which is largely interested in the development of the water-power proposition across the Mississippi River between Keokuk, Ia., and Hamilton, Ill., some time ago entered into a tentative agreement to purchase the electric and gas plants upon condition that a certain franchise be granted. This franchise was voted upon by the citizens of Keokuk June 12, 1911, and carried almost unanimously. The present condition of the utilities named is very poor, and Stone & Webster proposed to set about bringing the properties up to date immediately upon the grant of the franchise. The proposed improvements will cover the street railways, including a short interurban branch, the street lighting, general residence lighting, power, gas. The present electric plant is equipped with direct-current apparatus for railway service at 550 volts, and also supplies power in rather small quantities. The alternating current, used almost entirely for lighting, is single-phase, 60 cycles, and is generated at 1100 volts. Energy is furnished to Hamilton, Ill., and Warsaw, Ill. The street-lighting system of both Keokuk and Hamilton is by the old-fashioned open series arc, consuming 9.6 amp. The energy is furnished by two Brush arc machines, driven by a single direct-current 550-volt motor. The provisions of the franchise are that the street railway franchise, which had fifteen years yet to run, be extended to twenty-five years, which means a ten-year extension of the time of the present franchise, and that the central-station franchise, which gives the right to erect, operate and maintain a plant on the streets and in the alleys of the city and had fourteen years to run, be extended to twenty-five years. The city commissioners have entered into a tentative contract with the Stone & Webster interests for street arc lights for a period of seven years, which contract is now binding, the price to be $60 per year per lamp of the most approved type, to burn all night and every night. It is also understood that Stone & Webster have asked for a similar franchise from the city of Hamilton, Ill., mentioned above. At the above-mentioned election the city of Keokuk also established a Department of Publicity Development and General Welfare.

Rubber Market Conditions.—Samuel P. Colt, president of the United States Rubber Company, in speaking of conditions in the rubber trade, said in part: "The immediate outlook for the general line of mechanical goods is not encouraging. The company's output of mechanical goods for the last two months has been about 25 per cent below the corresponding months last year. Boot and shoe sales are also much below also, and we find very little desire to purchase by the jobbers. Our plants at present are working only about 60 per cent of capacity. There seems to be a waiting disposition in various quarters growing out of the uncertainty as to tariff revision and the interpretation of the Oil and Tobacco decisions, and as to the manner in which these two companies will reorganize in compliance with the Supreme Court ruling. Incidentally there is too much legislation. If business conditions in the fall show improvement I expect to see a betterment in the demand for rubber goods. Retailers, I find, are not anxious to purchase, although I do not believe that they had any great quantity of goods left over from last year. A year ago they showed the same feeling as now in regard to buying and for that reason no large stocks were held over. If better weather conditions prevail in the fall I expect to see business improve."

Capital in June Incorporations.—A record of papers filed in the Eastern States in June, with an authorized capital of $100,000 and over, and including increases in capital, shows a total of $159,550,000, which is a decrease of $4,045,000 as compared with May 1, and a decrease of $71,769,400 as compared with June, 1910. The record of charters taken out by other companies, with an individual capital of $100,000 and over, the figures including States other than those in the East, brings the total for the month up to $232,900,000, which compares with $6,144,000 for May of this year, and with $311,674,400 for June, 1910.

Recent Westinghouse Orders.—Among recent orders received by the Westinghouse Electric & Manufacturing Company are: Equipments for three substations, consisting of nine 1-kw, 33,000-volt, oil-insulated, self-cooling transformers, three five-panel switchboards and the necessary lightning protective apparatus, for the Chicago, Ottawa & Peoria Railway Company, Ottawa, Ill.; from the Merchants' Light & Power Company, Ogden, Utah, an order for four 500-kw, oil-insulated, water-cooled transformers and five 75-light metallic flame arc lamp outfits; for one 1500-kw air-blast transformer with blower outfit, from the Kentucky Electric Company of Louisville, Ky.; from the Morris County Traction Company, Morristown, N. J., ten quadruple equipments of No. 101-B-8 railway motors for type K-28-B control; from the Marshall Traction Company, of Marshall, Texas, for two double equipments of No. 307 interpole railway motors with Type K-10 control. Foreign railway motor business recently secured includes an order from Walter Brothers & Company, of Rio de Janeiro, Brazil, for fifteen double equipments of No. 101-G motors with type K-10-A control.

United Wireless to Complete Contracts.—The application of the New York receivers for the United Wireless Company for permission to raise funds for the receivers of the company in New Jersey and in Ohio, in order to carry on business, has been granted. Owing to the recent law requiring that all vessels traveling in excess of two hundred miles from the port of call, carrying fifty passengers and crew, be equipped with wireless telegraph systems by July 1, the United Wireless Telegraph Company had contracts for supplying thirty ships by that time.

Chicago Pneumatic Tool Company.—W. O. Duntley, president of the Chicago Pneumatic Tool Company, who recently sailed for Europe, is quoted as saying that the business of the company continues satisfactory, considering the present condition of trade, and that the plants of the company are kept running at full time by the volume of orders received. Present earnings of the company are close to 10 per cent per annum, and the officials of the company are gratified by the results of the first half of the current year.

Central-Station Franchise Compensation in Chicago.—A check for $385,192.97 has been sent to the city comptroller of Chicago by the Commonwealth Edison Company, as 3 per cent of the company's gross receipts for the year ended May 31, 1911, in compliance with the compensation clause of the franchise under which the company operates. The amount of compensation paid the city by the Commonwealth Company is $62,000 more for the year mentioned than the sum paid for the preceding year.

Burlington Light & Power Company.—At the annual meeting of the stockholders of the Burlington (Vt.) Light & Power Company the following directors were elected: Messrs. M. W. Stroud, S. P. Curtis, F. E. Burgess, F. H. Parker and Leslie B. Miller. At the directors' meeting which followed these officers were elected: M. W. Stroud, president; W. T. Robinson, treasurer; Leslie B. Miller, secretary, and W. L. Fox, assistant secretary and treasurer.

Edison Factories for Newark.—A site in the Silver Lake section of Newark, N. J., has been selected by Thomas A. Edison for the erection of two factories. One of these will be used for the building of storage battery automobiles and the other will be used for the manufacture of the new storage battery cars which were recently tested by Mr. Edison on the lines of the Erie Railroad.

Republic Railway & Light Company Incorporated.—The Republic Railway & Light Company, plans for the formation of which were described in the issue of July 1, has been incorporated at Trenton, N. J., with a capital of $17,500,000. Stock of the company is divided into $10,000,000 preferred, which is to bear 6 per cent cumulative dividends, and $7,500,000 common.

Equipment for Southern Traction Line.—The Ohio Brass Company will furnish all overhead materials for the 150-mile, 44,000-volt transmission line of the Greenville, Spartanburg & Anderson Railway and Piedmont Traction Company. The orders include all porcelain insulators for the line, together with those for the telephone, signal and feeder lines.

Electric Locomotives for South.—The Tennessee Coal, Iron & Railroad Company has placed an order with the General Electric Company for four 18-ton locomotives. These will be 220-volt, three-phase, 25-cycle locomotives and their service will consist chiefly of switching and placing cars in and about the company's plant at Corey, Ala.

Aluminum Notes and Prices.—The aluminum market has been quiet during the week, with ingots for smelting held at 21@21½ cents spot No. 1, the base for large ingots, while rods and wire are held at 31 cents, with sheets at 33 cents.

Sedalia Light & Traction Company.—A decree has been rendered to foreclose the $807,000 mortgage on the property of the Sedalia (Mo.) Light & Traction Company, provided the indebtedness is not satisfied in forty days.

Financial.

The Week in Wall Street.

Irregularity and weakness were the features of the New York market during the week, with interest and sales decreasing to a minimum on Saturday last on account of the holidays. Price changes throughout the list were of no particular moment, and no adverse effect resulted in the Steel shares upon news of indictment of several subsidiary company officials in the wire cases cited elsewhere in this issue. Returning interest in long-term issues was noted in the bond market of the week, while no decrease has occurred in the activity which has characterized this market for the past few months. Good business in Wall Street in the immediate future is considered likely, not only from the re-investment demands but from the better prospects for public buying. Improvement in the latter half of the year is expected by many in financial quarters, not so much in the way of large undertakings or large gain in prices as in conservative advancement, with establishment of confidence and stability. Much of this optimism is caused by the fact that activity in other years has started about this time, and some of it no doubt is due to the brighter outlook in political and crop conditions. These factors, including possible tariff changes, the size of the harvests and the scope of the government investigations, are the paramount questions to be settled before conditions will approach the normal either in Wall Street or the country as a whole. That ultimate good will result from the government examinations is a matter of general belief, but the attention of many who might be attracted to Wall Street is seemingly more concerned at this time with finding out the full requirements of the Sherman law and means to establish their affairs on a basis in keeping with these than with the possibilities of the stock market. Provision for July disbursements resulted in heavy demand for call money during this week, but there was no noteworthy change in prices. Rates July 1 were: Call, 2@2¼ per cent; ninety days, 2¾@3 per cent. The quotations in the tables are those of the close, July 1.

NEW YORK.

	June 26.	July 1.	Shares Sold.		June 26.	July 1.	Shares Sold.
All. Ch.	9*	9*	- -	Int. Met., pf.	49¾	50¼	16,900
All. Ch., pt.	29½*	30	50	Mackay Cos.	89½*	89½*	100
Amal. Cop.	70	69⅝	33,200	Mackay Co., pf.	74⅞*	74⅞*	100
Am. D. T.	20½*	20½*	——	Man. Elev.	135	135*	100
Am. Loco.	40	40¾	800	Met. St. Ry.	15*	15*	——
Am. Loco., pf.	109*	109*	——	N.Y.&N.J.Tel.	139½*	139½*	——
Am. Tel. & C.	80*	80*	— —	Steel, com.	78⅞	78⅝	405,650
Am. T. & T.	148¾	139⅛	20,000	Steel, pfd.	118¾	118¼	5,338
B. R. T.	80½	81½	27,900	W. U. T.	79½	78⅞	2,400
Gen. Elec.	162	161¼	2,500	West'h, com.	76	76*	2,250
Int Met.	17⅝	17⅞	5,600	West'h, pfd.	119	119*	267

PHILADELPHIA.

	June 26.	July 1.		June 26.	July 1.
Am. Rys.	44	43¾*	Phila. R. T.	19⅝	19¼
El. Co. of A.	12¼	12⅛*	Phila. Elec.	17⅜	17¼
E. St. Bt'y.	54½	53¾	Phila. Trac.	86½	86½*
E. St. Bt'y., pfd.	30*	30*	Union Trac.	49	49¼

CHICAGO.

	June 26.	July 1.		June 26.	July 1.
Chi. City Ry.	186*	186*	Chi. Tel. Co.	124½	124½*
Chi. Rs., Ser. 1.	80*	87½*	Met. El. Co.	26⅝*	27*
Chi. Rs., Ser. 2.	22	26½	Met. El., pfd.	73½	[illegible]*
Com. Edison.	129½*	130	Nat'l Car.	120*	120*
Chi. Subways.	3⅞*	4	Nat'l Car, pfd.	118½*	118½*

BOSTON.

	June 26.	July 1.		June 26.	July 1.
Am. T. & T.	149	139⅛	Mex. Tel.	4½	4½*
Cum. Tel.	156¾*	156½*	Mex. Tel., pfd.	6¼*	6¼*
Edison E. Ill.	285*	283	N. E. Tel.	147	146¼
Gen. Elec.	163	161½*	W. T. & T.	20*	18½*
Mass. E. Ry.	22½	22¾	W. T. & T., pfd.	96½	96*
Mass. E. Ry., pf.	91½	93½			

*Last price quoted.
Shares sold for the week, June 26 to July 1.

Financial Notes.

Ohio Public Utilities Consolidated.—The holdings of the Warren Water & Light Company and those of the Hydro Electric & Gas Company, both of Warren, Ohio, have been sold to the Trumbull Public Service Company, of the same city. The Trumbull Public Service Company is composed of all the directors of the Hydro Electric Company, George W. York, of Otis & Hough, of Cleveland, and Henry L. Doherty, of New York City. The deal was the result of plans formulated by the late Elmer W. Gillmer, of Warren, and was consummated by his former associates. The Warren Water & Light Company was a consolidation of the Warren Water Company and the Warren Electric Light & Power Company, and had held franchises secured by itself or its predecessors, for nearly twenty-five years in the territory. It was incorporated under its pres name some eight years ago, and E. L. B. Gardiner was pr dent, with offices in Paterson, N. J. The Hydro Electric Gas Company was organized some five years ago, and suppl energy to Newton Falls, Warren, Niles and Leavittburg, fr its stations in these townships. The company owned franchi and rights in Trumbull and Geauga counties, consisting of s teen parcels of land in Warren city and Warren and New townships, and nineteen parcels of land in Parkman townsh containing valuable power sites not yet developed. The Tru bull Public Service Company has filed for record a mortg deed for $1,500,000 to provide for payment of 6 per cent g mortgage bonds, and the capital stock of the company, w a present issue of $700,000, is $1,700,000, against which is mortgage mentioned above.

Postal Telegraph Matters.—The July issue of *The Po Telegraph*, the monthly bulletin of the Postal Telegraph-Ca Company, contains a number of clippings from public pri relating to competition with other telegraph and cable cc panies in Texas, and also an article headed "Monopoly Texas," of which the following is a part: "Does Texas w a monopoly in telegraph facilities or does Texas wish cc petition? That is one question. Can the Postal Telegra Cable Company of Texas (controlled by Bell interests) give r competition with the Western Union (controlled by Bell int ests)? That is the second question. Is the Texas Postal corr in its claim that for thirty-six years the Mackay interests m turn over to the Texas Postal (controlled by Bell interests) their telegraph business to Texas? Or, on the contrary, the Mackay interests correct in their contentions; first, that t go free from the old contract because one of its terms all them to withdraw if the Texas Postal and Western Un should fall under the control of the same interests; second, t if the Mackay interests continued to act under that contract, t would be *particeps criminis* to the illegal combine of the Te Postal with the Western Union and Bell Telephone; third, t the Texas public has something to say about all this? It is the State of Texas to decide whether it will tolerate a monop or whether it shall have competition in telegraphy."

Jenney Electric Manufacturing Company Sold.—The perior court has approved the sale of the Jenney Electric Ma facturing Company plant, mentioned in the issue of July 1. the American Rotary Valve Company, of Chicago. The of the Chicago firm was $135,000. The plant will be reope in July under the direction of the purchasers, Austin H. H secretary, being in charge. The American Rotary Valve Co pany contemplates closing its plant at Niles, Cal., and also plant in southern Illinois. The work done by these facto will in the future be turned out by the Jenney plants near derson. More than $100,000 will be expended on improveme at the plant, and according to Mr. Hart 500 mechanics will employed by the end of the year. For the present the purcha expects to continue the manufacture of Jenney electric mot and printing-press equipment, but will later manufacture str car air compressors, vacuum cleaners and other products which rotary valves are used. Extensive experimenting be done to perfect a rotary valve for use in gas engines. American Rotary Valve Company is a new corporation inc porated last February and its directors are: William Wal V. T. Lawson, Warren C. Fairbanks, Austin H. Hart, Dele H. Smith and William Waller, Jr.

Cincinnati, Newport & Covington Light & Tract Dividend.—Directors of the Cincinnati, Newport & Covi ton Light & Traction Company have declared a quarterly d dend of 1¼ per cent on the common stock and 1⅛ per c on the preferred stock, both payable July 15, placing the co mon stock on a 5 per cent basis. This is obligatory under lease which the Columbia Gas & Electric Company holds the property. It is reported that the common stock will placed on a 5½ per cent basis in April next, and that this be increased to 6 per cent in April next, which will be the p manent income basis after that time.

United States Light & Heating Company.—Discussion the advisability of increasing the par value of the common preferred stocks of the United States Light & Heating Comp was made at the recent directors' meeting. Application to the stocks on the New York Stock Exchange will be m in case the change is made. A committee was appointed consider the change, and its report will be taken up by board at a future meeting.

United Railways & Electric Company of Baltimore.—Commenting upon the proposed issue of $3,125,000 three-year collateral trust 5 per cent convertible notes of the United Railways & Electric Company of Baltimore, which will be used to provide funds for retiring maturing underlying bonds of the company, as mentioned in the *Electrical World* July 1, Alex. Brown & Sons, of Baltimore, state in part: "We sum up from the company's annual report for 1910 as follows: The report states that the physical condition of the property is 'on the whole better than that of any street railway in the country.' For the year 1910 net earnings over and above operating expenses, taxes, fixed charges, rentals, etc., were $1,226,853, of which amount $864,048 in pursuance of a program for the rehabilitation of the property was expended upon improvements, etc. The company on June 1, 1911, resumed payment of interest on its income bonds. On the basis of the above given earnings for 1910, after deducting operating expenses, fixed charges, taxes, rentals and interest on income bonds (less annual payments on securities retired with the proceeds of these notes), the surplus applicable to interest on these notes is over five times the interest charges. This is without allowing for any increase of net earnings during 1911. We will receive subscriptions for the above notes at 98½ per cent, at which price they pay slightly over 5½ per cent if allowed to run to maturity and proportionately higher if redeemed prior thereto; payment to be made in full in Baltimore or New York funds at our office on July 15, 1911, at which time either the notes or temporary certificates will be delivered, exchangeable for notes when prepared. The entire issue of notes has been underwritten by a syndicate. Subscriptions will be closed at 12 o'clock noon on July 8, 1911, or earlier, we reserving the right to close the subscription at any time without notice (except as to stockholders as hereinafter mentioned), to reject any application and to allot smaller amounts than those applied for. The stockholders of the company of record at noon on July 8, 1911, will be given precedence in the allotments; that is to say, every subscribing stockholder will receive an allotment of $100 of notes or multiples thereof for every ten full shares of stock or multiples thereof notwithstanding any over-subscription for the notes. The above issue is dependent upon the approval of the stockholders of the company and the Public Service Commission of Maryland."

Consolidated Gas & Electric Bonds.—The $1,000,000 4½ per cent bonds of the Consolidated Gas, Electric Light & Power Company of Baltimore, which were listed on the London Stock Exchange, as mentioned in the issue of June 22, have been offered to securities at 89. The securities are due February 14, 1935, and are a part of a total authorized issue of $15,000,000, there being $11,788,000 outstanding, $2,877,000 of which have been deposited as collateral security for notes of the company and bonds of the Baltimore Electric Company. The securities are a first mortgage on the Westport power station and on other parts of the gas and electric properties. They are also a general mortgage on the entire business subject to the outstanding issues of constituent companies aggregating $13,928,000, which amount cannot be increased.

Monterey Railway, Light & Power Earnings.—Gross earnings of the Monterey Railway Light & Power Company for the year ended December 31 were $144,182, which represented an increase of $22,095 over the gross returns of the previous year. While operating expenses also increased $14,483, amounting to $93,297, net earnings were $50,885, showing a gain of $7,612 in this term for the year. Other income added made a total income of $452,759, which was $132,652 larger than in the year preceding. Deducting interest charges of $253,472, there was left a balance of $199,287 available for dividends, $40,974 larger than the previous balance. Preferred dividends amounting to $25,000 were paid, leaving a surplus for the year of $174,287, which, added to the previous surplus, made a total of $381,175.

New England Traction Companies Merged.—Announcement is made of the absorption of the Old Colony Street Railway Company by the Boston & Northern Street Railway Company. Mention of meetings of each of these companies, June 2, at which it was voted to merge the two, was given in the issue of June 8. While the companies operate in a large number of towns and cities in Massachusetts, New Hampshire and Rhode Island, their lines do not connect, and as the Railroad Commission, under the general street railway law, cannot approve a consolidation of companies which have no physical connection with each other, special legislation was necessary to effect the merger. The companies have been under the same management for a number of years, but have been operated as separate companies. Both are owned by the Massachusetts Electric Companies, which control several electric railway companies through leases. The present offices of the merged companies will continue at 84 State Street, Boston, and Patrick F. Sullivan, Robert S. Goff and Charles R. Rockwell, who at present are respectively president, vice-president and treasurer of the merging companies, will continue in these capacities with the consolidated systems. The board of directors of the Boston & Northern Street Railway Company will be increased by the number of directors on the board of the Old Colony Street Railway Company.

Bronx Gas & Electric Company.—A report issued by the Public Service Commission for the First District of New York shows that operating revenue of the Bronx Gas & Electric Company for the year ended December 31, 1910, for electricity sold, was $130,380, a gain of $14,231 over this item in the previous year. The operating income, after deduction of expenses and taxes, was $37,233, which was $9,405 in excess of the result in 1909. The combined income from the sale of electricity and gas, after deducting of expenses and taxes, was $72,147, which is an increase of $4,107 over the figures for 1909. The profit and loss surplus, as of December 31, 1910, is given as $77,360.

Havana Electric's Year.—The most satisfactory year in the history of the Havana Electric Railway Company ended Dec. 31, 1910. Gross and net earnings were the largest on record, the former amounting to $2,656,980, comparing with $2,488,647 for the previous year, and the latter earnings being $1,291,339, as compared with $1,237,548 in 1909. In view of the large returns the dividend on the common stock was increased to 6 per cent, double the previous rate. General improvement is recorded in the various departments of the company, the gross earnings per mile being $44,000.

Narragansett Electric Lighting Company Stock.—Following a recent meeting of the board of directors of the Narragansett Electric Lighting Company, the treasurer was instructed to call in the $500,000 debenture certificates of the series of 1913, which were issued January 1, 1909, and to issue capital stock of an equal amount at par to the certificate holders of record July 1. This action increases the capital stock of the company to $4,500,000. It had been intended to redeem the debentures in 1913, but the affairs of the company have permitted earlier action.

Aberdeen Light & Power Company.—First-mortgage, 6 per cent twenty-year gold bonds of the Aberdeen Light & Power Company, of Aberdeen, S. D., are offered for sale by the Chicago Savings Bank & Trust Company. It is said that at the present time the net earnings are practically three times the interest charge and that the company has liberal franchises extending well beyond the maturity of the bonds, with favorable city contracts. The price is 101½ and interest, netting about 5.90 per cent.

DIVIDENDS.

Chicago Pneumatic Tool Company, quarterly, 1 per cent, payable July 25.

Edison Electric Illuminating Company of Boston, quarterly, 3 per cent, payable August 1.

Norfolk & Portsmouth Traction Company, quarterly, preferred, 1¼ per cent; payable July 10.

Pacific Coast Power Company, semi-annual, $2.50 per share, and extra dividend, 50 cents per share on common; payable July 17.

Railway & Light Securities Company, semi-annual, preferred, 3 per cent; common, 2 per cent, both payable August 1.

REPORTS OF EARNINGS.

Period	Gross Earnings	Operating Expenses	Net Earnings	Fixed Charges	Net Surplus
CUMBERLAND TELEPHONE & TELEGRAPH COMPANY					
May, 1911	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
" 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NASHVILLE RAILWAY & LIGHT COMPANY					
May, 1911	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
" 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORTHERN OHIO TRACTION & LIGHT COMPANY.					
May, 1911	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
" 1910	207,323	111,250	96,073	43,375	52,698
TWIN CITY RAPID TRANSIT COMPANY.					
May, 1911	$658,739	$311,974	$346,764	$140,079	$206,685
" 1910	627,946	289,382	338,564	140,112	198,451

General News

Construction News.

ALEXANDER CITY, ALA.—The Industries Light & Power Company [illegible] electricity to light the town.

BIRMINGHAM, ALA.—Morris Knowles, consulting engineer, of Pittsburgh, Pa., engaged by the City Commission to investigate the municipal electric-light plant at North Birmingham with a view of enlarging the plant to supply electricity for lighting the streets of Greater Birmingham, has advised the commission that the plant can furnish the service with some improvements and extensions, which can be made at a comparatively small expense.

DOTHAN, ALA.—It is reported that plans and specifications have been prepared for extensions and improvements to the municipal electric-light plant and water-works system, to cost about $75,000. The proposition to issue bonds for the proposed work will be submitted to a vote.

GADSDEN, ALA.—It is reported that it is proposed to develop the water power of the Little River, on Lookout Mountain, to generate electricity, which will be transmitted to Gadsden and other small cities in this section. It is said that $60,000 has already been spent in purchasing land and making surveys in connection with the project. It is expected that 20,000 hp will be available.

HARTSELL, ALA.—Bonds to the amount of $28,000, it is reported, will be sold by the city, the proceeds to be used for the installation of an electric-light plant, water works and sewer system. Bids will be asked for the work when the bonds are sold. Xavier A. Kramer, of Magnolia, Miss., is engineer.

RUSSELLVILLE, ALA.—Contracts have been awarded by the Mayor and Board of Aldermen for the construction of an electric-light plant and water-works system in Russellville to W. W. Moore, of Birmingham, Ala., to cost about $24,000. Plans for the plant were prepared by Professor Kay, of the University of Alabama, who will supervise the installation of same. The street-lighting system calls for 107 lamps.

HUNTINGTON PARK, CAL.—The City Council has passed an ordinance fixing the rate to be charged for electricity for the coming year at 8 cents per kw-hour. The present rate is 12 cents per kw-hour, with a minimum rate of $1 per month. The Pacific Light & Power Company supplies electrical service in Huntington Park. It is expected that the matter will be carried to the courts.

ONTARIO, CAL.—The City Council has awarded the Ontario Power Company contract to supply electricity to operate the pumps at the new municipal water system at Fourth Street. Under the terms of the contract the city can terminate the same at the end of two years by giving the company ninety days' notice and payment of $250; at the end of three years upon payment of $165, and at the end of four years upon payment of $80. Most of the pumping is to be done between the hours of 10 p. m. and 7 a. m., for which the rate will be 1 cent per hp-hour; for service between the hours of 7 a. m. and 4 p. m. the charge will be 1¼ cents per hp-hour. No pumping is to be done between the hours of 4 p. m. and 10 p. m., except in case of fire, for which 1¾ cents per hp-hour will be charged.

PASADENA, CAL.—The contract for installing a generating unit in the municipal electric-light plant has been awarded to the Westinghouse Company, of Pittsburgh, Pa., for $22,855. C. W. Koiner is general manager of the municipal electric plant.

SAN FRANCISCO, CAL.—The Pacific Wave Power Company has leased certain lands along the shores of Golden Gate at Baker's Beach, opposite Twenty-ninth and Thirtieth Avenues. The company is planning to construct and operate a miniature ocean wave power plant, work on which will begin at once. Omer Denny is consulting engineer, and W. H. Chamberlain is president.

SAN FRANCISCO, CAL.—The control of the City Electric Company was taken over by the Great Western Power Company on July 1, bringing the company into active competition with the Pacific Gas & Electric Company. The City Electric Company has a franchise to extend its service in all parts of San Francisco. The Great Western Power Company has a large hydroelectric plant on the North Fork of the Feather River in Butte County with high-tension transmission extending into Oakland, where the company has a large steam auxiliary plant.

FT. COLLINS, COL.—Steps have been taken by the City Council for the construction of a municipal electric-light and power plant. The City Engineer has been instructed to make surveys and estimates on the cost of installing a plant about 50 miles west of Ft. Collins.

EAST LYME, CONN.—The Lyme Power Company, it is reported, has been granted a franchise to supply electricity in East Lyme.

NEW HAVEN, CONN.—Preparations are being made by the Yale University to build a large heating and lighting plant at the corner of Ashmun Street and Winchester Avenue, to cost about $500,000. The new plant will supply heat and light for the university buildings.

PLAINFIELD, CONN.—Surveys have been made by the People's Light & Power Company, of Danielson, Conn., for the erection of its new transmission line from the Plainfield power house to Central Village. The line will be built over private right of way most of the distance.

WASHINGTON, D. C.—The contract for supplying electric incandescent lamps, under bids opened June 19 by the general supply committee, has been divided between the Columbia Incandescent Company, 2115 Locust Street, St. Louis, Mo., and the General Electric Company, of Schenectady, N. Y.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 11, for furnishing at the various navy yards and naval stations the following supplies: Washington, D. C.—Schedule 3722—Miscellaneous fire-alarm boxes, etc. Brooklyn, N. Y.—Schedule 3728—900 dry cells and miscellaneous electrical fuses. Norfolk, Va.—Schedule 3728—25,000 glass tube fuses. Boston, Mass.—Schedule 3727—5700 lb. naval brass rod; 860 lb. sheet brass; 750 lb. sheet copper, etc. Bids will also be received at the same place until July 18 as follows: Washington, D. C.—Schedule 3738—For six motor-generator sets. Newport, R. I.—Schedule 3733—Copper tubing. Brooklyn, N. Y.—Schedule 3739—Copper tubing. Applications for schedules should give the numbers desired.

ST. PETERSBURG, FLA.—Plans are being considered by the St. Petersburg Investment Company for the construction of power plant, car barns, etc. R. E. Ludwig is consulting engineer, and H. Walter Fuller manager of the company.

ATHENS, GA.—The Athens Electric Railway Company is enlarging its Mitchell's Bridge power plant, increasing the output from 1000 hp to 1200 hp. Plans are also being made by the company for increasing the capacity of the Tallahassee Shoals plant.

BOISE, IDAHO.—It is expected that the transmission lines of the Beaver River Power Company will be extended from the Malad River power plant northward into Boise and through the Payette country by Oct. 1, 1911. The initial installation of the plant now being erected on the Malad River will have an output of 10,000 hp with an ultimate development of 20,000 hp. The plant is located about 7 miles from Bliss. The company has recently been granted franchises to supply electricity in Mountain Home and Glens Ferry. L. B. Fuller, of Provo, Utah, is vice-president of the company.

CALDWELL, IDAHO.—The installation of a municipal electric-light plant in Caldwell is reported to be under consideration.

COLCHESTER, ILL.—The Colchester Electric Light & Power Company, it is said, will probably rebuild its plant in the near future, which was recently burned. The company has been granted a twenty-year franchise.

HILLSBORO, ILL.—The Hillsboro Electric Light & Power Company has awarded the contract for construction of a new power house to J. T. Morgan and Frarer Brothers.

MINONK ILL.—The Union Light & Power Company, recently formed by the consolidation of the Minonk Electric Light & Power Company and Rutland Electric Light Company, is reported to have purchased the property of the Toluca Electric Light & Gas Company, of Toluca. The company is capitalized at $100,000 and the officers are: S. C. Kipp, of Minonk, Ill., president; F. Z. Ames, of Rutland, secretary, and J. S. Webber, of Rutland, treasurer.

ORANGEVILLE, ILL.—The installation of an electric-light plant in Orangeville is reported to be under consideration.

OTTAWA, ILL.—Orders have been placed by the Chicago, Ottawa & Peoria Railway Company with the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for equipment for three substations having a capacity of 300 kw each. The company is building an extension from Morris to Joliet, a distance of 22 miles.

PEORIA, ILL.—The St. Louis, Springfield & Peoria Railway Company has contracted with the Westinghouse Electric & Manufacturing Company for equipment for two substations, one of 300 kw and the other of 500 kw capacity.

SPRINGFIELD, ILL.—Plans are being considered by the Springfield & Central Illinois Traction Company for extending its railway from Edwardsville to Greenville, to connect with the main line.

YORKVILLE, ILL.—Work has begun on the construction of a concrete dam by F. H. and George Simpson, who recently purchased the Millhurst water-power site. Negotiations are under way, it is said, for lighting the City of Plano.

SHERIDAN, IND.—The Town Council is reported to be negotiating with out-of-town parties with a view of selling the municipal electric-light plant, who, it is said, will install a new plant and lighting system.

VINCENNES, IND.—The Vincennes, Washington & Eastern Traction Company has awarded the contract for the construction of its proposed electric railway between Vincennes, Washington and Loogootee to the Canadian Construction Company.

BELLEVUE, IA.—Two Foos producer engines have been purchased for the municipal electric-light plant. Both engines are of the [illegible] three-cylinder vertical type and will develop 100 hp.

COUNCIL BLUFFS, IA.—The Commercial Club of Council Bluffs is advocating the installation of a municipal electric-light plant in Council Bluffs. A committee has been appointed by the club to investigate the feasibility of the plan and to secure estimates on the probable cost and operation of a plant of sufficient capacity to meet the present needs and also one of double the capacity. The cost of lighting the city last year was $20,472. The question of improving the present street-lighting system is under consideration. Dr. Donald McCrae is chairman of the special lighting committee of the club.

DE LAND, IA.—I. C. Bowsher is reported to have applied to the Village Board for a franchise to install and operate an electric-light plant in De Land.

WILTON, IA.—The local electric-light plant is reported to have been damaged by fire recently, causing a loss of about $3,500.

GARDEN CITY, KAN.—A special election will be held on August 1 to vote on the proposition to issue $40,000 in bonds, the proceeds to be used for the construction of a municipal electric-light plant in Garden City.

MANHATTAN, KAN.—The Public Utilities Commission has authorized the Manhattan City & Interurban Railway Company to issue $200,000 in bonds, the proceeds to be used to build an extension from Manhattan to Ft. Riley.

NESS CITY, KAN.—The electric-light and ice plant and mill, owned by the Ness City Mill, Light & Ice Company, was destroyed by fire on June 23, causing a loss of about $100,000.

SYLVAN GROVE, KAN.—At an election held June 26 the proposition to issue $35,000 in bonds, the proceeds to be used for the construction of an electric-light plant and water-works system, was carried.

SYKESVILLE, MD.—Sealed proposals will be received at the office of the Governor of Maryland, Union Trust Building, Baltimore, Md., until July 14 for the installation of equipment in the power house of the Springfield State Hospital at Sykesville, Md., consisting of boiler plant, engines, generators, switchboard and piping, according to plans and specifications prepared by Henry Adams, consulting engineer, 855 Calvert Building, Baltimore, Md.

CARLISLE, MASS.—The town of Carlisle has awarded a contract to the Edison Electric Illuminating Company of Boston for lighting the streets of the town for a term of ten years.

LUNENBURG, MASS.—The Leominster Electric Light Company is extending its transmission lines from the present terminus on Oak Avenue to the Dickinson place on the Northfield Road. A petition will soon be presented to the town officials asking for the extension of the street-lighting system over the same line.

MILFORD, MASS.—The Milford Electric Light & Power Company is installing two new generators and a switchboard in its power house. The gas service on Main Street is also being renewed.

PRINCETON, MASS.—At a town meeting held recently the citizens voted to authorize the electric-light committee to enter into a contract with the Roper Box Lumber Company to install a street-lighting system for a period of ten years. Under the terms of the contract the company is to supply fifty lamps at $20 each per year.

ROWLEY, MASS.—At a special town meeting held recently it was voted to extend the municipal electric-light system to the suburbs of the town and to appropriate the sum needed to pay the extensions.

BARAGA, MICH.—The Village Council is considering the question of installing a municipal electric-light plant and water-works system at an estimated cost of about $28,000. J. F. Pruer, of St. Paul, engineer, has been engaged to make preliminary surveys and prepare plans for same.

IRON MOUNTAIN, MICH.—Arrangements are being made by the Newton Construction Company, which has the contract for construction of the large dam at Twin Falls on the Menominee River, near Iron Mountain, for the Peninsula Power Company, to begin work on the same. It is understood that the Chicago, Milwaukee & St. Paul Railroad Company has agreed to build at once a short spur track from the main line to a point near the site of the dam.

SAGINAW, MICH.—Announcement has been made by the Pere Marquette Railroad Company of further improvements to its system, costing about $100,000, which will be made at once. A new power station with double the output of the present plant will be erected and 32-stall round houses will be built.

TROWBRIDGE, MICH.—The power house of the Commonwealth Power Company at Trowbridge was destroyed by fire, causing a loss of about $100,000. This plant has an output of 5000 kw and supplies electricity to Allegan, Otsego, Plainwell and Kalamazoo. It is said that the plant will be rebuilt.

DEERWOOD MINN.—The Cuyunna Range Light & Power Company is reported to be making arrangements to increase the output of its hydroelectric power plant, located near the Crow Wing River.

DULUTH, MINN.—The Suburban Street Railway Company is reported to have financed its proposed railway. It is understood that work will soon begin on the construction of suburban lines in Duluth. N. J. Upham, of Duluth, Minn., is interested in the company.

TOWER, MINN.—It is reported that arrangements are being made for the construction of a dam and electric plant at Like River, to cost from $12,000 to $15,000, bids for which will soon be called. D. A. Reed is engineer.

NEWARK, N. J.—Plans are being considered by the city officials and the Public Service Corporation for developing the water-power of the Pequannock River to generate electricity. The present plan is to have the city build a generating plant on the city property and sell the output of the plant to the Public Service Corporation or any other company utilizing electricity desiring the service. It is estimated that about 1000 hp can be developed. The project has been considered before with a view of supplying electricity in Newark, but it was found that the distance was too great to utilize the electricity generated at an advantage.

PASSAIC, N. J.—The Common Council has authorized the Mayor and public safety committee to engage an engineer to ascertain the cost of installation and maintenance of a municipal electric-light plant for Passaic, and also the cost of placing all wires on prominent streets under ground.

RED BANK, N. J.—The question of establishing a municipal electric-light plant in Red Bank is under consideration. The purchase of the local plant is contemplated.

DEMING, N. M.—P. E. Kern, of Deming, N. M., is interested in a project to establish a colony for a large development project around Iola, N. M., 20 miles south of Deming, in the Mimbres country. It is proposed to secure enough subscribers to develop 16,000 acres. The plan includes the installation of a central power plant with pumps and motors to irrigate half sections at a cost of $122,500. A committee, consisting of Mr. Kern, Ira P. Wetmore and Clarence V. Hon, has been appointed to inspect the different irrigating systems.

BINGHAMTON, N. Y.—Plans have been submitted to the Common Council by Electrical Engineer FitzGerald for the construction of an underground subway on Court Street, from Exchange Street to the bridge, the cost of which is estimated at $23,439. The plan provides for twenty-eight main ducts and ten laterals at a cost of $9,500; it also calls for six manholes, eighteen injunction boxes, forty-five service boxes used for branching conduits, eighty service boxes and for thirty-eight lamp posts and four police call posts. Provision has been made for ducts for the Binghamton Light, Heat & Power Company and four ducts for municipal electric wires in case a municipal plant is installed in the future, one duct for fire-alarm system, one for police-wire system and two ducts for boulevard lighting. It is the intention of the Binghamton company to carry its wires in a subway from the corner of Exchange Street up Court Street to its power plant.

BUFFALO, N. Y.—The Broadway Business Men's Association is considering the question of erecting electrically lighted arches along Broadway.

NORWICH, N. Y.—The Norwich Pharmacal Company, of Norwich, N. Y., it is reported, is contemplating building an addition to its factory building, now under construction, and the erection of a power house, 40 ft. x 80 ft., one story high.

ONEONTA, N. Y.—The contract for direct-connected engines and generators and switchboard for the State Normal School, Oneonta, N. Y., was awarded to the Troy Electric Company, of Troy, N. Y., at $2,977, and to the Conduit Electric Company, of Syracuse, N. Y., for feeder cables and interior electric light wiring, for $3,270.

POUGHKEEPSIE, N. Y.—The Public Service Commission, Second District, has granted the Central Hudson Gas & Electric Company permission to execute a mortgage for $5,000,000 to the Knickerbocker Trust Company, of New York, N. Y., and to issue at this time $600,000 in bonds, the proceeds to be used for proposed improvements. The company operates in Poughkeepsie, Newburg and Cornwall.

ROCHESTER, N. Y.—Arrangements have been made between the committee on lamps and electricity and the representatives of the Rochester Railway & Light Company and the New York Telephone Company, whereby the overhead wires in St. Paul Street and Clinton Avenue south will be removed within a year.

SYRACUSE, N. Y.—Orders have been placed by the Syracuse Rapid Transit Company with the General Electric Company of Schenectady, N. Y., for one 1000-kw rotary converter, three 350-kva transformers and a switchboard.

GASTONIA N. C.—The electric-power plant of the Spencer Mountain Power Company located on the Catawba River, about 7 miles from Gastonia, was destroyed by fire on June 24, causing a loss of about $20,000. It is understood that the plant will be rebuilt at once.

LISBON, N. D.—The Bemmels Milling Company is reported to be contemplating the installation of an electric plant to supply electricity for lamps and motors in Lisbon.

CINCINNATI, OHIO.—Proposals will be received by the Board of Trustees, Public Library, school district of Cincinnati, Ohio, until July 18, for rewiring the Public Library Building, 620 Vine Street, Cincinnati, Ohio, according to plans and specifications on file in the office of the clerk of Board of Trustees in the Public Library Building. Bids are to be addressed to R. H. West, chairman of the building committee.

DAYTON, OHIO.—The merger of the Dayton Lighting Company, the Citizens' Electric Company and the Dayton Light & Power Company has been consummated and the issue of $20,000,000 in capital stock authorized. The officers of the Dayton Lighting Company are: E. P.

Matthews, president; H. L. Tallett, treasurer, and F. M. Tait, vice-president, secretary and general manager.

IRONTON, OHIO.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until July 17 for the construction of United States post office at Ironton, Ohio, including plumbing, heating apparatus, electric conduits and wiring and lighting fixtures, in accordance with plans and specifications, copies of which may be obtained from the above office or from the custodian of site, James Knox Taylor, supervising architect.

TOLEDO OHIO.—The Auglaize Power Company, recently incorporated with a capital stock of $1,000,000, proposes to develop the water powers of the Maumee and Auglaize rivers and supply electricity in the counties of Lucas, Wood, Fulton, Henry, Williams, Defiance, Paulding and Putnam. The promoters of the new company are interested in the Ashley hydraulic plant recently completed on the Maumee River in Miami, which supplies part of the energy used by the Toledo Railways & Light Company. It is stated that the company proposes to build at least three hydroelectric power plants in northwestern Ohio, the first of which will be erected on the Auglaize River at Defiance, where water rights have been secured. About 3000 kw will be developed at this plant. The incorporators are: Robert R. Livingston, J. M. Ashley, Charles S. Ashley, Grant Miller and William P. Wallace, of Toledo.

GROVE, OKLA.—The citizens have voted to issue $35,000 in bonds, the proceeds to be used for the installation of an electric-light plant and water-works system in Grove.

PAWHUSKA, OKLA.—The proposition to issue $10,000 in bonds, the proceeds to be used for improvements and extensions to the electric-light system, will be submitted to a vote.

HALSEY, ORE.—The Oregon Power Company, of Albany, Ore., has been granted a franchise to construct and operate an electric-lighting system in Halsey.

KLAMATH FALLS, ORE.—The Medford River Electric Company, of Medford, Ore., has submitted a proposition to the City Council offering to supply electricity in Klamath Falls. The company offers to furnish the city with electric energy to be distributed by the city at a flat rate, or would be willing to operate under a franchise. If granted a franchise the company offers to make provision in the franchise giving the city the right at all times to regulate the rates to be charged for electricity and in addition would allow the city 5 per cent of the gross earnings of the company.

NEWPORT, ORE.—The Yaquina Electric Company, of Tacoma, Wash., recently incorporated, is planning to install an electric-power plant in Newport. Under its charter the company has the right to construct and operate electric railways and operate steamers.

EBENSBURG, PA.—Improvements are being made to the plant and system of the Ebensburg Light, Heat & Power Company. Most of the service will be changed from direct-current to alternating-current, heretofore both systems have been supplied.

IRWIN, PA.—The Borough Council has granted the Pittsburgh, McKeesport & Greenburg Railway Company a franchise to construct and operate an electric railway from Main Street to the west boundary line of the town connecting with the Trafford City extension of the Pittsburgh Railways Company.

LANCASTER, PA.—The Lancaster & York Furnace Street Railway Company is installing two 300-kw rotary converters in its power house.

MASONTOWN, PA.—Application has been made at Harrisburg for an extension of the West Penn Traction Systems through Masontown, Pa. to Morgantown, W. Va. The new railway will be known as the Masontown-Morgantown Street Railway Company. The first section will be built from Masontown to New Geneva, Pa., a distance of about 5 miles; later it will be extended to Point Marion, Pa., and ultimately to Morgantown. Plans are also contemplated by the West Penn Traction interests for extensions south from Masontown.

NEW CASTLE, PA.—An ordinance has been introduced to the City Council to call an election to submit the proposition to issue $500,000 in bonds to construct a municipal electric-light plant, sewage-disposal plant and for repaving and repairing streets, to a vote of the people. It is proposed to [illegible] an [illegible] plant to cost about $[illegible], a sewage-disposal plant, at a cost of $183,000, and to expend $117,000 for street improvements.

PHILADELPHIA, PA.—Plans have been completed for the erection of an electric plant for the Philadelphia Electric Company by John T. Windrim. The plant will be located at Twenty-sixth and Christian Streets, and will be used to supply extra power to the Philadelphia Rapid Transit Company. The cost of the plant complete is estimated at about $50,000.

PROVIDENCE, R. I.—The Gorham Manufacturing Company is installing additional boilers of 300 hp, erecting a new chimney and remodeling the steam mains; the heating plant is also being remodeled. C. E. Fairbanks is engineer in charge.

WASHINGTON, R. I.—At a meeting of the Washington lighting district held recently the committee was authorized to enter into a contract with the Narragansett Electric Lighting Company for lighting the district.

ANDERSON, S. C.—The Savannah Power Company is reported to be contemplating the installation of an auxiliary steam-power plant.

MOBRIDGE, S. D.—A franchise has been granted to the Mobrid Light & Heat Company to install an electric-light plant in Mobridge. Tl plant will be driven by steam power and an alternating-current, thre phase, 2300-volt, 60-cycle electric system will be installed. M. J Brookman is engineer in charge. Messrs. Hill & Smith are owners.

YANKTON, S. D.—It is reported that the electric light plant of tl Yankton Light, Heat & Power Company is being remodeled. It is pr posed to establish a twenty-four-hour service.

CHATTANOOGA, TENN.—The Chattanooga Railway & Light Con pany has applied to the City Council for a franchise to extend its stre railway system along Highland Park and Vance Avenue.

MEMPHIS, TENN.—A permit has been granted for the new powe house for the new union passenger station to be located at South Secon Street and Carolina Avenue. The building will be of brick and con crete construction and cost about $40,000.

BRYAN, TEX.—It is reported that the proposition to issue $20,000 i bonds to complete the electric-light plant, water works and sewer sy tems will be submitted to a vote.

BRYAN, TEX.—Rapid progress is being made on the power plar being erected for H. T. and J. S. Lawler, of New Orleans, La., i Bryan. It is expected to have the plant in operation by Aug. 1. Th plant will supply electricity for lighting the city and operating th pumping system of the water works.

HARDWICK, VT.—Plans are being considered for increasing th output of the municipal electric light plant for which bonds to th amount of $65,000 has been voted. A dam 13 ft. high will be buil above Jackson Bridge, about a mile from the village. The cost o building the dam is estimated at $24,000, new equipment $15,000 an land damages $20,000.

HYDE PARK, VT.—At a special village meeting held recently th Water and Light Commissioners were authorized to make improve ments and extensions to the municipal electric-light plant, the cost nc to exceed $7,500. The work will include the purchase of new ma chinery.

NORTH TROY, VT.—The Frontier Electric Company, recently in corporated with a capital stock of $30,000, it is said, will supply elec tricity in Orleans County and other parts of Vermont and Quebec.

ALEXANDRIA, VA.—The Alexandria Electric Company is reported t be contemplating remodeling and enlarging its power plant. It is under stood that contracts have been placed for additional equipment. Th company is planning to extend its transmission lines to various suburbs including Virginia Highlands, Mount Ida and Braddock Heights. Franci R. Weller, Hibbs Building, Washington, D. C., will supervise the work

LYNCHBURG, VA.—The contract for furnishing and installin lighting fixtures in the United States post office building in Lynchbur has been awarded to the Cassidy & Son Manufacturing Company, o New York, N. Y., for $2,525.

NEWPORT NEWS, VA.—At an election held June 24 the propositio to issue $150,000 in bonds, the proceeds to be used for construction of municipal electric-light plant, was defeated.

SUMAS, WASH.—It is reported that the town of Sumas will issu bonds to the amount of $7,000, the proceeds to be used to install ar electric-light and heating system.

KEYSTONE, W. VA.—The Appalachian Power Company is reported t have purchased the property of the Keystone Light & Power Compan in Keystone.

WELCH, W. VA.—The property of the Welch Water, Light & Powe Company is reported to have been sold to the Appalachian Power Com pany.

DE PERE, WIS.—The De Pere Electric Light & Power Company has awarded contract for deepening the tail race in the rear of its plant. The cost of the work is estimated at $5,000 and will increase the water-power available from 25 per cent to 30 per cent. Electricity for operating the local system will be obtained from the power plant at High Falls, with which the plant is connected.

MADISON, WIS.—The bill authorizing the Chippewa & Flambeau Improvement Company to construct and operate a system of reservoirs has passed the State Legislature. The proposed system is expected to regulate the flow of water at all seasons of the year so that the water-powers along these rivers will not be forced to stop during the low-water periods.

MILWAUKEE, WIS.—Mayor Emil Seidel has vetoed the resolution providing for the appropriation of $6,000 to engage engineers for preliminary work on the proposed municipal electric light plant, passed by the Council June 5. The reason for vetoing the bill was due to its being illegal, owing to the appropriation having been made before the fund was created.

NEW LISBON, WIS.—Bids will be received by W. S. Sargent, city clerk, until July 19 for the construction of an electric-light plant and water-works system. A Meyer, of Appleton, Wis., is engineer.

LETHBRIDGE, ALTA., CAN.—It is reported that additional equipment will be installed in the municipal electric-light plant to supply electricity to operate the proposed street-railway system in Lethbridge. The apparatus will include four boilers, an electrical generating unit and steam-driven exciter, a motor generator, switching apparatus and extension to present economizer and coal conveyor.

MACLEOD, ALTA., CAN.—It is reported that the by-law to [appropri]ate $40,000 for extensions to the municipal electric light plant [and wa]ter-works system will be submitted to the voters. E. F. Brown is town [cler]k.

WAINWRIGHT, ALTA., CAN.—The installation of a municipal [ele]ctric light plant in Wainwright is reported to be under consideration.

WETASKIWIN, ALTA., CAN.—It is reported that preparations are [bei]ng made for the installation of additional equipment in the municipal [ele]ctric light plant, including a gas-engine-driven generator and a [mo]tor-driven air compressor.

VERNON, B. C., CAN.—Bids will be received by the city of Vernon, B. C., Can., until July 10 for furnishing and installing one 200-kw, three-[pha]se, 2200-volt, 60-cycle generator, together with two-panel switchboard [and ex]citer complete. Specifications and form of tender may be ob[tain]ed at the office of the city superintendent. D. G. Tate is city clerk.

BEAMSVILLE, ONT., CAN.—A movement has been started by the [resi]dents of the district between Hamilton and Beamsville, Ont., to [sec]ure electrical service from the distributing system of the Hydro-[Ele]ctric Power Commission. It is expected that a substation will be [erec]ted at St. Ann's to supply this territory.

OTTAWA, ONT., CAN.—It is reported that American and English [capi]talists are interested in the erection of an electric smelting plant to [be] located at Chat Falls, about 20 miles west of Ottawa, work on [whi]ch will begin early next spring. It is proposed to build an electric [rail]way from the falls to the mines.

OWEN SOUND, ONT., CAN.—The Town Council is contemplating [secu]ring hydroelectric power either from Niagara Falls, by the way of [Eug]enia, or from the lately acquired Severn plant. The Council has [com]municated with the Hydro-Electric Power Company with a view of [asc]ertaining the approximate cost and opportunity of securing the [ser]vice.

MONTREAL, QUE., CAN.—The Isle au Heron Development Com[pan]y, recently incorporated, is reported to be contemplating a power [deve]lopment at the Lachine Rapids.

MOOSE JAW, SASK., CAN.—Proposals will be received by W. F. [Hea]l, city clerk, until July 24 for electrical apparatus as follows: Con[trac]t A—50 6.6-amp., direct-current, series-metallic, flame-arc lamps, [wit]h globes, etc.; fifty absolute cut-out hangers; current regulator for [fifty-l]amp circuit; one mercury rectifier for fifty-lamp circuit; one control [pane]l with switches for fifty-lamp circuit. Contract P—fifty ornamental [lam]p standards. Plans and specifications may be obtained from J. P. [Pet]ers, electrical superintendent.

WATROUS, SASK., CAN.—Contracts have been placed by the town [of] Watrous with the Brydges Engine & Supply Company for the in[st]allation of an 82-hp gas engine, 90-hp suction gas producer and a 50-kw [gen]erator for the municipal electric-light plant.

New Industrial Companies.

THE AMERICAN ELECTRICAL MANUFACTURING COMPANY, [o]f Los Angeles, Cal., has filed articles of incorporation, with a capital [stoc]k of $500,000. The incorporators are: R. Mansard, J. E. Seeley [an]d others.

THE ARTHUR MACHINE COMPANY, of Richwood, Ohio, has filed [ar]ticles of incorporation, with a capital stock of $20,000, to manufac[tu]re gasoline engines. The incorporators are: George W. Arthur. [C.] E. Zieg, E. J. Tobey, H. J. Brooks and M. W. Arthur.

[B]ASHTON, LAIRD & COMPANY, of New York, N. Y., has been [in]corporated, with a capital stock of $25,000, by W. E. McDonnell, [F.] R. Rosenbaum and A. B. Malcomsen, all of New York, N. Y. The [co]mpany proposes to manufacture welding apparatus, vehicles, motors, [en]gines, etc.

THE DAYTON-DICK COMPANY, of Quincy, Ill., has been incor[po]rated by H. F. Dayton, A. B. Dick and C. E. Epler, all of Quincy, [I]ll. The company is capitalized at $30,000, and proposes to manufacture [m]otors, engines and machinery.

THE DUFFY & BOYD HARDENED COPPER COMPANY, of [G]ardiner, Maine, has been incorporated, with a capital stock of $100,000, [b]y James H. Duffy, John Boyd, of Togus, Maine; C. A. Messer, of [G]ardiner, Maine. The company proposes to manufacture electrical and [ot]her machinery and appliances, especially the hardened copper trolley [w]heel invented by James H. Duffy. C. A. Messer is president and [Jo]hn Boyd treasurer of the company.

THE ELECTRIC OMNIBUS CORPORATION, of Albany, N. Y., [ha]s been incorporated by A. J. Parker, Jr., for the purpose of manu[fa]cturing electrical omnibuses.

THE WILLIAM S. HAMILL COMPANY, of Troy, N. Y., has been [gr]anted a charter with a capital stock of $25,000 to do a general en[gi]neering and contracting business. The incorporators are: W. S. [H]amill, M. S. Geyer and J. C. Hamill, all of Troy, N. Y.

THE INDIANAPOLIS GAS ENGINE COMPANY, of Indianapolis, [I]nd., has been chartered, with a capital stock of $10,000, by Thomas [S]track, W. P. Best, H. A. Noffke, Ray Carmichael and B. N. Lay. [T]he company proposes to manufacture gas engines.

THE INGLEWOOD GAS & ELECTRIC FIXTURE COMPANY, of Inglewood, Cal., has been incorporated, with a capital stock of $10,000, by E. B., B. S. and L. R. Raymond.

THE INLAND SUPPLY COMPANY, of Danville, Ill., has been granted a charter, with a capital stock of $35,000, to manufacture machinery and motors. The incorporators are: H. C. Yelon, O. Finney and G. Harroun, all of Danville, Ill.

THE LAKE CHARLES CONSTRUCTION COMPANY, of Lake Charles, La., has been incorporated, with a capital stock of $25,000, for the purpose of dealing in and installing electric light and gas fixtures. The officers are: J. Stuart Thomson, president; A. Brammer, vice-president, and Frank V. Gallagher, secretary and treasurer.

E. S. LINCOLN, Inc., of Brookline, Mass., has been incorporated, with a capital stock of $130,000, to deal in electrical supplies. The incorporators are: E. S. Lincoln, of Brookline, Mass., president, and H. B. Sherman, of Newtonville, Mass., treasurer.

THE LYRACHORD COMPANY, of Yonkers, N. Y., has been incorporated, with a capital stock of $150,000, to manufacture electric pianos. J. T. Gibson, 232 Washington Avenue, Yonkers, N. Y., is managing director.

THE NEW YORK MAGNAPHONE & MUSIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,000,000 by George R. Webb, Charles A. Benton, Josiah L. Blackwell, Benjamin Natkins, Adelbert R. Whaley and Oliver W. Doty, all of New York, N. Y., and Henry W. Webb, of Baltimore, Md. The company proposes to maintain a system of electric telephone for general telephone business and the distribution of music from New York to Buffalo, passing through Albany, Syracuse, Rochester and intermediate cities.

THE PARK ELECTRIC COMPANY, of Detroit, Mich., has been organized by Lewis G. Coleman and Edward C. Jarchow. The company proposes to do a general electrical contracting business in Highland Park. The place of business will be located on Woodward Avenue, Highland Park.

THE PEERLESS ENGINEERING COMPANY, of New York, N. Y., has been chartered by Elder P. DeTurk, 4241 Broadway; Charles F. Dussler, 346 East Eighty-fifth Street, and George R. Leib, 4241 Broadway, all of New York, N. Y.

THE SAN DIEGO IGNITION COMPANY, of San Diego, Cal., has been incorporated by H. A. Brown and C. B. McMaster, of San Diego, Cal. The company proposes to manufacture electric signs and to repair and care for electric motors.

THE SPHINX MOTOR COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $600,000. The incorporators are: Harry W. Davis, of Wilmington, Del.; Graham Faster and William H. Turner, both of New York, N. Y.

THE SPRING MOTOR FAN COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000. The incorporators are: F. R. Hansell, of Philadelphia, Pa.; G. H. Martin and S. C. Seymour, of Camden, N. J.

THE STALEY ELECTRIC ELEVATOR & MACHINE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000 to manufacture and deal in elevators and hoisting apparatus, etc. The incorporators are: Marcellus Staley, 245 Bay Tenth Street, Brooklyn, N. Y.; Judson J. Staley, 1838 North Twenty-second Street, Philadelphia, Pa., and Herman Moskowitz, 1748 Park Avenue, New York, N. Y.

THE STATES COMPANY, of Syracuse, N. Y., has been incorporated by Roger H. and H. A. Blakeslee, of Hartford, Conn., and Henry J. Blakeslee, of Syracuse, N. Y. The company is capitalized at $50,000, and proposes to manufacture electrical instruments and appliances. The office of the company is located at 202 West Water Street, Syracuse, N. Y.

THE UNITED STEAM UTILITIES CORPORATION, of Manhattan, N. Y., has been chartered with a capital stock of $30,000 by F. C. Farnsworth, of Brooklyn, N. Y.; F. M. Patterson, of Jersey City, N. J., and J. H. Allen, of New York, N. Y. The company proposes to manufacture and sell valves, steam traps, etc.

THE WICKECHECKE CORPORATION, of Trenton, N. J., has been incorporated, with a capital stock of $125,000, by T. C. Kitchin, M. E. Green and L. W. Skelton, of Trenton, N. J. The company proposes to do a general civil, mechanical, electrical and hydraulic engineering business.

THE W. T. ELECTRIC COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $25,000 to manufacture and deal in mechanical and electrical specialties. The incorporators are: B. P. Wiltberger, of New York, N. Y.; E. E. Trafton, of Portland, Maine, and C. McC. Chapman, of New York, N. Y.

New Incorporations.

BERRYVILLE, ARK.—The North Arkansas Power Company has been incorporated with a capital stock of $100,000 to develop the water power in the streams of Northern Arkansas to generate electricity. The directors are J. R. Neff, president; E. H. Ingram, Ellis D. Munger and W. D. Wilton.

ELBERTON, GA.—The Elberton & Eastern Railway Company has been chartered, with a capital stock of $50,000, by W. O. Jones, W. T. Anderson, J. H. Blackwell, J. M. Heard, R. L. Cauthen and J. Z. Rogers. The company proposes to construct and operate an electric railway between Elberton, Tignall, Washington and Lincolnton.

ROCKFORD, ILL.—The Northwestern Telephone & Telegraph Company has been granted a charter with a capital stock of $30,000 to construct and operate a telephone and telegraph exchange.

BERWICK, MAINE.—Articles of incorporation have been filed for the Power & Light Securities Company with a capital stock of $100.000. The officers are: W. Thompson, president, and F. A. Hobbs, treasurer and clerk, both of South Berwick, Maine.

BAY SPRINGS, MISS.—Articles of incorporation have been filed for the Bay Springs Electric Company with a capital stock of $10,000 by C. E. Burnham, L. L. Denson, E. A. Denson and others.

JEFFERSON CITY, MO.—Articles of incorporation have been filed for the St. Louis, Arcadia & Jefferson City Railway Company by T. J. Portis, Charles F. Vogel, E. F. Kinney, T. A. Hildebrandt, R. M. Hamlin, all of St. Louis, Mo., and H. D. Mackey, of Springfield, Mo. The company is capitalized at $250,000 and proposes to build an interurban railway extending from Russell Place, St. Louis, to Fenton, Mo., a distance of 15 miles.

INDIANOLA, NEB.—The Farmers' Creek Telephone Company has been chartered with a capital stock of $9.000 by A. O. Olson, W. H. Noone and E. H. Gilbert.

CHAUMONT, N. Y.—The Chaumont Electric Light Company has been granted a charter with a capital stock of $8,000. The incorporators are: Edgar H. Merriman, of Adams Center; Charles N. Arnold and George Diefendorf, of Chaumont, N. Y.

PORT EWEN, N. Y.—The Call Electric Light & Power Company has filed articles of incorporation with a capital stock of $200,000 to construct and operate electric-light and power plants. The incorporators are: Henry J. Eder, 251 Ninety-fifth Street, New York, N. Y.; Edward H. Mason, 1105 Marquette Building, Chicago, Ill., and P. J. Eder, 80 William Street, New York, N. Y.

DENNISON, OHIO.—Articles of incorporation have been filed for the Twin City Traction Company by Ralph E. Westfall, Smith N. G. Bennett, M. R. Thornton, H. Miller and W. M. Huffman. The company is capitalized at $100,000, and will take over property of the United Electric Company, which supplies electrical service in Dennison and Uhrichsville and operates an electric railway between the two towns.

JOHNSTOWN, OHIO.—Articles of incorporation have been filed for the Johnstown Water & Light Company, with a capital stock of $6,000, by M. R. Thornton and others.

WARREN, OHIO.—Articles of incorporation have been filed for the Trumbull Public Service Company with a capital stock of $10,000 by C. C. Ewens, Ellis R. Diem, Harold T. Clark, Clarence E. Sanders and Sterling Newell. The company proposes to erect electric and gas generating plants and drill for water and gas and to supply electricity, gas and water in various towns and cities in Trumbull and Geauga counties.

CLATSKANIE, ORE.—Articles of incorporation have been filed for the Clatskanie Electric Light & Power Company.

GRANT'S PASS, ORE.—The Jackson County Light & Power Company has filed articles of incorporation with the Secretary of State for the purpose of building an electric railway between Grant's Pass and Ashland, Ore.

BIGLERTOWN, PA.—The Conewago & Southern Railroad Company has been incorporated by H. W. Hamblin, of Harrisburg, Pa., president; M. A. Garvin and J. J. Garvin, of Gettysburg, and others. The company is capitalized at $150,000 and proposes to build an electric or steam railroad between Biglerville, Arendtsville and Cashtown.

CROYLE, PA.—The Croyle Township Light, Heat & Power Company has been granted a charter, with a capital stock of $5.000. The directors are: Albert Stineman, of South Fork, Pa., president; J. Wilbur Stineman and O. M. Stineman, all of South Fork, Pa.

LEWISBURG, PA.—The Citizens' Electric Company has filed articles of incorporation with a capital of $15,000. The directors are John P. Ruhl, of Lewisburg, Pa., treasurer; Harold McClure, C. Willard Oldt, Henry Stahl, John T. Judd, Willmer R. Follmer and Cloyd Steinger, all of Lewisburg, Pa.

NEW CASTLE, PA.—The Republic Railway & Light Company has filed articles with the Secretary of State at Trenton, N. J. The company is capitalized at $17,500,000, and proposes to do a general electric, gas, heat, light and power business. It will also take over the Mahoning & Shenango Railway & Light Company, with a capital stock of $10,000,000, which controls and operates many public utility companies in western Pennsylvania and eastern Ohio.

PITTSTON, PA.—The Pittston Heat. Power & Light Company has been incorporated. with a capital stock of $150,000, by James H. Shea, 299 East South Street, Wilkes-Barre, Pa., and C. W. Miller. The former is treasurer.

MEMPHIS, TENN.—The Lunda Light Company has been incorporated with a capital stock of $5.000 by P. F. Lunda, N. W. Lunda, W. L. Fisher and others.

CLARENDON, TEX.—Articles of incorporation have been filed fo the Clarendon Light & Power Company, with a capital stock of $25,00 by L. W. Chase, A. L. Chase and W. M. Odell.

WACO, TEX.—The Waco Gas & Electric Company has been grant a charter with a capital stock of $500,000. The incorporators ar J. F. Strickland, O. Goodwin and M. B. Templeton, all of Dallas, Te

WACO, TEX.—The Waco Street Railway Company has been inco porated with a capital stock of $1,000,000 by J. F. Strickland, O. Goo win and M. B. Templeton, all of Dallas, Tex.

JUNCTION, UTAH.—The Piute County Electrical Company h been chartered, with a capital stock of $12.000, for the purpose operating an electric lighting system in Piute County. The officers ar M. M. Steel, president; Fred Miner, vice-president, and Joseph Steel secretary and treasurer.

BYRDVILLE, VA.—The Mebane-Virginia Land & Water Power Co pany has been incorporated with a capital stock of $225,000. The o ficers of the company are: M. K. Harris, of Danville, Va., presiden J. D. Harrison, vice-president, and S. H. Marshall, of Spray, N. C secretary and treasurer.

WENATCHEE, WASH.—Articles of incorporation have been filed f the Wenatchee Traction Company with a capital stock of $250,000 b Louis W. Pratt, president; J. R. Askew, W. M. Harvey, Henry Hewit Jr., and A. A. Hilton.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Compar has been granted a charter with a capital stock of $150,000. The cor pany proposes to build an electric railway from Charleton to Dunba The incorporators are: Fred Paul Grosscup, Paul B. Grosscup, W. Davidson and H. D. Rummell, all of Charleston, W. Va.

VANCOUVER, B. C., CAN.—The Grouse Mountain Scenic Inclir Railway Company has been granted a charter with a capital stock $750,000. The proposed road will be near Vancouver and will cost abo $520,000.

Personal.

MR. CHARLES O. AUSTIN, who for the past three years has bee city electrician of Bangor, Maine, has resigned that office to take a p sition at Presque Isle, Maine, with the Maine & New Brunswick Ele tric Power Company.

MR. ALEXANDER MACOMBER, of the engineering staff of the Te ney Syndicate, and formerly assistant to the electrical engineer, h been appointed engineer of the electric department for these properti with headquarters at 201 Devonshire Street, Boston.

MR. F. B. SILSBEE has been awarded the degree of Master Science by the Massachusetts Institute of Technology, his thesis havi for its subject the effect of frequency on the permeability of iron. M Silsbee has joined the staff of the National Bureau of Standards Washington.

MR. F. C. SARGENT, formerly electrical engineer for the Tenn Syndicate, which controls and operates a number of gas and electric co panies in New England and New York, has become engineering manag for these properties, with headquarters as formerly at 201 Devonshi Street, Boston.

MR. E. O. SCRIVEN, a graduate of Beloit College, has received fro the Massachusetts Institute of Technology the degree of Master Science, his thesis having been on the subjects of the effects of hig frequency and on the multi-gap lightning arrester. Mr. Scriven h entered the employ of the American Telephone & Telegraph Compan

MR. J. P. HART has received from the Massachusetts Institute Technology the degree of Master of Science. Mr. Hart is a graduate the United States Naval Academy and the University of Kansas. H thesis was on the subject of the internal reactance of steel rails. M Hart has entered the employ of the Southern Pacific Railroad Compa at San Francisco.

MR. CHARLES R. STOVER, a graduate of the Pennsylvania St College, has received the degree of Master of Science from the Mass chusetts Institute of Technology. Mr. Stover's thesis was on an i vestigation on the reflection of light from walls and ceilings, includi an investigation of the cubical photometer, which produced some int esting results. Mr. Stover will go with the National Electric La Association at Cleveland.

MR. HUGH PATTISON has been appointed electrical engineer of t influential committee on electrification of terminals organized by t Chicago Association of Commerce. This committee, of which Mr. Ho ace G. Burt is chief engineer, will make a study of the proposed elect fication of the railroad terminals of Chicago. Mr. Pattison, who w enter on his new duties on Aug. 1, is exceptionally well qualified f the position, as he has been superintendent of construction for the e tensive Pennsylvania Railroad terminal electrification in New York.

MR. R. L. JONES has received the degree of Doctor of Engineeri from the Massachusetts Institute of Technology, of which he was graduate. His studies leading to the degree related particularly to a ternating-current theory and the transmission of energy, electrochemistr organization and administration of public-service companies, and math matics. His research thesis work was on the subject of heat treatme

transformer steel. By using an induction electric furnace ... able to carry on some interesting and important investigations, ... which results believed to be of value were obtained. Mr. ... has entered the employ of the Western Electric Company in its division of research and development.

MR. F. M. WHARFF, for the past two years superintendent of overhead construction and track bonding of the Syracuse, Lake Shore & Northern and South Bay Railways, has resigned to accept a position with the operating engineering department of the Illinois Traction System at Peoria, Ill., in connection with work on efficient operation of electric plants, gas plants and electric railways. Mr. Wharff, after having been for five years with the Beebe system of electric railroads in central New York as apprentice, became electrical engineer of the Syracuse, Lake Shore & Northern Railroad and the Syracuse & South Bay Electric Railroad in charge of power houses and substations and car shops and overhead work, and later superintendent, as stated above, during which latter period he was engaged particularly in building catenary overhead work.

MR. GEORGE H. WHITFIELD, who has been for many years general superintendent of the lighting and traction properties at Richmond, Va., has recently given up his work of management to devote himself more particularly to consulting engineering. In the latter capacity he will be retained for all the Gould properties in Virginia, including the plants at Richmond, Petersburg, Norfolk and Fredericksburg. Mr. Whitfield was graduated from Richmond College in 1892, and from Cornell University in 1896, with the degree of M. E. He went at once into the street-railway field and became superintendent of shops for the United Railways of Baltimore in 1899, remaining there until 1901. He was also general superintendent for a year of the San Francisco and San Mateo road, during which period negotiations were pending that resulted in the formation of the United Railroads of San Francisco. On going to Richmond in 1902, Mr. Whitfield found a large opportunity waiting for him, including the enlargement of power houses, the erection of substations, construction of transmission lines to Petersburg, construction of new cars, the installation of hydraulic and steam turbines and the elimination of electrolysis from the water-pipe system of Richmond. In addition, Mr. Whitfield engaged in the designing of the electrical feature of the plants of the Emporia Hydro-Electric Company and the Richmond and Chesapeake Bay Railway Company.

Trade Publications.

COUPLINGS.—In Bulletin No. 4818, just issued by the General Electric Company, are described that company's flange couplings and flexible couplings.

ALTERNATING-CURRENT SWITCHBOARD PANELS.—The General Electric Company has recently issued Bulletin No. 4846, which contains such information as will enable the prospective customer to select intelligently the switchboard panels best suited to his needs.

ELECTRICALLY OPERATED GOLD DREDGES.—Bulletin No. ...3, recently issued by the General Electric Company, describes a number of installations of electrically operated gold dredges and contains information which should be of great interest to all connected in any way with this industry.

COMMUTATING POLE GENERATORS.—Bulletin No. 4832 of the General Electric Company describes a line of commutating pole generators in which, it is claimed, commutating trouble is eliminated. These generators are built for slow and moderate speeds, range in capacity from ... kw to 150 kw, and are wound for 125 volts, 250 volts and 575 volts. They may be equipped with sliding base or with belt tightener as may be desired.

CABLE JOINTS ON UNDERGROUND HIGH-TENSION LINES.—Bulletin No. 52 of the Minerallac Electric Company, 400 South Hoyne Avenue, Chicago, is devoted to a description of the method of making high-tension underground cable joints by the use of the materials and plan of operations devised by the company. The bulletin contains several illustrations and is an interesting addition to the literature of practical construction work.

FLOW METERS.—The General Electric Company has just issued a publication describing another of its flow meters, which, in this instance, is designed for measuring the flow of steam. Two forms of the steam-flow meters are manufactured, one for recording and the other for merely indicating the flow. This meter resembles somewhat the air and water meters manufactured by this company, and is fully illustrated and described in this publication, which is No. 4836.

CURTIS STEAM TURBINES.—The General Electric Company has just issued Bulletin No. 4845, containing illustrations and descriptive matter in considerable detail of its horizontal steam turbine generators of from 100-kw to 1000-kw rating at 3600 r.p.m., which is the maximum speed possible for use with 60-cycle alternating-current generators. These units are particularly adapted to industrial and lighting plants requiring economical generation of a moderate amount of power.

ELECTRIC LOCOMOTIVES FOR INDUSTRIAL RAILWAYS.—Bulletin No. 4829 of the General Electric Company has for subject the electric locomotive as adapted to fulfil the transportation requirements of all industries, for which uses it possesses many advantages over steam ... locomotives designed especially for use in this connection are described, these locomotives ... styles.

BUSINESS NOTES

MR. FRANK W. HALL, manager of the Philadelphia office of the Sprague Electric Works, has been appointed manager of hoist sales, and after July 15, 1911, will be located at the New York office.

SALE OF LOMBARD GOVERNORS.—During the month of June the Lombard Governor Company, Ashland, Mass., sold governors to regulate 73,350 hp of water-wheels. This business was scattered over the entire country from Maine to California, and included the governing of water-wheels of nearly every make.

APOLLO PERPETUAL CALENDAR.—The demand for the Apollo all-metal perpetual calendar issued by the American Sheet & Tin Plate Company, Frick Building, Pittsburgh, Pa., has been so great as to make it necessary to issue a new edition. A copy of this will be forwarded upon application from an electrical engineer or dealer.

MR. JAMES A. CLIFFORD, manager of the Baltimore office of the Sprague Electric Works, has been appointed manager of the Philadelphia office and took charge there on July 1, 1911. The Baltimore office will be continued as in the past under Mr. Clifford's direction, but as subsidiary to the Philadelphia office, and with Mr. Henry S. Patterson in charge.

THE DELTA-STAR ELECTRIC COMPANY, Chicago, Ill., manufacturer of high-tension specialties, has moved to 617-631 West Jackson Boulevard, where increased manufacturing and office facilities have been secured. In addition to high-tension devices, a complete line of high-efficiency "Mazda" lighting units have been developed and were placed on the market July 1.

MR. ALFRED H. COATES, president of the Colonial Electrical Agency Company, of San Francisco, Cal., expects to leave early in July on his annual Eastern trip. He will spend some time in Warren, Ohio, at the headquarters of the Colonial Electric Company and the Economy Electric Company, both of which concerns are represented on the Pacific Coast by Mr. Coates' company.

F. N. MANROSS & SONS, manufacturers of hair springs at Forestville, Conn., have recently made extensive additions to their plant to meet rapidly increasing business, which has continuously grown since it was established by Mr. F. N. Manross in 1880. On Jan. 1 of this year Mr. Manross admitted into partnership his two sons, Arthur N. and Robert H., thus relieving Mr. Manross, Sr., of a great deal of detail which his rapidly increasing business entailed. The product of this company is used for electrical recording and measuring instruments, clocks, watches, and steam gages, and a close attention to this particular line of work has resulted in building up a trade which now extends to foreign countries, and the plant now enjoys the distinction of being one of the largest exclusive hair-spring factories in the world. The manufacture of these delicate springs requires most careful attention, and expert labor is necessary. All the tools used are designed and built in the factory. The springs are made in silver, bronze, brass and other metals, as well as the highest grade of imported cast steel, some of the material used to meet the exacting requirements of electrical measuring instruments costing as high as $200 per pound.

NEW SANGAMO BUILDING.—The Sangamo Electric Company has erected at Springfield a new building, 160 ft. x 40-42 ft., two stories high, of steel, brick and concrete construction. The south end of the lower floor is used for packing and shipping room, instrument-testing room and generator room. The north end downstairs is a machine and tool room and pattern shop. The entrance is through a large hall having on one side a fireproof vault for the storage of master patterns, master plates, records, etc. The south half upstairs is devoted to assembling and general testing rooms and the north half is divided into a general office, private offices and a drafting room, the offices being finished in dark paneling and light rough plaster above. The floors throughout are narrow hard maple. The new building is connected on the second floor by a passageway to the two-story old main building, which is 180 ft. x 30 ft., the upper floor of which is now devoted entirely to light manufacturing work, such as the manufacture of coils, recording trains, small brass and steel parts, etc., and to inspection and storage of finished light material. The lower floor contains machinery for heavy manufacturing, such as milling machines, drill presses, heavy turret lathes, hydraulic presses, punch presses, receiving room and storeroom for raw material. A brick building north of the old main building is the forge shop, 85 ft. x 30 ft., and japanning room, being equipped with fuel, oil furnaces, Bliss presses, disk grinders, etc., for the manufacture of all types of permanent magnets, and with very complete equipment of gas-heated ovens for japanning and baking insulating varnish. A smaller building to the north is used for the manufacture of molded insulation parts, being equipped with grinding machinery and hydraulic presses up to 250 tons capacity. The grounds occupied by the buildings and available for additional buildings are about 2¼ acres in extent. The factory is situated about 1½ miles from the center of the city, and is reached by two car lines.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 27, 1911.

(Prepared by Robert S. Allyn, of New York.)

996,068. ELECTRIC SNAP SWITCH; C. J. Dorff, Chicago, Ill. Filed Oct. 3, 19[illegible]. [illegible] complete movement [illegible] operation of a button.

996,069. TRAIN-INDICATING APPARATUS; J. B. Edings, Macon, Ga. Filed Sept. 20, 1909. A clock device with a plurality of hands [illegible] by a central [illegible].

996,088. COMBINED WIRE AND WIRELESS TELEPHONE SYSTEM; M. B. Johnson, San Antonio, Tex. Filed Oct. 6, 1910. Grounded "wireless" instruments are connected with wire lines so that conversation may be carried on between two wire-line circuits separated for instance by a river.

996,089. COMBINED WIRE AND WIRELESS TELEGRAPH SYSTEM; M. B. Johnson, San Antonio, Tex. Filed Oct. 6, 1910. A message is transferred automatically from a wire line to a wireless system, the wireless transmission mechanism being under the control of the operator at the remote wireless station.

996,090. WIRELESS-TELEPHONE SYSTEM; M. B. Johnson, San Antonio, Tex. Filed Oct. 6, 1910. A ground circuit in condition for receiving and transmitting messages without change.

996,091. SPARK-GAP MUFFLER; M. B. Johnson, San Antonio, Tex. Filed Oct. 6, 1910. Concentric glass cylinders to muffle the noise of discharge in wireless work, etc.

996,092. BOX FOR CARRYING WIRELESS SIGNALING APPARATUS; M. B. Johnson, San Antonio, Tex. Filed Oct. 6, 1910. A two-compartment box to be carried by hand or strap.

996,[illegible]. METHOD OF MAKING FUSIBLE COMPOUNDS OF ALUMINUM AND RECOVERING ALUMINUM THEREFROM; L. R. Keogh, Ottawa, Canada. Filed Aug. 22, 1908. Adds anhydrous sulphate and carbonaceous material to a compound [illegible] more electropositive than aluminum and heating to reaction and reducing electrically.

996,120. SIGNALING ATTACHMENT FOR SPEEDOMETERS; W. J. Norton, Denver, Col. Filed Aug. 4, 1909. For automobiles. Displays a signal upon reaching a certain selected speed.

996,143. COMMON-BATTERY LOCK-OUT TELEPHONE SYSTEM; H. J. Roberts, Evanston, Ill. Filed Oct. 22, 1908. Special signaling lock-out and selector relays are employed to eliminate inductive effects, maintain signaling connections, prevent interference, successively extend the circuits, facilitate inter-party conections and maintain supervision.

996,218. BRUSH-HOLDER SUPPORT; C. T. Crocker, Norwood, Ohio. Filed June 5, 1905. A bracket for the brush holder is fastened inside the motor casing by means accessible from outside.

996,253. DYNAMO-ELECTRIC MACHINE; F. A. Johnson, Colorado Springs, Col. Filed Jan. 9, 1911. A part of the face of the field pole is eccentric to the armature and a shiftable member is interposed to prevent distortion and shifting of the commutating field.

996,266. THREE-WIRE DYNAMO-ELECTRIC MACHINE; C. E. Lord, Milwaukee, Wis. Filed June 7, 1909. An improvement on Dobrowolsky 513,006 to simplify the rotor and maintain a balanced voltage.

996,267. ELECTRICALLY OPERATED HOISTING APPARATUS; F. E. Lutz, Philadelphia, Pa. Filed June 8, 1909. A three point switch and circuits for limiting the movement of machinery propelled by electric motors.

996,268. INCANDESCENT LAMP; D. G. MacDonald, Sydney, N. S., Canada. Filed July 11, 1910. Multiple filaments with terminal bands arranged on a tubular stem and a switch.

996,270. STATOR-COIL SUPPORT; E. Mattan, Norwood, Ohio. Filed Jan. 31, 1907. The end turns of chain windings are secured to the sides of insulating bracing members to prevent vibration.

996,273. FUSE HOLDER; R. C. Millard, Atlanta, Ga. Filed Feb. 19, 1910. A combustible strip of paper serves as an indicator.

996,279. ALARM; J. A. Bobinson, Denver, Col. Filed March 2, 1908. A fire and burglar-alarm attachment for a telephone.

996,280. HIGH-TENSION DISCHARGE APPARATUS; E. J. Rose, Los Angeles, Cal. Filed June 28, 1909. For direct or alternating current and to produce oscillatory current of differing character.

996,303. SCREWLESS SPRING CONTACT; H. Wilhelm, New York, N. Y. Filed Feb. 18, 1909. Wire springs are strung through the base without screws and operated by a push button.

996,312. INSULATOR; T. D. Childress, Ansted, W. Va. Filed Sept. 27, 1910. Special shaped base and cap members for telephone, telegraph, etc., wires.

996,331. PROJECTOR CONTROLLER; J. L. Hall, Schenectady, N. Y. Filed Dec. 14, 1908. Remote control of searchlights to follow the line of sight.

996,334. DRIVING DYNAMOS FROM VARIABLE AND NON-VARIABLE SOURCES OF POWER; C. D. Haskins, Schenectady, N. Y. Filed Aug. 5, 1908. A prime mover such as an internal combustion motor is arranged to compensate for variations in power derived from variable sources such as windmills and car axles.

996,335. FIRE-PROTECTION DEVICE; R. B. Hewitt and J. G. Nolen, Chicago, Ill. Filed May 29, 1903. The riser of an automatic fire-extinguisher system has a float operated by the movement of water, which float modifies an electric circuit to give the alarm.

996,336. CIRCUIT-CONTROLLING SWITCH; C. H. Hill, Schenectady, N. Y. Filed Jan. 13, 1909. A starting switch is operated step by step. An interlocking device prevents the circuit-breaker from being closed before the switch is in starting position.

996,344. ELECTRICALLY CONTROLLED SAFETY APPLIANCE FOR RAILWAYS; R. T. and F. T. Jones, Baltimore, Md. Filed Oct. 15, 1909. A heating device for keeping a signal rail clear of snow and sleet.

996,350. HOT-WATER BOTTLE; D. P. Lamb, Portland, Ore. Filed Sept. 21, 1910. A rubber "bottle" has a chamber for an incandescent electric light bulb.

996,371. VAPOR ELECTRIC APPARATUS; W. F. Sneed, Schenectady, N. Y. Filed Sept. 11, 1908. A mercury-arc rectifier lamp has reactance which is reduced for starting.

996,372. SYSTEM OF ELECTRICAL DISTRIBUTION; C. F. Steinmetz, Schenectady, N. Y. Filed Oct. 25, 1905. A core transformer is used in conjunction with a rectifier having a plurality of main anodes, a mercury cathode and a starting anode.

996,373. OSCILLATING ELECTRIC SWITCH; G. E. Stevens, Lynn, Mass. Filed Aug. 20, 1909. A pendent shell with a sliding button on the lower end.

996,376. NEUTRALIZING INDUCTIVE DISTURBANCES; J. B. Taylor, Schenectady, N. Y. Filed July 28, 1906. An artifical condenser and a transformer are connected between a single-phase trolley wire and an aerial signal conductor to impress upon the latter a balancing electrostatic charge.

996,377. ELECTRIC MEASURING INSTRUMENT; E. Thomson and R. Shand, Lynn, Mass. Filed Dec. 12, 1906. To indicate instantaneous value of current or emf in direct-current circuits. The pointer has a long and uniform scale and the moving element i damped to secure dead-beat.

996,379. REGULATOR FOR STORAGE BATTERIES; A. A. Tirrill Schenectady, N. Y. Filed Dec. 14, 1907. Special winding of the booster to regulate charging and discharging.

996,381. MAGNETIC SHIELD FOR ELECTRIC MACHINES; H. H Wait, Chicago, Ill. Filed Feb. 11, 1907. The retaining bands o a high-speed generator are shielded to avoid heating by eddy currents.

996,387. SWITCH FOR ELECTRIC CIRCUITS; G. Wright, Pittsfield Mass. Filed Nov. 8, 1904. Oil-immersed contacts. Type of paten 761,745. Special form of contacts and arrangement.

996,388. MOTOR-CONTROLLING DEVICE; C. E. Zix, Berlin Germany. Filed March 27, 1908. For reversible hoist motors, etc A plurality of two position interrupting switches normally in serie and a double-pole reversing switch.

996,390. MOTOR CONTROL; E. F. W. Alexanderson, Schenectady, N Y. Filed Jan. 5, 1910. To cause series motors to operate as brak ing generators to return energy to the source.

996,391. REINFORCER FOR TELEPHONE CIRCUITS; E. F. W Alexanderson, Schenectady, N. Y. Filed Jan. 6, 1910. To increas intensity without affecting quality, and inductor alternator with winding common to its field and armature has its field connected t the telephone circuit. The armature circuit is a closed local con taining a condenser and is tuned to resonance.

996,392. ARC LAMP; J. H. Allen, Chicago, Ill. Filed March 16, 19 A thermostatic rod short-circuits the lifting magnet to protect against abnormal currents.

996,393. CIRCUIT-BREAKER; C. C. and I. F. Badeau, Bethlehem Pa. Filed Dec. 10, 1906. Has an underload armature and an au iliary armature adapted to mechanically engage with it under no-loa

996,394. SWITCH OR CIRCUIT-OPENER FOR HIGH-POTENTIA CIRCUITS; C. C. Badeau, Bethlehem, Pa. Filed Aug. 8, 190 May be opened or closed from any desired point.

996,406. ELECTRIC WELDING MACHINE; J. L. Hall and A Metzger, Schenectady, N. Y. Filed April 1, 1907. Particularly fo tubing and tanks having long joints. One or more arcs are a ranged to travel back and forth automatically.

996,408. ELECTRIC-LIGHT SOCKET; T. E. Hamby, Rockwood, Tenn Filed Feb. 14, 1911. A switch to operate without jar.

996,414. CONTROLLING SYSTEM FOR REVERSING MOTORS; S H. Keefer, Plainfield, N. J. Filed Nov. 2, 1910. Prevents operatio of certain switches after current is cut off from the motor until th armature ceases rotation; prevents reversing while the motor arm ture is driven by momentum of the work as in machine tools.

996,420. MANUFACTURE OF LAMP FILAMENTS; J. T. Marshal Metuchen, N. J. Filed May 22, 1908. A carbon filament after th first firing is oxidized and roughened by electric current in air befor the usual flashing in benzine vapor and final firing to prevent th "metalized" coating from slipping.

996,429. ARC LAMP; A. Schellenberger, Berlin, Germany. Filed Jul 2, 1908. Feed control of converging electrodes.

996,439. ELECTRIC HAMMER; H. F. Whalton, Key West, Fla. File Nov. 22, 1910. Two sliding electromagnets; reversible action; cu rent is reversed after blow is struck.

996,440. ELECTRIC HAMMER; H. F. Whalton, Key West, Fla. File Nov. 22, 1910. Two solenoids in tandem.

996,445. TELEPHONE RELAY AND SYSTEM; E. F. W. Alexande son, Schenectady, N. Y. Filed Nov. 11, 1909. This is a reinforce of the type of Patent No. 902,195 and shows special arrangemen of the high-frequency alternator windings.

996,454. ELECTRIC HEATER; A Carpenter, Tacoma, Wash. File Nov. 12, 1910. A combination heater and fireless cooker.

996,460. RETURN-INDICATION DEVICE FOR ELECTRIC INTE LOCKING SYSTEMS; F. B. Corey, Schenectady, N. Y. Filed Sep 24, 1908. For motor-driven track switches. To prevent the retur indication magnet from being actuated by fluctuating direct curren

996,474. FRACTIONAL DISTILLATION OF METALS; C. C. Fin Schenectady, N. Y. Filed Feb. 7, 1908. Antimony and arsenic ore The charge is heated and pressure reduced.

996,475. BRUSH FOR DYNAMO-ELECTRIC MACHINES; W. Fish, Lynn, Mass. Filed Sept. 11, 1909. The carbon brush has a aluminum holder with radiating vanes for cooling.

996,489. TELLTALE FOR ELECTRIC LIGHTS; J. F. Key, Washin ton, D. C. Filed Dec. 30, 1908. Particularly for ships, to indica any failure of the running lights.

996,492. ELECTRIC MELTING AND REDUCTION FURNACE; B. Lorentzen, Notodden, Norway. Filed April 20, 1911. Speci feed channels.

996,500. AUTOMATIC EXCHANGE SYSTEM; W. H. Matthies, An werp, Belgium. Filed Nov. 12, 1910. The selectors are advanced a switched over the same circuit, by changing the resistance of closed circuit and by opening the circuit respectively.

996,501. ELECTRIC-ARC LAMP; L. C. H. Mensing, Edinburgh, Sco land. Filed Oct. 28, 1910. Improvement in the carbon magazi of Patent No. 881,015.

996,515. FLEXIBLE PROTECTOR FOR ELECTRIC CABLES AN LIKE PURPOSES; E. L. Pease, Darlington, England. Filed M 6, 1910. Sinuous strips having registering flanged apertures pr vide the conductor path.

996,529. SYSTEM OF MOTOR CONTROL; W. T. Sears and S. Keefer, Philadelphia, Pa. Filed Oct. 28, 1910. A pilot swit governs the starting, stopping and reversing of a drive motor and feed motor for machine tools.

996,551. ELECTRICALLY CONTROLLED CLOCK AND TIME-I TERVAL TRANSMITTER; H. J. Aiken, San Francisco, Cal. Fil Dec. 9, 1909. For artillery fire-control system, etc.

996,571. DYNAMO-ELECTRIC MACHINE; E. A. Edwards, Cincinna Ohio. Filed Nov. 30, 1901. Means for preventing sparking at t brushes.

996,579. ELECTRICAL CONDUCTOR; H. Geisenhöner and F. L. Sto chenectady, N. Y. Filed Mch. 1, 1905. A tubular metal ri secures a flexible conductor to a carbon brush.

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CONTENTS.

THE LOADING OF TELEPHONE CIRCUITS.

The recent hot wave, unprecedented in the records of the Weather Bureau for certain sections of the country, has had a remarkable effect in nearly doubling the normal volume of telephone traffic in some of the Eastern cities and towns. The regular telephone subscribers acted as though they could best keep cool by keeping the telephone switchboards hot. It is said that the modern telephone system has rendered possible the modern many-storied office building, by replacing the messengers that would otherwise overcrowd the elevators, so that the telephone is the reincarnate ghost of the displaced messenger boy. Now it may be said that the modern telephone system has substituted talking for walking in the hot-wave intervals of the American summertime. The loading of telephone circuits refers, however, in technical circles, not to the application of additional traffic, but to the application of additional reactance, whereby conversation is enriched in volume and improved in timbre, so as to go further and fare better.

The article which appears this week on page 165, by Messrs. Samuel R. Parker and J. Cavers, deals with certain aspects of the theory of loading telephone circuits by the insertion of reactance coils at uniform distances. It is pointed out that inductance and capacity in a telephone circuit are similar in respect to their property of storing electromagnetic energy without dissipation, but are different in respect to their method of storing energy and to the phase of current with respect to its driving emf. When energy is being stored in capacity the current precedes the emf, but when it is being stored in inductance the current gives precedence to the emf. If the linear reactance of the inductance can be made equal to the linear susceptance of the capacity, the two effects go hand in hand, neither the emf nor the current taking precedence. In general, the linear susceptance of the capacity in a telephone circuit greatly preponderates over the linear reactance of the inductance, especially in cabled wires, so that the circuit must be loaded with a considerable amount of reactance in order to re-establish the balance of power and allow the voltage and current to travel hand in hand.

If, however, the best amount of loading is used for overhead wires in fine, dry weather the circuit becomes overloaded when the insulation falls in wet weather, so that a compromise adjustment of loading has to be used in order to meet average conditions. Moreover, the loading which may theoretically be the most desirable from the standpoint of circuit efficiency may be prohibitively expensive in space or in cost. Incidentally, loading coils might seem to be most effective if devoid of iron cores, owing to the power losses in hysteresis and eddy currents that take place in such cores.

Nevertheless, air-cored coils are relatively so bulky and costly that it is found better to employ iron-cored coils, especially since the principal iron losses occur at frequencies that are high and silvery, while the tones that are needed in commercial conversation are the golden ones, and these are the infra-2000-cycle tones.

An excellent engineering paper on the subject of loading telephone circuits, which is abstracted on page 171, was read by Mr. Bancroft Gherardi at the recent convention of the American Institute of Electrical Engineers. It conveys a great deal of practical information in solution with the minimum of mathematical solvent. It appears that the most recent practice in loading approximately trebles the effective telephonic range with a given type of cable conductor, while it doubles the range on a given type of overhead wire conductor. New York and Philadelphia are already in permanent weatherproof communication by underground loaded cables, while Washington and New York on one side, Boston and New York on the other, are to be brought into similar communication, making telephonic communication possible even from Boston to Washington, by underground cable, in case of need. The projected cable will demand as nearly complete utilization of its conductors as possible, and phantom circuits will not only be used, but also loaded. It is to be the first large application of the phantoming of loaded cable circuits and the loading of phantom circuits. Our readers will remember that an "actual" telephone circuit comprises a going and a return wire, as well as the terminal apparatus. On the other hand, a "phantom" circuit employs a going and a return pair of wires, each such pair being a separate telephone circuit. A phantom circuit is thus the coupling together of two complete telephone circuits into a third, or compound, circuit. The talking on the compound circuit does not affect either of the two component circuits, because the disturbing emfs and currents are oppositely directed in them and so cancel off. Reciprocally, the talking on the component circuits does not affect the compound circuit, which is entirely inclosed within the loop of wire forming the going and returning conductors.

An interesting use is described, in the paper, of transformers at each end of a loaded line, stepping up at the sending end and down at the receiving end, in order to diminish the terminal losses that loading creates. Loading a line has the effect of raising the operating telephonic voltage and diminishing the telephonic current strength, with a reduction of I^2R power losses along the line, in much the same way as raising the voltage on power-transmission circuits. This change in the circuit produced by loading calls for a higher voltage type of generating and receiving apparatus for its most effective utilization. But since it is impracticable to use two sets of subscribers' apparatus, one wound of low resistance for ordinary unloaded lines and the other wound of high resistance for loaded lines, the standard low-resistance apparatus involves some loss or "terminal reflection loss" when used with loaded lines. By introducing transformers, however, at each end of the line these extra losses can be reduced, and they could be entirely avoided if the transformers themselves were perfect.

DEPRECIATION.

The papers and discussion on depreciation before tl recent convention of the American Institute of Electric Engineers in Chicago constitute a valuable addition to tl literature on this important subject. The paper by M Henry Floy included a compilation of data which have be used in recent valuation cases. One of the striking featur about this table, which showed the rates used in estimat of theoretical depreciation of different classes of apparat was the great difference in the figures allowed for lil items. It should hardly be necessary to say, but it is neve theless frequently forgotten, that the rate of depreciatic from age and wear is vitally dependent both on the manag ment and the amount and character of service which exacted from the apparatus. Mismanagement causes rap depreciation and loss, and this is one of the strongest arg ments for the employment of competent men. The metho employed by a poor manager can be changed by a go successor, but there is no easy cure for the excessive dete oration of apparatus which results from mismanageme

Mr. Bion J. Arnold, in his discussion of this subje called attention to a fact that is of vital concern in t valuation of property for rate-making purposes. Occasio ally it is asserted that public-service companies should allowed to earn a fair rate of return upon only the dep ciated value of the property as it actually exists. As M Arnold indicated, rates on such a low valuation would te to prevent a company making an investment of money raise the property up to its best operating conditions. the property is not in first-class operating condition at t time rate adjustments are made, further investment capital is necessary, and rates should be sufficient to provi a return not only on the depreciated value, but also on t additional amount required to place the property in con tion to furnish good service.

STREAM FLOW AND FORESTRY.

The relation between the flow of streams and the con tion of the watersheds with respect to vegetation is o which has been the subject of a great deal of hypothes more argument and little thorough investigation. T causes which govern the flow of streams are so compl that a thoroughly scientific study of the situation is tremely difficult. Worse than this, the variables concerr are far from being independent, so that it is extrem difficult to separate from the complicated mass the fa which are dependent on the action of any single cause. valuable contribution to this subject has recently been m in a *Bulletin* of the University of Wisconsin, by Profes Mead, in charge of hydraulic and sanitary engineering that institution. While it deals particularly with the riv of Wisconsin, its conclusions are in a measure applica to streams in other regions of similar general situati The conditions which exist in Wisconsin are those in g eral belonging to a rolling and initially heavy-woo country, free of mountainous areas. The Wiscon streams, therefore, have under all conditions a higher

gree of steadiness than is found, for example, in the Rocky Mountain country or the Sierra Nevadas, where the watershed is in the main composed of extremely mountainous country. For this reason, too, the effect of deforestation in rendering more unstable the run-off conditions is less severely felt in Wisconsin than it would be in many states of the Union.

Professor Mead has analyzed as carefully as may be the relations between precipitation and run-off as modified by various factors and as causing variations of high and low water. The study is particularly valuable as showing the relations of precipitation and run-off from month to month, a subject on which data are usually scant. Professor Mead, also, investigated the generally forgotten relation between temperature and flow throughout the year, a relation which, although less striking in Wisconsin than it would be in a mountainous country, is still interesting and important. One of the striking facts brought out in the investigation is that extreme flood conditions are due to the concurrence of conditions of temperature and precipitation which are favorable to excessive run-offs, and that no practicable works of man, like drainage works, reservoirs or reforestation, can materially affect the flood peaks on the larger Wisconsin rivers. This seems a reasonable conclusion for streams having relatively large drainage area and running through a comparatively level country in which large storage is extremely difficult and where there is no danger of actual denudation of important parts of the watershed in spite of the very large amount of forest which has been cut. Another important conclusion reached is that the number of concomitant factors governing stream flow are so great and complicated, and their combinations so numerous, that no problem of flow can be solved even approximately without taking into account also the conditions reached under similar circumstances elsewhere. This is not altogether a comforting statement for students of hydraulics, but it seems to coincide with the results of a very large amount of study of the subject made elsewhere.

With respect to the effect of deforestation on the stream flow, Professor Mead takes a somewhat conservative position, to which one would naturally be led by the study of streams on which the effect of deforestation could not be expected to present extreme conditions. He quotes, from a recent report of the State Forester, some startling figures from the San Bernadino Mountains, showing the prodigious rapidity of run-offs in a deforested region, but very properly discounts them with respect to Wisconsin streams on account of the extreme difference between the mountainous headwaters in the first class and the comparatively level drainage area in the second. With respect to the Wisconsin streams, indeed, Professor Mead is highly skeptical as to any material effect from the deforestation which has occurred, stating that in general the cutting in that State has had no material effect either on high-water or low-water conditions or on the regularity of flow, and that if there have been any effects resulting from deforestation, they have been obscured by the concurrent action of the drainage of marshes, the rise of second growth and the clearing of farm lands. He concludes, therefore, that reforestation of the head waters of the Wisconsin streams cannot be expected to improve the hydraulic conditions.

Of course, these statements must not be applied indiscriminately, for the reason stated, and, indeed, as regards some Wisconsin streams, and in particular the important Wisconsin River, the data given in Professor Mead's report are such as to lead to considerable doubt with respect to the validity of his conclusions. He records certain phenomena which, looked at in the large, require a deal of explanation to convince the students of hydraulics that they are in no wise chargeable to deforestation. Pretty accurate records of cutting are available since 1873 in Wisconsin, and for the same period records of precipitation and stream flow on the Wisconsin River are carefully recorded. The cutting of timber even at the earliest date mentioned was large, over 1,000,000,000 ft. It passed 2,000,000,000 ft. in 1881, 3,000,000,000 in 1888, and reached 4,000,000,000 in 1892, since which time, for lack of material, it has somewhat decreased. In 1897 there were more than 3,000,000,000 acres which had been stripped of their forest covering and several million acres more were but partially covered by the dead and dying remnants of the former forest. Over large parts of this area forest fires had swept at least once.

Now the gagings of the Wisconsin River at Portage are given by Professor Mead from 1873 to 1910. If one compares the gagings for the first fifteen years of this period with those of the second fifteen years, or any subsequent fifteen years, the results are at least sufficiently startling to cause a natural inquiry as to whether the effects of deforestation are conspicuous by their absence in this instance. In the first fifteen years, up to the period at which the cutting had passed 3,000,000,000 ft., there were twenty-eight days on which the gage height at Portage was recorded as above 10 ft. There were only four days in this whole period on which the gage record fell below 2 ft., representing somewhat extreme low-water conditions. The next fifteen years, during which the cutting had passed 4,000,000,000 ft. and was beginning to decline for lack of timber, the same gage showed sixty-nine days of flood above 10 ft. It recorded, however, 300 days of water below 2 ft. as against four days in the previous decade and a half. These enormous differences are somewhat chargeable to the fact that 1888 and 1889 were noticeable flood and dry years respectively. But, looking at the tabulated results in any way one pleases, the large fact stands out that the low-water stages in the Wisconsin River have been made more severe and numerous during the latter half of the period covered than during the former half. This may be chance, but it is at least significant that the low-water period should coincide with that in which the destruction of forest was most rapid and widespread. One can only append a question mark to the whole matter until records for much longer periods than those here recorded are at hand, in order to eliminate the effects of any long-period cycles of weather. Until these are available, however, we should hardly wish to advise anyone to cite the Wisconsin River as an example of the innocence of deforestation.

Change in Mailing Date.

Beginning with this issue, the *Electrical World* will be mailed to subscribers two days later in the week than formerly. This change of date will, of course, enable matters of news to be covered two days later in the week of issue.

Federal Suit Against Wire Manufacturers.

On Monday, July 10, forty-two of the men engaged in the manufacture of wire, wire rope and horse shoes, who were indicted on June 29 for entering into alleged combinations and conspiracies in restraint of interstate trade and commerce, appeared before Judge Archbald, of the United States Circuit Court of Appeals, Criminal Branch, sitting in New York, and entered pleas of not guilty. On the following day six others appeared and entered the same plea. Bail in each case was fixed at $1 000. District Attorney Wise stated that he entertained no fear that any of the remaining eighty-three men indicted would fail to plead, their non-appearance at the present time being due to absence abroad. The district attorney asked that the defendants be allowed thirty days in which to file a demurrer or any motion they might desire, but upon protest from counsel, who asked for sixty days, Judge Archbald fixed Sept. 1 as the limit.

International Electrotechnical Commission.

In conformity with the wishes of the Brussels Conference held in August, 1910, the delegates of the British, French and German electrotechnical committees met at Cologne in the middle of May last and accomplished some excellent work.

Prof. Eric Gerard, having presided at the Brussels Conference, at which the subject of nomenclature had been much discussed, was specially invited to attend, so that not only was there a continuity of ideas, but the delegates were entirely free to put forward their particular views. Those present were: Prof. Eric Gerard, president of the Belgian committee; Mr. M. E. Brunswick, delegate of the French commission; Dr. E. Budde, president of the German committee; Dr. Silvanus P. Thompson, delegate of the British committee, and Mr. C. le Maistre, general secretary of the commission.

Before the actual work of the meeting was commenced an important suggestion was outlined by Dr. Budde dealing with the international unification of symbols. On behalf of the German-speaking nations as represented by the Elektrotechnischer Verein of Berlin, Dr. Budde said that they would be prepared to abandon the use of W for resistance and adopt R if the English-speaking nations, on the other hand, would adopt I instead of C for current. Dr. Budde was quite ready to exclude J as a synonym for I owing to the confusion which would arise due to the fact that J is already employed to represent other quantities. Dr. Thompson, on behalf of the British committee, willingly concurred in this suggestion, and as the American Institute of Electrical Engineers adopted I in 1893, and through the good offices of the American electrotechnical committee the National Electric Light Association of America is being approached in the matter, there is every hope that at Turin the symbols I, E, R will be universally adopted. Such a decision if ratified by the commission, as no doubt it will be, will certainly be a most encouraging step in the right direction.

The discussion of the work of the various committees on the German "List of Terms" put forward at Brussels was then entered upon, and a list of some fifty industrial terms and definitions was agreed to in French and English. The qualifying word "industrial" has been introduced so as to distinguish this work from that of the vocabularies in course of preparation by several of the committees. The vocabularies include definitions of a character more abstract and general and more rigidly scientific than is necessary in the case of industrial terms, which are more conventional and can therefore be defined in less academic language and yet prove of value to the industry by facilitating commercial transactions between buyer and seller. As the time at their disposal was so limited, the delegates intend to meet again in Turin early in September so as to have an opportunity of revising their work prior to submitting it to the plenary meeting of the commission. In the meantime the work already carried out is being issued to the various committees for their consideration.

The special committee was much pleased with the work of the Danish committee, which was presented in an admirable manner and was of very considerable assistance to the other committees. The work of the Japanese, the Mexican and the Spanish committees was also most complete.

The small committee has been so successful in its task that in all probability the appointment of other small international committees to study certain particular subjects in a preparatory manner will be considered in the near future, and thus work will be going on continuously and more rapid progress insured than in the case of work in the past.

Code of Engineering Ethics.

The Institute of Consulting Engineers has adopted a code of ethics and a schedule for guidance in determining fees for professional service, as follows:

Code of Ethics.—It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Institute of Consulting Engineers:

(1) To act for his clients in professional matters otherwise than in a strictly fiduciary manner or to accept any other remuneration than his direct charges for services rendered his clients, except as provided in Clause 4.

(2) To accept any trade commissions, discounts, allowances or any indirect profit or consideration in connection with any work which he is engaged to design or to superintend, or in connection with any professional business which may be intrusted to him.

(3) To neglect informing his clients of any business connections, interests or circumstances which may be deemed as influencing his judgment or the quality of his service to his clients.

(4) To receive, directly or indirectly, any royalty, gratuity or commission on any patented or protected article or process used in work upon which he is retained by his clients, unless and until receipt of such royalty, gratuity or commission has been authorized in writing by his clients.

(5) To offer commissions or otherwise improperly solicit professional work either directly or by an agent.

(6) To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of a fellow engineer.

(7) To accept employment by a client while the claim for compensation or damages, or both, of a fellow engineer previously employed by the same client and whose employment has been terminated remains unsatisfied, or until such claim has been referred to arbitration or issue has been joined at law, or unless the engineer previously employed has neglected to press his claim legally.

(8) To attempt to supplant a fellow engineer after definite steps have been taken toward his employment.

(9) To compete with a fellow engineer for employment on the basis of professional charges by reducing his usual charges and attempting to underbid after being informed of the charges named by his competitor.

(10) To accept any engagement to review the work of a fellow engineer for the same client, except with the knowl-

edge or consent of such engineer or unless the connection of such engineer with the work has been terminated.

Schedule of Fees. As a general guide in determining fees for professional services, the American Institute of Consulting Engineers recognizes the propriety of charging: *A*, a per diem rate; *B*, a fixed sum; or *C*, a percentage on the cost of work, as follows:

A—Per Diem Rate.

(1) Charges for consultations, reports and opinions should vary according to the character, magnitude and importance of the work or subject involved, and according to the experience and reputation of the individual engineer, from $100 per day to a higher figure, and in addition, where expert testimony is required or where otherwise conditions warrant so doing, a retainer varying from $250 to $1,000 and upward. An additional charge should be made for all actual expenses such as traveling and general office expenses and field assistants and materials, with a suitable allowance for indeterminate items. In such cases six hours of actual work should be considered one day, except that while absent from the home city each day of twenty-four hours or part thereof should be considered one day, irrespective of the actual hours of time devoted to the case.

B—Fixed Sum.

(2) A fixed total sum for above-mentioned services may be agreed on in lieu of per diem charges. A fixed sum may also be charged for a portion or all of the items of preliminary surveys, studies, examinations, reports, detail plans, specifications and supervision, including all of the expenses above recited in (*A*).

C—Percentages on the Cost of Work.

(3) For preliminary surveys, studies and report on original project, or for examination and report on project prepared by another engineer, including in both cases all expenses of every nature except those that may be specifically omitted by agreement—from 1½ per cent to 3 per cent on the work.

(4) For the preliminary stage (3) and in addition thereto detail plans and specifications for construction, including all expenses of every nature except those that may be specifically omitted by agreement—from 2½ per cent to 5 per cent on the estimated cost of the work.

(5) For the preliminary and middle stages (3) and (4) and in addition thereto general supervision during construction, including all expenses of every nature except those that may be specifically omitted by agreement—5 per cent, but more for work costing comparatively small amounts, and from 4 per cent to 5 per cent where the amount involved is considerable.

(6) For full professional services (3), (4) and (5) and management, including the awarding of contracts, and including all expenses of every nature except those that may be specifically omitted by agreement, 10 per cent; but more for work costing comparatively small amounts, and 6 per cent to 10 per cent where the amount involved is considerable.

(7) When desired, the percentage basis may be adopted for one or more stages, supplemented by a daily or monthly charge or fixed sum for the remaining stage or stages.

D—General Provisions.

(8) The period of time should be designated during which the agreed percentages and daily or monthly charges or fixed sum shall apply and beyond which period an additional charge shall be made.

(9) The percentages are to be computed on the entire cost of the completed work or upon the estimated cost, pending execution or completion.

(10) Payments shall be made to the engineer from time to time in proportion to the amount of work done.

(11) When alterations or additions are made to contracts, drawings or specifications, or when services are required in connection with negotiations, legal proceedings, failure of contractors, franchises or right-of-way, a charge based upon the time and trouble involved shall be made in addition to the percentage fee agreed upon.

The code of ethics and schedule of fees have been printed in pamphlet form for distribution. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary of the Institute.

Vice-President Mortimer, of St. Louis, Favors Public Service Commissions.

In an address before the St. Louis League of Electrical Interests Mr. James D. Mortimer, the new vice-president of the Union Electric Light & Power Company of St. Louis, who is also vice-president of the North American Company, which controls the St. Louis property, said that the creation of public-service commissions with inquisitorial powers can do much in the future, as it has done in the past, to acquaint the general public with the many problems confronting the public-service corporations of to-day and to make the road easier for the corporations to travel, at the same time bettering the quality and lowering the cost of service by avoiding the imposition of burdensome regulations and unjust taxation.

Public-service corporations, he said, welcome regulation, as it will help them place before the public the many problems confronting them, and secure the help of the public in their solution. They feel, however that regulation and politics should be definitely and absolutely divorced. With the creation of public-service commissions in various parts of the country there has been placed in the hands of the ruling political party a most powerful device for perpetuating its reign. By the authority vested in such regulating bodies, such public-service corporations may be imposed upon or the poor man may be unjustly favored, to the end that votes may be made. Where such power is so exercised regulation will, of course, fail to meet the end it was designed to accomplish. Where public regulation has been used for political effect it is most discouraging to the public-service corporations enjoying such treatment; but Mr. Mortimer believes that in the long run things will right themselves and that the right to regulate will be exercised in a manner best for all the parties in interest.

President Vail Favors Public Utility Regulation.

In his annual report for 1910 President T. N. Vail, of the American Telephone & Telegraph Company, stated that public control or regulation of public-service corporations by permanent commission has come and come to stay, and he strongly indorsed the principle of such regulation. Last week he returned to the subject in an interview in Boston and said that he is in favor of the control by the people of the telephone, telegraph, electric-light and railway companies and the railroads.

President Vail advocated public-service commissions elected by the people, or appointed by the President or Congress, as the case may call for. While he is not prepared to say that it is possible under present conditions and with the present state of the interstate commerce law to inaugurate a national utilities commission, he believes this will be the ultimate solution of the problem. He says that he is not afraid, if a body representing the people and elected by them should take up the legal problems which must be met by all utilities, that the latter would suffer in consequence, but he is afraid of the demagogues and unprincipled politicians who would have the people believe that they are continually being cheated by the public-service companies.

While Mr. Vail believes that a national utilities commission will be the ultimate solution of the problem, the supervision of this commission should stop at control and regulation. It should not manage, operate or dictate what

the management or operation should be, beyond the requirements of the greatest efficiency and economy. State control or regulation should be, he says, of such a character as to encourage the highest possible standard in plant, the utmost extension of facilities, the highest efficiency in service and rigid economy in operation, and to that end should allow rates that will warrant the highest wages for the best service, some reward for high efficiency in administration, and such certainty of return on investment as will induce investors not only to retain their securities but to supply at all times all the capital needed to meet the demands of the public. A public-service commission should, Mr. Vail says, confine itself to passing judgment upon matters of justice and fairness, rather than upon matters of technical detail, just as a judge altogether unacquainted with mechanics may hear a patent case and render a decision upon it. Through wise and judicious State control and regulation all of the advantages without any of the disadvantages of State ownership are secured. State control of public utilities, if properly applied, should not prevent progress, and it should be sufficiently unrestricted to encourage the introduction and demonstration of the value of new or novel enterprises, and should allow sufficient reward for the initiative, enterprise, risk and imagination of the adventurers behind such enterprises. It should, however, discriminate between the useful adventurers or promoters and the pirates or sharks who, on the strength of other successses, extravagantly capitalize undeveloped ideas and exchange worthless securities for the savings of the deluded and credulous investors. Corporate control and restriction should always exist to a sufficient degree to prevent such speculative promotion and such stock-jobbing schemes.

Boston Hot-Weather Telephone Service.

During the recent five-day period of unprecedented heat in Boston the telephone service was taxed to the utmost to meet the greatly increased demands made upon the lines. The company met the emergency with great efficiency, the operators staying at their posts and giving excellent service under doubly trying conditions. In some of the exchanges the volume of business was double that of the average day, many business men remaining at home and conducting their business by wire. The operators were supplied at their posts with cool drinks of lime and grape juice, and with the abundance of electric fans the number who succumbed was surprisingly small. President Keller praised the employees for their loyalty under the hard conditions.

To illustrate the increase in calls resulting from the heat, 1900 toll calls were filed at Salem for Boston, as against the high record previously of 1100. To add to the difficulties thunderstorms prevailed in various parts of New England. One seashore residential town did more business in one day than had been done the whole of the week before.

St. Louis Railroad Electrification Report.

A committee on railroad electrification appointed by the Civic League of St. Louis in 1909 to consider the general problem of terminal electrification has submitted its report, giving an outline of its work and the conclusions to which it has been led. The report was drawn up by Prof. A. S. Langsdorf, dean of the School of Engineering at Washington University, who, acting as chairman of the committee, made a special study of the New York terminal electrification for the purpose.

Attention was called to the fact that all of the most important electrifications have been brought about because of the limitation imposed upon steam traffic by the existence of tunnels. These limitations are due to the fact that the smoky atmosphere demands slow speed to insure safety, and that large headway between trains is essential. The feasibility of electrification from a purely mechanical viewpoint has been amply demonstrated by installations now in service. The terminals in St. Louis could be electrically operated, but it must be remembered that such a project is more a financial problem than a technical one, and the ultimate settlement of the issue depends upon a careful balance between the economies that may possibly be effected by the use of modern appliances and the fixed charges on the investment.

The physical conditions in St. Louis differ somewhat from those in Chicago, where terminal electrification has been recommended by the investigating committee; from those in Boston, where the investigating committee urged caution because of the very large cost; and from those in Baltimore and New York, where electrification has been accomplished. In St. Louis there is a union terminal used by all roads entering the city, which fact alone is most favorable to economic operation; the suburban service is now and probably will long remain limited, which fact would tend to confine the electrified zone to the city limits. It was estimated that for the terminal electrification there would be required a 40,000-kw generating equipment, 150 $45,000 locomotives, a $1,400,000 transmission and distribution system and a $1,500,000 signal system, costing, with 10 per cent added for contingencies, about $17,116,000 for 262 track miles, or $65,300 per track mile.

The committee argued that the elimination of the principal grade crossings is necessary on the ground of public safety, and should be completed before electrification is begun. Electrification would eliminate the smoke now contributed by the railroads, which represents about one-third of the entire amount of the city's smoke, and is very desirable as it would increase the comfort and convenience of the traveling public. It does not follow, however, that electrification is the only solution of the smoke problem it being a fact that fuel-burning locomotives can be so handled as to reduce considerably the volume of smoke and cinders ordinarily emitted. The probable increase in suburban traffic alone would not justify electrification in St Louis. The money to pay for it might either be diverted from needed additions to terminal facilities or might necessitate increased local freight or switching charges. In either case there would be an added burden upon the manufacturing and commercial industries of the city which should be taken into consideration.

Merger of Chicago Elevated Railways.

The merger of the elevated railway companies of Chicago seems now to be an accomplished fact. The "deposit agreement" for the purchase of the stock of the South Side, Metropolitan and Northwestern Elevated roads was declared to be effective on July 1. An association known as Chicago Elevated Railways has been formed, and it is declared to control all the elevated railways in Chicago operating about 173 miles of single track

It is believed that the Commonwealth Edison Company sustained an intimate and friendly relation to the merger of the elevated railways. It is reported that in exchange for active assistance in promoting the plan and also as a return for pledging a large guarantee fund for the repayment of money advanced by the banks the Commonwealth company has a virtual contract for furnishing all the electrical energy needed by the combined elevated railways of the city. The central-station company now supplies a large part of the energy used by the "L" roads, but not all of it and apparently, by lending its assistance and credit to the merger plan it has clinched the whole of the business and secured ieself against possible competition.

Furthermore, as the Chicago City Railway Company and the Chicago Railways Company, operating the surface roads of the city, appear to have had a share in the

ıerger plan, it is likely that one important result of the ombination will be that the Commonwealth Edison Comany will supply before long all the electrical energy used y both surface and elevated railways in Chicago. It is lso declared that Mr. Insull will go on the board of the 'hicago Elevated Railways and will share responsibility or the management with Mr. Blair.

There seems to be some question whether the merger of ıe elevated lines will not entail universal transfers and a ngle fare. A resolution has been passed by the City Coun.il directing an investigation of the proposed merger.

Chicago Subway Hearings.

The hearings of the local transportation committee of the 'ity Council of Chicago in relation to subway proposals, hile perhaps of more local than general interest, are 'evertheless of some significance in showing the surprising umber of projects presented—some carefully thought out nd some fantastic. The latest hearing was held on July 10 nd the proposal submitted was that of the Chicago Subway .rcade & Traction Company. This company was organized ı 1895 and is the pioneer subway company of Chicago. Ir. Dwight H. Perkins, a director, presented a written rgument for a comprehensive subway system rather than limited subway. Notwithstanding the announced attitude f the city that the subways shall be municipally built and wned, Mr. Perkins asked for a franchise for his company. Ie promised that private capital to any amount could be btained.

One feature of the plan provides foundations for the subay that would prevent the settling of adjoining buildings, is said. An elaborate plan was presented providing for ıe building of a subway by private capital, but for municial ownership and control from the first. It is also pro.osed to connect with surrounding interurban railways. Mr. . D. Gookins, secretary of the company, followed with an ble presentation of the elaborate data and plans which have een prepared by the company. This scheme proposes that system of 38 miles of subway shall be built at once.

It was announced at the hearing of July 10 that President . E. Mitten, of the Chicago City Railway Company, had old some of the members of the committee that he was reatly interested in the subway proposals and that he had utlined a plan of his own which he would be willing to lay efore the committee if the aldermen cared to hear it. A ıtion was adopted inviting Mr. Mitten to lay his plan fore the committee.

Mexican 55,000-hp Hydroelectric Project.

The Mexico Northern Power Company, which is con.ructing a great dam across the Conchos River about 22 iles from Santa Rosalia (Chihuahua), Mexico, for the urpose of creating a water-storage reservoir for hydrolectric and irrigation purposes, expects to have the proect finished by June, 1913. The construction of this dam as interfered with by the recent revolutionary troubles nd for a period of several months only about 400 men ere kept at work, but now that peace has been restored ıe number of laborers has been increased to about 1200. he dam will impound 66,000,000,000 cu. ft. of water in a eservoir 30 miles long and 5 miles to 6 miles wide. The ydroelectric plant will have a capacity of about 55,000 hp, nd the electrical energy will be transmitted to Chihuahua, arral, Jimenez, Santa Rosalia and a number of other owns and industrial centers of the State of Chihuahua. he company owns about 200,000 acres of land in the valy of the Conchos River, all of which will be brought nder irrigation by means of a canal system which will deve its water supply from the big artificial lake. The cost of the works will exceed $15,000,000. Mr. J. G. McNab, a construction engineer of Mexico City, is in charge of the work. The company is composed of Canadians.

Motor Drive in a Great Coke-Oven Plant.

The Indiana Steel Company has just completed at its Gary plant the first section of the coke-oven equipment producing coke for the blast furnaces and fuel gas for the reheating and soaking furnaces of the mills. In the new coke-oven plant, said to be the largest in the world, all auxiliary operations are performed by motor drive, 6600-volt, energy for which is furnished by the blast-furnace gas-engine power plant. Preliminary to coking motor-driven crushers reduce the coal to a state of powder, in which condition it is hoisted by conveyors to the storage tanks over the retorts. The incandescent contents of the ovens are "drawn" electrically, the coke being discharged into cars which are pulled by 15-ton, 100-hp, three-phase locomotives to the quenching houses. Motor-driven blowers provide the pressure for distributing the fuel gas to the various reheating furnaces and soaking pits in the mill in which it is burned. A complete by-product plant has been installed in connection with the coke ovens for extracting the valuable ammoniacal and coal-tar materials from the gas before burning the latter in the ovens. Coincident with the completion of the coke-furnace plant a duplicate of the original gas-engine power house is being erected near the first station, opposite the line of blast furnaces on the Gary harbor front.

Telephone Situation in Los Angeles.

In a recent address delivered before the City Club of Los Angeles, Mr. Kempster B. Miller, retained as telephone expert by the Board of Public Utilities of that city, made an interesting review of the telephone situation. Los Angeles has two companies, and the competing, or Home, company made the mistake that many Independent companies have made, of charging at first rates that were too low. As a result of neglect to figure on depreciation, many telephone companies have been able to realize large apparent profits in the early stages of their business. But experience shows that a time of reckoning comes invariably in these cases, with the result that such companies have been forced to raise their rates or adopt some other unpleasant alternative.

The statement that the cost of giving service increases proportionately per telephone as the number of telephones increases is too broad to be true, according to Mr. Miller. It does cost more per telephone to give service in a large community, with a large number of telephones, than it does in a small community, with a small number of telephones. In a small town a telephone plant may be built often at a total expense of not more than $40 or $50 per telephone, whereas in a city like Los Angeles the plant will cost from $125 to $150 per telephone. The average length of lines is greater in the larger city, and more costly buildings are required. It is not true, however, as often stated, that with a given plant the cost of giving telephone service goes up per telephone as the number of subscribers increases. The reverse is likely to be true. Plants are ordinarily built for a greater ultimate capacity than their immediate requirements, and as the service is extended the cost per telephone is more likely to come down than to go up.

Mr. Miller said that he found that the exchange business of the Pacific Company (Bell) for the year 1909 resulted in a net profit of about 1 per cent of the estimated reconstruction cost of the plant within the city limits. The speaker made the interesting point that telephone investigations are almost always made on the basis of cost; people do not seem to realize that there is just as much difference in quality in telephone service as there is in price. Los

Angeles has been getting about as good a service as it has been paying for. However, there is a tendency everywhere among the public toward the use of the better grades of the service offered.

The rates suggested by Mr. Miller are somewhat higher than the old ones, and it is estimated that they will result in an increase of revenue of about $90,000 a year to the Pacific Company and about $174,000 to the Home Company. The difference is caused by the fact that the Home Company has been operating, under protest, at lower rates than the Pacific Company.

In relation to interchange of traffic between the two companies, Mr. Miller said that it was quite feasible from a physical point of view, but whether a scheme can be worked out that will be legally and commercially practicable is another matter.

Electrical Decorations in Rochester for Convention of Mystic Shriners.

Rochester, N. Y., was this week in the hands of the Imperial Council, Ancient Arabic Order, Nobles of the Mystic Shrine. Its streets were crowded with men in brilliant Arabic and Oriental costumes and at night its principal avenues were aglow with the light from some 75,000 30-watt incandescent lamps arranged in canopies at street intersections or in festoons from pole to pole on either side of all main avenues leading to the hotel district from the various railroad terminals. The convention began on Tuesday morning with a parade in costume followed by a session in the Convention Hall at which appropriate addresses were made by the Mayor of the city, the Lieutenant-Governor of the State and high potentates of the order. At night there was a grand parade of visiting Temples and Patrols, with brilliant electric illumination on the line of march, including floats lighted by electricity furnished by storage batteries.

Main Street, State Street, St. Paul Street, South Avenue, North and South Clinton Streets, Court Street, Exchange Street, Central Avenue and Mortimer Streets were festooned with lamps and high canopies were suspended from cables at the intersections of the main streets and also between blocks, there being twenty-one canopies in all, each holding 1500 lamps. In addition to these there were numerous emblems of the Mystic Shrine order outlined in light. Every avenue leading into the city had a sign on whose incoming face were the words "Feel-to-hum" and on the reverse side were different phrases such as "Come Again," "Stay With Us" or the name of the Temple in the city to which the road led.

The canopies were put up and paid for by public subscription and will remain in place and be lighted all summer long at a rate of 4 cents per kw-hour. There are numerous other large gatherings scheduled to assemble in Rochester, such as the Grand Army of the Republic next month, so that the canopy effects will suffice for all. The festooning, of which there was over 5 miles, was erected by a Cincinnati contractor at a cost of $6300. The energy for lighting the lamps in the festoons was contributed gratis by the Rochester Railway & Light Company. Many of the buildings were outlined with light in honor of the occasion and the whole city was gay with bunting, flags and other decorations appropriate to the order.

The feature of the week was the Water Carnival on the Genesee River on the evening of July 12. The preparations for this carnival entailed an enormous amount of labor. The illuminated parade consisted of decorated canoes, launches and club floats. These proceeded down the river to a point below the Oak Hill Country Club and then up again to Big Elm Tree Bend.

On July 13 there was a grand reception and ball in the New York State Armory which was the concluding feature of the convention. It is estimated that the decorations all told represented an outlay of over $100,000. Fully 50,00[illegible] visitors were in the city from all parts of the Unite[d] States, Canada, Mexico and island possessions of the Unite[d] States.

Electrical Fires in Chicago.

An interesting feature of the recent annual report of M[r.] William Carroll, city electrician of Chicago, relates to th[e] electrical inspectors' reports on electrical fires in that cit[y] during the year 1910. A table is given to show that the[re] were eighty such fires, with a total loss of $37,550, a sma[ll] amount compared with the total fire loss. Of this amoun[t] one fire caused a loss of $30,000, the cause in this case bein[g] the breaking of a lighted portable incandescent lamp, th[e] sparks from which fell into gasoline and oil on the floo[r]. The next largest loss was caused by a fire due to spark[s] from a defective socket falling on chemicals. This defe[c]tive socket was suspended over the chemicals by lamp cor[d] extended through a metal hood. The loss was estimate[d] by the inspector at $5,000. In all other cases the loss wa[s] comparatively slight.

Of the eighty electrical fires, fifteen were due to low tension wires short-circuited, nine to motor burn-outs, seve[n] to sparks from motor, five to overheated flatirons, five t[o] wires grounded in conduit, four to low-tension wir[es] grounded, four to defective rheostats, four to lightnin[g], four to short-circuit at fixture outlet, four to breaking o[f] incandescent lamp and the rest to a variety of causes.

Electrical Inspection in Chicago.

An electrical inspector in charge, reporting to the cit[y] electrician, with a force of twenty-two other inspector[s] constitutes, with clerical assistance, the municipal Burea[u] of Electrical Inspection of Chicago. The work of th[e] bureau is increasing at the rate of about 20 per cent a yea[r] and in his recent annual report the city electrician makes [a] plea for additional inspectors.

While the primary object of the work of the bureau is t[o] safeguard life and property, other important benefits a[re] derived by the general public. Safe electrical constructi[on] is very closely allied with good engineering practice, a[nd] an installation which complies with the high standard r[e]quired by the city ordinance may be considered in gener[al] as an example of high-class workmanship.

When a fire is reported the Bureau of Electrical Inspe[c]tion consults its records at once to see whether the buildi[ng] is wired for electricity. If it is, a thorough inspection [is] made to determine whether the fire is due to electric[al] causes. All serious or fatal accidents due, or thought [to] be due, to electrical causes are also investigated. A speci[al] investigation has been made of fires occurring from ele[c]trical causes during the year 1910, to determine what pr[o]portion of these fires occurred in buildings wired under th[e] old method, where insulators were not used. Such fires [as] have resulted from the condition of the wires themselv[es] have been classified into three general classes: A, whe[re] wires were run in conduit; B, where wires were install[ed] with concealed knob-and-tube work; C, where wires we[re] not placed on insulated supports. An analysis of the fi[g]ures obtained shows that the chances for fire occurring in [a] Class C building are about six to one as compared with [a] Class A building, and about three to one as compared wi[th] a Class B building.

During the year the work of reinspecting old install[a]tions was continued, although only one inspector devot[ed] his entire time to the work. A complete reinspection h[as] been made of the Union Stockyards and a great improv[e]ment obtained in the electrical work there. The great bu[lk] of the work of the bureau has to do with the inspection [of] new electrical installations.

Meeting of Central-Station Sales Managers.

The second annual convention of sales managers of a few of the larger Edison companies was held at Briarcliff Lodge, Briarcliff Manor, N. Y., on July 10 and 11. The chairman of the convention was Mr. R. S. Hale, of the Boston Edison company, and other members of the committee in charge were Messrs. E. W. Lloyd, of the Commonwealth Edison Company of Chicago, and T. I. Jones, of the Edison Electric Illuminating Company of Brooklyn. Other delegates present were Messrs. H. H. Winter, of the Seattle Electric Company; L. R. Wallis and E. C. Kimball, of the Edison Electric Illuminating Company of Boston; G. E. Miller, of the Cleveland Electric Illuminating Company; I. D. Israel, of the Philadelphia Electric Company; J. C. McLaughlin and W. K. Handy, of the Potomac Electric Company, Washington; Miss S. M. Sheridan, P. J. Savage and E. L. Crosby, of the Edison Illuminating Company of Detroit; L. F. Philo, of the Union Electric Light & Power Company, of St. Louis; J. F. Becker, L. A. Coleman and D. B. Smith, of the United Electric Light & Power Company, of New York; A. A. Pope and C. A. Littlefield, of the New York Edison Company; T. I. Jones, W. W. Freeman and C. A. Graves, of the Edison Electric Illuminating Company of Brooklyn, and J. F. Gilchrist, of the Commonwealth Edison Company of Chicago.

At sessions on Monday the topics of discussion were "Signs," "Tungsten Lamps," "Customers' Deposits and Credits," "Contract Order Routine" and "Shortening the Time of Installation After Application Has Been Signed." On Tuesday the subjects were "Financing Customers' Installment and House Wiring," "Advantages of National Advertising," "Compensation for Solicitors" and "Electric Rates." The object of the convention is to bring together men who are carrying on the same kind of business in different cities who are not competitors, in order to discuss important problems with which they have to deal.

Meeting of Empire State Association.

A meeting of the Empire State Gas & Electric Association was held at Trenton Falls, N. Y., on June 24, in accordance with the plan to hold meetings throughout the year at different points in the State. The attendance was about 0. The business session was devoted to the discussion of a number of different subjects, including the use of electric or gasoline auto trucks, methods pursued in the extension of mains and the practice regarding non-payment cut-offs. After the conclusion of this session a lunch was served. In the afternoon most of the delegates inspected the power-house of the Utica Gas & Electric Company. Some of the members visited the location where the company may install another dam and reservoir. Mr. J. C. De Long, of the Syracuse Lighting Company, presided at the meeting.

Meeting of Heating and Ventilating Engineers.

The summer semi-annual meeting of the American Society of Heating and Ventilating Engineers was held at the Hotel LaSalle, Chicago, July 6 and 7, with President R. P. Bolton, of New York, in the chair. Following an address of welcome by Mr. George Mehring, of the Illinois Chapter of the society, the president delivered his official address, in which he pointed out some interesting effects on the climate, rainfall and temperature of cities occasioned by the huge quantity of coal burned for heating and power purposes. Data quoted by Mr. Bolton for the city of New York showed that during the year 1909 1,400,000 tons of coal were burned for transportation purposes, 885,000 tons by the lighting companies and 920,000 tons for the production of gas, while 512,000 tons of oil were used for gas enrichment, equivalent to 758,000 tons of coal. The 745 power plants in New York's industrial, hotel and business buildings consume about 2,200,000 tons annually, while 6,380,000 tons are used for domestic purposes in houses, stores and apartments. Adding an appropriate portion for Jersey City, the total equivalent coal consumption in the New York district is thus nearly 19,000,000 tons per year. The combustion of this huge quantity of coal produces about 614,000,000,000 heat units daily, which would add 3½ deg. to the temperature of the amosphere one-half mile in height over the area of New York.

Adding to this the heat from all other sources, including animal heat, friction, etc., enough heat units are available to raise the temperature 1 mile high over the entire area of the city through 5 deg. Fahr. A secondary but objectionable effect of this great emission of heat is upon the rainfall, as is definitely shown by the records of precipitation. Cloudless days have increased in proportion, and a condition is reached where the moisture even when present in the atmosphere is not precipitated as rain, but remains suspended as fog. Examinations of records kept by the New York authorities show that the occurrence of a temperature as low as, or lower than, zero has been of less frequency for many years, and since 1904 has not been experienced at all. Curves illustrating these facts were included in President Bolton's paper, showing by a sort of stair-step diagram that this practical elimination of zero conditions has been brought about by artificial means. The decrease in precipitation during the winter months since 1884 is also shown graphically by a second curve partaking of similar stair-step characteristics. The coal consumption of New York City, concluded the author, is by no means excessive compared with the per capita rate throughout the country. At the present time the majority of domestic heating is effected at a very low percentage of efficiency, and, he added, "We must look forward to better methods for the production of heat as well as for power, especially in great cities, probably by greater concentration in central-station heating plants in place of the wasteful processes of domestic heating and power."

Following the reports of various committees a paper on the subject of "Free Engineering" was presented by Messrs. Perry West and George W. Knight. The authors pointed out that the tendency of large manufacturing companies to furnish free of charge expert technical advice to their customers results in an injustice to practising engineers, who thus suffer a reduction in fees. On the other hand, the manufacturers are put to a large and unwarranted expense which must be borne by them at a loss or else charged for by increasing the price of the equipment or machinery sold.

Mr. Paul P. Bird, former smoke inspector for the city of Chicago, followed with a paper on "Some Phases of Smoke Prevention," in which he discussed the problems of atmospheric pollution met with in Chicago, and the methods by which this free carbon and the soiling of the city can be prevented through intelligent inspection and smoke prevention. During the discussion of a paper later in the meeting Mr. Gifford, of Chicago, recounted that from an air-washing machine delivering 40,000 cu. ft. of air per minute and operated ten hours per day 60 lb. of solid matter was taken every three days. About one-half of this material, he said, was carbon, the remainder being dust, etc., among which pieces of vegetable fiber, peanut shell, coffee, etc., were found, depending upon the location of the installation. Such an air-washing machine removes about 99 per cent of the solid material from the air, said the speaker. President Bolton pointed out that the results of these air-washing installations might also prove excellent gages of the density of smoke in given cities or localities.

Mr. Frank L. Busey read a paper on "A Proposed Basis for Rating House-Heating Boilers and Furnaces" which referred particularly to small and medium-sized installa-

tions of steam and hot-water boilers and warm-air furnaces ranging between 2 hp and 50 hp. Mr. Busey's paper pointed out the unsatisfactory conditions under which this small equipment is now rated with two or three times the capacity which can be developed under normal working conditions. The tests cited were made at the engineering experiment station of the University of Illinois, using coals of various character and quality.

The session of Friday morning was opened with a paper on "The Heating and Ventilating of High-School Buildings in Decatur, Ill." The group of buildings described has its own separate fireproof boiler house, containing three 450-hp high-pressure tubular boilers for burning bituminous coal. Steam from these units operates one 75-kw and one 50-kw turbine-generator set, delivering 125-250-volt direct current for motors and lighting. While these turbines are not as economical as reciprocating engines, said the author, they are operated only when heat is required for the building, so that the production of electricity is carried on virtually as a by-product operation. The noiseless operation, long life and the small space occupied by the turbines, together with the fact that they require no internal lubrication, relieving the boilers of oil, were factors in the selection of these small units. The supply fan for the old building is belted to a 50-hp motor and delivers air to reheating coils in plenum chambers. A 2½-hp motor driving an exhaust fan also locally ventilates through metal ducts all toilet-rooms. All main vent flues can be cut off by compressed-air-operated dampers controlled from the engine-room. Thermostats in the classrooms move mixing dampers, which change the temperature of the air without curtailing its volume. In this way the power of the entire plant is finally directed to warming the most difficult room. In the new building the supply fans, driven by 20-hp belted motors, deliver 120,000 cu. ft. of air per minute. The chemical-laboratory hoods and other places requiring local ventilation are exhausted by an 8-hp motor-driven fan of special corrosion-resisting material. In starting to warm the building in the morning the fresh-air intake can be cut off and the air already within the building circulated in a closed path, effecting an appreciable saving of fuel.

In the absence of the author, Secretary W. W. Macon read a paper on "The Ventilation of the Macy Store, New York," prepared by Mr. D. M. Quay. The author's remarks referred particularly to the ventilating of the sub-pavement levels, which are denied natural sunlight and air. Five hundred persons are now employed in this basement, a number of them being boys and girls fourteen years of age, who are admitted with the full sanction of the New York board of health in view of the healthful conditions now obtaining in the basement. The general sentiment is expressed by visitors' remarks on the purity of air. The atmospheric supply comes from a point above the roof level, being carried down a shaft 12 ft. x 24 ft. in section and through tempering coils, from which it is discharged into the distributing ducts by two pairs of 160-in. steel-plate blowers. On account of the chimney effect of the lofty intake shaft motors 25 per cent heavier than usual had to be provided. The vitiated air from the machinery-rooms, shipping department and other rooms is discharged by motor-driven exhaust fans. The mechanical equipment of the Macy store includes 3000 hp in boilers, four 500-hp and two 300-hp electrical generating units, thirty-two hydraulic elevators, a 25-ton refrigerating and water-cooling system, four escalators, parcel delivery and conveyor system, and a vacuum-cleaning system.

"Street-Car Ventilation" was the title of a paper read by Mr. W. Thorn, who declared that this subject has not received the attention its importance demands, the small windows of the monitor deck being generally relied upon to freshen the air within the car. Several special devices, said Mr. Thorn, have been developed to meet the changed conditions with modern pay-as-you-enter cars having the front platform closed. One general type depends upon the speed of the car for its operation, while the others emplo local mechanical draft. The Chicago ordinance require the supply of 350 cu. ft. of air per hour per passenge stipulating that this air shall be brought into the car belo the heads of the seated passengers and taken out above th heads of the standing passengers. A mechanical syster used in that city consists of a motor-driven exhaust fa located on the vestibule roof. An exhaust chamber is forme in the upper ceiling of the car, there being openings at vari ous points in the ceiling and intakes at several points in th floor, where they can be connected to the electrical heater The ½-hp fan motor drives a 9-in. cone fan capable o handling 33,000 cu. ft. of air per hour. The size of th eight intakes located under the seats near the electric heat ers is arranged for a maximum velocity of about 400 f per minute. A number of aspirator systems have bee employed, the velocity of the car being used as the sourc of circulation. Tests have shown that with electric heat ers the amount of energy required to heat mechanicall ventilated cars is no greater than with deck-window venti lation. The reason for this, said Mr. Thorn, probably lie in the greater efficiency of the heating units when workin on a continuous flow of fresh air as against the ordinar practice of placing the heaters in a dead-air space wher energy is lost in heating the material of the seats and ad jacent woodwork.

On the convention program were set down a number o subjects for discussion by the delegates. One of thes "The So-Called Superiority of Exhaust-Steam Over Live Steam Heating," provoked a lively discussion by the adve cates of the different systems. Prof. J. D. Hoffman, o Purdue University, pointed out that live steam is obviousl hotter than an equivalent amount of exhaust steam fro which the heat units have been removed during the expar sion through engine cylinders. President Bolton said tha the claim of the exhaust-steam advocates has sometime been that the presence of moisture in this steam aids in th transmission of heat from the steam to the radiator sur face. Mr. Gifford substantiated this point, declaring tha saturated steam has a higher heating value in practical us than live steam, and he also said that an engine or othe prime mover is the most efficient and economical kind of reducing valve.

Among the entertainment features of the convention wer a reception on the Hotel LaSalle roof garden, a 25 mi automobile ride through the parks and boulevards of Ch cago, a moonlight boat ride on Lake Michigan, inspectio trips through the mechanical plants of the Blackstone, Cor gress and LaSalle hotels, besides several special entertair ment features for the visiting ladies.

Modification in New York System of Accounts.

An order was passed by the New York Public Servic Commission, First District, on June 23, modifying the un form system of accounts for electrical corporations. Effe tive on Jan. 1, 1912, two additional primary accounts ar to be provided in the classification of operating expense They will be entitled "joint transmission expense—dr." an "joint distribution expense—dr."

The text of "joint transmission expense" provides th when any transmission wires or cables or any poles or co duits carrying the same are maintained by another pers or company for the joint benefit of the accounting corpor tion and others under an arrangement for apportioning tl expense of maintenance and operation the portion of suc expense to be met by the accounting corporation shall l charged to this account. The portion so charged may i clude provision for depreciation of such structure or facil ties as well as current outlay for repair, but must not i clude any allowance for profit or return upon such pro erty. The allowance for profit should be charged to tl sub-account "joint facility rents" under "other rent dedu

-ns." Where no arrangement exists for division of the expense of maintaining a joint facility the entire payment ; chargeable to the sub-account "transmission subway .nt" or the sub-account "miscellaneous rent deductions" nder "other rent deductions."

When any distribution structure or facilities are maintained by another person or company for the joint benefit the accounting corporation and others under an arrangement for apportioning the expense of maintenance and operation the portion of such expense to be met by the accounting corporation shall be charged to the account "joint distribution expense." The portion so charged may include provision for depreciation of such structure or facilities as well as current outlay for repair, but must not include any allowance for profit or return upon such property. The allowance for profit should be charged to the sub-account "joint facility rents" under "other rent reductions." Where no arrangement exists for the sharing of the expense of maintaining a joint facility the entire payment is chargeable to the sub-account "distribution subway rent" or the sub-account "miscellaneous rent deductions" under "other rent deductions," according to the kind of facility.

Gas-Rate Controversy in Chicago.

Rates of 75 cents for the first year, 70 cents for the second and third years and 68 cents for the fourth and fifth years have been recommended by the City Council committee on gas, oil and electric light as the price for gas in Chicago. The Council has not yet adopted the committee's report, however, and if it does the People's Gas Light & Coke Company may fight the reduction in the courts. The present rate is 85 cents. Under the preceding administration, when the committee was differently constituted, it employed Mr. W. J. Hagenah as an expert to investigate the company's business and recommend a reasonable rate. Mr. Hagenah reported in favor of 77-cent gas, but his report was not satisfactory to the new committee, which employed Mr. Edward W. Bemis as a second expert. Mr. Bemis recommended a sliding scale of 75 cents for one year, 70 cents for three years and 65 cents for one year. The committee changed these figures somewhat, arriving at the decision mentioned previously. Mr. Bemis considered Mr. Hagenah's figures too high in many respects. After refusing to divulge records and working data on which his report was based, Mr. Hagenah resigned from the service of the committee on July 7. He said that the information was obtained from the gas company in confidence and he would not break his promise.

Rate Question in Toledo and Cleveland.

City Solicitor Schreiber, of Toledo, Ohio, has filed suit against the Toledo Railways & Light Company to force it to accept a franchise that was enacted by the City Council in May of this year. This franchise fixes the rate for energy at 8 cents per kw-hour, with a discount for payment of bills within a stipulated time. The minimum charge is fixed at 50 cents per month. The company had informed the City Council that it could not accept this ordinance, and proposed another plan by which the consumers would be charged according to the amount of energy used. In cases where an ordinary amount was consumed the charges would be even lower than those fixed by the ordinance, and where used in large amounts it would be furnished at such a price as to be attractive. The suit filed asks for an injunction to prevent the company from disconnecting consumers who fail to pay their bills according to the company's figures.

The petition states that the company has been operating under grants made to the General Chandelier Company, Citizens' Electric Lighting Company, Toledo Brush Electric Light & Power Company, Toledo Consolidated Electric Company, Toledo Electric Street Railroad Company and the Western Electric Light & Power Company.

An attempt is being made to reduce the prices charged by the Cleveland Electric Illuminating Company, Cleveland, Ohio, for service. These rates now range from 12½ cents per kw-hour to 5 cents, according to the number of lamps used and the amount of energy consumed. Councilman Haserodt has prepared an ordinance that will carry into effect the plans formulated by the late Mayor Tom Johnson, which would reduce the rates perhaps one-third, making the maximum 8 cents instead of 12½ cents. The basis of the proposed ordinance is the provision in the company's contract with the city that the rates may be readjusted by the City Council at the end of each ten-year period. This provision has not been taken advantage of for some time.

Rate Discussion at Los Angeles.

By LeRoy W. Allison.

Through an ordinance drafted by the City Council under recommendations of the Board of Public Utilities and a favorable vote of the people (see *Electrical World*, July 19, 1910), Los Angeles, Cal., has been accorded a 7-cent lighting rate, with $1 minimum, during the past year. In the fixing of charges for the ensuing year, July, 1911-12, the city has again engaged in a controversy.

On May 15 the Board of Public Utilities, a body of three, who, like the members of other commissions, serve without remuneration and solely for the honor attending the position, with the assistance of its regularly employed engineer, Mr. T. B. Comstock, and three consulting engineers, Prof. W. F. Durand, Leland Stanford University; Mr. E. F. Scattergood, chief electrical engineer of the city power bureau, and Dr. George L. Hoxie, New York, adopted a new schedule of rates to become effective July 1. These were based on a valuation of the existing plants of the power companies, allowing a 6 per cent depreciation on physical property, excluding real estate and permitting a percentage of return to capital invested of approximately 7 per cent.

The appraisal made of two of the three plants serving the city by the board of engineers conceded to the Southern California Edison Company a value of $6,466,241, including a contract with the Los Angeles-Pacific Railway. One million dollars of this sum represented, in the words of the board, "possible legitimate expenses for development which may not have been covered by past earnings." The Los Angeles Gas & Electric Company was credited with $2,570,415. Lack of sufficient time necessitated the omission of an inventory of the Pacific Light & Power Company. The annual statement filed by this corporation at the commencement of the year gives gross earnings of $1,333,900, and property valuation, neglecting franchise, of $6,474,061.

LIGHTING RATES.

The approximate annual output for lighting in the city is for the Southern California Edison Company, 13,687,383 kw-hours; Los Angeles Gas & Electric Company, 15,040,486 kw-hours; Pacific Light & Power Company, 11,022,565 kw-hours. The metered connections are between 57,000 and 60,000.

By considering the various classes of consumers and distributing cost for supplying service the board fixed what it believed just and equitable rates to company and consumers. A curve, shown in Fig. 1, was laid down for comparison of the rates in force and those proposed for a consumption under 300 kw-hours per month. In accordance with their conclusions a sliding scale of charges per month was established as follows:

First 250 kw-hours, 6½ cents; between 250 kw-hours and

500 kw-hours, 6 cents; between 500 kw-hours and 1000 kw-hours, 5 cents; between 1000 kw-hours and 2000 kw-hours, 4 cents; between 2000 kw-hours and 4000 kw-hours, 3 cents; in excess of 4000 kw-hours, 2¾ cents. The $1 minimum was abolished and in its stead a standing charge of

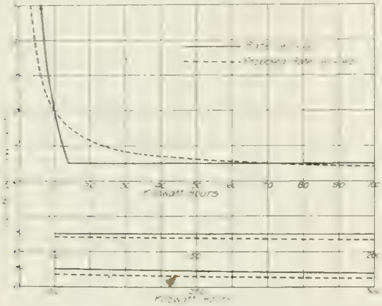


Fig. 1—Comparison of Unit Rates for Consumption Less than 30 Kw-hours per Month.

35 cents, termed a "connection charge," was established, this being based upon the cost to the company of rendering service, such as meter connection, reading meters, testing and repairs, collecting and clerical work.

The curve shown in Fig. 2 gives the cost to the small consumer under the present and suggested rate. It shows, as does Fig. 1, that when using under 10 kw-hours the user is benefited; the increase applies to those who consume

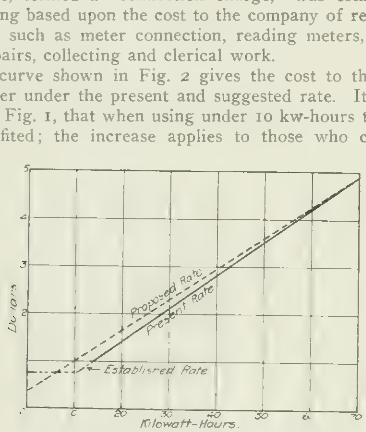


Fig. 2—Aggregate Charge up to 70 Kw-hours.

between 10 kw-hours and 70 kw-hours, who are variously estimated to represent from 70 per cent to 90 per cent of the consumers. Beyond 70 kw-hours the charge again becomes lower.

ENERGY RATES FOR MOTORS.

This is the first year that the city has extended its regulation to energy rates for motors. The schedule as provided by the board reduced the base from 9 cents to 7 cents per kw-hour, the new rates being as follows:

First 100 kw-hours, 7 cents; between 100 kw-hours and 500 kw-hours, 6 cents; between 500 kw-hours and 1000 kw-hours, 5 cents; between 1000 kw-hours and 1500 kw-hours, 4 cents; between 1500 kw-hours and 2000 kw-hours, 3 cents; in excess of 2000 kw-hours, 2 cents. There is a minimum charge of 50 cents per month per horse-power installed.

A special schedule arranged on the block system is based on a maximum demand, or fixed charge, plus an energy-consumption charge. The fixed charges are $1.50 a month per horse-power for demand from 1 hp to 10 hp; $1 a month per horse-power for demand from 11 hp to 20 hp, and 50 cents a month per horse-power for demands in excess of 20 hp. Thus a consumer having a maximum demand of 30 hp would be asked to pay a fixed charge of $15 for the first 10 hp, plus $10 for the next 10 hp and $5 for the next 10 hp, or a total of $30. To this would be ad the cost of electrical energy at the following rates: the first 3000 kw-hours, 2 cents; 100,000 kw-hours, 1 c and all above, 0.9 cent. Where the consumer is given option of direct current and alternating current and ele the former the rates given in the special schedule incre 15 per cent.

PUBLIC DISCUSSION.

Declaring that the proposed rates discriminated agai the small resident consumer, many citizens and protect organizations filed protests with the Mayor. Indust companies also entered complaint that their present would be increased under the new schedule, and, as p vided by the city law, the matter was placed before City Council.

Argument between the City Council, citizens and Board of Public Utilities reaching no ultimate conclusi a special committee composed from the membership of Council was appointed to confer with Engineers Scatt good and Comstock and instructed to arrive at an amica decision. Almost coincident with this ruling the Board Public Utilities tendered resignations to the Mayor June which were accepted.

On July 1 the special committee introduced an ordina providing a schedule of rates practically identical with t now in force and reducing the $1 minimum to 75 ce This is shown in the diagram, Fig. 2. The effective char become as follows:

Lighting Rates.—No meter charge. Minimum charge cents per month. First 250 kw-hours, 7 cents. Continu the same as suggested by the board up to above 4000 hours.

Energy Rates for Motors.—First 100 kw-hours, 7 ce between 100 kw-hours and 300 kw-hours, 6 cents; betw 300 kw-hours and 500 kw-hours, 5 cents; between 500 hours and 1000 kw-hours, 4 cents; between 1000 kw-h and 1500 kw-hours, 3 cents; between 1500 kw-hours 2000 kw-hours, 2½ cents; between 2000 kw-hours and 3 kw-hours, 2 cents; between 3000 kw-hours and 4000 hours, 1½ cents; in excess of 4000 kw-hours 1.4 cents.

The ordinance was formally considered a week later again on July 11.

New York Commission News.

The Public Service Commission, Second District, authorized the Central Hudson Gas & Electric Compan issue $1,400,000 of 5 per cent thirty-year bonds, for the p pose of paying off and canceling bonds of the Poughkee Light, Heat & Power Company to the amount of $600,0 of the Newburgh Light, Heat & Power Company to amount of $700,000, and of the Hudson Counties Ga Electric Company to the amount of $100,000, these c panies having been consolidated with the permission of commission. The company is also authorized to is $600,000 bonds, to be sold at not less than 95¼, for the charge of obligations of the consolidated company curred for proper capital purposes.

This week the commission will have further hearings the complaints of various municipalities in Westche County against the Westchester Lighting Company as prices of gas and electricity.

The Public Service Commission, Second District, authorized the Northern Westchester Lighting Compan exercise franchises granted for the furnishing of gas electricity to the villages of Pleasantville and Briar Manor and in the town of Mount Pleasant.

The commission has approved of the sale, transfer assignment to the New York Telephone Company of a tain franchise granted by the board of trustees of the lage of Cobleskill and held by the Cobleskill Teleph Company. The petition states that the best interests

telephone-using public in the villages of Cobleskill, Lawyersville, Sharon and the surrounding territory will be served by the direct ownership and operation of the property by the New York Telephone Company. The company also proposes to merge the Cobleskill & Sharon Telephone Company.

Maryland Commission News.

The Maryland Public Service Commission received last week from the Consolidated Gas, Electric Light & Power Company replies to complaints made as to the prices of gas and electricity by Mayor Preston and City Solicitor Poe. The company stated that it is ready to facilitate the inquiry and have the commission pass upon the reasonableness of the rates. The property and plants of the company and its records and books are open to investigation by the commission. The answer also indicates that future reductions in rates are probable, the policy of the company, as stated, being to reduce voluntarily the price of its commodities when the growth of its business and the cost of operation make reductions possible. The reply to the complaint about the cost of electricity was filed by Mr. Herbert A. Wagner, vice-president in charge of the electric division. Both answers hold that the present prices charged for gas and electricity are not unjust or unreasonable.

Preparatory to the inquiry into the rates of the Consolidated company, the commission has approved an outline prepared by its chief engineer, Charles E. Phelps, covering items of information to be included in the investigation. These items are grouped under six different schedules and cover the following subjects: Schedule 1—Book values of the elements that make up the total valuation of the plant and property operated by the electric division of the company for municipal street lighting; 2—Operating income and expenses of the electric division; 3—Data in respect to the production and distribution of electricity; 4—Book values giving the valuation of the separate items in the gas division of the company; 5—Operating income and expenses of the gas division; 6—Data in respect to the manufacture and distribution of gas. In adopting the recommendations of the chief engineer, the commission also decided that the inquiry should cover the entire gas and electric systems without any attempt to separate the values in the city of Baltimore from those in the adjacent territory, and should comprise complete inventories of the plants and properties of the gas and electric divisions separately. The commission's auditor, Colonel John A. Tompkins, will not be placed at work on the company's books until after the first public hearing, to be held July 19, which hearing will be in the nature of a preliminary one, at which the commission will be glad to hear from the general public. The real work, involving the preparation of these inventories and valuations, is expected to consume some months.

Wisconsin Commission News.

The Wisconsin Railway Commission, after an investigation into the affairs of the Madison Gas & Electric Company, has handed down a decision reducing the company's rates for electric lighting about 14 per cent. This will involve a decrease in revenues to the extent of approximately $25,000 annually. This is the second reduction made in the company's rates in the last year and a half. A decision and order of the commission in the case of the State Journal Printing Company et al. vs. the Madison Gas & Electric Company, dated March 6, 1910, made effective certain reductions and readjustments of the then existing schedule of rates. These changes involved the substitution of a rate based upon the connected load as well as the amount of energy used in place of a schedule based entirely upon the energy consumed with a discriminatory discount for quantity. The original maximum rate was 16 cents per kw-hour. In the decision, dated March 8, 1910, a schedule, involving a primary net rate of 14 cents, with a secondary rate of 8.5 cents and an excess rate of 5 cents, was ordered. The reduced schedule recently ordered is as follows: Primary net rate of 12 cents per kw-hour for the first thirty hours' use per month of the active connected load: secondary net rate of 8 cents per kw-hour for the next sixty hours' use per month of the active connected load; excess net rate of 4 cents per kw-hour for all additional energy consumed. The minimum bill is to be $1 per month.

The above schedule applies to Classes A, B and C. In Class A are included residences, flats and private rooming houses. Where the total connected load is equal to or less than 500 watts nominal rental capacity, 60 per cent of such total connected load is to be considered active; where the installation exceeds 500 watts, 33 1/3 per cent of such part of the total connected load over and above 500 watts is to be considered active. Class B consists of banks, offices, wholesale and retail merchandise establishments, saloons, public halls, restaurants, depots, etc. Where the total connected load is equal to or less than 2.5 kw nominal capacity, 70 per cent of the total connected load is to be considered active; where the installation exceeds 2.5 kw, 55 per cent of such part of the connected load over and above 2.5 kw is to be deemed active; lamps used exclusively in space devoted to the storing of goods are to be placed at 20 per cent active and are not to be included in the 2.5 kw specified above. In the original order all Class B installations were rated at 70 per cent active, but as an inducement to larger installations the commission reduced the percentages to the figures given above. Class C consists of federal, state and county buildings, churches, hotels, clubs, factories, private schools, warehouses, liveries, etc. In this class 55 per cent of the total connected load is to be deemed active. For all energy furnished the University of Wisconsin a maximum charge of 5.5 cents net per active lamp of 50 watts equivalent per month is to be made, plus 4 cents per kw-hour for energy consumed. Thirty per cent of the total connected load is to be considered active. For all signs and window lighting, on a yearly contract basis, a charge of 4.5 cents net per active 50 watts equivalent per month, plus 4 cents net for energy, is to be made. In this class the total connected load is active.

The reasons given for the second reduction are the economies effected by the company during the past year and the enormous increase in sales brought about by the inducements offered to use additional energy under the commission's form of rate. The company has operated under this rate for a little over a year, and an accurate comparison was, therefore, possible between conditions before and after the commission's form of rate was put into effect. The analysis of the electrical department costs disclosed rather interesting results. A comparison of the year ended March 31, 1911—the year in which the commission's first order was effective—with the year ended Dec. 31, 1909, showed that the cost per kw-hour for arc service had decreased from 5.69 cents per kw-hour to 5.6 cents; for incandescent lighting, from 9.78 cents to 9.31 cents; for motor service, from 5.63 cents to 5.55 cents. The consumer, demand and output costs for incandescent service, when compared with those for the year ended June 30, 1909, show a somewhat reduced cost. Consumer costs have decreased from $9.042 per consumer per annum to $7.566. Demand costs have been reduced from 5.55 cents per active lamp to 5.108 cents. Output costs have decreased from 4.52 cents per kw-hour to 4.181 cents. A comparison of unit costs showed a range in cost per kw-hour in the year ended March 31, 1911, varying from 11.39 cents where energy is used but one hour per day to 4.48 cents where energy is used for twenty-four hours, compared with a range of from 12.65 cents to 4.86 cents for the year ended June 30, 1909. The comparison showed further that the total

gross earnings have decreased from 6.5 cents to 6.3 cents per kw-hour sold; that the operating expenses have decreased from 3.44 cents to 3.05 cents per kw-hour sold. The decrease in the operating expenses was due to a decrease in the distribution, collection and general expenses, brought about by a more economical management. The net earnings of the company show an increase from 3.06 cents to 3.25 cents per kw-hour sold.

The effect of the commission's form of rate was most noticeable in the residence-lighting business. The investigation showed that while the residence consumers have increased 34 per cent, the number of lamps connected for this class of service has increased 53 per cent and the kw-hours sold 70 per cent. The large increase of demand and use of energy for the class has increased the revenues even under the reduced rate 35 per cent for the class. The net revenues from incandescent lighting increased from $59,017 in 1907 to $80,527 during the year ended March 31, 1911. Statistics show that a large portion of the increase in energy sold during the latter period was paid for at the secondary rate. That is, the increase was due very largely to a longer daily use of the active connected load as well as to the increase in the number of electrical appliances other than lamps, the use of which was encouraged by the low secondary rate. Stores had actually decreased their number of lamps connected, but have increased the amount of energy used 25 per cent. The accruing revenues increased 10.9 per cent.

The company's gas business did not show much of a change either in operating expenses or in revenues. It was deemed inadvisable to change the existing gas rates until certain contemplated additions to the plant are placed on a revenue-producing basis.

CURRENT NEWS AND NOTES.

A. I. E. E. SECRETARYSHIP.—A committee as follows has been named by President Jackson to canvass the candidates for the office of secretary of the American Institute of Electrical Engineers and report its recommendations to the board of directors: President-elect Gano Dunn, chairman; Vice-president Harold W. Buck and Manager W. S. Rugg. Among members who are mentioned in connection with the secretaryship are Messrs. Horatio A. Foster, F. L. Hutchinson, W. J. Jenks, H. H. Norris, George F. Sever, Samuel Sheldon and Percy H. Thomas.

* * *

AUTOMOBILE ENGINEERS' HANDBOOK.—The Society of Automobile Engineers is preparing for publication a handbook for automobile engineers, in which will be printed standard specifications for material and information as to the treatment of material and the methods of testing it, with further information pointing the way to many short cuts, etc., in calculations and testing.

* * *

PROCEEDINGS OF CONGRESS OF TECHNOLOGY.—The *Proceedings* of the Congress of Technology, held in Boston April 10-11, will be published in a volume of about 500 pages, which will be sold at a moderate price. The contents include the seventy-odd technical papers, relating to many fields of industry, which were read at the celebration of the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology.

* * *

PAYMENT TO CITY WHERE FRANCHISE HAS EXPIRED.—The Wayne County Circuit Court of Detroit has upheld the contention of the corporation counsel that the Detroit United Railway Company must pay the city $200 a day for the use of the streets occupied by its railway tracks and on which the Fort Street line franchise has expired. The company is allowed until July 18 to decide whether it will pay the rental. If it refuses to do so, the city is adjudg to have the right to stop the operation of the Fort Str line and to compel the removal of the company's equipme on the streets affected.

* * *

OHIO ISOLATED PLANTS SELLING ENERGY TO BE TAXED The Ohio State Tax Commission has decided to requi all private companies selling electrical energy to consu ers to list their properties for taxation on the same ba as gas and electric companies are required to do. Acti upon this idea, blanks have been sent to the Commerc Tribune Building Company and the Butler Building Co pany, of Cincinnati, with instructions that their enti properties be listed on this basis. It is said that there a twenty-five such private plants in Cincinnati. The co mission exempts companies which furnish energy tenants as part of their rent.

* * *

TORONTO RATES FOR ELECTRIC SERVICE.—A new sched of prices for electric energy, which the Toronto (On Electric Light Company announced some time ago wo shortly be issued to meet the competitive rates of the ci hydroelectric system, was made public on July 6. The co mercial lighting rate is 8 cents per kw-hour for thirty hou use per month, and 3 cents per kw-hour for all excess, w 10 per cent discount on one-year contracts. For alternatir current motors the rate is 5 cents per kw-hour for the fi fifty hours' use of maximum demand per month; 1 cent f the second fifty hours' use and ½ cent for all excess, w 10 per cent discount on yearly contracts.

* * *

CANADIAN CANAL WATER-POWER.—The government the Province of Ontario has challenged the right of t Dominion government to control and dispose of the wat powers developed by the canals. The contention of t Whitney (provincial) government is that the water belon to the province before it enters the canal and after leaves the canal, and that, except for purposes of navig tion, the water belongs to the province when it is in t canal. The provincial government claims that the Domi ion's only right under the Act of Confederation is to u the water in the canals for purposes of navigation, a the federal authorities have been informed that the provi cial government intends to assert its rights to control water-power grants in the canal and to demand a repa ment of the $100,000 per annum revenue which the Domi ion government now derives from such grants.

* * *

GOVERNMENT INSPECTION OF "WIRELESS" ON SHIPBOA —Three inspectors of wireless telegraph apparatus on v sels—Messrs. Richard Y. Cadmus, William D. Terrell a Charles St. J. Howard—have been appointed by the D partment of Commerce and Labor of the United Sta government. The law requiring all passenger vessels p ing from United States ports to have "wireless" equipme sufficient to call for help in cases of emergency is now force and all vessels will be inspected to see that they co ply with the law as soon as the newly appointed inspect can enter upon their duties. It will be the duty of the spectors to go aboard all outgoing vessels carrying mo than fifty passengers to inspect not only the apparatus itse but to pass judgment upon the qualifications of operato No vessel will be permitted to leave a United States p without a certificate of inspection. If an inspector is n at hand the master of the vessel is required to deposit certificate with the customs officials. Vessels violating t "wireless" laws will not be refused clearance, but will fined. Wireless operators holding certificates by the g ernments which ratified the Berlin wireless-telegraph co ference will be acceptable to the United States authoriti To secure a certificate from the United States governme it will be necessary for operators to pass an examination

Isolated Plants in Chicago.—Figures given in the recent annual report of the department of electricity of the city of Chicago show that there are 763 isolated electric plants in that city supplying 10,670 arc lamps and 788,34 incandescent lamps.

* * *

Electric Lighting in the Society Islands.—An electric-lighting system has just been installed in Papute, the chief city of the Society Islands, in the Pacific Ocean, and according to consular reports the new lamps are productive of the greatest curiosity among the natives, who come in from miles around to see them. Fifty kw of generating capacity is installed in the new plant, which is owned by a progressive American resident.

* * *

Annual Report of Department of Electricity of Chicago.—The annual report of Mr. William Carroll, city electrician, for the year 1910, recently issued, shows that the department of electricity of the city of Chicago expended $1,239,782 last year and earned $194,589. The expenses were principally for electric, gas and gasoline street lighting, while the revenue was mainly derived from electric inspections. On Dec. 31, 1910, there were 408 officers and employees in the department.

* * *

Street Lamps of All Kinds in Chicago.—Figures given in the recent annual report of the department of electricity of Chicago show that the total number of public street lamps in service on Dec. 31, 1910, was 37,994. Of these, 12,366 were municipal electric-arc lamps, 893 rented arc lamps, 11,990 gas-mantle lamps, 5426 gas flat-flame lamps and 7319 gasoline lamps. The cost of rented arc lamps is $75 a year, municipal arc lamps $61.95 a year, mantle gas lamps $18.91, open-flame gas lamps $15.41, and gasoline lamps $26.40.

* * *

Wireless Telegraphy in India.—The military authorities of the government of India have a plan of wireless telegraphy to knit together the various units of the army in India. Four stations have been completed and the wireless apparatus is to be installed by the Marconi company. This is the first appearance of the company in India, the system at present in use for commercial and general purposes being the Lodge-Muirhead system. The scheme is exclusively for military use, and it it understood that eventually every military station in India will have its wireless apparatus in charge of trained army officers.

* * *

That Gary Excursion.—The General Electric Company has issued a card in which it expresses its regret that its guests were disappointed on the occasion of the excursion to Gary on June 29, during the Chicago convention of the Institute, at not being taken through the electrically equipped rolling mills. The Indiana Steel Company explains the omission by saying that the party exceeded the number registered by 200, thus rendering inadequate the provisions made for the safe conduct of the party. The General Electric Company hopes that it may show this interesting electric drive to members of the party at some future time.

* * *

Exposition of Inventions at St. Louis.—The International Exposition of Inventions at St. Louis, postponed from last April, will, it is now promised, be held during the week of Sept. 11 in the St. Louis Coliseum. The purpose of the exposition is declared to be the bringing together of investors and inventors, and manufacturers and buyers. Patented machines, appliances, tools, devices and processes of varied character will be exhibited, a department being set aside for electrical inventions. The purpose of the promoters has been to establish an educational institution which shall attract the attention of capitalists and corporation officials, superintendents, etc., who will be interested in the development of the appliances shown. Mr. F. W. Payne is secretary-manager of the exposition.

* * *

Energy Generated in London and in New York.—The returns issued by the London County Council relating to the amount of electricity generated in and around London show that in London the borough councils generated or purchased 91,851,181 kw-hours, of which 75,115,968 kw-hours, or 82 per cent, was sold. Information regarding the kw-hours generated by the London companies is not available, but they disposed of 137,211,288 kw-hours. Whether this included that used by the railways is not stated. In New York City the amount of energy generated by the public-utility companies last year is estimated to have been 1,750,000,000 kw-hours.

* * *

Interlocking System of Chicago Subways.—Mr. J. W. Pearl, a former member of the Chicago city engineer's staff, appeared before the committee on local transportation of the Chicago City Council on July 5 to explain his plans for combined routes of "interlocking" subways for the city of Chicago. The scheme outlined by Mr. Pearl contemplates the construction of a number of interleaved loops in the down-town district in which tracks from the North Side share island platforms with West Side tracks, and other West Side tracks share island platforms with South Side tracks, permitting transfers across town to be made easily. As proposed the plan would require 13¾ miles of tunnels, which, the designer estimates, could be built at a cost of $15,000,000.

* * *

Resistance to Electric Shock.—A list of electrical accidents in the city of Chicago in 1910, given in the annual report of the department of electricity of that city, shows some curious discrepancies. Thus, on Aug. 17 Mr. Harry E. Ames, a lineman, received a shock while working on a ladder on a 40-volt alternating-current circuit which proved fatal, but on Sept. 29 Alice O'Neill, a schoolgirl, was merely burned and shocked by coming in contact with a conductor carrying 7300 volts. This accident is reported as "not serious," although the emf involved is so much greater. Of course, in all cases of electrical accident it is necessary to know all the circumstances to form a correct judgment. The instances cited, however, show that the voltage of a circuit, while an important, is not necessarily a determining factor in cases of accidental electric shock.

* * *

Cost Data of Commercial Vehicles.—At a meeting on June 29 of the Metropolitan (New York City) Section of the Society of Automobile Engineers the desirability of cost data applying to commercial vehicles was dwelt upon. Mr. William P. Kennedy, chairman of the meeting, said there are four main divisions to be considered, the first including such items as interest on investment, depreciation, etc.; the second, upkeep, including cost of tires, battery charging and lubricating oils; the third, garage expense, including garage labor, and, fourth, the chauffeur labor account. Interest and depreciation of buildings, office equipment, garage equipment and other non-working equipment can be easily agreed upon. The logical way to consider depreciation is to separate the working and non-working portions, bearings, tires, etc., being regarded as material used up in work. While ten years is a long time, it is not too long to assume, as shown by electric-vehicle equipments now in use. What the prospective purchaser most wants are reliable data on the cost of operation, and it was added that if some body like the present one does not provide proper cost systems the introduction of the commercial motor vehicle will be retarded.

Moving Pictures Aboard Transcontinental Trains.—As a means of exhibiting the beauties and resources of the Pacific Coast country which it reaches, the Southern Pacific Railroad is planning to put several moving-picture cars in service on its transcontinental trains. Lecturers will accompany the exhibition cars to give information to passengers.

* * *

Russian Hydroelectric Projects.—A Russian government technical commission has approved a project for two large hydroelectric developments, one at Lars, in northern Caucasus, and the other on Lake Gotchkha, in Transcaucasus. The promoter, who is a British subject, is now endeavoring to obtain capital in London to carry out the work.

* * *

Residence Lighting and Rates.—The Public Service Commission of Wisconsin has found that following the adoption in Madison of a schedule of rates favorable to residence lighting the number of residence consumers has increased 34 per cent, while the number of lamps connected has increased 53 per cent and the number of kw-hours sold no less than 70 per cent.

* * *

"Electric Delivery—Economical, Efficient."—The electric delivery wagons of the Commonwealth Edison Company in Chicago serve as a constant reminder of the advantages of electric vehicles wherever they go, as they bear the legend, "Electric Delivery—Economical, Efficient," in neat lettering. These four words seem to present the case of the electric commercial wagon with brevity and force.

* * *

Ohio Telephone Situation.—It is reported that the Bell and Ohio Independent telephone companies are working out a plan for consolidation of service where a town has two telephone systems, and that a proposition will be made to the new Public Utilities Commission whereby subscribers will pay for calls made, not by the month. In connection with this, it is said that a minimum charge will be made in order that companies may not be put to the trouble of installing telephones merely for the convenience of those who may want to make only an occasional call.

* * *

Turbine-Driven Vessel with Electrical Speed Reduction.—Opportunity for comparing the performance of recent improvements in speed-reducing gears with generator-motor systems of connection between steam turbines and propellers will be offered in the construction of two sister-ship colliers now building for the United States Navy. The new collier *Neptune* is to be equipped with Milville-MacAlpine reducing gears, while the turbines of the new coal-carrier *Jupiter* will drive generators which in turn supply energy for operating the motors on the propeller shafts.

* * *

Electric Fan Stolen from the Police.—It is reported from Pittsburgh that while a number of detectives were grouped about the desk of the assistant superintendent of police receiving instructions in relation to recent burglaries someone remarked that the atmosphere was "close," and it was found that an electric fan which had stood on a windowsill had disappeared. The freshly severed ends of the 110-volt circuit operating the fan seemed to indicate that a daring thief had cut the wires while the fan was in motion and had made away with it under the very noses of the detectives.

* * *

Interruption to Chicago Drainage Canal Hydroelectric Service.—During a severe thunderstorm on the evening of June 26 the transmission line of the Sanitary District, running from the Chicago Drainage Canal hydroelectric plant at Lockport, Ill., to Chicago, was put out of commission, being presumably disabled by lightning. All the energy for Chicago's 12,000 street arc lamps is received over this line, so that for several hours no electric street lamps were in service. Furthermore, all other customers of the Sanitary District were similarly affected, including a large amusement park.

* * *

Rates at Huntington Park, Cal.—The City Council of Huntington Park, Cal., has taken official action fixing the rate for electric service at 8 cents a kw-hour, instead of the previous rate of 12 cents, with a minimum charge of $1 a month. For some time there has been an agitation of this subject, and it is reported that the Pacific Light & Power Corporation has refrained from making extensions of its service in Huntington Park pending the outcome. The company is reported to have offered to make the new connections provided the City Council would agree to a rate not lower than 10 cents, but the city fathers refused to accept this compromise and there may be a contest in the courts. An election to vote on the question of municipal ownership of water-works and electric-service plant is in prospect also.

* * *

Royal Show at Norwich, England.—Judging by the exhibits at the Royal Agricultural Society's Show at Norwich, England, the use of electrical apparatus for agricultural purposes is still very limited in the United Kingdom. Ten generators were shown, most of which were coupled to gas or oil engines. Some motors used in connection with various small machines for farm work were to be seen, and also two complete electric-lighting equipments consisting of low-speed petroleum engines, generators, controllers, switchboard, etc., for forty lamps and 125 lamps respectively. These plants were automatic, the engine being started by turning one of the lamp switches and shut off when the lamps were switched off. For this purpose only small batteries were needed similar to those used for ignition purposes.

* * *

Production of Mica.—The total value of the mica produced in the United States in 1910, according to an advance chapter from "Mineral Resources of the United States, 1910," by Mr. Douglas B. Sterrett, just issued by the United States Geological Survey, amounted to $337,097, exceeding by $56,568 the value of the production of 1909, and was greater than in any other year except 1907, when it amounted to $392,111. The production of sheet mica amounted to 2,476,190 lb., valued at $283,832, an increase of 666,608 lb. in quantity and of $49,350 in value, as compared with the output of 1909. The production of scrap mica amounted to 4065 tons, valued at $53,265, a decrease of 25 tons in quantity and an increase of $7,218 in value, as compared with 1909. The production came from seven States—North Carolina, South Carolina, South Dakota, New Hampshire, Colorado, New Mexico and Massachusetts—named in the order of the value of their output. Sheet mica is used for gas-lamp chimneys, for lamp shades and for glazing and is punched into disks and washers or cut by shears—either hand or power—into patterns for use in stoves and electrical apparatus. The electrical industry consumes by far the greatest part of the sheet mica produced. A large quantity of mica too small to be cut into sheets and also the waste from the manufacture of sheet mica is ground and used in the manufacture of wall papers, lubricants, fancy paints, molded mica for electrical insulation, etc. Ground mica applied to wall papers gives them a silvery luster. Coarsely ground or "bran" mica is used to coat the surface of composition roofing material to prevent the tar or other composition used in its manufacture from sticking when the material is rolled for shipping.

ERIE COUNTY ELECTRIC SYSTEM.

odern Steam-Turbine Generating Station Erected Near Presque Isle Bay at Erie, Pa.

ERIE, Pa., has a population of 66,525. It has two electric-light companies, two telephone companies, two telegraph companies, two gas companies, three railway companies and five railroads, so that so far as competition is concerned it is not lacking. The Erie County Electric Company is the larger of the two electric-light companies, the other company, the Erie Company, operating a small combination light and steam-heating plant. The former company has just placed in ration a new steam turbine station located at Fifth and ılberry Streets, near Presque Isle Bay, and adjoining le Erie and Pittsburgh branch of the Pennsylvania Railad Company. Close by is Cascade Creek, whenceconnsing water of good quality is obtained. There is in adtion a 24-in. cast-iron pipe line from the station to a pumpuse on Presque Isle Bay, where there are installed two ntrifugal pumps driven by two 175-hp synchronous three- 2300-volt, 60-cycle motors built by the Burke Elec- mpany, Erie, Pa.

he design of the station is such that additions can be ıde to it readily, one end being closed in by a temporary all of corrugated sheet iron. The construction throughout fireproof, with a high turbine-room floor, so as to bring barometric condenser heads close to the turbines. The r-room basement, where the hot well is located, is 28 below the turbine-room floor. The steam-generating uipment comprises four Babcock & Wilcox water-tube ilers, each of which is rated at 512 hp and is fitted with chain grate stoker built by the boiler makers. The furces are fed with bituminous slack coal costing from $1.15 $1.30 at the hoppers. After being dumped from the cars

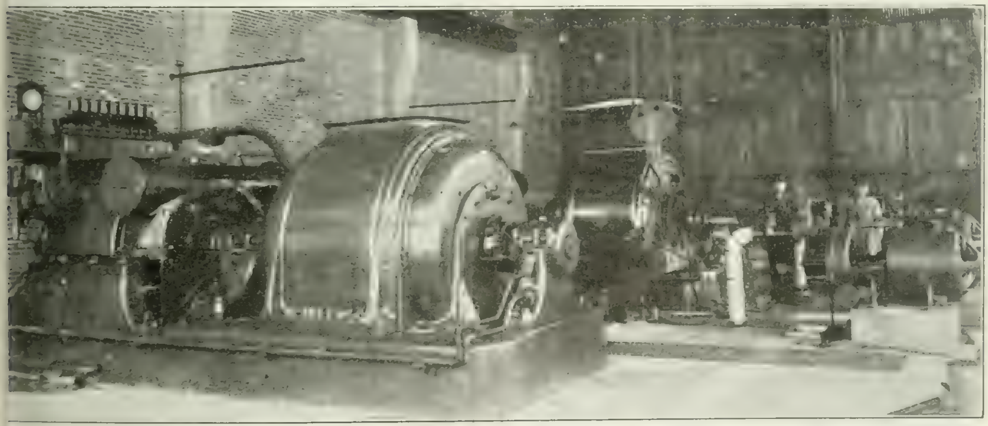


Fig. 1—View of Generating Room.

is taken on an overlapping pivoted bucket conveyor degned and installed by the Jeffrey Manufacturing Comıny, Columbus, Ohio. The track hopper is of steel conruction approximately 10 ft. by 10 ft. It is equipped with automatic feeding device which regulates the flow of al to each bucket as it passes under the hopper. The aded buckets are carried horizontally, approximately 31 , to a point just outside of the building, whence they are ken vertically to the top of the bins. The coal is then stributed over the storage bins by means of a traveling tripper operated by a winch and hand wheel placed at one end of the upper run. The coal is fed to the stokers through chutes.

The ashes, which are also handled by the conveyor, are dumped from below in the basement into the lower run of the conveyor, loading plates extending along the lower run for a distance of 62 ft. The ashes are carried around the system in the same way as the coal and are dumped into the

Fig. 2—View of Pumphouse and Intake.

ash chute by means of the traveling tripper. The ash chute is placed adjacent to the coal bins and discharges through the wall to cars on the track below. The conveyor is 117 ft. between vertical centers and when operating at a speed of 50 ft. a minute handles 50 tons of coal an hour. The driving mechanism in the basement comprises a head shaft, two countershafts and a 10-hp motor all gear-connected and supported on a self-contained steel frame. The conveyor line is fitted with an automatic gear lock to prevent the conveyor from running backward should the motor stop for any reason when the conveyor is loaded. At present the ashes are used for filling in the low spots around the station.

The reinforced-concrete bunkers are built V-shape and hold some 320 tons of coal. Moreover, the railroad siding provided outside the station has accommodations for 27 cars, so that when the bunkers are filled and the siding holds its full quota of cars approximately 3000 tons of coal are on hand, which is sufficient to tide the station over any reasonable period of shortage due to strikes or delayed shipments. A feature of the boiler-room is the setting of the boilers. Each is set singly with 20 ft. of clear space in front and in the rear, and with 6 ft. of space between units. This makes it possible to remove flues readily from either

the front or the rear of the boiler and renders inspection of the boiler and setting easy. The concrete foundations for the boilers and turbines extend down to solid rock.

Feed water is delivered to the boilers by two compound Heisler pumps, built by the Heisler Engineering Company, St. Mary's, Ohio, all of the auxiliaries exhausting through a

Fig. 3—Interior of Pumphouse.

Cochrane open-type heater built by the Harrison Safety Boiler Works, Philadelphia, Pa. Natural draft is relied on for the boiler furnaces, the products of combustion passing out of a 254-ft. radial brick stack with an inside diameter of 8 ft. erected by the M. W. Kellogg Company, New York City. The latter company also designed and erected all the steam piping in the station.

The turbine equipment consists of two 2500-kw, three-phase, 2300-volt, 60-cycle, four-stage, horizontal General Electric units, taking superheated steam at a pressure of 175 lb. and provided with forced ventilation. Three 35-kw turbine-driven exciters are provided. The condensers,

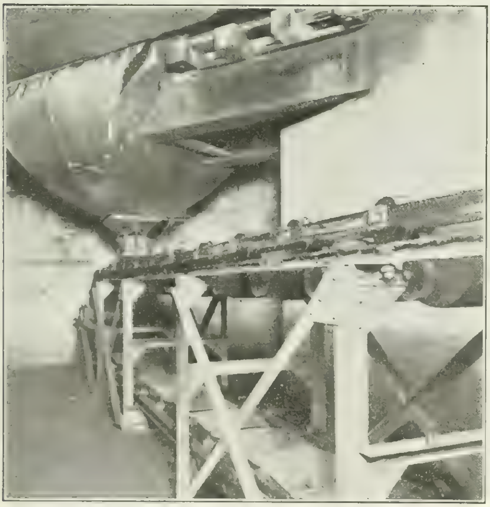


Fig. 4—Track Hopper and Coal Conveyor.

which are of the Alberger barometric type, are supplied with water from the creek flowing by the station or from Presque Isle Bay. The water from the latter source is lifted 60 ft. to the top of the hill overlooking the bay, whence it flows by gravity to the condensers. The pump-house on the shore is about 1600 ft. from the station, and is 40 ft. x 24 ft. in area. A pit 12 ft. deep by 24 ft. long ar 12 ft. wide is connected through a 30-in. pipe line to tl intake in the bay, some 157 ft. from shore. The intake made up of crib work below water and concrete abov Water enters on all sides. Screens are provided in the we in the pumphouse to keep out refuse and fish, principall the latter.

The switchboard is of the standard General Electric typ and contains two generator panels, one tie panel, tw exciter panels, one synchronizing panel, one Tirrill regulat panel and four feeder panels. The arrangement is suc that panels can be added at either end should the static equipment be increased. The oil switches are located the floor below, immediately beneath the switchboard, that the highest potential at the board itself is 125 volt Spanning the turbine-room is a 25-ton Cleveland crane. C the four sets of feeders provided, one set acts as a tie li between the old and the new station, and the other thre sets run to the old station also, the feeders being tied t gether between two sets of busbars. The lines pass unde ground from the station to a terminal pole about 100 f east of the building, whence they run overhead to the cent of the city.

The old station of the company is located at Twelfth ar French Streets, in the business section of the city. It co tains eight water-tube boilers with an aggregate rating 2500 hp and fitted with chain-grate stokers. The generatin equipment comprises one Filer & Stowell engine driving 550-kw, 275-volt direct-current machine; one Brown engi driving a 500-kw direct-current machine; one Erie City e gine connected to a 450-kw direct-current generator; o vertical engine driving one 450-kw, 275-volt direct-curre generator; one Ball engine driving a 450-kw, three-phas 2200-volt, 60-cycle alternator; one 250-kw motor-generat set with a 2200-volt, three-phase synchronous motor and 275-volt direct-current generator; one 550-kw motor-gene ator set similar to the above and eight Brush arc machin designed for 125 lamps; a 250-hp direct-current mot driving a pair of machines. It is proposed to transfer the machines to the new station and drive them with syn

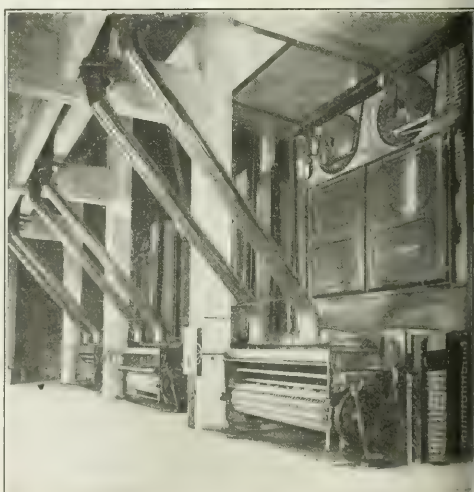


Fig. 5—Boiler-Room in New Station.

chronous motors. The boiler plant will be used for di trict steam heating.

The distribution is all overhead on 35-ft. poles, with 8- tops. The company owns and maintains its own poles a has no wires on foreign poles. The arc lamps are su pended from a stranded cable at the center of the inters

on of the streets. The direct-current three-wire system distribution with 230 volts between outside wires is nployed in the center of the city, and a 500-volt direct-irrent system for motors reaches the outlying sections. his system will eventually give place to a three-phase stem. On the outskirts of the city lamp circuits are sup-ied with 115-volt single-phase energy and motor circuits ith 230-volt or 2300-volt three-phase energy. The motor ad on the system has increased to such an extent that the w station is now fairly well loaded.

The company has over 2700 meters out on all classes of rvice. Natural gas is a strong competitor of electricity in ie and it sells at 30 cents per 1000 cu. ft. Every house the city is piped for natural gas, which is used for oking and lighting. Nevertheless, none of the public ildings except a single hotel has an isolated plant. The mpany no longer carries electrical supplies, leaving that rk to jobbers and contractors. Its rate for energy for sidence lighting is 10 cents a kw-hour, with a minimum of cents a month. Short-hour commercial business is sub-t to the same minimum, but with a 7-cent rate, and the ng-hour business is given a 5-cent rate. The rate for

Energy Consumption per Month	Rates in Cents.
80,000 kw-hours or over	96
40,000 " "	99
20,000 " "	1.05
10,000 " "	1.125
5,000 " "	1.25
3,000 " "	1.5
2,000 " "	1.8
1,000 " "	2.25
Less than 1,000 "	3.0

0-volt direct-current energy for motor circuits is 5 cents r kw-hour. For 2200-volt, 60-cycle, three-phase motor cuits the following rate schedule is in force: There is a rvice charge of $1 per kilowatt per month. For less than

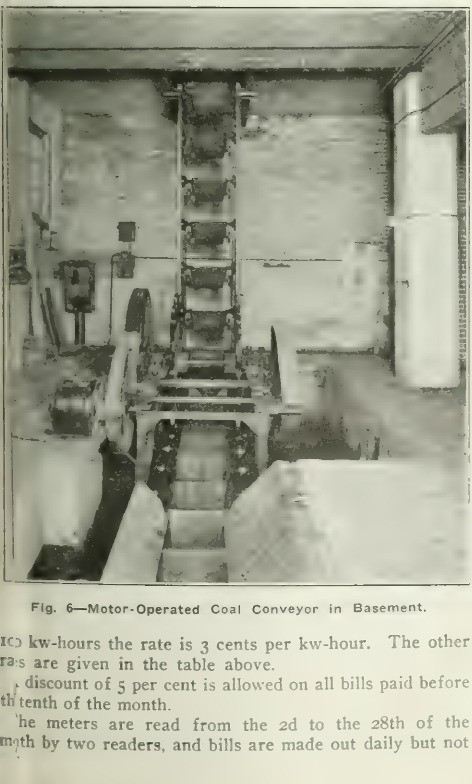


Fig. 6—Motor-Operated Coal Conveyor in Basement.

100 kw-hours the rate is 3 cents per kw-hour. The other rates are given in the table above.

discount of 5 per cent is allowed on all bills paid before th tenth of the month.

he meters are read from the 2d to the 28th of the month by two readers, and bills are made out daily but not mailed until the last day of the month. The bills are sent out on post cards and fully 90 per cent of them are paid over the counter. An addressograph is employed in addressing the post cards and this prints in addition the page of the ledger, the line of the light sheet and the number of the card in the margin, as shown herewith. When payment

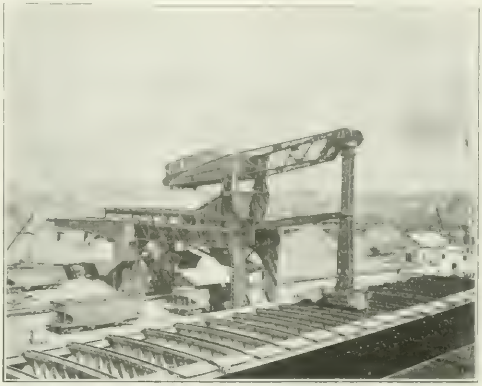
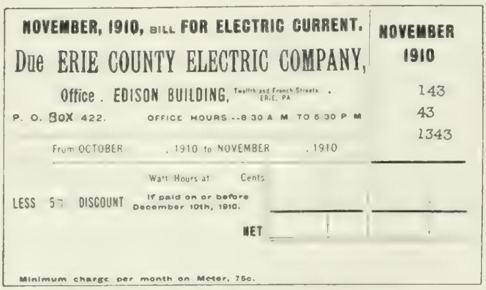


Fig. 7—Electrically Driven Hulett Unloader at Dock at Erie.

is made the card is placed in a machine which receipts it and at the same time chops off the stub at the right end containing the page, line and number, together with the amount. The receipted portion is returned to the customer and the stub serves as a memorandum for the cashier that the bill has been paid, the date being also stamped at the bottom of the stub at the time of payment. By means of the information on the stub the proper entries can be made in the ledger in a minimum time. This system is employed for all accounts.

The company has a number of interesting motor applications fed from its system. One of the largest single installations is that on the Hulett electric ore unloader on the dock of the United States Steel Corporation. There is a 250-hp motor-generator set consisting of a 2200-volt induction motor with flywheel and a 275-volt direct-current generator for supplying energy to the motors. The rated horse-power of the bucket opening and closing motor is 75; the boom hoist, which carries 100 per cent overload, is equipped with a 150-hp motor; for bridge and car haulage an



NOVEMBER, 1910, BILL FOR ELECTRIC CURRENT. | NOVEMBER 1910

Due ERIE COUNTY ELECTRIC COMPANY,

Office . EDISON BUILDING, Twelfth and French Streets ERIE, PA .

P. O. BOX 422. OFFICE HOURS --8 30 A M TO 5 30 P M

143
43
1343

From OCTOBER , 1910 to NOVEMBER , 1910

Watt Hours at Cents

LESS 5% DISCOUNT If paid on or before December 10th, 1910.

NET

Minimum charge per month on Meter, 75c.

Fig. 8—Back of Post Card with Monthly Bill.

80-hp motor is required, and the trolley motors and that for the rotating leg are rated at 50 hp and 25 hp respectively. The load on the installation varies constantly. The bucket lifts 10 tons of ore at a time and can be loaded and unloaded in a minute. The unloader was built by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. Other industrial

establishments using electric motors are as follows: Griswold Manufacturing Company, hardware specialties, 200 kw; Morse Iron Works, iron fittings, 175 hp; A. B. Felgemaker, organs, 40 hp; Erie Malleable Iron Company, iron castings, 700 hp; Lake City Forge & Wrench Company, forgings, 400 hp; Burke Electric Company, dynamos and motors, 200 kw; Williams Tool Company, tools, 70 hp; Holland Manufacturing Company, 30 hp, and a number of others. As stated previously, the motor load on the system is increasing rapidly, and, owing to the work of an energetic Chamber of Commerce, many new industries are being brought to the city which require electricity as a motive power.

The officers of the Erie County Electric Company are as follows: President, Mr. C. H. Strong; secretary, Mr. S. C. Walker; treasurer and general manager, Mr. T. J. O'Dea; superntendent, Mr. E. C. Greene, and chief engineer, Mr. A. J. Gillespie.

JORDAN STREET STATION OF THE UTAH LIGHT & RAILWAY COMPANY.

THE Utah Light & Railway Company supplies practically all the electric service for Salt Lake City, Utah, and during its growth has absorbed a large proportion of the output of the hydroelectric generating and transmission companies which utilize water-powers in the mountain regions surrounding the city. The increase of the business and the somewhat restricted possibilities of the available water-powers have led the management of the company to provide a steam-driven power station, primarily for the purpose of acting as a relay to the various hydroelectric transmission systems and to form a nucleus of such further steam-generating equipment as the future may require. An account of the improvements and additions to the system of the company was published in the *Electrical World*, Nov. 10, 1910. At that time a brief account was given of the Jordan Street station then under construction, and the new underground system, substations and changes in the generating stations and transmission lines were described rather fully.

The presence of coal in the Wasatch Mountains within 40 or 50 miles of Salt Lake City by rail led to an investigation to determine the best site for a steam-driven plant. In July, 1909, after considering the advisability of producer gas as well as steam, and the location of the plant at the coal mine as alternatives, the engineers reported in favor of a steam station to be located preferably on the Jordan River adjacent to Salt Lake City. In the spring of 1910 this report was acted on, and the engineers, Messrs. Westinghouse, Church, Kerr & Company, New York, were authorized to act also as constructors and to proceed with the design and construction of the new power station.

Among the conditions governing the design of this station were the following: Operation not continuous at first, but as a relay to the system; an ample supply of condensing water, unsuitable, however, for boiler feed; feed water to be purchased at a relatively low cost; coal to be brought from mines already developed in Wyoming carrying about 11,700 heat units per pound; power station site being on property owned by the company and having railroad connection.

The fact that the station is intended to be a relay, and not continuously operated, implies a very low load-factor, which called for the exercise of economy in first cost of construction. Accordingly, the building as well as the contained equipment was to be so laid out as to reduce the volume per unit of generating capacity to a very low figure. The cubic contents of the building (which includes ample switchboard room for all the generating equipment it can contain) is 56 cu. ft. per kilowatt of maximum continuous output.

This station is designed on the so-called "unit systen a "unit" comprising a combination of boilers, generati units, condensers and inclosed building, so arranged th it can be uniformly and economically duplicated, and wh so duplicated, economically operated either alone or in pa allel with the other sections. The boiler-room, which completely filled with six 600-hp boilers, is of the sa length as the turbine-room with its single 10,000-kva turb generator, condenser and auxiliaries. It is evident th future needs for greater capacity of this station can economically met by adding to it one or more units equipment and inclosing building of the same size as th first one.

The power station building is of brick, with concr slab floors and roof. The boiler-room includes an ov head coal bunker. This portion of the structure is skeleton steel construction carrying the greater part of t weight on columns. The turbine-room requires no st framing other than that needed for the roof trusses, fl beams and crane rails.

The foundation of this station rests upon a pile concr mattress composed of Oregon fir piles 36 ft. long, spac $2\frac{1}{2}$ ft. to 3 ft. between centers, overlaid with a practica uniform thickness of 3 ft. of concrete. The condenser take and overflow flumes, where within the building line, formed in the concrete foundation. The main flumes

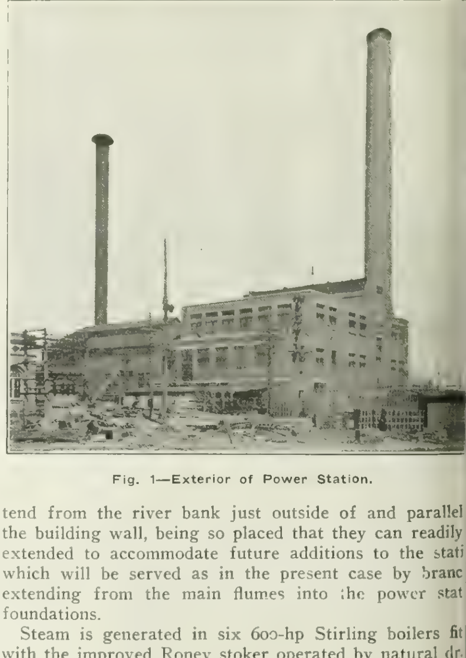


Fig. 1—Exterior of Power Station.

tend from the river bank just outside of and parallel the building wall, being so placed that they can readily extended to accommodate future additions to the stati which will be served as in the present case by branc extending from the main flumes into the power stat foundations.

Steam is generated in six 600-hp Stirling boilers fit with the improved Roney stoker operated by natural dr which is supplied by a single stack. The steam press is 200 lb. with 125 deg. superheat. The arrangement of fl and stacks was designed to fit in with the general unit s tem, which will involve the building of an additional st for every six boilers added to the plant. The boilers n the turbine-room are provided with a cross flue runn just under the coal bunker for connecting them with stack. By means of a system of skylights placed just be the level of the coal bunker, the firing alley between boi is provided with far better daylight illumination thar usual.

The load conditions at this plant did not warrant the stallation of economizers. The stack is of radial br $11\frac{1}{2}$ ft. in diameter and 225 ft. high. Commercial relati

ip with the management of the mines rendered it un-cessary to make provision for storing coal on a large ale, thus simplifying the problem of transferring the coal om the railroad cars to the stoker hoppers. The cars imp into a track hopper from which coal is carried up an inclined bucket elevator to the top of the boiler house one end, where it discharges onto a horizontal belt con-vor by which it is distributed through the bunker over ie boilers. The ashes are dumped from the ash pits into de dump cars which run on an industrial railroad in the oiler-room basement and are elevated by a platform lift the ground level, where they are run out to dump their ontents as filling for adjacent land.

The main turbo-generating unit is of 10,000-kva maxi-m continuous output, with a temperature rise of not exceed 50 deg. C. The machine is of the Westinghouse-arsons semi double-flow type of 3600 r.p.m., and generates ree-phase, 60-cycle energy at a potential of 4400 volts.

The condensing apparatus is of the mixing type, the Le-Blanc condenser being furnished by the Westinghouse Ma-chine Company. Although it has usually been the practice, here feed water has to be purchased, to use a surface con-enser, the engineers state that the greater efficiency due a higher vacuum, combined with the reduced cost of aintenance, more than offsets the increased cost of feed ater that has usually accompanied the older forms of ing condensers.

As is the case with other main features of the power-use equipment, the piping is of distinctly modern design nd construction. Pipe flanges for high-pressure steam are elded on, and cast-steel fittings and valve bodies are used. he valve seats, disks and spindles are of "monel" metal. articular attention is also given to providing for the ex-nsion and contraction inevitable with high-pressure steam d superheat temperatures. The Holly gravity return

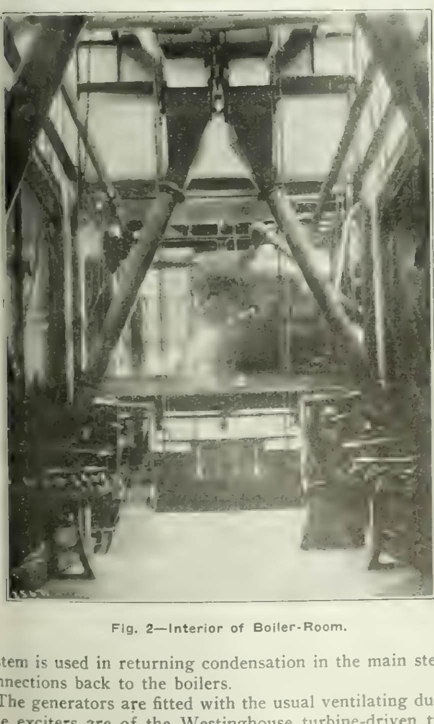


Fig. 2—Interior of Boiler-Room.

stem is used in returning condensation in the main steam nnections back to the boilers.

The generators are fitted with the usual ventilating ducts. he exciters are of the Westinghouse turbine-driven type 100-kw rating. The boiler-feed pumps are steam-riven, of the compound duplex pressure pattern. The air and circulating pumps on the LeBlanc condenser are driven by a small steam turbine.

The switchboard apparatus is contained in a cellular structure of the type now so common in high-tension power stations, being in this instance built of solid concrete throughout. The ring type of bus has been adopted as

Fig. 3—Interior of Turbine-Room.

offering the greatest flexibility in switching combinations of generators and feeders, with the least number of switches installed. The oil switches are General Electric make, electrically operated from a benchboard of the usual type.

Active construction on the station began about Aug. 19, 1910, upon the arrival of the first carload of piles. By the middle of October the piles were all in and the concrete wall inclosing the basement was well along toward completion. By Nov. 10 the building walls were nearly finished and the stack well under way. By the middle of December the exterior of the building was completed, the windows were in and the stack was finished. Steam was raised in the boilers on Feb. 6, 1911, the turbine was turned over for the first time on Feb. 15 and the station was reported ready to carry commercial load permanently on March 22. The entire work of design and construction was executed by Westinghouse, Church, Kerr & Company, under the direction of the Utah Light & Railway Company officials, Mr. O. A. Honnold, electrical engineer, being in charge of the work for them.

A FEW REASONS WHY HYDROELECTRIC DEVELOPMENT SHOULD BE ENCOURAGED.

By Clarence P. Fowler

LACK of the fullest knowledge on the part of the government of all of the engineering and commercial considerations surrounding hydroelectric enterprises has been, doubtless, in no small measure responsible for the unfortunate attitude of the former toward the latter.

Capital, like water and electricity, always follows the path of least resistance, and if governmental obstructions are thrown in the way of these beneficial hydroelectric undertakings the inevitable result will be that the funds that would otherwise have been used in their creation and expansion will be diverted to other enterprises which present less risk and upon the investment in which a better return may be reasonably expected. The artificial condition thus created will build up, of course, certain enterprises at the expense of our industrial expansion, which depends so largely for its continued success upon an ample supply of cheap electric energy, such as many of our existing hydroelectric systems have demonstrated their ability

to furnish. Failure on the part of the public to recognize these facts means that our national development will be retarded and unsymmetrical.

It is here interesting to note further the rather marked contrast that prevails between the federal and state governmental treatment of public-service corporations in general, as compared with that accorded other forms of business enterprise. With respect to industries generally, the government is so anxious to promote prosperity that it maintains a protective tariff, and this it does with general public approval. Far from taking any affirmative step to assist our public-service industries, practically all governmental activity has been directed to cutting down their revenues and rendering more difficult the inception or enlargement of their business. Such public servants, however, do not ask any affirmative assistance from the government, but merely request that the latter shall not obstruct any reasonable efforts they may put forth to serve the communities in which their lot may be cast.

Further, it should not be forgotten that while governmental control may proceed to the extremity of public management of public-service corporations' affairs through restrictive legislation and by compelling the highest standards of service at reduced rates, in the face of increasing cost of operation, yet at the same time this governmental jurisdiction cannot compel the investor to put his funds into enterprises which he regards as hazardous, even though the creation and development of such enterprises be for the public good.

Power companies seeking water-power rights are usually treated as supplicants for benefits and advantages instead of being more properly considered in the light of benefactors of the public at large. Because of the public advantages resulting from hydroelectric development, it would seem that the governmental interest in conservation generally should extend to include the conservation of the hydroelectric industry. The question is not, "Should the public encourage such enterprises?" but rather, "Can the public afford to get along without them?"

Water-power development and its governmental control have been the subject of much technical and popular discussion, and will now acquire a much wider interest by reason of the able papers and discussions presented at the recent public conference relating to this topic held under the auspices of the National Electric Light Association, at which there was elicited a large amount of information as to the common good of which hydroelectric development is capable if properly encouraged. In this connection it becomes interesting to review briefly further points which it is believed are worthy of some prominence.

COMPREHENSIVE HYDROELECTRIC SYSTEMS AS A FACTOR IN THE CONSERVATION OF CAPITAL.

Electric generating and transmission apparatus have done much to enhance the value of water-powers to the general public, by rendering them more generally useful than is possible with purely hydraulic works. Owing to their inherent limitations, the development of the latter proceeded somewhat slowly prior to the introduction of electrical equipment, and if proper incentive is to be given the inventor, the financier and the engineer, who have been jointly responsible for the greater availability of our water-powers, then suitable legislation should be enacted which will apply to hydroelectric systems as distinguished from the purely hydraulic works, long since obsolete.

The development of any great water-power usually involves considerable investment, which grows larger as the number of points at which wheels are located increases. If it is endeavored to render water-power available to a large number of users by purely hydraulic means, through the use of a long canal and a large number of wheels and pits, the outlay at once becomes considerably more than that required for comparatively few large wheels groupe together and driving efficient electric generators.

Further, in most instances, it will be found that to b commercially feasible large purely hydraulic systems mu be devoted to manufactures on a large scale, with the re sult that industries requiring power in only limited quant ties derive little or no advantage from the development o purely hydraulic works. This stands out in marked con trast with water-power electrically distributed, as with i industries requiring minute and subdivided power can b advantageously supplied, for the reason that it is particula ly in connection with such industries that the electric moto has made the greatest headway.

It is therefore seen that hydroelectric development render it possible for the small manufacturer to share in the ad vantages of water-power as well as his larger competito and, by the reduction in the cost of the otherwise equivaler hydraulic works, conservation of capital results; all o which is beneficial to the public, and in return the public o its representative, the government, owes at least fair trea ment to those who have made these benefits possible.

Then, again, with purely hydraulic power systems th locations for manufacturers are very limited in extent. Th may result in economic waste in several ways. It frequentl happens that water-power sites are occupied by industri whose power requirements equal only a part of the avai able power, the rest remaining unsold; and, even thoug the industries located on these sites make use of a the water-power, their limited area creates such a de mand for them that they may bring a rental value so hig that it wipes out any saving resulting from cheap powe A further inherent drawback in the purely hydraulic pla is that it prevents the sale of power to different consume at different hours of the day. As most manufacturing plan require power ten hours daily, the water flowing during th night runs to waste, thereby rendering more than one-ha of the total energy unavailable, though it would be of con siderable value to various industries.

From a review of the above facts it appears that th modern hydroelectric systems operate to prevent th monopolistic use of water-powers, so common in past year and make possible the subdivision and distribution of the powers into the smallest units, thereby rendering th greatest good to the greatest number. In fact, not only d these hydroelectric enterprises make possible the supply o water-power to a great many small consumers that coul not be supplied without them, but through the medium o long-distance electrical transmission several powers on th same stream, or even different streams, may be physicall linked together, and with the power of several watercours so connected, under common control, a great diversity i power demand and supply is thereby secured. Diversity i power demand means the greatest possible use of investme in plant, and, therefore, conservation of capital, which i turn secures to the public better rates. Diversity in powe supply often means that it is practicable to match th minimum discharge on one stream with a higher on anoth or to interchange power of streams having large storag capacity with those having little or none, which increas reliability of power supply and in many cases avoids th use of expensive auxiliary steam power, which also resul in advantage to the public in keeping down rates and wit common control gives the consumer at one point the ad vantage of securing water-power from another point, pe haps 200 miles away, when necessity arises.

From the above it is clear that, with reasonable govern mental regulation of water-powers, single control of all th powers that may be economically linked into one hydro electric system tends to benefit not only the companies, b the public as well, as with effective governmental contr the need for competition vanishes with all its attenda economic losses, which, if permitted to exist, must b eventually borne either directly or indirectly by the publi

'DROELECTRIC POWER AS A FACTOR IN PREVENTING ECONOMIC WASTE OF LABOR.

Considerable attention has been justly centered on the asteful thermal performance of steam prime movers as a urce of power, the most economical and modern stations this type throwing away 90 per cent of the energy in the al pile during conversion to electrical energy, which aste with an equivalent amount of hydroelectric power n, of course, be entirely eliminated. Intimately related and hardly less important than the question of fuel con- rvation is the conservation of labor also made possible rough the fullest use of our hydroelectric resources.

National welfare in no small degree depends upon the icient use of our national resources, as represented in ir material and labor, and it requires no argument to show iat the higher our efficiency in these respects the more pidly shall we be enabled to add to our national wealth. this connection when one stops to consider the vast nount of labor required for mining, distributing, storing, rning and finally removing ashes incident to the use of al, a large portion of which through hydroelectric de- lopment could be set free for the better interests of the untry, notably in agriculture, the urgent need for the couragement of such water-power development at once comes apparent.

HYDROELECTRIC POWER AS A FACTOR IN PROMOTING OUR INDUSTRIAL WELFARE.

In practically all industries one of the important require- nts for successful operation is an ample supply of cheap wer, and this need has assumed much greater relative portance in recent years than formerly, due to the transi- n from hand labor to power-driven machinery. Some ea of the growing importance of power used in manu- ctures may be gathered from the Bulletin of the United ates Department of Commerce and Labor, which records me interesting data on power employed in eleven selected lustries typical of the factory method of manufacture. iese industries include the manufacture of agricultural plements, boots and shoes, cotton goods, flour and grist- ll products, hosiery and knit goods, blast furnaces, steel orks and rolling mills, lumber and timber products, paper d wood pulp, silk and silk goods, woolen goods and orsted goods. In all of these industries but two there s a steady rise in the average power used per wage- rner during the thirty-five-year period covered by the re- rt, namely, from 1870 to 1905. During this interval, of ose industries which showed any increase none exhibited her a horse-power per wage-earner or a horse-power per ,000 of products for the year 1905 less than double that in e year 1870, with two industries showing a ratio in these o items for this period as high as five and two others one three. It is, therefore, evident that development of our ater-powers should be pursued with as little delay as pos- ble if we are to maintain our industrial status by keeping ce with our increasing industrial requirements for cheap wer, whch does not consume anything that cannot be placed. In the long run those countries which have ailable an ample supply of electric power will have a ramount advantage over other countries less fortunately uated, and they must in the end win out in the race for lustrial supremacy.

Closely allied with and necessary to the success of the anufacturing industry stands our transportation industry, e power requirements of which for the operation of ins, shops, lighting, etc., are of vast proportions. While re are not, in this country, any examples of very long etches of trunk-line electrification, yet the successful minal operation of both direct-current and alternating- rent systems under the severe traffic conditions obtain- g in the New York zone and also the highly satisfactory ults obtained with the electrification of tunnels elsewhere the United States have proved the feasibility and relia- bility of electricity as a motive power in heavy railroading.

As demonstrating the reliability of service now attainable with electric traction and its eminent fitness for long-distance trunk-line work, it is important to note that in its report of train operations in New York State during January last the Public Service Commission records the fact that the New York, New Haven & Hartford had 90 per cent of its trains on time, a fact which is especially notable when it is remembered that the single-phase system which is in operation on the New Haven road is handicapped by the necessity for operation of its equipment also over the direct-current zone in order to reach the Grand Central terminal. The unavoidable inference from this would seem to be that if the straight single-phase system were employed (which would be the normal condition in most cases of electrification undertaken) the reliability factor should be still further increased.

One of the drawbacks under which steam-railroad electrification is laboring in all of the cases just referred to is that, owing to the limited extent of route electrified, the most economical results for neither steam nor electricity are realized, and with sufficient traffic density and the electrification of, say, a whole engine district much greater saving may be effected through the use of the new type of motive power, even when operating from steam-driven generating stations.

However, with an ample supply of cheap hydroelectric energy within transmissible reach of at least a portion of our trunk-line roads, and where traffic density conditions warrant, steam-railroad electrification will be stimulated, with its attendant advantages in conserving labor and material.

A brief study will make it clear why hydroelectric systems can afford to sell electric energy to railroads at very attractive rates. Comparatively few hydroelectric enterprises, inclusive of those furnishing no small portion of industrial load, are able to market more than an insignificant portion of the total daily output during the night run. Now, when this is considered in connection with the fact that trunk lines move the greatest proportion of both through freight and passenger traffic over their lines at night, the operation of such railroad systems by electrically transmitted water-power may at once become feasible and thus make possible the use of a large portion of the run-off in our streams that now goes to waste, with the consequent improvement of the load-factor and the resulting low price for energy thereby attainable.

HYDROELECTRIC POWER AS A FACTOR IN PROMOTING OUR AGRICULTURAL WELFARE.

As American progress and prosperity depend mainly on the growth of agricultural production, the importance of increasing the productivity of the soil can hardly be overestimated, and that there is urgent need for more informed methods of seed selection, fertilization and cultivation to attain this end will be realized from the review of a few pertinent statistics, which show not only that our annual yield per acre is low by comparison with other countries, but that our consumption of the products of the nation's farms is rapidly overtaking production. Our farms produce less than 14 bu. of wheat per acre, as compared with 32 in England, 28 in Germany, 34 in the Netherlands. For oats the United States produces 23 bu. per acre, while England produces 42, Germany 46 and the Netherlands 53. Then, again, in 1908 our exports of the principal cereals had fallen 72 per cent as compared with out exports ten years previous, and based on past records, if the converging lines of production and consumption continue to approach each other as in the past ten years, one of our eminent authorities estimates that before very long we shall have become a food-importing nation, with all of its disadvantages. One of the ways of ameliorating this unfortunate nation-wide condition is by the application of artificial fertilizer to the soil. Recently addressing the New

England Railway Club on the commercial feasibility as also the necessity for soil fertilization, President Brown, of the New York Central Railroad, said: "In the past there was little incentive to fertilize the soil by the use of commercial fertilizers, whereas now these expenditures pay one-hundredfold." Till within the last few years the only commercial available sources of artificial fertilizers have been the Chili saltpeter deposits, the island guano deposits and the by-products of gas works. The first two of these must ultimately become exhausted and the present yield of the third is entirely inadequate to meet the nation's requirements. It is evident, therefore, that there is urgent demand for additional sources of artificial fertilizer supply, and relief from impending famine in this commodity, in the shape of fixed atmospheric nitrogen, would be commercially possible with an ample supply of cheap electric energy available, as the chief item of expense in the manufacture of this soil-recuperating agent is the cost of energy. The low rates possible for off-peak and secondary energy from hydroelectric plants turn to useful account energy that might otherwise be wasted, and at once make this process a commercial success. That this method of producing artificial fertilizer has passed the experimental stage will be appreciated when it is remembered that European hydroelectric plants having an aggregate rating of 100,000 hp are already successfully applied to this process.

Another menace to agriculture is found in the general tendencies of the rural and agricultural part of the population to concentrate in larger urban centers. The percentage of our population who work on the farm constantly declines. In 1790 only about 3.4 per cent of the American people lived in towns, whereas in 1900 more than 31 per cent of our population was urban, and it is expected that the last census will show even greater tendencies in this direction. There seem to be strong reasons for believing that, at least with farms which are not too scattered and with hydroelectric energy to be had at reasonable rates, it will be commercially feasible to group several farms together in such a manner that the general use of electricity will play no small part in rendering farm life more attractive and tend to check the continued exodus of the rural part of our population to the cities, as shown by the statistics given above.

CONCLUSION.

Summing up, it appears from a review of the facts cited above that the hydroelectric development of the water-power in our watercourses is destined to play no mean part in aiding our industrial and agricultural well-being—in short, in preserving and advancing our national status—and it is, therefore, not only the duty but the privilege of the government to see to it, without undue delay, that all reasonable encouragement be accorded private capital, which, with positive assurance of rational legislation, stands ready to bring about the fullest realization of these hydroelectric opportunities.

DATA OF TRANSMISSION LINES IN CHICAGO.

At the late Chicago convention of the American Inst tute of Electrical Engineers the Commonwealth Ed son Company gave in succinct form some tecl nical data on its principal generating stations and tran mission systems. Fisk and Quarry Street stations wer described briefly, as well as the new Northwest sta tion, two units of which will be placed in operation i September probably. In addition data were given on th transmission lines of the system corrected to the fall o 1911 and embracing the initial equipment of Northwes station.

It may be explained that there are three separate par in the system of high-tension transmission lines connectin the Fisk Street and Quarry Street generating stations wit the fifty-three substations from which distribution is accon plished.

The most important of the three is the 9000-volt, 25-cyc system, which carries by far the largest portion of th generated output, supplying all of the company's substatio and also the railway substations. It consists of some 45 miles of high-tension cable extending north to Evansto Ill., and south to Hammond, Ind.

The lines radiating from Fisk Street supply the nort and west territory, and those from Quarry Street the sout side of the city chiefly, including the traction substation

The long range portion of the 25-cycle system is ope ated at 20,000 volts and is derived from the 9000-volt sy tem through three 5000-kw transformers. It consists o four lines, two supplying Grand Crossing, South Chicag Roseland and Hammond, and two extending to Evansto where they connect with the systems of the North Sho Electric Company and the Chicago & Milwaukee Electr Railway.

The third portion is the 12,000-volt, 60-cycle syste Previous to 1910 a portion of the 60-cycle, 4000-volt distr bution system supplying some large industrial motor cu tomers had been fed from the 9000-volt, 25-cycle transmi sion system through frequency changers. This load i creased to something like 27,000 kw, and consequently tw 60-cycle generating units at Quarry Street were installe and the 12,000-volt transmission system was inagurated.

All told there are 130 transmission lines, with a tot length of approximately 525 miles.

At least two lines are provided for nearly every su station.

The direct control of the system is vested in the lo dispatcher's office, which for purposes of ready intercon munication is equipped with a private telephone syste connecting it directly with all stations and substations.

In this office is the load dispatcher's board, white-e ameled and showing diagrammatically every generato line and switch in the three systems, excepting convertin unit switches. Plugs are used to indicate oil switches op and closed. The absolute conditions are thus constant

TRANSMISSION-LINE DATA, CHICAGO.

	9000 Volts	12,000 Volts.	20,000 Volts.
No. of direct lines — From Fisk Street station	50	.	4
No. of direct lines — " Quarry Street station	25	17	. . . . .
No. of direct lines — " Harrison Street station	9	. . .	. . . . .
No. of direct lines — " Northwest station	16	.	. . .
No. of tie lines	24	4	5
Average length of tie lines	1.3 miles	2.4 miles	3.2 miles
No. of company substations supplied	*29	†13	‡5
No. of railway substations suppied	18	.	2
Average length of direct lines	3.6 miles	4.2 miles	12.5 miles
Size of wire, B. & S. and circ. mil.	No. 4-0 and 250,000	No. 4-0 and 250,000	No. 2-0
Average maximum load per line, company (winter months)	2000 kw	2500 kw	Combined 3,800 k
Average maximum load per line, railway (winter months)	2200 kw	. .	
Total maximum load (non-coincident)	155,000 kw (including transformers on 20,000-volt system).	23,900 kw (November, 1910)	Included in 9000-volt load

* Includes combination 60-cycle, 12,000-volt and 25-cycle, 9000-volt substation.
† Includes Crane Company, Grove Street, Bridgeport, and combination 9000-12,000-volt substations.
‡ Includes combination railway and Edison and two North Shore Electric Company stations.

ndicated. To supplement this board, which shows practically no detail of the substations, another map is used.

The following table shows at a glance the principal statistics of the transmission lines of the Commonwealth Edison Company as they will be after the initial equipment of Northwest station is in operation:

For distribution the Commonwealth Edison Company employs direct current in a central area of about 10 sq. miles and three-phase, 60-cycle alternating current in the remainder of the city. The direct-current area is supplied from twenty-two converter substations (thirteen of which have auxiliary batteries), three exclusively battery substations, and one direct-current generating station (Harrison Street). The standard sizes for feeders in this territory are 1,000,000 circ. mil and 1,500,000 circ. mil. These feeders connect with an intricate network of direct-current mains at various points, the whole system being tied together at street intersections.

The three-phase, 60-cycle system, which covers a far more extensive territory, is not thus interconnected, but consists of separate four-wire circuits with open emergency centers for tying in in case of trouble. It radiates from and is supplied by ten substations with 2000-4000 volts on the primaries, the service pressure being stepped down to 115-230 volts by line transformers installed where required.

NOTES ON THE LOADING OF TELEPHONE CABLE AND OPEN-WIRE CIRCUITS.

By Samuel R. Parker and J. Cavers.

THE subject of loading or inserting inductance to improve transmission over long-distance circuits, whether for telephone or telegraph work or for power transmission, is not new, Mr. Oliver Heaviside having gone into it theoretically in 1887. From that date, however, no practical steps of importance were taken to work out the theory of loading until Prof. M. I. Pupin, in 1899, showed from actual tests the feasibility of installing series inductance coils on working lines to improve their transmission. Although the subject of loading has come prominently to the front in recent years, information on it is very scattered and the object of these notes is to show why loading improves the transmission, and also some of the methods of calculation for obtaining the best results on various circuits.

The efficiency and limiting distance of speech of the telephonic circuit for long-distance transmission depend on the magnitude and mutual relations of the following electrical quantities, namely, capacity, inductance, resistance and leakage conductance. The essential difference between long-distance and short-distance transmission is that on long lines the electrical speech impulses are transmitted in the form of elastic undulations of electromagnetic waves, while on short lines the reflection of the impulse at the terminal instruments interfering with the advance of the wave crest prevents these waves from forming.

As each sound or word transmitted over the telephonic circuit has a definite frequency, amplitude and wave form, it will be readily seen that the speech impulses take the form of a very complicated number of superposed vibrations or waves of different frequencies. These impulses as they progress along the line are subjected to two deteriorating influences, namely, attenuation and distortion, the quality of the speech transmitted depending on how the frequency or pitch, amplitude or volume and wave form or timbre of the sound (which affects the articulation) are reduced or changed by these two deteriorating influences.

The frequency is the number of complete reversals per second of the alternating current, a complete reversal being understood to take place when the current gradually rises from zero to a positive maximum, falls to zero, increases to a negative maximum, and again falls to zero. This is known as a cycle or period. The amplitude is the extent of the vibration from the zero line, and the wave form is the shape of the curve in passing through a complete cycle or period.

The attenuation of the wave is a falling away of the amplitude due to a certain amount of energy being dissipated by the ohmic resistance (I^2R), by the shunting effect of leakage from the line, and by the reaction from the inductive action upon surrounding bodies, such as losses due to eddy currents and hysteresis losses if there are any iron bodies or circuits in the vicinity. Eddy currents and hysteresis losses react on the circuit in the same way as resistance, and can be represented as an addition to the ordinary resistance of the circuit measured under steady current conditions. Attenuation in itself is not harmful if not carried too far, as a receiver will convey an intelligible conversation when the amplitude is reduced to 1 per cent if there is no distortion of the wave form.

Distortion is due to the capacity and inductance of the cable or wires affecting unequally the waves of different frequencies composing the speech impulses, thus altering the relative position and proportion of the subsidiary waves, which in long distances causes the wave form or special quality or timbre of the sound to be lost and the words to become indistinguishable, even though the volume of the sound may be large.

The effect of capacity on transmission is that while the undulation of the speech wave is rising and falling the circuit is charged and discharged, this discharge driving back the current and causing a lead in phase. Capacity causes retardation in the speed of transmission, introducing a time element. It also levels down the higher periodicities of the waves, so that in lines of high capacity the waves of high pitch may be wiped out altogether and only low-pitched sounds transmitted correctly, the character of the sound received being altogether different from that impressed on the transmitter.

The effect of inductance on transmission is very similar to that of capacity, being to create a field in the surrounding dielectric which rises and falls in intensity with the undulations of the speech wave, thus setting up induced charges in the circuit. Inductance may be represented as the inertia of the circuit, and tends to prevent any rapid changes in the transmitted wave, driving forward the current and causing a lag in phase.

Thus while capacity produces a lead in the resultant wave, any phase in the resultant wave being earlier than a similar phase in the impressed alternating emf, inductance causes a lag, any phase in the resulting wave being later than a similar phase in the impressed alternating emf. Capacity and inductance are not dissipative like resistance and leakage conductance, as neither of them reduces the energy of the transmitted current.

The theory of loading is so to balance inductance and capacity in a circuit that they neutralize each other, and, as all actual telephone circuits contain far more capacity than inductance, it will be necessary to introduce more inductance into the circuits.

A circuit in which inductance completely neutralizes capacity at all periodicities is distortionless, and the speech impulses are subject only to attenuation—that is, in an ideal circuit of this kind, the speech wave at the receiving station would be an exact reproduction of the speech wave at the transmitting station, with a reduced amplitude depending on the distance between the two stations and the resistance and leakage conductance of the circuit.

A complete balance between capacity and inductance for any one periodicity can be obtained when the resultant wave produced by capacity leads the impressed emf by 90 deg. and that produced by inductance lags 90 deg. behind the impressed emf. As this result is impossible to obtain in practice, the same effect is obtained if the angle

of lead exactly equals the angle of lag, but separated by 180 deg. or π radians. This will be readily seen, as the distorting effects due to capacity and inductance will have their maximum and zero values at the same points, but with opposite signs—that is, when the distorting capacity effect is at a positive maximum the distorting inductive effect will be at a negative maximum, and the impressed emf for any one frequency will be in phase with the current, thus giving the best efficiency.

As capacity is evenly distributed along the line, to neutralize it inductance must be as evenly distributed as possible. If large amounts of inductance are cut into the line at long distances apart they merely act as choking coils. To get the best results the inductance should be introduced into the circuit at certain short predetermined intervals, depending on the wave length. From experimental tests it has been found that where the wave front passes from 7000 coils to 13,000 coils per second very good results have been obtained. Professor Pupin has worked out a mathematical formula by means of which he is enabled to determine the maximum distances apart which the added balancing coils joined in series to the line should be placed, in order to approximate in efficiency to an equal uniformly distributed inductance.

The theoretically perfect loading coil should have the same effective resistance for all essential periodicities of the telephonic wave to eliminate the distortion in the coil. Such a coil cannot be obtained in practice. The coil must have a certain inductance and must consist of several turns of wire. To reduce attenuation the resistance must be kept as low as possible, a few turns of large-gage copper wire being used. A reduction in the turns, and so in the resistance, can be most easily effected by introducing an iron core. If the coil is entirely of copper the effective resistance for frequencies within the range of telephonic periodicities will correspond to the loss due to eddy currents in the copper; if the core is of iron or other magnetic material additional losses will be introduced due to eddy currents in the core, as well as hysteresis losses in the iron, which will augment the difference between the actual resistance and the effective resistance. As it is impossible to eliminate these losses, the effective resistance will vary at different periodicities and produce distortion losses in the transmitted wave.

Practical and commercial reasons demand that an iron or other magnetic core be used, and as the tendency of the higher effective resistance of the iron-cored coils is only to suppress and reduce the higher periodicities of the voice wave, which is found not appreciably to affect the quality or intelligibility of transmission, the advantage of a wholly copper coil is not markedly noticeable. The best coil to use is one that gives the required inductance with the largest time constant (L/R), together with the smallest size.

In loading a line several considerations have to be borne in mind. The velocity $(V = \omega/\alpha)$ with which electromagnetic waves are propagated over a line may vary from 1 in. or less to 186,000 miles per second (velocity of light), depending on the values of R, C and L. The greater the value of L the less the velocity, and, as the wave length equals velocity divided by periodicity $(\lambda = V/f)$, the shorter the wave length for any one frequency of alternation. But when the wave length is small the number of coils for any given length will be large, as every wave length has to be loaded with a certain number of coils to get the best efficiency, thus making the cost of loading prohibitive. For this reason when loading a line the greatest amount of attenuation to be allowed on a line, or the coefficient of attenuation, should be determined and L calculated to give this attenuation, thus giving the greatest efficiency with the least added inductance, therefore the greatest wave length and the least number of coils. This method does not make the line distortionless by any means, as the inductance added does not completely balance capacity, but even a small amount of inductance will reduce the unbalanced distorting effect of capacity provided the distorting effect of the coils is small.

Another point is that where the coils are not evenly spaced the efficiency of the line is reduced very appreciably, due to reflection between the coils. In loading underground cables where the manholes are not evenly spaced, preventing the coils from being evenly distributed, this will cause considerable loss. If l equals the distance between coils the first and last coil on a loaded line should be placed $0.5\,l$ miles from each end, thus giving the line a tapered effect and also keeping the spacing even if at any time it is desired to join two loaded lines in series.

One of the difficulties encountered on loaded lines is terminal loss, due to the reflection of the speech impulse at points of non-uniformity in the line, such as a point where a loaded aerial circuit is joined to a cable or vice versa. It has been suggested that by tapering the coils this can be overcome, tapering being to reduce the inductance gradually at both ends of the line, keeping the spacing of the coils the same. The best efficiency is then obtained when the ratio L/C for the loaded line equals the ratio L/C for the unloaded line. Theoretically reflection can be overcome in cases like this by having a perfect transformer at each point of non-uniformity in the line.

Reflection also takes place at points where the instruments are bridged directly across a loaded line. It has been claimed that transmitting instruments for loaded lines should have a higher impedance than those for non-loaded circuits. The advantage of using apparatus of a higher impedance for loaded lines is most readily seen when considering the transmitter-end impedance of a very long overhead line, the impedance of such a line being $L\omega$, where ω is the angular velocity, or 2π times the frequency, and L is the inductance per loop-mile in henries. For unloaded lines this impedance is from 600 ohms to 700 ohms, but for loaded lines, seeing that inductance has been added, this figure should be greater. The transmitting apparatus in present use has been adopted for unloaded lines, and where loaded lines are used it is suggested that if instruments of a higher impedance were installed the transmission over short distances would be greatly improved.

The amount of inductance necessary completely to balance capacity at a frequency of about 800 cycles per second on aerial wires is roughly 4.4 henries and that for cables about 0.5 henry per mile. From these figures it will be seen that for any given amount of added inductance the increased efficiency of the cable will be much greater than that of the aerial wires.

Coming now to a consideration of some of the methods of calculation for obtaining the best results on various circuits, the first point to be considered is what frequency can be taken as representing the average for all speech waves.

In the discussion on a paper on "Loaded Telephone Lines in Practice," read before the Electrical Congress at St. Louis in 1904 by Dr. H. V. Hayes, it was shown that an underground telephone circuit, when used for transmitting speech waves having frequencies ranging from 100 cycles to 2000 cycles per second, behaves in regard to attenuation as though it were operated at a single frequency of 800 cycles per second, or an angular velocity of 5025 radians per second. This means that under telephonic conditions the circuit behaves as though the speaker's voice had a single frequency of 800 cycles per second.

In an alternating-current circuit the difference of potential Pd between the wires of a loop at d miles is equal to the difference of potential at the sending end Po times $e^{-\beta d}$, and Pd lags behind Po by an angle αd. The greater the distance the greater will be this angle of lag till a point is reached where the difference of potential is one complete cycle behind that of the impressed voltage Po. Since the

phase changes uniformly with the distance, it follows that he waves are traveling along the circuit with a constant velocity; therefore, when the phase has been delayed one period ad equals 2π or d equals $2\pi/a$.

The meanings of the symbols used in these discussions are as follows:

R is the resistance per loop-mile in ohms,
S is the leakage conductance per loop-mile in mhos,
C is the mutual capacity per loop-mile in farads,
L is the inductance per loop-mile in henries,
f is the frequency or periods per second,
ω is the angular velocity in radians per second,
e is the base of the Naperian or natural logarithms (2.718),
v is the velocity of light in miles per second,
V is the velocity of waves in miles per second,
d is the distance in miles,
l is the distance between coils in miles,
a is the velocity constant,
β is the attenuation constant,
λ is the wave length in miles, and
π is the ratio of the circumference to the diameter (3.1416).

When f periods have been passed through by Po, $(f-1)$ periods will have been passed through Pd where the phase has lagged one period. Then V, the velocity of the wave, equals d/t, t being the time of one period. If there are f periods per second, t equals $1/f$, therefore v equals $d \div 1/f$ equals $2\pi/fa$. But the wave length λ equals velocity divided by periodicity, (V/f) or $2\pi/a$, showing that the wave length is the distance at which the phase has been delayed by one period.

The letters a and β stand for constants, the value of a being $[\frac{1}{2}\{(R^2+\omega^2L^2)(S^2+\omega^2C^2)\}^{\frac{1}{2}}-\frac{1}{2}(RS-\omega^2CL)]^{\frac{1}{2}}$ and is the velocity constant; the value of β being $[\frac{1}{2}\{(R^2+\omega^2L^2)(S^2+\omega^2C^2)\}^{\frac{1}{2}}+\frac{1}{2}(RS-\omega^2CL)]^{\frac{1}{2}}$, which is the expression for the attenuation constant. It is not proposed to prove the formula used for these two constants, as they will be found in Mr. Oliver Heaviside's "Electrical Papers," Vol. II.

As the expressions for the constants a and β are somewhat unwieldly it is proposed to simplify them as much as possible.

As the leakage conductance for aerial wires would not be more than 1×10^{-6} and for cable not more than 1×10^{-7}, it can be neglected, which reduces these constants to:

$$a = [\tfrac{1}{2}\omega C\{(R^2+\omega^2L^2)^{\frac{1}{2}}+\omega L\}]^{\frac{1}{2}} \qquad (1)$$

and

$$\beta = [\tfrac{1}{2}\omega C\{(R^2+\omega^2L^2)^{\frac{1}{2}}-\omega L\}]^{\frac{1}{2}} \qquad (1)$$

In aerial wires, where the resistance is small compared to ωL, these will be simplified still further.

Expanding $(\omega^2L^2+R^2)^{\frac{1}{2}}$ by the binomial theorem, the expression equals $\omega L\left(1+\frac{\frac{1}{2}R^2}{\omega^2L^2}+\text{etc.}\right)$, the remaining terms being neglected, as ωL is large compared with R. This expression then reduces to $\omega L+R^2/2\omega L$. Substituting this value for $(\omega^2L^2+R^2)^{\frac{1}{2}}$ in equation (1), for a and β we get:

$$a = \{\tfrac{1}{2}\omega C(\omega L+R^2/2\omega L+\omega L)\}^{\frac{1}{2}} = (\tfrac{1}{2}\omega C \times 2\omega L)^{\frac{1}{2}}$$

The term $R^2/2\omega L$ can be neglected.

Therefore,

$$a = (\omega^2CL)^{\frac{1}{2}} = \omega(CL)^{\frac{1}{2}} \qquad (2)$$

$$\beta = \{\tfrac{1}{2}\omega C(\omega L+R^2/2\omega L-\omega L)\}^{\frac{1}{2}} = (\tfrac{1}{2}\omega C \times R^2/2\omega L)^{\frac{1}{2}}$$

Therefore,

$$\beta = \left(\frac{CR^2}{4L}\right)^{\frac{1}{2}} = \frac{R}{2}\left(\frac{C}{L}\right)^{\frac{1}{2}} \qquad (2)$$

In an unloaded cable where ωL is small compared with R $(R^2+\omega^2L^2)^{\frac{1}{2}}$ equals approximately R, and $R \pm \omega L$ equals approximately R.

Then a and β equal approximately $(\frac{1}{2}\omega CR)^{\frac{1}{2}}$ (3)

(These results are, however, not correct to within 5 per cent.)

In a loaded cable ωL cannot be neglected, and equation (1) must be used for a and either (1) or (2) for β.

The attenuation factor is $e^{-\beta d}$. From this the amplitude can be calculated at any distance. Assuming the amplitude to be 1 to begin with, at d miles it will be $1/e^{\beta d}$.

To find the balancing inductance for any circuit, by treating the speech wave as a simple alternating current having a frequency of 800 cycles per second, the angle of lag, θ, due to inductance is such that $\tan\theta = \omega Ll/Rl = \omega L/R$, the reactance being ωL and the impedance $(R^2+\omega^2L^2)^{\frac{1}{2}}$. Capacity, instead of prolonging the current, drives it back, producing a lead in phase which is such that $\tan\theta = -1/\omega CR$, the reactance being $-1/\omega C$ and the impedance being $(R^2+1/\omega^2C^2)^{\frac{1}{2}}$. Where inductance and capacity are both present, as in a telephone circuit, $\tan\theta = (\omega L-1/\omega C)/R$, the reactance being $\omega L-1/\omega C$ and the impedance $\{R^2+(\omega L-1/\omega C)^2\}^{\frac{1}{2}}$.

But as capacity and inductance produce opposite effects they neutralize each other when $\omega L-1/\omega C=0$ or when $\omega L=1/\omega C$. Therefore L (the balancing inductance for any one periodicity) $= 1/\omega^2C$. When this balance is set up the circuit is non-inductive and the current simply obeys Ohm's law—that is, only attenuation takes place, the circuit being distortionless. But as the periodicity of a telephonic speech wave is not constant, varying from 100 to 2000 and more, the divisor ω^2C will vary, thus changing L. From this it will be seen that under no conditions can a telephonic circuit be made absolutely distortionless.

Seeing from this that it is absolutely impossible to get a distortionless wave for all periods common to telephonic speech, these figures for L, where it equals $1/\omega^2C$, can be taken as the limiting values for loading, the efficiency decreasing beyond this and the distorting effect being a purely inductive one.

But in telephone practice all that is required is a certain standard of transmission, there being no object in increasing the efficiency beyond that point. A definite standard of transmission is represented by a definite attenuation constant β. This does not take into account the articulation, but merely the volume of sound transmitted.

Taking, for example, a 500-mile aerial line, say it is wished to have an attenuation constant of 0.014; then taking equation (2) for $\beta = R/2(C/L)^{\frac{1}{2}} = 0.014$; then L, the total inductance per loop-mile, equals $(R+Rc)^2 \times C/4 \times 0.014$, where Rc is the apparent resistance of the coils at 800 cycles per second, the amplitude at the distant end being $e^{-0.014d} = 1/e^{0.014d}$.

Taking another example:

To find the amount of inductance to be added so that the speaking efficiency of a No. 8 B. W. G. copper circuit at 1600 miles will equal the unloaded speaking efficiency at 1200 miles (which is approximately the limiting distance for speech).

The attenuation constant for 1200 miles equals approximately 3.3×10^{-3}; therefore the attenuation constant β necessary at 1600 miles to give the same speaking efficiency equals

$$3.3 \times \frac{1200}{1600 \times 10^{-3}} = \frac{39.6}{16 \times 10^{3}} = 2.84 \times 10^{-3}$$

and taking $\beta = R/2(C/L)^{\frac{1}{2}} = 0.00284$; $L = (R+Rc)^2 \times C/4 \times 0.00284$ henry.

The amplitude at the distant end equals $e^{-\beta d} = e^{-0.00284 \times 1600} = e^{-4.5} = 1/e^{4.5} = 1/90 = 0.0111 = 1.11$ per cent of transmitting-end amplitude.

From these figures it will be seen that Rc, the apparent resistance of the coils, greatly affects the value of β and thus, although loading improves the articulation, it reduces the volume of the sound, or the amplitude, and as the value Rc increases with the inductance of the coils it will be

readily seen that if a line is overloaded, or loaded more than absolutely necessary to get the standard of transmission required, the efficiency of the circuit is reduced instead of increased for long-distance transmission. For if the amplitude is reduced too far, although the articulation is good, telephonically speaking, the circuit will be inefficient. When the value of βd is such that $e^{-\beta d} = 100$, or $\beta d = 4.60511$, the limiting point at which loading is commercially of value has been reached.

From this it will be easy to calculate the most economical

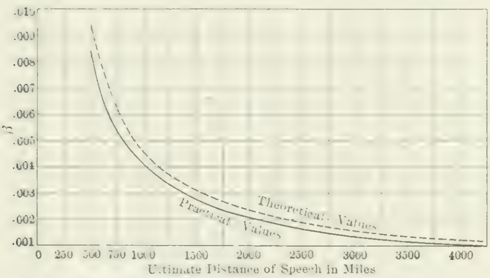


Fig. 1—Theoretical and Practical Values of β for Ultimate Speech Distance in Aerial Circuits.

value of β and thus the right amount of loading necessary to cut into a circuit of any given length to give the best efficiency. The best efficiency is obtained when $\beta = 4.60511/d$. From this it will be easy to calculate L, d in this case being the limiting distance for which the circuit is designed.

Considering now the best spacing for the coils, Professor Pupin has worked out a formula for the maximum spacing per wave length to give approximately the same efficiency as uniformly distributed inductance.

If the wave length be taken as a complete revolution, 360 deg., or in angular measure 2π radians, and the length l, the fraction of a wave-length between any two coils, be given in angular measure $= 2\pi l/\lambda$; then the nearness with which $\frac{1}{2}\sin 2\pi l/\lambda$ approximates to $\frac{1}{2} 2\pi l/\lambda$ radians will represent the approximation of the efficiency of the loaded line to that of a line in which an inductance of equal value is spread uniformly over the line .

When $l/\lambda = 0.1$, then $\frac{1}{2}\sin 2\pi l/\lambda$ equals $\pi l/\lambda$. So that the best efficiency is obtained when there are ten coils per wave length.

From experimental results it has been found that 7000/800, or 8.8, coils are the least that should be used per

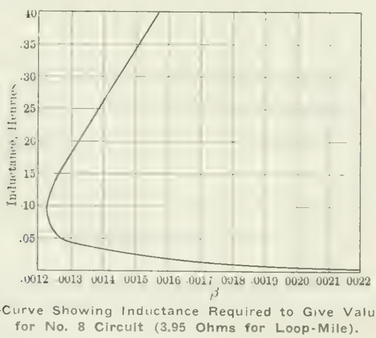


Fig. 2—Curve Showing Inductance Required to Give Values of β for No. 8 Circuit (3.95 Ohms for Loop-Mile).

wave length, and that there is no advantage in putting in more than 13000/800, or 16.2, coils per wave length. These results agree with the above calculated result.

The only other formulas necessary are those for finding the inductance and capacity of aerial lines, those for cable always being known, as they are manufactured to set standards. In this case for aerial lines L has been taken as equal to $0.1609 + 1.482 \log_{10} (2\,h/d) \times 10^{-3}$ henries, and C as equal to $0.0194\ lk/\log_{10} (2\,h/d) \times 10^{-6}$ farads. Five per cent should be added to this result to allow for the reaction of the adjacent wires.

In these formulas

h = distance apart of wires in inches.

d = diameter of wires in inches.

k = specific inductive capacity of dielectric between conductors (for air equals 1).

l = length in miles.

The only other point to be considered is the apparent re-

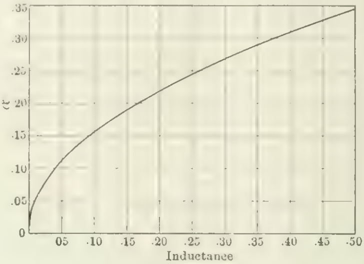


Fig. 3—Curve Showing Values of α for Desired Loading of No. 8 Circuit.

sistance of the coils at different frequencies. These coil are manufactured under patent held by the American Telephone & Telegraph Company in America and by Siemen & Halske in Europe, but little information is to be ha regarding their characteristics. Although manufacture under patent and sold by the Western Electric Company i five stock sizes, coded as 501 and 503 for aerial work, an 506, 507 and 508 for underground work, no bulletin i issued with them. But it may be taken as correct tha these coils are wound upon rings of magnetic material an have, practically speaking, no external field, consequentl they can be incased in metal. Provided there is a thin iro shielding plate between them to provide against electro static and electromagnetic action, they may be packed o top of one another without any fear of induction betwee themselves or from other outside sources.

The above-mentioned coils have a time constant of abou 0.240 (L/Rc), so that, L being known, the apparent resist ance at 800 cycles per second can be calculated. A coi

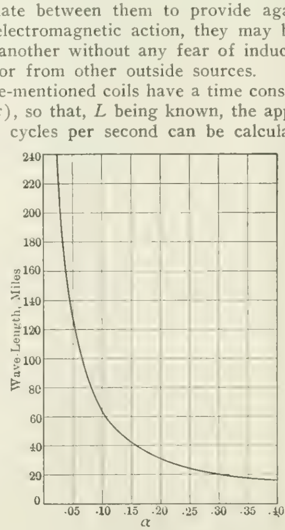


Fig. 4—Curve Showing Wave-Length for Values of α on All Aeria Circuits.

having an inductance of 0.252 henry has an apparent re sistance of 10.5 ohms at 800 cycles, and a coil with a inductance of 0.133 henry has an apparent resistance c 5.5 ohms approximately (Western Electric Company's coi code No. 507).

Summarizing the above results, it has been shown th no matter how heavily a circuit may be loaded it is in

possible to make it distortionless for all periodicities required in telephonic speech. This being the case, the circuit will give the best efficiency when it is loaded just sufficiently to give the required transmission for the ultimate distance for which it is designed. To get this result if d equals this distance in miles, theoretically β should equal $4.60511/d$, but in practice this value of β has to be reduced approximately 10 per cent to allow for extraordinary losses, such as leakage, eddy currents and hysteresis losses, which exist on the circuit, but which cannot be calculated. This value for β approximates very closely to the values calculated for the limiting distance of speech for metallic circuits of various gages.

From equation (1) or (2) for β, the value of β being known, L can be calculated.

The values of L, C and R (resistance of mile of circuit plus apparent resistance of coils per mile) being now known, α can be calculated, using equation (1) for cable and equation (2) for aerial wires.

From this we get the wave-length, and the distance between coils, l, equals 1/10 of the wave-length.

The required inductance per loop-mile being L, the inductance of each coil should be $L/2 \times l$. If there are no coils having this inductance the coil with the next lowest inductance should be used, and the distance l reduced so as to get the required added inductance per wave-length.

With this information before him the engineer will be in a position to determine whether more economical results will be obtained by loading an existing circuit or installing a circuit of somewhat heavier gage.

It is of considerable importance that the insulation resistance of a loaded line should be kept good, as, the velocity being reduced, the attenuation of the current due to leakage conductance will be considerably increased.

Fig. 1 shows the different practical (β equals $4.1446/d$) and theoretical (β equals $4.60511/d$) calculated values for β as the ultimate distance of speech increases from 500 to 4200 miles. This curve is applicable to all aerial circuits.

Fig. 2 shows the amount of inductance required to give any definite value of β.

This curve is plotted for a No. 8 Birmingham wire-gage circuit, strung 12 in. apart. The critical point of this curve is reached when 0.10 henry has been added per loop-mile, and, although theoretically 4.2 henries should be added to get a resonant circuit at 800 cycles per second, the added apparent resistance of the coils attenuates the current so much that the advantage gained in distinctness is lost in volume after the circuit has been loaded to 0.10 henry per loop-mile.

This curve only applies to an 8 B. W. G. circuit strung under the above conditions; for other circuits a similar curve should be plotted and the critical value determined.

Fig. 3 shows the value of α for any given amount of loading for a No. 8 circuit; for other sizes similar curves should be plotted.

Fig. 4 shows the wave-length and the distance between coils for any given value of α. This curve applies to all aerial circuits.

A. I. E. E. PAPERS AND DISCUSSIONS.

Following are further abstracts of papers presented at the recent Chicago convention of the American Institute of Electrical Engineers, together with abstracts of the discussions to which they gave rise.

MAKING APPRAISALS.

The paper by Mr. H. M. Byllesby, Chicago, entitled "Important Features Entering Into Making of Appraisals" opens with a sketch of electrical development during the past thirty years or more, after which the subject of public service franchises is discussed. The great expansion of the electrical industry in this country is ascribed partly to the liberal franchise grants issued in the past and the freedom from onerous restrictions, both for the occupancy of streets and the purchase and development of water-powers, united with a broad liberal construction which has justified the issuance of stock which would eventually make for the projectors and developers of these enterprises, when they become successful, something in advance and beyond a mere fair interest return on their investments. At the present time both the public and the corporation are reaching a common meeting ground, whereby public service corporations become regulated monopolies, governed as to their rates and protected from competition by public service commissions. Mr. Byllesby states that with this doctrine the public service engineer and operator have no quarrel, but that they do file a plea that these commissions be composed of men of character and of ability who have accomplished something in the world—men who, while fair and upright, are conversant with the business they are controlling. It is believed that the cry of the corporations for a fair hearing, a recognition of the benefits they have conferred and relief from the hardships and frauds which in many cases they have suffered at the hands of politicians will follow the institution of properly constituted public service commissions, appointed for "good behavior," composed of high-class men, suitably paid and operating under broad and liberal laws.

Mr. Byllesby said he desired to call the attention of the members of the American Institute of Electrical Engineers to the painful fact that it is extremely rare for a professional engineer or constructor in any branch of industry or construction to estimate the cost of construction with accuracy, and that the practically uniform experience has been that all such estimates have proved woefully less than the cost of the completed project. There has not, he said, been a considerable piece of public-service construction in recent years of which the finished cost has not overrun the estimated cost, ranging from a minimum of 10 per cent to a maximum of 100 per cent or more. The professional engineer should be fair-minded and liberal in appraising the value of the property of another man or of a corporation, when upon such appraisal is to be based the return to be allowed. The tendency of the times, at best, is to allow a public-service corporation, after its operating expenses and depreciation charges, a distributable sum equivalent to from 7 per cent to possibly 10 per cent upon its reproduction value; it therefore becomes evident how grievous a hardship may be worked if an appraisal is much below the real value of the property. Possibly 90 per cent of the activities of the electrical engineering profession have resulted from the development of public-service corporations, and if these corporations, through under-appraisals or drastic regulations, are discouraged, this will be immediately reflected in a lessening demand for the services of electrical engineers. The electrical engineering profession could not exist if capital withdrew its support from enterprises requiring their services. The professional engineer cannot get along without the services of capital. Capital should treat the public, the laboring man and the professional man with fairness and liberality; on the other hand, the professional man, who carries a large influence in the community in which he operates, must not forget that close correlation is necessary between brains and capital, nor allow himself, through professional indifference or jealousy, to give capital an unfair hearing or an unjust decision.

Beyond the naked physical value of a property there is required a very large sum to make it an earning entity, and engineers are asked to give the fullest consideration to the question of intangible values. These values embrace interest, accidents and insurance during construction, engineering and supervision charges, the large sums expended in developing a business, in educating the public and in producing a market for the commodity. Other proper charges are the legal expenses of organization and those

necessary to put the enterprise on its feet, discounts on securities sold, the brokerage paid for finding the capital and the large sums spent by the older companies in the period of experimenting to obtain the best apparatus, systems and methods adapted to their requirements. Due regard should also be given to the added cost of piecemeal construction, and losses should be included due to obsolescence and the discarding of machinery long before its life has been exhausted.

A recent example of an appraisal was cited, being the case of a property which in the past had placed a part of its system underground before the streets were paved. In making the appraisal it was ruled that the company was not entitled as a part of its value to the cost it would have been put to had it placed this work under the paved streets, notwithstanding that the company was allowed the cost of the paving incident to that part of its distribution placed underground after the streets were paved. Because the company did part of the work in advance it was not allowed this value, thereby discouraging enterprise. It is pointed out that with the tendency of governing bodies to make a decision such as that just referred to it becomes extremely important for an engineer intrusted with an appraisal to be sure that he gives to the property under consideration the benefit of the full value that he believes it is entitled to, both physical and intangible. In conclusion, Mr. Byllesby referred to the unusual opportunities possessed by members of the American Institute of Electrical Engineers for forming a basis for a proper measure of the questions of value, which questions should be approached with high intelligence, with a professional sense of responsibilities involved, and with an appreciation of the fact that in the combination of capital, the public and professional engineering no hardship can be worked upon any one of the three without inevitably producing its full quota of disaster to the other two.

DEPRECIATION OF ELECTRICAL PROPERTIES.

Mr. Henry Floy presented a paper entitled "Depreciation as Related to Electrical Properties," in which attention was called to the confusion and non-uniformity in the terminology employed in discussing depreciation and the various methods which have been used for estimating the depreciation. He gave detailed definitions of the words depreciation, physical value, development expenses, intangible or overhead values, original cost, cost of reproduction, scrap value, wearing value, service value, present value, going value, good will and franchises. He discussed depreciation under the heads of wear and tear, decrepitude, inadequacy, obsolescence and deferred maintenance. A considerable portion of the paper was devoted to the discussion of absolute and theoretical depreciation, depreciation accounts or reserve funds and of the application of depreciation.

The author called attention to the fact that the rate of depreciation adopted in estimating and providing for accruing depreciation should not be confused with the total sum of depreciation in physical property. Theoretical depreciation must be assumed and provided for as a part of operating expenses if the capital is to remain unimpaired and rates are such as to give the maximum service at the minimum expense. Service value determined from the consideration of the absolute depreciation of physical property should be used in connection with certain proper non-physical values, such as development expenses, going values, franchises, etc., as the basis on which rates should be fixed, capitalization allowed and taxes assessed. Development expenses bear no fixed relation to the cost of the physical property, as their amortization has no necessary relation to the rate of depreciation of the physical property. The author concluded that there exists an urgent demand for co-operation among engineers, manufacturers and service corporations for an intelligent collection and correlation of data on which properly to base estimates on depreciation.

Discussion.

In opening the discussion of the general subject of appraisals and depreciation, Mr. Bion J. Arnold, of Chicago, said that the engineer can perform no higher service to his community than to enter into and explain public-utility corporation relations with the public. In the past, he admitted, perhaps the error has been made by corporations in not viewing the public's side, and from this sentiment swung over until the corporations themselves suffered from public opinion; but the popular verdict is now returning to the point where the public is desirous of treating corporations with fairness and honesty. After mature reflection Mr. Arnold said he is convinced that a public-service corporation is entitled not only to a fair return or interest value on the investment in its properties, but more than this. In cases where stockholders have invested their money during time of stress and financial hazard, the company should be given the right to earn either temporarily excessive profits or good profits for a longer time.

Public-service commissions, in fixing rates, should consider this right of the corporation to recoup its former losses, which should remain in the capitalization until earned. This was the method, said Mr. Arnold, used in the recent physical valuation of the Chicago properties. In arriving at valuations, he added, there should be included not only the cost of reproducing the physical property, but also development costs, interest during investment, engineering costs, promoters' fees, contractors' fees, etc., all of which latter will amount to from 10 per cent to 25 per cent above the mere reproduction value. Mr. Arnold maintained that rates should be based upon the cost of reproducing the property new, or upon its depreciated value plus the money required to put it in first-class condition, declaring as short-sighted the policy of fixing the rates on the present depreciated value alone.

Mr. W. F. Wells, of Brooklyn, urged that only absolute and not theoretical depreciation be considered, pointing out that where the property is in a first-class condition its value should not be depreciated for purposes of rate-making. The company, he said, is entitled to increment values in such cases as, for instance, where a subway is covered by new pavement. Mr. Wells also outlined the work of taking a complete inventory of the Brooklyn Edison Company's underground plant, using Hollerith tabulating machines.

Mr. J. W. Lieb, Jr., of New York, referred to the difficulty of dealing with appraisal cases through the means of legal assistance, and urged that electrical men become better informed on these matters, enabling them to discuss at first hand these important aspects of their business. Mr. Lieb pointed out that tables of depreciation usually do not include obsolescence, which forms an important factor in arriving at the actual value of much electrical equipment in this day of rapid changes in the art. Mr. Lieb also spoke of the necessity for scrapping large quantities of apparatus for which securities are issued and which represent bona fide stock necessary to the development of the business, although not represented in the existing physical value of the plant.

Dr. S. S. Wheeler, of Ampere, N. J., declared his opinion that a definite value on apparatus might be obtained at any and all times, urging that all kinds of depreciation be unified and that as a simplification of the problem only one kind be considered. Mr. Emil Leonarz, of Mexico City, pointed out that, though commissions often decrease the rates, such rates are not proportionately raised when lines are extended into new territories of low income production, removing from part of the capital invested its proper rate of return. Prof. A. H. Ford, of the University of Iowa, proposed that, instead of commissions fixing a definite rate of income for corporations, such earning should be marked by upper and lower limits, falling below which the rates might be increased and above which rates might be decreased. This, Professor Ford declared, would assist in maintaining the equilibrium between company earnings and investments.

LOADING OF TELEPHONE CIRCUITS.

Mr. Bancroft Gherardi, of the American Telephone & Telegraph Company, presented a paper in which were described the results obtained by using distributed inductance to improve the transmission efficiency of telephone circuits according to the Pupin system. At the present time very general use is made of two systems for loading telephone cables, one of which is characterized as medium loading and the other as heavy loading. The heavy loading employs about 0.2 henry per mile, and the spacing between coils is about 1¼ miles. The medium loading provides 0.1 henry per mile, with coil spacings of 1¾ miles. In a few cases a third style, known as light loading, is employed. Light loading employs 0.05 henry per mile, with spacings of about 2½ miles.

The results from the loading of underground cables have been highly satisfactory, and noteworthy improvements have also been obtained from the loading of open-air circuits. The general plan of loading open-air circuits is similar to that used on underground cable lines. The relay coils are built so that they will withstand a breakdown test of 8000 volts.

The outside diameter of the coil is about 10 in., and the resistance of the two windings to direct current is 2½ ohms, while an alternating current of a frequency of 800 cycles per second takes 6½ ohms. One of the very valuable results which have followed from the loading of open-wire lines has been a very substantial extension to the distance over which telephonic service can be given. Without loading 1000 miles represented the greatest distance of telephonic transmission over No. 8 B.W.G. wire. By the loading of a No. 8 circuit the distance has been extended to 2000 miles.

The author stated that in the United States there are at present about 85,000 miles of loaded open-wire circuits and over 170,000 miles of loaded underground circuits. To load these circuits there have been employed about 125,000 loading coils. The day-by-day experience with this enormous loaded line plant has fully demonstrated the success of the undertaking.

Discussion.

Mr. E. H. Bangs, of Indianapolis, in opening the discussion, remarked that it has taken ten or fifteen years of earnest work to perfect the details of loading telephone circuits. The problem is quite similar to the same conditions met with in heavy power transmission, only, of course, in minute form. Dr. F. B. Jewett, of New York, said that the actual attenuation results on loaded lines check up very closely with computations made in advance. The same is true of dielectric dissipation. It is to be remembered that loading means a higher degree of line maintenance than on unloaded circuits. Circuits of various characteristics, loaded and unloaded, must be connected by suitable terminal apparatus to secure flexibility.

Mr. E. H. Colpitts, of New York, commented on the difficulties encountered in introducing the loading coils and also on the refinements of electrical measurement made necessary by this improvement. First of all, high-frequency generators had to be designed, giving frequencies of 200 to 3000 cycles, with outputs of almost pure sine waves. Methods of measuring losses in iron had to be devised, as well as losses in dielectrics, and it was necessary also to measure very accurately the inductance and effective resistance of the loading coils, as well as the bridged impedance on loaded circuits and very small capacities.

Mr. E. B. Craft, of New York, described in an interesting manner the actual construction of inductance coils for loading. He spoke of enameled insulation for the wires in the coils of only 0.0005-in. thickness. Automatic machines have been devised for applying the windings. An ordinary containing case for cable circuits holds twenty-one coils and weighs about 2000 lb. It is placed in a manhole.

Allard Smith, of Chicago, described the system of loading used in that city, and Mr. J. G. Wray, of the same city, said that in Chicago it would be impossible to carry on telephonic conversations commercially without the use of loading coils, inasmuch as overhead wires are not permissible. The loading coil is generally considered as particularly adapted for long lines, but it is also of the highest importance in large cities, with their underground circuits.

Central Station
Management, Policies and Commercial Methods

FREE ELECTRIC-FAN SERVICE FOR INVALIDS.

Electric fans are a great boon to the sick in warm weather, but poor people may not be able to afford to pay for them and the necessary electric service, even though the cost is small. Those who were in attendance at the recent convention of the N. E. L. A. in New York City will remember that in the discussion on residence business Mr. . M. Searle, of the Rochester Railway & Light Company, elicited some applause when he stated that his company some time ago notified every physician in Rochester that it would at his request supply any invalid with an electric fan, run the necessary service and supply the energy without expense whatever to the patient during the period of his sickness.

Messrs. H. M. Byllesby & Company, of Chicago, also are inaugurating free electric-fan service to invalids by all the electric-service companies they control in a number of States. All invalids who can be reached from the present distribution system are to be furnished free fan service this summer on the certificate of a physician that the fan will be beneficial and that the patient is financially unable to pay for the service. If necessary, service wires will be installed, with the necessary interior wiring; the fan will be loaned and the electricity supplied gratis. Letters will be sent to physicians informing them that the company desires to give free fan service to invalids unable to pay and asking them to certify in writing the desired facts, also notifying the company when the necessity for service has ceased.

Whether or not this is a good stroke of business enterprise, it is certainly a worthy charity, for which the Byllesby interests are to be heartily commended.

EMPLOYEES' HANDBOOK.

A comprehensive "Employees' Handbook" has been issued by the Commonwealth Edison Company of Chicago. Its purpose is to acquaint the 3000 employees with the company's policies and to enable them to adapt themselves to the spirit of the organization. The ideal of the company is expressed as "courtesy to the public and the best possible service." It is shown how this ideal is approached. The policy of the company toward its employees is explained, and the employees' savings fund, merit system, the company library, public library station, Commonwealth Edison Section of the N. E. L. A., night-school scholarships, rewards for suggestions and other aspects of that policy are dealt with at some length. The book also includes general information about the company, including the rates charged for electricity and a list of other handbooks issued by the company. These other handbooks relate to (1) the general

characteristics of the company's service, (2) electric vehicles, (3) wiring regulations, (4) the proper use of the telephone and (5) an emergency directory more particularly for the use of employees in the operating departments. The "Employees' Handbook" makes a pamphlet of twenty-nine pages, and it is written in the earnest, enlightened spirit which characterizes the best electric-service practice of the day.

ECONOMICAL ELECTRIC-TRUCK SERVICE AT BOSTON.

Short-haul trucking service has always been an extremely difficult field for the electric vehicle, but records secured recently at Boston indicate that electricity is capable of driving the horse from this stronghold. The trucking house of Lewis Flanders & Company recently installed a 5-ton truck equipped with two motors mounted in two forward couple-gear wheels, the large rear wheels of the outfit being steel-tired and without motors. The truck makes 25 miles per day and operates at a speed of 5.5 miles per hour loaded

Electric Truck.

and 7 miles per hour empty. The results of the first 1000 miles' operation show that the total cost per day is only $7, the items being: Operator's wages, $2.50; energy, at 3 cents per kw-hour, $1; tires, 80 cents; battery maintenance, $1.25; repairs, 25 cents; fire and liability insurance, 45 cents, and floor space and superintendence, 75 cents. Experience shows that a standard gasoline motor truck of the above capacity cannot be operated at less than $15 per day, the cost of running two double teams being about $12. In the above 5-ton truck 40 per cent of the weight is carried on the driving tires, which are of solid rubber and duplex. A life of 12,000 miles is guaranteed on the tires. Experience has already shown that the elimination of the rubber tires from the rear wheels, which is the chief source of economy, does not interfere with the proper working of the battery.

STATISTICS OF ELECTRIC STREET LIGHTING IN CHICAGO.

On Dec. 31, 1910, the city of Chicago, as shown by the annual report of City Electrician Carroll, was operating 12,366 arc lamps for street lighting, while it rented 893 arc lamps from the Commonwealth Edison Company. The average number of lamps owned and operated wholly by the city during the year was 12,230. The average "cash cost" of the operation and maintenance of these lamps was $38.16 a lamp per year. This includes labor and materials, superintendence and office charges, but does not include interest, depreciation, lost taxes, water rates, rent of office in the city hall, rental of poles belonging to private companies, nor a portion of the cost of other branches of the city government which do more or less work for the electric-lighting service. If these charges be added, the annua cost of maintaining each lamp is $61.95. This is figurin interest at 4 per cent and allowing for depreciation at th rates reported to the City Council by the Arnold Compan in 1908. The contract price for rented arc lamps used fo street lighting is $75 a year.

Electrical energy obtained from the water-power develop ment of the Sanitary District is now used for all publi street lighting in Chicago. In the year 1910 the city pai the Sanitary District the sum of $142,610 for electricit used for this purpose. An itemized statement of the cas paid out for maintaining each of the public arc lamp shows that the cost of Sanitary District energy was $11.66 lamp trimming, $8.60; repairs to circuits, conduits an posts, $5.31; firemen, engineers and other station labor $3.19; electrodes, $2.66; repairs to lamps, $2.32. Othe items, including repairs to electric plants, superintendenc and office expenses, etc., bring the total up to the $38.1 mentioned.

In relation to the recently executed contract with th Sanitary District by which the latter agrees to maintai the city's street-lighting system and install 10,000 lamps i addition, Mr. Carroll in his report said that, judging by th December figures, the saving for the year 1911 will b about $78,000, compared with the previous contract, figur ing on the present number of lamps. All money expende by the District in the installation of new lamps and th rebuilding of old equipment will be repaid by the city i yearly instalments covering a period of seven years, begin ning in 1912. It is estimated that after the old equipmen has been replaced by modern lamps the annual saving fron the use of hydroelectric energy instead of steam will b over $100,000, while the new lamps will give more ligh than the old ones.

UNPRECEDENTED DEMAND FOR FAN MOTORS.

It is an ill wind that blows nobody good, and therefor the recent "spell" of warm weather may be said to hav a beneficial side in stimulating the business of makers an sellers of electric fans. In Chicago, where there has bee a long-continued period of unusually warm weather, in quiry reveals the fact that all dealers in electric fan have been put to their wits' ends to meet the demand The principal central-station company was fairly deluge with letters and telephone calls, and was forced to cal in all the solicitors of its merchandise sales departmen to meet the demand for handling fan business alone. I is believed that the sales of fans of this company in 191 will be about 250 per cent those of an average year. O July 3 this company sold over 350 fans in its retail sales room alone. Oscillating fans have been greatly in de mand, particularly in the 12-in. sizes, and probably 10 per cent more of these fans will be sold this year tha last year. There is also a greatly increased demand fo 8-in. fans.

One of the Chicago supply companies reports the de mand for fans as most remarkable, the season being a unprecedented one. The demand began early and on mor than one occasion this company was almost entirely cleane out. Ordinarily the fan season lasts about six weeks, an is over about July 15. Nearly all fans not sold by tha time must be carried over until the succeeding seaso and as the average fan represents an investment of abo $11, the interest on the money so tied up is considerabl The business is something like that in fireworks, with short season, but an exceedingly brisk demand while lasts. During the height of the fan season men engage in other departments are taken to help out during the rus and all departments of the business are affected more o less. A jobber must carry at least forty sizes, and th

particular dealer from whom these facts were obtained thinks that possibly there should be larger profits for the sellers, in order to offset the hazards and annoyances of the fierce but peculiar demand.

Another dealer reports that it has been almost impossible to get fans fast enough to keep up with the demand. In many cases shipments have been made by express. Never before has there been so great an outcry for electric fans. It has been particularly difficult to supply the need for alternating-current machines; plenty of direct-current fans were on hand, compared with the demand for that type. It is particularly difficult to supply the requirements for 16-in. oscillating alternating-current fans. The season began this year nearly a month earlier than usual, and very likely will last until Aug. 1, or about three months. The big central-station companies realize the advantage to them of putting out all hot-weather appliances possible, as fans, heating and cooking appliances, in order to help fill up the "valley" in the summer load. The central-station companies in the smaller cities, however, do not seem to realize this fact so keenly, and with some exceptions are not, perhaps, as active as they might be in pushing the fan-motor business.

Manufacturers as well as dealers remark the greatly increased demand this season for the oscillating type of fans, and this appears to be true of all sizes. For office and restaurant use the 16-in. oscillating fan whose powerful breeze seeks out every corner of the room, is in great favor. The number of stationary fans which are being converted to the oscillating type is attested by the large number of orders received for the swinging platforms worked by vanes, air wheels or other mechanical devices which have been ingeniously adapted to fan movements.

Even fan manufacturers and salesmen were taken by surprise at the suddenness and number of the fan orders which they received in June and early July in Chicago. On a number of days orders were filled at the rate of 1000 fans a day by several of the manufacturers in Chicago alone.

Department stores and other retailers of electrical supplies all confirm the general cry that the demand for these comforting appliances has been of unprecedented magnitude.

MUNICIPAL WATER PUMPING BY CENTRAL STATION.

In looking over the field for new business to be sought after most central stations do not give proper consideration to the subject of water-works pumping, said Mr. F. D. Spencer, of Cheboygan, Mich., before the Michigan Electric Association, June 22. Of the many reasons why the subject has not been given the serious effort which it deserves, probably the foremost is that the central station when not municipally operated feels that the time and effort necessary to convince the municipality of the advantages of electric pumping are not worth the prospective business. It is true that, as a rule, said Mr. Spencer, the municipality is a difficult customer to obtain. Political situations must be overcome, as well as, in many cases, a gross lack of knowledge of the true conditions surrounding the operation of the pumping plant by the municipality. The want of confidence in the ability of electric service to operate the pumping machinery without interruption has in the past been a strong objection for the central station to overcome.

The municipality should be shown, however, the saving it can effect through the purchase of energy developed under central-station conditions, as well as the lesser space and lower cost of maintenance of electrical installations.

At the same time the central station gains a long-hour load and one that can generally be kept off the peak hours in the smaller plants. All recognize the importance of improving the load-factors of stations, and a pumping load is very desirable in that it helps to even up the underloaded condition of boilers, engines and dynamos, thus decreasing the coal cost per kw-hour output when the station is operated nearer to the full-load point. Further than this there is the possible great saving in labor offered by the remote control of electric-driven pumping equipment and the use of synchronous motors to improve the power-factor of an alternating-current circuit. "With these conditions assured we should not lose heart at the repeated failures to interest the municipality," said Mr. Spencer, "but keep everlastingly at it until the contract is ours."

In considering the best kind of equipment for electrical pumping, there are two systems to consider: First, the plant pumping directly from a stream, shallow well or reservoir into the main; second, the plant pumping from deep wells to a reservoir and from the reservoir to the mains. In the first instance either the plunger type of pump or the centrifugal pump will give satisfactory service when driven by motors. When considering both repairs and efficiency there is practically no choice between the centrifugal and triplex pumps. The efficiency of the triplex pump ranges from 55 per cent to 75 per cent and that of the centrifugal pump from 50 per cent to 70 per cent. In the second place, when pumping from deep wells of moderate depth, the very small plant with limited finances and a limited service may use a plunger type of pump satisfactorily. When considerable quantities of water are pumped or the lift is high the reciprocating deep-well pump is usually troublesome and repair bills are high. In general, however, where the small plant can make use of it, the deep-well centrifugal pump will give the best service. This pump is of the vertical-shaft type and is sunk deep in the well below water level. Where the quantity of water to be pumped is from 250 gal. to 1000 gal. per minute this type of installation is probably the most satisfactory known. The efficiency of this type of pump is from 50 per cent to 60 per cent.

While the air lift is not very economical, it proves to be very satisfactory in many systems. In operations the air-lift pump compresses air which is discharged from a small pipe into a larger pipe sunk below water level. The air thus forces the water to the surface reservoir. The efficiency of the air lift may be anywhere from 20 per cent to 50 per cent, depending on installation conditions. The depth to which the air pipe is submerged and the air pressure necessary have important bearing on the efficiency. The first cost of the air lift is less, however, than the deep-well centrifugal pump, and since it eliminates some of the uncertainty of service and cost of repairs of the latter it may be more desirable for small plants with limited reserve capacity.

Although the cost of pumping naturally varies largely with the conditions under which the water is pumped, Mr. Spencer cited a number of examples giving the figures of electrical consumption for 1000 gal. pumped. One company operating a triplex pump driven by a 35-hp motor and pumping against 100-ft. head reports an average consumption of 700 watt-hours per 1000 gal. pumped. Another company operating a motor-driven deep-well plunger pump reports a consumption of 1333 watt-hours per 1000 gal. pumped against a head of 120 ft. Another plant reports a consumption of 1220 watt-hours per 1000 gal. pumped by a motor-driven deep-well plunger pump lifting 110 ft. One water-works plant in a city of 12,000 inhabitants installed a generator, placing a 7-hp motor at each of nine 65-ft. wells which fed a reservoir. A 100-hp motor driving a triplex pump delivered 1,000,000 gal. of water per day to an elevated tank and the distributing system. As a result the fuel cost was reduced one-half and the number of employees from thirteen to three. A small municipal pumping plant by expending $6,000 in order to change from steam to electric drive claims to have reduced its operating expense $5,000 the first year, energy being purchased on the basis of $26.40 per hp-year.

HOUSE OF EDISON LIGHT AT BOSTON.

The accompanying photographs illustrate the so-called House of Edison Light, which has recently been moved

Fig. 1—Dining-Room of an Electric House.

from Winchester to Newton Center, Mass., by the Edison Electric Illuminating Company of Boston. The house is

Fig. 2—Library of an Electric House.

equipped with a large number of useful electrical conveniences, including heating, lighting and motor apparatus

Fig. 3—Kitchen of an Electric House.

of tried value in domestic service. It is lighted according to the best canons of modern illumination practice, and has an electric pleasure vehicle and garage attached. The house is of the portable type, and is in charge of a prominent resident of each of the Boston suburbs in which it is located, the duration of the stay being several months in each community. The artistic character of the house and its furnishings has already attracted many thousands of interested visitors, who thus come into close contact with the best electrical applications in residence service.

Wiring and Illumination

FACTORY LIGHTING.

In its report to the National Association of Manufacturers at its annual meeting in New York recently the committee on ventilation, heating and lighting embodied information on factory lighting culled from answers to letters sent to some 3250 firms. The answers in the main make clear that the question of good artificial light has not had very careful consideration from manufacturers in the past, although a number of replies indicate that some of them are keenly alive to the importance of the subject. A few examples of such replies are as follows:

A shoe manufacturer reported that painting walls and ceilings white and keeping them in good condition results in better work being done and keeps the employees better satisfied. A manufacturer of caramels stated that proper lighting is absolutely necessary to get the best results and a large production. One manufacturer reported that he employs a well-known illuminating engineer to solve the lighting problem for him, and another replied to the effect that the actual conditions of artificial lighting in the factory in question are ideal, but nevertheless the output averages 20 per cent less than under daylight. A silk manufacturer stated that it is of great benefit to the work to have well-lighted, well-ventilated and properly heated shops, and that even if these were not necessary on account of the effect on output, he would still have them for the comfort of his employees.

In investigating the question of artificial lighting in factories the first information desired is the degree of importance of the subject, which can be ascertained only by obtaining some idea of the effect of varying light conditions on the product, and it was information of this kind which it was hoped would be obtained from the answers to the questions. It is the belief of the committee that the effect of varying character of artificial light on the quality and quantity of product may be and often is very great and consequently affects the cost of production to a very considerable extent. The committee feels that it is a matter of ordinary observation to those at all expert in the question of artificial lighting that factory lighting, generally speaking, is very far from what it ought to be. The following statement is a brief summary of the principal defects which are ordinarily to be found.

In very many cases there is insufficient illumination. This condition, however, is rapidly improving as the result of the advent of lamps of various kinds of much higher efficiency than anything that has been available in the past It is a fact, however, that in a great many cases where the absolute amount of illumination is sufficient the light is nevertheless exceedingly unsatisfactory for various reasons. If the light falls on the work from the wrong direction, not only is there great liability that awkward shadows of the machinery or of the operative's body will interfere with the work, but in addition if light is reflected from polished portions of the machinery or from the work itself directly into the eyes of the operative, the results will be anything but satisfactory. Failure of light to come in the right direction is often very distressing to the eyesight and also, in addition, since it may cause the operative to work in an unnatural position, it may result in unnecessary bodily

fatigue as well. Such unfortunate results are often obtained if an attempt is made to light a workroom with too few sources of light. Under these conditions, although some operatives may receive a very satisfactory light, others are extremely likely to get the light in the wrong direction, with the unsatisfactory results above enumerated.

Another very common defect in factory lighting is the exposure of the eyes of the workers to the direct beams of very brilliant lamps. The use of bare incandescent lamps is almost invariably not only inefficient but also dangerous. Generally, however, there is no difficulty in avoiding this trouble if proper care is taken.

It is true, also, that as the result of using the eyes under improper conditions troubles of various kinds, such as headache, nausea, etc., are often induced, although commonly ascribed to some other cause, and these troubles not only reduce the efficiency of the operative while working, but lead to absences which might otherwise be avoided.

Still another defect often seen is either too great or too little contrast in the illumination of rooms. The former of these is by far the most common, and as an example might be given work on sewing machines, where individual lamps with opaque reflectors are supplied which brilliantly illuminate the machines, but leave the rest of the room in comparative darkness. This too great contrast is not only a great strain on the eyes, but has as well a psychologically depressing effect on the workers. On the other hand, the brilliantly lighted room in which the illumination of all surfaces is practically equal to that of the working surfaces is also bad, since the eyes thereby are given no opportunity for rest when raised momentarily from the work.

A great waste of light is often permitted to occur, owing to the failure to keep lamps and equipment clean. The loss of light due to this cause is often as great as 50 per cent. One reply and one only referred to this question and showed that its importance was fully realized. The reply was from a typewriter company, which stated that its incandescent lamps were cleaned and polished once a week.

Mr. William Coale, treasurer of the Sterling Electric Manufacturing Company, Warren, Ohio, is the chairman of the committee.

FOURTH OF JULY CELEBRATION IN NEW YORK.

On July 4, 1866, a great portion of the city of Portland, Maine, was wiped out by a $10,000,000 fire which was started by firecrackers. There is not a city, town or hamlet but what has its list of Fourth of July fatalities. In recent years through the extreme and reckless use of fireworks it has come to such a pass that the fire departments in all American cities are kept on the jump from morning until long after midnight. Medical statistics show a great number of cases treated in clinics or consigned to wards in hospitals as a result of Fourth of July accidents. Then, to top off everything else and to provide a fitting climax for the "glorious Fourth," cities spend thousands of dollars for night fireworks. New York City this year spent $31,000. For half of that sum it is probable that every park in New York could be beautifully illuminated for two nights in the same manner as City Hall Park was lighted with electric lamps in Japanese lanterns. In order to show what could be done along this line and in furtherance of Mayor Gaynor's safe and sane Fourth of July movement the New York Edison Company volunteered to illuminate the City Hall and park, bearing the entire expense. Two bands of 8-cp incandescent lamps encircled the entire building, one at the top and one at the lower ledge. These lamps were colored alternately blue and white, the city colors, and were spaced 1 ft. apart. Garlands of lamps were festooned from tree to tree throughout the City Hall Park, creating a most pleasing garden effect. At night the national emblem and the State and city flags floated from City Hall, while several search-lanterns played on them continuously.

To the thinking observer there was a strikingly obvious contrast between this charming illumination, which lasted the whole evening, and the momentary flashes of

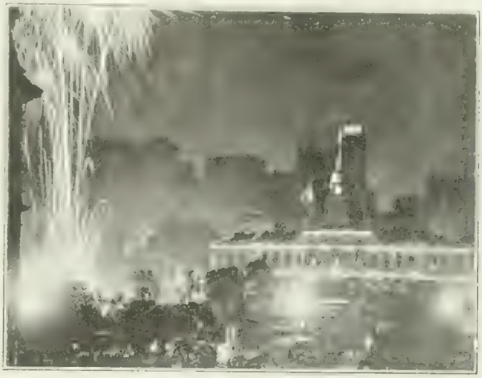


Fig. 1—New York City Hall.

Roman candles and skyrockets, which represented the burning of part of the city's $31,000. Here was a permanent form of beauty which attracted the eye and pleased as

Fig. 2—Bronx Borough Hall.

long as one cared to look at it, while, on the other hand, the costly fireworks were but a transitory gleam of colors in the sky accompanied by a few explosions.

LETTERS TO THE EDITOR.

Globular Lightning.

To the Editor of Electrical World:

SIR:—The reference to "globular lightning" in your issue of June 22 recalls an incident that was brought to my attention several years ago, and which I suspect has some relation to the phenomenon called "globular lightning."

During a severe thunderstorm lightning caused a short-circuit or arc in a chandelier supplied by direct current of 110 volts. At the same instant the occupants of the room were horrified to observe a "ball of fire" burst out of the chandelier and drop to the floor a yard or two distant and

then roll or bound along over the carpet, gradually becoming smaller and finally vanishing before reaching the end of the room, leaving a smell of burning wool. There was no visible damage to the carpet, however. On opposite ends of the room were open windows with the chandelier between and the course of the "ball of fire" was in the direction of the draft of wind through the room.

My explanation was that the arc caused a large amount of metallic gas to be forced out through the opening in a key socket, which, floating down through the current of air, soon condensed or oxidized and disappeared from sight, singeing the carpet slightly in its course.

I have wondered if any "globular lightning" has ever been observed that could not be accounted for in some such way.

Chester, Mass. E. LeRoy Gardner.

Long-Distance Wireless Telegraphy.

To the Editor of Electrical World:

Sir:—In connection with the abstract on page 1592 of your issue for June 22 of a lecture recently delivered by Mr. Marconi in London, it may be of interest to note that in Fessenden's United States Patent No. 706,737, applied for May 29, 1901, and issued Aug. 12, 1902, at page 3, line 48, the applicant states:

"A further advantage incident to the employment of low frequencies is the fact that there is, as I have discovered, less absorption of the electromagnetic force as the waves travel along the ground than when the waves have high frequencies."

Low frequencies (and the necessary accompaniment, long waves) have been used by Fessenden with a distinct realization of their advantages for long-distance work. It is only recently that Marconi has taken up this means of reducing absorption, probably because of Fleming's statement that absorption would increase with wave-length (Fleming's "Principles of Wireless Telegraphy," page 618, 1906 edition only). Marconi was unsuccessful in his attempts at transatlantic telegraphy until he adopted the long waves, when he at once established communication. It is manifestly unfair that Marconi should be credited with the discovery (as in the abstract of the lecture) when it was understood and utilized by Fessenden so very long before.

New York. John L. Hogan, Jr.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Principle of the Static Balancer.—C. C. Hawkins.—A mathematical article dealing with the principle of operation of the auto-transformer used with a double-current generator to obtain the neutral point for a three-wire direct-current system. The alternating emf impressed at the terminals of the transformer coil produces within the coil its normal exciting current. The author shows that it is only approximately correct to treat the actual current in each limb of the balancer as composed of the exciting current and a fixed portion of the out-of-balance neutral-wire current.—Lond. *Electrician,* June 9 and 16.

Static Frequency Changers.—M. Joly.—The author describes static frequency changers for raising the frequency of an alternating current to the double or triple value. The principle of a double-frequency transformer is shown in Fig. 1. Two identical transformers have their primaries

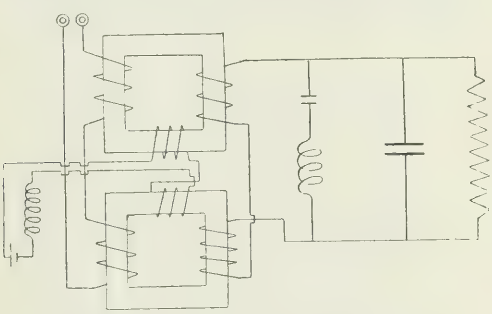


Fig. 1—Static Frequency Changer.

connected in series. The secondaries are also connected in series, but in such a way that the emfs induced in them are opposed to each other. When such a system is supplied with alternating current there will be no energy given out in the secondary as long as no special means are taken to produce in the secondaries emfs of multiple frequency which are not equal and opposed to each other at any instance so as to annihilate each other. The method consists in producing a non-symmetric magnetic field, for instance by the use of a superposed direct-current magnetization, as shown in the illustration, where each of the two transformers is seen to carry an auxiliary winding, both being connected to a source of direct current. The mathematical theory of the arrangement is given and a triple-frequency transformer is also described.—*La Lumière Elec.,* May 20.

Lamps and Lighting.

Photometric Units.—L. Murphy.—A letter with reference to the recent articles of Trotter and Harrison. The author thinks that, while candle-power is a very useful term for describing the luminous intensity in a definite direction of a light source of small dimensions, it should be reserved entirely for use in this connection. As at present employed it sometimes means intensity and sometimes flux. He thinks that a definition of the shadow effect as suggested by Harrison would be quite difficult, since there are "hard" and "soft" shadows, and, while both help to define the outline of an object and thus, within limits, add to the effectiveness of the illumination, there is no doubt that the former is usually much more objectionable than the latter. The diversity of the illumination on opposite sides of a solid body would give no indication with regard to this most important point.—Lond. *Electrician,* June 9. In his reply to Mr. Murphy Mr. A. P. Trotter maintained that, except for various theoretical considerations, there is nothing unscientific or illogical in using candle-power as the unit of luminous intensity, candle-power per square inch or per square millimeter as the unit of intrinsic brilliancy, and the ft.-candle as the unit of illumination.—Lond. *Electrician,* June 16.

Illumination of the Largest Steamship.—An illustrated article giving a general characterization of the illumination of the steamship *Olympic,* the electrical equipment of which was outlined on page 1593 of our issue dated June 22, 1911. The anonymous writer remarks that "so far as the decorative effect of the illumination is concerned there has been an effort, conscious or otherwise, to produce glitter and sparkle rather than softness and harmony, and this ill accords with the general air of refinement which characterizes the decorations. There is not a room in which the ey

ould not be sorely tried by the constant encounter of merous brilliant points. While electricity has been rned to every possible account in other respects, it has r from realized its possibilities in the way of illumination. this respect at least there is a golden opportunity for the xt in succession of mistresses of the sea to score a comete victory. Let the next largest ship be illuminated in manner befitting the progress shown in engineering and val architecture."—*Ill. Eng.* (New York), July.

Arc-Lamp Electrodes of Titanium-Chromium Carbide.—note on a recent British patent (13,518, June 1, 1911) of e British Thomson-Houston Company (General Electric ompany of this country). The object is to increase the e of titanium carbide electrodes by the addition of a all percentage of chromium carbide. An iron tube, osed at the lower end by a plug, contains the mixture. It found that an addition up to 5 per cent of chromium rbide increases the life of the electrode and also slightly creases the candle-power of the arc, but beyond this, ough the life of the electrode is increased, the candlewer slightly decreases. The best results have been tained with a mixture of 95.5 per cent of titanium carle and 4.5 per cent of chromium carbide.—Lond. *Elec. g'ing,* June 8.

Illumination for Coronation.—An illustrated article on ectric-lighting devices installed for the coronation festivis in London.—Lond. *Elec. Rev.,* June 9.

Color in "Blackboards."—A. J. MARSHALL.—A note sugsting that "blackboards" be made from depolished darkeen glass sheets and that the writing thereon be done by llow crayon. The author expressed the belief that such combination would be desirable from the psychological, ysiological and esthetic viewpoints, being somewhat betr than the use of white letters on black background and ich preferable to the use of black letters on white backound.—*Ill. Eng.* (New York), July.

Generation, Transmission and Distribution.

Increase of Connections of German Central Stations 1900 to 1909. G. DETTMAR.—An article giving statisal data on the increase of the connections of German ectric central stations from 1900 to 1909. Only those ations were considered which had been in operation for ore than two years in 1900. The results are based on a tal of 164 stations. A distinction is made between cities different sizes and a general distinction between cities th and without a gas plant. In order to get comparative ures the connections were calculated per inhabitant. The ures given are average connections in watts per intant

WATTS PER INHABITANT

Number of Inhabitants.	Without Gas Plant.		With Gas Plant.	
	1900	1909	1900	1909
Up to 1,000	77	121		
1,001 to 5,000	42	75	[illegible]	114
5,001 to 10,000	33	60	.	[illegible]
10,001 to 20,000	37	[illegible]	30	73
20,001 up to 50,000	.		21	54
50,001 to 100,000	..		17	43
Above 100,000	..	..	[illegible]	66

Some interesting conclusions can be drawn from this table. he rate of increase in the connections during the nine years s been very much higher in cities which had a gas plant an in those which had no gas plant. Moreover, those ies which had no gas plant had in 1900 generally more ectrical connections per inhabitant than those cities which d a gas plant. In 1909 the reverse was true. This shows at in cities which have a gas plant it takes more time in e beginning to get connections for the central stations, t later the increase in the connections is very much higher. As a general result it may be said that the existence of gas plants in cities has no detrimental effect on electric central stations. Another interesting conclusion from the table is the relatively higher value of connections per inhabitant in small cities than in large cities. Statistical data were also compiled concerning the change of gas production from 1900 to 1909. In this time the gas mean production per inhabitant increased somewhat (by about 25 per cent) in German cities with 20,000 to 100,000 inhabitants, while in cities with more than 100,000 inhabitants the figure has very slightly decreased.—*Elek. Zeit.,* May 18.

Electricity in Flour Mills.—W. CRAMP AND B. E. STOTT.—An abstract of a paper read before the National Association of British and Irish Millers. The authors consider first what proportion of the total cost of a sack of flour is attributable to the cost of energy, and state the value to be from 4 cents to 12 cents per sack of flour produced. The amount involved is sufficient to justify a careful consideration of the most economical method for supplying the energy needed. Although the choice of the type of power plant depends upon the size and location of the mill and the cost of fuel, yet it so happens that there is always some part of a mill that can better be driven electrically than otherwise. Since electric lighting is almost universally employed, it is necessary merely to provide a larger generating equipment to supply the additional energy for the mill motors. Essential requirements for flour-mill service are reliability and regularity of movement. The best arrangements for a steam-driven mill are not necessarily best for one driven electrically, and there are, besides, differences in detail which must be allowed for. One of the chief of these is the speed of the line shafts. If motors are to be used to their best advantage, belts and ropes should be avoided wherever possible. This involves raising the speed of the roller mill shafts from 200 r.p.m. to about 350 r.p.m., and the centrifugal and purifier shafts may go even faster. All such auxiliaries as hoists, pumps, fans, etc., should be equipped with individual motors, and the main shafts themselves are usually most satisfactory if split up so that one or more motors drive the roller mills and other motors are arranged to drive the purifiers, centrifugals, etc. There is no reason why, by proper electrical connections, the whole of the motors in the mill should not start at one time; and when the miller has his own generating plant they may be arranged to start up all together in absolute synchronism with the engine. Certain general conclusions are drawn from figures given in the paper. Since electricity can rarely be supplied in large quantities at less than 0.6 cent per kw-hour, and in small quantities at less than 1 cent, it seldom enters as a competitor against steam, gas and oil. Turbo-electric drives are of value only for large mills, where, however, they stand pre-eminent. For country mills suction gas and oil are about equal, and when ground space and cleanliness are of importance the Diesel engine is to be preferred. For increasing the power and economy of existing plants the exhaust-steam turbine is often of value, but it will not as a rule justify its inclusion in a new plant. Of electrical systems the three-phase is to be preferred for all purposes—even where only part of the plant is driven electrically.—Lond. *Electrician,* June 16.

Series System in Mines.—DINOIR.—A discussion of the use of the high-tension direct-current series system of Thury in mines, its advantages and limitations.—*Bull. et Compt. Rend. Mens. Soc. de l'Ind. Min.,* March, 1910, page 233; abstracted in *Elek. Zeit.,* May 11, 1911.

Traction.

Protection of Gas and Water Pipes Against Stray Currents from Electric Tramways.—The complete report of the stray-current committee appointed jointly by the German Association of Electrical Engineers, the German Society of Gas and Water Engineers and the German Tramway and Light Railway Society. The report is signed by Messrs. Besig, Buschbaum, W. H. Lindley, Michalke and

Otto. The regulations are accompanied by notes and explanations. The regulations are to be enforced only for direct-current tramways and railways which use the rails as conductors and where the rails are less than 200 m (656 ft.) from a gas pipe or water pipe. The regulations are not to be enforced where the rails are laid insulated on a special track. The rails should form as much as possible a continuous conductor. The resistance of a length of track, including joints, must not be more than 20 per cent higher than the resistance of a continuous rail of the same length, the same cross-section and the same electric resistivity as the rail. The rails of one track, as well as of several tracks near together, must be connected at least at every tenth joint by a cross-connection with a conductor equivalent to a copper wire of 80 sq. mm (0.124 sq. in.) cross-section. Special arrangements must be made at drawbridges, etc. Concerning the voltage drop in the rails a distinction is made between districts in cities in which there is a network with many branches and suburban lines. In the city itself (of course, only as long as there are gas and water pipes at a distance of less than 200 m from points of the rails) the potential difference between any two points of the tramway system must not be more than 2.5 volts. On the suburban lines the voltage drop must not be more than 1 volt per kilometer (1.61 volts per mile). The transition resistance from rails to earth should be as high as possible, but no figure is specified. To increase the transition resistance between rail and earth it is recommended to place the rails in ground of poor conductivity and well dried. The use of salt for melting ice or snow should be limited to cases of absolute necessity. The distance of the rails from the water and gas pipes in proximity should be as great as possible and "if possible at least 1 m (3.3 ft.)." The corrosion of water and gas pipes is considered to depend essentially on the current density at those points where stray currents pass out of the pipes. If this current density is more than 0.75 milliampere per square decimeter (0.0484 milliampere per square inch) the pipe is considered to be in danger and special precautions of protection should be taken. For potential measurements at regular intervals testing wires should be provided to different points of the network.—*Elek. Zeit.*, May 25.

Installations, Systems and Appliances.

Magnetic Switch Control System.—C. Pirtle.—A paper devoted to the operating characteristics and practical applications of a series-wound magnetic switch which provides automatic current-limit acceleration without the use of separate relays. This switch was described on page 107 of our issue dated July 8.—*Jour. Eng. Soc. of Penn.*, June.

Tariff and Central-Station Finances.—Norberg-Schulz.—An article giving statistical data from central stations in Norway showing that for these stations the receipts of the station per installed kilowatt approach a value of about $25 when the rate charged per kw-hour is more and more reduced.—*Elek. Zeit.*, June 8.

Regulations.—H. Taaks.—A critical discussion of the government regulations for electric lighting and motor service installations in the kingdom of Württemberg in Germany.—*Elek. Zeit.*, May 18.

Use of Electricity in Medicine.—S. Turchini.—A review of the present situation of the use of static and galvanic electricity in medicine.—*La Lumière Elec.*, May 27.

Wires, Wiring and Conduits.

Aerial Conducting Structures.—A note on a recent British patent (2242, June 8, 1911) of H. Lange. As a substitute for metal wires for aerial conducting structures use is made of metal ribbons. Formerly marginal radiation was prevented at the expense of increasing the solidity of the structure, by shaping it with beaded edges and inserting wires or cords, which need not be very thick to be sufficiently solid, and yet the thicker the wire the better the radiation. In this invention the inserted material is made of hemp or cotton, which is a favorable form to prevent radiation and at the same time gives sufficient solidity. T[illegible] metal ribbon may be bent round one or more ropes made [illegible] the above material, and the thickness can be chosen s[illegible] that the ribbons bent round them in no place show sm[illegible] radii of curvature without increasing the weight as in [illegible] case of the inserted metal. This method gives a grea[illegible] flexibility to the structure.—Lond. *Elec. Eng'ing,* June [illegible]

Impregnated Poles.—F. Moll.—A review of results [illegible] tained in recent years with different methods for impr[illegible] nating wooden poles. The author thinks that the old me[illegible] ods of creosote impregnation and of impregnation w[illegible] corrosive sublimate are the best and will hardly be repla[illegible] soon by others.—*Elek. Zeit.*, May 25.

Electrophysics and Magnetism.

Spark Voltage of Alternating Currents.—W. Wicker[illegible] A long paper giving the results of experiments with num[illegible] ous diagrams. As is the case with direct current and l[illegible] voltages, so with alternating current and high voltag[illegible] sparks may occur not only initially when there is the f[illegible] visible discharge, but also when one form of discha[illegible] passes over into another form. With alternating curr[illegible] this latter case is especially fulfilled when the limit of [illegible] brush discharge is reached. These two kinds of format[illegible] of sparks are entirely different in the manner in wh[illegible] they depend on the form of the electrodes, on atmosphe[illegible] conditions, on humidity, on frequency, etc.—*Elek. Ze[illegible]* May 4 and 11.

Number of Electrons in the Atom.—H. A. Wilson[illegible] From theoretical considerations the author concludes t[illegible] the number of electrons per atom is eight times the ato[illegible] weight.—*Phil. Mag.*, June.

Electrons.—W. F. G. Swann.—A highly theoretical n[illegible] on the longitudinal and transverse mass of an electron[illegible] *Phil. Mag.*, June.

Electrochemistry and Batteries.

Conductivity of Acids.—E. P. Wightman and Ha[illegible] C. Jones.—A report of an experimental investigation [illegible] the conductivity and dissociation of organic acids in aq[illegible] ous solution between zero and 35 deg. The authors fo[illegible] that the temperature coefficients of conductivity, expres[illegible] in conductivity units, increase rapidly with dilution [illegible] decrease rapidly with rise in temperature for weak orga[illegible] acids—when not hydrated. When the acids are hydra[illegible] the temperature coefficients of conductivity are larger [illegible] their increase with dilution and decrease with rise in te[illegible] perature both take place at a slower rate. Organic ac[illegible] with the largest constants also have the largest temperat[illegible] coefficients of conductivity expressed in conductivity un[illegible] —*Amer. Chem. Jour.*, July.

Electrometallurgy in Norway and Sweden.—Jos. Richards.—An illustrated paper describing the elect[illegible] metallurgical revolution in the iron and steel industry [illegible] Norway and Sweden. Claiming that the conditions [illegible] Canada are very similar to those of Norway and Swe[illegible] the author predicted interesting electrometallurgical de[illegible] opments in Canada in the near future.—*Proc.* Eng. S[illegible] Western Penn., May.

Units, Measurements and Instruments.

Frequency Meter.—H. Abraham.—A description o[illegible] new frequency meter the principle of which is shown [illegible] Fig. 2. The electromagnet 1 is connected in series wit[illegible] resistor of small resistance 2 across the terminals PP' [illegible] the network, the frequency of which is to be determin[illegible] A second circuit connected to PP' consists of a resistor [illegible] high resistance 3 and a small mutual-inductance coil [illegible] without iron. On account of the high self-induction of [illegible] electromagnet the current in the first circuit (in 1) is [illegible] time-quadrature with the emf of the network, while [illegible] current in the second circuit (in 3) is in time-phase w[illegible] this emf. The moving coil 6 is in series with the resist[illegible] of the first circuit and the secondary 5 of the mutual [illegible] ductance coil in the second circuit. The emfs in 2 an[illegible] would tend each to produce rotations of the moving [illegible]

in opposite directions, but they oppose each other and the instrument is so adjusted that the moving coil remains at rest (the needle being on zero) for the normal value of the frequency. When the frequency of the network varies the effects no longer compensate each other, since one decreases as the other increases. The equilibrium is thereby dis-

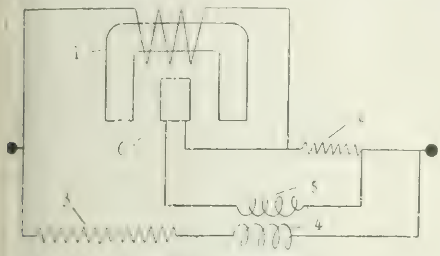


Fig. 2—Frequency Meter.

turbed and the moving coil is deflected in one or the other direction according to whether the frequency increases or decreases.—*Bull. de la Soc. Internat. des Elec.*, March; abstracted in *La Lumière Elec.*, May 13.

Energy Measurement in High-Tension Arcs.—J. ZENNECK.—If the energy consumed in high-tension arcs (such as are used in connection with the method of fixation of atmospheric nitrogen developed by the Badische Company) is determined by means of measuring transformers, serious errors may occur even with precision instruments. The cause is to be found in the electrical properties of the alternating-current arc. In the present paper the author shows that it is the direct-current component of the arc voltage which is at the bottom of the errors of measurement.—*Phys. Zeit.*, May 1.

Exhibit of Apparatus.—J. REYVAL.—The conclusion of his illustrated report on the recent exhibition of instruments and apparatus of the French Physical Society in Paris.—*La Lumière Elec.*, May 13.

Single-Phase Induction Meter.—A long and fully illustrated description of a new single-phase induction meter of the Allgemeine Elektricitäts Gesellschaft.—*La Lumière Elec.*, May 13.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—G. MARCONI.—An illustrated account of a lecture delivered at the Royal Institution, London, and noted on page 1592 of our issue dated June 22, 1911.—Lond. *Elec. Review,* June 16 and 23.

Electric Transmission of Signals on Board Ship.—F. SECHTING.—An illustrated description of a new alternating-current system of transmitting signals on board ship. The principle is that the transmitter produces a phase difference and the indication of the receiver depends on this difference. Two different types of transmitters are described and the details of the system are given with many illustrations.—*Elek. Zeit.*, May 25 and June 1.

Wireless Telegraphy.—E. BELLINI AND A. TOSI.—An article on the use of their wireless telegraph system for communicating between coasts and ships at times of fog. It is possible either to place the dirigible telegraph instruments at the coast and the ordinary receiver on the ship or to use the reverse arrangement. In case the ships are provided with dirigible receiving systems the authors use their "compas azimutal hertzian."—*La Lumière Elec.*, May 27.

Miscellaneous.

Electric Dust Figures.—J. ROBINSON.—The author shows that the formation of electric dust figures can be explained by Koenig's theory that they are due to sound waves emitted by the electric spark.—*Phys. Zeit.*, June 1.

Rules for Firemen.—Rules in force in Saxony, Germany, for firemen when fighting fires in the proximity of electric installations.—*Elek. Zeit.*, June 1.

Austria and Hungary.—Statistical tables on the imports and exports of electrical apparatus into and from Austria and Hungary in 1910. Both imports and exports have increased.—*Elek. Zeit.*, June 1.

BOOK REVIEWS.

THE SEVEN FOLLIES OF SCIENCE. By John Fin. Second edition. New York: D. Van Nostrand Company. 231 pages, 34 illus. Price, $1.25.

The first edition of this popularly written work on paradoxes and scientific "follies" appeared in 1906. The present edition contains fifty-six pages of new matter in which are briefly treated such subjects as: That most great discoveries are made by accident; that lightning never strikes twice in the same place; that powdered glass is a poison, etc. The last six pages are devoted to words which convey erroneous ideas, such as galvanic battery, sparrowgrass, Jerusalem artichoke, etc.

* * *

ELEKTROMOTOREN, UMFORMER UND ELEKTRISCHE MOTORANTRIEBE. Second edition. By Dr. Niethammer. Leipzig: S. Hirzel. 469 pages, 604 illus., including twenty-five plates. Price, 20 marks.

The present is Vol. IX of a series entitled "Handbuch der Elektrotechnik," and is an elaborate and carefully prepared treatise on electric motors and their applications. The principal divisions of the book are as follows: Direct-current motors; single-phase and polphase motors; converters; selection of motors; motor applications; outline of the utilization of motors in factories.

The work will be of great interest and value to advanced students in motor and converter design, as well as to practising electrical engineers installing motors. The descriptions are clear and the illustrations excellent. Much practical information is offered concerning the applications of motors.

* * *

DYNAMOBAN. By Karl Pichelmayer. Vol. V of "Handbuch der Elektrotechnik." Leipzig: S. Hirzel: 745 pages, 432 illus., including twenty-four plates. Price, 36 marks.

A very extensive and compendious treatise on the construction of dynamo machinery, elaborately prepared and illustrated. Some of the plates of machines might serve as working drawings. The work is divided into thirteen main chapters and numerous subdivisions of the same. The subjects dealt with in these main chapters are as follows: Introduction; materials for construction; fundamental principles; windings; computation of the emf induced in windings; commutation in direct current machines; simple magnetic circuits; complex magnetic circuits; losses and efficiencies; temperature elevations; design of dynamos and transformers; mechanical design and construction of dynamos; descriptions of particular types of dynamos and transformers.

There have been no pains or expense spared in the preparation of this fine treatise on dynamo machinery. The book will be very valuable to advanced students of dynamo design and to constructing engineers.

* * *

PRINCIPLES OF WIRELESS TELEGRAPHY. By George W. Pierce. New York: McGraw-Hill Book Company. 350 pages, 235 illus. Price, $3.

A textbook on wireless telegraphy suitable for college students and specialists. The author presents a very useful treatise containing many of his own experimental researches. Especially full treatment is given to the subjects of crystal rectifiers and wave meters. The descriptions

are definite and clear, the diagrams simple and easily followed. Altogether the book is one of the best treatises on wireless telegraphy which have been published in the English language.

* * *

Beispiele und Uebungen aus Elektricitat und Magnetismus. By Prof. Dr. Robert Weber. Leipzig: B. G. Teubner. 330 pages, 69 illus. Price, 5.25 marks.

An excellent book either for the classroom or for the private study of electrical and magnetic principles as employed in electrical engineering. Nearly 900 questions or problems are given in the book on consecutive topics in electricity and magnetism. The solutions of these problems are either worked out directly in the text or they are clearly indicated. The book has a very evident field of usefulness and will be much appreciated by a large number of stud ts of elementary electrotechnics.

* * *

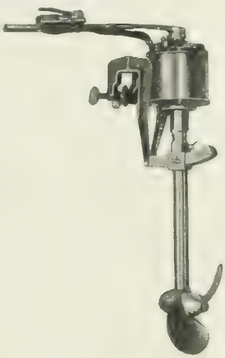
Wireless Telephones. By J. Erskine-Murray. i w York: The Norman W. Henley Publishing Comp y. 68 pages, 17 illus. Price, $1.

An elementary and descriptive little handbook show g how wireless telephones work. The following are the ch ter titles: How we hear; historical; the conversio sound into electric waves; wireless transmission; the duction of alternating currents of high frequency; how electric waves are radiated and received; the receiving i struments; detectors; achievements and expectations; g sary. The treatment is clear and simple, no algebra b g used. The book will be of interest to the educated publi

New Apparatus and Appliances

ELECTRIC BOAT PROPELLER.

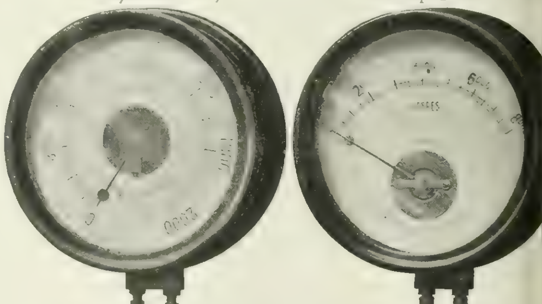
The electric boat propeller illustrated herewith is detachable and may be applied to high or low boats, boats with straight or slanting sterns, or can be attached to the side of a boat if desired. The device is the invention of Mr. J. E. Haschke, of Chicago, who has had wide experience in storage-battery and electric-launch work. A small motor is mounted vertically, and its armature is attached to the propeller shaft by worm gearing, with a reduction of 1 to 4. It is provided with a steel magnetic frame and is series-wound, with field coils in sections for speed control. No resistance is used in the three-speed controller. A reverse switch on the controller permits reversing the boat. Two portable storage batteries, each consisting of three cells, will operate a three-passenger boat, it is said, at the rate of 5 miles an hour for six hours. For larger boats having carrying capacity for as many as five passengers an extra 6-volt battery is used; or, if it is desired to operate the smaller boat at 6 or 7 miles an hour, the three batteries may be used. The weight of the propeller unit is 35 lb., and each battery weighs about 40 lb.



Electric Boat Propeller.

SWITCHBOARD METERS.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a complete line of 7-in. and 9-in. meters for switchboard use. The alternating-current meters are built as ammeters, voltmeters, wattmeters, power-factor meters, frequency meters and synchroscopes, while the corresponding direct-current meters are built as ammeters and voltmeters. The scales of both sizes alternating-current meters are $14\frac{1}{2}$ in. long, but this l scale feature is not depended on alone to make the me easily readable. Instead of the usual metal front, a glass front is used, which makes it possible thoroughl illuminate the dial from the front without troublesome flections. The features of compactness and readability the 7-in. meters, combined with the damped indications



Figs. 1 and 2—Ammeters.

improvements in the electrical design, mark an advanc n switchboard meter practice. The 9-in. meters embody e same improvements and meet the demand for a larger m where economy of space is not a prime consideration. meters have no moving coils or connections, as they ope e on the induction principle. The construction of meters n this principle has a number of inherent advantages.

Fig. 3—Ammeter Movement.

Fig. 4—Ammeter-Moving Eleme

absence of a moving coil makes the use of flexible or sl ing conductors unnecessary and greatly simplifies the c struction so that repairs are easily made. The lightnes of the moving element makes the likelihood of damage to e pivot jewels remote and reduces jewel wear to a minim. It is well known that the proximity of heavy busbars aff s

oving coil and moving iron instruments, even when special ernal shields or iron cases are provided. Freedom from e effects of external field, and high torque, are among the vantages gained by utilizing the induction principle. This inciple has now come to be recognized as the most practable principle in the case of alternating-current watt-hour eters, and it is reasonable to assume that the induction icating instruments will assume the same position for

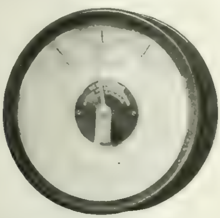


Fig. 5—Frequency Meter.

itchboard service. A feature of the meters is the damped racter of the readings. The pointer does not overshoot, en with full scale variation. This result is obtained by viding a special damping disk moving in the concentrated gnetic field of two permanent magnets. Compared with a dampers this method is asserted to be not only more cient, but so rugged in construction as to be practically olproof." High torque is developed in the meter, and s makes possible the use of a controlling spring of special ay, tempered and artificially aged to insure permanence ler all conditions. Simple zero and calibrating adjustnts are provided. Extremes in weight have been avoided these instruments, and wherever the principle of operan permits the weight has been made as small as posle consistent with substantial and serviceable construcn. To this end the movement is made self-balancing to id the use of counterweights, the weight of the control ing is carried on the stationary support, all moving parts ept the shaft are of aluminum, and the pointer is an minum punching of U-cross-section. The fact that the ter element can be removed from the case as a unit ows all parts to be inspected without changing the calibran. The parts can be easily removed and replaced, and absence of moving coil or flexible connections makes s possible without danger of damage. The previous dens of Westinghouse indication meters have been revised eliminate the effects of temperature changes, either of the or of the meters themselves, and inaccuracies due to iations in frequency. The frequency meters, powertor meters and synchroscopes are of the well-known

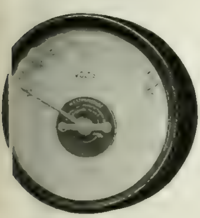


Fig. 6—Voltmeter

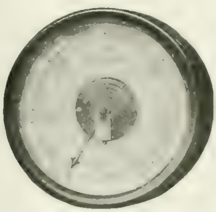


Fig. 7—Wattmeter.

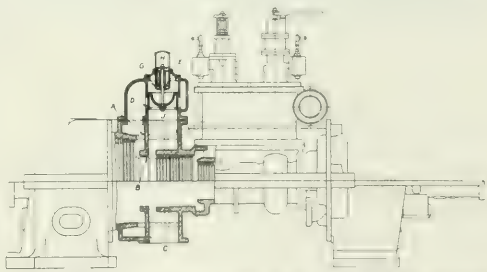
stinghouse types with the added improvements developed the rest of these lines.

he direct-current meters supplement the line of alternatn-current meters and match them very closely in appeare. They have glass covers, the same types of cases and ilar dial appearance, with scales 8 in. long. The meters rate on the D'Arsonval principle, but differ, however, m most meters employing this principle in having only one gap in the magnetic circuit. The moving coil is pivoted at one edge, incloses a circular pole piece, and the other moves through the air gap. With this construction the moving element can be removed and replaced without disturbing the magnetic circuit, and the entire magnetic circuit is magnetized, "aged" and tested as a unit, thus preventing any variation in the strength. The shape of the permanent magnets is such as to shield the meter from external magnetic fields and make it free from the effects of nearby conductors. The moving coil is mounted on a light metal frame, the motion of which in the air gap of the magnets produces a damping effect that makes the readings practically dead-beat. As the coil is pivoted at one edge, its weight counterbalances that of the pointer, resulting in a naturally balanced moving element. This leads to long life of pivot jewels and accuracy of reading. The meters have high full-load torque. The dials of all the meters are hand-calibrated on white cards, thus insuring accurate scales. The divisions are clear and open and the figures large and distinct.

AUTOMATIC BLEEDER TURBINE.

During the recent meeting in Pittsburgh of the National District Heating Association the members of that body visited the works of the Westinghouse Machine Company, where the detail features were exhibited of one of that company's new developments in steam-turbine design, known as the automatic-bleeder turbine.

Its principal advantages result from always using the steam economically before diverting it to the heating system and at the same time being capable of automatically supplying large quantities of atmospheric or low-pressure steam for central distribution or industrial applications without affecting its electrical output.



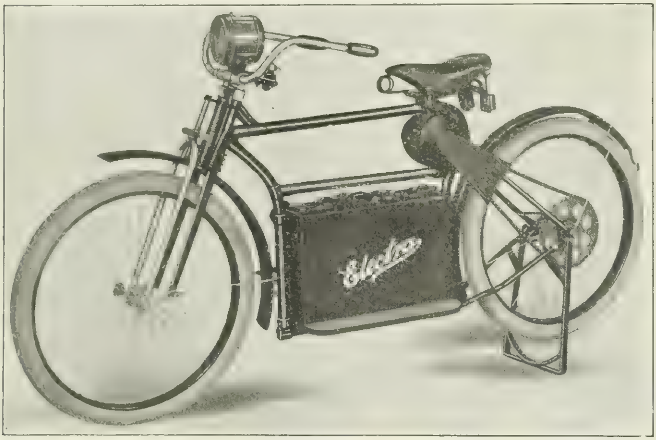
Steam Turbine with Bleeder Connection and Constant-Pressure Valve.

A diagrammatic sectional detail is shown in the accompanying illustration. Generally, the design of the bleeder turbine closely resembles the standard Westinghouse single-flow construction. The division wall *A* is introduced and strip packing provided at *B*, forming a labyrinth with no mechanical contact. Thus the steam leaving the intermediate stage may flow into the heating system through the nozzle *C* or else, with a reduced heating demand, a part of the steam passes through the valve *D* and performs work in the low-pressure section. The automatic valve *D* is controlled by a predetermined pressure in the heating system and the requisite balancing dead weight on the upper side *H*. The piston *E*, inclosed in an oil-filled chamber *G*, is provided to dampen any sudden movement due to pressure fluctuations. Thus if the pressure in the heating system is fixed at 18 lb. absolute and the pressure at the end of the intermediate stage tends to rise, due to an increased turbine load, the valve opening will increase, by-passing a greater portion of the steam to the low-pressure stages. On the other hand, if the load decreases and the

pressure at J falls, the valve opening will decrease until the pressure is again built up to 18 lb.

A NEW ELECTRIC MOTORCYCLE.

Electric motorcycles seem to offer advantages over gasoline machines like those given by the convenient and pleasant electric automobile as compared with the gasoline car. The operator of the electric motorcycle does not have to run half a block to get the thing started, nor does he sit over a heat-emitting "gatling-gun" engine. Mr. F. E. Hatch, of 85 Horton Avenue, Detroit, Mich., has invented the electric motorcycle illustrated herewith, and he declares that it is a practical machine.



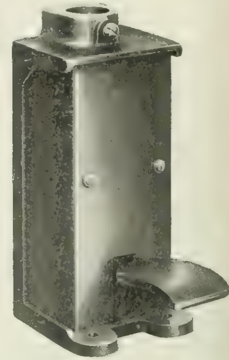
Electric Motor Cycle.

Six cells of storage battery are used to operate the specially designed 12-volt motor, which drives on the rear wheel. The vehicle is said to have a radius of 100 miles per charge on paved streets, and 75 miles over country roads. It is provided with a three-speed controller, by which speeds of 4, 15 and 35 miles an hour may be attained. The weight of the complete outfit is about 200 lb. The battery is mounted low in the frame, and affords a ballast which makes it comparatively easy to learn to ride the machine. The frame is made so that Edison, Exide or any form of standard storage battery may be used.

The seat and the footboard are conveniently arranged, and comfort in motoring is said to be assured to the rider This motorcycle has a 51-in. wheel base, and the motor is provided with ball bearings and is noiseless. The brake is of the external band type, and the spring fork is cushioned.

FOOT SWITCHES FOR TELEPHONE TRAIN-DISPATCHING CIRCUITS.

On telephone train-dispatching circuits the stations are all connected to the same wires and there may be on such a line any number of telephone sets up to sixty or seventy. For conditions like this, where it is possible for any number of these stations to be listening in upon the circuit simultaneously, and where quite frequently from four to six stations are called in to receive orders, special high-efficiency transmission apparatus is required. The Western Electric Company has solved this problem by the use of a switching device. In the normal position of this switch the most efficient circuit for receiving is obtained, and when the switch is thrown the most efficient circuit for transmitti is cut into service. At many stations it is considered prefe able to have the operator work this switch by his fo rather than to use a key which he must throw with his har The advantage of the foot switch is obvious in that it leav both hands free for other purposes. This foot switch shown herewith. It consists merely of a cast-iron case which the switch springs are mounted and from which lever projects to operate the springs. Another advanta of the foot switch is that it makes for greater speed in t use of the telephone apparatus. For this reason it is large used in connection with the special types of telephone ar



Foot Switch.

with which an operator does not have to put on any he set nor touch any receiver. These arms were specially (signed for use in interlocking towers, where the operator obliged to get away from the telephone quickly to hanc his levers, and these arms, in combination with the fc switching device above described, form a most efficie telephone equipment for train-dispatching service.

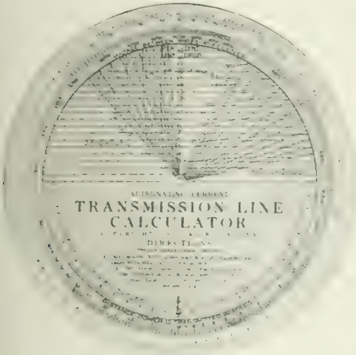
ALTERNATING-CURRENT TRANSMISSION-LINE CALCULATOR.

While the determination of the voltage and energy lo in alternating-current transmission lines and distributi circuits does not present any especial difficulty to the c signer who has frequent use for the necessary tables a formulas, there are many operating engineers and super tendents who are responsible for results and recognize t value of accurate methods, but whose knowledge of t technical details involved has been crowded out of mi by broader executive problems. It is in view primarily the needs of the latter class that there has been devis and is now being placed on the market a simple and rel ble device for calculating the line drop and energy loss alternating-current circuits. This device is called t "Alternating-Current Transmission-Line Calculator," a is made by Mr. Robert W. Adams, 10 Hyde Street, Newt Highland, Mass.

The calculator consists of two disks, a stationary one opaque white celluloid 4⅛ in. in diameter and a revolvi one of transparent celluloid 3 9/16 in. in diameter, e leted to the stationary disk so as to turn easily upon These disks are printed with the necessary diagrams, stationary diagram being in red and the revolving diagr in black to permit of easy reading. The printing is d

by a patented process which renders the lines moisture-proof and non-erasible. The ranges of the various scales are as follows: Load, from 10 kw to 20,000 kw; voltage, from 1000 volts to 50,000 volts; power-factor, from 10 per cent to 100 per cent; distance, from 1 mile to 100 miles; conductor, from No. 8 to No. 4-0; line drop, from 0 per cent to 20 per cent; frequency, 25 cycles and 60 cycles.

In operation it is only necessary to make two settings to obtain the result. The value of "K," which is obtained in the first setting, is a transmission factor depending on the load, voltage and distance of transmission, and this factor is used directly in the second setting to determine the line drop, or "regulation," which is defined as the difference in voltage between the two ends of the line expressed in per cent of the receiver voltage. The method of securing the result includes in an accurate manner the effect of load



Transmission-Line Calculator.

power-factor, which has become increasingly important with the recent remarkable development of motor load, and, furthermore, is easily reversible, a feature which is not possessed by the algebraic methods and one which is of great value where it is desired to obtain the size of wire necessary to produce a given drop.

Complete directions are printed on the back of the calculator, together with a typical example, by following which a person having no technical training whatever may readily learn the method.

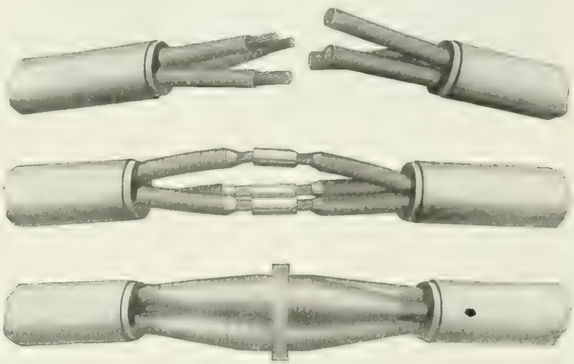
Upon the back of the stationary disk is also printed a convenient reference table giving the weights and costs of bare and triple-braid weatherproof copper wire per mile of two-wire, three-wire and four-wire circuit. This table is new and will prove useful for estimating the cost of proposed lines. Another useful feature is that the two lower revolving scales ordinarily representing distance and transmission factor can also be used as an emergency slide rule for solving problems in multiplication and division. The time required for a person acquainted with the calculator to make a complete determination of line drop is stated to be less than one minute.

The calculator is based on the use of annealed copper wire at 20 deg. C. (68 deg. Fahr.) or hard-drawn copper wire at 15 deg. C. (59 deg. Fahr.), and on three-wire, three-phase, and four-wire, two-phase circuits. Single-phase circuits can be calculated as easily as three-phase, although the device is primarily designed for three-phase circuits as being the most common for transmission work. The diagrams are based on a spacing of 18 in. between wires and are sufficiently correct for all practical work on circuits varying from 6 in. to 48 in. spacing. It is stated that the accuracy of the calculator will compare favorably with similar results obtained by any of the formula or graphic methods, and in all cases will come far within that of the original assumptions of load and power-factor.

MAKING CABLE JOINTS ON UNDERGROUND HIGH-TENSION LINES.

Owing to modern methods it is possible nowadays to use underground potentials in cities which were not considered possible with the materials and methods of construction of a few years ago. The Minerallac Electric Company, of Chicago, has devoted much attention to this important subject, and has produced compounds and tapes which are widely used for this purpose.

First the areas surrounding the cables to be joined should be cleaned and dried as much as possible in order to prevent the introduction of foreign matter. The cables should then be carefully trained and supported in the exact position which they are to occupy after the completion of the joint. In making the joint the materials needed in addition to the



Figs. 1, 2 and 3—Process of Making Cable Joints.

necessary tools are linotape in 1½-in. and ¾-in. widths, semi-liquid compound, semi-solid compound, three copper sleeves for connecting the cables and a lead sleeve for covering the joint. The first three are Minerallac company products.

The two ends of the cable are sawed off so that they will butt squarely together. Next the lead sheath is removed for 8 in. from the end of each cable, and the outer cable paper insulation is also removed to within ¾ in. of the remaining lead sheath.

Directions for Jointing.—Cut back the paper insulation on each conductor about 1⅛ in. from the end. Fig. 1 shows the appearance of the severed cable at this juncture. Clean

Fig. 4—Joint Completed.

and tin the copper of the conductors, always using soldering flux for this purpose. Slip the large lead sleeve which is to be used in covering the completed joint over one end of the cable and back far enough so as to be out of the way. Then insert the two ends of each conductor within the copper sleeves which are to be used as connectors and solder them very thoroughly into their separate sleeves by pouring melted solder over the connections. Remove all excess solder, while hot, with care.

Cut the paper insulation of each conductor ⅜ in. farther back from the copper sleeves in order to remove any material which may have become charred during soldering. Starting 1 in. back from the end of this insulation, taper the paper down to the conductor, as shown in Fig. 2. Then wind the ¾-in. linotape on the section of exposed cable until the diameter is built up to that of the copper sleeve. This wrapping must be applied in such a manner as to fill

the space completely and the semi-liquid Minerallac compound, slightly heated, should be freely applied with a brush between the layers of wrapping in order to exclude the air. Next apply the $1\frac{1}{2}$-in. linotape to the joint, with the compound, as before, the turns overlapping two-thirds of the width of the tape. Continue this wrapping until the insulation around each conductor is built up to a thickness equal to that of the original paper insulation.

Starting at a point on the insulated conductor 3 in. from the lead sleeve on one side of the joint, apply a layer of tape to within 3 in. of the sleeve at the other side of the joint, each turn overlapping the one preceding by one-half the width of the tape. The following layers are started and finished $\frac{1}{2}$ in. nearer the center of the joint than the preceding layer, the completed wrapping forming a cylindrical body of insulation at the center of the joint, with conical ends tapering down to the original paper insulation. The total diameter of this completed cylindrical portion is determined entirely by the voltage of the cable; for example, the diameter of the cylinder should be about $1\frac{1}{2}$ in. for 10,000 volts.

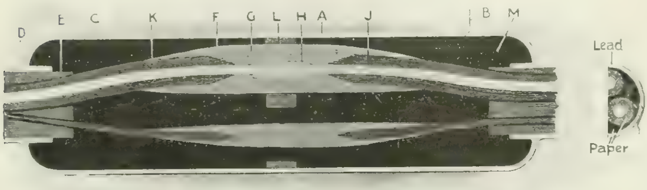


Fig. 5—Section of Cable Joint.

After all three conductors are insulated as described, place a roll of tape $\frac{3}{4}$ in. in diameter between the conductors to act as a spreader. Finally, wind a narrow wrapping, built up to the inside diameter of the lead sleeve, around all of the conductors, in order to hold them together and also to center them within the sleeve. The joint will then appear as shown in Fig. 3.

Slip the lead sleeve into its proper position and fasten the ends to the two cables by "wiping." This must be done in a workmanlike manner in order to insure a water-tight joint. Make a hole about $\frac{3}{4}$ in. square on the top of the sleeve near each end by cutting on three sides and bending back the lead on the fourth side as a hinge. Heat a quantity of the semi-solid compound sufficient to fill the joint completely and pour it slowly into one hole until the joint is full. Leave it undisturbed for half an hour, thus allowing the compound to cool and shrink. When cool, carefully level the joint and pour in more hot compound until it flows from both holes, showing that all voids have been filled. Replace the hinges of lead which were bent back to form the holes and seal carefully by soldering. The completed joint will now have the appearance shown in Fig. 4. If the work is properly done this joint will be as strong, mechanically and electrically, as any other portion of the cable.

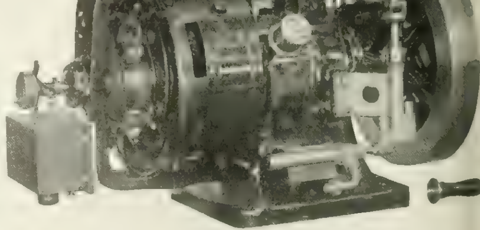
Fig. 5 is a sectional view of a cable joint made in accordance with the foregoing instructions. Referring to the lettering, the various parts are as follows: *A*, lead sleeve which covers completed joint; *B*, opening cut in sleeve through which joint is filled; *C*, opening corresponding to *B*, which has been closed by soldering; *D*, "wiped" joint, connecting the lead sleeve and the sheath of the cable; *E*, paper insulation of cable; *F*, paper insulation of each conductor, showing taper to the copper; *G*, linotape wrapping around each conductor; *H*, copper sleeve connecting ends of conductors; *J*, copper conductor; *K*, paper insulation around conductor; *L*, roll of $\frac{3}{4}$-in. linotape around all three conductors; *M*, semi-solid compound used to fill completed joint.

ONE-KW GAS-ELECTRIC GENERATING SET.

The General Electric Company, which manufactures gasoline-electric generating sets having ratings of 3 kw, 5 kw, 10 kw and 25 kw, has added to this line a 1-kw set which is designed for furnishing electricity for motors and lighting in private residences, small hotels, rural railroad stations, etc., not now served by central stations, and on board boats. This set comprises a single-cylinder, vertical, two-cycle water-cooled gasoline engine direct-connected to a 1-kw direct-current generator. The regulation and steadiness of the voltage of this set are stated to be so good that it is possible to supply current direct from the generator, thus avoiding the expense of installing and maintaining a large battery and the loss of power and troubles incidental to the operation of the latter.

The engine is provided with a suction gasoline pump for lifting fuel from a tank placed underground and located at some distance from the engine, thus fulfilling the requirements of the National Board of Fire Underwriters. The cooling is by a thermo-siphon, thus doing away with the necessity of a pump to provide forced circulation of the cooling water. The governor is located in the engine flywheel and operates a throttle valve, giving very close regulation and satisfactory operation at all loads. The dimensions of this 1-kw set are as follows: Length, 2 ft. $6\frac{5}{8}$ in.; height, 2 ft. 2 in.; width, $17\frac{5}{8}$ in.; total weight, 350 lb.

As it is frequently desirable to install a small storage battery to provide lighting on occasions when the generating set is not running, the General Electric Company manufactures for use with these sets a suitable board for controlling both the generating set and such a battery, as well as two types of switchboard for controlling the set alone. The combination generator and battery switchboard is so arranged that the battery can be charged at the same time that the generating set furnishes power for lamps or motors without affecting the operation of these appliances, while when the battery is fully charged it can be connected with the system so that the generating set can be shut down without interrupting the service.



One-kw Gasoline-Electric Generating Set.

Industrial and Commercial News

The Week in Trade.

Taking into consideration the oppressive weather at the important trade centers, and the natural curtailment of operations resulting therefrom, the record of the week has, in general, been satisfactory. Greater improvement is being shown in the steel trade, not only in the affairs of the Steel Corporation, but also in those of many independent concerns. The monthly statement of the former, showing an increase of 247,000 tons as compared with the report of June 1, was regarded as a most favorable indication of progress in business conditions, particularly in view of the period of the year. In addition to the advices from the steel trade, the report of the Department of Agriculture, showing the condition of crops on July 1, was a feature of great interest throughout the country. The report showed, in spite of appreciable damage to wheat, corn and hay, as a result of the prolonged absence of moisture, that both spring and winter wheat will be well up to the average in total production, and that the amount of wheat in bushels will probably show little variation from the average of the last five years. The outlook for crops as a whole, while under the expectations of the early part of the year, is exceedingly hopeful, and is strengthened by news of rain in cotton and corn belts in the early part of the current week. Owing to the uncertain attitude toward crop conditions, affairs in the West are said to be somewhat weakened, with activity on a diminishing scale, as indicated by cancellation of orders in many lines. The business of the country as a whole is showing signs of improvement, and from present indications the transactions of the second half of the year will be in much greater volume and far more satisfactory than those of the first part. Business failures for the week ended July 6, as reported by *Bradstreet's*, were 180, as compared with 227 for last week, 182 in the same week of 1910, 182 in 1909, 246 in 1908 and 185 in 1907.

The Copper Market.

Reduction of 8,561,768 lb. in copper stocks was shown in the report of the Copper Producers' Association for the month ended June 30, and this was also the chief item of interest in the trade during the week. The decrease was in keeping with the expectations of the trade, and the report as a whole was well received. Production was 124,554,232 lb., a decrease of 2,408,232 lb. in the output as compared with May, and domestic deliveries were 61,665,561 lb., being 2,888,402 lb. less than in the preceding month. Export deliveries were somewhat larger than in June, the total being 71,460,519 lb., representing an increase of 9,481,962 lb. While the decrease in stocks is hopeful, the gain in export business is the most important and encouraging part of the report, for without doubt a large portion of the decrease in surplus copper is due to shifting of stocks. Domestic consumers are still out of the market for large amounts, and such improvement as may be made in the month of July will probably be a result of activity abroad. There is a possibility that July production will show a falling off owing to necessity of curtailing operations at the smelters on account of the extremely hot weather, and such reductions, small as they may be, will be a step in the right direction. Although business has been dull throughout the week, prices are well sustained, and 12¾ cents is being asked for electrolytic. The improvement in the steel trade is regarded as a favorable sign for increased activity in the copper trade, and the attitude is far more cheerful than in recent weeks. Exports for the month, including July 11, were 9,735 tons. The daily call on the Metal Exchange July 11 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.12½	12.25	.....
July	12.15	12.35	12.25
August	12.17½	12.37½	12.27½
September	12.17½	12.37½	12.27½
October	12.17½	12.37½	12.27½

The London market, July 11, was as follows:

	Noon. £	s	d	Closing. £	s	d
Standard copper, spot	57	3	[illegible]	57	[illegible]	0
Standard copper, futures	57	1[illegible]	[illegible]	57	1[illegible]	3

Extreme fluctuations for this year:

	Highest. £	s	d	Lowest. £	s	d
Standard	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
London, spot	£57	10	[illegible]	£53	[illegible]	6
London, futures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
Best selected	61	10	0	57	5	0

Industrial and Commercial Notes.

General Electric Sales.—The Terre Haute, Indianapolis & Eastern Traction Company, of Terre Haute, Ind., has placed an order with the General Electric Company for two 300-kw rotary converters, fifteen 100-kva transformers and a switchboard. The rotary converters and six of the transformers will be installed in the Maywood substation. Six of the transformers will be installed in the Mooresville substation and three in the Martinsville substation. The transformers are oil-cooled, 25-cycle units, 33,000 volts primary and 390 volts secondary, and are provided with 50 per cent starting taps on the secondary. The switchboard will be installed in the Maywood substation and will control the 33,000-volt incoming lines, the bank of step-down transformers and the rotary converters. It will consist of an alternating-current, rotary-converter panel, two direct-current, rotary-converter panels, rotary-converter starting panel, and a blank alternating-current, rotary-converter panel. The ammeter for the incoming line is connected directly in the primary circuit, being insulated with post type insulators for this service. A triple-pole, automatic K-10 oil-break switch protects the transformers. The order includes an equipment of 33,000-volt, three-phase aluminum-cell lightning arresters with horn-gap disconnecting switches.

Republic Railways & Light Company to Make Improvements.—It is stated that the management of the Republic Railways & Light Company, which was recently formed to acquire a large number of traction and lighting properties in Ohio, as described in the *Electrical World*, July 1, plans to spend a large sum of money in improving the conditions of the various properties, and in lowering the costs of operation at many of the plants. It is further stated that about $3,000,000 will be expended for this purpose within the next five years. The improvements will include better equipment in the shops at the various traction properties, additions to existing power stations, double tracking on some of the systems, and various means toward reducing the cost of generating energy. The franchises of the company in Pennsylvania are perpetual, while the city franchises in Ohio were recently renewed for twenty-five years; the interurban franchises are said to expire at various times from 1945 to 1950. The largest power station owned by the company is that at Youngstown, which has a capacity of 6,000 kw. The capacity will be increased in the fall by 4,000 kw.

Allied Machinery Company Making Progress.—Captain G. L. Carden, of the Allied Machinery Company of America, which was recently formed to sell American machinery abroad, as described in the *Electrical World*, June 15, has established a branch office for the company in Paris, and will shortly open a branch office in Vienna. Similar offices will be opened in many other European cities, each of which will be managed by an American with such American assistants as are available, and with such local assistants as may be desirable for meeting the needs of customers in the various sections. C. N. Thorn, manager of the home office, 55 Wall Street, New York City, says that inquiries are being received in good volume, and that many quotations have been furnished to date to prospective customers at the Paris office.

Boston Edison Company Contracts.—Among important lighting contracts received recently by the Edison Electric Illuminating Company of Boston is that from the Hotel Thorndike, in Boston, and a street-lighting contract from the town of Chelsea, Mass. The isolated plant which has been in operation in the hotel for a number of years will be dismantled. The contract with the town of Chelsea is for a period of ten years, and the extension of the mains for this service brings the lines of the Edison company close to the New Hampshire boundary.

Pennsylvania Railroad Urges Economy.—With a view to promoting economy in all branches of its affairs, the Pennsylvania Railroad Company has issued a circular to employees on one of its divisions, outlining the necessity for reduction of expenses, and various ways in which money can be saved for the company by careful attention to details. The idea is applicable to many lines of industry other than the railroads. The circular says in part: "Every employee can assist in accomplishing the desired reduction in expenses. As a practical illustration: If everyone of the 1400 employees of this division would save 10 cents a day for the company, it would mean a total saving of $140 per day, or in the month a total of $4,200, which would go toward paying the increased rates of wages which we are now enjoying. How easy it would be for each employee to do this in his own line of work; engine men in the use of oil; firemen in the use of coal; clerks by economy in the use of stationery and by avoiding errors; trackmen in gathering up old bolts and spikes; shopmen by doing their work properly and thus avoiding breakdowns on the road; warehousemen by loading freight so as to avoid damage; and all employees in many ways which will occur to them in the intelligent performance of their respective duties."

Electrical Industry in Switzerland.—In a report to the Bureau of Manufactures the United States Consul-General at Zurich, Switzerland, Mr. Robert E. Mansfield, states that the electrical industry underwent important changes in the past year. The strong competition of the large German electrical works, with greater capital and a wider field of operation, caused the Swiss manufacturers to form combinations with foreign interests, chiefly to enable them to compete with their more powerful rivals. The activity in the industry during the past few years was largely due to the business of installing hydroelectric plants and equipment for street and interurban railways. Electrical development has been general in recent years, and practically every town, hamlet and community in the country is supplied with electric light and power, while all the street railways and many of the interurban and mountain roads are equipped with electricity. But the local trade is no longer sufficient to support the industry, and it is for the purpose of meeting foreign competition and securing international business that combinations with outside concerns have been formed.

Affairs of American Electric Fuse Company and Its Officers.—It is alleged that the liabilities of the American Electric Fuse Company, of Muskegon, Mich., which was declared a bankrupt on June 30, will amount to over $700,000. Frank G. Jones, president of the company, pleaded guilty to the charge of forging a check for $5,482.64, purporting to have been signed by R. Williamson, of Chicago. He was arrested on the complaint of the Old National Bank of Grand Rapids, Mich., and on July 6 was sentenced to imprisonment for an indeterminate sentence of from four to fourteen years, with a recommendation for ten years. Jones insists that the money raised in what appears to be a remarkable series of forgeries was used in the business of the company, and that he did not profit by it. Charles L. Johnson, of Evanston, Ill., former treasurer of the company, was arrested on July 1, charged with complicity in the fraudulent transactions. Jones is said to have involved Johnson in his confession. The ex-treasurer was released on $7,000 bail pending trial.

Triumph Electric Company Sales.—Orders received by the Triumph Electric Company, Cincinnati, Ohio, during the month of June were as follows: Four motor-generator sets, aggregating 325 kw; 162 motors, aggregating approximately 1850 hp; 103 generators of approximately 4160 kw, three 300-kva alternators, and one synchronizing set. These orders were distributed over fourteen States. The company also reports that it has orders for about 200 motors of various sizes in its shops. A number of inquiries have been received in the past month from foreign countries, including several from India, South Africa, New Zealand and South America. The directors of the company have declared a quarterly dividend of 1½ per cent on the preferred stock, payable July 15. This is the twelfth quarterly dividend paid consecutively. Since moving into its new plant eighteen months ago a handsome gain in business has been shown. The first six months of the present year show a gain of 15 per cent over the same period last year.

Vacation with Pay to Factory Employees.—The Holtzer-Cabot Electric Company, through its president, Charles W. Holtzer, announces that it will give to each of its employees who has been in the company's service ten years or more a week's vacation with full pay in the present summer. The announcement was posted in the Brookline and Boston factories last week and goes into effect as soon as arrangements can be made to enable a certain number of men from each department to leave at the same time. The company employs about 500 mechanics, and of these about 150 will profit by the plan. The offer of Mr. Holtzer comes entirely unsolicited and is said to be without precedent in New England. The action is consistent with the company's settled policy of considerate and kindly treatment of its employees.

New Generating Station in Grand Island, Neb.—Work has been started by the Grand Island Electric Company, of Grand Island, Neb., on a new power station which is to replace the present one, with the exception of the boiler house. This will be retained and will be equipped with new boilers. A 500-kw horizontal Curtis turbo-alternator has been purchased and a new switchboard and other equipment will be provided. A 165-ft. reinforced-concrete stack is to be built by the General Concrete Construction Company, of Chicago, and in addition to the new power plant, a new office building will be erected. B. E. Sunny, of Chicago, is president of the Grand Island Electric Company, and Pierce, Richardson & Neiler are the consulting engineers.

Doherty Plants.—On July 11 the Denver Gas & Electric Company, the Denver Steam Heating Company and the Lacombe Electric Light Company were absorbed by the Denver Gas & Electric Light Company. A 300-kw unit has been purchased for the Citizens' Light, Heat & Power Company, Mt. Vernon, Ill., and a 500-hp Stirling boiler has been purchased for the Easton Gas & Electric Company, Easton, Pa. Work is progressing rapidly on the alterations to the fourteenth floor of No. 60 Wall Street, New York City, the whole of which is now being occupied by the Doherty company, as mentioned in a recent issue. Mr. Doherty, who has been for several weeks in England and Norway, returns Aug. 17.

Allis-Chalmers Cincinnati Plant.—The engineering, purchasing and sales departments of the Bullock electric plant at Cincinnati have been reinstated, and E. T. Pardee, of Milwaukee, has been appointed general manager in charge of all departments. E. R. Knight continues as superintendent. Between thirty and forty people will be transferred from Milwaukee, some of whom were taken to Milwaukee four years ago when the Allis-Chalmers Company took over the active operation of the plant. Hereafter all correspondence in regard to sales will be between the Cincinnati office and the sales agencies of the company, instead of through the Milwaukee office.

Standard Underground Cable Company to Build in Canada.—A branch factory, to cost about $500,000, will be built at Hamilton, Canada, by the Standard Underground Cable Company, of Pittsburgh. The buildings will be of the most recent factory construction, and there will be six in the first set. There will be a three-story brick and structural iron building, 64 ft. x 335 ft.; a one-story saw-tooth building, 60 ft. x 224 ft.; a one-story saw-tooth building, 60 ft. x 250 ft.; two one-story buildings, 64 ft. x 90 ft., and one 30 ft. x 70 ft., and an office building. When the plant is completed, about 500 men will be employed.

General Motors Company to Develop Foreign Business.—A company known as the General Motors Export Company has been incorporated in Michigan to take care of the foreign business of the General Motors Company. The officers of the company are: Thomas Neal, president; Gleason Murphy, first vice-president, and C. B. Bennett, vice-president and general manager. The headquarters of the company will be in New York, and agencies will be established as soon as possible in various cities abroad and in the Latin-American countries.

Otis Elevators for Municipal Building of New York.—Contracts for the thirty-three gearless traction-type elevators for the Municipal Office Building of the city of New York, in the course of construction, as described in a recent issue, have been awarded to the Otis Elevator Company. The bid of the Otis company was $582,000. There was only one other concern in the bidding, but since it did not conform to the requirements by sending a deposit with the proposal, its offer was rejected.

Aluminum Notes and Prices.—The aluminum market, as of July 11, is reported quiet, with ingots for remelting held at 21@22½ cents spot No. 1, the base for large ingots. Rods and wire are held at 31 cents, with sheets at 33 cents.

Financial.

The Week in Wall Street.

TRANSACTIONS on the New York Stock Exchange continue on the narrow scale of recent weeks, with minor changes following the news of the day. The dullr:s of the latter part of the previous week, caused by waiting f the government crop report, was broken at the opening on Monday by news of rainfall in the agricultural districts. Some disappointment from the financial standpoint was found in the gvernment figures when received, and stocks reacted from t advances in the earlier part of the day. On Tuesday a s:ht recovery was made, with the tone of the market strong al the trading largely professional. The strongest issues were t:se of the roads traversing the crop areas, indicating that a:erse crop reports were discounted to a large extent. The bnd market has lost some of its activity, and the falling off

NEW YORK.

	July 1.	July 11.	Shares Sold.		July 1.	July 11.	Shares Sold.
. Ch.	[illegible]*	8½	———	Int. Met., pf.	50[illegible]	50[illegible]	3,[illegible]
Ch. pf..	30	28*	800	Mackay Cos..	8[illegible]*	89*	2[illegible]
[illegible] C. p...	69⅝	69½	45,100	Mackay C., pf.	74[illegible]*	7[illegible]	2[illegible]
D. T...	20[illegible]*	20[illegible]	———	Man. Elev...13[illegible]*		13[illegible]*	———
I[illegible]...	40¾	41	———	Met. St. Ry..	15*	1[illegible]*	———
I[illegible] pf	109*	109*	———	N.Y.&N.J.Tel.	13[illegible]*	139½	— —
L[illegible] & C.	80*	80*	———	Steel, com...	78[illegible]	7[illegible]	14[illegible],500
T & T.	139[illegible]	138⅞	9,325	Steel, pfd..	118¼	118[illegible]	2,050
I. R. T.....	81½	84	18,600	W. U. T....	78[illegible]	81	1,[illegible]
[illegible] Elec...	161¼	163	3,525	West'h, com.	76*	76	4,250
I Met.....	17⅞	18	1,100	West'h, pfd..	119*	119*	———

PHILADELPHIA.

	July 1.	July 11.		July 1.	July 11.
. Rys	43¾*	44	Phila. R. T........	1[illegible]	20¾
I Co. of A........	12[illegible]*	[illegible]2¾*	Phila. Elec........	17[illegible]	17[illegible]
[illegible] St. Ry......	53¾	54[illegible]	Phila. Trac........	86[illegible]*	86¼
[illegible] St. Ry., pfd..	30*	30*	Union Trac........	49[illegible]	50

CHICAGO.

	July 1.	July 11.		July 1.	July 11.
C. City Ry........	186*	186*	Chi. Tel. Co.......	124½*	124[illegible]*
C. Rs., Ser. 1....	87½*	87½*	Met. El. Co........	27*	27*
C. Rs., Ser. 2....	26½	26	Met. El., pfd......	73½*	74[illegible]*
Cn. Edison........	130	136	Nat'l Car..........	120*	114*
[illegible]ways.......	4	3⅞	Nat'l Car, pfd......	118[illegible]*	118

BOSTON.

	July 1.	July 11.		July 1.	July 11.
. T & T.........	139⅛	138[illegible]	Mex. Tel..........	4½*	4½*
[illegible] Tel...........	156½*	158*	Mex. Tel., pfd......	6[illegible]*	7*
[illegible] E. Ill.......	283	281¾*	N. E. Tel..........	146[illegible]	145
[illegible]...........	161½*	163	W. T. & T........	18½*	20
[illegible] E. Ry........	22¾	23½	W. T. & T., pfd...	96*	96*
[illegible] E. Ry., pf....	93½	95			

Last price quoted.
Shares sold for the week, July 3 to July 8.

i attributed to temporary satisfying of the prolonged investmnt demand. The stock market in the past few weeks has bn dominated in the main by crop reports, and to a mild ebent by the disturbances in Morocco and political apprehensns. Prices abroad broke sharply upon the dispatching of a German vessel to the seat of trouble, and the heavy selling of international stocks for European accounts assisted in weakenir the market. A fair degree of optimism was engendered by t: improvements reported in the steel and copper trades, and ao by belief that rains in the early part of the week in the ar.cultural districts will cause better yields than indicated by t: government report. Resumption of work in a number of industries following annual shut-downs for inventories and reprs, together with the possibility of an early adjournment of Congress, were regarded as favorable incidents of the early pt of the week. The money market shows few changes. Rates Jy 11 were: Call, 2⅜@2½ per cent; ninety days, 2¾@3 per ct. The quotations in the tables are those of the close July 11.

Financial Notes.

American Power & Light Company. — The directors of t: American Power & Light Company, which is controlled b the Electric Bond and Share Company and affiliated intests, have authorized an issue of $2,200,000 ten-year 6 per ct gold notes. The notes will be dated Aug. 1, 1911. Holdc of preferred stock and voting trust certificates for common stock as of record July 24 will be allowed to subscibe at par to the extent of 25 per cent of their holdings. e right to subscribe will expire at the close of business on Spt. 1, 1911. The notes will be redeemable as a whole upon ay interest day at 102 and interest. Each note is to be accmpanied by what is known as an option warrant entitling the hlder to receive a certificate for shares of the common stock c an aggregate par value equal to the principal of the note at ay time before Aug. 1, 1921, upon the surrender of the optn warrant and the delivery of the note, or upon the surrender of the option warrant and payment in cash for the stock at par. The entire amount of notes offered to stockholders has been underwritten by the Electric Bond & Share Company. The notes will be issued to provide partly and temporarily for a floating debt amounting to $3,359,221 and later to increase working capital. This debt was made by purchasing water rights and lands; advances made to the Pacific Power & Light Company; by purchasing $400,000, par value, of the preferred stock of the Kansas Gas & Electric Company and an expenditure to provide for future growth in business. Both the Pacific Power & Light Company and the Kansas Gas & Electric, together with the Portland Gas & Coke Company, are controlled by the American Power & Light Company through the ownership of common stock. The American Power & Light Company has issued to its stockholders a report showing that for the year ended May 31, 1911, the total income was $749,705; expenditures, taxes and interest, $366,495; net earnings, $383,210; subsidiary companies undivided surplus earnings, over dividends paid, accruing to the benefit of American Power & Light Company, $223,896; total net income, $607,106; American Power & Light Company's preferred dividend paid (6 per cent), $168,674; amount transferred to reserves, $50,000; total deductions, $218,-674; surplus, $388,432; previous surplus, $238,920; total surplus, $627,352.

Consolidation of Independent Telephone Systems in Northwest.—The State Public Utilities Commission of the State of Washington is reported as making plans for a consolidation of the independent telephone companies operating in Seattle, Tacoma and Spokane. In this connection, Charles M. Fassett, commissioner of public utilities of Spokane, is quoted in part as follows: "The State Commission has already broached the matter to officials of the Bell and Home systems. How the consolidation will be accomplished, if it is in the end, there is no telling, as the proposition is merely tentative so far. Either an actual consolidation of the two companies or a working agreement by which the subscribers on one system can connect with subscribers on the other is the object sought. I understand that Bell officials have already signified their willingness to take over all the Home lines, providing the State Commission can show them a way to do so and still make dividends for their stockholders. Bell officials have said that to take over the Home lines now would mean that a raise in rates on both systems would have to result. The Public Utilities Commission estimates that the dual systems at Seattle are costing the people an unnecessary $1,000,000."

Public Utility Merger in Pennsylvania.—Announcement is made that the West Penn Traction Company has acquired the electric-light and power properties of the Van Horn Ely Syndicate. The transaction includes all the lighting plants in Washington and Greene Counties, together with many charters held by these companies but never utilized. Various companies operating at Edgeworth, Sewickley, Woodlawn, Aliquippa, Ambridge and neighboring localities are included. The West Penn Traction Company is said to have paid some $2,000,-000, for which bonds will be issued. New York, Pittsburgh, Baltimore and Philadelphia bankers have formed a syndicate to underwrite these bonds. The acquisition of these properties means an increase of over 100 per cent in the scope of operation of the West Penn company.

Central Hudson Gas & Electric Bonds.—The Public Service Commission for the Second District of New York has authorized the Central Hudson Gas & Electric Company to issue the $1,400,000 5 per cent thirty-year bonds, permission for which was recently applied for as referred to in the issue of July 1. These bonds are to cancel $600,000 bonds of the Poughkeepsie Light, Heat & Power Company, $700,000 bonds of the Newburg Light, Heat & Power Company, and $100,000 bonds of the Hudson Counties Gas & Electric Company. In addition to issuing the foregoing the Central Hudson Gas & Electric Company has been authorized to issue $600,000 bonds for meeting certain obligations of the company, incurred for capital purposes. These are to be issued at not less than 95¼.

Federal Receiver for United Wireless Telegraph Company.—In order to co-ordinate the affairs of the United Wireless Telegraph Company, a federal receiver has been appointed to supersede a number of state receivers who were appointed following conviction of several officers on charges of fraud as was mentioned in a recent issue of the *Electrical World.*

Union Gas & Electric Company. — Accompanying the checks sent out a few days [illegible] for dividends on the preferred stock of the Union Gas & Electric Company was a long letter explaining the financial conditions of the company, its plans for the future and a statement of the business it is doing. Among other things the letter said: "The net earnings for the eleven months ending May 31, 1911, were $282,676.41. The estimated earnings for June, 1911, are $25,000, making a probable total for the year ending June 30, 1911, of $307,676.41. Your company is entirely free from debt and has ample working capital. When it started business on Sept. 1, 1906, there were 51,769 gas consumers. There are now 87,040 gas consumers, an increase of 35,271. In 1906 the company was manufacturing artificial gas, which was sold at an average price of 67 cents per 1000 feet. The company was threatened with competition, and the first aim of your management was to forestall and put your company in an impregnable position. In the electrical department the earnings have shown a steady increase, notwithstanding the introduction of tungsten lamps has materially curtailed the consumption of current. The loss in this direction, however, has been overcome by an extension of the service, so that the net profits have shown a steady increase. We have just entered into an advantageous contract with the city of Cincinnati for a period of ten years. This contract carries with it some valuable rights which are of material benefit to this company."

Public Utility Offerings.—Among investment bonds for July funds offered by Perry, Coffin & Burr are those of a number of public utility companies in various parts of the country. First mortgage 5 per cent gold bonds of the Southern Power Company, due March 1, 1930, are offered at 100, and interest yielding 5 per cent; first mortgage collateral trust 5 per cent bonds of the El Paso Electric Company, due January 1, 1932, are offered at 98 and interest yielding 5.15 per cent; general mortgage 5 per cent bonds of the Southern California Edison Company, due November 1, 1939, are offered at 96 and interest yielding 5.27 per cent. Among other bonds offered by this firm are those of the Boston & Northern Street Railway Company, Old Colony Street Railway Company, Utica Gas & Electric Company, Oregon Electric Railway Company, Consumers' Power Company, Pensacola Electric Company, and the Texas Traction Company. Estabrook & Company are offering $1,000,000 three-year, 5 per cent gold notes of the Columbus Electric Company, of Columbus, Ga. These are due July 1, 1914, and are callable as a whole, but not in part, on any interest day on sixty days' notice at 101 and interest. The company is under the management of Stone & Webster, and with its controlled companies does the electric railway, electric lighting, gas and power business in the city and vicinity and in two adjoining towns. The proceeds of this issue of notes are to be used for hydroelectric development. The notes are offered at 98 and interest to yield 5¾ per cent.

Back Dividends of Massachusetts Electric Companies.—Commenting on the payment of back dividends of the Massachusetts Electric Companies, a trustee of the companies is quoted as saying: "There is no one more anxious to pay up the $17.75 a share in back dividends on Massachusetts Electric preferred than the trustees, but the company cannot pay out money for back dividends from funds which do not exist. Present earnings, however, are very satisfactory and the time when action can be taken to pay up these back dividends will depend entirely on the growth of net earnings. It speaks well for the Massachusetts Electric system to show an increase of $420,000 in gross earnings during the past year when general business conditions are considered. If the system can show this large increase when the mills in many of the cities served by our lines have placed our patrons on short time and consequently with reduced means for riding, what should our roads show when business picks up and the mills are again running full time with employees prosperous? President Mellen believes in the future growth of New England and is spending millions on his lines from which he expects to derive a good return in the not distant future. The same conditions that will help the Mellen roads will help the Massachusetts Electric system, namely, greater business activity."

Long Acre Electric Light & Power Company Bonds.—A form for a mortgage on the franchises and properties of the Long Acre Electric Light & Power Company, providing for an ultimate bond issue of $50,000,000, was submitted to the Public Service Commission for the First District of New York on Wednesday. The plan calls for an immediate iss of $6,000,000, with a later issue of $4,000,000, and the propos bonds are to bear interest at the rate of 5 per cent and run f fifty years. A statement made by counsel for the compa relative to the $1,000,000 stock issued prior to appointment the Public Service Commission said that $400,000 of this amou held in the treasury, will be canceled at once, and that $100,0 collateral security for indebtedness, will be canceled upon pa ment. Payment of interest or principal on the balance $500,000 will not be made except upon approval of the comm sion. Reference to the plans of the company following t issuing of securities was made in the *Electrical World* July

Chicago Elevated Merger.—The National City Bank New York advertises that it will receive subscriptions for $3 000,000 three-year, 5 per cent gold notes of the Chicago E vated Railways, of which Henry A. Blair is chairman of t board of directors. Mr. Blair has been at the head of the mov ment to effect the amalgamation, the progress of which has be cited in the *Electrical World* from time to time. In additi to the $30,000,000 in notes, the capitalization of the Chica Elevated Railways is to include $16,000,000 in 6 per cent cumul tive preferred stock and $20,000,000 in common stock. Furth information in connection with the merger will be found page 146 of this issue.

United Railways of St. Louis.—Arrangements have be made by the United Railways of St. Louis for a ten-year exte sion at 4½ per cent interest of the $1,500,000 first-mortgage per cent gold bonds of the Lindell Railway Company, maturi Aug. 1. For a limited time the present holders will ha the privilege of having their bonds extended and receiving t extended 4½ per cent bonds at 97¾. It is learned further th the discounts, amounting to $27.50 per $1,000, will be paid cash. Such holders as may not desire to extend their bon may have them paid at par and interest at the office of the Me cantile Trust Company, of St. Louis.

Springfield Railway & Light Company.—Gross and n earnings of the Springfield Railway & Light Company Springfield, Mo., in the twelve months ended March 31, 191 were the largest in the history of the company. The gross ear ings were close to $462,000, and the net earnings were near $214,000, each showing a gain of some $17,000 over the figur of the previous year. In the last three years, the net earnin of the company have averaged over one and two-thirds t interest requirements on the bonds, and in the twelve mont ended March 31, 1911, they were over twice the requir amounts.

Maryland Company Changes Hands.—The interests co trolling the Frederick Railroad Company, Frederick, Md., ha purchased the stock of the Frederick Gas & Electric Lig Company.

DIVIDENDS.

Associated Gas & Electric Company, quarterly, preferred, 1 per cent, payable July 15.

Electric Company of America, semi-annual, 3½ per cei payable Aug. 22.

Ft. Smith Light & Traction Company, quarterly, preferre 1¾ per cent, payable July 15.

Northern States Power Company, quarterly, preferred, 1 per cent, payable July 15.

Oklahoma Gas & Electric Company, quarterly, preferre 1¾ per cent, payable July 15.

Ottumwa Railway & Light Company, quarterly, preferre 1¾ per cent, payable July 15.

Sierra Pacific Electric Company, quarterly, preferred, $1. per share, payable Aug. 1.

Western States Gas & Electric Company, of Delawar quarterly, preferred, 1¾ per cent, payable July 15.

REPORTS OF EARNINGS.

COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY.

Period.	Gross Earnings	Operating Expenses.	Net Earnings.	Fixed. Charges.	Net Surpl
May, 1911	$422,709	$249,004	$173,705	$103,281	$70,4
" 1910	392,792	218,634	174,160	103,926	70,2

LAKE SHORE ELECTRIC COMPANY.

Period.	Gross Earnings	Operating Expenses.	Net Earnings.	Fixed. Charges.	Net Surpl
May 1911.	$105,321	$54,429	$50,892	$34,584	$16,3
" 1910	100,424	52,983	47,441	35,035	12,4

MEXICAN TELEPHONE & TELEGRAPH COMPANY.

Period.	Gross Earnings	Operating Expenses.	Net Earnings.	Fixed. Charges.	Net Surpl
May, 1911	$52,193	$27,746	$24,447	......	....
" 1910.........	45,998	22,863	23,135	......	....

General News

Construction News.

TUSCALOOSA, ALA.—Application has been made to the Council by [illegible] G. Blair and H. E. Foster for a franchise to [illegible] an electric-light plant in Tuscaloosa.

TEMPE, ARIZ.—Application has been made to the City Council by the Reclamation Service, through C. H. Fitch, local engineer for the Reclamation Service, for permission to erect a 100,000-volt transmission line in Tempe. The proposed line will enter the city from the south at Mill Avenue and Eighth Street, and extend to the government's pumping station on the San Francisco River.

LITTLE ROCK, ARK.—The Little Rock, Pine Bluff & Eastern Traction Company is reported to have secured the right-of-way of the Little Rock & Pine Bluff Traction Company, which will connect Little Rock and Pine Bluff, via Altheimer, Stuttgart, Helena and Clarenden, a distance of 37 miles.

MORRILLTON, ARK.—Preparations are being made by the Morrillton Light & Power Company for the installation of an additional generating unit, consisting of a 150-kw alternator and Corliss engine. This company will supply electricity to operate a large cotton-gin plant which is to be located near by. Judge W. L. Moose is president of the company and G. H. Burr vice-president.

ALAMEDA, CAL.—The City Council has decided to submit the proposition to issue $125,000 in bonds for improvements to the municipal electric-light plant to a vote of the people. Of the proceeds $75,000 will be used for general improvements, $25,000 for a new power house, $15,000 for new wire and $10,000 for miscellaneous equipment.

GLOBE, CAL.—Arrangements are being made by the Tulare Power Company for the main canal which is to take the water out of Tule River, 2 miles above Springfield, returning the same to the river near Globe, where the power house is to be established. It is expected to have the canal completed by the close of the summer, when work will begin on the construction of power house and installation of machinery. The canal will be about 6 miles in length and will provide a head of about 470 ft. Plans are now being prepared by C. H. Holley, chief engineer and promoter of the company, for construction of auxiliary steam plant and substations. The company was recently granted a franchise to erect transmission lines and operate an electric system in [illegible]

KENNETT, CAL.—Preparations are being made by the Northern California Power Company to erect a substation in Kennett. The company is now erecting its transmission lines from Redding to Kennett, which, it is expected, will be completed to this place by Aug. 1.

LOS ANGELES, CAL.—Plans have been completed for the erection of an electric fountain 60 ft. in diameter in Los Angeles, to cost about $5,000. Bids will soon be called for construction of the same.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors until Aug. 31 for furnishing and installing two engine-driven generating units in the Hall of Records Building, plans and specifications for which may be seen at the office of the board.

OAKLAND, CAL.—The Oakland Traction Company has placed an order with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., for ten equipments of type HL (non-automatic) unit-switch control.

OAKLAND, CAL.—A proposition has been submitted to the Board of Supervisors by C. N. Beal, manager of the Central Oakland Light & Power Company, offering to supply electricity to the county at the rate of 2¾ cents per kw-hour. The service is now supplied by the Oakland Gas Light & Heat Company for 3 cents per kw-hour. The Central Oakland Light & Power Company is a subsidiary company of the United Properties Corporation and has a steam generating plant at Second and Alice Streets from which it supplies electrical power to local consumers. An unlimited supply of electrical energy can be obtained by the company from the Mount Hamilton watersheds of the Bay Cities Water Company.

OAK PARK, CAL.—The South Sacramento Power Company has entered into an agreement with the Great Western Power Company which permits it to supply electricity to the territory outside of Sacramento. The South Sacramento Power Company has erected transmission lines in Colonial Heights, Columbia Terrace, Elmhurst, the Maple tract and as far south as the Fruit Ridge Road and is supplying electricity at the same rate charged in the city. Plans are now being made by the company to erect a feed wire through the Riverside district.

REDWOOD CITY, CAL.—The City Trustees have granted Edward S. Fitzpatrick a franchise to construct and operate an electric railway from Redwood City to Woodside, a distance of about 6 miles.

SACRAMENTO, CAL.—It is reported that the State Legislature has made an appropriation of $103,000 for a power plant to be equipped with both gas and electrical machinery.

SACRAMENTO, CAL.—Negotiations have been closed between the North Sacramento Land Company and the Great Western Power Company, whereby the latter will supply North Sacramento with electricity for lamps and motors. Work will soon begin on the erection of the distributing system. It is expected to have the system installed and [illegible]

SACRAMENTO, CAL.—The Great Western Power Company has secured a large number of contracts in Sacramento in addition to the contract secured from the State recently to supply electricity for lamps and motors at the Capitol and Capitol Park. At present the company is furnishing energy for power purposes only in Sacramento, but will probably supply electrical service to small consumers for all purposes through a separate company, of which, it is said, George W. Peltier will be the head.

SAN DIEGO, CAL.—Steps are being taken by a Citizens' Committee to secure for San Diego a large electrical power plant for municipal purposes with a view of furnishing the city with electrical service at much less than is now charged by the San Diego Consolidated Gas & Electric Company. Private capital is making an effort to interest the municipal authorities in a water power project.

SAN FRANCISCO, CAL.—Orders have recently been placed by the San Francisco, Oakland & San Jose Railroad Company, of San Francisco, Cal., with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., for twenty-five double equipments of No. 302 railway motors and type M control.

SAN RAFAEL, CAL.—Plans are being made by the Pacific Gas & Electric Company for extensive improvements in its service in Marin County, which will involve the expenditure of a large amount of money, and will include the installation of a 5000-kw steam turbine at some point in the southern part of the county, which will be used as an emergency plant to supply high-tension transmission lines. The company is also making arrangements to extend its gas mains to the Bush tract and ultimately to Deer Park. Announcement will soon be made by the company of a reduction in the price of electricity for commercial purposes of 2 cents per kw-hour, and for power purposes a reduction of 3 cents per kw-hour will be made upon a yearly guarantee. Wallace H. Foster is local manager.

SANTA ANA, CAL.—The question of installing a new street-lighting system in Santa Ana is under consideration. The Southern California Edison Company, of Los Angeles, has the contract for street lighting.

STOCKTON, CAL.—Plans are being made for the construction of an electrical railway from Stockton to Byron, which will ultimately be extended to Antioch and Oakland. The company will be known as the Stockton & Bay City Short Line, and operated as an auxiliary company, and capitalized at $750,000. Articles of incorporation will be filed soon for the controlling corporation, which will be capitalized at $1,000,000.

PUEBLO, COL.—Investigations are being made by J. Fred Anderson and Charles L. Wuertz, of New York, who, it is said, represents Eastern capitalists, in this section with a view of developing the waterpower in the Arkansas River in the Royal Gorge to secure power to operate a large hydroelectric power plant. The plan calls for the construction of a large dam across the canon west of Canon City, which would at least be 1000 ft. high. The proposed plant would supply electricity in Pueblo and other cities in the Arkansas valley and furnish power to operate an interurban railway system over the entire southern part of the State and to light the entire valley.

BRISTOL, CONN.—Orders have been placed by the Bristol & Plainville Tramway Company with the General Electric Company for complete equipment for power plant, including two 937-kva horizontal turbine generator units, switchboard, rotary converters, motor-driven and turbine-driven exciters, etc. The switchboard contains twenty-five panels, forming one main station board and one substation board. The main station board will be alternating-current and will control two 937-kva generators and two 25-kw exciters provided with voltage regulators. The substation switchboard, which will control three 300-kw, 600-volt rotary converters, consists of three alternating-current and three direct-current rotary-converter panels and three alternating-current rotary-converter starting panels. Provision is also made for two panels controlling single-circuit railway feeders. The outfit also includes three 50-lamp, 66-amp mercury-arc rectifiers for street arc lamps.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Washington, D. C., until Aug. 1 for furnishing lamp standards and brackets that may be required for various buildings under the control of the Treasury Department, in accordance with plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is Supervising Architect.

DAYTONA, FLA.—The proposition to grant the Schantz Electric Light Company, of Daytona, a new franchise in Daytona was defeated.

BARNESVILLE, GA.—Arrangements have been completed by the Central Georgia Power Company, of Macon, Ga., to extend its transmission lines to Barnesville. The company will supply electric service to the city and numerous manufacturing plants here. It is expected to have the system ready for operation by Sept. 1.

BAXLEY, GA.—The installation of a municipal electric-light plant at Baxley is reported to be under consideration.

CUTHBERT, GA.—Bonds to the amount of $20,000 have been sold by the city of Guthbert, Ga., the proceeds to be used for improvements to the municipal electric-light plant and water-works system, work on which will begin in the near future.

ROCKMART, GA.—J. S. Davitte, of Rockmart, Ga., is reported to be in the market for equipment for a 10-mile street railway system, including electric plant, wiring, etc., and four cars.

SAVANNAH, GA.—Application has been made by the Joseph Hull Company for a charter to be capitalized at $60,000 with the privilege to increasing it to $1,000,000. The company proposes to deal in real estate, stock and bonds, warehouses, water, steam and electric power plant, boats, etc., and in all business in which motive power is developed. Joseph Hull, Alexander B. Hull and Daniel B. Hull are interested in the project.

FREMONT, IDAHO.—The plant and holdings of the Fremont County Independent Telephone Company have been purchased by the Capital Electric Company, of Salt Lake City, Utah. It is understood that the purchasers have made arrangements to ask for new franchises in a number of towns in Idaho for the purpose of extending the system from St. Anthony, the central point of the Fremont County system. R. W. Nicol is president of the Capital Electric Company.

BLANDISVILLE, ILL.—The installation of an electric-light plant in Blandisville is under consideration. The Village Council is said to be offering inducements in way of a franchise for installation of an electric-light system.

CARROLLTON, ILL.—A committee, consisting of Mayor Waggoner, S. E. Pierson and B. C. Hodges, has been appointed to look into the matter of securing an extension of the Alton, Jacksonville & Peoria Interurban Railway from Jerseyville to Carrollton. The cost of the proposed branch is estimated at about $250,000. Edgar M. Davis is president of the company.

CHICAGO, ILL.—The Chicago Association of Commerce has engaged Louis H. Evans, former chief engineer of the Chicago Junction Railway, and Hugh Patterson, who supervised the electrical equipment of the New York terminals of the Pennsylvania Railroad Company, to prepare plans for complete electrification of all steam terminals in Chicago.

CHICAGO, ILL.—Announcement has been made of definite steps toward the organization of the Chicago Suburban Edison Company, which, it is said, will control the electric light and power business in Northern Illinois outside of Chicago. An offer will be made to the stockholders of the Economy Light & Power Company, the North Shore Electric Company and the Illinois Valley Gas & Electric Company to deposit their stock under a merger agreement. A majority of the stock of the three companies is owned or controlled by the Commonwealth Edison Company. The combined capital stock of the three companies to be merged into the Chicago Suburban Electric Company is $11,977,000, and the combined funded debt is $9,751,000. The companies have plants and substations in 200 municipalities and serve about 1,000,000 customers.

ELGIN, ILL.—The Aurora, Elgin & Chicago Railroad Company has subscribed $5,000 to the Elgin outer belt line fund. The Western United Gas & Electric Company has given a similar amount.

FOREST PARK, ILL.—The construction of an electric railway between Berwyn, Forest Park, Lyons and Cicero is reported to be under consideration. Henry J. Mohr, of Forest Park, Ill., and associates are interested in the project.

FREEPORT, ILL.—The construction of an electric interurban railway between Freeport and Dixon is reported to be under consideration. L. H. Burrell, Robert Kuehner, Jacob Weiss and J. W. Miller are said to be interested in the project.

GALENA, ILL.—The construction of an electric railway from Galena to Sinsinawa Mound, 14 miles in length, tapping a large mining region, is under consideration. The Galena Commercial Club has taken up the matter.

GENEVA, ILL.—The installation of an independent power plant to supply electricity for lamps and motors for the county court house and jail at Geneva is under consideration by the court house committee of the Board of Supervisors. At present electricity for the court house is generated at the county almshouse and transmitted by cables to the court house. By the installation of a new dynamo in the boiler-room of the court house it is estimated that sufficient power could be obtained to light the buildings.

GIBSON CITY, ILL.—Work has commenced on the erection of the power house, 60 ft. x 57 ft., in Gibson City, for the electric plant of the Central Electric Light & Power Company.

LENA, ILL.—Orders have been placed by the Lena Electric Light & Power Company with the Westinghouse Electric & Manufacturing Company for two 75-kw, 3-phase, 2300-volt, 60-cycle, 900-r.p.m. generators, belted, with exciters and switchboard.

LODA, ILL.—Arrangements have been made with the Paxton Electric Company, of Paxton, Ill., to supply electricity to light this village. The company will erect a transmission line from its power house t Loda. The local distribution system, owned by Addems, Morgan Con pany, of Loda, has been purchased by Matthew Coffey, who, it is saic will have charge of the local system.

MOUNT CARMEL, ILL.—The United States Court has directed th plant of the Mount Carmel Gas & Electric Company to be sold a auction Aug. 14, to satisfy claims amounting to $250,000.

PRINCETON, ILL.—Plans are being considered by C. N. Gerard of Bradford, for the construction of an electric railway to extend fro Kewanee to Henry, Elmira and Bradford, a distance of about 40 miles.

VIRGINIA, ILL.—The Virginia Light, Heat & Power Company i reported to be contemplating the installation of a new street lightin system.

CRAWFORDSVILLE, IND.—The new municipal electric-light plan was put into operation for the first time June 20. The service will b changed from the old to the new plant gradually.

GREENCASTLE, IND.—The plant and holdings of the Greencastl Gas & Electric Company are reported to have been purchased by W. A Martin, of Laporte, Ind., and associates. It is said that the ne owners contemplate improvements to both plants.

INDIANAPOLIS, IND.—The Indianapolis, Chicago & Meridian Rai way Company, it is reported, is planning to erect new power statio at Monticello and at Indianapolis. M. J. Mooreland is interested in tl company.

KOKOMO, IND.—Contracts have been awarded by the Kokomo, Frank fort & Western Traction Company, recently incorporated, for the co struction of its proposed electric railway to connect Kokomo and Frank fort and intermediate towns. The company will also supply electricit for lamps and motors to the towns, villages and farmers along the line.

NEW CASTLE, IND.—The plant and holdings of the New Castl Light, Heat & Power Company have been purchased by W. A. Marti of Laporte, Ind., and associates. The property includes both gas an electric plants. The new owners, it is said, contemplate making im provements and extensions, including the installation of new machiner

TERRE HAUTE, IND.—Contracts have been placed by the Terr Haute, Indianapolis & Eastern Traction Company, of Terre Haute, Ind with the General Electric Company, of Schenectady, N. Y., for tw 300-kw rotary converters, fifteen 100-kva transformers and a switchboar The rotary converters and six of the transformers will be installed in th Maywood substation. Six transformers will be installed in the subst tion at Mooresville and three in the Martinsville substation. Th transformers are oil-cooled, 25-cycle, 33,000 volts primary and 39 secondary. The switchboard will be installed at the substation in Ma wood and will control incoming lines, the bank of step-down tran formers and the rotary converter.

WAKARUSA, IND.—The Council has granted a franchise to tl Electric Light & Power Company. It is said that the company wi install a plant at once.

DES MOINES, IA.—The Des Moines City Railway Company ha placed orders for a portable substation to be used on its lines durin congested traffic.

DES MOINES, IA.—Plans are being made by the Des Moines Ci Railway Company for building an addition to its power plant, located East Maple Street and the river, which will be equipped with a 200 kw, low-pressure turbine with necessary condensers, switchboard ar transformers. A new coal and ash-conveying plant and an electrical operated, 30-ton crane will also be installed in the power house. A 30 kw rotary converter will be installed at the station at Klondike Jun tion, north of Grand View Park, and a 500-kw rotary converter at t Flint Junction station.

KEOKUK, IA.—Steps have been taken toward the organization of a interurban railway, which is to be known as the Interurban Railwa Company, to build an electric railway to connect Keokuk and Fo Madison, Ia., Quincy, Carthage, Hamilton and Niota, Ill. The cost o constructing the proposed railway from Quincy to Niota, Ill., is est mated at $1,500,000. Subscriptions amounting to $15,000 have be raised to extend the railway from Niota to Fort Madison.

POCAHONTAS, IA.—It is reported that petitions will be present to the City Council asking that another election be called to vote o the proposition to issue bonds for the construction of an electri light plant. The bonds recently voted have been declared illegal.

VAN HORN, IA.—The plant of the Van Horn Electric Light Power Company was destroyed by fire on June 29, causing a loss about $14,000.

FORT SCOTT, KAN.—The Atlas Coal Company has awarded tl contract for the construction of an electric-light and power plant at mine at Rich Hill. The proposed plant will supply electricity f lighting and operating the machinery in the mines.

HORTON, KAN.—Preparations are being made by the city of Horto for the installation of three 100-hp steam boilers, equipped with o burners, in the municipal electric-light and water plant, bids for whi have been received. B. B. Norris is city clerk.

MINNEAPOLIS, KAN.—At a special election held June 20 the pro osition to issue bonds to the amount of $15,000, the proceeds to used for the construction of a municipal electric-light plant, was carrie

PERRY, KAN.—A movement has been started for the installation o an electric-light plant in Perry.

GRAND CANE, LA.—A movement is under way for the installation of an electric-light and water-works system in Grand Cane.

LAFAYETTE, LA.—The City Council is reported to have decided to install two Diesel gas engines. It is [illegible] from direct current to alternating current as soon as arrangements can be made to float the certificates of indebtedness. The cost of the work is estimated at about $40,000.

FARMINGTON, MAINE.—The property of the Farmington Electric Company was purchased by A. Studley Hart, of Providence, R. I., on June 29 at a foreclosure sale. Mr. Hart represented the bondholders. This company has no connection with the Farmington Electric Company which is now operating in this place. The old company generated electricity at a steam-power plant located in Farmington, while the present company secures electrical energy from the hydroelectric plant of the Franklin Power Company, located on the Carrabasset River.

BALTIMORE, MD.—At a special meeting of the stockholders of the United Railways & Electric Company held July 5 it was voted to authorize the issue of $3,125,000 in three-year collateral 5 per cent coupon notes.

LITTLETON, MASS.—Three companies are reported to have submitted bids to furnish electricity in the town of Littleton—the Lowell Electric Light Corporation, of Lowell, Mass.; the Edison Electric Illuminating Company, of Boston, Mass., and the Connecticut River Power Company, at Brattleboro, Vt. The lines of each company reach the town within 10 miles, and the Edison Company will furnish electrical service in Carlisle within a short time, about 8 miles east of Littleton. This town is soon to install a public water service, an act enabling it to do so having just passed the Legislature, and it is probable that the pumping service will be operated by the company that supplies the electrical service.

REVERE, MASS.—The citizens of Revere have applied to the Gas and Electric Light Commission for a reduction in the price of electricity charged by the Suburban Gas & Electric Light Company.

IRONWOOD, MICH.—The Appleyard interests have taken over the plants, franchises and holdings of the Twin City General Electric Company, the Ironwood Water Works Company, and the Hurley Water Works Company. The Appleyard interests now control all electric properties in Gogebic County and will start at once to develop the water power near Mellen, Wis., and to extend the street railway system from Ironwood to Bessemer, Mich., and to several small towns beyond Bessemer.

NEWBERRY, MICH.—It is reported that the Village Council is contemplating the installation of new machinery at the municipal electric plant, to cost about $4,000. The citizens recently voted against the proposition to issue $11,000 in bonds for the construction of a new electric plant.

TROWBRIDGE, MICH.—Preparations are being made by the Commonwealth Power Company to rebuild its plant, recently destroyed by fire at once. The power house together with all the equipment is practically a total loss. It is understood that new equipment will be ordered and work on reconstruction will begin immediately.

DEERWOOD, MINN.—The Cuyuna Range Light & Power Company is endeavoring to place contracts for furnishing electricity for lamps and motors to the towns of Staples, Wadena, Aitkin and Perham. The steam plant of the company is located in Deerwood. The company is making arrangements to erect a hydroelectric power plant at or near the Crow Wing River. The company is also making arrangements to supply electrical energy to mines in this vicinity. The rate for electrical service in the above town is 4 cents per kw-hour for lamps and 3 cents per kw-hour for motors. M. D. Stoner is manager.

MINNEAPOLIS, MINN.—The City Council is considering the question of installing an incandescent light system consisting of 150 lamps, electricity for maintaining the lamps to be supplied by the plant at the garbage crematory, to cost about $50,000.

MINNEAPOLIS, MINN.—Preparations are being made for rebuilding the New York Life Building, located at Fifth Street and Second Avenue, at cost of about $100,000. The improvements to be made include the installation of new elevator systems, new heating plant, new lighting system, etc.

ST. PAUL, MINN.—The City Council of St. Paul has adopted a resolution to join with Minneapolis in promoting a corporation to control the power to be generated by the new government dam. Under a law enacted by the last Legislature provision is made to form such a corporation under the direction of the Mayors of the two cities and the president of the university board of regents. It is believed that power developed at the dam will generate sufficient electricity to light the streets and public buildings of both cities. The corporation, through bonds guaranteed by the two cities, will construct and equip the power plant and will pay the federal government rental amounting to 4 per cent on the cost of the erection of the dam.

ST. PAUL, MINN.—The Consumers' Power Company, which controls the Northern Heating & Electric Company, of St. Paul, Minn., has filed a mortgage for $10,000,000 in favor of the Standard Trust Company, of New York, N. Y., and F. M. F. Miller as trustees, to secure an issue of the same amount in bonds. The Consumers'' Power Company, it is said, proposes to purchase small lighting and heating plants in all parts of the State. It is expected that the company will connect the local plant with the water-power projects recently obtained from H. M. Byllesby & Company, of Chicago, Ill., at Cannon Falls, Mankato, Apple River and Blue Earth. The power plant at Blue River is nearly completed. In addition to the sites mentioned the company obtained control of the light and heating plants at Stillwater, South Stillwater, Red Lake Falls, Grand Forks and East Grand Forks. On the Red River site it is understood that 3000 hp can be developed and about 2000 hp will be available at the Blue Earth and Apple River sites. The deal covers practically all of the property held by the company in the State of Minnesota besides that held within St. Paul.

TOWER, MINN.—It is reported that bids will soon be called for the construction of a dam and electric plant at Pike River, to cost from $12,000 to $15,000. D. A. Reed is engineer.

CLARKSDALE, MISS.—Plans are being considered by the City Council for extensions to the water-works, electric-light and sewer systems, to cost about $50,000. W. S. Bobo is general superintendent.

KIRKWOOD, MO.—The committee appointed to make an investigation of the municipal electric-light plant, it is said, will recommend overhauling and maintaining the municipal electric-light plant and an issue of $10,000 in bonds to pay for same.

MONETT, MO.—Bids will be received by the city of Monett until July 18 for furnishing machinery and equipment for the municipal electric-light plant as follows: One 225-hp simple Corliss engine for direct connection to a 150-kw, alternating-current generator; one 90-hp simple side-crank engine for direct connection to a 60-kw, alternating current generator; one 160-hp simple side-crank engine for direct connection to a 100-kw, alternating-current generator; one 4-panel switchboard, three horizontal return tubular boilers, of 100-hp each, with stack; one 500-hp open heater, one 400-hp boiler feed pump complete, pole-line equipment including tungsten lamps, transformers, poles, wire, lightning arresters, etc. Rollins & Westover, Beals Building, Kansas City, Mo., are engineers. Perry Short is Mayor.

SEDALIA, MO.—An order of foreclosure has been entered in the federal circuit court against Sedalia Light & Traction Company, in which the company is given forty days after June 27 to adjust its indebtedness of $807,000 to the City Trust Company, of Boston, Mass.

SPRINGFIELD, MO.—Six double equipments of No. 323 railway motors with type K-10-A control have been ordered from the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., by the Springfield Traction Company, of Springfield, Mo.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company, it is reported, is contemplating the installation of pressure pumps in its power plant this season.

FALLON, NEV.—Arrangements are being made by the United States government for the construction of a large electric plant at the new Lahonton dam for the purpose of supplying electricity to operate the gates and dams of the large Truckee-Carson project and for operating the electrical pumps to drain the Carson Lake. The residents of Fallon have petitioned the government to have this work done at once and to sell power to the city of Fallon.

TUSCARORA, NEV.—The Jack Creek power plant, which supplied electricity for lighting and operating the Tuscarora mines, was totally destroyed by fire on June 22, causing a loss of about $55,000. The plant is located about 20 miles from Tuscarora. It is understood that the plant will be rebuilt, which will take several months.

FABYAN, N. H.—Surveys are being made by the civil engineers of the Boston & Maine Railroad for the construction of the proposed electric railway up Mount Washington, to take the place of the present cog-wheel railroad.

CHATHAM, N. J.—Work has commenced on construction of the power house of the Morris County Traction Company in Chatham. It is expected to have the plant completed in about three months.

ALBUQUERQUE, N. M.—Preparations are being made for the construction of a large hydroelectric power plant on the Gila River, in Grant County, plans for which are being prepared by H. von Schon, of Detroit, Mich. The proposed plant will supply electricity for the mines and mills in the Mogollon mining district.

BINGHAMTON, N. Y.—The City Council has voted to call an election on Aug. 18 to vote on the proposition to issue bonds to the amount of $20,000, the proceeds to be used for the installation of a boulevard lighting system and placing the wires underground on Court Street from Exchange Street to Chenango River.

BUFFALO, N. Y.—The Public Service Commission, Second District, has authorized the Buffalo & Lackawanna Traction Company to expend the sum of $196,000 for the purchase of rolling stock and equipment.

CAMDEN, N. Y.—The installation of an additional engine, to cost about $20,000, in the municipal electric-light plant is under consideration.

CLAVERACK, N. Y.—It is reported that the Red Hook Light & Power Company has applied for a franchise to install an electric-light system in Claverack.

CORNING, N. Y.—The City Council has awarded the contract for street lighting to the Corning Gas & Electric Company for a term of ten years, dating from June 1. The contract calls for the installation of luminous-arc or magnetite-arc lamps to replace the lamps now in use. Under the new contract the company is to furnish arc lamps at $75 each per year, 75-watt incandescent lamps at $25 each per year, 125-watt incandescent lamps at $27.50 each per year, or 40-watt lamps at $18 per lamp per year. Under the present contract the city pays $80 per lamp

per year for arc lamps and $30 each per year for 75 watt lamps. All current used for special street lighting for decorative purposes, cluster lamps, special lighting, etc., will be charged at the rate of 5 cents per kw-hour. Under the new contract the city will save about $7,000 during the ten years. Work will begin soon on the installation of the new system. A number of changes will be necessary in the power house, including the installation of two rectifiers for two 75-lamp circuits and a Tirrill regulator.

NEWBURGH, N. Y.—The Public Service Commission, Second District, has authorized the Orange County Traction Company to issue $83,500 in bonds to be sold for cash at not less than 85, the proceeds to be used for the payment of new property and equipment.

NEW YORK, N. Y.—The Public Service Commission, First District, has adopted a resolution instructing the commission's counsel to submit a form of certification for the third-tracking of the Second, Third and Ninth Avenue elevated railways.

NEW YORK, N. Y.—Bids will be received at the office of William J. Gaynor, Mayor, chairman of Armory Board, Hall of Records, Chambers and Centre Streets, New York, N. Y., until July 20 for furnishing and installing lighting fixtures in the Second Battery Armory, 166th Street and Franklin Avenue, the Bronx, in accordance with plans and specifications, which may be seen at the office of the Armory Board.

NEW YORK, N. Y.—Bids will be received by Patrick A. Whitney, Commissioner of Correction, at the office of the Department of Correction, 14 East Twentieth Street, Borough of Manhattan, New York, N. Y., until July 20 for furnishing machinery, appliances, etc., and labor to lay and draw into ducts and properly connect up a complete electric feeder system, including covers for manholes, for the lighting, including the furnishing and connecting up mechanically and electrically the lamp-posts, lanterns, etc., on Hart's Island, New York. Bids will also be received at the same time and place for furnishing at Hart's Island, New York, lead-sheathed, rubber-covered, single-conductor feeder and sub-feeder cables; also duplex, rubber-covered, lead-sheathed, steel-armored cables. Blank forms and further information may be obtained at the office of the department.

OLEAN, N. Y.—The Olean Electric Light & Power Company has applied to the Public Service Commission, Second District, for permission to issue $185,000 in bonds, the proceeds to be used for the construction and equipment of a new electric plant at Sears and the erection of a high-tension transmission line from Sears to the city of Olean and for improvements to its distributing system in Olean and an additional distributing line to Allegany, N. Y., installing a new arc lighting system in Olean and for refunding of present mortgage indebtedness.

CHARLOTTE, N. C.—The Piedmont Traction Company, of Charlotte, N. C., has placed an order with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., for a quadruple equipment of No. 308-B-5 railway motors and special type HL (non-automatic) control. These motors are insulated for operation on 1500 volts. The railway is now nearing completion. T. C. Lee is engineer in charge.

CHARLOTTE, N. C.—Five quadruple equipments of No. 308-B-5 railway motors for operation on 1500 volts, with special type HL (non-automatic) unit-switch control, have recently been ordered by the Greenville, Spartanburg & Anderson Railway Company, of Charlotte, N. C., from the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

RALEIGH, N. C.—It is reported that surveys are being made by the Carolina Power & Light Company for the erection of a transmission line to extend from Raleigh to Goldsboro. The company will supply electricity in Goldsboro for lamps and motors and to operate the street railway system. Electrical service will also be supplied to towns along the route of the transmission line.

AKRON, OHIO.—The Northern Ohio Power Company has awarded the contract for the construction of a large dam across the Cuyahoga River at Cuyahoga Falls to furnish power for operating a portion of its large hydroelectric plant now under construction there. The dam will be located some distance above the falls, and will be about 500 ft. long and about 60 ft. high, built of concrete reinforced with steel. An independent steam power plant will be built above the falls capable of generating about 18,000 hp. The plans include a pleasure resort along the water and a miniature electric railway will be built along each side of the valley.

COLUMBUS, OHIO.—The City Council has authorized the expenditure of $32,000 of the $75,000 appropriated for extending the electric-light system into the new territory. This will be used in purchasing magnetic arc lamps and installing the new safety switchboard at the municipal electric-light plant.

DAYTON, OHIO.—In a special appropriation for city needs the sum of $25,631 was included for the installation of an ornamental street lighting system.

DAYTON, OHIO.—The Western Union Telephone Company is contemplating placing its wires underground and making other improvements to its system in Dayton, involving an expenditure of about $40,000.

DELAWARE, OHIO.—The City Council is considering the question of purchasing the local electric-light plant to be owned and operated by the city or installing a new municipal electric plant. It is understood that the present plant will have to be practically rebuilt.

TIFFIN, OHIO.—The plant and holdings of the Tiffin Electric Company have been taken over by the Ohio Light & Power Company, which was recently organized to take over the plants in Tiffin and other local...

WARREN, OHIO.—The Trumbull Electric Service Company, of Warren, Ohio, recently incorporated, has increased its capital stock from $10,000 to $1,700,000. The promoters, it is said, plan to consolidate lighting and traction properties in Trumbull and surrounding counties, including Warren, Girard and Hubbard, Ohio, and Sharon, Pa. The proposition, it is said, has no connection with the Republic Railway & Light Company. Harry M. Daugherty, of Columbus, Ohio, president of the Cities Service Company, which controls properties in several Western cities, is one of the promoters of the company.

YOUNGSTOWN, OHIO.—Preparations are being made by the Mahoning & Shenango Railway & Light Company for extensive additions and improvements to its North Avenue power house, increasing the output to 13,000 kw, an increase of about 50 per cent. The work will include in addition to the power house the installation of a 4000-kw turbine, a 12,000-sq. ft. surface condenser, a 200-hp pump for supplying water for condenser, two 500-hp boilers, boiler-feed pumps and other auxiliaries, contracts for which have already been placed.

KLAMATH FALLS, ORE.—The Klamath Water Users' Association is considering the question of securing the Keno power site to be developed for power and irrigation purposes. It is estimated that a bond issue of between $400,000 and $500,000 will be required to purchase and develop the property.

PORTLAND, ORE.—The Mount Hood Railway & Power Company has been granted permission to erect transmission lines along the streets of the city.

GREENSBURG, PA.—Application has been made to the Borough Council by the West Penn Traction interests for a franchise for the Greensburg Terminal Company. It is proposed to lease the tracks of the Pittsburgh, McKeesport & Greensburg Railway Company and the Greensburg & Southern Electric Street Railway Company in Greensburg and to build extensions within the borough limits. The agreement provides that all the work will be completed within two years after the franchise is granted.

McCALL FERRY, PA.—The Pennsylvania Light & Power Company is planning to add 3 ft. to the McCall dam in the Susquehanna River. The purpose of raising the dam is to guarantee sufficient water to operate the full 100,000 hp at the lowest stage of the water.

PITTSBURGH, PA.—A syndicate consisting of Brown Brothers, Ladenberg, Henderson & Loeb and H. B. Hollins & Company, New York, N. Y., has underwritten bonds to finance the purchase of the electric lighting and power companies in Waynesboro, Washington, Canonsburg, Oakdale, McDonald, Glenfield, Woodlawn and several other towns in the Ohio River territory acquired by J. S. & W. S. Kuhn, Inc., from the Ely syndicate. The deal involves nearly $3,000,000. Bonds of the Western Pennsylvania Traction Company will be used in financing the purchase of these properties and for extensive improvements to the systems.

TITUSVILLE, PA.—The Titusville Electric Traction Company is reported to have decided to issue additional bonds to provide funds for the construction and equipment of an extension to Cambridge Springs, and an extension southward to Oil City, Pa., will also be made, making a total of 34 miles.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has placed an order with the General Electric Company, of Schenectady, N. Y., for a twenty-seven-panel switchboard consisting of an instrument and controlling benchboard of twenty panels and an exciter and switchboard of seven panels. This switchboard will control three 3...-kw and one 4000-kw, 2300-volt, 60-cycle turbo-generator. The equipment includes motor oil switches, busbars, meters, instruments, etc.

ANDERSON, S. C.—The Anderson Water, Light & Power Company is reported to be making preparations to install a steam turbine generating plant to have an output of about 1600 hp. The cost of the proposed plant is estimated at $50,000 and the equipment includes condensers, cooling towers, switchboards, transformers, etc. It is understood that the substation buildings are to be enlarged to provide for the new machinery.

EDGEFIELD, S. C.—Bonds to the amount of $15,000 have been sold, the proceeds of which will be used to establish a municipal electric-light plant. Bids for construction of the plant will be asked for soon.

ARLINGTON, S. D.—The installation of an electric-light plant in Arlington is reported to be under consideration. George Johnson is said to be interested in the project.

RAPID CITY, S. D.—A private electric-lighting plant will be installed in the new McKenna Hospital, now being erected. A concrete subway will be built and electric elevators installed.

WHITE LAKE, S. D.—A canvass of the town is being made with a view of securing patrons for a proposed electric plant. A local capitalist, it is said, will install a plant if sufficient patronage is guaranteed to pay for establishing such a plant.

BRISTOL, TENN.—The Bristol Gas & Electric Company has been granted a franchise by the County Court of Sullivan County to supply electricity in the county outside of Bristol. The company has recently contracted with the Watauga Power Company to take a large amount of energy generated at its hydroelectric plant, located at Horse Shoe Bend on the Watauga River. The Bristol company proposes to extend its service to all parts of the county.

NOXVILLE, TENN.—The Council of Mountain View has granted th Ocoee Power Company, of Polk County, a franchise to supply elec trity in that municipality for lamps and motors. It is expected to have system ready for operation in Mountain View by Jan. 1, 1912.

NOXVILLE, TENN.—The Knoxville Electric Light & Power Compa has purchased from the Westinghouse Electric & Manufacturing Cpany one 150-kw, 3-phase, 2300-volt, 60-cycle, 600-r.p.m. generator, be d, with exciter; one 50-kw, 3-phase, 2300-volt, 60-cycle, 1200-r.p.m. gerator, belted, with exciter and one five-panel switchboard.

·UDON, TENN.—Surveys are being made by the East Tennessee Lt & Power Company for the erection of its transmission line into Ldon from its power plant now being built on the Ocoee River at Parksville.

cKENZIE, TENN.—Sealed proposals will be received by the Board of Aldermen and Mayor of McKenzie, Tenn., until July 27, for the cotruction of an electric-light plant and water-works system. For fther information address F. D. Walpole, Recorder, McKenzie, Tenn. C. L. Jenks, of Union City, Tenn., is engineer.

USTIN, TEX.—The City Council has accepted the proposal submed by William D. Johnson, of Hartford, Conn., and New York, N. Y for the construction of a dam across the Colorado River at Austin an the installation of a hydroelectric plant, subject to ratification by popular vote by the people. The consideration is $1,400,000, to be pr in twenty-five instalments.

ROWNSVILLE, TEX.—Application has been made to the City Cncil by J. C. Debruin, of Brownsville, for a street railway franchise coring the principal streets of the city.

DALLAS, TEX.—The Stone & Webster Engineering Corporation, wh is preparing to construct an interurban electric line between Das and Waxahachie, Tex., a distance of 30 miles, is securing right of way for the road. It is proposed to ultimately extend the railway soh to Waco and also to Corsicana, for which preliminary steps have be taken. It is reported that the Stone & Webster Engineering Corporati proposes to build an electric interurban railway extending from Sman, on the north, to Galveston, on the south, traversing the most populous part of the State.

ARSHALL, TEX.—Arrangements are being made by the Marshall Ttion Company for extensions to its system, including an extension tos line in North Marshall. The residents in that portion of the city ha raised a liberal bonus toward the proposed extension.

ORT LAVACA, TEX.—Two franchises have been granted by the C Commissioners to two companies to operate electric-light and power plts and water-works systems in Port Lavaca. One was granted to C. and J. K. Spittal, owners of the Port Lavaca ice and power plant, at the other to W. E. Shell, representing a new company.

AFT, TEX.—An electric-light plant is being installed by the Coleman-Fon Pasture Company to supply electricity for lighting the town.

IOGA, TEX.—A proposition has been submitted to the Commercial C by A. L. Marshall regarding the installation of an electric-light plt in Tioga.

AUREL HILL, VA.—Surveys have been made for the location of a d and hydroelectric power plant, which is to supply electricity in Lrel Hill.

AWRENCEVILLE, VA.—At an election to be held Aug. 1 the position to issue $50,000 in bonds, the proceeds to be used for the castruction of an electric plant, water-works and sewer system, will besubmitted to a vote. D. S. Hicks, Jr., is Mayor.

ULASKI, VA.—The Appalachian Power Company, which contemples five water-power developments and the construction of two storaj reservoirs on the New River, in Virginia, details of which were gn in the issue of July 7, has secured the use of the new 5350-hp stm turbine plant of the Pocahontas Collieries Company to serve as a rerve to its water-power plants. Duplicate transmission lines are to be cted to Bluefield, one by the way of Wytheville, and the other thugh Pulaski. A single transmission line from Pulaski to Roanoke, a stance of 48 miles, is under consideration. Secondary high-tension lis will be erected to the iron mine regions along the New River, to Princeton in the vicinity of Pulaski and to other collieries. It is said th about fifteen months will be required to complete the water-power plts, transmission lines and other construction work. H. M. Byllesby & Company, of Chicago, Ill., are consulting engineers and will operate th plants when completed. Messrs. Viele, Blackwell & Buck, of New Yk, N. Y., are the designing and constructing engineers.

MITHFIELD, VA.—The installation of an electric plant is reped to be under consideration by the Smithfield Water Company. BP. Gay is manager.

ACROSSE, WASH.—The Washington Water Power Company is reped to be contemplating extending its transmission lines from Colfax to Lacrosse.

LYMPIA, WASH.—Proposals will be received by the State Board of Control, Olympia, Wash., until July 20 for one 20-kva, two-phase, 2110-volt generator, direct-connected to a vertical 10 x 10 (or equivalt) engine, with belted exciter. Specifications and further information ca be obtained at the office of the Evans-Dickson Company, consulting engineer, 725 Commerce Street, Tacoma, Wash.

ORT ORCHARD, WASH.—The Bremerton & Charleston Light & P Company, it is reported, has applied to the County Commissioners for a franchise to erect transmission lines on certain streets ... to supply electricity for lamps and motors.

PORT TOWNSEND, WASH.—The Olympic Power Company, which is erecting a power plant on the Elwha River in Clallam County, is making surveys for the erection of its transmission lines to supply electricity to the various cities and towns on the Olympic peninsula. The line has been located to Port Angeles and surveys have been made as far as Sequim, which is being extended toward Port Townsend and Irondale, where numerous contracts have been placed for electrical service. Contracts have been signed by the city of Port Townsend for light purposes and by the Western Steel Corporation, of Irondale, for electricity for both lamps and motors.

PROSSER, WASH.—The Pacific Power & Light Company has commenced work on improvements to its plant, which will involve an expenditure of about $15,000 and include the installation of three 66,000-volt new transformers and a 600-kw generator.

WALLA WALLA, WASH.—The Northwestern Gas & Electric Company has acquired rights of way for power site purposes from the mouth of the White Salmon River for a distance of 5 miles and within 2 miles of Husum.

WALLA WALLA, WASH.—A deal has been closed whereby the Attalia Land Company has purchased the holdings of the Columbia Canal Company in the Attalia irrigation project. The new company proposes to irrigate a large tract of land in this vicinity and to install a large number of pumps, operated by electricity, to supply water from the river close by. Robert Grinnell, of Spokane, Wash., is president.

CHARLESTOWN, W. VA.—The power plant of the Charlestown Light & Power Company was sold June 24 by John O. Lemon, trustee, to Thomas C. Bowling and others for $16,500.

MORGANTOWN, W. VA.—Contracts are being taken by the Pittsburgh Hydroelectric Company, promoter of the Big Sandy dam project, to supply electrical service from the large power plant. It is stated that one of the falls which will be created by the large dams will be 675 ft. high. Benedum & Trees, Pennsylvania capitalists, are said to be interested in the enterprise.

WHEELING, W. VA.—The Wheeling Traction Company is making improvements to its power house in Wheeling.

MILWAUKEE, WIS.—The City Council has adopted the report of the Finance Committee recommending that $6,000 be appropriated to engage engineers for preliminary work of the municipal electric-light plant. An appropriation of $6,000 has been vetoed by Mayor Emil Seidel, owing to its being illegal, the appropriation having been made before the fund was created.

RACINE, WIS.—The Milwaukee Electric Railway & Light Company has notified the City Council that it will make a reduction in the price of electricity for lamps in the parks. The company also states that plans are being made for improvements to the local system and that new cars will be in operation before winter. It also states that it is willing to construct a street railway on Grand Avenue, Fourteenth and Sixteenth Streets to Asylum Avenue if the people petition for same.

EDMONTON, ALTA., CAN.—The ratepayers on June 19 defeated the by-law authorizing an expenditure of $100,000 for a power development at Grand Rapids on the Athabaska River, about 200 miles north of the city, in connection with the municipal electric plant. It is believed that the project would cost between $3,000,000 and $4,000,000.

PENTICTON, B. C., CAN.—Tenders will be received by F. H. Latimer, consulting engineer, Penticton, B. C., until Aug. 10, for furnishing and installing equipment for the municipal hydroelectric plant as follows: Two 100-kva, three-phase, 4600-volt, 900 r.p.m., alternating-current generators, direct-connected to impulse wheels operating at 2045 ft. effective head; pressure pipe line, about one mile of 10-in. pipe and one mile of 12-in. pipe; switchboards, transformers, meters, distributing and street lighting system. Plans and specifications may be seen at the office of the consulting engineer, Penticton, B. C., and Mather, Yuill & Company, Ltd., Vancouver, B. C.

BRANDON, MAN., CAN.—Tenders will be received by Harry Brown, clerk of Council, Brandon, until July 17 for two 2,000,000-gal. variable speed pumps and other machinery necessary to equip the municipal pumping station to be operated by electricity, and to be installed so as to permit the present steam plant to be used as a duplicate. Tenders will also be received for a Diesel gas engine of same capacity.

COBALT, ONT., CAN.—Negotiations have been completed whereby the Temiskaming and Northern Ontario Commission has purchased the Nipissing Central Railroad, for $250,000, which will be operated as a branch of the Temiskaming & Northern Ontario Railway. The line will be extended to the water's edge at Haileybury, and into the government's station at Cobalt, and later through New Liskeard and into Quebec Province as far as Quanse, and also south from Cobalt to Latchford, a distance of 10 miles. Extensive improvements are contemplated to the railway, including the equipment of the road for electrical operation. A company has been formed to operate the road, of which J. L. Englehard is president and A. J. McGee, secretary and treasurer.

HAMILTON, ONT., CAN.—The Colonial Engineering Company, of Montreal, Que., Can., is reported to be seeking to obtain franchises to build and operate electric-light plants, water-works systems and street-railway lines in towns and territories now without such service or purchasing existing properties with a view of combining them into one

property. The company may be given an opportunity to take up the Hamilton, Waterloo & Guelph Railway project and also the old Caledonia & Lake Erie Railway proposition. L. G. Read is president of the company.

PETROLIA, ONT., CAN.—A temporary arrangement has been made between the municipality and the Petrolia Electric Light, Heat & Power Company, whereby the streets are lighted again by electricity. Owing to a disagreement between the Council and the company the service was discontinued. The contract, which is only in effect from month to month, provides for the following rates: A discount of 25 per cent on all commercial lighting, if paid by the 10th of the month, and $55 each for arc lamps, of which there are thirty-eight, the ten lamps installed by the municipality to be free. The light committee is making investigations with the view of installing a municipal plant in connection with the Hydro-Electric Power Commission's service. The plant operated by the company is considered obsolete. R. Stirrett is chairman of the light committee.

PORCUPINE, ONT., CAN.—The Porcupine district of Northern Ontario has been swept again by forest fires destroying the power plants and camps of the Dome Extension. Porcupine has not a post office.

WELLAND, ONT., CAN.—The Town Council has engaged an electrical engineer to make an appraisal of the electric plant of the Welland Electrical Company with a view of purchasing the same, to be owned and operated by the municipality.

New Industrial Companies.

THE ELECTRIC RESISTANCE COMPANY, of St. Louis, Mo., has been incorporated by William A. Phillips, Frank M. Rumbold, of Jefferson City, Mo.; James H. McCord, of St. Joseph, Mo., and Ralph L. Smith and A. V. Reyburn, Jr. The company is capitalized at $2,000, and proposes to manufacture and deal in all kinds of supplies used for resistance conductors and all other kinds of electrical devices.

THE EXCELSO STORAGE BATTERY COMPANY, of San Marcos, Tex., has been granted a charter with a capital stock of $10,000 by A. B. Rogers, A. E. Lawrence and P. A. Hofheinz.

Personal.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, left Chicago on July 6 for a month's absence which he will spend in a flying trip to Europe.

MR. EDWARD P. RICH, of Chicago, a member of the firm of Pierce, Richardson & Neiler, consulting engineers, was married to Miss Lilabel Griffiths, of the same city, on June 24.

PROF. WILLIAM G. RAYMOND, dean of the college of applied science at the University of Iowa, has been elected president of the Society for the Promotion of Engineering Education.

MR. THOMAS A. EDISON, whose alkaline storage battery holds the record (244.5 miles) for travel of a vehicle on one charge, has been elected an honorary member of the French Automobile Club.

PROF. ROBERT A. MILLIKAN, of the department of physics of the University of Chicago, well known for his work relating to the isolation of the ion, has been given the degree of doctor of science by Oberlin College.

COL. SAMUEL REBER, of the Signal Corps, United States Army, has been detailed by Gen. Leonard Wood, chief of staff, to attend the international aviation meet to be held at Grant Park, Chicago, on August 12 to 20.

MR. N. B. AYERS has resigned as chief engineer of the Dayton Power & Light Company, and has organized the Ayers Engineering Company, which will engage in engineering, with offices in the Conover Building, Dayton, Ohio.

MR. EDWARD RIEDEL has resigned as general manager of the Walnut Ridge & Hoxie Light, Power & Transit Company, Walnut Ridge, Ark., to accept the position of electrical engineer and master mechanic of the Doe Run Lead Company, Rivermines, Mo.

MR. L. H. EVANS has been appointed terminal engineer for the committee on railroad terminal electrification organized by the Chicago Association of Commerce. Mr. Evans has been consulting engineer for the Chicago Junction Railway Company.

PROF. L. V. LUDY, of the department of mechanical engineering of Purdue University, has been granted a year's leave of absence for the forthcoming school term, during which he will be located at Madison, Wis., engaged in research and instructional work at the University of Wisconsin.

MR. O. H. LINTON has resigned from the staff of Niles-Bement-Pond Company, New York, to become associated with Messrs. Griggs & Holbrook, consulting engineers, 3 South William Street, New York, and will have charge of their Canadian business with headquarters at 23 Scott Street, Toronto.

GENERAL MORRIS SCHAFF has been reappointed by Governor Foss as a member of the Massachusetts Gas and Electric Light Commission, to which office he was first appointed in 1893. General Schaff is a graduate of West Point, has a notable Civil War record, and is the author of several works on military subjects. In politics he i Democrat.

PROF. S. M. KINTNER, of the electrical engineering department the University of Pittsburgh, has resigned his position as engineer the railway department of the Westinghouse Electric & Manufactur Company to become general manager of the National Electric Sig Company, which controls the Fessenden wireless telegraph and phone systems.

MR. WALTER J. WARDER, JR., formerly motor designer for R Brothers & Company, of Chicago, and more recently of the industrial power department of the Westinghouse Electric & Manufacturing (pany at East Pittsburgh, has returned to Chicago and is now conne with the Adams & Westlake Company, of that city, doing developm work in electrical engineering.

MR. A. A. TIRRILL, well known as the inventor of the volt regulator bearing his name, has undertaken development work the engineering department of the Westinghouse Electric & Ma facturing Company at East Pittsburgh. For the past two years, s leaving the General Electric Company, Mr. Tirrill has been presid of the Tirrill Manufacturing Company, Athens, Pa.

MR. EVAN J. EDWARDS has been appointed associate engineer the engineering department of the National Electric Lamp Associat Cleveland, Ohio. Mr. Edwards was instructor in electrical engineer at the Massachusetts Institute of Technology for three years after graduation from the University of Iowa, in 1907. For the past y he has been in charge of the course of instruction in illuminat engineering which is given to new technical graduates coming with National Electric Lamp Association.

MR. W. H. HODGE, publicity manager for H. M. Byllesby & C pany, has an article entitled "Plans That Won Profit for Public Utiliti in *Judicious Advertising* for July. Mr. Hodge describes among ot things the recent newspaper advertising campaign to secure the elec wiring and equipment of old dwellings. The campaign lasted fr Oct. 1 to Nov. 15, and in seventeen cities where it was tried 1468 ho wiring contracts were secured, at an average cost to the local compar including cost of advertising, cost of soliciting and wiring contract profit, of $4.83.

MR. WILLIAM ARTINGSTALL, division engineer of tunnels and ways for the Board of Supervising Engineers, Chicago Traction, gav talk on "City Tunnel Work" at the luncheon of the Electric Club Chicago on July 5. He described the La Salle Street tunnel of Chicago Railways Company under the Chicago River, and showed how was built for ultimate subway connection. Beneath this tunnel is anot one for water pipes and electric and other conduits. This second tur is built of concrete, and is about 11 ft in diameter, of horseshoe sh Its bottom is 83 ft below the surface of the river. Brick shafts at ei end serve to bring the pipes of the utilities up near the surface.

MR. V. H. GREISSER, electrical engineer for the Washington W. Power Company, Spokane, Wash., is making a five weeks' inspe tour in the East. While the main purpose of Mr. Greisser's visit i select the switchboard apparatus for the new 90,000-hp hydroelec plant which the above company is building at Long Lake, 30 m from Spokane, he will also visit the power plants and transmission tems at Niagara and Schenectady and in North Carolina. The Long L plant will, when completed, have four 22,500-hp turbines now being l by the I. P. Morris Company, of Philadelphia. The generators will l a rating of 13,900 kva and will be designed for 25 per cent contin overload. The dam for this plant will have a spillway 180 ft. high, highest in the world. Roller dams, built in Germany, will be there for the first time in this country.

HON. CHARLES A. PARSONS, F. R. S., well known as the invento the steam turbine bearing his name, was honored by the King of E land on the occasion of his coronation by being appointed Knight C mander of the Bath. Mr. Parsons is the son of the fourth Earl of R and grandson of the third earl, who built the famous telescope at B He was elected a fellow of the Royal Society in 1898 and an honor member of the (British) Institution of Electrical Engineers in 1909. is managing director of the Parsons Marine Steam Turbine Company director of the Cambridge Electric Supply Company, the Scarboro Electric Supply Company and the Parsons Foreign Patents Compa The Royal Society of Arts recently awarded to him the Albert me for his experimental researches into the law governing the efficient ac of steam in turbines and his invention of the reaction type of turbine.

PROF. JAMES A. EWING, F. R. S., best known for his pioneer vestigations of molecular magnetic phenomena, was the recipient of honor in the appointment as Knight Commander of the Bath by K George V on the occasion of his coronation. Professor Ewing was e cated at the University of Edinburgh as an engineer and he entered u engineering work immediately after graduation. He was professor mechanical engineering at the Imperial University, Tokyo, Japan, from 1 to 1883, when he was appointed professor of engineering at the Univer College, Dundee. In 1890 he became professor of applied mechanics at University of Cambridge. In 1903 he was appointed director of naval e cation, which position he now holds. Professor Ewing has published var papers on scientific subjects, his classical paper on magnetic inductior iron and other metals having been published in 1891. In 1879, at age of twenty-four he married Miss Anna Washington, daughter of late T. B. Washington, Claymont, W. Va.

MR. H. F. GURNEY, president of the Gurney Elevator Company, of New York, and the Gurney Electric Elevator Company, of Honesdale, Pa., which on June 1 succeeded to the business of the National Elevator Company, began his connection with the elevator industry immediately after graduation from Stevens Institute, in the early nineties, by entering the employ of the Sprague Elevator Company. In the following years he was successively draftsman, chief draftsman, shop superintendent, construction superintendent and general superintendent of construction for the Sprague Elevator Company and its subsidiary, the Metropolitan Electric Construction Company. When in 1898 the principal elevator companies, including the Sprague, were combined under the corporate title of the Otis Elevator Company, Mr. Gurney was appointed assistant superintendent of construction, and later general superintendent of construction in charge of all work east of Chicago, including not only electric machines, but also hydraulic, plunger, steam and belted. Among the notable installations made under his direction were those in the Broad Exchange, Metropolitan Life and Park Row Buildings and the Waldorf-Astoria Hotel, in New York. In 1905 he acquired the controlling interest in the National Elevator & ... Company, of Honesdale, Pa., one of the few independent elevator companies in existence at that time, and immediately proceeded to develop a line of electric elevators, his long experience in both the manufacturing and construction departments of the elevator business fitting him for detecting and remedying weak features common to electric elevators generally. For direct-current work he adopted the costly interpole motor, the mechanical controlling devices were abandoned and electric operating devices substituted. Gurney elevators met at once with success and a number of important buildings have been equipped with them, including the new buildings of the Equitable Life Assurance Society, the Trinity Church corporation, the Bush Terminal Warehouses and the Chelsea ...ks.

H. F. GURNEY.

Obituary.

MR. N. WETMORE HALSEY, of the financial house of N. W. Halsey Company, of New York, Chicago and other cities, died in New London, Conn., on July 1. Mr. Halsey organized the banking firm which bears his name, and, as it was a prominent dealer in the bonds of public-utility corporations, he enjoyed a considerable acquaintance among electrical men. Mr. Halsey was a director of the Electrical Utilities Company, the Netherlands Tramways Corporation and the Pacific Gas & Electric Company. Before organizing his own business he was for many years the resident partner in New York City for N. W. Harris & Company.

Trade Publications.

TRAIN LIGHTING CONNECTORS.—The Delta-Star Electric Company of Chicago has issued pages 11-14 of its sectional catalog, which contain a complete description of the automatic and non-automatic Gibbs type train connectors for use in steam-railroad train lighting.

ELECTRIC BUFFING LATHES.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued Bulletin No. 3709, replacing Bulletin No. 3707 on electric buffing lathes for direct and alternating currents. The lathes for direct-current circuits have internal speed-regulating coils connected to the switch, giving three running speeds of approximately 1600, 2400 and 3400 r.p.m. The alternating-current lathes operate at one speed only.

BUSINESS NOTES.

THE HOLOPHANE COMPANY, NEW YORK OFFICE.—The New York office of the Holophane Company has been moved to 16 East Fortieth Street.

INDIAN REFINING COMPANY.—After July 1 the general and executive offices of this company will be located permanently in the Whitehall Building at 17 Battery Place, New York.

BOSTON HOLOPHANE OFFICE MOVES.—The Boston office of the Holophane Company, in charge of Mr. H. C. Jones, moved into new quarters on June 26. The new address is 10 High Street, where both the office and stockroom are now located.

SANGAMO CHICAGO OFFICE.—The Sangamo Electric Company, Springfield, Ill., announces that after July 1 its Chicago office will be located at 617-631 West Jackson Boulevard, occupying joint offices with the Delta-Star Electric Company, whose president, Mr. H. W. Young, is also manager for the Sangamo company.

PITTSBURGH TRANSFORMER WESTERN AGENCY—The Pittsburgh Transformer Company announces that its Western sales agency will, from July 1, be conducted by the Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill. The Western agency was formerly held by the Republic Electric Company, controlled by stockholders of the Delta-Star Electric Company. The officers of the Delta-Star Electric Company are H. W. Young, president, and A. S. Pearl, secretary.

PUBLIC SPIRIT IN FT. WAYNE WORKS.—The Ft. Wayne Electric Works of the General Electric Company, Ft. Wayne, Ind., maintain a volunteer fire department of thirty men. This department is a member of the Northeastern Indiana Volunteer Firemen's Association, which held its annual reunion June 29 at Winchester. The department from the Ft. Wayne Electric Works with the Electrotechnic Band, also from the same company, won first prize for appearance in the parade. Three men from the department won first prize in the water battle and the hose team won first prize in the hose-laying contest from eleven contestants. The Electrotechnic Band, in order to make a clean sweep of it, won first prize that evening in the band contest from the best bands in the State. Organizations of this character do much to increase "team spirit" at the Ft. Wayne Electric Works, and an outing of this kind once in a while is greatly appreciated by both the fire department and the band.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 4, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

996,491. MAGNETIC PREPARATION OF ORES; A. A. L. ...; London, England. App. filed April 14, 1911. Magnetite, oil and K_2S are added, the ore and the mixture separated in a wet magnetic separator.

996,606. GROUNDING CLAMP; M. H. Bodley and F. T. Kleffman, Altoona, Pa. App. filed Nov. 21, 1910. A continuous U-strip of sheet metal with recesses for the wires and bolts connecting the upper and lower portions.

996,615. ELECTRIC SWITCH; H. J. Carrigan, Buffalo, N. Y. App. filed Aug. 9, 1909. An annular row of fixed contacts, a rotatable contact arm and a rotatable baffle to prevent tampering with the switch by unauthorized persons; as in automobile ignition systems.

996,618. FIRE ALARM; A. W. Cormack, Olyphant, Pa. App. filed June 12, 1909. An audible signal is operated by a switch actuated by a motor set in operation by rise in temperature,

996,676. SECONDARY BATTERY; G. I. Rawson and L. B. Shultz, St. Louis, Mo. App. filed Jan. 9, 1911. A block of insulating material forms a cap for the container and is held in place by a plastic seal.

996,701. AUTOMATIC CUT-OUT FOR AERIAL TELEPHONE LINES AND THE LIKE; L. W. Carroll, Anamosa, Ia. App. filed May 24, 1907. An impedance coil in circuit with the parts of a divided conductor and a resistance in shunt affected by hygrometric conditions.

996,713. FREQUENCY-MEASURING INSTRUMENT; R. Hartmann-Kempf, Frankfort-on-the-Main, Germany. App. filed May 31, 1907. The current impulses vibrate resounding bodies tuned to different periodicities. A permanent magnet counteracts one set of alternating magnetic impulses.

996,755. TRANSFORMER; C. Le G. Fortescue, Wilkinsburg, Pa. App. filed July 6, 1908. Laminated terminal-supporting bridges extend between laminated insulating barriers between the coils.

996,758. ELECTRIC HEATING DEVICES; W. S. Hadaway, East Orange, N. J. App. filed July 24, 1908. Improvement in 890,856 sadiron. The heating element is a ribbon disposed as a flattened double helix.

996,762. ELECTRIC MACHINERY; K. Hertwig and F. Collischonn, Frankfort-on-the-Main, Germany. App. filed May 6, 1903. Fluctuations of the current supplied to colliery winding machines are compensated for so that the work is stored and later used.

996,764. PRIMARY BATTERY; C. E. Hite, Burlington, N. J., App. filed Aug. 16, 1906. The combination of two receptacles, one of which is divided into compartments by plate electrodes.

996,770. COMBINED TELEPHONE AND ELECTRIC LAMP; F. J. Kerbel, New York, N. Y. App. filed March 27, 1908. A stand with a bell-like lamp shade and having a telephone transmitter within the bell.

996,782. INSULATOR; W. S. Moore, Princeton, Ill. App. filed Nov. 22, 1910. A block with grooves above and below for cross-line wires, and tie wires extending through holes in the block.

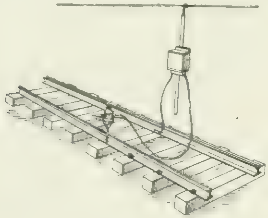
996,804. ALARM INDICATOR FOR BOILING PURPOSES; G. Schumacher, Wermelskirchen, Germany. App. filed Nov. 22, 1906. To avoid overboiling of milk, etc. The alarm device is supported by means decomposed by moist steam.

996,822. BRIDGING BLOCK FOR DYNAMO-ELECTRIC MACHINES; F. W. Young, East Orange, N. J. App. filed April 21, 1910. A core of magnetic material with an insulating covering and an enveloping helix of magnetic material.

996,833. ELECTRIC TOOL; C. B. Coates, Chicago, Ill. App filed July 20, 1908. A pilot switch on the drill, etc., under control of the operator's hand, controls a larger main switch supported independently of the tool.

996,848. VAPOR-RECTIFIER SYSTEM; C. M. Green, Lynn, Mass. App. filed Aug. 11, 1905. A mercury-vapor rectifier has its anodes connected to alternating-current terminals and its load circuit connected to a point on the alternating-current source. The alternating-current voltage is varied by means responsive to the direct current in the load circuit.

996,849. ARC LAMP; G. M. Guerrant, Danville, Va. App. filed April 15, 1910. The electrodes are rotatable circular disks on axes at an angle to each other and bodily movable in intersecting planes to maintain an arc in a fixed position.



996,833.—Electric Tool.

996,851. CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed Oct. 8, 1910. Oil-immersed type for use in manholes of underground cable systems. Cable outlets and operating lever may be independently turned to any angle for convenience.

996,853. TERMINAL FOR ELECTRIC WIRES; G. L. Herz, New York, N. Y. App. filed Feb. 10, 1910. A spring yoke with convex adjacent faces (attached to a spark plug, etc.) and a screw eye (on the conductor cord) to engage the yoke rotatably.

996,854. AUTOMATIC ELECTRICALLY GOVERNED ENGINE-CONTROLLING APPARATUS; H. D. Hinckley, Hartford, Conn. App. filed Oct. 20, 1910. A starting and stopping valve is operated by an electric motor and controller.

996,862. ELECTRIC REGISTER; R. Kraus, Hamilton, Ontario, Canada. App. filed July 14, 1910. Alternate conducting plates and resistance members of constant specific conductivity are arranged in groups separated by non-conductors and yieldingly supported; for heating rooms, etc.

996,865. VAPOR ELECTRIC APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed Jan. 9, 1904. A plurality of inclined condensing chambers minimize the impact caused by the return of the products of condensation.

996,874. RELAY; W. W. Moak, Schenectady, N. Y. App. filed Oct. 21, 1908. The stationary contact is so mounted that it cannot be thrown out of adjustment without breaking the seal and opening the casing which contains the movable contact.

996,876. JUNCTION BOX; M. J. Myers, Syracuse, N. Y. App. filed Nov. 26, 1907. Closures for the outlets in an insulating cap are held in place by a thin glaze readily breakable.

996,878. INSULATING BUSHING; L. C. Nichols, Milwaukee, Wis. App. filed Oct. 25, 1909. A series of flat disks are held together by parallel axially extending members and separated from the central conductor by a spiral of paper and an insulating liquid.

996,883. DYNAMO-ELECTRIC MACHINE; H. C. Reist, Schenectady, N. Y. App. filed March 1, 1905. A cast spider for the revolving member with ventilating and stiffening portions.

996,894. SYSTEM OF ELECTRICAL DISTRIBUTION; E. W. Stull, Milwaukee, Wis. App. filed July 18, 1908. A variable voltage circuit, a generator armature in a second circuit supplied from the first and a Wheatstone bridge arrangement connected for varying and reversing the generator voltage.

996,895. COMMUTATOR FOR ELECTRIC MACHINES; W. S. Sutton, Madison, Wis. App. filed Sept. 23, 1907. The commutator bars are spaced apart and supported by a plurality of internal supporting rings with a fusible insulating enamel bond between the rings and bars.

996,927. ARMATURE CORE; J. D. Ihlder, New York, N. Y. App. filed Dec. 8, 1904. Laminations combined with spacing disks of successively reduced diameters separated by air spaces.

996,936. APPARATUS FOR EVACUATING INCANDESCENT-LAMP BULBS; J. R. Massey, Cleveland, Ohio. App. filed Dec. 20, 1905. Automatic machine. Bulbs simultaneously heated and exhausted. A series of bulbs are contemporaneously in different stages of evacuation. (Fifty claims.)

996,951. METHOD OF AND APPARATUS FOR DEVIATING ELECTRIC ARCS; J. J. Thoresen and F. Tharaldsen, Norway. App. filed Feb. 16, 1905. A rotary magnetic field deviates the arc and a current of gas is passed through the arc, for instance, as in the production of nitrogen and oxygen compounds from air.

996,960. END-CELL SWITCH; J. M. Andersen, Boston, Mass. App. filed Dec. 20, 1910. A circuit controller is moved step by step to add or subtract cells to or from a storage battery in a central power station.

996,973. SWITCH; C. E. Carpenter, New York, N. Y. App. filed May 9, 1907. Electromagnetically operated; double break with blow-out; a part of the magnetic circuit of the blow-out magnet is formed by the armature of the operating magnet.

996,975. RECTIFIER SYSTEM; A. Churchward, New York, N. Y. App. filed Oct. 14, 1907. An auxiliary arc is produced in the rectifier by means of a storage battery when the main-load current reaches or approaches the instability point of operation.

996,979. VAPOR ELECTRIC APPARATUS; J. T. H. Dempster, Schenectady, N. Y. App. filed April 21, 1904. A circuit controller in the tube (lamp) is actuated by the bombardment of the vapor particles in the arc path.

996,990. ELECTRIC CIRCUIT CLOSER; C. F. Lewis, New York, N. Y. App. filed May 31, 1906. A casing to be carried, for instance, by an elevator car and having pivoted arms with projecting brushes

997,012. APPARATUS FOR CHECKING THE USE OF TELEPHONES; O. Schmid, Heilbronn, Germany. App. filed Feb. 10, 1911. A strip of record paper is fed by the movement of a locking device for the receiver hook.

997,036. BURGLAR ALARM; C. E. Blackburn, Hodge, La. App. filed Dec. 15, 1910. A spring-pressed plunger switch released by the opening of a door or window.

997,042. CABLE TERMINAL; F. B. Cook, Chicago, Ill. App. filed July 3, 1909. Porcelain distributor formed in two parts.

997,043. CABLE TERMINAL; F. B. Cook, Chicago, Ill. App. filed July 15, 1909. Closed-head type, of two porcelain halves having extended edges for fanning strips.

997,044; ARC SOLDERING IRON; M. Danko, South Bethlehem, Pa. App. filed Oct. 22, 1910. The head contains a shell insulated from it and containing arc terminals.

997,054. PENDENT ELECTRICAL SWITCH; W. J. Gagon, Bridgeport, Conn. App. filed Sept. 4, 1908. Two-button push type with special shaped "porcelain."

997,066. DEVICE FOR INSULATING THE TWISTED ENDS OF ELECTRIC WIRES; J. Krannichfeldt, Cologne, Germany. App. filed Nov. 22, 1910. A water-tight filled tube for protection in electric ignition of explosives in moist earth.

997,070. BACTERIOLOGICAL OVEN OR INCUBATOR; H. L. Lowe, Pittsburgh, Pa. App. filed Aug. 22, 1908. The heating resistances are normally in parallel, but are thrown in series to reduce heat by the action of a thermostat in a surrounding water jacket.

997,085. ANTISTATIC FRICTION DEVICE; J. J. O'Toole, New York, N. Y. App. filed March 4, 1910. A number of metal brushes extend across a lithographing or printing press to extract the static electricity from the paper.

997,087. INSULATED PIPE JOINT OR COUPLING; S. E. Peeples, Washington, D. C. App. filed Oct. 16, 1910. Socket and nipple members are secured together with insulation so as to prevent condensation from the short-circuiting.

997,106. ELECTRIC SWITCH; J. C. Walden, Mystic, Ia. App. filed April 5, 1910. Devices carried by a street-railway car operate the track switch on the approach of a car from either direction.

997,135. TROLLEY; W. W. Irwin, El Paso, Tex. App. filed Nov. 23, 1910. Two angularly disposed wheels, forming a passage between their flanges for the wire.

997,155. LAMP REGULATOR; E. H. Smith, Aberdeen, Wash. App. filed Oct. 18, 1910. For varying the luminosity of an incandescent electric light. Has a ventilated rheostat ring to prevent overheating.

997,165. TROLLEY; I. Widowicki, Jersey City, N. J. App. filed April 5, 1911. Spring-pressed guide arms are pivoted on the ends of the usual wheel and have rollers on their upper ends.

997,194. ELECTRIC HEATER; B. G. Jamieson and C. A. Keller, Chicago, Ill. App. filed May 4, 1909. A helical conductor is embedded in waterproof cement.

997,215. SIGNALING SYSTEM FOR ELECTRIC RAILWAYS; J. B. Strubble, Wilkinsburg, Pa. App. filed March 11, 1909. For alternating-current work. Signaling currents in the track circuits are supplied from one generator and relay currents are supplied from a second.

997,224. CIRCUIT CONTROLLER; C. W. Yerger, Milwaukee, Wis. App. filed Nov. 4, 1909. Two automatic switches and a master controller.

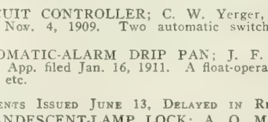
997,230. AUTOMATIC-ALARM DRIP PAN; J. F. C. Bendt, Baltimore, Md. App. filed Jan. 16, 1911. A float-operated device for refrigerators, etc.

PATENTS ISSUED JUNE 13, DELAYED IN RECEIPT.

994,854. INCANDESCENT-LAMP LOCK; A. O. Mackin, Johnstown, Pa. App. filed July 21, 1910. An attachment having spring wire coils to bind in an ordinary socket and a spring to hold an ordinary lamp.

994,980. ELECTRICAL RECEPTACLE; J. S. Crossley, Solvay, N. Y. App. filed Nov. 18, 1909. For incandescent lamps and plugs and may be connected and disconnected to line wires in an outlet box without drawing out the wires.

995,100. ELECTRIC HAND LAMP; H. Siegenbruch, Heissen, Germany. App. filed April 29, 1910. The handle has ball bearings, to permit the lamp to turn freely and thus avoid twisting the lamp cord.



996,865.—Vapor Electric Apparatus.

PATENTS ISSUED JUNE 27. DELAYED IN RECEIPT.

996,580. WIRELESS TELEGRAPHY; C. M. Green, Lynn, Mass. App. filed Sept. 30, 1907. A multiplex system using multiphase current. Maintained periodic electromagnetic waves of ineffective volume are reinforced in accordance with the desired signals.

996,582. STATIC PROTECTOR FOR VAPOR ELECTRIC APPARATUS; J. L. Hayden, Schenectady, N. Y. App. filed Jan. 5, 1906. A good conducting shell surrounds one of the electrodes and is connected to its supply lead to prevent deterioration and arcing.

996,583. ELECTROLYTE FOR ELECTROLYTIC CELLS; J. L. R. Hayden, Schenectady, N. Y. App. filed March 5, 1908. Solution of ammonium octoborate with glycerine or milk sugar for high voltage, moderate temperature rise and inappreciable deterioration.

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CONTENTS.

HIGH FREQUENCY SUPERPOSED TELEGRAPHY AND TELEPHONY.

A very interesting and important paper, read before the recent Chicago convention of the American Institute of Electrical Engineers, was by Major G. O. Squier, United States Army, on his system of "Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires." Up to the present time the science and art of electric wireless communication has been built up and enriched with material adapted from the older science and art of electric wire communication. In ordinary wire telegraphy the frequency is very low, speaking from an alternating-current standpoint. Reactances in the circuit are therefore relatively trivial, and ohmic resistances mainly control the strength of the current on the line. In wire telephony, as ordinarily conducted, the effective frequencies run up to 2000 cycles per second and the reactances of the circuit contest with the ohmic resistances for supremacy in determining strengths of current. In wireless telegraphy and telephony, after the electric impulses leave the mast and take their flight over the conducting surfaces of land and sea, they are freed almost completely from the dominion of ohmic resistance and are subject to the control of pure reactance, the power being carried entirely by electromagnetic fluxes permeating the air and free space at frequencies of hundreds of thousands to millions of cycles per second. A special technique and a special department of science have had to be developed to deal with and measure the phenomena produced at such frequencies.

Major Squier's paper indicates a reimportation of the knowledge gained in the wireless arts to the service of wire communication. He employs the methods of wireless telegraphy and telephony upon already existing wires without disturbing appreciably the regular service carried on by such wires. The wireless apparatus brought into connection with such a circuit does not disturb telephonic communication, because its frequency is ultra-audible. On the other hand, the regular low telephone frequency does not disturb the wireless apparatus, because the latter is tuned to far higher rates of vibration. Moreover, the manipulation of the wireless apparatus on the wire circuit is very much simplified and takes far less power than usual, since the current is guided over the circuit wires in one dimension of space, instead of being scattered over the surface of the planet in two dimensions. Consequently, at least for short distances, the signals received are much more powerful with the wireless apparatus over wires than over the sea or land.

From a technical standpoint there is a great gain in introducing these high-frequency methods onto wires. The reactances developed are very large with respect to the ohmic resistances, although the latter are considerably en-

hanced by imperfect current penetration. The phenomena of wire telegraphy and telephony at 100,000 cycles per second are a valuable preparation for the pure reactance phenomena of wireless telegraphy and telephony at the same or still higher frequencies. The sudden transition between the technique of wire and wireless operations will be avoided, and the breach in theory between the two will be filled in. From a practical standpoint the advantage gained by the Squier methods is likely to come more slowly, owing to the special character of the high-frequency generators used. If alternators of 20,000 r.p.m. were easily procured, the diplexing of telegraph and telephone circuits in this way might follow speedily; or if the singing arc could be generally employed, the same result might be expected. Nevertheless, even although the applications come slowly, they may be expected to come surely, and the advantage of a potential duplicate system of communication is a permanent asset that nothing can destroy. The fact that in ordinary wireless communication reactance is supreme is shown by the constant necessity for tuning—that is, for balancing positive and negative reactances. The importance of such tuning manifests itself very clearly in Major Squier's adaptation of these methods to wire transmission. The reactances developed are so large that it becomes desirable, or even imperative, to tune the circuits to the high frequencies employed. As pointed out in the paper, it is difficult to tell at the sending end of a short line whether the wires at the receiving end are disconnected or connected together. With this new method of operation a new chapter in the arithmetic of telegraphy and telephony is opened and a wide field for investigation is developed. There can be no doubt that the results of such investigation will react with great advantage upon the knowledge of both wire and wireless phenomena.

GASOLINE-ELECTRIC TRACTION.

A paper on the development of gasoline-electric traction abroad, published in another column, gives a most illuminating view of those differences in practice which, arising both from difference of temperament and of conditions, cause striking variations between American and European practice. The gasoline-electric car, or rather the car propelled by an internal-combustion engine with electric reducing gear, has been in the field for some twenty years. As Mr. Drake, the author of the paper in question, points out, the earlier attempts were handicapped both by the weight and inefficiency of the early gasoline motor and by the employment of a costly, heavy and generally useless storage battery as part of the equipment. As the early gasoline motors had a very limited range of efficient performance and needed to be worked quite near their full-load rating to obtain even tolerable results, the early experimenters traveled upon the theory of a gasoline motor running continuously at full load and charging a storage battery, from which the electrical supply could be drawn as necessary. The storage battery itself, with its enormous weight and low efficiency, was enough to condemn the scheme, and nothing except stock issues and disappointment resulted. As the gasoline engine, thanks to the automobile, has been improved in efficiency, weight and reliability, it has beer possible to work it under good conditions over a consider able range of load, and hence to take up the work of trac tion either with mechanical coupling, such as is used or the ordinary automobile, or with the electrical coupling The electrical transmission gearing is simple, reliable anc convenient, and the fact that it has found large use abroac is a safe indication that it possesses practically valuable properties. The great difference, which Mr. Drake points out, between the use of such automobile cars here and those abroad is due perhaps to that gloomy obsession of stand ardization which afflicts so many American engineers However modest the original intent in developing the gaso line-electric car in America, the end of a short line of evo lution has been a heavy motor car of the Pullman type weighing, as Mr. Drake points out, about 1 ton per pas senger seated, and entailing upon the user both large fixe charges and heavy operating expense, due to the hug weight unnecessarily dragged about and necessarily pro vided with costly equipment. The same tendency is re flected in every part of our transportation systems in thi country. The light railway in the sense in which that ter is used abroad is almost unknown in America. Its func tion as feeder to trunk lines is either not recognized o forgotten. Now, the gasoline-electric car is emphatically car for light and infrequent service, to be used in situation where the traffic is not heavy enough to warrant the con struction of a railroad with regular equipment or an elec tric line of the ordinary sort. Its field is distinctly on separated both from trunk-line service and from that s fully occupied by ordinary electric traction. The require ments of this field have been grasped by the foreign buil ers, who turn out a light and relatively inexpensive ca amply sufficient to do its work and not undertaking to d the work of anything else.

It is interesting to note that the nearer the power unit are kept to the sizes familiar in automobile practice th more reliable are the operating results. The high-powe car requiring heavy engines of large cylinder capacity avoided in European practice, and with the adoption c moderate power and moderate speed the applicability of th system to light-railway service is greatly improved. Fo example, on one of the lines described by Mr. Drake th locomotive, equipped with a six-cylinder, 90-hp gasolir engine and electric drive, weighs 18 tons and commonly employed to haul two trailers, each weighing 11 tons empty thus the train with seating capacity of 100 passenger weighs loaded less than 50 tons, which is hardly more tha the weight of a single gasoline-electric car of typical Amer can construction. The commercial speed does not muc exceed ten miles an hour, and the consumption of gasoline approximately between 2.5 lb. and 3 lb. per train-mile, ce tainly an encouraging figure from the economic standpoin particularly at American prices for gasoline.

Developed along these lines, which are strictly those c the European railway, the gasoline-electric car is givir promise of great usefulness and undoubtedly increasir popularity. What can be done with it in this country another matter. The development of transportation he seems to have proceeded largely upon the theory that eve

line is likely to become a trunk line and every station a metropolis. In the early days of railway transportation these great possibilities of growth were ever present and sometimes were in part justified by the result, but as the development of the country itself has gone on it is perfectly safe to say that certain lines never can in any reasonable period become lines of large traffic, and that certain cities do not have characteristics that make for indefinite growth. Hence one might as well recognize the fact that certain lines of transportation are destined for a very long period to be lines of light service. Such lines may often be conveniently electrified in the ordinary way to good advantage. Where the traffic is too scant even for this, the gasoline-electric car would seem to fill a very useful place, but to fill this place it should be relatively light and cheap to lower the fixed and operating charges to a point justified by the traffic.

STRESSES IN WIRE SPANS.

The calculation of stresses and sags in wire spans is a mechanical problem of great importance to the electrical engineer. The rapid strides made during the last decade in the methods of constructing high-tension transmission lines and of suspending trolley wires for high-speed electric traction emphasize both the importance of the problem and the necessity of going into its refinements. More than sixty years ago Weisbach laid down the fundamental law of the catenary in exact analytical form, but the majority of writers since his time have apparently regarded it as unnecessarily complex. At any rate, we find a large variety of inconsistent formulas, usually offered as approximate, but seldom with the error exactly defined. The best physical example of the catenary is a link chain freely suspended between two rigid supports. Such a chain is resistant only to longitudinal tension and is perfectly flexible when the tension is removed. When the links are made infinitesimally short the chain becomes a perfect catenary. The ordinary calculation of stress or sag with given conditions of loading is not formidable, but with changes in loading the analytical treatment becomes somewhat involved. All materials yield under stress, but return to their original dimensions when unstressed unless the yield point has been passed—that is, within the limits of Hook's law. A change of temperature in the catenary which, for example, lengthens it also increases the sag and increases it in much greater proportion than the heat expansion, provided that the ratio of sag to span is small, or over a few per cent.

This is a peculiar property of the catenary, and one which is responsible for the complex form of the analytical treatment. At the same time that the sag increases the stress decreases, and by reason of the accompanying elastic contraction the catenary tends now to shorten. Obviously these phenomena are simultaneous and must be so treated. Under increasing loads the elastic stretching lengthens the catenary and thus increases the sag, in turn preventing an increase of stress proportional to the increase in load. In practice the perfect catenary is not attained because a continuous wire or a stranded cable is not perfectly flexible and therefore acts to some extent, near the supports, like a continuous girder. And, again, the ordinary support which is assumed to be rigid is actually never so, particularly at tangent intersections with considerable angularity. The flexible support which results with insulators of the strain or suspension type introduces at least one more variable to deal with analytically. Here, of course, there must be not only no possible upward component of wire tension—caused by unequal heights of support—but the tensions from continuous spans must wholly neutralize each other except for a component vertically downward. Difficulties arise when spans of unequal dimensions are joined at a flexible support. These are easily surmountable, of course, by dead-ending the spans, but as this increases the cost it should be done only as careful judgment and experience dictate.

Three papers on the subject here considered were presented at the recent Chicago A. I. E. E. convention, one by Mr. Percy H. Thomas, one by Mr. William LeRoy Robertson and the other by Messrs. Harold Pender and H. F. Thompson, all of which employ a combination of analytical and graphical methods. The papers by Messrs. Thomas and Robertson are notable because both employ the rigorous theory of the catenary, and the treatment presented by Mr. Thomas is especially noteworthy for its brevity. Mr. Robertson also presents an interesting comparison of various formulas for spans with actual measurements on an 80-ft. span. The catenary gives the closest agreement and the parabola is the second choice. These observations ought to be extended to longer spans, flanked by at least one span on each side in order to get the continuous girder effect and determine its magnitude. The paper by Messrs. Pender and Thompson contains a very ingenious graphical solution which is worthy of study. One of the points to be emphasized is the difficulty which attends any attempt to digest these three papers at one sitting and draw conclusions as to the relative facility of methods. It cannot be expected, of course, that three or four authors will make the same approach to a problem which has at least five variables and sometimes more. The differences in nomenclature alone are very confusing in these papers, and the high-tension committee of the Institute could perform a valuable service in selecting proper and consistent nomenclature and establishing—if such a thing is feasible—a standard method or set of methods for handling span problems. This would be of value to engineers generally, and especially in the matter of teaching the subject to engineering students. But what stands out most prominently, perhaps, is the need of comprehensive data in relation to the sleet and wind loads which occur each winter with considerable regularity. We need, of course, to have independent values of wind, sleet and temperature; we also need simultaneous values in all possible combinations. There are two channels of research open. One is the records of the Weather Bureau, and the other is the experience of the wire companies. Both ought to be pursued with diligence and energy, because the largest issue in the whole problem to-day is the assumed loading. Methods of calculation exist in profusion, and elimination for the survival of the fittest is much needed. But of loads we know relatively little and at that point are especially weak.

Convention of the Ohio Electric Light Association.

The seventeenth annual convention of the Ohio Electric Light Association will be held at Cedar Point, Ohio, on July 25, 26, 27 and 28. The headquarters of the association will be at the Breakers Hotel, where arrangements have also been made for an exhibit. The program, outside of the usual address of the president and the reports of the secretary and treasurer, contains the following papers: *Why the Central Station Should Take Over the Isolated Plant,* by Mr. Waldo Weaver, Tippecanoe City; *Systematic Central-Station Records,* by Mr. O. B. Reemelin, Dayton; *Limiting the Energy Demand and Voltage Variation of a Circuit by Floating a Flywheel Motor-Generator on the Line,* by Mr. A. M. Seeger, Toledo; *Boulevard Lighting System,* by Mr. G. A. Doeller, Dayton; *Advantageous Uses to Which Mercury-Arc Rectifiers May Be Put on Central-Station Lines, by* Mr. T. J. Kermode, Cleveland; *Report of Committee on Motor Application; The Utility Law of Ohio and Its Application to Electric-Light Companies,* by Mr. D. L. Gaskill, Greenville; *Pumping Water for Municipalities and for Irrigation by Electricity,* by Mr. B. H. Gardner, Dayton; *Insurance Rates as Charged Electric-Light Stations in Ohio,* by Mr. D. L. Gaskill, Greenville; *Report of the Committee on Meters,* by Mr. J. G. Gilmartin, Toledo; *Motor-Driven Refrigeration,* by Mr. W. C. Anderson, Canton; *The Use of Tungsten Lamps in Signs and Outline Lighting,* by Mr. W. B. Goudey, East Liverpool; *Progress of Electrical Cooking in Small Towns,* by Mr. P. L. Miles, Cleveland, and *Report of Committee on Electrical Transmission.*

There is a musicale and card party for the ladies on July 25, and an informal dinner followed by a dance in the evening. In the morning of the next day a ladies' bowling party has been arranged, and in the afternoon the ladies will be taken for a boat ride on Sandusky Bay. Later in the day a water-ball game between central-station men and supply men will take place on Lake Erie. In the evening the association will give a banquet to all in attendance, after which a short entertainment will be provided. During the afternoon of July 27 the ladies will have a musicale and card party, and the men will engage in a baseball game. In the evening there will be an informal banquet followed by a vaudeville entertainment and dancing. On the final day of the convention the ladies will have another musicale and card party.

The officers of the association are as follows: President, Mr. E. H. Beil, Youngstown; vice-president, Mr. W. C. Anderson, Canton; secretary-treasurer, Mr. D. L. Gaskill, Greenville.

Chicago Subway Hearings.

At the meeting of the local transportation committee of the Chicago City Council on July 13 Mr. W. S. Jackson, of New York, explained the proposal of the Chicago Municipal Subway Company. This company desires an ordinance which will enable it to build a comprehensive system of about 46 miles of subway in Chicago for about $65,000,000. The engineering under this proposal would be done by a city commission, the company building the subway for the privilege of operating it for twenty years. Mr. Jackson explained the financial features of this plan at considerable length.

According to an opinion of the corporation counsel, presented at a meeting of the committee on July 17, the city of Chicago has general power to own and construct a system of subways. This applies, however, to subways for the transportation of passengers and not of merchandise. The city may allow utilities owned by individuals and private corporations to use a portion of the space in the subway, provided such use does not interfere with the primary object of street-railway transportation. The expense of the reconstruction and readjustment of such utilities must be borne by the owners. The city has no power to operate a street railway in the proposed subways without a popular vote approving the proposition. However, the city has the power to lease the subways to railways incorporated under the laws of the state for a term not exceeding twenty years. Bonds issued for the building of the subways will be a lien upon that property only, and are not to be included in the general bonded debt of the city.

Bureau of Mines Electrical Section.

An electrical section of the Bureau of Mines was organized in 1909 to investigate the conditions under which electricity is used underground, and in order to obtain data which will be of assistance to state officials who have charge of the regulation and inspection of mines, and also to those who use or manufacture electrical mining equipment. This section is part of the mining experiment station of the bureau at Pittsburgh. Technical paper No. 4, issued by the Bureau of Mines, sets forth in detail the purposes and equipment of the section, and gives an account of some of its work.

Preliminary investigations on incandescent lamps were made, which showed that certain sizes of lamps when broken ignite surrounding explosive mixtures of gas and air, and tests are now under way to determine the factor of safety of such lamps as have not caused ignition in previous experiments. An investigation is also being carried on relating to the action of acid mine water upon the insulation of electrical conductors. Tests have recently been finished of electrical fuses with relation to their use in mines. Seven different types of inclosed fuses were tested by being mounted in standard clips or holders and placed inside a gas-tight, boiler-iron box, which was provided with means of admitting any desired percentage of gas. The results of the tests were as follows:

1. One or more sizes of all the brands of fuses tested ignited the gas, although in varying degrees. Two brands ignited the gas at once; three brands ignited it in more than 50 per cent of the tests. 2. The principal sources of danger in fuses as they are now designed is the device for indicating whether or not a fuse has acted. 3. Danger from blowing at the relief ports will probably develop in some, and possibly in all, brands if tested with enough generating capacity.

Boston Electric Vehicle Club.

The Electric Vehicle Club of Boston held a meeting on July 12 which had been postponed from the week previous owing to the nearness of the holiday. Mr. L. A. Tirrell, of the Commercial Truck Company of America, presided, and after luncheon Secretary Gibbs told of advertising work that has been done through the daily newspapers of a sort that is especially timely, in that many horses are being struck down by the heat. On July 8 reading notices, calling public attention to the advantages of electric trucks in hot weather, were inserted in the Boston papers, one of which was generous enough to run the matter as news in its "hot-weather story." He showed a photograph of a grouping of the 114 horse vehicles and 30-odd gasoline cars that are to be replaced soon by electric cars and trucks.

Mr. Tirrell advocated a plan of starting a night school for the instruction of drivers of electric vehicles, particularly trucks, at which instruction will be given in the repair of motor vehicles, besides lectures by experts on matters pertaining to the use and care of the vehicles. The plan met with the approval of the club, which, it is planned, will back the enterprise.

Mr. C. F. Smith, head of the automobile division of the

Boston Edison transportation department, said that drivers are now being trained in his garage and that the plan is very successful. Mr. Kelly, of the Edison Storage Battery Company, of New York, said that Macy's department store, in that city, punishes drivers of electric delivery wagons who fail to take care of their cars by putting them back to driving horse wagons. This has the effect of making them very careful thereafter.

It was voted that the chairman name a committee on the proposed school, and his choice will be announced later. The sessions of the club are suspended until about Sept. 15, subject to special call.

National Electrical Contractors' Association.

The eleventh annual convention of the National Electrical Contractors' Association was held at the International Hotel, Niagara Falls, N. Y., July 19, 20 and 21. The attendance numbered about 200, representing different sections of the United States and Canada.

One session was devoted to the presentation and discussion of papers as follows: *Relation Between the Central Station and the Contractor,* by Mr. Arthur Williams, New York; *Credit Protection,* by Mr. Franz Neilson, New York; *The Proper Lamp for the Circuit,* by Mr. P. F. Bander, National Electric Lamp Association, Cleveland; *The National Fire Protective Association,* by Mr. F. E. Cabot, Boston; *The Contractor as a Merchant,* by Mr. C. E. Whitehorn, New York; *Co-operation in the Electrical Industry,* by Mr. P. S. Dodd, National Electric Lamp Association, Cleveland. The business of the association was transacted in closed sessions, at which, among other subjects, practical and economic matters relating to labor and other kindred questions were discussed by the contractors.

As usual at these conventions, many forms of entertainment were provided. On the opening day there was a ride for ladies and guests around the falls and to points of interest with Messrs. Emmet Fleming and O. W. Cutler in charge. In the evening a reception and dance was given at the International Hotel, Mr. and Mrs. M. L. Barnes and Mr. and Mrs. P. N. Thorpe receiving. On July 20 there was a banquet for ladies, guests and members, followed by a vaudeville performance. On the following day a trip was taken over the Gorge Route and visits made to the Niagara Falls power houses and to the Catholic College grounds. In the afternoon there was a baseball game between teams of Eastern and Western contractors.

During the convention the Sons of Jove held a rejuvenation at which between thirty and forty new members were initiated, the ceremony being in charge of Mr. A. E. Brock.

The association has made remarkable progress during the past year under the administration of President M. L. Barnes, of Troy, N. Y., the membership having increased over 80 per cent, and the coming year promises to make a similarly good showing.

The officers elected for the ensuing year are as follows: President, Mr. M. L. Barnes, Troy, N. Y.; first vice-president, Mr. Ernest Freeman, Chicago; second vice-president, Mr. H. S. Potter, Boston; third vice-president, Mr. J. C. Hatzel, New York; treasurer, Mr. John R. Galloway, Washington, D. C.; secretary, Mr. W. H. Morton, Utica, N. Y.; sergeant-at-arms, Mr. J. C. Sterns, Buffalo.

Chicago Electrical News.

PROBABLE MERGER OF SUBURBAN ELECTRIC COMPANIES NEAR CHICAGO.

It is generally believed, as previously reported in these columns, that the North Shore Electric Company, the Economy Light & Power Company and the Illinois Valley Gas & Electric Company will be merged in one company, which may, perhaps, be called the Chicago Suburban Edison Company. All of the companies named operate in northeastern Illinois, within a radius of 100 miles from Chicago, and all of them are controlled by interests friendly to the Commonwealth Edison Company of Chicago. Mr. Samuel Insull, who is president of the Commonwealth Edison Company, is also president of the three other companies. The North Shore company supplies electricity in the suburban area immediately surrounding Chicago. The Economy company has its operating headquarters in Joliet, where it has a water-power plant on the Desplaines River, and it supplies electrical energy in and near Joliet. The Illinois Valley Gas & Electric Company was formed about a year ago and took over a number of public-utility properties in La Salle, Grundy, Will and adjoining counties in northern Illinois. Its operating headquarters are at Streator, and it may be said to possess the outer belt of territory served by the three companies. The three companies have many interests in common, and an amalgamation has been expected for some time, although no official announcement of the merger has been made at this writing. The combined capital stocks of the three companies which are expected to be merged amount to about $12,000,000, and the combined bond issues outstanding amount to about $5,000,000. The companies serve a very wide area—approximately 3200 sq. miles—and supply public utilities to about 150 cities and villages.

It is reported that the Kankakee Gas & Electric Company, of Kankakee, Ill., and the Chicago & Southern Traction Company, which operates an interurban line between Chicago and Kankakee, will be taken into the new combination. The total capitalization of the Kankakee company is $1,300,000, and it supplies electrical energy in the city of Kankakee and also in the suburban communities of Bradley and Bourbonnais. The Chicago & Southern Traction Company is in the hands of receivers. It purchases electrical energy from the North Shore Electric Company.

CENTRAL-STATION AND ISOLATED PLANTS IN CHICAGO.

In the report of the department of electricity of the city of Chicago for the year 1910 there is given the following interesting table showing the number of electric-lighting stations and lamps in the city under the jurisdiction of the department:

	[illegible]	Arc Lamps.	Incandescent Lamps.
Commercial companies, central stations	21	17,769	[illegible]
[illegible]	[illegible]	19,670	[illegible]
[illegible]		12,366	
[illegible]	[illegible]	80	3,449
[illegible]	[illegible]	[illegible]	4,446,343

To most electrical men it will be rather surprising to know that there are eighteen commercial central-station concerns in Chicago. The largest of these, of course, is the Commonwealth Edison Company, with four generating plants, serving 3,406,643 incandescent lamps (3,730,078 on June 3, 1911), 16,857 arc lamps and industrial motors rated at 177,785 hp. Considering rating of motors connected, the next largest concern is the Sanitary District of Chicago, with 10,430 incandescent lamps, 175 arc lamps and motors rated at 12,639 hp. The third on the list in this order is the Cosmopolitan Electric Company, with 48,450 incandescent lamps, 113 arc lamps and motors rated at 3209 hp.

PREPARATION FOR THE NEW STREET LIGHTING OF CHICAGO.

Under its contract with the city of Chicago the Sanitary District of Chicago, which operates the hydroelectric plant on the Chicago Drainage Canal, is to finance an ultimate addition of 10,000 street arc lamps to the 12,300 municipal street arc lamps now in service. The Sanitary District has arranged to purchase the large amount of material necessary for this extension, but some delay has been caused because the exact make of lamp to be used has not been decided. The district intends to use powerful flame-arc lamps, and in its specifications called for 4000 inclosed series alternating-current lamps of this type for initial equipment. Bids were received from the General Electric Company and the Stave Electrical Company under these specifications, the former offering a double-globe lamp requiring trimming every ninety hours, and the latter a single-globe lamp said to be guaranteed for 125 hours. The Stave lamp is a lamp of foreign design, but if it is selected for the Chicago contract the lamps will probably be made in this country by the Westinghouse Electric & Manufacturing Company.

The specifications require that the lamps must be adapted for service on street-lighting circuits, connected in series to a maximum of 100. The lamp must be of the flame type, differentially wound, with superimposed electrodes and focusing arc. Each lamp must be provided with an accessible automatic cut-out. The inner globe, where there is an inner globe, must be of clear glass, not less than 3 in. internal diameter. All lamps must be adjusted for operation on a current of 10 amp. at a frequency of 60 cycles, with from 50 volts to 60 volts at the arc. The watts consumed between the terminals of the lamp must not exceed 465. Under the above conditions the lamp must operate at a power-factor of not less than 78 per cent. The voltage regulation of the arc must be normally between the limits of 50 to 60, and the hours of life specified shall not be less than ninety hours on the average for each trim. The automatic cut-out must be adjusted to extinguish the lamp before the voltage of the arc exceeds 75.

Lamps were supplied by the two companies mentioned, for testing, and were subjected to a test of twelve days' duration at the terminal station of the Sanitary District by Messrs. E. Fenger and A. B. Gates, testing engineers, under the supervision of Mr. E. B. Ellicott, electrical engineer for the Sanitary District. Tests were made with electrodes giving both yellow and white light to show variation or swings in candle-power for an hour's burning. Photometric measurements were made at various angles, and the amperes and volts consumed were also measured. Other tests were made to show the characteristics of the lamps in starting; this is an important feature in flame-arc operation, owing to the resistance of the slag of the electrodes. Furthermore, the temperature rise of the cut-out circuit when in operation was tested. Curves were plotted showing the distribution of light for the two lamps and for both yellow and white light, as well as for American-made and foreign electrodes. The report on these tests is now in the hands of the trustees of the Sanitary District.

As the long-burning flame-arc lamps are practically of a new type and unusually powerful, it was deemed essential by the Sanitary District that a durability test be made, and for that purpose the district offered to purchase 250 of each of the types of lamps submitted and subject them to a sixty-day operating test. This proposal was unsatisfactory to one of the bidders, however, and consequently the selection of the lamp was undecided at the time this was written. It is hoped that at the meeting of the trustees on July 27 some conclusion will be reached. One result of the tests of the Sanitary District seemed to be that there was practically no difference in efficiency whether the electrodes giving white or those giving yellow light were used.

Contracts recently entered into by the Sanitary District for material to be used in carrying out its contract for the city street-lighting extension, in addition to those mentioned heretofore, are as follows: Republic Electric Company, sixteen 250-kva transformers at $829 each; Electric Railway Equipment Company, tubular wrought-iron lamp-poles, standard pipe and extra strong pipe, at the prices named in its bid, approximating $25,000; Fort Wayne Electric Works, oil-immersed constant-current regulators at $284 for each regulator complete; Western Electric Company, 300 miles of No. 6 weatherproof wire at $81.12 per mile; Ferguson & Lange Foundry Company, 2000 cast-iron lamp brackets at $3.40 each.

ANOTHER TELEPHONE REPORT FOR CHICAGO.

At its meeting on July 17 the committee on gas, oil and electric light of the Chicago City Council instructed Mr. Edward W. Bemis, who has just made a report on the gas rates of Chicago, to make an investigation of the affairs of the Chicago Telephone Company to the end that the committee may have further expert information in preparing for the proposed revision of telephone rates. This will be the third report of experts on the telephone-rate subject to be made in Chicago within a short time. The first was a joint report by the Arthur Young Company and D. C. & W. D. Jackson, engineers. This was not satisfactory to the city and was not accepted, although there was no criticism of the engineers' end of the report. Then Mr. W. J. Hagenah, formerly connected with the Wisconsin Railroad Commission, was called in, and he made a very elaborate report on the telephone situation for the committee. Since this report was presented there has been a change in the political complexion of the committee, and now Mr. Bemis has been retained to make a third report, so the subject will be well covered, apparently.

Mr. Bemis made a statement to the committee in which he explained that he would have to examine certain parts of the Hagenah report, such as the present valuation of the plant, the method of figuring depreciation, classification of service, etc. He could not tell in advance how much the work would cost, but said that he would give his service at the rate of $50 a day and expenses. He though the probable cost of his telephone report would be less than $4,000. The Hagenah telephone report cost about $6,000, this sum including the remuneration of Mr. Hagenah's assistants. Mr. Hagenah also made a report on gas rates. This was made under greater pressure and cost about $8,000 or $9,000. The city paid $2,500 for the Young portion of the Jackson-Young report, although the claim is said to have been $3,700. It is said that the compensation for the Jackson end of that report has not been agreed upon. These figures are interesting as indicating the amount of money which municipalities now feel authorized in paying to secure expert information in relation to pressing questions of public-utility adjustment.

Electric Vehicle Service in Springfield (Mass.) Fire Department.

Motor vehicles have of late been taking a place of increasing prominence in fire-department service, and where the horse has been discarded the area of protection has been greatly increased, both in urban and suburban fire fighting. The city of Springfield, Mass., has the distinction to be the first in the United States to make a thorough service application of the electric vehicle in fire-department operation, an 85-ft. aerial ladder truck and a combination hose and chemical wagon having been propelled by electricity with entire success since their installation in March of the present year. Marked economies in the cost of operation are indicated by the use of electric vehicles in this important service, and as might have been expected, the apparatus has demonstrated 100 per cent reliability, the fire department executives being enthusiastic in their praise of electric automobile equipment in place of horses.

The Springfield apparatus was selected only after an exaustive investigation of the best types of gasoline engineriven fire-department equipment. Energy is supplied by ıe United Electric Light Company, of Springfield, and the quipment is housed at the central headquarters station on 'ynchon Street, in the heart of the business district. New uarters will shortly be taken up in a new and improved tation in the Court Square district, the latter being fitted ith only motor-driven apparatus and equipped with the ıtest type of signaling devices, automatic machinery and atteries. No provision for horses is being made in the new eadquarters building.

The new electrically driven truck carries a total length of 25 ft. in ladders and a crew of seven men, all of whom are vailable for service after the equipment reaches a fire. he ladder truck was built by the Seagrave Company, olumbus, Ohio, and is driven by four 3-hp, direct-current ıotors mounted in the wheels on the Couple-Gear system, nergy being supplied from a battery of eighty cells of National" seventeen-plate, "WBX" storage units. The ruck has a guaranteed maximum speed of twenty miles per our on a level roadway, and on a test run made a halfile in 1 min. 17 sec., corresponding to a speed of 23.4 miles er hour. The weight of the truck, including its full comement of men, is 10 tons, and it will run about 15 miles : full speed on a single charge. The truck is equipped with side seat and special steering gear, Sangamo amp-hour eter, motor-driven syren, electric tail-lamp and tungsten ead-lamp. The apparatus has five speeds in both the forard and reverse direction.

The combination wagon is provided with a 40-gal. chemiıl tank and 200 ft. of chemical hose, besides 1000 ft. of egular 2½-in. fire hose. It is driven by four 3-hp motors

Electric Ladder Truck.

ı the Couple-Gear system, and weighs about seven tons. s speed guarantee is 30 miles an hour, and its battery uipment is the same as that of the ladder truck above ioned. On account of the high speed made by this out- "Presto-lite" searchlight equipment has been supplied. n electric horn is provided, and the tail lighting is by ectricity. On a 12 per cent grade this apparatus has made measured speed of 12 miles per hour. The combination tfit was purchased in various localities and the parts sembled by the department organization at Springfield.

Both pieces of apparatus are supplied with energy through 7.7 Crocker-Wheeler motor-generator set located in the adquarters station. This outfit consists of a 35-amp, 220-lt generator, driven by a direct-connected 500-volt, directrrent motor running at 1175 r.p.m. The motor-starter, ttery-charging rheostatic equipment and generator field regulator were supplied by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Flexible cables with plug connections convey the energy to the battery-charging plugs on the apparatus. The charging equipment occupies a space 5 ft. long by 3 ft. wide. A Weston voltmeter and ammeter are installed, and the apparatus can be disconnected within one or two seconds in case an alarm is received during the charging period. About ten alarms per month are at present answered by the electrically driven vehicles, their district in the main covering a radius of 1 mile from the business center of the city.

The results of operation have been satisfactory in every particular. On a test run the ladder truck ascended a 12 per cent grade at a speed of 8 miles per hour. Its reliability is unquestionably superior to that of gasoline, on account of the complexities of the latter equipment. Three new electrically driven hose wagons have just been ordered by the city authorities in spite of the vigorous competition of local gasoline machine manufacturers having a strong foothold in the city. The cost of energy for the first month's service was only $3.78, and for the second month $7.77, the rate being about 3 cents per kw-hour. The initial cost of the motor-driven ladder truck was about $12,000. A first-class horse outfit costs about $5,500, but the annual cost of operation by horses is far greater than with electricity. Three horses cannot be maintained in the condition necessary for fire-department service on less than $1,000 per year. The cost of shoeing horses with the best rubber pads is at least $4 per month. The small cost of energy is noteworthy, and even if a life of but a single year should be obtained from the battery, which is, of course, an absurdly short time of usefulness, there would still be a margin of nearly 100 per cent in favor of electricity. Both Chief Daggett and Assistant-Chief Kimball spoke to the writer in the highest terms of commendation of the electric-vehicle equipment, pointing out that it can be handled more rapidly and safely on the streets than horses, emphasizing the quicker acceleration possible, the readiness with which a higher average speed can be maintained, and especially touching upon the value of the driver as an additional fire-fighting unit, the perfect condition of the engine houses from the sanitary point of view, absence of heavy expense in maintaining exercising outfits and costly planking in stalls, and the saving in time effected through the omission of the usual "quick hitching" of harnesses, opening of stall doors and traversing of the engine-house rooms by horses. There is no question, judging from the experience of Springfield, that the low cost of operation, reliability and speed of service rendered by the electric automobile will result in its general application in fire-department service in this country. On account of the intermittent character of the service and the low mileage usually run off per unit per month, the load of such apparatus does not appear to be very striking in each individual case, but it is essentially of the off-peak or at least the long-hour type, and is worth cultivating by central stations.

Electric Train-Lighting Development.

The advent of the low-voltage tungsten lamp into the train-lighting field has given a marked impetus to the use of electricity in this class of service. Year by year the standards of comfort on the best American railway trains rise higher, and along with the recent adoption of triple-width window screens in Pullman cars the improved use of fan motors and tungsten lamps is an important factor in the comfort of summer travel. In the latest steel-car equipments considerable detailed study has been given to the selection of lamps and shades, to the provision of adequate control circuits carried in iron conduit, the adoption of artistic fittings, and the arrangement of lighting units to meet the requirements of taste and convenience.

The superiority of electric train lighting has never been better shown than in the recent period of excessive heat, when the atmospheric conditions in Pullmans equipped with Pintsch gas mantles were almost unendurable.

The advantages of electric train lighting are generally appreciated by the traveling public, but the perfection of the latest installations of this service is not so widely known. As a result of the study which has been given to the illumination of sleeping cars the passenger finds himself in possession of a remarkably flexible equipment. In a typical twelve-section Pullman with mahogany finish the principal lighting is accomplished by five four-light pendent fixtures equipped with translucent shades, the fixtures in each case being located above the center aisle about 7½ ft. above the floor. Each fixture is equipped with four 15-watt, 32-volt tungsten incandescents, each pair of lamps being hung at right angles to the other, thus providing for both the longitudinal and the lateral illumination of the aisle and adjacent seats. The location of the fixture centers opposite the bulkheads between the sections on each side enables the occupants of eight seats to read in comfort, the berth lights being available for supplementary service when necessary. As a rule these lights, consisting of 15-watt units, and allotted two for each upper and two for each lower berth, are not required for reading before the curtains are drawn for the night, the distribution from the aisle being adequate for all open-section activities. The combination of the lower-berth lamp pockets with a clothes hook, and the provision of a controlling spring and button with reflector of parabolic type, mark a distinct forward step in the direction of simplicity and convenience. On the hottest night the 15-watt berth lamp may be used with little sacrifice of comfort, the low expenditure of energy being insufficient to raise the temperature of the section perceptibly. Any other form of lighting in such a limited space and behind curtains of an inflammable character would be out of the question.

The lighting of all doorways by overhead lamps of 15-watt rating, and in particular the illumination of vestibules with lamps provided with downward reflectors throwing light upon the steps and hand rails, is an important improvement in detail accomplished during the last few years. The provision of numerous sectionalizing push-button switches, of one or two lamps above each mirror, in addition to the installation of a single unit in the center of the ceiling of toilet-rooms and a three or four-light fixture in washrooms, with about eight lamps in the stateroom, complete the equipment. The cost of operation of a total of about 100 15-watt lamps per car is moderate with the present system of axle generation, and the character of illumination, its steadiness, cleanliness and safety are certain to lead in the future to a still wider use of electricity in the field of train lighting.

Hydroelectric Developments in Sweden.

Through the work of the Royal Water Power Commission, which was established in January, 1909, accurate figures have been obtained as to the water-power developed and available in Sweden. According to a preliminary report recently published by this commission the total water-power in Sweden is estimated to be 10,000,000 hp during six to nine months of the year, and about 2,500,000 hp during the low-water period. By regulating dams, lakes and rivers the low-water power can be increased to 3,600,000 hp and possibly 5,000,000 hp. Taking into consideration the fact that many power consumers, such as electrochemical factories and certain electrical furnaces, sawmills and pulp mills, can to advantage use the so-called "season power," that is, use more power during the high-water periods, it is estimated that about 3,800,000 hp to 5,000,000 hp could be utilized at present.

According to statistics of 1908 the developed water-power was at the end of that year 420,000 hp, of which 165,000 hp was used for driving electric generators. The total power generated by hydroelectric, steam and other motive powers during 1908 amounted to 930,000 hp. Adding the water-power development finished since 1908 the total water-power output is estimated to be about 600,000 hp, of which about 340,000 hp is being used for driving electric generators. In the above-mentioned statistics the total rating of stations above 500 hp aggregates 450,000 hp. The stations grouped according to rating of turbines are as follows: Three stations larger than 20,000 hp; two stations of 10,000 hp to 20,000 hp; eight stations of 5000 hp to 10,000 hp; 102 stations of 1000 hp to 5000 hp.

The largest rivers are in the northern part of the country, where, unfortunately, the disadvantages for water-power developments are considerable on account of the severe climate and the long low-water period. On account of these facts some of the northern power schemes provide for an actual use of only five to seven months of the year. Owing to the cold climate one power station, at Porjus, on the Lule River, is being built 50 m below the surface, with intake and discharge tunnels of considerable length. In the middle and southern part of Sweden the conditions are more favorable, but not by any means ideal.

The hydroelectric power output during the years 1899-1908 increased by 80 per cent. Practically all the power is used for industrial and municipal purposes. The question of using electrical energy for railway motive power is still in an early stage in Sweden, though experiments have been made by the government under direction of Mr. Robert Dahlander to determine the adaptability of electric motive power for railroads, and the report on the subject seems to leave no doubt that a considerable portion of the State railroads will be electrified in the near future. On one section, Kiruna-Riksgränsen, a distance of 80 miles, the work of electrification has already commenced, as mentioned in the *Electrical World* of Oct. 13, 1910. The power station at Porjus, on the Lule River, is being built and transmission lines installed, for which work the government has appropriated $6,000,000, the installation to be completed in 1914. A railroad connecting Porjus with Gellivare, on the main line between Lulea and Riksgränsen, is also being built, and on Dec. 1, 1910, about 20 miles were finished, the whole distance being 34 miles. This road forms part of the Inland Railroad being built from Gellivare to Östersund, a distance of nearly 400 miles. About 100 miles of the southern part of this road is completed and partly opened. This road will have an ample supply of water-power along its whole length from the large northern rivers, and will along its route open a new country for various industrial enterprises. The country it traverses is very sparsely populated, some of the provinces having only one to five inhabitants per square mile. The government has recently bought waterfalls costing $1,350,000 in the southern part of Sweden, and most likely appropriations will be made by the Riksdag for electrification of other lines of the government railroads.

The government owns at present waterfalls with an effective power of approximately 880,000 hp, of which about 670,000 hp does not require any storage. These figures do not include a number of large falls in Norrland, the ownership of which is in dispute. The largest falls owned by the government are Trollhättan, Porjus and Alfkarleby. Trollhättan is now generating 40,000 hp and has an additional 40,000 hp under development, the ultimate capacity being 150,000 hp. The Porjus plant, now being built, will have 50,000 hp output with provision for an additional 50,000 hp. The Alfkarleby plant is designed for 40,000 hp initial output with provision for considerable future enlargement. Plans for this station have recently been submitted to the government for approval. Some larger falls which the government owns, or claims to own, have not yet been developed.

A number of municipalities have in recent years built ydroelectric plants for electric-railway and street-lighting urposes. Electric street lighting is installed in seventy f the total ninety-five cities in Sweden, and in a large umber of towns and small villages all over the country, ost of the municipalities buying energy from private inustrial plants.

In the zone which extends betwen Gefle and Gothenurg there are an exceptionally large number of plants. his district is a well-populated and well-developed art of the country, rich in mining and other indusial centers. Among the largest power schemes in this ection are Trollhättan, Bullerforsen, Gullspang and varnsveden. The government is rebuilding and deepeng the Trollhättan Canal from Gothenburg to Lake änern at a cost of $6,200,000, which will largely increase e possibilities for industrial development in this part f the country.

In Götaland there are several large power schemes, most nportant of which are the Yngeredsfors, on the River tran; four interconnected plants, Majenfors, Bassalt, pper and Lower Knared, on the River Lagan; Fridafors nd Hemsjo, on the River Morrumsan, and Torsebro, on e River Halgean, all of which are private industrial lants. Besides these there are a number of textile and ood mills, pulp and flour mills, etc., which have isolated lants.

In Norrland the principal industries are saw and pulp illing and mining. Sawmills do not, as a rule, use hydrolectric power, most of the mills being driven by steam, sing waste for combustion. If, however, a profitable use ould be found for the waste water-power would be more ommonly used. The wood-pulp industry, the chemical as ell as the mechanical, can with advantage use hydrolectric power. The chemical wood-pulp industry needs a ore regular power supply than the mechanical, which can se the "season power" to a large extent. This is a great dvantage as the northern rivers carry considerably less ater in the winter. Recently several large pulp mills ve introduced electric motive power, for instance, the d Sulphite mill which employs about seventy-five otors for individual drives. Other installations of equal nportance are being made. The different industries erved and the respective amount of energy consumed by ach are shown in the following table:

	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] industry	[illegible]
e industry	10,000
ghting and various smaller motor loads	185,000

Up to the end of last year a total of 910 concessions had een granted for electric works and undertakings in weden. Those for long-distance transmission have an ggregate rating of 253,300 hp and an aggregate length of ne of 2500 miles. Of the total, 127 were granted in 1910 nd represent 50,260 hp. The most important are the Bulrfors station, 24,000 hp, belonging to the Stora Kopparergs Bergslags Company, and the Mockfjärd station, 6,000 hp, of the Grängesburg Company.

Municipal Ownership in England.

The present status and prospects of municipal electrical upply are discussed in an article in a recent issue of the ondon *Times,* with particular reference to the recent nnual meeting of the Incorporated Municipal Electrical Association. When this society was formed sixteen years go there were about thirty municipal electric-lighting lants in Great Britain, with a capital of about $10,000,000. Now there are 326 municipal stations, with a total investent of nearly $225,000,000.

Regarding [illegible] municipal enterprises [illegible] that the expectations of early enthusiasts have not been fully realized. The net earnings on about $200,000,000 of municipal electrical capital are, according to the "Manual of Electrical Undertakings," $15,766,125; and after paying $5,691,580 in interest, $5,934,555 to sinking fund, $1,568,545 for bad debts and special charges, placing $1,380,210 to depreciation and reserve, and $1,340,400 to taxes, there is a deficit of $149,165. These figures can hardly be said to show a very broad margin. Interest and sinking fund absorb so much of the net earnings that there is comparatively little left for contingencies or those contributions to the municipal treasury which taxpayers were once taught to regard as a means of reducing their burdens to a minimum.

The members of the I. M. E. A. regard payments to reduce taxes as a vicious policy. Their object is to cheapen and extend the services of electricity as far as possible, and from that point of view the milking of balances by the borough treasurer is considered contrary to the public interest. The city councils have often forced the electricity committee to increase their contributions beyond the limit proposed by the later and in this have always been heartily supported by the gas committees, whose members argue that the electricity department ought to relieve the taxes on the same scale as the gas department. The relative claims of these two public-service departments, which are to a large extent competitive, present one of the most critical problems before the local authorities. The effort of the gas committee is often concentrated upon forcing municipal electric undertakings to charge higher prices, to put larger sums to reserve, to pay more to the taxes, and to take no steps in developing business by advertising and kindred methods. This, it is stated, is a form of pressure which the I. M. E. A. must, for its own sake, resist to the utmost; and its resistance may be supported by the argument that the public is entitled to the best that electricity can offer, at the lowest possible price, independently of the effects that this electrical advance may have upon the progress of gas.

One serious question that will come up before the council of the I. M. E. A. is the matter of raising loans. Not many years ago the process of applying to the Local Government Board for permission to raise loans for electrical development was more or less a pleasant formality. Lately, however, it has become a searching inquisition and there has undoubtedly been some effect in checking outlay upon municipal supply undertakings. Central-station engineers have postponed the evil day as long as possible, and they have been inclined to ask sanction for the lowest possible amount rather than for the sum they would like to spend upon the liberal development of their business. At present a local authority has no means of raising working capital except as part of a special loan. A municipality can raise and spend money only on objects specified when the money is raised by application to the Local Government Board. This system is stated to be inappropriate to the conditions of electric supply progress. The amount of working capital required cannot be estimated far ahead, and there is always a reasonable demand for some simple machinery or for extension of mains and plant which will require extra capital to be raised.

Another important question before the association is stated to be the securing of power by municipal electrical authorities to wire premises and to sell fittings, motors and cooking and heating apparatus. There is a very strenuous opposition against this by electrical contractors, plumbers, taxpayers' associations and even the gas interests, and it is doubtful whether the association will find it advisable to advocate such a measure. It would seem rather to be desirable in the interest of electrical progress to gain the co-operation of the contractors and the electrical trade by not opposing their interests.

Proposed Public Service Commission in Illinois.

A commission consisting of five State Senators and five State Representatives has been appointed by the Illinois Legislature to investigate the general subject of public-service commissions, with a view to forming a public-service commission in the State of Illinois. This commission will regulate the affairs of electric-light and gas companies, telephone and telegraph companies, heat, water and power utilities and probably street railways. The commission will have ample time to study the subject and make a report, for a year and a half will elapse before the next regular session of the Legislature. Senator John Dailey, of Peoria, is chairman of the commission, and Representative William P. Holaday, of Georgetown, is secretary. The Legislature failed to make any appropriation for the commission's expenses, owing to a political fight, but the members of the joint committee promise to go ahead just the same, paying their own expenses and trusting to the Legislature to reimburse them. They propose to visit Madison, Wis.; Albany, N. Y.; New York and Boston in securing information on the subject of public-service commissions.

New York Commission News.

The Public Service Commission, Second District, has authorized the Ft. Covington Light, Heat & Power Company to make a first mortgage covering all its properties to secure the issue of $7,000 of bonds. The company is allowed to issue at present $5,000 of bonds to discharge and refund existing obligations, and a hearing is ordered upon the request for $2,000 additional bonds to be used for construction of a concrete dam.

After several postponements, hearings were begun July 13 before Commissioner Maltbie on a series of investigations of certain rates of the Edison Electric Illuminating Company of Brooklyn, alleged discriminations having been called to the attention of the commission. Counsel for the commission placed in evidence the receipted bills of several customers to show the rates under which these customers had been charged, after which the question of minimum guarantee on certain forms of contracts was taken up. Mr. W. W. Freeman, vice-president of the Brooklyn company, testified that the guarantee on a customer's bill depends upon the equipment installed and connected in service. Thus, if a customer has a contract for fifty sockets, he is held to the guarantee on this equipment whether or not all of these sockets are in actual use, on the theory that the actual use of lamps is something entirely within the province of the customer and not known to the company. The hearing was adjourned to July 20, 1911.

New Jersey Commission News.

The following rulings by the Board of Public Utility Commissioners of New Jersey have recently been made public in printed form:

An indorsement of the policy of regulated monopoly rather than competition was given in the ruling on the application of the Atlantic Highlands Gas Company for the approval of an ordinance passed by the township committee of Shrewsbury. The board held that competition is likely to be short-lived and that the services afforded by public-utilities tend eventually to be rendered under conditions of monopoly. Where competing companies serving the same consumers finally unite the unnecessary duplication of plant and appliances entails a permanent burden upon the public. The creation of various boards and commissions with supervisory powers over public utilities and often with eventual powers of rate fixing demonstrates that the illusive doctrine of competition in this field is being superseded by an experimental régime of strictly regulated monopoly. However, exceptional circumstances might exist in particul cases and warrant approval of an ordinance to a competir company. Such conditions were not found to exist in tl case under consideration.

In passing upon the continuance by public utilities existing rates for educational and charitable purposes, tl board has announced that the continuance of existing rat which have the sanction of custom, where such rates a presumably of assistance in facilitating education and tl administration of charities, and thus in line with publ policy, will not be regarded as conflicting with the statu prior to the hearing and determination of specific cases ir volving the points at issue.

The board has called attention to the fact that its a proval of the issue of securities by a public-utility corpor tion does not imply any confirmation of the business financial standing of the issuing corporation as a whol This action by the board was rendered necessary by reasc of misleading statements published to influence the sale certain public-utility securities. The board has also calle attention to the fact that it has not authorized the increa of rates by certain public utilities, unfounded statements the contrary notwithstanding.

The board has ordered the Atlantic Coast Electric Con pany to print upon each bill rendered for metered servi the readings of the meter at the time the charge is mac and when the last preceding charge was made, and also brief, clear description of the company's method for rea ing meters.

At the June term of the Supreme Court the order of tl Board of Public Utility Commissioners restoring a reduce rate of fare to school children over the lines of the Publ Service Railway Company was sustained. The court calle attention to the carrying of small children free of charg and claimed that there was no reason why the special ra accorded to school children should be considered undu preferential.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commissic on July 14 gave its decision in the matter of the joi applications of the Greenfield Electric Light & Power Con pany and the Shelburne Falls Electric Light & Pow Company, and of the Greenfield Company and the Colra Electric Light & Power Company, respectively, determinir that the facilities for furnishing electricity for all purpos will not be diminished by the consolidations of these con panies and that the consolidations are consistent with tl public interest. The applications were heard at the san time. The terms of both consolidations had been approve at meetings called for the purpose, by votes representir more than two-thirds of the interests of the contractii parties.

The Greenfield company operates in that town and Deerfield, Northfield and Bernardston. The Shelburn Falls company operates in that town and Buckland. She burne Falls is contiguous to Greenfield. The Colrain con pany supplies electricity in Colrain, which is also contigu ous to Greenfield. The Shelburne Falls company was o ganized in 1909, and in 1910 acquired the property and bus ness of a partnership that had before that time operate under the same name. It issued stock to the amount $45,000, which is now outstanding. The plant had on Apr 30, 1911, a book value of $66,401.95 and other assets $5,891.51, and owed $26,448.36. It has as yet paid r dividends.

The Colrain company was organized in 1908 with capit stock of $2,500. April 30, 1911, it had a plant with a boc value of $2,710.58, and other assets of $568.85, owir $1,073.76. It has never paid a dividend. Since June 3 1910, the Shelburne Falls and the Colrain companies hav passed under the control of the owners of the Greenfie

...pany. With this change of ownership the two former ...panies ceased to generate and instead bought electrical ...ergy from the Greenfield company. The prices which ...vail in Greenfield have been put in force in the other ...ows and for all practical purposes the three companies ...ve been operating as one company.

... the terms of the agreement to consolidate the Shel... ...urne Falls and the Colrain companies are to convey to the Gr...nfield company their franchises, locations, moneys and oth... property and the Greenfield company is to issue and ...xchange, share for share, at par, 475 shares of its capital sto..., respectively, for the outstanding 450 shares of the Sh...burne Falls company and the twenty-five shares of the Co...ain company. By an order simultaneously adopted the Gr...nfield company has been authorized to issue 475 shares ...f ...ew capital stock for the purpose of effecting the con...olidations.

...e consolidated company will be known as the Green...iel. Electric Light & Power Company.

F...om Sept. 30, 1908, to April 30, 1911, the cost of addi...io... to the Greenfield company's plant, less depreciation ...n...credits, was about $95,000. The company had made at ...he ...atter date contracts for additions to its generating ...la... that were to cost $65,000. The board authorizes, in ...d...ion to the issues of the 475 shares for effecting the ...on...lidations, the issue of 1275 shares of new stock, the ...ro...eds of 950 of which shall be used for the purpose of ...an...ling obligations of the company, and of 325 shares to ...ay ...or additions to the plant made subsequent to April 30, ...91...

Ohio Commission News.

T...e Ohio Public Service Commission still remains the ...ailroad Commission and will, as in the past, have to give ...tte...tion to this branch of its work. Consequently, with ...he ...dditions made by the new public utilities law, it will ...av... its hands full.

I...is believed that the Columbus natural-gas rate will be ...he ...rst real case brought before the new commission. The ...ity ...as fixed a rate of 30 cents, while the company desires ...o... It will be for the commission to decide upon the ...ea...nableness of the demand made by the city.

T...e public utilities law makes it impossible for electric ...ig... and power, gas, telephone and other such companies ...o ...tend the usual courtesies to ministers, who in the future ...vil...receive neither free service nor reduced rates. The ...nl... favored ones named in the bill are the federal govern...me..., state government and its subdivisions and employees ...f ...e companies. Where contracts exist between com...pa...s and ministers they will not be abrogated, but when ...he... expire there will be no renewal. This is one among ...he ...nteresting features that have resulted so far from an ...nv...tigation of the law.

Maryland Commission News.

...e Maryland Public Service Commission last week ...po...oned until July 26 consideration of the application of ...he ...ashington, Potomac & Chesapeake Railway Company for ...ermission to increase its capital stock from $500,000 to $2,...0,000 and to issue bonds to the extent of another $2,...0,000, the proceeds to be used to complete its road thr...gh Prince George's and St. Mary's Counties. Mem...ber of the commission were anxious to ascertain the re...sp...sibility of the parties behind the project and other inf...mation. Mr. Edgar Allan Poe represented Mr. Henry W. Watson, of Philadelphia, who owns the railroad fran...chi..., and, while not able to give at once information sought by ...e commission, stated that he would gather all the data de...ed for presentation at a future meeting of the commis...sio... Mr. W. Bernard Duke objected to any recognition of Mr. Watson's franchise on the grounds that holders of the franchise are required to construct at least 5 miles of road each year, a duty that the company had failed to perform; therefore proceedings are in order to vacate the charter. The commission also received a letter from Mr. A. B. Linderman, of Philadelphia, asking for a postponement.

The Baltimore & Virginia Railroad Company, which recently acquired the interest of Mr. Edward Lauterbach, of New York, in what is generally known as the old Drum Point Railroad last week made application to the Public Service Commission for permission to begin construction work on the section running from Millersville through Anne Arundel and Calvert Counties to the terminus on Drum Point Harbor. Plans for financing the road, which has been capitalized at $2,000,000, have, it is said, already been worked out, and application for permission to issue that amount of stock, together with $500,000 in first-mortgage 5 per cent bonds, will shortly be made to the Public Service Commission, which, under the law, must pass on all such matter. The necessary advertisements have been running for about fifteen days. Application for permission to begin construction was made at this time because the issuance of stock is not necessarily a prerequisite.

Canadian Hydroelectric Commission News.

A controversy has arisen as to whether the present rates for supplying electricity in Brantford, Ont., are higher than in similar cities supplied by the Hydroelectric Commission. At present Brantford is paying 8½ cents per kw-hour for residential lighting, with 10 per cent off for prompt payment, and $48 for arc lamps for street lighting. It is contended by the Hydroelectric supporters in the city that these rates are much higher than those charged in Berlin, Ont. The Western Counties Electric Company, which is supplying electricity to Brantford, has written to the City Council denying that the rates are higher than the prices charged in Hydroelectric municipalities. This company, which is a subsidiary company of the Cataract Power and the Dominion Power & Transmission companies, of Hamilton, Ont., is operating in Brantford under a five-year contract which guarantees rates 10 per cent less than those charged in any Hydroelectric city, the cost of transmission being taken into consideration. A special meeting of the Council will be called to take the matter up. The contract with Brantford was the cause of agitation in the city during 1907 and 1908, owing to the keen competition between advocates of the Hydroelectric Commission and of the Cataract Power Company, and the action of the City Council in giving the contract to the Cataract company gained for Brantford the distinction of being the only municipality that declined to enter into the arrangement made by other western Ontario municipalities with the Hydroelectric Commission for the supply of energy under a thirty-year contract.

CURRENT NEWS AND NOTES.

DATE OF NEXT YEAR'S N. E. L. A. CONVENTION.—The date for the next convention of the National Electric Light Association has been fixed for June 10 to 14, 1912. The convention will be held in Seattle, unless some unforeseen change is made in the plans.

* * *

ILLINOIS CENTRAL RAILROAD PROMOTES ELECTRICAL STUDY.—Courses announced by the Illinois Central Railroad education bureau for its employees include elementary electricity. Additional courses probably will provide for the study of electric light and power, as well as telegraphy and telephony.

Vermont Electrical Association.—The tenth annual meeting of the Vermont Electrical Association will be held at Lake Dunmore, Vt., Sept. 13 and 14, 1911. Mr. A. B. Marsden, Manchester, Vt., is secretary.

* * *

Automatic Emergency-Brake Operation.—Much favorable comment has been created by the successful operation of an automatic emergency brake on a New York subway train when Motorman W. A. Stone died while the train was running at full speed on July 15. It is believed that the motorman was killed by striking a post while leaning from the side of the cab. The push-button relay switch on the controller handle acted immediately to set the brakes and bring the train to rest within several hundred feet.

* * *

Gas Rates in Chicago.—The Chicago City Council has passed the ordinance fixing the rates for gas for a five-year period at 75 cents for the first year, 70 cents for the second and third years and 68 cents for the fourth and fifth years. It is provided, however, that the company shall be permitted to charge a penalty of 5 cents per 1000 ft. if consumers do not pay their bills within ten days. The People's Gas Light & Coke Company has not accepted the ordinance, and it may refuse to do so, necessitating extended litigation until the courts decide whether the rates offered by the city give the company a reasonable return.

* * *

Los Angeles Energy Rates.—At a recent meeting of the Los Angeles City Council rates for the ensuing year were passed by a vote of six to three to become effective on Aug. 7. The rates are identical with those stated on page 152 of our issue dated July 15. A minimum charge of 50 cents per month per horse-power installed and not less than $1 in any one case was allowed for motor service. A protest received from the Southern California Edison Company, stating that the proposed rates will prove insufficient to produce the income necessary to the proper conduct of its business, was ordered filed.

* * *

Indiana Water-Powers.—State Geologist Barrett, of Indiana, and assistants are locating sites along the rivers of Indiana suitable for water-power purposes. The data collected will be filed with the next Legislature, in which a bill will be introduced to preserve the power site rights to the State. Data concerning such sites will not be at the disposal of private interests prior to official publication. Mr. Barrett is stated to be greatly pleased with the great number of excellent water-power sites in Indiana that might be easily and successfully improved.

* * *

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on July 12 it was decided to have a letter ballot to determine whether the club shall give a picnic this year. Mr. C. G. Osborne, of the Illinois Steel Company, who was to address the club on electricity in steel making, was unable to be present, and in his absence Mr. A. A. Gray gave a talk on the subject, largely based on a recent paper by Mr. Osborne, describing the Héroult electric furnace at the South Chicago steel works, and originally presented at the American Electrochemical Society's convention in New York last April.

* * *

Wiring by British Central Stations.—The British Municipal Officers' Association is arranging for the introduction into the House of Commons next year of a bill for the purpose of conferring on municipal corporations owning their own electrical works power to wire and fit the houses of consumers of energy in their districts. A government bill including the same subject was passed only after a clause providing for this had been excised. The association appears to have been ready at one time to compromise the situation with the contractors. While the contractors are nominally opposing the proposal, it appears that the gas companies are in reality the opponents, because electricity competes with gas to such an extent as to make it desirable that no facilities should be given to municipal undertakings where the gas works are not also under the control of the local authority.

* * *

The Trade Continuation Schools of Munich.—A publication just issued by the National Society for the Promotion of Industrial Education as Bulletin No. 14, entitled "The Trade Continuation Schools of Munich," deals with the system of industrial education of Munich, where boys are compelled to attend trade continuation schools during their entire apprenticeship or until their eighteenth year. For this purpose employers must release their apprentices for the required number of hours per week for daytime attendance. The report of the Wisconsin Commission upon the plans for the extension of industrial and agricultural education which were submitted to the Governor of that State on Jan. 10, 1911, laid much stress on the possibility and desirability of a modification of the Munich plan to meet conditions obtaining in Wisconsin. The publication may be secured from the secretary of the National Society for the Promotion of Industrial Education, 20 West Forty-fourth Street, New York City.

* * *

Sale of Electricity in Joliet, Ill.—In a letter addressed to the Sanitary District board last month Mr. F. Wood, of Joliet, makes a report on the proposal that a company subsidiary to the Sanitary District of Chicago be organized for the purpose of selling electrical energy in and near Joliet, Ill. Mr. Wood declares that there is dissatisfaction with the price and service of the Economy Light & Power Company, of Joliet, and that there should be available contracts for electrical energy to the amount of about 3500 hp. However, the writer does not recommend the organization of a subsidiary Sanitary District company unless the district would co-operate actively in the expense of construction or else give to the proposed new company prices on a sliding scale to meet any price which the Economy Light & Power Company might make. Mr. Wood is of the opinion, however, that something should be done toward the building up of a better feeling between the Sanitary District and the people in Joliet and vicinity. That city is advantageously situated for the benefits of cheap hydroelectric energy, and he says that the business men there seem to think that they are not deriving the benefits they should from this location.

* * *

Light of the Military Tournament at Grant Park, Chicago.—A national military tournament is to be held in Grant Park, Chicago, next week, very similar to the one held in the same place last year. The lighting also will follow last year's plan very closely. Eighty flame-arc lamps will be suspended over the open-air arena and thirty ordinary multiple alternating-current arc lamps will be used about the grounds. The flame-arc lamps are mounted on suspension wires having a span of 600 ft. between 55-ft poles. These suspension wires are composed of ⅜-in. cable, and there are ten of them, each supporting eight lamps. The poles supporting these long spans are guyed to smaller posts and in turn to "deadmen." The ordinary arc lamps are used for general illumination of the grounds, the arena lighting being entirely by the flaming-arc lamps. The latter are suspended 35 ft. from the ground and are supplied with half-round cone-shaped reflectors, open on the side farthest from the spectator. These lamps are trimmed by the use of a street-railway tower wagon, to which a 40-ft. extension ladder is attached. The Commonwealth Edison Company did the installation and is supplying the electrical energy for the illumination, which requires about 69 kw., alternating current being used.

Four Hundred and Forty Volts, Not Forty, Kill.—By a typographical error in a news paragraph headed "Resistance to Electric Shock" printed last week on page 155 it was stated that a lineman received a "40-volt" alternating-current shock which proved fatal. As may be supposed, the voltage of the circuit was higher than this, although still surprisingly low to cause death. It was 440 volts, not 40 volts.

* * *

New Chicago Post Office on Old Western Electric Property.—As a site for the new West Side post office in Chicago Mr. MacVeagh, Secretary of the Treasury, has selected the block bounded by Van Buren, Clinton, Congress and Jefferson Streets. This was the location of the old Western Electric factory in Chicago, and as such is of some interest to electrical men. However, the property had passed out of the hands of the Western Electric Company before the government indicated its choice of a location.

* * *

Electric Irrigation in California.—Two farmers, George H. Grover, of Missouri, and H. W. Hosmer, of Idaho, who recently purchased land in Shasta County, Cal., have installed an irrigation system in which the water is pumped from a river adjoining their land by electric power. The former owns 356 acres of land, and the latter 160 acres, and to supply these with water for irrigation a 50-hp motor has been installed which will supply ample water against a head of 28 ft. The area of the combined farms is 516 acres, and it is stated that the cost of irrigation by this method will be $2 an acre per season. It is estimated that through irrigation the productiveness of the land will be increased sixfold.

* * *

Telephonic Enunciation.—In the constant effort of the telephone companies to arrive at the greatest possible clearness in enunciating the numerals used as telephone calls the Chicago Telephone Company is experimenting with a system which has been used elsewhere with success that eliminates the word "double." For instance, the number 5007 has been enunciated heretofore in Chicago as "Five—double O—seven." The new plan would make of this number "Five O—O seven," with a pause as indicated by the dash. The number 100 would be "One—hundred" instead of "One double O." The number 1111 would be "One one—one one," and so on. A part of the plan is to use pauses in a measure corresponding to the grouping of the lines in the telephone switchboard as to hundreds and thousands.

* * *

Municipal Ownership in California.—The Supreme Court of California has decided a case in favor of a municipality in which it was contended that while the city might have power to supply electrical energy for light and heat it could not supply electric power. The court declared that such a distinction could not be made. With respect to a proposition that one of the articles of the California constitution forbids the granting of power to cities to engage in public-service work where there are private systems of a like kind in operation the court held that the article quoted merely relates to the exclusive privilege to use public streets as a way for conduits and applies only to private companies. Where cities have no inherent right to engage in administering public utilities, such permission may be obtained by a grant from the State Legislature.

* * *

Rochester Idea Spreads Over the Country.—The idea of supplying the sick with free-fan service, which originated with Mr. R. M. Searle, of the Rochester Railway & Light Company, and which was afterward more widely circulated among the members of the National Electric Light Association at its recent convention in New York City, has spread with remarkable rapidity all over the country. The plan, slightly modified, has been put into effect in fifty-five or more communities in the South, North and West supplied with energy from the public-service companies in the Byllesby group; in Stockton, Cal., and in a number of other places. Newspapers, to which such an attitude on the part of public-service corporations is a revelation, comment favorably on the plan, and it is certain that the value of the advertising thus received more than compensates for the cost of the service gratuitously given.

* * *

Institute of Operating Engineers.—The first annual convention of the Institute of Operating Engineers will be held in New York City, Sept. 1-3, in the Engineering Societies Building. As this is the first annual meeting, much business of importance will be transacted in the way of adopting a constitution, by-laws, fixing educational and apprenticeship requirements, study courses, etc. The first day's session will consist of addresses by prominent speakers, the appointment of and allotment of work to committees. The second day's session will be taken up with the executive business of the Institute, and the third day with sightseeing. Special rates will be provided for all attending the convention. Ladies who attend with members of the Institute will be entertained by a special committee who will show them the sights. Further information may be secured by addressing the secretary, Mr. Hubert E. Collins, 29 West Thirty-ninth Street, New York City.

* * *

Winnipeg Municipal Plant.—It is definitely announced that the municipal power plant of Winnipeg, Manitoba, will be ready for operation by Aug. 15, and the city authorities have given instructions to take contracts for power dating from Sept. 15. Operation will begin with 8000 hp, which will be increased to 20,000 hp on Dec. 1. One of the substations for distribution is far behind, but it is claimed this will not lead to delay. Work of laying conduits is being rushed. It seems probable that there will be a rate war between the city and the Winnipeg Street Railway Company. The latter has announced that it is prepared to meet whatever rates the city may charge for light and power, that it is in the field to stay, and property owners are cautioned about signing contracts with the city until it is certain what rates the latter intends to charge. A contest is also on between the city and the company over the question of laying of gas mains. The company built a new gas tank and reservoir to which the city objected and the use of which it is endeavoring to prevent. It is alleged that the company laid gas mains without permits, and if upon investigation the charge is found to be true, the police will be ordered to remove the mains.

* * *

Commonwealth Edison Field Day.—The annual field day of the Commonwealth Edison Company, of Chicago, bids fair to become a permanent event. The second one took place on the afternoon of July 15 on the grounds of the new Northwest station. It was held under the auspices of the C. E. Outing Club, of which Mr. B. G. Jamieson is chairman. The company, however, donated money for the purchase of prizes and also fitted up the grounds for recreation purposes, providing a baseball diamond, a running track, tennis courts, etc. These unusual central-station appurtenances are permanent. The attendance at last week's outing was about 350, including both men and women employees of the company. There was a departmental baseball game between the street department and the engineering department, won by the former by a score of 5 to 4. There was also a regular Commercial League baseball game between the Commonwealth Edison team and the nine representing the Anderson & Lind Manufacturing Company. There were also track and field games, golf, driving, tennis playing, trap shooting and linemen's games, the latter including pole-climbing contests and throwing a weighted rope over a high wire. Valuable prizes were given to the winners of all contests.

Completion of Large Exhaust-Steam Turbines at Milwaukee.—The pair of 7500-kw exhaust-steam turbines added to the Commerce Street station of the Milwaukee Railway & Light Company, and into which steam from the eight vertical cross-compound engines already installed will be exhausted, as described in the *Electrical World* of Feb. 16, are now erected and completed ready for their initial tests. Work is also being begun on the installation of the two 14,000-kw high-pressure steam turbines for which provision is made in the new plant addition.

* * *

International Rubber Exhibition.—Some interesting processes in connection with the cultivation, gathering and manufacture of india rubber were shown at the International Rubber Exhibition, which was held at the Agricultural Hall, London, from June 24 to July 14. The process of rubber manufacture was shown from the collection of the latex to the finishing of the manufactured article. Specimens of new rubber for insulating and other purposes were shown and their qualities demonstrated by tests. In all thirty-two countries were represented and there were over 2000 exhibitors.

* * *

Danger of Illuminating Gas.—In a paper in the May issue of the *Journal of the American Public Health Association,* entitled "The Relation of Illuminating Gas to Public Health," Prof. W. T. Sedgwick and Assistant F. Schneider, Jr., of the Massachusetts Institute of Technology, state that upon investigation they were "surprised, shocked and astounded by the extent to which illuminating gas poisoning is going on in this State and in other states." It is pointed out that the number of deaths from illuminating gas nearly approaches and in cases exceeds the deaths from many common diseases. The remedy offered is a return to the old-fashioned illuminating gas, notwithstanding that its illuminating value is as 16 to 24 compared with that of the dangerous water-gas now almost exclusively manufactured.

* * *

Large Gas Engines for New Gary Power Plant.—The six gas engines being installed as the initial group in the new power house of the Indiana Steel Company at Gary, Ind., are the largest units ever constructed, and have a rating of 3200 kw each. The new engines are of the twin tandem double-acting Allis-Chalmers type, with cylinders 44 in. x 60 in. The engines will operate on blast-furnace gas and are to drive alternators delivering 6600-volt, 25-cycle, three-phase energy to the power network of the Gary mills. Energy from the Gary power house will also be transmitted to the new plants of the American Bridge Company and the American Sheet & Steel Company, west of Gary, and to the Indiana Harbor and South Chicago steel mills of the steel corporation. Three gas-engine sets similar to the new Gary units have been ordered for the Central Furnaces at Cleveland, Ohio, and two other units for the Joliet plant of the Illinois Steel Company.

* * *

Everybody to Tell Time by Wireless.—According to a South Bend (Ind.) horologist, as reported at a jewelers' convention in St. Louis, the watches of the future will be far simpler affairs than they are now. According to this prophet, there will be a great central system of clocks, regulated by Washington Observatory time, and these will propagate Hertzian waves, which in turn will actuate pocket timepieces. A man will take from his pocket a small instrument with a dial, something like the watch of to-day. He will press a button and the hands will indicate the correct time. The mechanism will be simple, it is asserted, and these "wireless watches" will be cheap and need no regulating and practically no repairs. Our watchmaker friend should have given some enlightenment as to the details of the "simple mechanism."

Trolley Induction of Telegraph Circuits.—[The] Indiana Appellate Court has decided that all that is [re]quired of an electric railway to escape damages in [an] action at law on a complaint that the telegraph system [of] plaintiff's parallel road is greatly interfered with by in[duc]tion from the trolley circuit is to show that the defen[dant] company is using the most improved methods to pre[vent] such interference. The court said that a case cited w[hich] held that a street-railway company could be prevented f[rom] causing electrolysis of a water company's pipes will [not] support a complaint against an electric railway on in[ter]ference by induction with the telegraph system of a st[eam] railroad. The title of the case is the Lake Shore & Mi[chi]gan Southern Railway Company versus Chicago, L[ake] Shore & South Bend Railway Company.

* * *

2000-hp Swiss Single-Phase Locomotive.—One [of] the single-phase locomotives for the recently opened S[im]plon-Lotschberg Railway is equipped with single-ph[ase] motors, each of 1000 hp, and exerts a drawbar pul[l of] 22,000 lb. at 26 miles per hour, at which speed it can [haul] a 310-ton train up a grade of 1:37. The weight is 90 t[ons]. On the neighboring St. Gothard railroad two steam loco[mo]tives, weighing together 230 tons, are required to ha[ul a] train of the same weight at only 22 miles per hour. [The] 2000-hp locomotive was built at the Oerlikon Works, [the] motors being of the Oerlikon single-phase type. Ano[ther] single-phase locomotive was supplied by the Allgem[eine] Elektricitäts Gesellschaft, of Berlin. The latter is equip[ped] with two 800-hp Winter-Eichberg motors and draw[s a] train of 250 tons on the maximum gradient at 26 m[iles] per hour. On one section of the Lotschberg line the as[cent] in 7.8 miles is 1385 ft.

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Single-Phase Railway Adds 60-Cycle Lighting L[oad]—The Chicago, Lake Shore & South Bend Railway, wh[ich] operates high-speed, 6600-volt, single-phase electric rail[way] service from South Bend, Ind., through Michigan City [and] Gary to Chicago, is installing a new 3000-kw, 60-c[ycle] turine-generator set in its Michigan City power ho[use]. A new 1000-kw motor-generator set is also being adde[d to] the existing equipment of two 500-kw, 60/25-cycle [fre]quency changers, which will be employed for distribu[ting] the 25-cycle and 60-cycle demands between the pr[ime] movers. The railway company recently completed a c[on]tract for the sale of approximately 1,000,000 kw-ho[urs] yearly for lighting and motor purposes from its 6600-v[olt] 60-cycle system and the newly added equipment will en[able] this load to be divided to advantage between the 60-c[ycle] and 25-cycle generating apparatus. A 1000-kw, 6600/33,0[00]-volt transformer has also been newly added for stepp[ing] the transmitted energy up to line potential.

* * *

Overhead Wires in Underground District in [Los] Angeles.—According to the Los Angeles daily papers, [Mr.] W. B. Cline, president of the Los Angeles Gas & Elec[tric] Corporation, and Mr. C. A. Luckenbach, manager of c[on]struction for the same company, are charged with m[ain]taining overhead electric wires in the conduit district [of] Los Angeles. Both have pleaded not guilty, but it is s[aid] that the prosecuting attorney was asked to dismiss the c[om]plaint against Mr. Cline, provided Mr. Luckenb[ach] pleaded guilty. For the defendants it has been argued t[hat] Mr. Cline, although president of the company, was [not] responsible for Mr. Luckenbach's acts, and for that r[ea]son a dismissal of the charge against the president [was] asked. However, the prosecuting attorney contends t[hat] Mr. Cline was as much responsible for the alleged vi[ola]tion of the law as Mr. Luckenbach, for he was the latt[er's] employer and as such responsible for his acts.

STEAM TURBO-GENERATING STATION.

·w Power-Plant Development of the Worcester Electric Light Company.

AMONG the interior cities of New England, Worcester, Mass., combines in unique degree the advantages of a large industrial and educational center. ·r many years the electrical development of the comunity has progressed along the lines of sound business ministration, and, while spectacular departures from andard practice have not been evident, the administration the local central-station property has been characterized careful engineering methods and a commercial policy hich has constantly yielded a reasonable return upon the vestment employed in the company's service. Within the st two or three years in particular the company's business s undergone rapid expansion, and the growth of the city, mbined with the limitations of the former generating ation, has led the company to build a new and thoroughly odern plant upon an advantageous site, with full provisn for the probable needs of many years. Since the inaguration of central-station service in the city in 1883 the siness has always been carried on by the Worcester Elect Light Company, local capital being largely employed in i work and the control being maintained at Worcester spite several determined efforts on the part of outsiders t acquire the property.

In the *Electrical World* of Sept. 5, 1908, page 942, an accnt was given of the development of the company's Farad Street station, which for about twenty-one years remined the source of the company's production and its most iportant center of distribution. The first plant built in orcester for central-station service was located near Fanklin Square, a point practically in the electrical center o distribution of the city. Space was so limited here that t growth of the business soon outstripped the rating of the generating plant, which was about 500 hp, the equipment consisting of five high-speed engines belted to generators. The Faraday Street station was built in 1889, and it furnishes an interesting example of power-plant evolution from the low-speed engine and the belted line-shaft generator drive to the use of directly connected engine-driven alternators, and later the installation of a turbine-driven outfit. At the close of its productive usefulness the Faraday Street station attained a generating rating of approximately 4000 kw, and in common with other plants in New England illustrated the marked tendency to adopt alternating-current to the practical exclusion of direct-current service.

The Faraday Street station was limited in respect to economical energy production on account of the necessity of teaming all coal to the plant from the nearest railroad yard, and on account of the relatively high cost of water obtained from Salisbury Pond, on the shore of which the station stands. Given ample facilities for economical coal delivery and a water supply of minimum cost, the plant could have been increased manyfold in rating without exhausting the available space. The building is 200 ft. long by 75 ft. wide, with a commodious basement, and it has the advantage of being within three-quarters of a mile of the Worcester City Hall, the electrical center of the city. Although an initial installation of a 1500-kw turbine set was made in 1908 at this plant, the officers of the company, under the administration of the then president, the late Gen. A. B. R. Sprague, decided to build an entirely new plant in a locality which would be favored by the most economical coal-handling facilities and further benefited by an ample supply of feed and condensing water at nominal cost. A site was found in the southern section of the city on Webster Street, at the border of Curtis Pond, and the firm of Westinghouse, Church, Kerr & Company, New York, was retained as consulting engineers for the development. It was decided to install a turbo-alternator station at this point, with an ini-

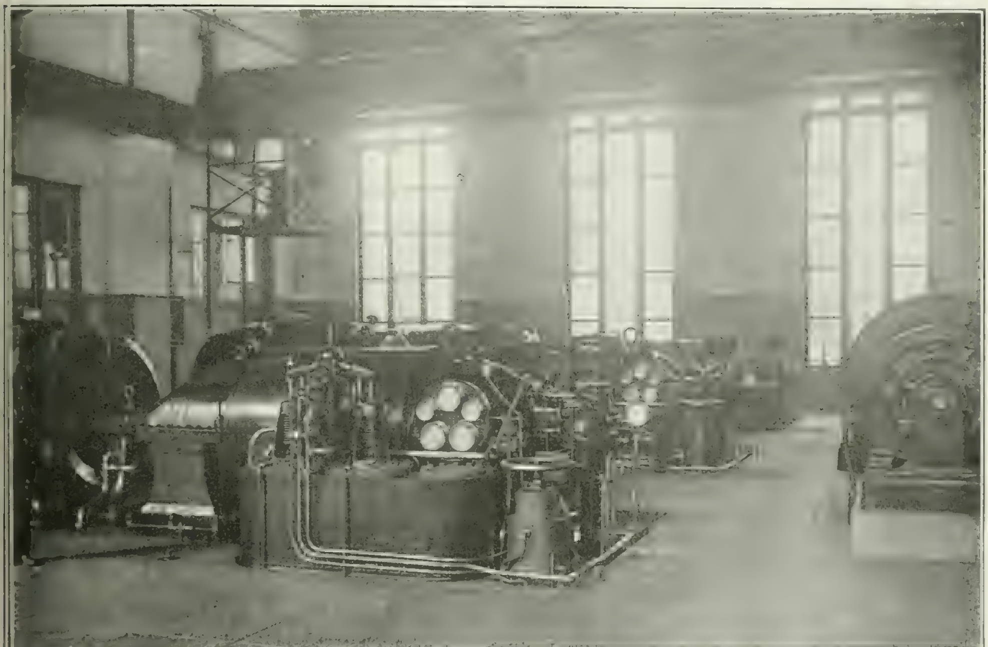


Fig. 1—General View of Turbine-Room.

tial rating of 7500 kva, the building being of sufficient size to permit the installation of a total of 10,000 kva without extended alteration. The new plant has recently been completed by the installation of three 2500-kva Westinghouse units, and it now is carrying the entire load of the system. The Faraday Street station is used as a distributing center,

Fig. 2—Location of Plant.

the generating equipment there being held in reserve for either emergency or supplementary service as a steam-driven auxiliary. The company is considering the partial use of the old plant as an auxiliary to another system of supply during the summer months, but has not at this time reached any agreement for the disposal of its surplus energy.

The Webster Street station is located about 3 miles south of the Faraday Street substation, and consequently is about 2.75 miles distant from the City Hall district. The company recognized the fact that the reconstruction of the Faraday Street plant would have been an exceedingly expensive piece of work, even had the fuel and water facilities been favorable. Energy is generated at Webster Street at 2400 volts, three-phase, the frequency of the system being 60

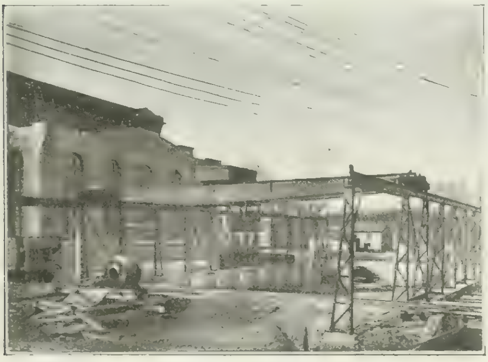


Fig. 3—Coal-Storage Yard and Crane.

cycles. Although it is transmitted to Faraday Street at present before being used and then distributed from the latter point, the loss is not sufficient to offset the advantages of cheap coal-handling and water facilities. Later a considerable amount of distribution will be effected from Webster Street, feeder and switchboard apparatus having been installed there for that purpose. The new and o plants are now connected by five three-phase, 500,000-ci mil tie lines carried across the city in underground condu

The new plant is a concrete and steel structure support on concrete foundations, the building being 149 ft. 4 i long by 79 ft. 7 in. wide. The site of the plant is on We ster Street, between Middle River ar Webster Court, the north end of tl building being about 181 ft. from tl stream. It was necessary to exerci the greatest care in determining tl bearing quality of the soil, in order t support the loads imposed by the boiler turbines and auxiliary equipment. B fore beginning construction the con pany purchased Curtis Pond, with son of its tributary water, which is us for condensing and boiler-feed servic This pond has an area of about 80 acre and the quality of water is excellent f plant operation, the supply being lar and continuous at all seasons of tl year. Exhaustive borings were made c the property to determine the charact of the soil for foundations, and it w necessary to move the foundations c the two stacks which serve the pla soon after the excavation began. I the main good gravel bottom was foun but on account of a dip, probably caus by an old stream bed, the original site c the chimney foundations had to be abandoned.

The principal external features of the plant are shown the accompanying plan of the property. These comprise tl station building, a coal-storage yard at the east, flanked l concrete walls, two reinforced-concrete stacks 175 ft,. hi and 8 ft. inside diameter, intake and overflow flumes co necting the station with the pond and river. Coal is broug to the station by a spur track of the Boston & Albany Ra road, and ashes may be removed by this route if desire The track is carried westward through the station proper over a receiving hopper at the south end of the coal ya and past the south side of the station building over a seco receiving hopper, beneath which are located a coal crush and the beginning of a conveyor system. Above the tra

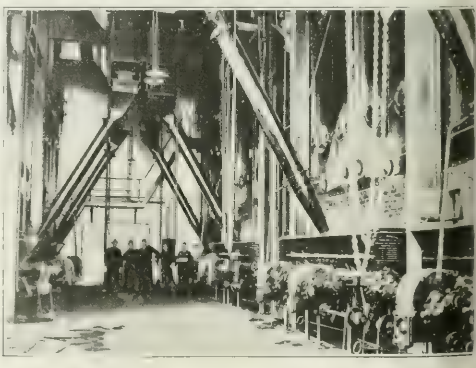


Fig. 4—Boiler-Room.

and between the two chimneys is an ash hopper of rei forced-concrete construction from which delivery can made by gravity to the cars. The external coal yard has holding capacity for about 6000 tons, the present annu coal consumption of the company being about 10,000 to The yard is served by a 5-ton Toledo electric traveli

cane equipped with 220-volt induction motors. This crane ls a span of 80 ft. and the length of its runway is about 12 ft., these being the dimensions of the yard. The crane rnways consist of I-beams supporting T-rails carried on lticed columns set in concrete pilasters at the side of the yrd retaining walls. The crane is provided with a central cerator's cab, and can be used either to distribute coal in

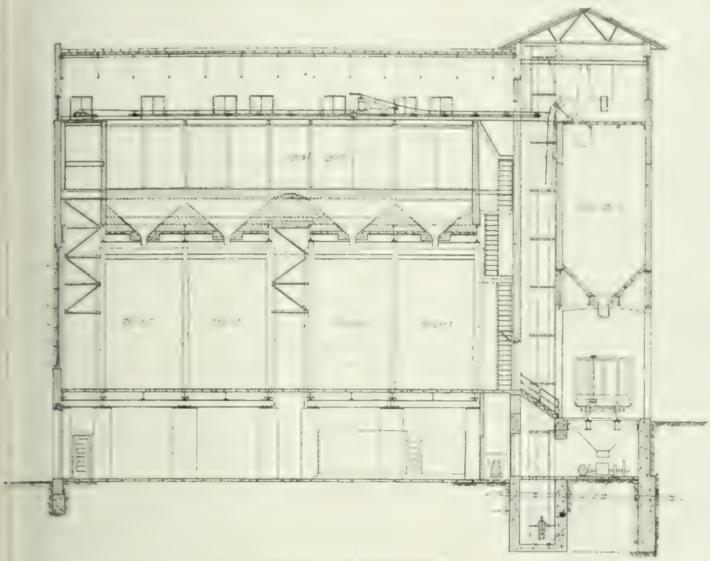


Fig. 5—Section of Boiler-Room.

t storage yard or to transfer it from the yard to cars to b run over the hopper at the side of the plant nearest the scks. For the latter service a larry car will probably be italled, and arrangements made to handle it by electricity.

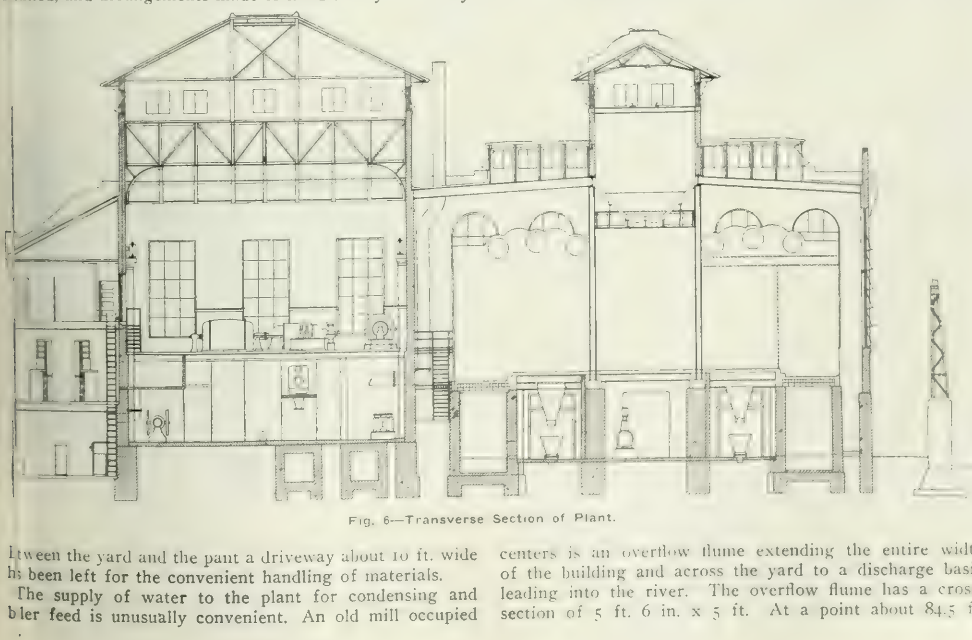


Fig. 6—Transverse Section of Plant.

ltween the yard and the pant a driveway about 10 ft. wide hs been left for the convenient handling of materials.

The supply of water to the plant for condensing and bler feed is unusually convenient. An old mill occupied the premises upon which the station stands, and two water-wheels were used in connection with two flumes supplying them from the pond. It was found that with some slight repairs and the construction of new intakes and racks these flumes could be utilized to furnish the new station with water, and a study of the contour of the ground and the pond level showed that the grades allowed the design of a station permitting the water to flow from the pond to the plant in one flume and from the plant back to the pond in the other. This allows a recirculation of water without pumping, a feature highly desirable in the event of low water, since by the avoidance of repumping a consumption of steam for that purpose is obviated, with a resulting decrease in water requirements, in addition to the advantage of being able to use the water over and over again in the boilers. The intake flume consists of a stone-arched conduit lined with concrete of a thickness of about 3 in., connected at the plant with a section of octagonal conduit having an area of 20.5 sq. ft., provided with 12-in. concrete walls and horizontal reinforcing rods. Stop planks and screens are installed at the intake connection with the pond. The intake flume is carried under ground to the station, where it turns by a right angle and crosses beneath the turbine sets, the flume being carried centrally through the foundations of the turbines to the north side of the building, where it is dead-ended. Parallel to the intake flume and about 11 ft. distant from it on centers is an overflow flume extending the entire width of the building and across the yard to a discharge basin leading into the river. The overflow flume has a cross-section of 5 ft. 6 in. x 5 ft. At a point about 84.5 ft.

beyond the turbine room wall an overflow flume of 5-ft. riveted pipe branches from the discharge flume to the pond, the length of the former being about 260 ft. A dam about 75 ft. wide is in service at the north end of the pond to prevent flooding. A gate house is installed at the junc-

Fig. 7—Circulating and Feed Pumps.

tion of the two flumes to facilitate altering the flow of water, and stop planks are in service at the upper and lower ends of the overflow flume between the pond and the discharge conduit. In normal operation water for condensing steam will flow from the pond to the plant through the intake and thence to the river direct, but in periods of low water a simple valve change at the gate house, with a trifling adjustment of stop planks at the head of the overflow flume, will enable the water to be turned back into the pond after passing through the condensing equipment. The outlet of the overflow flume in the pond and the inlet of the intake flume are about 220 ft. apart, so that there is no danger of interference. Water must flow a total distance of about 700 ft. after leaving the pond before it can again enter it.

The station is divided into a boiler-room, basement, coal bunker, turbine-room and switch house, brick fire walls separating the boiler, turbine and switch sections. The basement is also divided into sections, the coal and ash-handling equipment, pumps and other auxiliaries being well segregated. There are installed six 600-hp Stirling boilers in three batteries on each side of a central firing aisle. The boilers are equipped with Taylor automatic stokers of the seven-retort size, supplied by the American Ship Windlass Company, of Providence, R. I. The blower engines for these equipments are located in the basement below the boiler-room. Coal received at the hopper outside the boiler-room passes through the crusher, which is driven by a 20-hp induction motor, and from the latter it is carried by a belt conveyor driven by a 15-hp induction motor to the top of the building, whence horizontal distribution is accomplished to various sections of a reinforced-concrete bunker located above the boilers and having a holding capacity for 450 tons. Delivery of fuel to the stoker hoppers is effected through spouts equipped with hoppers holding about 700 lb. each. No weighing devices are installed, but records are maintained of the number of delivery hopper emptyings handled. Ashes are removed from the building by a skip hoist which is charged by ash cars running in the boiler-room basement on a track of 20-in. gage located beneath the ash hoppers of the furnaces. These ashes are delivered by the skip into an overhead storage bin of 100 tons holding capacity located above the railroad track outside the building, or, if desired, the ashes can be used for filling the yard on the north side of the plant. The coal-and-ash-handling equipment, including the crusher, conveyor, collecting and distributing apparatus, was install by the Exeter Machine Company, Pittston, Pa. The as handling skip hoist, which is driven by a 20-hp inducti motor, is designed to receive a load of ashes and upon t pressing of a button to rise to the top of the buildi where it automatically discharges into the ash bunker. desired, the ashes can be discharged from this bunker gravity into wagons for city distribution.

The boiler-room is large enough to admit a fourth b tery without extension, the room being about 76 ft. wi and 56 ft. in height. The boilers are equipped with sup heaters which raise the steam temperature about 100 d Fahr. for delivery to the turbines, and they are design for operation at a pressure of 200 lb. per square inch ma imum. The grates are designed to burn mixed anthrac and bituminous coal. The steam piping has been assembl with pipe having welded flanges, the latter being welded by the old-fashioned coke-furnace method. The fittings a of cast steel and the valves have cast-steel bodies. The rangement of piping is such that any boiler or any hea section can be cut out without interfering with the servi The same care has been exercised in the design of the fe piping, two feed pumps being installed and so arranged to make it possible to feed the entire boiler equipment w either pump through a duplicate feed main. The feed-wa heater is a 5000-hp Whitlock equipment. The ordina operating steam pressure is about 175 lb. A monitor is stalled at the top of the boiler-room above the coal-conv ing equipment, and this, with the turbine-room, is provid with a tile roof. The boiler-house proper is provided wi a tar and gravel roof. Additions to the plant will be ma on an extension of the present center line of the boiler-ro and symmetrical with the present installation. This w allow the convenient extension of the coal-distributing m chinery and will make the unloading, elevating and handli equipment applicable to the plant when extended. The firi aisle is 18 ft. in width

Two Warren boiler-feed pumps are installed with 10 x 18.5-in. x 9-in. x 18-in. cylinders, arranged for duple compound operation. Each pump draws water through 8-in. suction line from the intake conduit, and thence livers it to the heater, which is by-passed for convenien Beyond the heater, which receives the steam dischar from the auxiliaries in the usual manner, two 6-in. fe lines are carried across the boiler-room as far as the fro of the batteries nearer the turbines, one line being cont

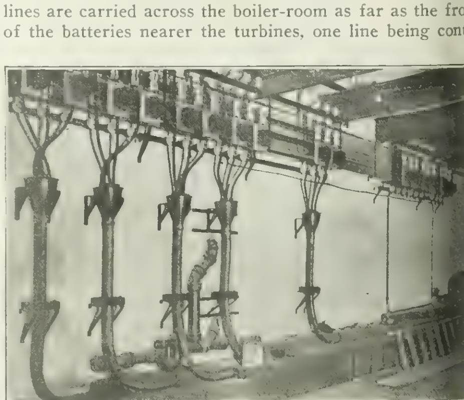


Fig. 8—Outgoing Tie Lines.

ued to the boiler fronts on the further side. The individ boiler feeds are obtained through 3-in. connections lead into the drums. These connections are piped to a 4-in. f trunk line, running across the fronts of the batteries each side of the firing aisle, and the two trunk lines connected at the ends of the batteries by 4-in. cross-li

orming a complete loop by means of which any boiler may be fed from either pump or trunk line with or without the use of the feed-water heater. Numerous valves are installed to facilitate the operation of the loops. All live-steam drips are collected and returned to the boilers by the Holly loop system. The valves on the main supply lines, when above the reach of the fireman, are provided with extension spindles and handles, so that rapid operation from the floor level is readily effected. Special care has been taken in the plant to provide for the incandescent lighting of all steam and water gages. The wiring for auxiliary lighting and motor service throughout the plant is carried in conduit, with "Condulet" fittings at all connection and outlet points. The boiler blow-off lines are 2.5 in. in diameter, and each is run to a 4-in. outgoing line which discharges into the Middle River about 178 ft. north of the building.

The live-steam piping of the plant provides for continuous and flexible service under all except the most extraordinary conditions. From each boiler a 5-in. steam delivery outlet connects with a 10-in. header, which is carried completely around the boiler-room in a closed loop, the boilers in the east battery feeding into one side and the two west batteries feeding into the other. The two sides of the loop are also connected by a 3-in. main from which 2-in. steam lines are run to the stoker engines in the boiler-room basement. From the header on the side next the turbine-room 8-in. risers lead to the individual turbines, the valves being installed on the turbine-room side of the wall. In the turbine-room basement a 6-in. auxiliary steam header is provided, with connections to the main boiler-room header at each end of the station, forming another closed loop which provides for normal and emergency operation of the auxiliaries.

The principal live-steam connections made from this header include a 3-in. line to each condenser air pump beneath the turbine equipment and 2-in. lines to the individual boiler-feed pumps and dry-vacuum pumps, all of which are installed in the basement of the station. Two small oil pumps for turbine service are installed in the basement, each being supplied through a 0.5-in. steam line. The plant is equipped with two turbo-exciters, each of which is served by a 4-in. steam line from the auxiliary header. An 11-in. x 12-in. x 13-in. Westinghouse steam-driven air compressor is installed in the basement for general cleaning service about the plant. No single line of piping outside the short

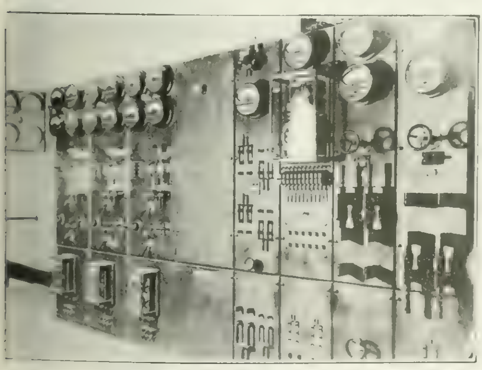


Fig. 9—Generator Switchboard.

local connection to the header is depended upon as the sole reliance of any equipment in relation to steam supply.

The present turbo-alternator installation of three units operating at 3600 r.p.m. is placed in the generator room with the axes of the units at right angles to the boiler-room wall, thus permitting a symmetrical expansion of the plant parallel to the lines of future boilers. The turbines are placed next the boiler-room, giving the minimum length of high-pressure piping and allowing the condenser installation to be compactly arranged. Each turbine exhausts into a Wheeler counter-flow jet condenser of new design, the con-

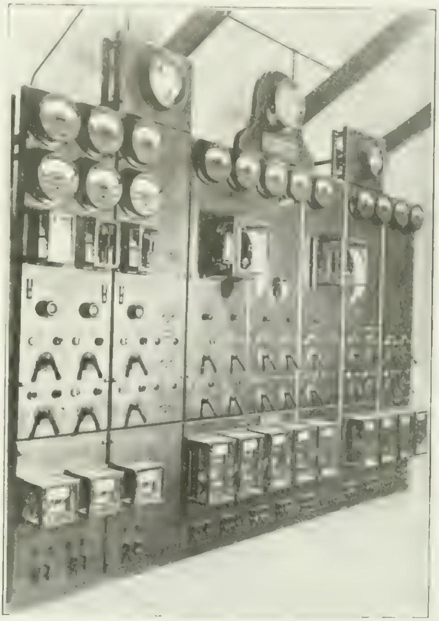


Fig. 10—Feeder and Tie-Line Switchboard.

denser being placed directly below the turbine in the basement.

The water is introduced in the condenser at the upper corner into an extended trough or pan, from which it overflows through numerous short tubes, falling into a second or similar pan provided with overflow pipes and a weir, finally falling into the lower part of the shell, and thence to the discharge outlet. The steam passes horizontally through a shower of water at the first level, ascends to the second level, passes through an upper shower, and finally all that is left of the steam vapor, together with the air and other gases, passes over the entering and coldest water at the top of the dry-vacuum pump suction, which is located in the upper part of the shell. The cross-section of the passage traversed by the steam continuously diminishes as the volume of steam is reduced by condensation and consequently a steady velocity is maintained throughout, leaving no dead pockets in which air might accumulate. In this condenser it is impossible for any steam to pass to the air-pump suction pipe without having traversed all the sprays, and the water is finely divided by small baffles hung below the tubes. In some of the older types of direct-contact condensers the condenser cone was substantially an open chamber in which the hot steam would naturally rise to the top while the air would fall to the bottom. This is the opposite of a desirable condition, for if an air pump receives steam instead of air it works most inefficiently, while the air continues to accumulate until the vacuum is seriously lowered. In the Worcester plant a 29-in. mercury-column vacuum is readily maintained. Each condenser is equipped with a 12-in. centrifugal circulating pump directly driven by a 50-hp Kerr steam turbine making 1000 r.p.m. and a Wheeler 9-in. x 22-in. x 12-in. dry-vacuum pump operating at 90 r.p.m. A

centrifugal priming pump is installed in the basement for starting the circulating-pump service, the former being driven by a 10-hp induction motor running at 850 r.p.m. A steam-driven 6-in. x 8.5-in x 6-in. general service pump is also in use in connection with the water supply for washing, toilet and other purposes.

Each condenser is connected with an outward exhaust line 20 in. in diameter, which terminates in a head above the roof level. In general, the auxiliary exhaust lines are brought into a 14-in. main, from which a connection is taken off through a Davis back-pressure valve, the former leading to a 14-in. outboard exhaust. Other connections provide for the use of the auxiliary steam in the feed-water heater, as in usual practice. The normal method of operation carries the exhaust steam from each auxiliary through the heater to a suitable drain outlet, and the condensation from the turbines is delivered to the discharge conduit beneath the turbine-room and thence carried to the river or pond as may be desired. The Kerr turbine equipments exhaust into 6-in. lines leading directly to the trunk exhaust in the basement, the dry-vacuum pumps exhaust through 2.5-in. lines into a 4-in. main leading to the trunk, the boiler-feed pumps exhaust through 4-in. lines leading to the trunk, and the stoker engines deliver exhaust steam through 3.5-in. lines connected with the trunk by a 6-in. main. Each exciter turbine delivers its exhaust into the trunk line through a 10-in. line. An extensive system of iron galleries has been built in the basement of the plant to facilitate access to the valves on the piping, and the piping has been painted the following colors to enable the attendants more readily to distinguish the different lines: High-pressure steam, cream; Holly system, cream with red band; exhaust steam and drip piping, yellow; steam-heating system, drab; boiler-feed lines, light blue; boiler blow-off, dark blue; water drains, light blue; air piping, green, and oil piping, uncovered, pink.

The electrical switching arrangement and cables occupy space on three levels in a switch house or annex to the turbine-room on the west side of the building. The basement-floor grade is depressed to permit convenient access to the outgoing underground conduit lines and also to avoid carrying the switchboard-room too high above the rest of the plant, which would have cut off light and ventilation from the turbine-room and detracted from the architectural appearance of the building. On the basement floor are located the feeder and tie cable outlets, regulators and field rheostats. On the next floor a busbar and oil-switch structure are installed, and on the third floor, which is about 5 ft. above the turbine-room, are located the operating switchboard, offices for the station staff and a storage-battery room, the equipment of the latter being used to operate the main oil switches of the plant, which are of the solenoid type. The switch house is separated from the turbine-room by a fire wall into which are set windows of clear, wired glass, and a similar partition separates the office of the chief engineer from the turbine-room.

The operating room contains two switchboards, installed opposite each other, one being for generator and the other for feeder service. The generator board contains eight slate panels and is 13 ft. 4 in. long. The feeder board is of the same material and contains seven panels, having a total width of 11 ft. 8 in. Two sets of 2400-volt, three-phase busbars are provided, and any generator may be connected to any bus or any feeder or tie circuit may be run off either busbar.

No high-voltage line enters the operating room, the entire service being of the remote-controlled type. Each generator panel contains a Weston ammeter and power-factor indicator, voltmeter, field ammeter and switch, watt-hour meter, polyphase wattmeter, governor-control switch for turbine synchronizing, field rheostats, oil-switch control for the main alternator, push-button signal system connecting with each turbine, and pilot lamps showing the position of main switches. On a swinging bracket at the end of t board are installed a voltmeter for each busbar set and machine voltmeter and Weston synchronizing indicat Shunt and series instrument-calibrating terminals are stalled on each generator panel. A single-stroke signal b is installed on the generator board in connection with t turbine-operating service, energy being supplied from t battery supplying energy to the oil-switch solenoid coi The battery consists of fifty-five cells of the chloride ty mounted in glass jars in an acid-proof room at the side the switchboard-room. An air-whistle installation, operat by an electromagnet controlled from the switchboard, is service in the turbine-room. The battery supplies ener also to an emergency lighting circuit serving various pa

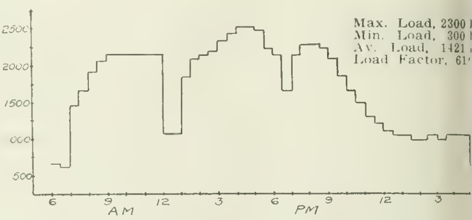


Fig. 11—Output in Kilowatts on April 14, 1911.

of the building, operates the governor control, field rheost motor equipments and solenoids. The auxiliary direct-c rent service is operated at 110 volts and the auxiliary s tion motor and lighting services are run at 240 volts a 120 volts respectively. The regular lighting service is su plied through a 25-kw transformer and the motor serv through a 50-kw three-phase transformer installation. common with the tie and feeder lines these may be co nected to either 2400-volt busbar set by a remote-control oil switch. In addition to the generator panels, the ge erator board contains a Tirrill regulator panel, also equip with turbine-room signal buttons, frequency indicator a shunt instrument-calibrating terminal; a battery pa equipped with circuit-breaker, ammeter, reactance used connection with the rectifier outfit which is employed charging the battery, various auxiliary switches a two exciter panels. The battery may be charged from exciters if desired, and energy from the exciters is used operate the engine-room crane, which is a 50,000-lb. Ma outfit equipped with operator's cab and trolley hoist. T exciters are of the interpole type, each being rated at kw and delivering energy to either a pair of main or a p of auxiliary busbars at 125 volts.

The feeder switchboard contains two panels controll the tie lines between the plant and the Faraday Street s station, two incandescent-lighting panels for future serv and three motor panels to be utilized later. Each tie l is provided with an ammeter, watt-hour meter, inver time-limit relay, oil-switch control, pilot lamps, shunt a series instrument-calibrating terminals. Line-drop co pensators are also installed and adjusted to maintain a c stant voltage at the Faraday Street busbars regardless the load changes within the adjustment range. The fee panels contain the usual complement of ammeters, vo meters, contact-making voltmeters and inverse-time-li overload relays, with full provision for remote control. T outgoing lighting circuits will be controlled by motor-dri feeder regulators installed in the basement, but the fut motor circuits will be run directly from the busbar switches to the centers of distribution. Both the swit boards, with their auxiliary switching equipment, were stalled by the General Electric Company, which also f nished the apparatus utilized in connection with the dis bution service at the Faraday Street substation.

At Faraday Street each incoming cable is brought i

te substation basement through cable potheads and selector itches, and thence to a pair of oil switches of the automatic, solenoid-operated type. Either switch when selected f remote-control operation from a switchboard in the old nerator room of the station delivers energy to a corresponding three-phase busbar set, the busbars being installed fireproof compartments in the basement. Each incoming te is rated at 1000 kw. Each outgoing feeder circuit may connected to either set of busbars by remotely controlled l switches located in compartments built of concrete sides d bottoms and slate tops, installed in the basement. In is installation the oil-switch relays are mounted on the gle irons of the switches themselves, instead of being cated at a distance, with the result that inspection, adjustent and repairs are greatly facilitated. One man can sily attend to a switch since the location of the relay ose by renders it unnecessary to depend upon a second tendant at the switchboard in the operating room upirs.

The oil-switch solenoids are operated by means of energy om a fifty-five-cell storage battery, which is charged rough a mercury-arc rectifier. Each incoming line is uipped with an inverse-time-limit relay, pilot lamps showg the condition of the line and additional lamps showing e open or closed status of the controlling switches, conol relays, synchronizing connections and the usual series d shunt instrument transformer equipment. An edgeise-type Thomson ammeter is also inserted in each incomg circuit, with operating connections between the series ansformers and switchboard panels. Only three panels e needed to control the incoming lines, the distribution ing effected by a remotely controlled installation which as been established at the former alternating-current disibuting switchboard in the operating room. A Hartmannempf frequency indicator has been installed on the busars of the distributing board, the instrument being supied by Machado & Roller, New York. From Faraday treet eight lighting feeder circuits, two three-phase motor, ur commercial arc, five direct-current, 500-volt and twenty unicipal arc circuits are run into the company's territory. he arc-lighting system consists of 900 magnetite units of e 4-amp size supplied with energy through mercury-arc ectifiers and constant-current transformers. The details f the arc-lighting system were given in the issue of Sept. 1908.

At present there are in operation at Faraday Street vo synchronous motors, one of 800-hp rating and the other f 750-hp. The larger motor is mounted on a line shaft in e basement and drives two Brush arc machines and a 00-kw, 100-volt direct-current generator delivering energy a limited motor-service clientèle. The Brush machines apply energy to commercial arc-lighting customers. The rger direct-current machine carries the greater portion of e day direct-current motor load, the smaller unit being un alone at night. The synchronous motors are directly eneficial in maintaining a high power-factor on the system s a whole, the company being able to secure between 95 er cent and 100 per cent without difficulty. A typical daily ad curve of the Webster Street plant is given herewith, he load-factor averaging 61 per cent on the day shown, ith a maximum load of 2300 kw and a minimum load of 00 kw.

The foregoing work has been completed under the adinistration of President George T. Dewey, the other fficers of the company at that time being: Treasurer, Mr. I. H. Fairbanks; superintendent, Mr. William H. Coughlin, nd assistant superintendent, Mr. Fred H. Smith. As noted n our issue for May 25, Mr. Smith is now superintendent, Ir. Coughlin having resigned.

The plans of the Webster Street station were prepared nd the purchasing and installation of the equipment were n general handled by Westinghouse, Church, Kerr & Company, New York.

GASOLINE-ELECTRIC TRACTION IN EUROPE.

By Francis E. Drake.

Much progress has been made in the past four or five years with the simplest form of gasoline-electric vehicle for railways and tramways. The most notable installations of gasoline-electric cars—generally termed "automotrices"—have been in Hungary. Successful installations are also recorded from Germany, Holland and France. England and Sweden have already placed important orders for the automotrice, which bids fair to take an important position in the European traction field.

Several European countries have already gained experience with steam motor-cars, which, in the beginning, seemed to offer a solution as a substitute for small locomotives and trains. The steam motor-car was found unsatisfactory, chiefly because of difficulties with the boiler. Moreover, the heat in summer and the presence of smoke and dirt annoyed the traveling public. The remarkable development and rapid improvement of the automobile type of gasoline motor led many to the conclusion that this type of engine could be used successfully for railway motor-cars. It was only after an expensive experience as to maintenance that the mechanically coupled motor-car was practically retired as being unable to meet the conditions for modern short distance or intermediate passenger traffic.

Nearly twenty years ago the first practical attempts were made with the gasoline-electric cars, in which, as a rule,

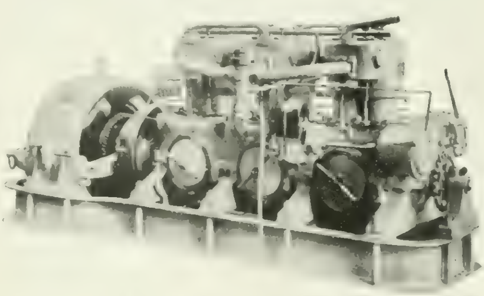


Fig. 1—Gasoline-Electric Generating Set.

the storage battery was an important part of the equipment. The system was found unsatisfactory and abandoned because of the heavy cost of maintenance, car weight and complication. The gasoline motors at that epoch were crude and unable to give continuous service.

Passing briefly the various stages of experiment and disappointment which mark the record of all industrial enterprises, it is important to note that the present success of the gasoline-electric automotrice on many European lines, operating under widely varying conditions, can be attributed to:

1. The reduction of motive power and of auxiliary equipment to the simplest elements, i. e., gasoline engine, direct-connected generator and secondary motors on the axles.

2. Reduction of total car weight to the lowest possible minimum for safety and security.

The solution of this type of traction in Europe has been arrived at by a route almost diametrically opposed to that accepted by American railway engineers, where the influence of the Master Car Builders has been opposed to the light car. Their specifications have required a double-truck Pullman type sufficiently heavy to be coupled with any existing rolling stock. The inevitable result has been that the railway motor-car in the United States has been a self-propelling Pullman. The total weight of the car has averaged from 40 tons to more than 50 tons.

Naturally if a speed of 25 miles per hour to 40 miles per

hour is required the power equipment, comprising engine, generator, motors, etc., must be correspondingly heavy. With a seating capacity of forty to fifty passengers the dead weight of the train becomes the equivalent of 1 ton per passenger. The European attitude toward this problem has been, in principle, to admit that the automotrice is useful in developing business on new lines or where

Fig. 2—Gasoline-Electric Train on Dreibergen-Arnhem Line, Holland.

traffic is sparsely centered and, consequently, very expensive if conducted by steam trains, or as feeders for trolley and steam-train business. Instead of 1 ton train weight per seated passenger, as obtains with the M. C. B. standard American railway motor-car, the European automotrice has but half this weight and in some cases less. Lower train weight means smaller and lighter engines, generators and motors, and consequent reduction in the operating costs.

A significant and important consideration in the size of the gasoline engine is that the nearer these units are kept to the well-developed automobile motor standard the more certain and reliable are the operating results. The larger high-speed gasoline engines have difficulties in cylinder cooling, lubrication, etc. There is also a greater danger from vibration, which, when communicated to the body of the car, is found objectionable by the passengers.

In general, it may be stated that according to European practice an automotrice capable of seating forty passengers will weigh not to exceed 20 tons. The power equipment may be either a 60-hp or a 90-hp engine and generator group, which, with this weight, will give a speed on the level of 25 miles per hour to 40 miles per hour.

Among the notable installations of automotrices in Europe is the Arad Csanad Railway, in Hungary, which is the largest and most important of the privately owned railways of that country. The company operates nearly 400 km (250 miles) of standard-gage line and has in operation more than forty automotrices. This company has been one of the pioneers in the adoption of the railway motor-car, its experience beginning over six years ago with the steam motor-car service. This was succeeded by a car driven by a gasoline motor from which the power was communicated to the axles through mechanical transmission, such as is common with the automobile. Both of these systems were finally discarded and replaced by the simplest form of gasoline-electric automotrice designed and executed by the Société Anonyme Westinghouse. In the course of four years the passenger traffic of the Arad Csanad Railway, which now aggregates more than 1,500,000 passengers per annum, has been entirely converted to automotrice service. The commercial results have enabled the company to reduce the fares one-third and increase the number of passengers carried threefold. The passenger traffic of the line, which formerly under small locomotive traction gave a loss of $40,000 per annum, now produces a net profit of $100,000 per annum.

Two forms of automotrice trains are used—the slow or "omnibus" trains with frequent stops and limited speed and the express service, comprising, according to traffic conditions, one automotrice and one or more trailers. The express trains make a speed of 40 miles on the level, although the commercial schedule speed is probably 25 miles per hour.

Another interesting installation has been carried out on the lines of the Oosterstoomtram in Holland. This line is approximately 50 km (31 miles) in length with 1067-m gag The line extends from Dreibergen, near Utrecht, throug Rhenen on the Rhine, to Arnhem. Until 1909 this line wa operated with steam locomotives. Owing to the compos tion of the trains, following the government regulations, th Oosterstoomtram decided to use automotrice locomotive which could also serve as baggage and postal cars. Th light passenger cars which had formerly been hauled b steam locomotives serve as trailers for the automotric locomotives. (See Figs. 2 and 3.)

The automotrice locomotive comprises separate compart ments for the mails and baggage. The gasoline engine an generator are installed in the center of the car. The tota length of the chassis of the automotrice is 10.8 m (35.24 ft. and the width of the car body 1.9 m (6.21 ft.). The powe equipment consists of a six-cylinder, 90-hp Westinghous engine and direct-current generator. In the power com partment are the gasoline and water tanks. The radiator i placed on the roof of the automotrice and the cylinder-cool ing water is made to circulate through same. In the driv ing cabins, at either end of the car, are placed an operatin controller and a lever for the regulation of the drivin group, indicating instruments, circuit-breakers and the air brake lever. The weight of the automotrice locomotive i 18 tons, and will ordinarily haul two bogie trailers, eacl weighing 11 tons empty. The train, with passengers, wil therefore weigh 40 tons and contains seating capacity fo 100 people.

During the trials one of these automotrice locomotive started a train of 71 tons of construction material on curve of 18 m (59 ft.) radius, followed by another in the op posite direction of the same radius. This train was haule at an average speed of over 10 miles per hour from Dreiber gen to Sandenberg, a distance of 6 miles. The line betwee Dreibergen and Arnhem has curves with a maximum o 3.7 per cent and 3.2 per cent for a distance of 1000 ft. an 3500 ft. respectively. There are many curves with a radiu of 20 m (6.56 ft.). The automotrices actually in service o these lines make from 80 miles to 100 miles per day. Owin to the presence of several steam trains the commercia speed of the automotrice train cannot exceed 10 miles pe hour. Much of the line lies through villages and well settled communities where frequent stops must be made there being 170 stops during a day's run. The averag consumption of gasoline per train-kilometer, density 0.765 is 800 grammes, and for gasoline of a density of 0.715, 75 grammes. Naturally the consumption of gasoline will var according to the speed of the train and the number of stops

Another interesting installation of an entirely differen character is the automotrice on the tramway line, Dinard & St. Briac, in France (Fig. 4). The line in question

Fig. 3—90-hp Gasoline-Electric Locomotive, Oosterstoomtram, Holland.

which passes through the town of Dinard and connects with other summer-resort localities, has a total length of about 6 miles. The automotrice chosen by the company seats thirty-seven passengers, first and second class, and is equipped with a 90-hp generating group (Fig. 1). Formerly the service was secured entirely by small steam locomotives, but the demand of the public for improvement in

e service and comfort caused the adoption of the auto-trice. Owing to the fact that the passenger traffic exists y during the four or five summer months, an electric lley installation on account of its heavy first cost was nsidered out of the question. The Dinard automotrice ghs, with passengers, 22 tons. Following the schedule operation for the steam trains the automotrice makes a

Fig. 4—Gasoline-Electric Car for the Dinard-St. Briac Railway.

aily run of 74 km (45.8 miles), with seventy-nine stops, nd consumes, including switching, a total of 56 kg 250 gr 125 lb.). Until the steam locomotives are all replaced the d train schedule must be maintained.

One of the recent installations of the automotrice in rance is on a private railway connecting the Mines de arvin with the Chemin de fer du Nord. The automotrice rain, comprising automotrice and one trailer, with passeners weighs a total of 39½ tons (Fig. 5). The consumpion of benzol (produced by the mines as a by-product rom coke ovens) is 423 grammes per train-kilometer, not ncluding stops and switching. The trains make an average f 65 km (40 miles) per day with thirty-three stops. The otal consumption of benzol per train-kilometer is 570 rammes, indicating that the combustible consumed in tops, switching, etc., amounts to practically 25 per cent. revious to the installation of the automotrice the small team locomotives used on this line consumed 1¾ tons of oal briquets per day. The mine estimated the value of the riquets to be 18 francs per ton. The saving in fuel on the asis of 64 kg 500 gr of benzol per day at 16.77 francs gainst coal at 31.40 francs used in the locomotives amounts o approximately 50 per cent, to say nothing of the saving f firemen's wages, etc., and maintenance costs.

In Germany the Oestdeutsche Eisenbahn Gesellschaft

Fig. 5—Motor-Car and Trailer on the Mines de Carvin Railroad.

dopted the automotrice of 60-hp capacity for a line 55 km 34 miles) in length with maximum grades of 1.6 per ent. During the past three years three trips per day contitute the average run. The commercial speed is about 8 km (11.2 miles) per hour.

In nearly every country in Europe the government regulations concerning railway material are more or less stringent and follow a certain long-established practice. The introduction of the automotrice is sometimes effected with difficulty with the government inspectors, who have the control of such rolling stock. The types and general finish of car bodies also follow certain prescriptions which have in many cases been adopted by the governing authorities. Having struggled against earlier failures, born of unripe experience and unreliable elements, the gasoline-electric automotrice has finally established for itself a sure and rapidly growing popularity.

COMPARATIVE THERMAL TESTS OF AN ELECTRIC FIRELESS COOKER.

By [illegible]

THE use of an electric heater with a fireless cooker would seem to give the highest possible efficiency for the electrical heater, by confining the heat in one place and thus raising the temperature to a higher mark and holding it there, for a given time rate of supplying electrical energy. The net efficiency of the thermal box or fireless cooker would also be increased for the reason that if a hot body is placed in a cold hay box, or whatever material is used for heat insulation, everything surrounding the hot body must be warmed up to nearly its temperature. To do so the hot body itself must give up some of its heat, and in so doing its temperature will drop some degrees before a temporary thermal equilibrium is established throughout the box. On the other hand, if instead of placing a hot body in a cold box, a cold body be put in a cold box and the

Fig. 1—Experimental Fireless Cooker.

cold body heated by an electric heater, then it is true that some heat will be lost by the body before it is brought to the desired temperature, but the heat that passes out of the body goes into the surrounding heat-insulating material and warms this material adjoining the inside body to the same temperature as the body itself, so that the total amount of heat supplied is made useful.

Laboratory experiments were made by the author along the above lines extending over a brief period of a few weeks. With the exception of some electrical measuring instruments the apparatus used was of the crudest kind. The fireless cooker was made of a wooden box which had been constructed originally for packing a typewriter for shipment. The dimensions of this box were 17 in. x 17 in. x 15 in., the thickness of walls being from ½ in. to ¾ in. Different heat insulations were used—sheep's wool, sand, paper and asbestos such as is used in incasing large steam pipes. In the center of this box, supported on glass rods, was placed a tin bucket 8 in. in diameter and 8 in. high. A hole was cut in the lid of the bucket in order to admit an electric heater into the very middle of the body to be heated. This hole was made large enough to admit an incandescent lamp, as it was intended to try one of these as a possible heater.

A cylinder of tin to incase the heater was fastened onto the cover so as to extend down into the bucket. A cross-section view of the outfit would look somewhat like Fig. 1.

In order to get quantitative results a known amount of water was heated each time. Use was made of an automatic recording thermometer consisting of a coil of copper wire connected to an automatically balancing Wheatstone bridge. The resistance of the copper coil being a known function of the temperature, the Wheatstone bridge became a temperature-reading instrument and by means of a chronograph attachment it was made to draw a time-temperature curve.

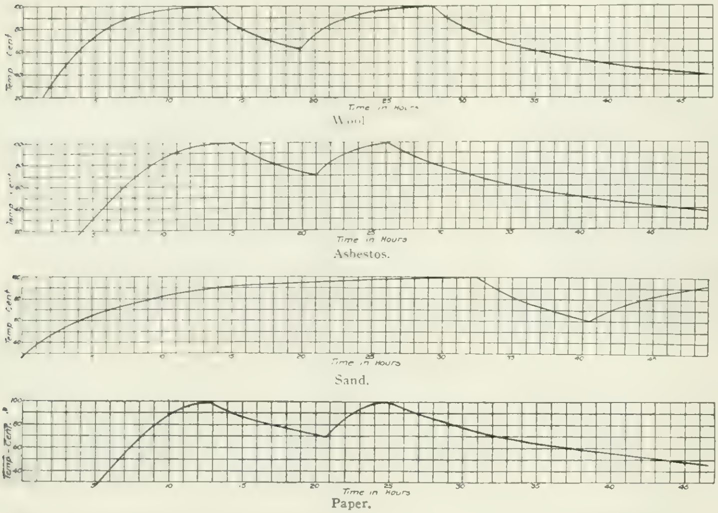


Fig. 2—Curves Obtained When Using Wool, Asbestos, Sand and Paper Respectively as Heat-Insulating Material.

The results for four insulating materials are shown in the accompanying curves. A 16-cp carbon lamp was used as the heater. It was run on a 110-volt circuit and drew approximately 0.5 amp. Knowing the amount of water used, which was 1 gal., and the mechanical equivalent of heat, one can easily estimate the rate at which the temperature of the water should rise if there were no loss of heat whatever. It is found that almost 5 minutes is required to raise the temperature 1 deg. C. If then the temperature is to be raised from, say, about 15 deg. C. (tap water) to the boiling point, then under ideal conditions approximately seven hours of time and 385 watt-hours of energy would be required. In reality it will take a much longer time than this ideal minimum, for the reason that the whole surroundings must be heated to some higher temperature and also from the fact that some of the heat generated passes entirely out of the inclosure and is lost. Moreover, the longer the time required for heating the greater the loss becomes, and hence for practical purposes it would be better to use a larger energy flow and heat the inside body more quickly so as to reduce the time element in which heat loss occurs. For this purpose use may be made of a heating unit consisting of a non-oxidizing wire, of which there are now several alloys on the market, and after the desired temperature is reached a small lamp may then be used instead of the first heater, in order to hold the temperature at some desired point. A thermostat such as was described in the *Electrical World* of Jan. 12, 1911, may also be used to control the temperature; this may be set at any temperature so that it will cut off the energy supply when the temperature goes above that point and make connection again when a certain lower temperature is reached.

One way of stating the efficiency of such an apparatus would be the expression $A \div B$, where A is the minimu amount of heat necessary to bring the inclosed body to t desired temperature and B is the actual amount of heat us in attaining the desired temperature in any particular ca If B is equal to A, then the efficiency would be 100 per ce according to this definition, which ideal condition is n reached or expected. The e ficiency at any temperature m be expressed as the ratio of t amount of time required change the temperature 1 de under ideal conditions to t actual time required to chan 1 deg. at that temperature. the case of each test here r corded the bucket containin the water and heater was buri in the middle of the box l packing on all sides with t particular heat insulator the being used. In one case t box was filled full of sand th had been stored in a barrel f a month but was not yet pe fectly dry. The weight of was considerable, the volum shrinkage about 5 per cent it dried and the heat loss b conduction large while in th moist condition.

The method of procedure wa to obtain data for points o a heating curve until the wate was brought to the boilin point or until the energy suppl was turned off at night, and then to allow the mass t cool, the cooling curve thus obtained showing its actio as an ordinary fireless cooker would cool. The tempera ture-recording apparatus was run continuously by mean of storage batteries. The heating curve was again begu as soon as the supply of energy from the station was re stored in the morning. Incidentally this temperature rec ord shows at just what time the energy was turned o and off at the plant.

It was necessary to support the bucket of water on glas rods when wool and asbestos were packed around it in orde to keep it from sinking to the bottom. The wool was tor apart into fine particles and packed in loosely. It was dry but slightly oily. The results would probably have bee better if the oil had been entirely removed. The asbesto was originally in the form of steam-pipe casings, but wa entirely pulverized so that it packed easily into all the avail able space. The sand became perceptibly warm all aroun the outside edges. No heating whatever could be felt by th hand at the surface of the wool, wool being a poor therma conductor. A thermometer inserted into the wool a shor distance at various places and left quite a while would, how ever, show an increase of several degrees of temperature The asbestos was slightly warmed at the surface in only one place just above the bucket of hot water.

Newspapers used for insulation were wrapped round and round the bucket, the bottom of the containing box being thickly covered with them, the space between the walls being well filled and the top also covered with several layers so as to make the thickness as nearly as possible the same as that used in the other cases. The accompanying curves show that paper insulation gives the highest efficiency. The slope of the heating curve is larger and that of the cooling curve smaller than for any other insulator, thus indicating the highest efficiency. Anything that will prevent air currents and alternate with air to make many layers or coverings will provide good heat insulation. Of course, newspapers could not be used at very high temperatures owing to

anger of becoming ignited. For all domestic purposes hey are, however, probably entirely safe.

As a summary, then, it may be said that for moderate temeratures an electric fireless cooker may be used advanageously, and that the highest efficiency is attained where ewspapers are used for heat insulation and the heater conumes enough power to reach the desired temperature in a hort time and thereby minimizes heat losses.

A. I. E. E. PAPERS AND DISCUSSIONS.

The following are the remainder of the papers presented t the recent Chicago convention of the American Instiute of Electrical Engineers, together with abstracts of he discussions to which they gave rise:

SINGLE-PHASE MOTORS FOR HEAVY SERVICE.

Mr. E. F. W. Alexanderson, of the General Electric Comany, read a paper in which were recorded the results of nvestigations relating to the use of polyphase motors upon ngle-phase circuits. The method described represents a odification of the scheme of using a previously operating olyphase motor receiving energy from a single-phase system to supply polyphase voltage to another motor which to be brought to full speed from starting conditions. As rdinarily applied this method provides polyphase voltages hat are far from being balanced, and hence the result has ot always been satisfactory.

The author shows a method by which the phase displacement can be corrected in order to obtain approximately alanced polyphase voltages. A two-phase motor is opered without load as a phase-converter to supply two-phase oltages to the system. This machine acts like a series ansformer between one phase and the other, to transform e current from one line to the other, and displace it by pproximately 90 time degrees. In order to make this rangement effective the author has interpolated in the le phase of the phase-converter a voltage derived from e single-phase line, so as to create artificially a phase disacement between the output of the phase-converter and e input of the motor.

The author remarked that this method of operating twoase motors appears particularly to advantage when a ngle-phase converter can be used to furnish quadrature oltage to an aggregate of several motors. He remarked at designs have been made for a phase-converter having output corresponding to 1600 motor hp. He estimated at the total increase in the weight of the electrical equipent for single-phase power would be 15 per cent over the rresponding polyphase equipment with the same output d starting torque.

LECTRICAL OPERATION OF THE WEST JERSEY & SEASHORE RAILROAD.

The author of this paper, Mr. B. F. Wood, gave data on e electric road operating between Camden and Atlantic ity, N. J. This branch of the Pennsylvania Railroad was rmerly operated by steam, but no comparison is made with e operation of the parallel steam service and no attempt made to analyze or compare the data with any heretofore esented on the subject. The road was described in these lumns shortly after it was placed in operation. (See *lectrical World*, Nov. 10, 1906.) It is 64.6 miles long and erates on the multiple-unit, 675-volt, direct-current system th an over-running third-rail. There are a single generng station 5.6 miles from the Camden terminal rated at 00 kw and eight substations equipped with six-phase nchronous converters. The paper is replete with data ken direct from the operating records with only such additins as would make them more readily understood. No fort has been made to curtail or to modify in any respect e data selected. After giving the entire equipment of the ad in detail the author appends in tabular form its cost of construction, the unit cost of electrification, cost of operation and maintenance, detentions to train service and causes, renewal of parts of car equipment, gear and pinion breakage and certain general power data of interest. This latter statement shows the kw-hour output from the generating station, the cost in mills per kw-hour output, pounds of coal burned per kw-hour and the efficiency of transmission and conversion from the alternating-current bus in the generating station to the direct-current bus in the substations. Improvements are noted in each of the four years of operation, the cost of energy and the coal consumed per kw-hour decreasing with each successive year from 6.8 mills and 3.67 lb. respectively in 1907 to 5.42 mills and 3.25 lb. respectively in 1910. The data are valuable for comparison with other systems and as a matter of record.

ANALYSIS OF TRUNK-LINE ELECTRIFICATION.

A paper entitled "Electrification Analyzed and Its Practical Application to Trunk-Line Roads, Inclusive of Freight and Passenger Operation," presented by Mr. W. S. Murray at a meeting of the American Institute of Electrical Engineers held at Toronto, Can., on April 7, 1911, was presented in review for discussion. An abstract of this paper was given in our issue dated April 13, 1911.

In expounding his long paper, Mr. Murray said that its object was to present the results of six years' work with single-phase electrification. There are three classes of railroad locomotives, passenger, freight and switching, and the speaker said that electric locomotives are replacing steam locomotives for all three. Electrical engineers must not talk one system exclusively; they should have a sense of standardization on the general principles of using electricity for heavy trunk-line railroading, including terminal and suburban traffic. Freight traffic cannot be considered for electrification without considering the yards problem. On the Eastern roads the yard mileage is perhaps 50 per cent of the main-track mileage on a freight basis. Mr. Murray cited the Harlem yards of the New York, New Haven & Hartford system to show that the overhead catenary construction for single-phase operation enables the electrification of terminal yards to be made at one-third of the cost of any other system. Moreover, this system of distribution is less expensive for main-line construction than any other. The weight and cost of equipment for single-phase operation were serious at first, but both of these items are being reduced.

Discussion.

Mr. Frank J. Sprague, of New York, chairman of the Institute railway committee, opened the discussion. He recalled his inaugural address as president of the Institute at the Chicago meeting of 1892, when he chose electric-railway possibilities as his subject. He said that he would change the conclusions then advanced only in a few particulars at the present time, and he quoted from that address. There are those, he said, who think there is a mean between alternating-current and direct-current employment for railway operation. Some think that the direct-current motor possesses advantages to be united with alternating-current transmission by the rotary-converter transformer or the motor-generator. This is a safe and conservative attitude. There are others who would add alternating-current distribution. The experience of the New Haven road with single-phase has not changed the speaker's opinion of several years ago.

The general subject of railroad electrification should be discussed as a question of steam versus electricity, based on known operatingcosts. It is unwise to discuss this or that system, but best to get actual facts from existing systems. Single-phase development has promised much and disappointed much; the history of single-phase operation on interurban roads has been most unsatisfactory. As to trunk-line systems, the railroad people have shown extraordinary reluctance to give actual results of operation. This ap-

plies also to the cost of producing electrical energy by railroads, although such cost is well known in other electrical enterprises. Only a few of the railroads having generating plants have made direct comparisons of the cost of energy, considering steam and electricity. Mr. Wood's paper on the West Jersey road sets an example which other roads should follow. The thanks of the railway committee and the Institute are due to Mr. Wood and his company for the perfect frankness exhibited. One comment that may be made on this paper is the rather wide variation in the cost of operation per car-mile compared with the comparatively slight variation in the cost of energy delivered to the contact shoes. This, however, is influenced by the demands for electricity for lighting and heating.

Mr. Murray's paper was criticised by Mr. Sprague as a specious plea for a pet system. It is as though the single-phase advocates say, "We've made it work, now let's make it pay." The speaker noted that it was proposed to abolish the 25-cycle motor and substitute induction motors or even direct-current motors. However, other European and American engineers recommend 15-cycle operation. The speaker declared that every wheel in the electric zone of a railroad system should be operated by electricity; the diversity factor should be extended in railway work as well as in central-station service. The day of individualization in railroading will pass. The railroads' demands for energy will be met by great central stations. The New York Central terminal system in New York could be better supplied to-day by a central station like that of the Commonwealth Edison Company of Chicago.

Referring to the Chicago electrification situation, Mr. Sprague said that when electrification comes in that city the engineers will see the maximum benefit to the railroads and the community with the minimum burden. This means polyphase transmission and direct-current distribution. Referring to the storage-battery question, the speaker said the New York Central put in batteries because of the absolute necessity for insurance and not to reduce the kw-hour cost. In conclusion, Mr. Sprague said, "Let it be a battle between steam and electricity. I stand against that attitude which compares the promises of one electric system with a denial of the possibilities of another."

Mr. E. B. Katte, of New York, also praised Mr. Wood's paper. He noted in it a much larger number of detentions on the trolley part of the system than on the third-rail part. In relation to Mr. Murray's paper, Mr. Katte read a written communication in which he said that he believed that any steam railroad could be equipped reliably either by the single-phase, polyphase or direct-current system. Not one of these systems is entirely satisfactory by itself. The question is, Does electricity effect saving enough to meet the additional fixed charges? As a matter of fact, electrical operation of trunk-line railroads is more or less of a luxury or installed to meet some special condition, as in terminals or tunnels. If the steam locomotive is abolished as a nuisance in cities, the cost of electrification should be shared by the city or state, as in the case of the abolition of grade crossings.

Referring to the New York Central direct-current operation and the New Haven single-phase operation, Mr. Katte said the saving in energy consumption on grades is in favor of the direct-current locomotives. The record shows less interruption to train service on the direct-current system than where single-phase is used. Mileage records were also compared, to the advantage of the direct-current system, and the speaker also declared that reliability of electrical operation is not peculiar to the single-phase system. He pointed out the economical effect of batteries in equalizing load on power stations. Successful electric locomotives should not only be reliable, but of low maintenance cost, and here the direct-current machine seems to have an advantage. The first cost of the direct-current locomotives appears to be less also. Mr. Katt believes that the conclusions of Mr. Murray's paper ar not justified. However, his purpose is not to urge direc current as opposed to single-phase current, but to point ou that so far the former has made the better record. Bot systems are available, however, and the selection should b left to the requirements of each specific case.

Mr. L. C. Fritch, of Chicago, spoke from the viewpoin of a steam railroad engineer. He made the interesting dis closure that he had prepared a paper on the subject at on time which was, however, suppressed by steam-railroad me as being pro-electric. Mr. Fritch believes that there is n work in heavy trunk-line service that the electric locomo tive cannot perform more efficiently than the steam ma chine. Railroad men are making a mistake in warding o something that is inevitable. The Mallet type of locomc tive was referred to as the last gasp of the steam locomc tive, and compared with the electric locomotives used i the Pennsylvania terminal in New York City to the advar tage of the latter. The question of electric systems mus be established. Controversy furnishes ammunition to stea railroad advocates. In Chicago, for instance, how coul one company adopt one system and another another sys tem and interchange traffic? The speaker favored a unive sal system, and said that one could be reached. Electric engineers should cease battling for rival systems and adop a standard. In Chicago it will be contended by steam rai roads that it would cost $250,000,000 to electrify the rai road terminals. However, the entire terminal situatio should be revised, and there should be electrification wit in a certain reasonable limit. Mr. Murray's point abo the electrification of yards was praised. A very importa point is that the number of switching locomotives may l reduced by using electricity. Mr. Murray's paper has den onstrated the feasibility of electrifying large freight te minal yards.

Mr. J. L. Woodbridge, of Philadelphia, took issue wi Mr. Murray on the battery question. He believes that th storage battery properly installed is a profitable investmen and cited the case of the Chicago City Railway Compar in connection with the contract made with the Commo wealth Edison Company. Here the battery shows a retu of 12 per cent on the investment. Trunk-like service is sti more favorable to the storage battery. The advantage developing energy at minimum cost rather than under co ditions of maximum cost was pointed out. However, it not economical for the battery to take all peaks above below an average load line.

President D. C. Jackson, of Boston, left the chair take part in the discussion. He praised the courage a vigor of the New Haven engineers in working out a gre alternating-current system. It seems to be proved that bo alternating and direct-current systems will meet all conc tions of railroading. The speaker pointed out that the could be standards even where there are different system Really the only open question is whether the improv service can be given without increasing the cost of servic The future can be viewed with equanimity, as the indic tions point in the right direction.

Mr. N. W. Storer, of Pittsburgh, praised Mr. Woo paper, which he examined in some detail. He thoug some of the speakers had gone out of their way to ma an unfavorable comparison of the overhead trolley with t third-rail. There is a good reason for the greater cost maintenance of the trolley wire. The use of a pantogra trolley will nearly wipe out the larger cost of maintenan with trolley wheels. Referring to Mr. Murray's paper, M Storer said that he was not prejudiced in favor of t single-phase system, but perhaps some of the advocates the direct-current system could not say as much. The l ter have done little or nothing for the development of single-phase system. The speaker agreed with Mr. Frit

at there should be some standard system. He believes at single-phase operation offers superior advantages for e transmission of energy, especially in the means for col-cting energy from the line. It can be applied to yard nstruction much better than the direct-current system any voltage.

Single-phase locomotives have been criticised as heavy d expensive, and it is not contended that this type of achine is as powerful for a given weight as a direct-cur-nt locomotive, but progress is being made. Mr. Storer hibited drawings of a new single-phase locomotive with ur pairs of drivers, each surmounted by two motors. The mbined weight of the two motors is less than that of e big motor. The control equipment has been simplified d the weight of the locomotive reduced to 116 tons, de-loping a tractive force of 40,000 lb., at a speed of 50 miles hour. The speaker urged the "get-together" policy. "What's the use of fighting?" he remarked. Direct-cur-nt apparatus is reliable, but the question is whether it is apted for the main propositions in electric railroading at are coming up.

Mr. J. W. Lieb, Jr., of New York, discussed power-house eration for railroads. The electric-service companies nt this business and are not very much interested whether gle-phase, three-phase or direct-current operation is used, ovided they can supply the electricity. However, it is of imense importance to be able to interchange electrical ergy with local sources of supply. Twenty-five cycle cur-nt was urged with this in view. Railroad companies ould feel that they can purchase electrical energy at a ice at least not to exceed what it would cost them to nufacture the electricity themselves. Great economic ad-ntages inure in one electric service system supplying rail-y, lighting and industrial loads in great cities, both in ration to carrying the peak loads and in improved load tor. The storage battery is a vital necessity for con-tuity of service; it would be a practical impossibility to ain the existing record of great cities in continuity of eration without batteries. The fact that the great central-stion companies stand ready to furnish electricity to rail-ds at least as cheaply as they can make it should be an portant factor in hastening the day of railroad electrifica-th. The speaker concluded by praising the Common-wlth Edison Company of Chicago for being the leader in aining railway load.

Mr. C. F. Scott, of Pittsburgh, reviewed briefly the his-ty of the subject. The manufacturing companies have de their part; the problem is now one of operation. Sndardization should come as rapidly as engineers are se of their ground, but leaving opportunity for develop-mt. The speaker declared that those who know most of tl troubles of single-phase operation are loudest in sing-ir the praises of that system.

n closing, Mr. Alexanderson said that alternating-cur-rt railway practice had been "tackled" the hardest way ft. He felt confident that all of the traction work on tl New Haven road could have been carried out by induc-tn motors. Mr. Wood confined his remarks to the power-hse end of the situation. Railroad companies do not want ecially to build power houses. The West Jersey power hse has a load factor of 16 per cent, whereas the Chi-co central-station system, with its diversity of output, has aad factor of 45 per cent. Mr. Wood spoke favorably o railroads buying their electrical energy where it could bobtained as cheaply and reliably as in Chicago.

Mr. Murray replied to the criticism that some vital points we omitted from his paper by saying that because of the med steam and electric operation on the New Haven road, a further from the fact that both single-phase and direct-crent are used, the figures called for are unavailable. It isot fair, he said, to point out the receiverships of cer-ta single-phase interurban railroads, whereas no comment was made on the fact that other single-phase interurban systems are in satisfactory operation. The management of the New Haven Railroad, after trying the single-phase system, is willing to pledge $12,000,000 for extensions. As far as the case can be analyzed, the economies of single-phase operation will cover the interest on investment for electrification. Mr. Murray does not want to be understood as deprecating use of the storage battery. In many cases it should be installed. He pointed out that the direct-current system is thirty years old and the single-phase six years. He asked that the latter be given time to "make good." He also spoke of the economy of catenary overhead construction in freight terminal yards.

COMBINED WIRE AND WIRELESS TRANSMISSION.

In a paper by Major George D. Squier, U. S. Signal Corps, entitled "Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires," a description was given of experiments relating to the combination of the present engineering practice of wire telephony and telegraphy with the engineering practice of wireless telephony and telegraphy. It has been found possible to superimpose upon the ordinary telephonic wire circuits now commercially used electric waves of ultra-sound frequencies, without producing any harmful effects upon the operation of existing telephone service. The experiments described were conducted between the small research laboratory at the Bureau of Standards and a small construction laboratory of the Signal Corps in Washington, separated by a distance of about 7 miles. Each of the laboratories is supplied with a wireless telephonic and telegraphic installation with suitable antennas. In addition, the laboratories are connected by a standard telephone line, which was employed in the experiments described.

Use was made of a special form of inductor alternator designed for 100,000 cycles per second and for an output of 2 kw. The alternator is provided with 600 armature slots cut in the radial face of the stator, and is wound with quadruple silk-covered copper wire 0.016 in. in diameter. The rotating inductor has 300 teeth on each side of its periphery spaced 1/8 in. between centers. The rotative speed is 20,000 revolutions per minute, and since the rotor has a diameter of 1 ft. the peripheral speed is 700 miles per hour. The machine develops about 150 volts with the armature coils connected in series. The machine is intended to be used with a condenser, the capacity reactance of which at 100,000 cycles balances the armature inductive reactance, which is 5.4 ohms.

The first experiments performed over the telephone line between the two laboratories were directed to the inquiry as to whether or not it is possible to superimpose upon the minute telephonic currents now employed in telephony over wires electric waves of ultra-sound frequencies, without causing prohibitive interference with the battery telephonic currents. It was found that alternating currents of frequencies ranging from 30,000 to 100,000 complete cycles per second, when coupled directly, inductively or electrostatically to local circuits from the generator, produced absolutely no perceptible physiological effect in the receivers. In actual operation various forms of detectors, such as are now used in wireless telegraphy, were introduced between the telephone receiver itself and the energizing circuit. Use was made of the regular forms of automatic interrupters, such as are now employed in wireless telegraphy, for modifying the continuous train of sustained oscillations from the generator into groups or trains the period of which falls within the limits of audition. The result was that, with the two additional and essential pieces of apparatus operatively connected between the telephone receiver and the generator, the energy of the generator was delivered to the ear in a form well suited for physiological effects.

The author described a large number of arrangements which were actually employed for carrying out the above-

mentioned method of superimposing the currents. He claimed that the experiments made indicate that either the existing wire system or additional wires for the purpose may be utilized for the efficient transmission of telephonic and telegraphic messages, the former without interfering with the existing telephone traffic on these wires. The fact that each of the circuits created by the use of superimposed high-frequency methods is both a telephonic and telegraphic circuit interchangeably makes it possible to offer to the public a new type of service which will possess many advantages for the commercial world. This type of circuit should be particularly applicable to press association service, railway service and leased-wire service of all kinds.

The author showed that the ohmic resistance of the wire can be made to play a comparatively unimportant part in the transmission of speech, and the more the phenomena are of the ether instead of those of metallic conduction the more perfectly will the modified electric waves, which are the vehicle for transmitting the speech, be delivered at the receiving point without distortion. He showed that the phenomena of resonance, which are encountered in so many different branches of physics, exhibit very striking and orderly results when applied to electric waves propagated by means of wires. The use of tuned electrical circuits at the receiving end readily admits electromagnetic waves of a certain definite frequency, and bars from entrance electromagnetic waves of other frequencies, thus permitting the possibility of utilizing a single circuit for multiplex telephony and telegraphy.

Discussion.

Dr. Frank B. Jewett, of New York, pointed out that in commercial practice complications would arise not found in Major Squier's simple circuit. He spoke of the attenuation of the energy with the very high frequencies proposed. In commercial plants a sufficient amount of energy must be delivered to give the customer audible speech in his receiver. To do this with the Squier method, using No. 8 gage wire and a circuit of 1000 miles, it would be necessary to put into the circuit from 4000 to 300,000,000 times as much energy as now required for commercial practice, if frequencies of 15,000 to 50,000 cycles be employed. Figures were given for other sizes of wire. The problem of applying the high-frequency method to existing wire plants would be an exceedingly difficult one. The speaker also referred to probable interference between different high-frequency circuits. It will be practically impossible to blot out inductive interference with any reasonable amount of tuning. Transposition would not be practicable. The question of signaling also presents a difficulty. Pupin inductance or loading coils are now used to increase the talking efficiency of telephone circuits. Every one of these coils would have to be bridged with a condenser if the high-frequency system were used. This necessity would again interfere with the practicability of the system. As a laboratory experiment the proposed method is a beautiful thing, but the speaker does not as yet see the answers to the objections which would arise in practice.

Mr. E. F. W. Alexanderson, of Schenectady, agreed that the frequencies proposed are too high to be used over wire circuits, although the mechanical means of producing such high frequencies can be supplied easily; but there might be hope for a frequency of 3000 cycles in multiplex telephony without distortion of wave shape.

Mr. S. G. McMeen, of Chicago (speaking for the author in the latter's absence), pointed out that telephone circuits are in existence to-day that are used entirely in talking and cannot be used for signaling. In considering the high frequency proposal, it must be remembered that the inductances and capacities would be of extremely small electrical dimensions. The important feature of the paper is its hope for development.

TELEPHONE TRAFFIC ENGINEERING.

Mr. F. P. Valentine, of the New England Telephone Telegraph Company, presented a paper giving a discussi of certain phases of telephone traffic engineering ba upon the result of studies made in the territory of t above-named company. The factors covered were qual of service, efficiency of labor, efficiency of operating me ods, production efficiency of central office equipment, p duction efficiency of trunk and toll circuits.

The author stated that the essential qualities of telepho service are accuracy, speed of connection and uniform in both speed and methods of handling calls.

About one-half of the paper was devoted to the prod tion efficiency of trunk and toll circuits, which was said be affected by the quality of service which it is desired produce, by the efficiency of operating labor, by the e ciency of operating methods, to a certain degree by t efficiency of central office equipment, and also by the v ume of traffic to be handled and the contract conditi under which the service is sold. In order to show t bearing of local conditions upon the engineering proble involved, a detailed study was made of a hypothetical c relating to two large offices 30 miles apart and four smal offices situated at distances of 5 miles, 8 miles, 8 miles a 20 miles from one of the large offices. It was shown tl when the traffic between the smaller stations and one the large stations is placed on a "short-haul" basis, inst of having direct circuits between the various stations, net result is a great improvement in the quality of serv and greater economy in operating and in the use of equ ment and circuits.

The author cited a case of 730 central offices, nea every one of which formerly had its own separate t position or toll board, although in the smallest offices toll operation was handled in combination with the lo The method of operation having been changed, to-day toll traffic between these 730 offices is handled at seven nine toll centers. The general effect on service has been place all short-haul traffic on an approximately for second basis; to concentrate the longer-haul high-gr circuits in large groups between centers; to concentr the long-haul toll operation at these centers, with the creased economy and efficiency of a larger and more hig developed toll force; to remove from the small offices burden of labor entailed in handling toll calls, this result in a smoother local service and, through making availa large groups of trunks on main routes, affording a m speedy, dependable long-haul toll service to all offices.

Discussion.

Mr. A. P. Allen, Chicago, spoke of the gradual determi tion of settled facts in the practice of telephone engineer He gave the results of tests showing "peaks" in long- tance traffic. Curves were given also to show the guess that has to be done on the ability of operators. It is ho in the end to get accurate data on which to base fundame plans in telephone engineering, but this stage has not b reached yet.

Mr. W. Lee Campbell, of Chicago, inquired if sc mechanical device could be introduced between subscrib and operators by which the load could be distributed eve between all the operators. Mr. Bancroft Gherardi, of N York, said that such a plan would require very exact operation of traffic and plant engineers. The question i very interesting one, but at the present time the spea fancies that the answer must be in the negative. There s some further discussion on this point, and Mr. Valen e closed by saying that telephone studies have reduced m things thought to be variable to well-known quantit This work is carried on with increasing intelligence, d there has been great advancement in the last four or e years.

TELEGRAPH TRANSMISSION.

The electrical characteristics of transmission systems of ie closed-circuit Morse type were treated mathematically a paper by Mr. Frank F. Fowle, of Chicago. In addition discussing the fundamental features of telegraph trans-ission the author discussed the value of insulating resist-ice, the requirements of transmission, the design of relay, e general improvement in terminal conditions and improve-ents introduced in line insulation.

Discussion.

Mr. Bancroft Gherardi, of New York, praised Mr. Fowle's iper as one of the few presented in this country on the ientific treatment of telegraphic problems. The speaker ferred to the design of insulators for telegraph and tele-hone lines and said that a suspended type of insulator has en proposed and is now under study. Copper-steel wire oks promising for use on important circuits. Prof. George Shepardson, of Minneapolis, also contributed briefly to ie discussion.

ORGANIZATION AND ADMINISTRATION OF A STATE UNIVERSITY.

Mr. Ralph D. Mershon, of New York, described a scheme organization and administration designed for a State niversity, which follows closely the methods employed with rge public-utility and industrial enterprises. He described ie duties of the president, the secretary, the treasurer, uni-ersity faculty, university council, alumni advisory board, ie deans and college faculties. According to the scheme roposed the alumni advisory board would be clothed with considerable amount of power, the suggestion being made iat the membership of the board be drawn from those of ie older alumni who have had wide experience and who revious to their election shall have stated their ability and illingness to attend faithfully the meetings of the board.

Discussion.

Prof. A. H. Ford, University of Iowa, thought the umni visiting committee scheme, as outlined in the paper, ot a workable plan, so far as it referred to the confirma-on of appointments. Otherwise it was admirable. The udget plan recommended in the paper was to be com-ended. Professor Ford recited some defects in the pres-nt system of administering State universities. He depre-ated political appointments on the board of trustees and out-ned a scheme of organization in which the duties of trus-es would be limited to some extent while the powers of ie president were enhanced as compared with the Mershon an. The paper neglected the social welfare of students, nd Professor Ford outlined a plan for preceptors of ormitories, with a dean of such preceptors, or two in ne case of a co-educational college.

Prof. C. F. Harding, of Purdue, regretted that the paper id not touch on the curriculum and the administration of course of studies. The plan proposed would benefit the usiness conduct of universities, but would not better the utput greatly. Owing to local conditions in different States was difficult to see how a standard organization could be dopted for State universities. The speaker favored the o-operation of alumni, but proposed an alumni advisory oard of four or five, instead of twenty.

Prof. B. B. Brackett, State College, Brookings, S. D., pposed an alumni advisory board in so far as it might be-ome a controlling factor. Why should it be considered nat alumni would have a wider view in educational mat-ers than the college authorities?

Prof. A. S. Langsdorf, Washington University, St. Louis, hought the question would arise after reading the paper. Where is the faculty? The present-day college professor is lo longer a scholarly recluse. In the scheme proposed the aculty was subordinated and the powers of the trustees, resident and alumni were exaggerated The record of lumni in athletics had not been such as to lead university authorities to intrust them with great powers. Co-ordina-tion of the work of college faculties in a university was urged.

Prof. G. D. Shepardson, University of Minnesota, ad-vocated the harmonizing of all public educational institu-tions in a State. Usually universities were chartered by the State and it was difficult to change the charters. Generally speaking, alumni organizations should have advisory pow-ers only.

Professor M. C. Beebe, University of Wisconsin, ex-plained that the two-headed arrangement, as it is called, is being tried at the University of Wisconsin, where there is not only a president, but a business manager, the idea be-ing to allow the president to give his attention entirely to pedagogical duties. This plan seemed to work well.

ELECTROLYSIS IN REINFORCED CONCRETE.

In a paper by Prof. C. Edward Magnusson, of the Univer-sity of Washington, and Mr. G. H. Smith much information was given relative to electrolytic corrosion in reinforced-concrete tests made by the authors, showing that concrete and cement, when dry, are good insulators, their specific re-sistances being of the order of 1000 megohms per cubic centimeter. The conductivity of concrete and cement de-pends upon the porosity of the material and the nature of the solution in the pores. When the pores are full with an aqueous sodium chloride solution both cement and concrete are fairly good conductors of electricity. The current in the concrete probably follows the ordinary laws of electrolysis, with the liquid in the porous spaces of the concrete mass as the conductor. An electric current of low density passing through cement or concrete does not affect the compressive strength of the material.

When the current leaves the iron through an aqueous solution, oxygen, and under some conditions chlorine, will be liberated at the iron surface. An iron oxide or a salt will be formed and these chemical changes are accompanied by an increase in volume. When iron is changed to ferric oxide the volume is increased in the ratio 1 to 2.2 and a similar increase occurs when the other compounds are formed. No attempt was made by the authors to determine the magni-ture of the stress that may be developed in this manner, but it is known that enormous forces are required to prevent chemical action by mechanical pressure. Without doubt the forces produced by chemical action are ample to break the concrete, and all the observed facts can readily be explained on this basis. The observed data give evidence that the corrosion of the iron caused by the electric current pre-cedes the crack in the concrete; that the increase in volume when the iron changes into an oxide or a salt is the direct cause of the failure of the concrete.

Discussion.

Mr. Burton McCollum, of Washington, D. C., spoke of the experience of the Bureau of Standards in similar test-ing work. In testing blocks of concrete a soft band was found near the cathode, seeming to show that there is some electrolytic effect near the cathode as well as the anode. Mr. McCollum spoke of the danger of coating reinforcing iron with insulating paint in relation to the shearing stress. It has been found that filling the pores of the concrete is not effective. Efficiency of corrosion, that is, the percentage of actual corrosion to the maximum, is very important. Most electrolytic corrosion seems to be due to the calcium sulphate in the cement. If this ingredient is left out the efficiency of corrosion is reduced to less than 1.5 per cent. One theory of electrolytic corrosion is that it is due to the migration of the SO_4 ion. Whether this may be a contribut-ing cause has not been investigated. As to the actual de-struction of structures, it is rather doubtful whether great damage is being done, although the possibility of danger must be realized. In many cases where stray railway cur-

rent has been blamed for failures it has been found that electrolysis has played only a very minor part.

Mr. E. W. Stevenson, of Wilkes-Barre, Pa., referred to a case in Allentown, Pa., where escaping railway current was accused of electrolysis afterward found to be due to the faulty construction of an isolated plant.

Prof. George A. Hoadley, of Swarthmore, Pa., asked if a metallic by-pass could be arranged to take care of the disturbance.

Prof. A. S. Langsdorf, of St. Louis, said that tests he had made several years ago confirm those of Professor Magnusson. Small currents seemed to do as much damage as large ones. However, actual danger is believed not be imminent. In one case the concrete footings of a buil ing in St. Louis have been bonded to prevent electrolys

Prof. G. D. Shepardson, of Minneapolis, said that in ma cases of alleged electrolysis the disturbance is due to pure chemical action or to local electrical currents. It is unwi to arouse too much alarm directed against escaping railw current.

Several written communications were received, and one of them Mr. Guy F. Shaffer, of New York, was earne in urging ample discussion, as the question has an impo tant bearing on the foundations of buildings in New Yor

Central Station
Management, Policies and Commercial Methods

CLEVELAND LIGHTING RATES.

The Cleveland Electric Illuminating Company has reduced its basic rate for lighting service from 12½ cents to 10 cents per kw-hour, with additional units at 5 cents as in the past. The number of kw-hours charged at the maximum rate varies somewhat according to conditions, but it is estimated that the change will effect a saving of from 20 per cent to 25 per cent to the small householder. The company is also working on a schedule for factories. Mr. Robert Lindsay, general manager, states that a reduction of rates has been under advisement for some time, but that the figures were completed only in time to apply the rate on July 1.

NEW CINCINNATI RATE SCHEDULE.

A new schedule of rates was put into effect the first of July by the Union Gas & Electric Company, of Cincinnati, by which, it is claimed, consumers will effect a saving of from 7½ per cent to 12 per cent over the present plan. The new rate is 10 cents per kw-hour as a basis, with the 10-cent rate applicable for the first thirty hours. For the second thirty hours the rate is 6 cents, and for consumption over this there is a fixed schedule of discounts on the bill ranging from 5 per cent to 50 per cent, until a minimum rate of 1½ cents per kw-hour is reached.

CENTRAL-STATION WIRING PROPOSAL TO CONTRACTORS.

The Edison Electric Illuminating Company has made a proposal to contractors, extending from July 15 for two months, whereby it agrees to give a wiring job, secured by its new installation bureau on a house already built, to any Brooklyn electrical contractor who secures for himself the wiring of a house already built and along the line of the company's mains. That is to say, every time a contractor independently secures such a job the Edison company awards him a similar job secured by its own staff. The offer is stated to be in the nature of an experiment, but if the results are satisfactory it will be continued beyond the present time limit.

ADVERTISING THE ELECTRIC FAN.

Although the unusually long-continued warm weather of this summer would seem to make it almost unnecessary to advertise the merits of the electric fan, various manufacturing and operating companies, as well as dealers in supplies, have not relaxed their vigilance in calling attentic to the merits of this alleviator of warm-weather condition Several concerns point out that it is possible to obtain r freshing sleep by the use of the electric fan in bedroom When the night temperature is 90 deg. or more in dwellir houses this is indeed a desideratum. Another point ma this summer is that by the use of the electric fan one c practically enjoy a vacation at home, and the Union Ele tric Light & Power Company, of St. Louis, shows in newspaper "ad" an attractive picture of children playir about the home in comfort in the breeze of an electric fa Of course, one important argument for the use of electr fans in offices is that it increases the working efficiency the office force, and several manufacturers and deale dwell upon this point.

REPORT OF ELECTRICAL DEPARTMENT OF SANITARY DISTRICT.

For the year ended Dec. 31, 1910, Mr. D. M. Deininge comptroller of the Sanitary District, has presented an inte esting report of the financial operations of the electric department of the Sanitary District, operating the hydro electric plant of the Chicago Drainage Canal.

It is shown that the gross income of the electrical de partment for the year was $573,550.26, of which $562 546.46 was received from sales of electrical energy fo motors and lamps. The total operating expenses are place at $251,295.77, leaving net earnings of $322,254.49. Fro this $200,755.03 was deducted as fixed charges, leaving profit for the year of $121,499.46. The fixed charges in clude taxes, $30,298.43; interest on plant and equipmen $169,962.08, and rental of leased lines, $494.52. Under th head of general and miscellaneous expense, an item o $75,682.57 is given for depreciation.

The operating expenses are divided as follows: Produ tion expense, $30,645.90; transmission expense, $52,101.3 distribution expense, $22,827.42; utilization expense, $11 896.22; commercial expense, $11,062.51; general and mi cellaneous expense, $122,762.39. The last item, which the largest of all, being nearly half of the total operatin expense, includes the item of depreciation heretofor enumerated, $28,101.38 for general office salaries, and number of other items, including $3,541.94 for insurance.

As might be expected in a hydroelectric plant so favo ably circumstanced as this one, the cost of producing ele tricity is very small, the total production expense bein $30,645.90, of which the station superintendence and labo was $21,978.40. In the transmission expense the large item, $17,279.57, is for substation labor, repairs to sul station electrical equipment costing $7,091.22. In distrib tion expense, the largest item is repairs to transformer $6,936.34, and the next largest, repairs to overhead di

ribution, amounting to \$5,274.83. In utilization expense the largest item is for consumers' installations, \$4,974.09, and the next largest is for operation and maintenance of utility equipment, amounting to \$4,307.20. Commercial expense is made up of commercial demonstration and promotion expense, the latter item amounting to the sum of \$7,851.34.

It is interesting to note that of the total sales of electrical energy, amounting to \$562,546.46, the sum of \$205,173.16 was received from municipalities and public institutions. More than half the receipts, apparently, come from private consumers. The city of Chicago paid the Sanitary District \$144,516.47 for electrical energy during the year, principally consumed for street lighting.

The balance sheet given in the report shows that the cost of plant and equipment is \$4,590,091.83. As the interest on this is carried as \$169,962.08, it must be figured at 3.7 per cent, which is very low. The total number of employees in the electrical department of the Sanitary District on Dec. 31, 1910, was 245, of whom 128 were in the operating departments, seventy-seven engaged in construction work, ten in the accounting department and eight in the engineering department, the remainder being employed in the administration, testing, meter, purchasing, storeroom and contracting departments.

ORNAMENTAL ILLUMINATION IN MINNEAPOLIS.

The accompanying illustration gives a view of a night scene on Nicollet Avenue, Minneapolis, during the recent civic celebration. To produce the decorative effect over 7000 16-cp lamps were used. Forty-eight 16-cp carbon lamps were used on each post, and the lamps in the festoons were spaced 18 in. apart. Nicollet Avenue is regularly

Night Scene at Minneapolis Civic Celebration.

lighted from tungsten posts, as shown in the illustration. The view is engraved from a night photograph having an exposure of about eighteen minutes, and it will be noted that the sky line of the building is very plain, thus indicating the great volume of light which was thrown upward. The cost of the extra decoration was \$10,000, and the power required for lighting the ten blocks covered was about 740 kw. The decorative lighting was designed and installed by the Northwest Electrical Company.

TOLEDO RATES.

The Toledo Railways & Light Company some days ago filed a demurrer to the petition of the city of Toledo which seeks to force the company to comply with the terms of an ordinance passed some time ago fixing the rate at 8 cents per kw-hour, with a discount of 1 cent if paid by the tenth of the following month. In arguing for the demurrer, Mr. Borton Smith, attorney for the company, alleged that points of illegality exist in several sections of the new ordinance, and said that the income of the company would be increased \$20,000 a month if it is enforced. Under the new ordinance everyone using energy must pay 8 cents, with a discount of 1 cent. Under a decision of the Supreme Court, he said, the company has no right to sell energy under a price fixed by the City Council. At least 70 per cent of the company's customers have been paying less than the rate fixed by the city, he said.

The ordinance forces the company to give a discount to those who pay by the tenth of the month following that for which bill is rendered, but the full price is to be charged others. Under the utilities law this is illegal, Mr. Smith said. In fact, to allow a discount is a criminal offense, punishable by imprisonment. He contended further that the city has no right to regulate the minimum charge or force the company to furnish meters. Mr. Smith argued that the matter should have been brought before the public utilities commission, whose business it is to supervise public service companies and regulate rates.

MERCANTILE BUSINESS OF A CENTRAL-STATION COMPANY.

In the electric-service industry of the present day there are many interesting side lines, so to speak, in addition to the main business of making and selling electricity and of financing the expanding enterprise. In an address delivered before the Commonwealth Edison Section of the National Electric Light Association in Chicago recently Mr. John F. Gilchrist, who is assistant to the president of the Commonwealth Edison Company and also president of the N. E. L. A., explained some of the features of the remarkably large mercantile business of the Chicago company.

The speaker first considered the stores department of the Commonwealth Edison Company, which employs eighty-six men and has charge of all the stores and supplies used by the company. Every effort is made, of course, to keep this stock as low as is consistent with safety, as it represents an investment not earning money directly. The number of merchandise invoices made out daily by this department during the last year reached an average of 276. The department also handles all the second-hand machinery of the company, which is considerable in amount, owing to the number of isolated plants supplanted by central-station service. The company's stationery is also looked after by this department.

In a measure, the purchasing department is complementary to the stores department. In this department there are thirteen employees and about 200 requisitions per day are handled. During the last year the company made purchases aggregating over \$9,000,000 from 1050 different concerns; this includes coal handled through a separate fuel department.

About 2700 tons of coal is burned daily in the generating stations of the company at the present time. The stock of coal on hand is about 214,000 tons. The maximum consumption in any one day so far reported was 3471 tons on Jan. 5 last. A little over one-half of the cost of the coal is due to the cost of carriage rather than to the cost of the fuel itself.

Turning to the merchandise-sales end of the business, Mr. Gilchrist remarked that about \$850,000 worth of goods (aside from electricity, of course) was sold last year. There are seven employees in this department, and they have relations with the large purchasers of electrical supplies in Chicago. A considerable percentage of the merchandise sales consists of lamps. The Commonwealth Edison Company will probably purchase about 3,000,000 incandescent electric lamps for itself and its customers this year.

About \$250,000 is spent annually by the company for transportation, and there is a separate transportation department. The expense of this department is due principally to traffic wagons. The company owns thirty-four electric

delivery wagons, as well as a number of electric runabouts and fifteen gasoline passenger automobiles. It has also 119 horses, but it is the policy of the company not to buy any more horses, supplanting them with automobiles as the present stock of animals gives out. No less than 103 men are employed in the transportation department.

The employment department, with its eight employees, has many and varied duties, but perhaps its chief task is to keep up a list of 600 accepted applicants who have become eligible for positions in the company's service. Other departments make requisitions on this department when additional help is needed, and it is important that the list of accepted applicants be kept up to date. All new employees must report for medical inspection within two weeks after accepting employment with the company. This is done so that the force of the company's employees, now numbering about 3200 persons, may not be exposed to contagious or infectious diseases. About forty applications for employment are received every day, and about 2000 positions were filled last year, perhaps 80 per cent of these being caused by resignation, discharge or death, the remainder being due to the growth of the company. The employment department has a number of miscellaneous duties and is the headquarters for the examining board, which considers applications for promotion or change from one department to another. This department has a great deal of correspondence, handling about 30,000 letters a year.

One of the newer departments is the information bureau, which has five employees and answers about 600 inquiries daily. This bureau is prominently located on the street floor of the headquarters building, and has proved its usefulness in many ways. In general, under the supervision of the president's office, it has charge of handling the mail and of all interdepartmental communications, with a complete messenger service. About 4000 pieces of United States mail and 3000 pieces of interdepartmental messages are handled daily by this department.

Electric Shop, the beautiful display-room and salesroom of the Commonwealth Edison Company, was established first with no idea of making a commercial profit in itself, but simply to be an adjunct in extending the company's sales of electricity, and also to be a convenient and handsomely appointed downtown meeting place for the company's customers, particularly ladies. The shop is one of the handsomest and best located in Chicago, and as the enterprise has developed, is becoming a source of profit to the company. All sorts of electrical goods are sold here to the general public, ranging from the most expensive art lamps and fixtures to the utilitarian devices of every-day life. A mail-order business is about to be started here, and it is believed that this department will be of assistance to small central-station companies in other cities, enabling their customers to obtain electricity-consuming devices in a convenient way.

MILWAUKEE HOUSE-WIRING CAMPAIGN.

Since April 1 an old-residence house-wiring campaign along rather unusual lines has been under way in Milwaukee, where the central-station company (the Milwaukee Electric Railway & Light Company), while holding itself in readiness to do wiring according to a fixed and advertised schedule, takes care to advise and even to demonstrate to prospective customers that local contractors can do the work more cheaply.

Realizing that many householders have an ungrounded fear of the excessive cost of wiring, the central-station company desired to place in the hands of its solicitors means of quickly arriving at an outside or limiting cost figure for a given job, which could be quoted to the customer and for which the electric company would itself guarantee to do the wiring, taking its payment in twel monthly instalments. The elements of this cost schedul which are set forth in a booklet distributed to "prospects are given below.

Having reassured the householder that the cost of wirin is not unreasonable even at this price, which, the solicitc explains, is itself an outside figure, intended to cover ge eral cases, the company's representative is then furthe able to enlist the interest of the customer by suggestin that some local contractor can probably make even a bette price. A contractor is summoned, and, after estimating o the job, he usually offers to do it at a figure about three quarters of the list price quoted by the electric compan This estimate is based on payment for the work in twelv monthly payments, but if the contractor prefers—and h usually does—the company offers to hand him cash for th price of the job minus 10 per cent—later reimbursing itsel by collecting the amount in twelve monthly payments fro the customer.

As the result of this method of soliciting house-wirin contracts, the salesman is able to furnish quickly an est mate on the limiting cost of the work. This acknowledge limit reassures the customer that he will not be subjecte to unexpected extra charges, whether the company or th contractor does the work. The customer is also pleased b the attitude of the company in helping him to have th work done more cheaply than at its own price. The con tractor is pleased and his attitude kept friendly to th company by having business turned over to him, withou cost of soliciting, which has been met by the compan The central station avoids the trouble of conducting wiring business and enjoys the good will of both custome and contractor by this policy. The getting of houses wire by contractors has throughout been the ultimate purpos of the company, and in this it has been entirely successfu the work in the case of the 200 houses thus far connecte being in every instance done by contractors, in competitio with the company's figures.

The time-payment plan offered by the Milwaukee Elec tric Railway & Light Company is tendered only to th owners of completed but unwired residences on the com pany's lines, who are permitted to pay the cost of the in stallation in twelve monthly instalments, due with th monthly bills for electric service, which the customer con tracts to use for one year. In case of cash payment of th entire amount the customer gets a discount of 5 per cen

The following cost figures per outlet have been taken a liberal estimates of the cost of doing wiring, the effor being made, as already explained, to safeguard the compan in case it is required to do the work, but preferably t deflect the business into the regular channels. This wirin schedule also differs from those in which the cost per ou let diminishes with the number of outlets, as it has bee assumed by the Milwaukee officials that after getting th

HOUSE-WIRING COST SCHEDULE.

Wiring	Base Charge.	Outlet Charg Per Outlet
Single flooring	$4.00	$3.00
Double flooring	4.00	4.00
Hardwood flooring	4.00	4.00

Switches	
Push-button switches, each	$1.
Push-button three-way switches, per set of two switches	2.
Rotary switches, each	1.
Rotary three-way switches, per set of two switches	2.
Snap switches, each	[illegible]
Snap switches, three-way, per set of two switches	1.5
Bryant flush plate receptacles	1.
Chapman flush plate receptacles	1.
Hubbel baseboard receptacles	1.
Drop cord with key socket	.7
Drop cord with chain pull socket	1.0

tools and men on the job the cost of installing the fiftiet outlet is not likely to be less than the twenty-fifth or th tenth. To cover the above-mentioned "starting" cost

'wever, a base charge of $4 per installation is added to fe fixed cost per outlet, but in return for this extra $4 te customer is entitled to have installed, without cost, tra outlets for heating appliances in kitchen and dining-om. The cost of wiring for different classes of building construction, as given in the company's booklet, is printed the preceding page.

The booklet also contains illustrations and prices of tpes of fixtures offered by the company in connection with i house-wiring campaign, together with its rules for the rnewal and sale of lamps.

From four to eight salesmen have been continuously engged in the Milwaukee house-wiring campaign under the gneral direction of Mr. C. N. Duffy, comptroller of the Mlwaukee Railway & Light Company, who is also general sles manager of the electric-lighting department. In ingurating the campaign, the city was divided into sec-ns and a house-to-house canvass was made.

Wiring and Illumination

ILLUMINATION OF THE BRONX OFFICE OF NEW YORK EDISON COMPANY.

order to secure a better distribution of light over the font of the building of the Bronx office of the New York Edison Company, a scheme of cornice lighting has been istalled. Two hundred 8-cp frosted, carbon-filament lmps are extended from the cornice at an angle, throwig a soft light over the entire front of the building. One hundred of these lamps are run across the first-fr cornice and 100 across the roof cornice. The lamps at supported by iron braces on the cornices, extending 2 in., and bringing the lamps to a slight angle, thus pro-

Bronx Office of the New York Edison Company.

cing the distribution of light. The brackets are so aranged that they can be withdrawn or extended 4 in. o 5 in. further, bringing the lamps to any angle desired. Te installation was made by Evans & Kaestner, electrical ctractors.

SPECIAL LIGHTING AS ARCHITECTURAL FEATURE OF A BUSINESS BUILDING.

The new La Verne Building, in that part of Michigan Boulevard, Chicago, known as "Automobile Row," was designed with special respect to the use of elaborate electric

Tungsten Lighting on the La Verne Building, Chicago.

lighting effects in connection with its architectural ornamentation. As the result of the 10,000 watts total rating in tungsten lamps on its 290-ft. glazed terra-cotta front, this building probably presents the most striking after-dark appearance of any on the boulevard, which is thronged nightly with passing automobiles. Of further interest is the fact that this elaborate lighting is maintained by the owners as part of the operating expense of the building, and is operated quite independently of the tenants, who are principally automobile sales representatives. The cost of the special lighting, from dusk to 11 p. m., is said to be only $800 a year, which is wholly disproportionate to the striking publicity effects gained by this small expenditure.

The La Verne Building, when completed, will have a 290-ft. front, containing twelve 24-ft. storerooms on the ground floor with an equal number of second-story glass-fronted display rooms. The entire front of the building is of glazed white terra cotta.

Marking the division walls between each pair of store fronts are terra-cotta standards on which sit massive bronze standards, each surmounted by four 40-watt tungsten lamps inclosed in separate 12-in. frosted balls. Beneath the cornice, 30 ft. above the pavement, is an inverted trough containing 290 25-watt clear tungsten lamps, spaced 1 ft. apart. These lamps are protected from the weather by the overhang of the cornice, which also serves as a reflector to direct most of the light downward. On bronze bracket pieces, at 12-ft. intervals along the top of the cornice, are mounted 40-watt lamps inclosed in 14-in. frosted globes.

The storerooms are illuminated by an arrangement of beam lighting, in which the 25-watt lamps in reflectors, placed at 1-ft. intervals behind the ceiling beams, project all light downward and onto the objects in the room, the units themselves being invisible from the front. Within the storerooms, as outside on the street surface, a very high intensity of illumination is thus obtained.

The electric-lighting service of the La Verne Building is distributed from a switchboard in the basement and from cut-out cabinets on the first floor near the center of the building. Conductor sizes have been selected so as to give less than 1 volt difference in voltage, due to drop, at the numerous outlets of the installation. Mr. A. S. Alschuler was architect of the building, the lighting plans of which were prepared by Mr. M. C. Hartman.

ORNAMENTAL STREET LIGHTING IN KOKOMO, IND.

By O. M. Booher.

Kokomo, with a population of over 17,000 people, is a typical hustling manufacturing center of northern Indiana, whose merchants appreciate the commercial advantage derived from an ornamental and efficient street-lighting system.

Fig. 1—Kokomo Standard.

They at once see that such improvements reflect credit upon their city, please the people and indicate very decidedly their city's prosperous condition and progressive spirit.

The Kokomo, Marion & Western Traction Company, which operates a central station in Kokomo and serves the people with electrical energy, was quick to grasp the situation enhanced by the public desire for better street illumination and immediately directed the efforts of the "new-business" department to making a special study of the various systems of modern street illumination and to selecting fixtures which should secure to the fullest measure possible modern ideas both in construction and in the matter of artistic effect.

The solicitors of the company called on the most important merchant of each block and outlined the benefits to be derived from a comprehensive scheme of ornamental lighting. This merchant was asked to serve as trustee of his respective block and to call upon his neighbors for their support. With very few exceptions each merchant asked to serve as trustee willingly accepted and did all he could to forward the movement. In this manner a co-operative force was organized and put in the field to secure the names of the remaining merchants benefited by the improvement. The following method was employed in financing the installation.

The municipal authorities were asked to prepare an ordinance embodying the city's agreement to pay for maintenance and current costs for a period of five years, provided the merchants were willing to pay all installation costs. The ordinance passed the Common Council by a unanimous vote.

The city was asked to pay maintenance and energy costs because otherwise those who might not be directly benefited by the improvement would sooner or later withdraw from the list, thus creating a deficit in the central station's monthly revenue.

The standard selected by the Kokomo, Marion & Western Traction Company is shown in Fig. 1. This standard, which is made by the Adams-Bagnall Electric Company, is of cast and pressed steel and represents an interesting development in ornamental street-lighting specialties. Each standard supports one 100-watt and four 60-watt tungsten lamps inclosed within special diffusing globes of 16 in. and 12 in. diameters respectively. The standards are placed on both sides of the street in a parallel position and at intervals of 85 ft. Connections are made by means of a steel-taped lead cable containing three No. 10 double insulated copper wires which is placed in the gutter a few inches beneath the pavement. A pair of switches is provided for controlling each half block, these being placed at the alley intersections and operated by the night patrolman. The three-wire arrangement permits the large lamps to burn entirely independent of the smaller lamps. All lamps burn from dusk until 11 o'clock; the 100-watt lamps burn all night.

The monthly revenue per lamp, including maintenance, realized by the central station is as follows:

Four eleven o'clock 60-watt lamps	$2.[illegible]
One all-night 100-watt lamp	1.[illegible]
Total monthly revenue per post	$4.[illegible]

The price charged the merchant to cover the installation costs was $1.15 per front foot.

Forty-two of these standards have already been installed. The merchants are exceptionally well pleased with the pedestal scheme of lighting, the property owners feel that it is a good investment, and evidence of the satisfaction is indicated by a further contract for three or four additional squares. It is hoped in the near future to light Kokomo's entire business section in the same effective manner.

Fig. 2—Day View of Main Street.

Fig. 3—Night View of Sycamore Street.

LETTERS TO THE EDITOR.

Double-Wound Single-Phase Motor.

To the Editor of Electrical World:

SIR:—In your issue of June 1 in a report of the papers presented at the N. E. L. A., an abstract is given of a description of a commutator-type, single-phase motor, using a double-wound rotor, with a magnetic separator between the squirrel-cage and commutated winding. This type of motor has been in successful use since 1905 in motors of 2 hp and smaller. Application for a patent on this device was filed by the writer Nov. 17, 1905, and the patent (No. 848,719) was issued April 2, 1907. A motor using this device was described in the *Electrical World* of July 7, 1906, and in the issue dated July 13, 1907, a more complete description was given of the same motor.

This device suppresses sparking and relieves the commutator, especially at running speed, by shifting part of the load to the squirrel-cage winding. It is applicable to any commutator-type. alternating-current motor, either single or polyphase.

St. Louis, Mo. EDW. BRETCH,
Advance Electric Company.

Underground Distribution in a Small Town.

To the Editor of Electrical World:

SIR:—I note in your issue of July 1 that there seems to be an increasing interest in underground cable work in small communities where the esthetic sense of the public does not desire poles. We have been interested in this subject since we bought up our local plant in 1902, and in a village of 1900 inhabitants we have 15 miles of duct and no poles whatever. We have developed a very reasonable type of construction for this method of distribution and we should be glad to give any one the benefit of our experience in this line. We can doubtless save them some money, as we have learned much that one cannot find in books.

Incidentally we may say that the chief source of satisfaction from the underground construction, aside from the elimination of poles, lies in the fact that we have no maintenance account. Since we learned how to install cable cheaply we have had no repairs, and, so far as it is possible to determine, cable laid eight years ago is in perfect condition to-day. We should be glad to have any one contemplating such an installation call on us at any time. There is so much to say about this matter that one cannot write about it without interfering with his business, but for downright satisfaction in snowstorms, thunderstorms or any other disturbances that might cause interruption to service there is nothing like underground distribution.

HENRY BURDEN,
President Cazenovia Electric Company.
Cazenovia, N. Y.

Nomenclature of Instrument Transformers.

To the Editor of Electrical World:

SIR:—In your issue of June 1, page 1446, it is stated in reference to instrument transformers that while the terms "current transformer" and "potential transformer" "would be understood by operating men, they are not correct. 'Series' and 'shunt' are preferable to 'current' and 'potential.'" In this connection it may be of interest to note that the contrary view is apparently held by some other authorities. In the Meter Code prepared by the Electrical Testing Laboratories for the joint use of the Association of Edison Illuminating Companies and the National Electric Light Association on pages 53 to 59 the term "current transformer" and "voltage transformer" are used to the exclusion of the terms "shunt" and "series." The term "shunt transformer" does not appear in the Code, and "series transformer" only in the index in the way of a cross reference to "current transformers." In the July, 1909, *Proceedings* of the American Institute of Electrical Engineers, page 981, in a paper by Mr. L. T. Robinson, of the standardizing laboratory of the General Electric Company, the terms "current" and "potential" transformers are used and no mention whatever is made of "series" or "shunt" transformers. In reprint No. 116 of the Bureau of Standards the term "series transformer" is used in the text, but the general heading on page 23 is "current transformers." The adjective "shunt" does not appear, "potential" being used exclusively. It may here be stated that if one uses the adjective "potential" he is logically committed to use "current" also, just as he who uses the adjective "shunt" to be consistent should use "series" also. In later instrument transformer *Bulletins* (reprints Nos. 129 and 130) of the bureau, the adjectives "series" and "shunt" do not appear, "current" and "potential" being used exclusively.

I think from the foregoing that the Bureau of Standards, the Electrical Testing Laboratories, the meter committees of the Edison and the National Electric Light associations, and the standardizing laboratory of the General Electric Company may all be said to prefer the terms "current" and "potential" (or "voltage") transformer to "series" and "shunt" transformer, and that their views have weight from the viewpoint of both the engineer and the physicist. The writer believes the terms "series" and "shunt" as applied to instrument transformers are not in general use as much at present as they were ten years ago and that they are being abandoned in favor of "current" and "potential" (or "voltage"). This would seem to be the case with the Westinghouse company, for in its 1902 catalog (No. 300, pages 109 and 172) the adjectives "series" and "shunt" are used in reference to instrument transformers, while in its 1910 catalog (No. 3001, sec. 731) "current" and "voltage" are used exclusively.

The General Electric Company as far back at least as 1901 was using "potential" and "current" in preference to "shunt" and "series," and the same is true to-day. After some years' experience in the meter work of a light and power company and the testing and care of instrument transformers, both out on the line and in general power-house and substation use, the writer personally prefers the terms "current" and "voltage." It seems to me, from the viewpoint of precise English, perhaps there is little choice between "series" and "current" and "shunt" and "voltage," as applied to instrument transformers, but as expressive and apt terms for every-day use in making practical electrical measurements, or in the literature of that subject, "current" and "voltage" are preferable for use in that connection.

Toledo, Ohio. JOHN GILMARTIN.

[Commercial dicta or personal preference scarcely furnish authority for changing technical nomenclature from a more correct to a less correct form. Lack of regard for this consideration is what fosters the spread of "engineering English." The qualifying words "series" and "shunt" describe properly the types of transformers used with instruments. The words "current" and "potential," or "voltage," are objective in their significance and therefore are secondary qualifications. Moreover, the so-called potential transformer is a "potential" transformer in that it sets the ratio of the primary and secondary voltages; it is likewise a "current" transformer in that it sets the ratio of currents. The so-called constant-current transformer is a "current" transformer in setting the ratio of currents; it is likewise

a "potential" transformer in varying the ratio of the primary and secondary voltages. Thus all transformers are equally as much "voltage" transformers as "current" transformers, while specifically some instrument transformers are connected for "series" service and some for "shunt service. Hence the desirability of employing the term "series" and "shunt" in the designation of instrument trans formers.—Ed.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Direct Current Armature Windings.—H. C. Walter.—A discussion, with the aid of diagrams, of the "lap" and "wave" forms of closed-coil drum windings used on direct-current armatures. These forms cover practically all of the important windings for modern large and moderate-sized direct-current machines.—*Elec. Jour.*, July.

Series Transformer Characteristics.—Harold W. Brown.—An article introductory to a later discussion of various connections of series transformers in three-phase, three-wire and four-wire circuits. Outlines are given of the characteristics with short-circuited secondary, with resistance and reactance in the secondary circuit, with interconnected secondaries and with secondaries in series and in parallel.—*Elec. Jour.*, July.

Variable-Voltage Motor-Generator.—A note on a British patent (No. 29,726, June 22, 1911) of Crompton & Company and Mr. H. Burge relating to a method for converting constant-voltage alternating current into variable-voltage direct current. Use is made of a rotary converter driving a direct-current generator wound for the same voltage and connected in series with it and provided with a reversing field regulator, so that current can be delivered at any voltage from zero to twice that at the brushes of the converter.—Lond. *Elec. Eng'ing*, June 29.

Lamps and Lighting.

Indirect Lighting.—Justus Eck.—In order to controvert the view that indirect lighting gives an illumination that fails to produce proper light and shade effects, the author reports the result of measurements taken in a room illuminated by an inverted-arc lamp. The tests showed a contrast in illumination values practically the same by artificial light as by daylight.—Lond. *Electrician*, June 23. In a communication from Mr. Hayden Harrison attention is called to the fact that "inverted-arc lighting can hardly be described as indirect lighting" in that the illumination is not derived from all directions, and inasmuch as the illumination of the ceiling is twenty times that of the floor.—Lond. *Electrician*, June 30.

Coronation Illumination.—Large quantities of special fittings, wiring material and devices were required for the illumination during the celebration of the coronation of the King and Queen of England. Details of the lighting equipments are given in Lond. *Elec. Eng'ing*, June 29, and Lond. *Elec. Times*, June 29.

Wires, Wiring and Conduits.

Three-Wire Direct-Current Service Connections.—W. A. Vignoles.—An illustrated article giving cost data relating to service connections in three-wire direct-current underground systems. Particulars are given of connection boxes that have been used with much satisfaction at Grimsby, where the main leads are triple-concentric cables, the neutral being on the outside and the negative at the core. The article is of interest to central-station engineers in showing the methods that have proved satisfactory in installing underground circuits, although the methods employed are not wholly in accord with American practice. Fig. 1 shows a form of junction box for street-lighting service designed for use where the chief requisite was small cost. The taps are made to only the outer and middle leads of a triple-concentric cable—balance of load being obtained at other locations—so that it was necessary to cut only th outer conductor, the middle conductor being simply bared t receive the connection; the inner conductor was nc touched. The current required for each service connectio being small, sufficient contact is made by the copper stri "nipped" up on to the middle conductor with a specia Prescott fitting without damaging the paper insulation ui

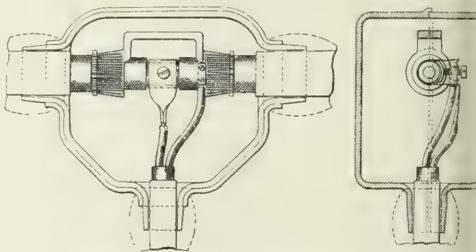


Fig. 1—Box for Positive Service from Triple-Concentric Cable.

derneath. The joints onto the outer fitting are made b binding the wires to the fitting and sweating; these join have to carry the full current flowing along the main, an hence they must be well made. The box itself is of ca lead, which enables the two halves of the box to be seale by soldering; this is much safer than any joint that can b made between the lid and the box where cast iron is use Use is made of twin service cable connected directly to th fittings on the distributor, doing away with the fittings c the service cable. This box, with fittings, costs $1.32. has been found by experiment that from 30 amp to 50 an can be taken through this joint without heating, so that the future this box will be used for all services from th positive side of the three-wire system for not more tha 30 amp. The box shown in Fig. 2 has been designed fo

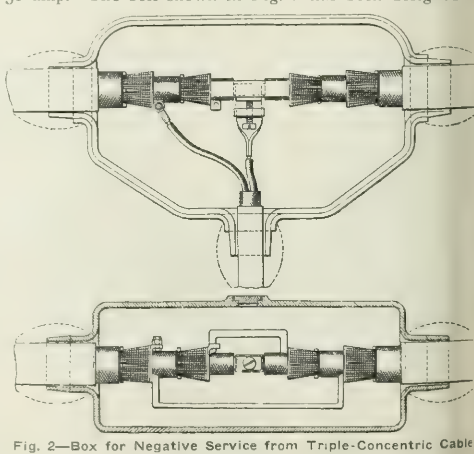


Fig. 2—Box for Negative Service from Triple-Concentric Cable

connections between the core and outer lead: the servi cable would be of the twin type and the connections wou have to carry at least 20 amp. The cost of this box

[ab]out $1.56. Fig. 3 shows a box used where the main leads [ar]e brought out separately rather than concentrically. The [b]ox is considerably smaller than one for a triple concentric [ca]ble. When used with concentric service wires the cost is [ab]out $1.74; where twin service wires are used the cost is [re]duced to $1.32 because no fittings are required for the [en]ds of the service cable. The author stated that it is [ch]eaper to use twin service cable in most cases, although

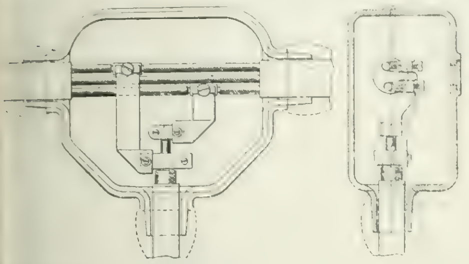


Fig. 3—Box for Concentric Service from Three-Core Leeds.

[it] costs about 10 per cent more than concentric, there being [th]e saving of about 18 cents in the fittings in the fuse box, [w]hile labor in jointing is also less. The service wires would [ha]ve to be of considerable length before the saving would [b]e neutralized by the extra cost of cable, as this in the most [us]ual cases would be only about 2 cents per yard.—Lond. *[Ele]ctrician*, June 23.

Generation, Transmission and Distribution.

Brighton Generating Station.—An illustrated article de[v]oted to the Southwick steam-turbine generating station [o]f the Brighton Corporation. Details are given of a 3500-[k]w turbo-generator, the turbine of which is of the "two-[cy]linder" Parsons type, for which high efficiency is claimed. [T]he specific steam consumption at a load of 3550 kw was [1]5 lb. per kw-hour with inlet pressure of 200 lb. per [sq]uare inch and temperature of 523 deg. Fahr., and outlet [v]acuum of 28.46 in. mercury column.—Lond. *Electrician*, [J]une 23.

Electricity in Mining.—James Miller.—An abstract of [a] paper read before the Rugby Engineering Society. After [ou]tlining the conditions which render it desirable for a [co]al-mining company to install its own generating plant [ra]ther than to buy electrical energy from a transmission [co]mpany, the author describes the electrical systems now in [u]se. The electrical side of the generating plant is, almost [w]ithout exception, three-phase. The generating voltage [v]aries between about 3300 and 3400, according to the re[q]uirements. Where the amount of energy to be trans[m]itted is comparatively small and the distances not very [g]reat, it is usually found most economical to generate at [ab]out 500 volts, as the cost of transmission would be con[si]derably less for the low voltage than for the high. Again, [th]is saves transforming down for motors working at the [co]al face, where high voltage cannot be used. If the amount [o]f energy to be transmitted is large, then high-tension [tr]ansmission is nearly always adopted. With the introduc[ti]on of electricity pumping in mines has undergone a [ra]dical change. The type of pump most commonly in use [fo]r underground work is the reciprocating pump, generally [o]f the three-piston or four-piston type. This type of pump [c]an be made in a very compact form, and the torque on the [m]otor is practically constant, as is also the flow of water. [T]he motor generally used with this form of pump is the [sq]uirrel-cage type, as it can easily be arranged that the [m]otor starts on light load only, a by-pass valve being pro[vi]ded on the pump. This pump is generally placed along [w]ith the driving motor on a common-base plate, and it has [se]veral distinct advantages over its rival, the reciprocating [pu]mp, namely, the space and cost are less and no heavy foundations are necessary. On the other hand, where the head is very large it may be necessary to do the pumping in several stages, thus increasing the initial cost, and the turbine pump is efficient at only the particular head for which it was designed. At the Cowie Colliery, Stirlingshire, turbine pumps have recently been installed to deliver 1000 gal. per minute against a head of 1020 ft. The pumps are arranged in three stages. The bottom stage consists of a multi-stage pump driven by a direct-current motor running at 1100 r.p.m. and capable of pumping 600 gal. per minute against a head of 234 ft. and taking 80 hp. The middle stage consists of a pump capable of pumping 740 gal. per minute against a head of 354 ft., when driven by a motor running at 1000 r.p.m. and taking 86 hp. The top-lift pump runs at 900 r.p.m. and discharges 900 gal. per minute against a head of 432 ft. and takes 236 hp. This means that the power absorbed is about 400 hp. The total cost of the plant was about $5,000, exclusive of the cost of the pipes. When the cost of the generating plant was added to this there would be a saving of probably $15,000 over a steam-engine installation and there would be a considerable saving in the pipes, as a much higher velocity would be used, hence much smaller pipes. The cutting of coal by machinery has been in operation for the last forty years, but until a comparatively recent date it was carried out on only a very small scale. At first only direct current was used for driving coal-cutters, as it was essential for the older form of coal-cutter that the motor should be able to start up under load in case the machine should be shut down under load; but at the present time there are coal-cutters which are driven by squirrel-cage induction motors, and induction motors with wound rotors are also extensively used with great success. The author stated that the judicious use of properly selected coal-cutting machinery makes possible the profitable working of the very thin seams which could not possibly show a profit when worked by hand. For the haulage of the coal from the inner workings to the pit bottom, use is made of three types of equipments, namely, the main rope haulage, the main and tail haulage and the endless haulage. As showing the economy which can be effected by the installation of electric-haulage equipment underground rather than a surface haulage system the author gave the following data: The length of the road is 1500 ft., the haulage is of the endless type with a rope speed of 1⅛ miles per hour, and the power absorbed is about 33 hp. The total output is 300 tons per day, and the cost of working it is found to be 0.78 cent per ton. Originally this road was worked by a steam-haulage gear on the surface, and the working cost was found to be 3.54 cents per ton. This shows a clear gain of 2.76 cents per ton, which with this output means a saving of about $1,500 per annum. Electric locomotives are used to some considerable extent on the Continent for underground work, but there are very few in operation in England, probably because of the stringent mine regulations existing. They are only suitable for use in roads exceeding 6 ft. in height, and, of course, can only be used in roads which are ventilated with fresh air—that is, for roads near the downcast shaft—on account of the considerable amount of sparking at the collector.—Lond. *Electrician*, June 16.

Traction.

Leeds-Bradford Railless Trolley Traction.—The official opening of the Leeds and Bradford railless trolley routes took place on June 20, the event being celebrated by a luncheon served at the Leeds Town Hall to about 200 guests. The cars employed are constructed to hold twenty-eight passengers and are driven by two 20-hp motors. They run smoothly on wheels with solid rubber tires. If necessary they can be steered to the extreme edge of the road.—Lond. *Electrician*, June 23. Illustrated articles giving details relating to the cars and overhead supply system appear in Lond. *Elec. Eng'ing*, June 29, and Lond. *Electrician*, June 30.

Gasoline-Electric Omnibus.—A fully illustrated article giving details of a gasoline-electric omnibus placed in public service in London. The vehicle carries a four-cylinder engine spring-connected to a generator arranged to operate at speeds of from 350 r.p.m. to 1400 r.p.m. The generator supplies energy at an emf of from 0 volt to 400 volts to a series-wound motor coupled through a universal joint to the propeller shaft which drives the back axle through a worm and worm-wheel and differential mechanism. On level roads and ordinary gradients the whole of the control is effected by a gas-throttle pedal operated by the driver's foot. On steep gradients shunt resistance is employed to allow of increased engine speeds.—Lond. *Elec. Review,* June 23.

Installations, Systems and Appliances.

Electricity in Newspaper Plant.—L. B. Breed.—An illustrated article devoted to the electrical equipment and operating characteristics of the newspaper printing plant of the Pittsburgh *Press.* The equipment includes seventy-four 110-volt, direct-current motors, aggregating in rating 435 hp. The matrix driers are heated electrically, the temperature being maintained automatically between 350 deg. and 380 deg. Fahr. There are four driers, each of which consumes between 1.10 kw and 13.5 kw. In a separate article by Frank Thornton, Jr., data are given showing that the total amount of energy required for a period of seven days to produce 270 matrices for the various editions of the paper, including one Sunday morning edition, was 1050 kw-hours.—*Elec. Jour.,* July.

Domestic Uses of Electricity.—A. Hugh Seabrook.—In an article on encouraging the use of electricity for domestic purposes, other than lighting, the author considers briefly the bearing of the following on the problem: The rates for service, the business-getting department, showrooms, hiring accounts, hire, purchase, cookers and the business instinct. Examples are given of the methods followed by the author in the St. Marylebone undertaking —Lond. *Electrician,* June 23.

Electrophysics and Magnetism.

The Biological Effects of Radium.—William Allen Pusey.—An address before the Illinois State Academy of Science. Attention is called to the similarity of the radium burns to X-ray burns, the effects of the two agents upon tissues being practically identical. When the human skin is exposed for a sufficient length of time to an active radium salt a definite reaction is set up, of which the first striking feature is that it does not develop until after a relatively long period of quiescence—as a rule about two weeks. The reaction resembles sunburn, but the process may go much further, and reach a condition which is in fact an exact, sometimes exaggerated, picture of the atropic senile skin with its dilated blood vessels and senile keratoses. The author claimed that cancers can be produced by excessive X-ray or radium burns. He described the various uses to which radium, properly controlled, can be put for therapeutic purposes.—*Science,* June 30.

Electrochemistry and Batteries.

Treatment of Sulphated Storage Cells.—G. A. Perley.—When a lead storage battery is neglected sufficiently white lead sulphate forms over the surface of the plates and the storage capacity decreases accordingly. The author reports the results of a detailed study of the problem of restoring the cell to its initial condition. He states that a badly sulphated cell can be restored by charging at the normal rate in a sodium sulphate solution. It is desirable, but not necessary, to use lead dummies outside the end plates. The concentration can be varied within very wide limits, but a concentration of 200 grams of $Na_2So_4 . 10\ H_2O$ per liter is recommended. It is essential to the life of the cell that the sodium sulphate should meet the requirements as to purity which are laid down for battery acid. A very badly sulphated cell can be restored by about sixty hours' charge at normal rate. The cost of electrical ener to restore a 40-amp-hour cell should not exceed 10 cen Since sodium sulphate is not deleterious to the cell it not necessary that the sulphate solution be washed co pletely out of the pores of the plate.—*Jour. Phys. Che.,* May.

Units, Measurements and Instruments.

Mechanical Electric-Current Gage.—A brief outli of a novel device for ascertaining to a fair degree approximation the current in a conductor without s ering the latter or interfering with it in any way. T instrument is known as a "Frisy current gage." It pa takes of the nature of a pair of tongs, as shown in Fig

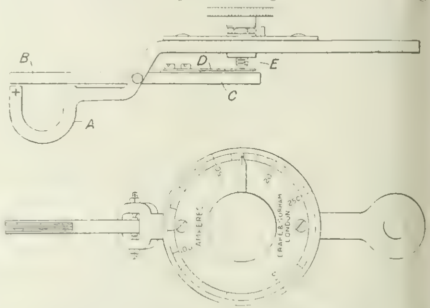


Fig. 4—Elevation and Plan of Current Gage.

A V-shaped bend of laminated iron A is fixed to a pr longation of the handle, and a lever carrying an ir armature B is pivoted between centers J carried by t latter, approaching the iron bend at one end, and carryi a flat spring D at the other. A screw E bearing agai the spring is turned by a milled head F provided with pointer, which moves over a dial. In use, the instrume is applied to the cable, fuse or other conductor, so that t latter lies anywhere in the bend, magnetizing the iron, a attracting the armature against the poles, the pointer ha ing first been set to the zero position. The screw is n slowly turned until the armature springs away from t poles, when the current strength is indicated by the positi of the pointer on the scale, which is divided from 20 250 amp. The instrument is of extremely simple a strong construction, and should prove of utility in vario applications; for instance, the currents in the several cab connected to the busbars in a feeder pillar can quick be gaged, and similarly the current in the cables in street manhole, on a switchboard, etc., can be ascertained. Lond. *Elec. Times,* June 29, Lond. *Elec. Eng.'ing,* June and Lond. *Elec. Review,* June 30.

Harmonic Analysis Diagrams.—R. Beattie.—An a alysis of a single-valued periodic junction by measureme of the ordinates when the curve is plotted to rectangul co-ordinates. For convenience of analysis according Fourier's theorem, the scale for measuring the ordinat is made non-uniform, being arranged as either reciproc sines or reciprocal cosines, so as to avoid the laborio multiplications required with uniform scales. The auth shows that, although the diagrams for the higher ha monics would usually be constructed with a relatively i creased number of ordinates to correspond to the order the harmonic sought, yet it is possible with the expenditu of a little extra labor to use a diagram of a few ordinat in such a way as to be practically equivalent to a diagra of many ordinates.—Lond. *Electrician,* June 9 and 16.

Telegraphy, Telephony and Signals.

British Conference on Telegraphy.—At a meeting of t Imperial Conference, held on June 15, Sir Joseph Wa presented the following motion dealing with the subject inter-commercial communication: "That, in view of t social and commercial advantages which would resu

tion increased facilities for intercommunication between the dependencies and Great Britain, it is desirable that all possible means be taken to secure a reduction in cable rates throughout the empire." The motion was discussed by Postmaster-General H. L. Samuel, Sir Wilfrid Laurier, Hon. A. Fisher, Hon. G. F. Pearce, Sir DeV. Graaff and Sir E. Morris, the resolution being agreed to. The following resolution by Postmaster-General Samuel was unanimously adopted: "That, in the event of considerable reductions in transatlantic cable rates not being effected in the near future, it is desirable that the laying of a State-owned cable between England and Canada be considered by a subsidiary conference." The following resolution, presented by Sir Joseph Ward, was also approved: "That the great importance of wireless telegraphy for social, commercial and defensive purposes renders it desirable that a chain of British State-owned wireless stations should be established within the empire."—Lond. *Electrician*, June 23. An editorial note commending to the above-mentioned subsidiary conference the consideration of a scheme for encouraging additional private-owned cables as alternative to a State-owned cable scheme appears in the Lond. *Elec. Review*, June 30.

Miscellaneous.

Precipitation in the Sierras.—CHARLES H. LEE.—A report of investigations of the annual precipitation in the Sierras as affected by altitude which have been conducted for the benefit of the Los Angeles aqueduct. The report strongly confirms earlier observations that the precipitation is higher the greater the altitude. It was found that the annual precipitation upon the west slope of the Sierra, between the Yuba and Tuolumne Rivers, increases at a variable rate which, expressed as an average, is 0.85 in. per 100 ft. rise between the floor of the Great Valley and the contour. Above the 5000-ft. contour it decreases approximately at the rate of 0.40 in. per 100 ft. rise to the crest of the Sierra. Precipitation upon the east slope of the Sierra decreases at differing rates depending on the elevation of the crest and depth of precipitation at the summit. The rate is constant above the 5000-ft. contour and for the sections studied is as follows: Central Pacific, 1.74 in. per 100-ft. fall; Mokelumne, 1.43 in. per 100-ft. fall; Taboose and Oak, 0.46 in. per 100-ft. fall, and Bairs, 0.34 in. per 100-ft. fall. The author stated that it is not increasing elevation alone which causes increase in precipitation, but broad, rising slopes which give an upward movement to bodies of moist air driven by prevailing winds.—*Jour. Elec. Power and Gas*, July 8.

Book Review.

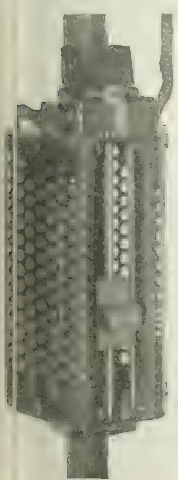
STORAGE BATTERIES. By A. E. Watson, E. E., Ph. D. Lynn, Mass.: Bubier Publishing Company. 166 pages, 63 illus. Price, $1.50.

This is an elementary practical treatise on the theory, construction and operation of storage batteries, adapted for the use of electrical artisans, storage-battery attendants and the public interested in electrical apparatus. The book, which is 17.5 cm x 13 cm x 1.3 cm, small enough for a large pocket, is thus well adapted for the storage-battery attendant's use.

New Apparatus and Appliances

SPOT-LIGHT DIMMER.

Portable incandescent spot lights (usually rated at 100 cp) have come into extensive use in theaters in recent years. Several makeshift types of resistances have been used for dimming, but all have been rather bulky and have other objectionable features. The Cutler-Hammer Manufacturing Company, of Milwaukee, has put on the market a new spot-light dimmer by means of which a wide range in brilliancy can be secured in the most convenient and accessible manner. This dimmer, unlike the "Simplicity" dimmer plate made by the same company, is mounted on and partly embraces the upright pipe standard of the lamp. It takes up a minimum amount of space, does not project bulkily and has no exposed live parts. The fiber handle travels on a guide rod in a slot in front of the frame, and the contact buttons are on the inside, mounted directly upon the units by through screws. They are, therefore, directly connected to the resistance wire. The weight of this dimmer is only a little over 5 lb. and its over-all height only 10 in. Twenty steps and an "off" point are provided.



Spot-Light Dimmer.

OIL CIRCUIT-BREAKERS.

The rapid growth in recent years of high-tension transmission systems has developed a demand in many places for apparatus capable of being installed out of doors. A logical result of this was an outdoor-type high-tension switch for controlling the circuit, and the Westinghouse Electric & Manufacturing Company has met this demand by a modification of its type GA oil circuit-breaker, which has been most successfully used for some years past.

The breaker itself is the same as the indoor type with a weatherproof protection for the operating mechanism and terminals as shown in the accompanying illustrations. The breaker is made for either hand or electrical operation, automatic or non-automatic, for use on circuits of from 44,000 volts to 110,000 volts, 300 amp capacity.

Each pole is a separate and distinct unit and a multipolar breaker consists of two or more units connected together by the operating or pull rods working the contacts and tripping mechanism. The tanks are made of heavy welded boiler-sheet iron with an insulating lining. Each tank is provided with a cast-iron cover securely bolted to a flange riveted to the upper edge of the tank upon which is mounted the operating mechanism. The tank is filled with a high-grade insulating oil, the height of which may be determined by a sight gage near the top of the tank. Where the pull rod passes through the tank it is surrounded by a stuffing box which acts as a wiper and removes the oil from the rod and prevents its being thrown over the operating mechanism—a point that will be greatly appreciated by operators.

The upper or fixed contacts are firmly secured to the lower ends of the leads, which are of the well-known condenser type of the Westinghouse company. This upper contact consists of a circular piece of brass of greater area

than the moving contact, which insures the entire surface of the latter bearing upon the stationary upper contact. With this construction the necessity of accurately centering the contacts one upon the other is eliminated. The lower or movable contacts are carried by a heavy metallic crossbar and consist of pieces of cylindrical brass rod backed by compression springs which insure alignment.

Electrically operated breakers are equiped with operating coils wound for direct current at standard voltages. They are also equipped with a tell-tale device consisting of a double-throw knife switch and colored lamps which indicate the position of the contacts. The automatic breaker may be tripped by current from standard series transformers, mounted at any convenient point, or special transformers built around the leads of the breaker. The latter method is considered standard and is usually employed when the tripping current is 100 amp or over. Another method of tripping is furnished by a series relay which operates in connection with springs to trip the breaker. This device is suspended from high-tension insulators immediately above the breaker and an insulating mechanical connection is made to the breaker. The actual power for tripping is furnished by springs which are compressed when the breaker opens, the relays being required to trip only the latch releasing the springs.

In order to adapt these breakers to outdoor use a housing is placed over the operating mechanism and rain shields over the condenser terminals. The housing over the operating mechanism consists of a cast-iron cover which is cast into and forms an integral part of the cover of the breaker. It is cast in two parts, which are securely bolted together, and hinges are provided which permit the upper portion to be raised for the purpose of inspection of the mechanism. In the electrically operated type of breaker the operating solenoid is also protected by means of a cast-iron housing, and the operating leads are brought out through brass bushings, thus permitting the use of lead cables and wiped joints. With this type of breaker there is also furnished a small knife switch mounted under the housing for controlling the incandescent lamp, which may be placed at any convenient point to indicate the position of the circuit-breaker contacts.

The condenser type terminal lends itself very readily to

Fig. 1—Three-Phase, 88,000-Volt Outdoor Oil Circuit-Breaker

weatherproof protection by means of porcelain rain shields. These shields are porcelain petticoat insulators slipped over the terminals and securely fastened thereto. This construction is clearly shown in the accompanying illustration. The shields are secured to the terminal on the inner si by a waterproof gum and on the outer side where expos to the weather by a waterproof cement. This form of co struction prevents absorption of any moisture by the tern nals and renders them entirely waterproof.

A large number of this type of outdoor breakers ha

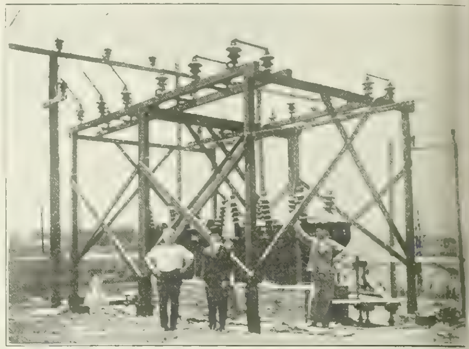


Fig. 2—Oil Circuit-Breaker on Southern Power Company's Line

been installed on the lines of the Southern Power Compan One of the particular applications this company has ma is the use of the breakers as sectionalizing switches in pa allel lines of loops which have been built to insure co tinuity of service. By this means a defective portion of line can be cut out and a good line cut in without any i terruption to the service, which, of course, would not l possible by the use of disconnecting switches alone. Son of these breakers are also used in testing the lines to loca trouble and in such use are often thrown on short-circu or dead grounds and are thus subjected to very severe ser ice, but they have withstood such tests in a manner entire satisfactory to the engineers of the operating compan On the 100,000-volt double-circuit steel-tower trunk li which feeds several of the larger towns in North Caroli the company desired some means of supplying certa customers from either one of the two lines which might might not be operating in parallel. This was accomplish by using two outdoor-type oil circuit-breakers and mecha

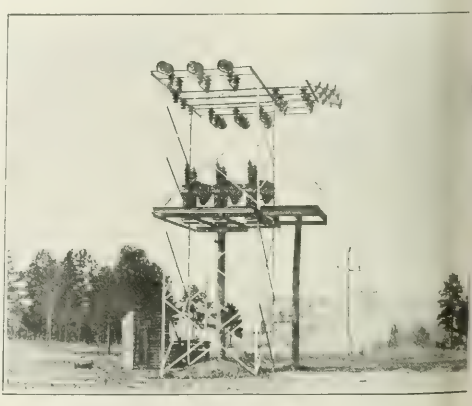


Fig. 3—Oil Circuit-Breaker Mounted on Steel Tower.

ically interlocking them so that one breaker could be clos at a time—in effect, a three-pole double-throw breake This arrangement renders it impossible for the operat to throw the two lines together.

ALTERNATING-CURRENT SWITCHBOARDS OF SMALL CAPACITY.

The increasing demand for alternating-current switch- ards of moderate capacity and price has caused the West- ghouse Electric & Manufacturing Company to extend its . to cover a wide range of switchboard applications. One type of panels is particularly adapted for use in small central stations and isolated plants operating at voltages between 1100 and 3300. This type of switchboard embodies all the essential features required for satisfactory operation. Each panel consists of a black, marine-finished marble slab, which is unaffected by oil, containing the controlling and indicating apparatus, which is mounted on a gas-pipe framework.

Fig. 1—Switchboard Panel.

The framework is composed of two 1¼-in. gas-pipe uprights, each fitted with flanges for bolting to the floor and connected at the top by a continuous wrought-iron strap of 1⅜-in. x ½-in. cross-section, which runs the full length of the switchboard framework. This construction insures perfect alignment of the panels and rigidity of structure. Pipe sockets for wall braces are supplied with the frame. The total height of the frame is 76⅜ in.

The marble panels are 48 in. high, 1½ in. thick, with ¼-in. bevel on the front edges. The width depends upon ie amount of apparatus to be mounted on the panel, and aries from 16 in. to 32 in.

The instruments furnished with this type of switchboard e Westinghouse Type K ammeters and voltmeters, utiliz- g the principle originated by Lord Kelvin. The voltmeter used either to indicate voltage of the circuit or to deter- ine the extent of a ground. This is accomplished by eans of a combined voltmeter and ground-detector outfit, nsisting essentially of plug switches and a voltage trans- ormer. This device eliminates the extra expense of a ecial ground-detector instrument. A non-automatic oil witch is recommended for the control of the generator rcuit.

Three styles of feeder panels are listed, each having the uipment as follows: 1. Non-automatic oil switches, with

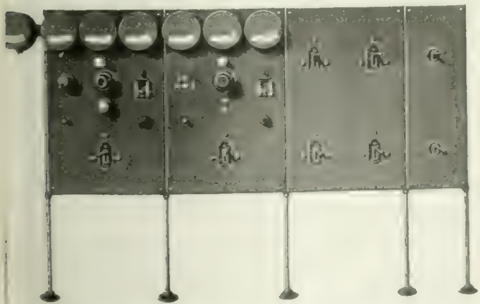


Fig. 2—Alternating-Current Switchboard.

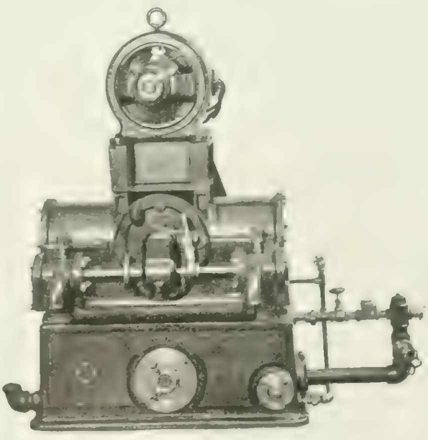
ises mounted on the panel. 2. Non-automatic oil switches, ithout fuse protection, fuses to be provided by the cus- omer. 3. Automatic oil switches, eliminating the neces- ty of fuse protection.

The panel sizes and detail parts are such that they can be packed for mule transportation, making this type of switchboard preferable for installation in places which are not readily accessible for larger panel construction.

ROTARY-VALVE VACUUM CLEANER.

The vacuum cleaner shown in the accompanying illustration is designed for residence and apartment-house use, but embodies the general principles and advantages of the larger outfits also made by the American Rotary Valve Company, 156 North Dearborn Street, Chicago. In these machines the valves used on the air cylinders are of the Moorhead rotary type, being positively driven through bevel gearing from the main shaft. By a very simple adjustment the machine can be converted from a vacuum pump into a compressor or vice versa. The cylinder is also arranged with a patented "unloading" device by means of which the delivered air pressure or vacuum may be set at a given value which is automatically maintained regardless of changes in demand on the machine. The bed of the machine serves as a combined air-washer and receiver for absorbing variations in demand of air pressure or vacuum. The base is a hollow casting filled with water to a depth of several inches. Air drawn from the vacuum-cleaner outlets enters this base and passes through the spray created by a rapidly revolving paddle wheel which washes the air, cleaning it of entrained matter before it enters the pump mechanism. To empty the base the pump is converted into a compressor, and by compressed air the contents of the basin are blown into the sewer through the drain connection provided. A special feature of this machine is the scrubbing service which can be carried on at one or more outlets while other outlets are used for dry-vacuum cleaning. After scrubbing the surface all water is quickly removed by the suction line. Another combination tool for use in removing dust from irregular surfaces where a vacuum alone is not applicable is provided with a compressed-air line, the air from which dislodges the dust, which is then removed by the suction.

The American Rotary Valve Company, maker of these



Rotary-Valve Vacuum Cleaner.

outfits, has recently acquired the plant of the Jenney Electric Manufacturing Company at Anderson, Ind., and is now equipped to manufacture its own motors and control devices used in connection with its stationary vacuum-cleaning apparatus.

Industrial and Commercial News

The Week in Trade

Changes of importance have been few in number and the waiting attitude still prevails, with trade showing minor advances or retrogressions in various parts of the country. Partial relief from the torrid weather of the previous week has improved individual sentiment with but slight reflection, however, in business affairs. Trade is dominated, apparently, by desire to defer action until the future can be gaged by actual crop returns, and as a consequence activity is on an extremely narrow scale and likely to continue so until harvest results are known. If this attitude is maintained it will probably be well into the fall before substantial improvement will be made. There seems to be no good season from the present standpoint why revival of trade should not become greatly accelerated at that time. Confidence and stability will grow with good harvests, and current reports predict, in the main, that yields will be satisfactory despite earlier impairment. Many railroad interests are expecting activity to follow the harvesting period and are said to be making plans accordingly. A feature of encouragement in the present situation is the improvement made in building operations during the month of June, the figures showing 11.5 per cent more business than in May of this year and 4.1 per cent more than in June, 1909. No decrease has taken place in the operations of the iron and steel trades, and from the large volume of inquiries and the closing of many delayed contracts for pig iron and finished steel indications point to further increase. Railroad earnings for the month of June are reported as showing a decrease of 1.5 per cent, which is not surprising in view of the relatively small freight tonnages and the increased costs of operation. Collections were irregular during the week and bank clearings were greatly improved. Business failures for the week ended July 13, as reported by *Bradstreet's*, were 196, as compared with 180 for last week, 202 for the same week in 1910, 206 in 1909, 258 in 1908 and 177 in 1907.

The Copper Market.

Such improvement as was caused by the report of the Copper Producers' Association for June disappeared early in the week, and the trade returned to its former dullness. With the majority of domestic consumers apparently well supplied for present requirements and out of the buying, the outlook for increased business from this source is exceedingly poor. Conditions abroad indicate improvement, and the present movement shows a tendency to carry larger stocks. A weaker tone in prices for electrolytic and lake copper appeared during the week in company with the quieter market, but the price shadings have been chiefly among the smaller dealers, who are reported as making prices from five to ten points under the prevailing quotation of 12¾ cents. Standard copper was very

Standard Copper	Bid.	Asked.	Settling Price.
Spot	12.10	12.30	.....
July	12.10	12.30	12.20
August	12.10	12.30	12.20
September	12.10	12.30	12.20
October	12.10	12.30	12.20

The London market, July 18, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	56 13 9	56 13 9
Standard copper, futures	57 5 0	57 5 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	[illegible]
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

dull at New York during the week, and the net advance in London was small, being 2s. 6d. on spot and futures, while offerings of electrolytic abroad at £58 10s. brought but few orders of any magnitude. The slump in the market at this time is regarded as exceedingly unfortunate, in view of the fact that prices have been in the ascendency and thought in a fair way to reach record levels. The present status of the copper trade, in view of the continuation of heavy production, seems to show need for either a further reduction in prices as a stimulation to consumption or a large increase in consumption as a result of improvement in all lines of trade throughout the country. Foreign trade for the first six months of the year shows total exports of 158,074 tons, which represents an increase of 28,850 tons over the shipments for the same period in 1910 and approaches within some 6000 tons the record shipments in the first half of 1908 of 163,871 tons. Exports for the month, including July 18 were 17,971 tons. The daily call on the Metal Exchange July 18 quoted copper as per the accompanying table.

Industrial and Commercial Notes

Personnel of Republic Railway & Light Company.—All matters attendant to the formation and operation of the Republic Railway & Light Company have been completed and the company is now established in its offices at 60 Broadway, New York City. The officers of the company are: James Parmalee president; De Forest Candee, vice-president; George A. Galliver, vice-president and treasurer; G. F. Ravenell, secretary The executive committee is composed of the following: Henry H. Wehrhane, chairman; Anson W. Burchard, Samuel McRoberts, George A. Galliver and Harrison Williams. The following compose the board of directors: J. J. Bodell, of Bodell & Company, bankers, Providence, R. I., and director American Textile Company; R. E. Breed, president American Gas & Electric Company; Anson W. Burchard, assistant to president General Electric Company; De Forest Candee, president Federal Utilities Inc.; Norman McD. Crawford, president Mahoning & Shenango Railway & Light Company; George A. Galliver, director Federal Utilities, Inc.; Myron T. Herrick, president Society of Savings, Cleveland, Ohio; Parmeley W. Herrick, director Cleveland Electric Illuminating Company; Samuel McRoberts vice-president National City Bank, of New York; James Parmelee, president Cleveland Electric Illuminating Company Thomas A. Reynolds, assistant cashier National City Bank, of New York; Henry W. Wehrhane, Hallgarten & Company bankers, and executive committee American Gas & Electric Company; Harrison Williams, American Gas & Electric Company, Federal Light & Traction Company, Federal Utilities Inc., and president Springfield Railway & Light Company, of Springfield, Mo.

Enlargement of Desert Power & Water Company.—The annual meeting of the stockholders and directors of the Desert Power & Water Company was held at the office of the corporation at Kingman, Ariz., on July 8, at which the following officers were elected for the ensuing year: F. A. Wilde, president; James H. Davidson, vice-president; F. A. Wilde, Jr. treasurer and general manager; W. A. Richardson, secretary The officers, together with W. L. Peters, of Riverside, Cal. constitute the new board of directors. Contracts will at once be let for the enlargement of the present engine and boiler rooms and the installation of an additional 1250-kw direct-connected generator and two 1000-hp boilers, with auxiliary apparatus. This will be the third addition to the plant within two years. Transmission-line extensions are also being considered. This company supplies power to the largest mines in the district as well as power and light to the city of Kingman Its policy is to insure its patrons absolutely dependable service by having in reserve an ample electrical and mechanical equipment immediately available should any cause necessitate its use. With the improvements now under way the company will have the largest and best equipped central station in Arizona

Catskill Aqueduct Contractors to Employ Electricity.—The New York Edison Company has signed contracts with the Pittsburgh Contracting Company, 3785 Broadway, New York for 4500 hp to be used for electric drills on that portion of the Catskill Aqueduct in New York City extending from University Heights to Central Park, and with Grant, Smith & Company and Locher, 25 West Forty-second street, for 3000 hp to be used for various purposes on that portion of the aqueduct extending from Central Park to Union Square. Work has just begun on both contracts.

Western Electric Business for June.—A decrease of approximately 4 per cent is shown in the sales of the Western Electric Company for the month of June, compared with 1910

Fight for Control of Westinghouse Electric & Manufacturing Company.—The annual meeting of the Westinghouse Electric Manufacturing Company will be held at the chief office of the company in East Pittsburgh on Wednesday, July 26, at 10 o'clock a. m. for the election of directors and for the transaction of other business. All of the former non-assenting stock of the company having been exchanged for assenting stock, which now constitutes the only class of the stock of the company outstanding other than the preferred stock, a resolution will be considered and acted upon that the assenting stock be hereafter denominated common stock. Further contention for control of the company is shown in a circular letter issued to stockholders by Charles J. Canda, who is a large holder of the assenting stock of the company and who was a member of the shareholders' committee which was formed to further the rehabilitation of the company about three years ago. The letter requests stockholders to send proxies to George Westinghouse for use at the meeting announced above. Mr. Canda in his letter charges that in the reorganization of the company in 1908 the personnel of the board of directors was dictated by the bankers, thus ignoring the rights of the shareholders to receive reasonable dividends. At a recent meeting of the directors a proposal by Mr. Westinghouse was voted down which asked for quarterly dividends of 1 per cent, requiring only 4 per cent out of the 13 per cent of net earnings which were made by the company on its assenting stock over and above all fixed charges and the 7 per cent dividend on the preferred stock during the last fiscal year. Mr. Canda states that the company is in excellent financial condition and has a large cash fund ($6,634,677) on deposit in the banks. During the two last fiscal years the net income of the company has aggregated $7,941,770. There are sixteen directors, of whom only four are to be elected on July 26, and he suggests that these new directors should be elected to represent the assenting shareholders. In conclusion Mr. Canda says that Mr. Westinghouse's interests are entirely with the assenting shareholders and that he is earnestly desirous of making their property valuable.

This was followed by a letter by George Westinghouse, in which the writer stated his profound conviction that the recent policy and management of the company has been ill-advised and detrimental, that the rights and just expectations of the stockholders have been disregarded, and that a change of policy and management is imperative. A rejoinder by members of the merchandise creditors' committee states that the proxies sought by Mr. Canda and Mr. Westinghouse are to be voted against the re-election of the following directors: Messrs. Charles F. Brooker, James S. Kuhn, Edwin F. Atkins and E. M. Herr. The report alleged that the desire to replace these directors is solely because they have not as yet seen fit to declare a dividend on the assenting stock, and adds that the payment of liberal dividends is not the only or best evidence of good management. The failure of the company in 1907 is attributed in part in this letter to the maintenance of high dividends, while at the same time large investments were being made in foreign manufacturing companies which resulted in heavy losses. The present board of directors, the letter says, thought it wise to take these losses into account, and owing to this financing, together with certain short-time obligations and improvements to plants, etc., to defer to a later day the resumption of dividends on this assenting stock. The letter concludes with an expression of confidence in the present board, and a statement that the interests of the assenting stockholders are being wisely served.

Robert Mather, chairman of the board of directors, replied on July 19 to the criticisms of the present administration, saying that the implications conveyed by Mr. Westinghouse are unwarranted. Mr. Mather states further that the fifteen members of the board of directors, aside from Mr. Westinghouse, own in the aggregate, either personally or through corporations whose holdings they represent, more than 58,000 shares of the company's assenting stock; that members of the board were creditors of the company at the time of the receivership, and as such had power to force a sale of the company's assets and thus absolutely to destroy the then outstanding stock and to deprive the then stockholders of their entire interest in the company. It was through their forbearance in accepting, Mr. Mather adds, through the working out of the readjustment plan, shares of assenting stock at par in payment of their claim that Mr. Westinghouse and other stockholders now have any interest in the company; and the determination that the best interests of the company require for the present postponement of dividends is as directly a financial loss to themselves as to the other stockholders.

J. G. White & Company, Ltd.—The annual report of J. G. White & Company, Ltd., of London, recently presented at the company's twelfth ordinary general meeting by its chairman, Mr. J. G. White, shows the phenomenal success of an engineering firm of American origin, though operating entirely as a British company. The English company is the direct outcome of the successful operations of J. G. White & Company, Inc., of New York, in foreign territory. Organized in 1900, the English company was equipped to undertake the largest problems in the field of consulting, designing and supervising engineering and construction as well as the operation of public-service properties and participation in financing such properties. The English company has this year declared a total dividend of 12 per cent on its preferred stock and 62 per cent on its common stock, after which the net earnings for the year have been sufficient to write off the balance of "purchase of business" account and increase the special reserve and surplus account to an amount equaling the total dividends paid. This has been done after making ample provision for contingencies and without writing up the value of securities owned. Some of these securities have increased materially in value in the year, so that even greater profits were actually made, although not realized, and, consequently, not considered as earned. The market value of the ordinary shares, par value £1, has increased from £1 6s. in 1906 to £7 4s. in 1911. The chairman in his report stated in part: "The net profit for the year amounts to £91,466 as against £64,801 for last year; the quick assets of the company, in the form of cash and loans against securities, amount to £136,331, an increase of about £18,000 over the figures shown in the preceding year. This quick-asset item is nearly double the total single-creditor item on the other side of the balance sheet. The figure for investments stands at £150,781, which is also considerably more than twice the company's total debts. This item shows an increase of approximately £28,000 over last year."

Report of Mexican Light & Power Company, Ltd.—The sixth annual report of the Mexican Light & Power Company, Ltd., shows that the business of the company during the year has exhibited satisfactory increases, thus fully warranting the extension of work on the Necaxa reservoir and other improvements authorized and commenced in 1909. The net revenue for the year 1910, after paying all expenses and fixed charges, was $1,456,612. This, together with $149,385, the balance brought forward from 1909, and $163,004 set aside from the profits of 1909 to provide for the accrued portion of the quarterly dividend paid Jan. 15, 1910, on the common stock and the accrued portion of the semi-annual dividend on the preferred stock paid May 1, 1910, makes a total credit balance of $1,176,002. Of this, the sum of $860,150 was paid to stockholders, representing a dividend of 7 per cent on the preferred stock and 4 per cent on the common. The balance carried forward to profit and loss account is $745,848, and the reserve account remains at $377,883. All branches of the business of the company are reported for the year as in excellent condition, and it is further remarked that the relations between the company and the federal, state and city officials in Mexico are most harmonious.

Gigantic Southern California Merger.—According to a newspaper dispatch, Henry E. Huntington has arranged a merger of the electric lighting and power properties of Los Angeles and adjoining sections of southern California, involving an ultimate bond issue of $50,000,000, of which $10,000,000 has already been subscribed in New York. The plan includes a hydroelectric development of several hundred thousand horsepower in Big Creek in Fresno County. Inquiry in New York of interests identified with the properties mentioned brought no confirmation of the news, though such a merger was considered probable.

Canton Electric Company's Record Earnings.—In the twelve months ended May 31 the gross earnings of the Canton Electric Company, of Canton, Ohio, were the largest in the history of the company. Total income was $294,490, and operating expenses were $134,841, leaving net earnings of $159,649. Bond interest was $53,750; after deducting this amount the balance available for dividends was $105,899. From this preferred dividends at the rate of 6 per cent were paid, amounting to $15,000, leaving a balance of $90,899 available for dividends on the common stock.

Baltimore Machine Products Company Absorbs Viaduct Electric Company.—The plant and business of the Viaduct Electric Company at Relay Station, Baltimore, Md., has been merged into the Baltimore Machine Products Company, which was recently incorporated under the laws of Maryland for this purpose. The officers of the new company are as follows: President, Senator A. P. Gorman, Jr.; vice-president, E. C. Mayo; treasurer, Conway S. Hodges; secretary, Dr. W. R. Eareckson. The Viaduct company was one of the oldest concerns manufacturing telegraphs and telephones in the country. When started, as Davis & Watts in 1871, its output was at first confined to telegraph instruments and district-messenger call boxes. A few years later the manufacture of magneto telephones was taken up, and the firm became a licensed manufacturer of the American Bell Telephone Company, continuing in this capacity until 1883. In 1884 the Viaduct Manufacturing Company was formed with A. G. Davis as president, and the plant was removed to Relay Station in the outskirts of Baltimore. The manufacture of fire alarms was next added to the list of its products, as well as switchboards, both for telephone and telegraph systems, the Postal Telegraph Cable Company for many years using a large part of the output of the Viaduct works. In 1894 the entire plant was destroyed by fire and temporary quarters were taken in Baltimore until 1896, when a new plant at Relay, with eleven new buildings and equipped with new machinery, was occupied. Owing to competitors springing up on all sides, in time a great deal of patronage was diverted to other concerns that had adopted more modern methods of doing business, and in 1907 the inevitable occurred, when at the first pinch of the panic the company was forced into the hands of a receiver and was then succeeded by the Viaduct Electric Company, which operated the plant for four years and made many improvements, both in equipment and methods of manufacture. The friends of the old company were loyal, and orders increased to such an extent that the company, having a limited capital and being burdened with a heavy load of assumed mortgages, has turned the entire plant over to the Baltimore Machine Products Company. Many more improvements are being made by the new organization, including new machinery and increased facilities for turning out its product in a modern way.

Westinghouse Equipment.—Among recent orders for railway equipment received by the Westinghouse Electric & Manufacturing Company are the following: For the Piedmont Traction Company, Charlotte, N. C., a quadruple equipment of railway motors and special non-automatic control, these motors being insulated for operation on 1500 volts; for the Oakland Traction Company, Oakland, Cal., ten equipments of type HL, non-automatic, unit-switch control; six double equipments of No. 323 railway motors with type K-10-A control, for the Springfield Traction Company, of Springfield, Mo.; for the San Francisco, Oakland & San José Railroad Company, San Francisco, Cal., twenty-five double equipments of No. 302 railway motors, type M control; five quadruple equipments of railway motors for operation on 1500 volts, with special non-automatic, unit-switch control, for the Greenville, Spartanburg & Anderson Railway Company, Charlotte, N. C.; for the Knoxville (Ill.) Electric Light & Power Company, one 150-kw, three-phase, 2300-volt, 60-cycle, 600-r.p.m. belted alternating-current generator with exciter; one 50-kw, three-phase, 2300-volt, 60-cycle, 1200-r.p.m. belted alternating-current generator with exciter and one five-panel switchboard; and for the Lena (Ill.) Electric Light & Power Company, two 75-kw, three-phase, 2300-volt, 60-cycle, 900-r.p.m. belted alternating-current generators with exciters and switchboard.

Canadian Wagner Company.—The Wagner Electric Manufacturing Company, of St. Louis, has announced the formation of the Wagner Electric Manufacturing Company, Ltd., of Canada, under a Dominion charter, with a capital stock of $50,000 fully paid. The Canadian corporation becomes the exclusive Canadian licensee under patents owned and controlled by the St. Louis company. Alfred Collyer, who for many years, as representative of Wagner interests in Canada, has been largely responsible for the volume of Wagner business there, has been appointed manager of sales of the new company. Various alternating-current apparatus in which the Wagner company specializes, including the new unity power-factor and adjustable-speed motors, have been patented in Canada, and the new Canadian Wagner company will proceed to manufacture and popularize these in Canada along the same lines as the St. Louis company does in the United States. The officers of the new company besides Mr. Collyer are: S. M. Dodd, president; W. A. Layman, vice-president and general manager; W. S. Thomas, treasurer. The previous headquarters of the Wagner Electric Manufacturing Company in the Bell Telephone Building, Montreal, become the headquarters of the new company.

Montreal Street Railway.—Although not yet announced, it is stated on good authority that the Montreal Street Railway has made arrangements with a prominent Boston financial house in accordance with which the company will secure money for needed extensions and improvements and to take up some seven or eight million dollars now tied up in various lines. The Canadian Light & Power Company, which controls the Montreal Street Railway, will commence to deliver electric power in Montreal before the end of the month from its generating plant at St. Timothée on the Beauharnois Canal. The first 7500 hp unit will commence operating at that time and another similar unit will be shortly added, while within a year the company expects to be developing over 25,000 hp. Through the purchase of the Central Light, Heat & Power Company from the Carsley estate and the control of the Montreal Railway the Canadian Light & Power Company has demands for more power than it will be able to generate for a year or more.

Bonus for Waterwheel Efficiency.—Edward B. Ellicott, electrical engineer of the Sanitary District of Chicago, certifies in a communication of recent date that "Unit No. 3" in the hydroelectric station on the Chicago Drainage Canal at Lockport, Ill., has earned a bonus of $16,320 in accordance with the bonus and penalty clause of the specifications for the waterwheels in that plant. The specifications called for a guaranteed efficiency of 80 per cent, and provided a payment or a forfeiture of $1,000 for each one-quarter of 1 per cent in excess of or less than this efficiency as shown by test. At a test at Holyoke, Mass., the guaranteed efficiency was exceeded by 4.08 per cent, and the $16,320 bonus mentioned above was ordered paid to the makers of the unit, the Wellman-Seaver Morgan Company. The contract under which this was done was dated Dec. 14, 1908, and later minimum guarantees on waterwheels have been 83 per cent.

Extensive Arc-Lighting Equipment for Chicago.—In the execution of its contract with the city of Chicago to extend the city street-lighting system, the Sanitary District of Chicago is purchasing large quantities of electrical apparatus. It has already awarded a contract to the Waterbury Company for about $80,000 worth of underground cables, and one to the Clay Product Company for multiple-duct conduits to cost $17,900. For the 10,000 new arc lamps required (see *Electrical World* of April 13, 1911, page 894) it is said that the General Electric Company and the Stave Electrical Company are very close competitors. At this writing it is proposed that a trial order of 250 lamps be placed with each company. It is said that the Stave lamps are 130-hour lamps, and that the General Electric lamps are of the ninety-hour type. Both are powerful illuminants.

Isthmian Canal Proposals.—Circular No. 640 of the Isthmian Canal Commission, Washington, D. C., contains invitations for proposals for one turbo-generator unit, 500 kw, three-phase twenty-five cycles, 2200 volts, mixed pressure, together with switchboard and auxiliaries, including fittings and valves for connections to exhaust-steam mains; also one 30-hp, 2200-volt three-phase, twenty-five-cycle, squirrel-cage induction motor, the starting panel for this motor being included in the above-mentioned switchboard equipment; 1200 feet stranded triple copper conductor and 34 cable bells. Proposals will be received until Aug. 4, 1911.

American Electric Company.—The American Electric Company, of which P. C. Burns is president, announces that it has purchased the machinery, tools, equipment and patents of the bankrupt American Electric Telephone Company, of Chicago. The new company will make a complete line of telephone apparatus, and will use the factory building of the old American Electric Telephone Company at South State Street and East Sixty-fourth Street.

Manila Electric-Light Plant in Market for Extensions.—O. M. Shuman, Manila, P. I., has leased from the government an electric-light plant which he will extend considerably, and asks us to state that he is in the market for electrical supplies for power-house, lighting and power circuits, and would like to receive catalogs and price lists from manufacturers.

Aluminum Notes and Prices.—The aluminum market is quiet, with ingots for remelting held at 21@21½ cents spot No. 1, the base for large ingots, while rods and wire are held at 31 cents and sheets at 33 cents, prices being for July 18.

Financial.

The Week in Wall Street.

Extreme dullness has been shown in the dealings on the New York Stock Exchange, and on Saturday the sales were the smallest on any Saturday this year. Total sales for the week ended July 15 were 984,800 shares as compared with 1,081,929 shares for the previous week. Operations on the bond market are still under the scale of the earlier part of the year, and the large investment demand expected in July has not materialized. There seems to be little disposition shown on the part of bankers to float new issues on the market prior to increase of public interest. Prices drifted during the week with but few changes of moment. On Monday the trading was but little better than on Saturday, and in the early trading most of the issues usually active were practically neglected. Securities of roads that are expected to participate in the benefits of the large cotton crop were strong throughout the day. Toward the close the market declined, with the lowest prices of the day in the last hour. Tuesday's market was dull until very near the close, when advances were made on nearly the entire list, led by a rise of 3 points in Interborough-Metropolitan shares as a result of news that settlement of subway matters might be expected very shortly. With the price changes came a short period of activity, maintained until the close. Incidents of the day included a decline in New York City 4½ per cent. bonds to 102½, whereas sales have been made at 104⅞ as against the issue price of 101⅞. Affairs in the stock market are as yet influenced chiefly by crop conditions. Advices from the agricultural districts in the early part of this week were favorable. The government's weekly weather report showed fair rainfall in Nebraska, Oklahoma and Kansas and lower temperatures in many crop sections where excessive heat had prevailed. Few changes of importance have taken place in the money market. Time money is held rather firmly, but demand is not heavy. Rates July 18 were: Call, 2½@2⅝ per cent.; ninety days, 2¾@3 per cent. The quotations in the tables are those at the close July 18.

NEW YORK.

	July 11.	July 18.	Shares Sold.		July 11.	July 18.	Shares Sold.
Al. Ch.	8½	8½*	100	Int. Met., pf.	50¼	55	12,500
Al. Ch., pf. ..	28*	28*		Mackay Cos.	86	87*	310
Amal. Cop. ..	69½	69⅝	19,000	Mackay Cos., pf.	73½*	74	20
Am. D. T. ..	20½	20½*	—	Man. Elev.	138*	140	—
Am. Loco. ..	41	41	135	Met. St. Ry. ..	15*	15*	—
Am. Loco., pf.	109*	108*	—	N.Y.&N.J.Tel.	139½	139	—
Am. Tel. & C.	80*	80*	—	Steel, com.	79	79⅝	158,100
Am. T. & T.	138⅝	137⅝	7,500	Steel, pfd. ...	118⅞	118½	2,850
B. R. T.	84	83	51,910	W. U. T.	81	81	10,800
Gen. Elec. ...	163	161½*	1,000	West'h. com.	76	75½	1,950
Int. Met. ..	18	19¾	5,205	West'h. pfd.	119*	119*	—

PHILADELPHIA.

	July 11.	July 18.		July 11.	July 18.
Am. Rys.	44	44*	Phila. R. T. ...	20¾	21⅛
Elec. Co. of A.	12¼*	12¼	Phila. Elec. ...	17⅛	17⅛
Elec. St. Bt'y	54⅛	54½*	Phila. Trac. ...	86¾	87
Elec. St. Bt'y., pf. .	30*	30*	Union Trac.	50	52⅛

CHICAGO.

	July 11.	July 18.		July 11.	July 18.
Chi. City Ry.	186*	186*	Chi. Tel. Co. ...	124½*	123*
Chi. Rs., Ser. 1 ...	87½*	90*	Met. El. Co.	27*	27*
Chi. Rs., Ser. 2	26	27⅞	Met. El., pfd.	74⅞*	75*
Com. Edison	136	136⅞	Nat'l Car	114*	113
Chi. Subways	3⅞	3¾	Nat'l Car, pfd. ..	118	119*

BOSTON.

	July 11.	July 18.		July 11.	July 18.
Am. T. & T.	138⅞	137⅝	Mex. Tel.	4¼	4
Cum. Tel.	158*	158*	Mex. Tel., pfd.	7*	6½
Edison E. Ill.	281¼*	282	N. E. Tel.	145	146
Gen. Elec.	163	161¼	W. T. & T.	20	20½
Mass. E. Ry.	23½	23⅛*	W. T. & T., pf.	96*	97½
Mass E. Ry., pf. ...	95	93½*			

*Last price quoted.
Shares sold for the week, July 10 to July 15.

Financial Notes.

Illinois Valley Gas & Electric Company.—The first annual report of the Illinois Valley Gas & Electric Company, of Chicago, was submitted to the stockholders on July 12. This company was organized a year ago to take over a number of electric-service and gas companies in the northeastern part of Illinois. The company has electrical generating stations in the cities and villages of Streator, Wilmington, Odell, Cornell, Grand Ridge, Henry, Lacon, Mendota and Havana, and it also has gas plants in Streator, Ottawa and Morris, with a number of electrical substations. In his report for the year ended May 31, 1911, President Samuel Insull reports that during the year the company constructed more than 77 miles of high-tension electric lines and acquired seven substations for use in connection therewith, enabling the company to distribute energy from economically operated stations. The territory now served is about 1790 square miles for electric service and a lesser area for gas service. The connected load on May 31, 1910, was the equivalent of 48,965 standard 16-cp lamps, whereas a year later the figure was 120,298 16-cp lamp equivalents. During the year the number of electric meters in use has increased from 1943 to 4265, and the number of gas meters and gas stoves in use also shows a substantial increase. Some electric-railway business is done by the properties owned by the company and the passengers carried increased from 677,964 for the year ended May 31, 1910, to 744,750 for the year ended May 31, 1911. The gross earnings for the year ended May 31, 1911, were $327,641, and the net earnings $79,415. From the latter amount $39,665 was paid for bond interest and $23,245 for preferred-stock dividends, leaving a balance of $16,503, which makes the surplus reported $66,503. Mr. Insull reports that the first year of the company's business demonstrates that there is a large amount of business offering in the territory served. Officers of the company are: President, Samuel Insull; first vice-president, Charles A. Munroe; second vice-president, John F. Gilchrist, secretary and treasurer, John H. Gulick; assistant secretary and treasurer, H. F. Addenbrooke.

Orders Sale of Hudson River Power Companies.—Decision has been handed down in the cases of the Hudson River power companies, which were financed by E. H. Gay & Company, the Boston banking house, whose failure in 1908, subsequent to the flotation of the project, was described in the *Electrical World* April 6, 1911, and referred to in the issue of June 8. The decision provides for consolidation of the eight companies involved and the sale of the consolidated companies under decrees which will be granted within a short time. In rendering its opinion the court outlined the plans of the promoters of the companies and their intention to develop gas and electric generating plants over a large territory in upper New York State and parts of Vermont, and then outlined the operation of the affiliated companies in part as follows: "For some years the plants were run under one management. Earnings of all companies were massed and used for the benefit of all. It is far from probable the equities between these several corporations could ever be known if they were sold as separate concerns. Connected and operated as one whole system, they are of great value. As single corporations some would be of little value. If separated and efforts were made to settle their rights between themselves, the litigation would be ruinous and well-nigh endless. There are also reasons growing out of the making of the mortgages, one company guaranteeing those of another, etc., which make the consolidation advisable." Most of the $10,270,000 first mortgage bonds and $5,446,600 outstanding stock of the companies is held by investors residing in New England.

United States Telephone Company.—At the recent annual meeting of the stockholders of the United States Telephone Company at Cleveland a reorganization was effected under the plan of the Morgan interests, with the election of G. R. Johnson and William F. Burdell, both of Columbus, as directors. Mr. Johnson is general manager of the company and Mr. Burdell is the vice-president of the State Savings Bank & Trust Company. These men take the place of Clarence Brown, of Toledo, who represented James A. Brailey, and Herman Stifel, of St. Louis, backer of the Continental Telephone & Telegraph Company, which was in the fight for the lines in Ohio. All the other officers and directors were re-elected. Charles A. Otis was re-elected president of the Cuyahoga Telephone Company and all the other officers also retain their places. J. B. Fay resigned as a member of the board of directors and M. C. Harvey was chosen in his place.

Chicago Elevated-Railway Stockholders Prefer Cash.—Of the 9[illegible] per cent of stockholders of the Chicago elevated railway companies who deposited their stocks under the Blair merger agreement now being worked out, it is reported that 86 per cent elected to be paid in cash rather than to receive 70 per cent of their holdings in cash and 30 per cent in preferred stock in the new company, with a bonus of 24 per cent of the new common stock. A cash payment of over $20,000,000 will be made to the owners of the old stock under the offer which has been made.

Ohio Company Defaults Bond Interest.—The Hamilton Gas & Electric Company, of Hamilton, Ohio, has defaulted on the coupons due July 1 on its $1,000,000 5 per cent bonds, not having earned the interest.

Washington, Baltimore & Annapolis Securities.—It has been announced that the new securities of the Washington, Baltimore & Annapolis Electric Railway Company, which are to be given in exchange for the present holdings of stock and bonds of the road under the reorganization plan, will be ready for distribution on July 24. The security holders will receive thir stocks and bonds from the Safe Deposit Company, of Baltimore, while other holders will be looked after by the Cleveland Trust Company, of Cleveland, Ohio. The directors at a meeting held in Cleveland last week authorized the officers of the company to have the new bonds and preferred stock listed on the stock exchanges of Baltimore, Washington and Cleveland. The larger part of these securities is held by persons outside of Baltimore. In all there are $5,000,000 of bonds, $1,460,000 of preferred stock and $3,000,000 of common stock. A matter of congratulation for the security holders, the officers and the receivers who have brought about the reorganzation plan is that the new company, since its organization on April 1, and for the period from April 1 to June 30 last, has made $30,000 clear above interest and taxes.

Monterey Railway, Light & Power Company.—The annual report of the Monterey Railway, Light & Power Company for the fiscal year ended Dec. 31 showed marked improvement in the affairs of the company. The surplus available for dividends on the common stock was equivalent to 4.25 per cent on the $4,100,000 stock outstanding, comparing favorably with the 3.25 per cent earned in the previous year. Substantial increase was made in gross, net and surplus earnings, resulting in a surplus of $174,286 at the close of the fiscal year. Considerable expense was entailed in consolidating the plants of the railway, light and power service, but the report justifies this by showing a decrease of 14 per cent in the cost of producing energy as a result thereof. During the year the company made a reduction of 10 per cent in its lighting rates, but the revenue for this class of service, however, was larger than in the previous year. A new-business campaign, aimed particularly at power users, is being carried on this year.

Colorado Telephone Merger.—The Tri-State Telephone Company has been merged with the Colorado Telephone Company. The former company operates in southern New Mexico and a small part of Arizona and is capitalized at $1,000,000. "The Colorado company will not issue additional stock at this time because of the merger," said E. B. Field, Jr., vice-president of the company. It is rumored that the Colorado Telephone Company may buy in the Rocky Mountain Bell Telephone Company and other Bell telephone companies in the Rocky Mountain region, thus giving to one company control of the lines throughout that section of the West. If this were done the Colorado Telephone Company would have lines from Canada to Mexico and probably to the Pacific Coast.

Toronto Railway Company.—The Toronto Power Company, a subsidiary of the Toronto Railway Company, which in turn is a Mackenzie and Mann interest, will pay $135 cash per share for the stock of the Toronto Electric Light Company, recently absorbed, payment to be made Aug. 1. At a meeting of the directors of the railway company on July 13 it was decided to issue to the shareholders $2,000,000 in stock at par, give a stock bonus of $1,000,000 and increase the dividend from 7 to 8 per cent per annum dating from July 1. In anticipation of such a decision the stock rose from $134 to $168 prior to the meeting of the directors. In addition, $1,000,000 of stock will be held in the treasury, the total increase of capitalization thus being from $8,000,000 to $12,000,000.

Denver Gas & Electric Light Company.—With further reference to the merger of the Denver Steam Heating Company, the Lacombe Electric Company and the Denver Gas & Electric Company into one company known as the Denver Gas & Electric Light Company, as mentioned in the issue of July 15, the new company has authorized an issue of $25,000,000 5 per cent bonds. Of this amount $8,000,000 are reserved to take care of an equal amount of Denver Gas & Electric Company bonds and of $900,000 bonds of the Lacombe Electric Company upon maturity. The balance of the issue will be available for improvements and additions to the properties.

Electric Light Merger in Indianapolis Halted.—Plans for the merger of the Indianapolis Light & Heat Company, the Merchants' Heat & Light Company and the People's Light and Heat Company have been halted temporarily because of a legal opinion to the effect that such a merger would be in violation of Indiana anti-trust laws. The three companies have agreed to the terms of the merger, but if the courts decide these to be illegal a new plan will be adopted. Each of the three companies is now operating on similar franchises providing that the maximum rate for electric lighting shall not exceed 10 cents per kw-hour, but in some instances three different rates for the same kind of service are in force.

Chicago Railways Company.—The Chicago Railways Company has just sold to a syndicate of financiers an additional block of $5,000,000 of the first-mortgage 5 per cent bonds secured under the open mortgage of Feb. 1, 1907, bringing the amount issued up to $45,955,000. The proceeds from these bonds will supply funds sufficient to complete all rehabilitation work on the company's lines. About 205 miles of track have been already relaid with 129-lb. rails, and the right-of-way has been almost entirely repaved. At present 1500 pay-as-you-enter cars are in operation and contracts for 215 more are to be placed soon.

Commonwealth Edison Shares.—There was considerable activity in the shares of the Commonwealth Edison Company in the stock market of Chicago last week. On July 13 the stock sold for 137¼, which was the highest price reached up to that time. The stock is on a 7 per cent basis. The intimate relation of the company with the merger of the Chicago elevated railway companies has no doubt affected the stock favorably, while the prospect of the formation of a great suburban electric-service company by the same interests may have also stimulated the demand for Commonwealth Edison stock.

Earnings of Bell Telephone System.—The statement of earnings of the Bell Telephone System in the United States, as given in the table below, refers to the report of the American Telephone & Telegraph Company and associated holding and operating companies in the United States, not including connected independent or sub-licensee companies, for five months ended May 31, 1911. All duplications, including interest, dividends and other payments to the American Telephone & Telegraph Company by associated holding and operating companies, are excluded.

DIVIDENDS.

Commonwealth Edison Company of Chicago, quarterly, 1¾ per cent; payable Aug. 1.

Electric Bond & Share Company, quarterly, preferred, 1¼ per cent; payable Aug. 1.

Havana Electric Company, quarterly, preferred and common, 1½ per cent; payable Aug. 12.

REPORTS OF EARNINGS.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
6m., June, '11	$18,203,624	$1,782,461	$16,421,163	$2,805,884	$13,555,278
6 " " '10	17,595,895	1,694,485	15,901,410	2,586,355	13,315,055

*BELL TELEPHONE SYSTEM IN UNITED STATES.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
5m., May, '11	$72,710,093	$28,357,638	$44,352,455	$28,836,771	$15,515,684
5 " " '10	66,831,950	24,746,815	42,085,135	26,317,282	15,767,853

BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$82,628	$41,907	$40,721	$29,691	$11,030
" 1910	75,458	37,340	38,118	29,161	8,957

COLUMBUS ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$40,417	$17,308	$23,109	$10,690	$12,419
" 1910	37,227	15,506	21,721	17,616	4,103

DALLAS ELECTRIC CORPORATION.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$132,585	$88,079	$44,506	$27,942	$16,564
" 1910	115,592	81,398	34,194	26,621	7,573

GALVESTON-HOUSTON ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$128,831	$75,724	$53,107	$24,668	$28,439
" 1910	103,823	66,318	37,505	23,547	13,958

LOWELL ELECTRIC LIGHT CORPORATION.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$30,304	$17,305	$12,999	$4,564	$8,435
" 1910	32,847	20,358	12,489	4,635	7,854

MINNEAPOLIS GENERAL ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$112,614	$43,603	$69,011	$38,232	$30,779
" 1910	93,626	40,626	53,000	31,157	21,843

NORTHERN TEXAS ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$136,227	$70,688	$65,539	$25,032	$40,507
" 1910	117,766	64,484	53,282	19,722	33,560

SAVANNAH ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$56,777	$38,231	$18,546	$18,422	$124
" 1910	53,379	34,307	18,072	18,020	52

SEATTLE ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
May, 1911	$447,989	$256,821	$191,168	$114,889	$76,279
" 1910	467,961	273,934	194,027	115,736	88,291

*See note, head of table.

General News

Construction News.

DOTHAN, ALA.—Application has been made to the City Council by Charles Dothan, of Troy, Ala., for a franchise to supply electricity in Dothan from the large power plant which he proposes to erect in Elba soon.

ELBA, ALA.—It is reported that Charles Henderson, of Troy, Ala., is contemplating the construction of an electric-light plant in Elba.

EUFAULA, ALA.—The City Council has decided to erect a municipal electric-light plant in Eufaula, to cost about $50,000. As yet the location of the power house has not been decided upon.

VALDEZ, ALASKA.—Plans are being prepared to equip the machinery at the Cliff mine for electrical operation. Electricity for operating the plant will be supplied by the Alaska Water, Light & Telephone Company, of Valdez, which is making arrangements to increase its output by the installation of an additional plant in Sulphide Canyon, near Camp Comfort. A transmission line is now being erected from the town to the proposed power station, which will later be extended down the bay to the Cliff. The present station of the company is located in Solomon Gulch.

BISBEE, ARIZ.—The plant and holdings of the Bisbee Light & Power Company were recently sold at a foreclosure sale to satisfy a mortgage held by the Los Angeles Trust Company, of Los Angeles, Cal., for $30,000. W. J. Ainsworth, of West Union, Ia., purchased the property.

KINGMAN, ARIZ.—Plans are being considered by J. H. Hays and Robert S. Waters for the installation of a hydroelectric plant on Trout Creek in the eastern part of Mohave County. Electricity generated at the plant will be transmitted to the mining districts in that section to [illegible] the machinery in the mines and mills.

KINGMAN, ARIZ.—Contracts will soon be awarded by the Desert Power & Water Company for extensions and improvements to its plant, including the installation of additional machinery, consisting of one 1250-kw direct-connected generator and two 1000-hp boilers with auxiliary apparatus. Extensions will also be made to the transmission lines. The company supplies electricity for lamps and motors in Kingman and electrical energy to the largest mines in this district. F. A. Wilde is president of the company, and F. A. Wilde, Jr., is treasurer and general manager.

BROWNS VALLEY, CAL.—Preparations are being made by J. C. Campbell to equip the mines on the old Pennsylvania claim in Browns Valley for electrical operation. It is understood that orders have been placed for electrical machinery. At present oil is used for fuel.

FRESNO, CAL.—Work has commenced on the construction of a new substation by the San Joaquin Light & Power Company, about 10 miles west of Lemoore. The new substation, known as the Henrietta, will tap the Bakersville loop when finished, thus giving more direct connections for the Coalinga line and will give more efficient service for the Coalinga district and the oil fields region.

GREENVILLE, CAL.—It is reported that the Indian Valley Electric Light & Power Company is preparing for a water-power development and erection of a 25-mile transmission line, bids for which will be called for in about thirty days. The company is planning a development with a total output of 31,000 hp, which includes the plant at Greenville. The main offices of the company are located at 1116 Crocker Building, San Francisco, Cal.

LONG BEACH, CAL.—The Southern California Edison Company has awarded the contract for the erection of two steel towers for its transmission line, one at each side of the channel of the inner harbor, to the Security Construction Company, of Los Angeles, Cal., for $13,973.

LOS ANGELES, CAL.—Bids will be received at the office of the Supervising Architect, Washington, D. C., until Aug. 21 for the installation of a vacuum cleaning system in the United States court house and post office building at Los Angeles, Cal., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the custodian at Los Angeles, Cal. James Knox Taylor is supervising architect.

POMONA, CAL.—The Board of Supervisors has granted the Pacific Light & Power Company a franchise to erect a transmission line in the foothill district east of the city limits of Los Angeles and extending to Pomona to supply electricity for lamps and motors to suburban residents. The price paid for the franchise was $100.

PORTERVILLE, CAL.—Efforts are being made by the officials of the Tulare County Power Company to complete its central power plant on the upper Tule River by Sept. 1. Rights of way are being secured by the officers of the company for an electric railway, which will connect Porterville and Lindsay on the north and Tulare on the west, and [illegible] will tap the [illegible] and dairy district of eastern Tulare County.

REDDING, CAL.—A mortgage has been filed by the Sacramento Valley Power Company in favor of the Anglo-California Trust Company for $2,000,000, to secure an issue of bonds of the same amount, of which the proceeds will be used to take up $400,000 of bonds of subsidiary companies, $600,000 for enlarging its plants and extensions of transmission lines, and $1,000,000 will be held in reserve. This company is a consolidation of the Sacramento Power Company, the Shasta Power Company and the Northern Light & Power Company. It has two power plants located near Lassen, each having an output of 2000 hp, both of which will be increased to 7000 hp. The transmission lines of the company will be extended to Willows and to a connection with the lines of the Great Western Power Company, from which it will purchase additional energy as needed. The company proposes to cover the field north of Redding. The Sacramento Power Company and the Great Western Power Company are controlled by the same interests.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company, it is reported, will erect a large building for its offices at the corner of Eleventh and K Streets.

SAN BERNARDINO, CAL.—Surveys are being made by the Nevada-California Power Company for the erection of a transmission line from its plant on Bishop Creek, in Inyo County, to San Bernardino for the purpose of transmitting electricity into Southern California for distribution. The proposed line will be about 240 miles in length.

SAN BERNARDINO, CAL.—Application has been made to the City Council by F. A. Worthley, superintendent of the municipal electric plant at Riverside, Cal., for a franchise to erect transmission lines for the distribution of electricity in this city. Mr. Worthley states that it is proposed to install a plant with an output of about 10,000 hp, which will probably be located in San Bernardino, at a cost of about $300,000. The company also proposes to erect high-tension lines through the Moreno and Perris Valleys to supply power to operate pumps for irrigation purposes. A transmission line will also be extended to the territory north of Corona. Franchises have been applied for in both counties. It is said that Mr. Worthley represents the California-Nevada Power Company.

SAN DIEGO, CAL.—Bids will be received by Allen H. Wright, city clerk, for the purchase of a franchise for the right to construct and operate an electric railway ending Sept. 1, 1952.

SAN DIEGO, CAL.—The Board of Park Commissioners has entered into an agreement with the San Diego Consolidated Gas & Electric Company whereby the company will supply electricity for the lamps and operating the pumps of the fountain in the plaza at a flat rate of $100 per month.

SAN JOSE, CAL.—The Peninsular Railway Company is preparing plans for the construction of an extension south from San Jose to Palo Alto toward Paraja. Five extensions of franchises were granted to the Peninsula Railway Company to build electric railways in various parts of Santa Clara County by the County Supervisors. These franchises cover about 12 miles of road.

SAN FRANCISCO, CAL.—Plans are being prepared for the installation of an electric-light system at Fort Miley, near San Francisco, Cal. The plant will supply electricity for lamps and motors for thirty-two buildings and for street lighting. The equipment will include transformers, lamp-posts, line material, etc. The cost of the system is estimated at about $20,000. For further information address Col. George McK. Williamson, care Constructing Quartermaster's Department, Fort Mason, San Francisco, Cal.

CLIFTON, COL.—Plans are being made by the residents of Clifton to incorporate the town for the purpose of securing electric-light and water-works systems.

COLORADO SPRINGS, COL.—An agreement has been entered into by the Colorado Springs Electric Light Company, the Colorado Telephone Company, the Western Union Telegraph Company and the Postal Telegraph Company whereby all electric wires, except trolley wires and their supports, will be placed underground on Tejon Street.

DENVER, COL.—Plans are being made by the Denver Gas & Electric Light Company for rebuilding the steam-heating plant and extending the mains of the Denver Steam Heating Company, which was taken over by the company recently. The cost of the work is estimated at about $500,000.

DENVER, COL.—The Board of Supervisors has passed an ordinance providing for a ten-year contract with the Denver Gas & Electric Company to supply incandescent street lamps at $20 each per year. Under the new agreement the company is to furnish electricity for lighting the streets and boulevards and to assume the expense of underground wiring and all materials necessary for installation. The city under the [illegible] pays $20 per lamp per year and is required to [illegible]

[illegible] about 1000 incandescent lamps in use and [illegible] will be installed.

DENVER, COL.—At a meeting of the directors of the Denver Gas & Electric Company, the Lacombe Electric Company and the Denver Steam Heating Company, held in Denver recently, it was decided to consolidate the three properties, to be known as the Denver Gas & Electric Light Company, the last-named company having been incorporated some time ago. Bonds to the amount of $25,000,000 have been authorized by the new company, of which $8,000,000 are reserved to take care of the same amount of bonds of the Denver Gas & Electric Company and $900,000 for bonds of the Lacombe Electric Company when they mature. The balance of the issue is to be used for improvements or additions to the system as they may be needed in the future. It is understood that none of the new bonds will be issued within the next few months.

FRUITA, COL.—Preparations are being made to install a hydroelectric power plant in the South Side ditch. The proposed plant will supply electricity in Fruita and the entire lower end of the Grand Valley.

GLENWOOD SPRINGS, COL.—The federal court has handed down a decision in favor of the Glenwood Light & Water Company, which holds that the city must live up to its contract with the company. The city of Glenwood Springs has issued bonds to buy the plant of the company, which the company refused to sell on the ground that it had an existing contract with the city which had not expired. By the terms of the decision the city will not be allowed to buy the plant or erect its own plant until the contract with the company expires, which has several years to run.

WINDSOR, COL.—Contract has been placed by the business men for the erection of ornamental lamp standards with tungsten lamps, to be installed on the two principal business blocks. The Northern Colorado Power Company is to pay half of the cost of installation. Post office address is New Windsor.

COS COB, CONN.—The New York, New Haven & Hartford Railroad Company has placed an order with the Bigelow Company, of New Haven, Conn., for twelve 625-hp Bigelow-Hornsby water-tube boilers for its new power station at Cos Cob.

MANCHESTER, CONN.—The South Manchester Light & Power Company has purchased the plant and holdings of the Manchester Light & Power Company, the latter company operating in the North End. Electricity for operating the system of the Manchester Light & Power Company has been supplied by the South Manchester Light & Power Company for several years.

MOOSUP, CONN.—The Nashawaug Electric Power Company, of Plainfield, Conn., has applied to the Selectmen for permission to erect its transmission line, which will connect the villages, across the town farm property.

NEW HAVEN, CONN.—The railroad committee of the General Assembly has reported favorably on several petitions of the Connecticut Company for extensions to its railway lines in New Haven and West Haven.

STAFFORD SPRINGS, CONN.—The Tolland County Street Railway Company, which was granted a charter several years ago, has recently organized to build an electric railway between Stafford Springs and Staffordville. The directors are: A. S. May, B. I. Spockland and N. S. Buckingham.

STAMFORD, CONN.—The Stamford Gas & Electric Company has recently issued $100,000 in capital stock, the proceeds to be used for extensions and improvements to its plant to provide for the increased demand for service.

WILMINGTON, DEL.—Plans are being considered for the installation of a new lighting system on Market Street. It is proposed to erect ornamental lamp standards and to place four tungsten lamps on each post.

WASHINGTON, D. C.—The Baltimore & Washington Transit Company has applied to the Public Service Commission of Maryland for permission to issue $50,000 in bonds. The company is planning to build an extension to Sandy Spring, Md., a distance of 14 miles.

WASHINGTON, D. C.—The Washington-Virginia Railway Company is reported to have leased the Bluemont branch of the Southern Railway Company for a term of ninety-nine years. Plans are being made by the Washington-Virginia Railway Company to equip the Bluemont branch for electrical operation and operate it in connection with the rest of its system.

ATLANTA, GA.—The Appalachian Power Company has applied to the Railroad Commission for authority to issue $250,000 in capital stock and the same amount in bonds. The company has acquired extensive water-power rights on Panther Creek in Habersham County, which it proposes to develop. Louis B. Magid, of Atlanta, Ga., is president of the company.

MARIETTA, GA.—Owing to the City Council and the Kennesaw Paper Company being unable to come to an agreement on the price to be charged for street lamps, application has been made to the Railroad Commission to fix a rate. The contract expired some time ago and the company wishes to increase the price for the service, which the city will not consent to.

PERRY, GA.—It is reported that bonds to the amount of $6,000 have been voted, the proceeds to be used for the installation of electric-light plant.

WAYCROSS, GA.—Application has been filed by the Ware Coun Light & Power Company, of Waycross, Ga., with the Railroad Commissi for authority to issue $20,000 in bonds, the proceeds to be used to er a gas-generating plant.

NEZ PERCE, IDAHO.—A deal has been closed whereby A. Wel and R. B. Montague, of Portland, Ore., have purchased the prope of the Nez Perce Light & Power Company, which includes the N Perce water system, the high-tension transmission line to Vollmer and l now under construction, the light and power franchises in Ilo, N Perce and Kamiah and the power plant and sawmill on Lolo Cree two miles above Greer. The consideration is said to be $70,000. T new owners, it is said, propose to develop the power plant at L Creek to its full capacity and will at once enter the prairie field competition with the Grangeville Electric Light & Power Compan which has a high-tension transmission line into Cottonwood, where recently purchased the local system and is planning to extend power line from there into Vollmer.

BLOOMINGTON, ILL.—Recommendation has been made to t Council by Seth S. Noble, superintendent of the municipal wat and light plant, for the installation of additional equipment at t municipal electric-light plant. He states that the plant cannot car the additional load contemplated by the installation of ornamental stre lamps.

CHICAGO, ILL.—Sealed proposals will be received by the Sou Park Commissioners, Washington Park, Chicago, Ill., until July 26 f approximately 138 electric-light posts and thirty electric-light fixtur for concrete fence posts at Square Four, Forty-fifth Street and Princet Avenue. J. F. Neil is secretary.

DELAND, ILL.—The Village Board has granted I. C. Bowsher twenty-year franchise to construct and operate an electric-light pla in Deland.

DIXON, ILL.—The Westinghouse Electric & Manufacturing Co pany has sold to the Lee County Lighting Company, of Dixon, Ill., o 200-kw, three-phase, 2300-volt, 60-cycle, 600-r.p.m., revolving-field, alte nating-current generator, belted, complete with exciter and switchboar

GALESBURG, ILL.—The Retail Merchants' Association is plannir to place arc lamps on top of the poles now being erected by t Galesburg Railway & Light Company.

LENA, ILL.—The capital stock of the Lena Electric Light & Pow Company has been increased from $12,000 to $20,000.

MACKINAW, ILL.—The City Council, it is reported, has appoint a committee to investigate ornamental street lighting systems in oth cities with a view of establishing an ornamental system in Mackinaw.

MACOMB, ILL.—The Macomb Electric Light & Gas Company contemplating exchanging its present lighting system. The erection concrete lamp standards is also under consideration by the merchan in the city.

OREGON, ILL.—Arrangements are being made by the Oregon Lig & Power Company to extend its transmission lines to Ashton, where has been granted a twenty-five-year franchise by the Village Boar The line will be extended from the Oregon-Franklin Grove line Brown's Corners.

PONTIAC, ILL.—The Pontiac Light & Water Company, of Pontia Ill., has purchased from the Westinghouse Electric & Manufacturin Company one 300-kw, three-phase, 2300-volt, 600-r.p.m., alternating-cu rent generator, belted, with direct-connected exciter and three-pan switchboard.

QUINCY, ILL.—The contract for installing 118 ornamental lam standards, each carrying five tungsten lamps, was awarded to the J. W Turner Construction Company, of Des Moines, Ia., by the Civic Im provement League.

QUINCY, ILL.—The Mississippi River Power Company has secure the right-of-way through Adams County for its proposed interurba railway. The company proposes to build a belt line from Rock Islan to St. Louis. The Stone & Webster Engineering Corporation, of Bo ton, Mass., has the contract for building the railway.

QUINCY, ILL.—Arrangements are being made for organizing company for the purpose of building an electric railway from Quinc to Niota, Ill., with branches to Keokuk, Ia., Warsaw, Carthage an Nauvoo, Ill. The company will be incorporated under the name of th Quincy & Western Illinois Electric Company. The capital stock wi be placed at $5,000. Henry Dayton, of Quincy, Ill., has been electe president.

ROCK ISLAND, ILL.—The City Council has adopted an ordinanc permitting the Central Union Telephone Company to purchase th property of the Union Electric Telephone & Telegraph Company. Th consent of the Moline Council has not yet been secured.

WHITEHALL, ILL.—The Alton, Jacksonville & Peoria Railwa Company is planning to build a new power house on Piasa Creek, abou 9 miles beyond Alton.

CONNERSVILLE, IND.—It is reported that plans are being pre pared by E. D. Johnson, president of the local hydraulic company, fo the construction of a dam across the Whitewater River and to erec and equip two power plants, one to be located on the canal at th

[illegible] water works and the other [illegible]

LINTON, IND.—An election will soon [illegible] proposition to the voters as to whether bonds shall be issued for enlarging the municipal electric-light plant, or whether to sell the municipal plant to a private corporation.

MOORESVILLE, IND.—The plant of the Mooresville [illegible] Power Company was wrecked by an explosion July [illegible], caused by the bursting of a fly wheel.

NOBLESVILLE, IND.—Henry [illegible], referee in bankruptcy in this district, has appointed the Wainwright Trust Company, of Noblesville, receiver for the White River Light & Power Company. An application will soon be made to sell the plant. A petition has been filed asking that the hydraulic dam and other property belonging to the company be turned over to the bondholders, which was withdrawn with the understanding that the Wainwright Trust Company be made receiver. The White River Light & Power Company owns a dam located about two miles north of Noblesville, work on which was begun about three years ago and has never been finished owing to lack of funds. It is understood that a new company stands ready to take over the property and operate the plant.

WARREN, IND.—A day service has been established in connection with the municipal electric-light system in Warren. The Town Board has made arrangements with the Marion, Bluffton & Eastern Traction Company to supply electrical energy for the service. Preparations have been made to supply electricity for factories and industrial plants. The Town Board would like to communicate with parties contemplating the establishment of new plants or making a change in location of their plants with a view of offering them inducements to locate in Warren. We are informed that there are several buildings suitable for factory purposes and that power can be secured at reasonable rates. William [illegible] Stewart is president of the board, and W. H. Hickerson is superintendent of the municipal electric plant and water-works system.

BOONE, IA.—Contracts have been awarded by the Boone Electric Company to the Allis-Chalmers Company, of Milwaukee, Wis., for two [illegible]00-kw turbines, and to the Edge Moor Iron Company, of Edge Moor, Del., for three 400-hp boilers. The company has recently closed negotiations with the Chicago & Northwestern Railway Company by which it will supply electricity to operate the large new car shops of the railroad company.

CENTER POINT, IA.—Another special election will have to be called by the town of Center Point before it can issue bonds for the installation of an electric-light system.

COUNCIL BLUFFS, IA.—The City Council has accepted the proposition submitted by F. A. Nash, president of the Citizens' Gas & Electric Company, to install a new lighting system in the business district of the city, provided the Council gives the company a five-year contract for street lighting at the expiration of the present contract, which expires [illegible] 1, 1911. Under the terms of the contract the company is to install not less than forty flaming-arc lamps, of which part are to be placed on ornamental lamp standards and part to be overhead construction in the center of the street. The price is to be $95 per lamp per year, with a guarantee that the net price (deducting royalty) paid by the city shall not exceed $75 per lamp per year. The company also agrees in consideration of the renewal of the contract for five years to charge consumers for electricity on the regular Omaha schedule of [illegible] cents and 6 cents per kw-hour and to supply gas at the rate of [illegible] per 1000 cu. ft. The company is to continue to the city of Council Bluffs the same royalties on gas and electricity as are now being paid, and also to provide ornamental iron posts for the installation of flaming-arc lamps.

DAVENPORT, IA.—The Davenport-Muscatine Railway Company has begun work on the construction of its proposed railway between Davenport and Muscatine, 30 miles in length. Electricity for operating the railway will be secured from the Tri-City Railway & Light Company. The company will supply electricity for lighting purposes. J. F. Porter, of Davenport, Ia., is president of the Davenport-Muscatine Company.

SILVER CITY, IA.—The installation of an electric-lighting system in Silver City is under consideration.

SIOUX CITY, IA.—The question of securing power from the Niobrara River in Nebraska for Sioux City is under consideration by the Sioux City Service Company. R. J. Dunham, of Chicago, Ill., is president of the company.

VAN HORNE, IA.—A petition has been presented to the City Council asking for a special election to be called to vote on the question of establishing a municipal electric-light and power plant in Van Horne. The plant of the Van Horne Electric Light & Power Company was destroyed by fire on June 29. It is not expected that the plant will be rebuilt. The town at present is without electrical service.

CANTON, KAN.—Plans are being considered for the installation of a municipal electric-light plant and water-works system, to cost about [illegible]0,000. T. Newton Frantz is city clerk.

LEAVENWORTH, KAN.—Plans are being prepared by D. A. McKibben, of Leavenworth, Kan., and W. B. Walker, of Excelsior Springs, Mo., to organize a company to build an electric railway from Leavenworth to Excelsior Springs, Mo. The proposed railway will be 40 miles in length and will pass through Beverly, Platte City and Liberty, [illegible] Leavenworth [illegible] The company [illegible] Leavenworth & [illegible] Springs Railway & Power [illegible] and will be capitalized at $2,000,000.

MOLINE, KAN.—The citizens have voted against the proposition to grant an electric-light franchise. The Moline Stone, Lime & Cement Company, it is said, will submit a proposition to light the town.

TOPEKA, KAN.—[illegible] State power plant, bids for which will be called for in the near future.

BOYCE, LA.—The Town Council has awarded the contract for the installation of a municipal electric-light plant in Boyce.

VIVIAN, LA.—The Vivian Ice, Light & Water Company, recently organized with a capital stock of $50,000, is reported to be contemplating the installation of an electric-light plant, ice plant, waterworks and sewerage systems. O. C. Jacobs, of Oklahoma City, Okla., is president, and J. D. Wilkinson, of Shreveport, La., secretary.

BIDDEFORD, MAINE.—The building used by the Atlantic Shore Railway Company for its storage-battery building in Biddeford, Me., was destroyed by fire recently, causing a loss of about $10,000.

GREENVILLE, MAINE.—The Greenville Light & Power Company is erecting a dam 70 ft. long and 30 ft. high in Elliottsville and will build a hydroelectric plant to supply electricity to the slate quarries and other industries in Monson.

WATERVILLE, MAINE.—The Waterville & Fairfield Railway & Light Company is in the market for a second-hand 500-kw turbine for its power house in Waterville.

WEST SCARBORO, MAINE.—The Consolidated Electric Light & Power Company, of Portland, Maine, is extending its transmission line from Windham to Dunstan Corner. The company will supply electricity for lighting the village of West Scarboro and also to the Portland Railroad Company.

BALTIMORE, MD.—The installation of a municipal heating, lighting and power plant is reported to be under consideration. The proposed plant would be installed in conjunction with the pumping station and would furnish heat and electricity for the City Hall and annexes and court house.

CUMBERLAND, MD.—The Mayor and Council have passed an order approving the proposed consolidation of the Chesapeake & Potomac Telephone Company and the Western Maryland Telephone Company. Under the terms of the consolidation the stockholders of the Western Maryland Company will receive $80,000 for their stock and the Chesapeake & Potomac Telephone Company will assume the bonded indebtedness of $165,000.

HAGERSTOWN, MD.—Plans have been completed by P. O. Keilholtz, electrical engineer, for the proposed power plant to be erected by the Western Maryland Power Company at Security, which will supply electrical energy for the Frederick Railroad Company, of Frederick, Md., and the Hagerstown Railway Company, of Hagerstown, Md. The proposed plant will cost about $200,000 and will have an output of about 2800 kw.

TAKOMA PARK, MD.—The Town Council has authorized Mayor W. G. Platt to enter into a contract with the Potomac Electric Power Company to install an electric lighting system in Takoma Park, consisting of 100 incandescent lamps of 32 cp. At present the town is lighted by oil lamps.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has applied to the Board of Gas and Electric Light Commissioners for authority to extend its transmission lines into the towns of Barnstable, Bourne and Sandwich for the purpose of supplying electricity for lamps and motors.

FALL RIVER, MASS.—A contract has been placed with the General Electric Company for the installation of an electric plant for the Pilgrim Mills.

FOXBORO, MASS.—The Southeastern Electric Company has submitted a proposition to purchase the plant of the Foxboro Electric Company and also plants in several towns in this vicinity. The Southeastern Electric Company, it is said, if successful in securing the plants, will install a large central power plant, probably in Foxboro.

GRANITEVILLE, MASS.—The Lowell Electric Light Corporation has applied to the Board of Selectmen for locations for poles for its transmission lines in the villages of Brookside, Westford Centre, Forge Village and Graniteville. It is expected to have the street-lighting system installed by Sept. 1.

READING, MASS.—The Board of Electric Light Commissioners is preparing plans for extending the local electric light service to Wilmington.

DEERWOOD, MICH.—We are informed that the Cuyuna Range Light & Power Company does not propose to do work of any importance on its proposed hydroelectric plant, to be erected at or near the Crow Wing River, until next year.

GRAND HAVEN, MICH.—Owing to the municipal electric light and power plant being unable to meet the demands made upon it the City Council has asked the Grand Rapids-Muskegon Power Company, of Muskegon, Mich., to submit a proposition to take over the municipal plant and furnish electricity for lighting the streets and municipal buildings and for commercial and residential lighting. In order to equip the municipal plant for the additional service it will require an

expenditure of quite a sum of money, and it is thought that the power company can furnish electricity at less cost than the city can generate it.

HOUGHTON, MICH.—A proposition to install a new street-lighting system on Shelden Street has been submitted by Gardner Rogers, general manager of the Houghton County Electric Light Company, to cost about $2,000 per year. At present strings of incandescent lamps are used, which are paid for by subscriptions from the business men. Under the new plan it is proposed to erect flaming arc lamps. The village pays $750 for the arc lamps now in use, which would be included in the scheme, and business men would be asked to pay for the remainder.

IRON MOUNTAIN, MICH.—The Peninsula Power Company has awarded contracts to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for machinery for the initial installation at its plant at Twin Falls on the Menominee River, including two turbine wheel generators and other accessories. The flume to be constructed will provide for five wheels. The contract for construction of dams, flumes, etc., has been awarded to the Newton Construction Company, of Milwaukee, Wis.

ISHPEMING, MICH.—The Marquette County Gas & Electric Company is contemplating the purchase of a 200-kw converter.

SEBEWAING, MICH.—Plans are being made for the construction of a municipal electric-light plant in Sebewaing, bids for which will be received until Aug. 7. J. Hummelein is city clerk.

LITTLE FALLS, MINN.—The American Engineering & Construction Company, of Cleveland, Ohio, has applied for a franchise to install an electric-light and power plant and street-railway system in Little Falls.

ST. PAUL, MINN.—Contracts have been awarded by the St. Paul Railway Promotion Company to the Hoy, Elzy Company for the construction of its proposed electric railway between Inver Grove and Hastings, work on which will begin in the near future. Cars will enter the city from Inver Grove on the tracks of the Twin City Rapid Transit Company. It is said that negotiations are under way for extending the railway to St. Paul Park, Newport and possibly Langdon. The railway will eventually be extended from Hastings to Red Wing, Frontenac, Lake City, Mankato and Faribault.

HICKORY, MISS.—The installation of a municipal electric-light plant in Hickory is reported to be under consideration.

NEWBURG, MO.—The Board of Aldermen has granted W. N. Schwabe and E. Spaulding, of Newburg, a franchise to construct and operate an electric-light plant in this city for a term of twenty years.

QUEEN CITY, MO.—The contract for furnishing equipment for the municipal electric-light plant has been awarded to the Fairbanks-Morse Company of St. Louis, Mo., for $4,080.

RICH HILL, MO.—The Atlas Coal Company is reported to have awarded contract for construction of its proposed electric-light and power plant to F. D. Martin, of Ft. Scott, Kan. The contract includes electrical work and the erection of about 3000 ft. of pole line. Contract for engine has been awarded.

ST. JOSEPH, MO.—The proposition to enlarge the municipal electric-light plant is reported to be under consideration.

HELENA, MONT.—The State Board of Examiners has awarded the contract for furnishing and installing fixtures in the State Capitol Building at Helena to the Morean Company, of Cleveland, Ohio, for $10,000.

MINDEN, NEB.—At an election held July 11 the citizens voted in favor of the proposition to issue bonds to the amount of $15,000, the proceeds to be used for the installation of a municipal electric-light plant. The Minden-Edison Light & Power Company, which furnishes electrical service in Minden, has filed an injunction suit enjoining the issuance of the bonds. Owing to excessive rates charged by the company for its service the city has decided to install and operate a municipal plant. The maximum price charged by the company for electricity is 22 cents per kw-hour. The city also tried to secure a reduction in the price of street lamps and to extend the street-lighting system, but was not satisfied with the proposition submitted by the company.

RENO, NEV.—Plans are being perfected by the Reno Power, Light & Water Company for extensive improvements to its system.

BERNARDSVILLE, N. J.—The Pennsylvania Electric & Power Company is reported to have purchased the plant and holdings of the Bernardsville Water Company. The latter company supplies electrical service in Millington, Mendham, Lyons, Peapack, Gladstone and other cutlying districts.

NEWARK, N. J.—The W. V. Snyder Company has decided to install an electric-light and power plant to supply electricity for lighting its store, operating elevators, cash systems, etc., and also to heat the building. The contract for equipment has been awarded to George W. Fowler & Company, engineers, of New York, N. Y.

PATERSON, N. J.—Bids will be received by William H. Mason, chairman of road committee, Court House, Paterson, N. J., until Aug. 2 for lighting the public boulevards and roads, and places controlled by the Board of Chosen Freeholders of Passaic County, as follows: (1) About 200 arc lamps of 1200 cp, for contract for one, three, five and ten years. (2) About 200 arc lamps of 2000 cp, for contract for one, three, five and ten years. For 32-cp incandescent lamps about 400, to light the places now lighted by arc lamps, for contract for one, three, five and ten years. Plans and specifications are on file at the office of the clerk of board.

WEST ORANGE, N. J.—The Town Council has entered into contract with the Public Service Electric Company for street lighti for a term of five years, under which the company is to furnish a lamps at $80 each per year.

DEMING, N. M.—Plans are being made for improvements and tensions to the plant of the Deming Ice & Electric Company, whi will involve an expenditure of about $100,000. The company is pl ning to supply electricity to a 4000-acre tract, which is to be coloniz about 3½ miles east of Deming. It is proposed to install motors each 100 of the 4000 acres to operate pumps for irrigating purposes.

RED ROCK, N. M.—Preliminary surveys are being made with t view of locating a site for a large hydroelectric plant on the Gila Riv near Red Rock. Transmission lines will be erected from the pow station to the Mogollon mining district to supply electricity to opera the mills and mines, and also to Silver City and a number of tow and industrial centers within a radius of 100 miles of Red Rock. C J. W. Carter, of Silver City, N. M., and associates are interested the project.

ALBANY, N. Y.—The State Trustees of Public Buildings ha awarded the contract for steam equipment for the Capitol power hou and the steam and return connections between the power house, Capi and State Education Building to Gillis & Geohegan, of New York, Y., for $202,083, and to the Lord Electric Company, of New York, Y., the contract for electric equipment between the buildings for $95,2

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, sup intendent of school buildings, Department of Education, corner Park A nue and Fifty-ninth Street, New York, N. Y., until July 31 for install electric equipment in new Public School 168, located on Throop Aven between Bartlett and Whipple Streets, Brooklyn, N. Y. Blank for plans and specifications may be seen at the above office, and also branch office, 131 Livingston Street, Brooklyn, N. Y.

BUFFALO, N. Y.—Arrangements have been made whereby Niagara, Lockport & Ontario Power Company will secure control the Oswego County Light & Power Company, in which William Gannon and Charles A. Lux, of Syracuse, are interested. The Osw County Light and Power Company has a power development on Salmon River of from 15,000 to 20,000 hp.

BUFFALO, N. Y.—Negotiations have been closed by the F eral Telephone & Telegraph Company, of which the Frontier T phone system is an integral part, for the purchase of the property the Independent Union Telephone Company, of New York and Pe sylvania. The property includes about 300 miles of long-distance cal and twenty exchanges. The property is valued at about $1,000,(The Federal Company recently purchased the property of the Roches Telephone Company.

CATSKILL, N. Y.—Application has been made to the Public Serv Commission, Second District, for approval of the consolidation of Upper Hudson Electric & Railroad Company, the Schoharie Light Power Company, of Schoharie, N. Y., and the Catskill Illuminating Power Company, of Catskill, N. Y., under the name of the Upper H son Electric & Railroad Company. The new company is to be capitali at $500,000 and proposes to execute a mortgage to secure a bond is of $1,000,000. The company asks for authority to issue $420,000 bonds at once.

CENTRAL ISLIP, N. Y.—The contract for engine, dynamo, etc., the North Colony power house, bids for which were opened May has been awarded to the Commercial Construction Company, of N York, N. Y., for $6,463. K. McGarr is secretary.

FT. COVINGTON, N. Y.—The Public Service Commission, Sec District, has authorized the Fort Covington Light, Heat & Power C pany to mortgage its property to secure an issue of bonds to amount of $7,000. The company has been granted permission to is presently $5,000 in bonds to discharge existing obligations and a h ing is ordered upon the request to issue $2,000 in bonds, the proce to be used for the construction of a concrete dam.

HALFMOON, N. Y.—Plans are being made for the construction an electric railway from Rexford Flats to either Waterford or Coh The new line will be known as the Crescent-Halfmoon Railway. officers are: John Richmond, president; C. B. Hawley, vice-presid C. B. Hawley, secretary, and A. C. Newton, treasurer.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, su intendent school buildings, Department of Education, corner Park Ave and Fifty-ninth Street, New York, N. Y., until July 31 for installing tric equipment in Washington Irving High School, located at Ir Place. Sixteenth and Seventeenth Streets, New York, N. Y. Blank for plans and specifications may be obtained at the above office.

NEW YORK, N. Y.—It is reported that orders have been pl by the Dry Dock, East Broadway & Battery Railroad Company, New York, N. Y., with the Electric Storage Battery Company, Philadelphia, Pa., for equipping thirty-five new cars with storage teries. The work will begin in August and will continue at the rat seven a week.

NEW YORK, N. Y.—Bids will be received by the Department Public Charities, foot of East Twenty-sixth Street, New York, N. until July 28, for furnishing and installing two new boilers and ac sories in the power house of the Metropolitan Hospital District, Bl well's Island, Borough of Manhattan. Blanks and further informa may be obtained at the office of the supervising engineer of the

[illegible]

EW YORK, N. Y.—The Long Acre [illegible] Light & Power Comp py has applied to the Public Service Commission for permission to ise bonds ultimately to the amount of $50,000,000. It is not pro ped to apply for authority at present to issue more than $10,000,000. A present it is understood that the company desires only $6,000,000. Carles N. Jackson, superintendent, states that a plant with sufficient oput to begin with could be built within a year at a cost of about $275,000, including all expenses. It is proposed to install a plant with an [illegible] output of [illegible] kw and an ultimate output of [illegible] hp.

.EW YORK, N. Y.—Contracts have been awarded by C. B. J. Snyder, superintendent of school buildings, Department of Education, New York, N. Y., as follows: For repairs, alterations and additions to the e tric equipment in Public School 160, Manhattan, to the Anderson-Martin Electric Company, for $1,639; for installing electric equipment in new Public School 46, the Bronx, to T. Frederick Jackson, Inc., at $,762; for installing electric-light equipment in Truant School, Brooklyn, to Reis & O'Donovan, Inc., at $3,940, and Public School 73, Brooklyn, to the New York Construction Company, for $6,120, and for repairs, alterations and additions to the electric equipment in Public School 37, Brooklyn, to the J. F. Electric Company, for $1,068.

NORTH TONAWANDA, N. Y.—A contract has been awarded by the J. Spaulding & Sons Company, of Rochester, N. H., to the Aberthaw Construction Company, of Boston, Mass., for the construction of a large fiber mill, to be located in North Tonawanda, N. Y. One building w. be 265 ft. x 300 ft., one story high, the other building 265 ft. x 60 ft two stories high, with small connecting building for machine shop and power station.

PERRY, N. Y.—The plant and holdings of the Perry Electric Light Company are reported to have been sold to Edwin D. Hamlin and E. L. Phillips, both of New York.

SOUTHAMPTON, N. Y.—The Village Trustees have awarded a contract to the Suffolk Lighting & Heating Company, of Southampton, for lighting the streets of the village for a period of three years. Under the terms of the contract the company is to furnish 156 incandescent [illegible] and five 1200-cp arc lamps at $0.457 per year.

SYRACUSE, N. Y.—Work will begin immediately on the erection of a new transformer station for the Syracuse Rapid Transit Company. The new substation will be located on Townsend Street and will supply electricity for operating the Butternut, Oak, East Syracuse, Hawley and east end of East Genesee street-railway lines. The station will ultimately be equipped with two 1000-kw rotary generators, one of which will be installed at once. The cost of the station is estimated at about $73,000.

UTICA, N. Y.—In a decision handed down by Judge Ray, of the United States District Court, the property of the Hudson River Electric Power Company and its subsidiary companies has been ordered to be consolidated and sold, with the exception of the Saratoga Springs Gas & Electric Company and the Madison County Gas & Electric Company, which are to be sold separately.

WEST HEBRON, N. Y.—It is reported that Peter Busseno is planning to install an electric-light plant at the People's Exchange.

LOWELL, N. C.—Contracts have been placed by the Spencer Mountain Mills for the reconstruction of its power plant, which was recently destroyed by fire. The cost of the work is estimated at about $,000. The company also supplies electrical service in Gastonia, N. C.

MANDAN, N. D.—The contract for the construction of the power station of the municipal electric-light plant has been awarded to G. W. Herert, of Fargo, N. D. The cost of the plant is estimated at about [illegible]

CINCINNATI, OHIO.—A new schedule of rates for electricity was put into effect the first of the month by the Union Gas & Electric Company, by which, it is claimed, a saving of from 7½ per cent to 12 per cent over the present rates will be made. The present rate is 10 cents per kw-hour as a basis, with the 10-cent rate applicable for first thirty hours; for the second thirty hours the rate is 6 cents, and for all energy consumed over this amount there is a fixed schedule of discounts on bills ranging from 5 per cent to 50 per cent. Under the new schedule the maximum rate is 10 cents per kw-hour and the minimum rate 1½ cents per kw-hour, according to the amount consumed.

COLUMBUS, OHIO.—W. C. Kennedy, custodian of the Federal Building, has awarded the contract for supplying electricity for lighting the government building, located at State and Third Streets, to the Columbus Railway & Light Company. The installation of an electric-light plant in the government building has been abandoned.

COLUMBUS, OHIO.—Bids will be received by the Director of Public Service, Columbus, Ohio, until Aug. 1, for furnishing and installing for 75-lamp rectifier equipments for magnetic lamps, 320 magnetite arc lamps, and two synchronous condensers, plans and specifications for which are on file at the office of the Director of Public Service, Department of Lighting, from whom copies may be obtained. H. S. Hilton is Director of Public Service.

MOUNT VERNON, OHIO.—Sealed proposals will be received by the Ohio State Sanatorium Commission at the office of Dr. C. O. Probst, secretary, State House, Columbus, Ohio, until Aug. 12 for furnishing materials and installing complete the feed wires and yard lamps at the Ohio State Sanatorium, located near Mount Vernon, Ohio, for which plans and specifications are on [illegible] the office of [illegible] of Frank L. Packard, architect, Columbus, Ohio.

NAPOLEON, OHIO.—The plant and holdings of the Napoleon Home [illegible] for $21,000 by R. P. Brown, receiver, subject to the approval of the court.

SHARPSBURG, OHIO.—The Black Diamond Coal & Coke Company has awarded the contract for the construction of power house and coal tipples at Lathrop, Ohio, to E. Elford, of Columbus, Ohio.

TOLEDO, OHIO.—Preliminary plans have been made for the new power building and nearly $25,000 has been raised toward the project. The company will be known as the Toledo Factories Company and will be capitalized at $300,000. It is understood that the company will issue $200,000 in bonds, of which one-half will be issued immediately. The cost of the building complete is estimated at about $360,000.

BARTLESVILLE, OKLA.—The plant and holdings of the Bartlesville Light & Water Company have been sold to Ira L. Kobe, representing bondholders, for $90,000. It is understood that improvements will be made to the plant.

BUTLER, OKLA.—The Town Trustees, it is said, have granted W. K. Kise a twenty-year franchise to construct and operate an electric-light plant in Butler.

CUSTER CITY, OKLA.—Preparations are being made for the construction of an electric-light plant and water-works system in Custer City, bids for which have been asked. The Western Engineering Company, consulting engineers, of Oklahoma City, Okla., has charge of the engineering work.

OKLAHOMA CITY, OKLA.—Arrangements are being made by the Oklahoma Gas & Electric Company for the construction of a substation in the industrial addition south of the Morris packing plant.

CENTRAL POINT ORE.—The Rogue River Electric Company, of Medford, Ore., which supplies electrical service in Central Point, has announced that for the purpose of encouraging factories and industrial plants to locate in Central Point, the company will supply electricity free of charge for one year, providing the new factories started do not compete with industries already established. Dr. C. R. Ray, of Medford, is president of the company.

EUGENE, ORE.—Beginning July 1 electricity for operating the city pumping station has been supplied from the municipal hydroelectric plant at Waterville, 14 miles distant. The plant consists of two units of 2600 hp each, delivering current at 2300 volts, which is stepped up to 22,000 volts for transmission to Eugene. Only a small part of the power generated at the plant is required for pumping the city water, and plans are under way for the installation of a municipal street-lighting system. The proposition to issue bonds to provide funds for same will soon be submitted to a vote. The Oregon Power Company now supplies electrical service in Eugene.

HOOD RIVER, ORE.—The local power plant of the Hood River Light & Power Company will soon be closed down and electrical energy for the local system will be transmitted from the company's power house on the White Salmon River. Transmission lines are now being erected from The Dalles to Hood River. The local power station will be held in reserve for use in emergencies.

KLAMATH FALLS, ORE.—The Klamath Falls Light & Power Company has announced a reduction in the price of electricity of 30 per cent. The meter rate has been reduced from 15 cents to 10 cents per kw-hour, and the flat rate has been reduced accordingly.

KLAMATH FALLS, ORE.—The Rogue River Electric Company, of Medford, Ore., has applied to the City Council for a franchise to supply electricity in Klamath Falls. In the proposition submitted to the Council the company agrees to supply electricity at a lower rate than is now given the city, and in addition would pay the city 5 per cent of the gross profits of the company.

METOLIUS, ORE.—Preparations are being made for the installation of an electric-light system in Metolius this summer. It is proposed to generate electricity in connection with the pumping plant of the town well. It is proposed to secure electrical service later from the power plant now being erected on the Crooked River by Pineville capitalists. Metolius has not a post office.

PANAMA.—Proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until Aug. 4, for furnishing one 500-kva, 25-cycle, three-phase, 2200-volt turbo-generator unit, road roller, hose and creosoted cross ties. Blanks and general information relating to this circular may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officier.

ASPINWALL, PA.—The contract for generator, switchboard, etc., for the municipal electric-light plant has been awarded to the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

CHAMBERSBURG, PA.—The question of making improvements and installing new machinery at the municipal electric-light plant is under consideration.

EAST STROUDSBURG, PA.—The Eastern Pennsylvania Power Company, of Easton, Pa., has applied to the Borough Council for a new franchise in this borough.

ETNA, PA.—Bids will be received at the office of the Borough Council until July 24 for construction of power house and furnishing equipment and machinery, complete, for a new electric-light plant for the borough. Plans and specifications may be obtained at the above office. J. C. Armstrong is clerk.

LEBANON, PA.—Application will soon be made for a charter for the Lebanon & Campbelltown Street Railway Company to construct and operate an electric railway between Campbelltown and Lebanon. The incorporators are M. S. Hershey, J. B. Leithiser, John B. Snyder, S. C. Stecher and F. B. Snavely.

LOCUST GAP, PA.—The new electric plant at the Locust Gap Colliery has been completed. The plant will also supply electricity for lamps and motors at the Potts Colliery, at Locust Dale.

POTTSTOWN, PA.—The City Council is considering the question of submitting the proposition to issue $75,000 in bonds for a municipal electric-light plant to a vote of the people.

SWARTHMORE, PA.—The contract for construction of a power plant, 61 ft. x 176 ft., for Swarthmore College, to cost about $75,000, has been awarded William Provost.

WAYNESBURG, PA.—The Beaver Valley Electric Light Company has taken over the plant and holdings of the Waynesburg Electric Light & Power Company under lease. It is understood that the new company will make improvements to the plant, including the installation of a Westinghouse generator and a gas engine.

YORK, PA.—Plans are being prepared by the Pennsylvania Railroad Company for equipping the Frederick branch between Columbia and Frederick, a distance of 50 miles, for electrical operation.

MANILA, P. I.—Plans are being made by O. M. Shuman, of Manila, for extensions to the electric-light plant which he has leased from the government. Mr. Shuman is in the market for electrical equipment for power house and for lighting and power circuits, and would like to receive price lists and catalogs from manufacturers.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has erected various styles of lamps on Arch Street and Parkis Avenue for the purpose of demonstrating the efficiency of incandescent lamps as compared with arc lamps on streets which are heavily shaded by trees. The company will burn the tungsten lamps on Parkis Avenue for a month so that the city may have an opportunity to decide which is more suitable.

GREENVILLE, S. C.—The Southern Power Company, of Charlotte, N. C., has secured contracts to supply electricity to operate the new Dunean and Westervelt mills in Greenville, now under construction. Each mill is to be equipped with 50,000 spindles with full accompaniment of looms and other machinery, each using about 1500 hp. The new Dunean mill will be equipped for individual motor drive and will require more than 200 small motors.

HONEA PATH, S. C.—The Board of Public Works is reported to have engaged Thomas W. Cothran, of Greenwood, S. C., to prepare plans and take charge of the construction of the proposed municipal electric-light plant, for which bonds to the amount of $11,000 were recently voted.

NEWBERRY, S. C.—The Southern Power Company has recently closed a contract with the Oakland Cotton Mills to supply electricity to operate its mills when completed. The plant will be equipped with 20,000 spindles.

WHITMORE, S. C.—The Glenn Lowery Cotton Mills Company, of Whitmore, has decided to abandon its steam plant and operate its mills by electricity, and has closed a contract with the Southern Power Company, of Charlotte, N. C., to supply energy to the amount of 1500 hp.

SOUTH PITTSBURG, TENN.—The plant of the South Pittsburg Electric Light & Power Company was destroyed by fire July 13. The plant was located in the old pipe works and foundry building, owned by the United States Cast Iron Pipe & Foundry Company, of Chattanooga, Tenn. The total loss is estimated at about $14,000, of which the loss to the electric company is placed at about $8,000. The electric plant, it is said, will be rebuilt at once.

DALLAS, TEX.—Preliminary plans are being prepared by the East Texas Traction Company for the construction of an interurban electric railway between Dallas and Terrell, Tex. Schuyler B. Marshall, of Mesquite, Tex., is president of the company.

DEL RIO, TEX.—Announcement has been made by D. B. Chapin, who is promoting the construction of a large dam across Devil's River and the establishment of a large irrigation system for reclaiming more than 100,000 acres of arid lands in the vicinity of Del Rio, that arrangements have been made for financing the project, provided certain stipulations are complied with in the matter of securing the necessary lands. Mr. Chapin has secured options on 90,000 acres and contracts will be closed for 30,000 acres more. The plans embrace the installation of a large hydroelectric plant and the erection of transmission lines to a number of towns in west Texas. A number of industrial plants, among them a cotton mill, are proposed in connection with the project.

FORT WORTH, TEX.—The holdings of the Citizens' Railway & Light Company, of Fort Worth, Tex., which were sold at a receiver's sale on July 2, were purchased by different interests, the total consideration for the various properties being $660,000. The Arlington Heights & Rosen Heights street railway lines, embracing about twelve miles of tracks with equipment and bonus, were acquired by the Nort Texas Traction Company, for $400,000. The J. R. Nutt Light & Po Company, of Cleveland, Ohio, purchased the electric power plant franchises for $250,000. Lake Como Park, a pleasure resort, was to A. J. Duncan for $10,000. The Northern Texas Traction Comp it is said, will improve the two railway lines and merge them into present system.

HILLSBO'RO, TEX.—The citizens of Hillsboro and adjacent t tory have accepted the proposition submitted by the Southern Trac Company to construct an electric interurban railway, to extend f Dallas to Waco, through Hillsboro. The proposition provides that ferred stock of the company to the amount of $75,000 shall be scribed and the right of way from a point in the northwest portio Hill County through the county to a point south of Abbott, includir franchise through Hillsboro, be donated. J. F. Strickland, of Dalla president of the company.

HOUSTON, TEX.—The City Council has granted the Houston tric Company and the Galveston-Houston Interurban Electric Rai Company a franchise to construct and operate its proposed railway the streets of the city. The franchise also gives the companies right to enter into supplemental contracts with each other for use of tracks in Houston. Both companies are owned and operate the Stone-Webster syndicate, of Boston, Mass.

HOUSTON, TEX.—The General Electric Company has received order from the Houston Lighting & Power Company, of Houston, for a 37-panel switchboard. This switchboard will control one 3000 one 2500-kw, one 1500-kw and two 600-kw generators, all 2500- 60-cycle, three-phase machines. The switchboard will consist of six erators, four exciters, four station auxiliary, two alternating-cur rotary converters, two direct-current rotary converters, one synchro motor, one direct-current generator, five direct-current feeders, alternating-current feeder panels and four blank panels for fu circuits. All alternating-current panels are equipped with new- form K-12 remote-control oil-break switches. The equipment incl a double set of alternating-current buses equipped with knife connecting switches, which also act as selectors between the oil swi and buses.

NEW BRAUNFELS, TEX.—Bonds to the amount of $67,000 been voted by the taxpayers of New Braunfels, the proceeds t used for the construction of a dam across the Guadalupe River for other improvements. A hydroelectric power plant and water-w pumping station will also be installed at the dam.

SAN BENITO, TEX.—Arrangements are being made by the Benito & Rio Grande Valley Railroad Company to extend its gas motor railway to Brownsville. Rights-of-way have been secured the railway to Santa Matia. The company already operates forty of track. Samuel Robertson is president of the company.

WACO, TEX.—A mortgage has been filed on the property of Waco Street Railway Company and the Waco Electric Light & Company to secure an issue of bonds to the extent of $75,000. understood that improvements and extensions are contemplated to systems. The construction of an interurban electric railway is to be under consideration.

PROVO, UTAH.—The Telluride Power Company has filed an am ment to its charter with the Secretary of State, which provides the company may sell and lease surplus water and water rights.

PROVO, UTAH.—Preliminary surveys have been completed for proposed Salt Lake-Payson Interurban Railway. Simon Bambe of Salt Lake City; James S. McBeth, of Payson; W. L. Hayes Pleasant Grove, and others are interested in the project.

DANVILLE, VA.—At an election held July 11 the propositio issue $150,000 in bonds, the proceeds to be used for the installatio a municipal electric-light plant, was carried.

HARRISONBURG, VA.—Plans are being considered for imp ments to the municipal electric plant, the cost of which is estim at about $4,000.

NEWPORT NEWS, VA.—Mayor Jones has notified the New News & Old Point Railway & Electric Company that unless the st car and electric-light service is improved the City Council wil forced to consider the revocation of the franchise. In March the appealed to the State Corporation Commission, which ordered the pany to put its electric plant in repair by July 29.

RICHMOND, VA.—The contract for motors, switchboards and for the new electric-light plant has been awarded to the Westingh Electric & Manufacturing Company, of Pittsburgh, Pa., for $4,455. proposals for pumps were rejected and new bids will be asked.

GOLDENDALE, WASH.—The Northwestern Electric Company purchased the power sites owned by Samuel Hill in the Klickitat G above Lyle. The consideration is said to have been about $20,000.

GOLDENDALE, WASH.—Announcement has been made that have been advertised for by the Northwestern Electric Company for construction of a large dam to be erected at the power site on Big Klickitat River, to cost about $100,000. The company propose build a large hydroelectric power plant at that place at a cost of $500,000. Electricity generated at the plant will be used for muni purposes and for railroad development.

CHARLESTON, W. VA.—The plant of the Charleston Ligh &

[illegible] Company has been [illegible] recently incorporated with [illegible] Boaling, who recently purchased [illegible] [illegible] the company.

[illegible]NTINGTON, W. VA.—The Ohio Valley Electric Railway, it is [illegible], is planning to increase the output of its power plant by [illegible] 60 per cent. New machinery will be installed, including two [illegible] boilers and two 1000-kw turbines. It is also proposed to erect [illegible]

[illegible]MICHEN, W. VA.—The City [illegible] street lighting to the Ohio Valley Electric Company, of Ben-[illegible] W. Va.

[F]OND DU LAC, WIS.—The City Council has voted to install orna-[illegible] lamps on Main Street [illegible]

[M]ILWAUKEE, WIS.—It is reported that negotiations are under [illegible] by the Milwaukee Electric Railway & Light Company for the purchase of the Plankinton Block power plant.

[N]ORTH FREEDOM, WIS.—The plant and holdings of the North [illegible] Light Company have been [illegible] of North Freedom, and A. H. Voeck.

[L]ARAMIE, WYO.—The Goldsborough Engineering Company, recently incorporated with a capital stock of $1,500,000, has contracts for extensive irrigation work near Laramie, Wyo.

[W]INNIPEG, MAN., CAN.—It is reported that water will be turned [illegible] municipal hydroelectric generating station at Point du Bois [illegible] Aug. 15, and the plant will be ready to supply electricity [illegible] Winnipeg by Sept. 15. At first two units of 4000 hp will be [illegible] operation. It is expected that the plant will be able to supply [illegible] Dec. 1. Work is progressing rapidly [illegible] [illegible] distributing system.

[H]AMILTON, ONT., CAN.—The Board of Control has recommended [illegible] submit a by-law to the ratepayers to authorize [illegible] $505,160, for the construction of a plant for the distribution of electricity to be supplied by the Hydro-Electric Power Com-[illegible]

[M]IMICO, ONT., CAN.—The Hydro-Electric Power Commission has submitted a proposition to the Mimico Council offering to install a local plant capable of supplying electricity for fifty street lamps and forty private houses for $7,000, which can be paid for in thirty annual instalments. From 20 hp to 25 hp would be required, which would be sup-[illegible] from the substation at Cooksville.

[O]RILLIA, ONT., CAN.—A smelter for treating ores from the Cobalt mines has been erected by a company organized by Rhode Island capitalists under the laws of Canada. The plant covers nearly ten acres and will be operated by electricity, which will be supplied by the Orillia municipal electric plant.

[P]ORT ARTHUR, ONT., CAN.—Among the by-laws passed recently by the ratepayers is an appropriation of $14,000 for extension of the electric-lighting system and $37,000 for changes to the street railway [illegible]

[T]ORONTO, ONT., CAN.—The directors of the Toronto Railway Company have decided to ask the stockholders to authorize an increase of capital stock of from $8,000,000 to $12,000,000, of which $1,000,000 will be given to shareholders as a stock bonus, $2,000,000 will be issued at par to stockholders, in proportion of one new share for every four shares held, and the remaining $1,000,000 will be held in the [illegible]

[T]ORONTO, ONT., CAN.—The Civic Hydroelectric Commissioner has issued a schedule of rates for the installation of underground services for lighting the streets in residential districts where the ratepayers object to overhead wires and cement poles. The charge for underground construction is $2.50 per foot frontage on each side of the street. Lamps will be erected on single lamp standards placed 100 feet apart. No installation of less than one block will be made.

[W]IARTON, ONT., CAN.—The Council of Wiarton has asked the Hydroelectric Power Commission to submit prices for supplying electrical energy to the amount of 1600 hp to the town.

[Y]ARMOUTH CENTRE, ONT., CAN.—The village of Yarmouth Centre is contemplating the installation of an electric-light system. It is proposed to secure electrical energy from the Hydroelectric Power Commission.

[M]ONTREAL, QUE., CAN.—The City Council is reported to be considering the purchase of the plant and holdings of the Montreal Water & Power Company. The price asked for the property is understood [illegible]

[M]ONTREAL, QUE., CAN.—The Shawinigan Water & Power Company has secured practically all the right-of-way for its transmission line from the power plant at Shawinigan to Montreal. The company is now erecting 70-ft. steel towers to carry the wires. The Montreal Light, Heat & Power Company has contracted to take all the energy generated by the Shawinigan company. The contract calls for [illegible]000 hp in addition to the 23,000 hp always furnished by the power company. A second development has been completed at Shawinigan which will be capable of ultimately developing 75,000 hp, which with the [illegible]000-hp plant in operation, will give a total output of 130,000 hp.

[M]ONTREAL, QUE., CAN.—Announcement has been made by the Canadian Light & Power Company, which controls the Montreal Street [illegible] month from its generating plant at St. Timothée, on the Beauharnois Canal. In about two weeks the first unit of 7500 hp will be put into operation and soon after another unit will be put in commission. It is expected to generate over 25,000 hp within one year. Through the purchase of the Central Light, Heat & Power Company, recently noted in our columns, and its control of the Montreal Street Railway, the Canadian Company has a demand for more electrical energy than it will be able to generate for the next year or so.

SHERBROOKE, QUE., CAN.—The stockholders of the Sherbrooke Railway & Power Company have ratified the purchase of the property of the Eastern Township Electric Company, of North Hatley, Que., and the Stanstead Electric Company, of Stanstead. The Eastern Township Electricity Company furnishes electrical service in North Hatley and several adjacent towns, and the Stanstead Electric Company supplies electricity for lamps and motors in Lennoxville, Rock Island, Beebe Plains, Derby Line, Beebe and Derby Centre, Vt. The Sherbrooke company, it is said, will erect a transmission line from Sherbrooke to Stanstead and will supply electricity to villages along the line.

ZIMAPAM, HIDALGO, MEX.—A concession has been granted to Andrew Mackenzie, of Mexico City, by the State government for the installation of a large hydroelectric plant and the erection of transmission lines to extend to the mines in this district and other industrial centers of the State. The concession gives him the use of water rights of the Moctezuma and Tula Rivers to be developed to generate electricity.

New Industrial Companies.

THE BELOIT LIGHTING & HEATING COMPANY, of Beloit, Wis., has filed articles of incorporation under the laws of the State of Illinois with a capital stock of $30,000, for the purpose of manufacturing and assembling heating and lighting machines.

THE CITY ELECTRIC OMNIBUS COMPANY, of Camden, N. J., has been chartered with a capital stock of $500,000 by F. R. Hansell, J. A. MacPeak and I. C. Clow, of Camden, N. J. The company proposes to manufacture electric passenger buses and vehicles, etc.

THE CONTINENTAL TUNNEL MACHINE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 to manufacture machinery, engines, etc. The incorporators are: J. J. McElhinny, A. J. J. McElhinny and R. D. Eggleston, all of New York, N. Y.

THE ERIE CONSTRUCTION COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $100,000. The incorporators are: S. T. Bush, H. E. Nichols and W. L. O'Rourke, of Buffalo, N. Y. The company proposes to do a general contracting business, construct and repair railways, electric wires, etc.

THE GENERAL ENGINEERING COMPANY, of Cleveland, Ohio, has filed articles of incorporation with a capital stock of $10,000 to do a general electrical business and manufacture electrical equipment. The incorporators are: Charles McChapman, Bertram T. Wiltberger and Ernest B. Traffbow.

THE GRAFTON ELECTRIC CONSTRUCTION COMPANY, of Grafton, W. Va., has been organized with a capital stock of $6,000 to manufacture and deal in electrical and mechanical fixtures and supplies of all kinds. The incorporators are: William Ile, George L. Abbott, W. F. Faust, John F. Caveney and William Archdeacon, of Grafton, W. Va.

THE HOLMES MOTOR COMPANY, of Kittery, Maine, has been incorporated with capital stock of $500,000 to manufacture and deal in and repair engines, motor cars, motor boats, flying machines and all vehicles requiring or using motive power. L. B. Swett is president, and G. E. Burnham, treasurer, both of Kittery, Me.

THE ILLUMINATING PRODUCTS COMPANY, of Newark, N. J., has been granted a charter with a capital stock of $25,000. The company proposes to manufacture a new design of flaming-arc lamp, sign lamp transformers, etc. Plans are being made by the company to erect a plant in Newark, N. J. Steinharter & Jost, 320 Broadway, New York, N. Y., it is said, have charge of the company's affairs.

THE MERCHANTS' ELECTRIC AUTO COMPANY, of Indianapolis, Ind., has been incorporated by Harry B. Stout, M. L. Darrow, John E. Speigel, Charles B. Tingle and H. B. Stout, Jr. The company is capitalized at $50,000 and proposes to manufacture automobiles and electrical supplies of all kinds.

THE NEW PROCESS LIGHTING & HEATING COMPANY, of Laporte, Ind., has been granted a charter with a capital stock of $50,000 for the purpose of manufacturing gas machines, gas engines, gasoline engines and other appliances. The incorporators are: Charles F. Peterson, Charles J. Mudleman, Fred W. Steigely, James Kolar and Harry B. Johnston.

THE NEW YORK DIE-WHITE-SCHROEDER COMPANY, of Owego, N. Y., has been incorporated by A. Dewes, C. W. Dewes and F. White, of New York, N. Y. The company is capitalized at $30,000 and proposes to do a general mechanical and electrical engineering business; also to manufacture dies, tools, machinery, etc.

New Incorporations.

SAN FRANCISCO, CAL.—The Mokelume River Power Company has been incorporated with a capital stock of $3,000,000 by L. Brown, A. H. Elliott, A. M. Sherman, M. E. Logan and S. C. Elliott.

MERIDEN, CONN.—The West Peak Railroad Company has been chartered to build an electric railway from Southington to the summit of West Peak in Meriden. The proposed railway will connect with the Connecticut Company at Southington. C. J. Danaher, of Meriden, is interested in the project.

WILMINGTON, DEL.—The National Water & Power Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $250,000. The incorporators are: H. W. Davis, S. E. Roberson and F. M Shive, of Wilmington, Del.

TOCCOA, GA.—The Appalachian Power Company has been granted a charter with a capital stock of $250,000 and a fifteen-year franchise by the City Council to erect and operate an electric system in Toccoa. The company is planning to develop about 3200 hp. The incorporators are: Louis B. Magid, of Tallulah Falls, Ga.; William Hurd Hillyer, of Atlanta, Ga., and D. S. Wommack, of Toccoa, Ga.

GIBSON, ILL.—Articles of incorporation have been filed for the Central Electric Light, Heat & Power Company by A. Hood, H. L. Clarke and J. Hood. The company is capitalized at $100,000 and proposes to operate a heat, power and light plant.

ODIN, ILL.—The Odin Telephone Exchange Company has been incorporated by James M. Dace, Charles E. Sloan, Lafayette Somerville and J. M. Dace, of Odin, Ill. The company is capitalized at $15,000.

PRESTONBURG, KY.—Articles of incorporation have been filed for the Prestonburg Electric Light Company by Howard Estell, O. P. Powes and J. H. Spaulding. The company is capitalized at $6,000.

ATLANTIC CITY, N. J.—The Atlantic County Telephone Company has been incorporated with a capital stock of $50,000 by F. A. Demarset, of Philadelphia, Pa.; C. W. Caskell and G. W. Stone, of Atlantic City, N. J. The company proposes to operate telephone lines, etc.

BEACH CITY, OHIO.—The Beach City Electric Light & Power Company has been incorporated by A. H. Elliott, Iva Arnold, W. H. Smith, George D. Viere and A. T. Dennis. The company proposes to supply electricity for lamps and motors in Beach City.

NEW PHILADELPHIA, OHIO.—The County Electric Company, of New Philadelphia, has been incorporated with a capital stock of $700,000 by S. L. Louden, H. K. Cavener, L. H. Purcell, M. R. Thornton and H. Miller. The company proposes to lease and operate natural and artificial gas plants and purchase stocks in other companies.

EBENSBURG, PA.—The Cambria Township Light, Heat & Power Company has been incorporated with a capital stock of $5,000 by Thomas D. Davis and Walter Jones, of Ebensburg, Pa., and T. P. Burns, of Nanty Glo.

WEST LEBANON, PA.—The West Lebanon Electric Light & Power Company has been granted a charter with a capital stock of $5,000 to supply electricity for lamps and motors in West Lebanon. The incorporators are: Daniel Weaver, treasurer; Jacob B. Weaver, Henry Weaver, Raymond S. Bicksler and John S. Weaver.

NEW CUMBERLAND, W. VA.—Articles of incorporation have been filed by the Hancock County Electric Company with a capital stock of $12,000 by N. D. Miller, J. F. Flood, H. E. Armstrong, S. E. McCoy and S. D. Stewart. The company proposes to operate an electric plant in New Cumberland and transmit electricity across the river from Freemans by cable or aerial lines.

Personal.

MR. HENRY L. DOHERTY, who is expected back from abroad on Aug. 20, was the guest of the Institution of Gas Engineers at its meeting in Glasgow, Scotland, last month.

MR. CLARENCE P. KING has been elected president of the Washington Railway & Electric Company and the Potomac Electric Company, Washington, D. C., succeeding Mr. C. F. Norment, resigned.

MR. JAMES H. WISE, who has for the past eight years been with the Pacific Gas & Electric Company, has been appointed assistant general manager of that corporation with headquarters in San Francisco.

MR. W. I. BARCLAY has been appointed chief engineer of steam plants of the Portland Railway & Light Company, Portland, Ore., to succeed Mr. B. W. Slocum, who has become general manager of the Oregon Dry Dock Company.

MR. R. H. FENKHAUSEN, who for the past six years has been chief electrician at the Risdon Iron & Locomotive Works, has joined the staff of the Union Iron Works Company, of San Francisco, as electrical engineer.

PROF. C. L. CORY, of the University of California and of San Francisco, has been retained by President Huntington, of the Washington Water Power Company, to make an independent valuation of the company's holdings in and near Spokane.

MR. E. S. LINCOLN will build at Brookline, Mass., a laboratory for testing purposes and research work, one of the features of which be an equipment for high-voltage testing, including a 200-kw transfor with its secondary wound for 400,000 volts.

DR. GEORGE L. HOXIE, New York, who recently served as cons ing engineer for the Board of Public Utilities in fixing the energy r in Los Angeles, is now in San Francisco investigating certain hydroe tric and irrigation properties for the owners of which he is acting as c sulting engineer.

MR. PHILIP TORCHIO, electrical engineer of the New York Edi Company, was recently honored by the Italian government with decoration Cavaliere of the Crown of Italy. The decoration is usu bestowed in recognition of meritorious work or signal service to government or people.

MR. ALEX. DOW, of Detroit, Mich., who has been acting as c sulting engineer for the Toronto Hydroelectric System, which tributes energy purchased from the Hydroelectric Power Commiss of Ontario, in Toronto, Ont., no longer acts in that capacity, hav tendered his resignation a few weeks ago.

MR. D. A. HEGARTY has been appointed general manager of the r way and lighting departments of the New Orleans Railway & Light C pany, New Orleans, La. Mr. Hegarty, who is a graduate of the Univer of Pennsylvania, was formerly vice-president and general manager of Little Rock Railway & Electric Company, Little Rock, Ark.

MR. GEORGE W. MARTIN, at one time editor of the *Electrical A* and more recently connected with the publicity department of the Babc & Wilcox Company, has become associated with the New York Serv Company as general manager. The company is engaged in power-pl management, building management and steam-heating work.

MR. CLYDE W. TORREY, superintendent of the Avon (N. Y.) E tric Company for twelve years, has resigned to take a position with Long Island Lighting Company at Islip, L. I. Four electric compan have been recently merged on Great South Bay and Mr. Torrey have charge of these concerns and the construction of 70 miles of t transmission lines. Frederick Rowe, engineer of the Avon station, been promoted to succeed Mr. Torrey as superintendent.

MR. JAMES H. WISE, who was recently appointed assistant gene manager of the Pacific Coast Electric Company, was formerly emplo by this company, dating from his graduation from the University California in 1903, to 1910, when he resigned as hydraulic engineer the company to become hydraulic engineer with F. G. Baum & Compa His present work will cover the construction of new steam and hyd electric plants and additions to older plants of the company.

MR. CHARLES J. GRIFFITH has been appointed general supe tendent of the Little Rock (Ark.) Railway & Electric Company to s ceed Mr. D. A. Hegarty in charge of operation. Mr. Griffith has b with the company since 1892, except for a few years when he was c nected with the Southern Engineering Company, installing electric-li plants and water-works. Until his present promotion he was superinte ent of the railway department of the company, which is a Ford, Bacon Davis property.

MR. JAMES D. MORTIMER, vice-president and secretary of the No American Company, has been appointed vice-president of the Un Electric Light & Power Company and will take active charge of affairs of the company until a permanent successor to former Pr dent Alten S. Miller is elected. Mr. Mortimer, who has been act as general manager of the Milwaukee Electric Railway & Light Compa since the resignation of Mr. John I. Beggs, will divide his time betw St. Louis and Milwaukee.

MR. C. L. CAMPBELL has been elected treasurer and purchas agent of the Dayton Power & Light Company, with office in Dayt Ohio. Mr. Campbell has been with the New York, New Haven & Ha ford Railroad Company trolley properties for the past ten years. was made auditor of the Consolidated Railway Company in June, 19 and continued in charge of the accounting department of the trolley a lighting companies controlled by the New Haven road until June when he resigned to accept the above position.

MR. J. G. HENNINGER, of Cleveland, Ohio, delivered an addr on "Jewelry Store and Window Illumination" on June 27 at the ann convention of the Ohio Retail Jewelers' Association, which was h at Cedar Point, Ohio, June 26-28. Mr. Henninger's paper dealt w the various factors to be considered in the choice and location of lan and of reflectors for satisfactory and efficient results. The talk v illustrated by stereopticon, and was supplemented by a demonstration several types of reflectors, showing their respective fields of usefulne

MR. C. A. CAHILL was appointed chief engineer of power plants the Milwaukee Electric Railway & Light Company on July 1, succeed Mr. C. J. Davidson, who resigned to engage in consulting engineer work in Chicago. Mr. T. D. Crocker has also been appointed super tendent of heating for the Milwaukee company, assuming charge of w formerly under the direction of Mr. Davidson's department. Both M Cahill and Mr. Crocker have been associated with the company for number of years, in immediate charge of the departments whose w they now direct.

MR. MASON B. STARRING has been elected president of the Chica Oak Park Elevated Railroad Company, succeeding the late Clarence Knight. Mr. Starring is now president of the Northwestern Elevated R road Company of Chicago, and as the two companies are closely as ciated, the choice is a natural one. Like Mr. Knight, Mr. Starring is,

[illegible] by profession. He was formerly [illegible] and [illegible] manager of the Chicago City Railway [illegible]. He [illegible] modern school of public-utility operators and is noted for his frankness in dealing with the public.

MR. ARTHUR WILLIAMS, chief inspector of the New York Edison Company, will sail on the steamship [illegible] semi-business trip abroad. Mr. W[illegible] and Leipzig and if time permits will motor through parts of Ireland and southern France, returning to New York in September. He will seek electrical novelties for the coming New York Electrical Exhibition, but will interest himself chiefly in studying certain phases of welfare work, such as the co-operative protection movement against non-employment existing in Leipzig and social economics as exemplified by Mr. Lloyd George in [illegible].

MR. H. W. BRIGGS has been [illegible] the Westinghouse Electric & Manufacturing Company, with headquarters at San Francisco and with jurisdiction over the Pacific Coast. Mr. Briggs has been engaged in the electrical business since 1886, when he began as a boy in the arc lamp department of the California Electric Light Company. Later he was connected with the Electric Improvement Company, and for three years, from 1893, was electrician for a mining company in Idaho. In 1896 he joined the sales force of the Fort Wayne Electric Company, and became connected with the sales department of the Westinghouse company in 1899, becoming district manager in 1905, which position he held up to the time of his present appointment.

MR. OSBORN MONNETT has been appointed smoke inspector of the city of Chicago by Mayor Harrison, succeeding Mr. Paul D. Bird, resigned, and the appointment has been confirmed by the City Council. Mr. Monnett, who has been Western editor of *Power*, was named on the recommendation of the chairman of the Smoke Abatement Commission, which is an advisory committee of citizens. His practical experience in power-plant operation, embracing railroad, marine and stationary work and covering a period of twelve years, followed by five years in technical journalism, make him well equipped for his new position. Mr. Monnett has resigned his editorial position and will give his entire time to his new duties as soon as he can arrange his business affairs to that end. The salary of the smoke inspector is $4000 a year.

Trade Publications.

VACUUM HEATING.—Warren Webster & Company, Camden, N. J., have just puublished an attractive pamphlet entitled "Webster Vacuum Heating System in the Boston City Hospital." It describes the installation in the face of unusual obstacles of their "Hy-Lo" or Type "D" system in twenty-six buildings of this hospital.

ALTERNATING-CURRENT POTENTIOMETER.—H. Tinsley & Company, Eldon Park, South Norwood, England, have issued a descriptive price list of Dr. C. V. Drysdale's alternating-current potentiometer. The list touches only on some of the applications of the instrument, but enough to allow one to judge of its wide possibilities.

DISPATCHER'S SIGNALS FOR ELECTRIC INTERURBAN RAILROADS.—Bulletin No. 1001 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., describes in detail the dispatcher's signal system, which is a standard semaphore controlled electrically by the train dispatcher, the semaphore being located at each siding or turn-out.

ELECTRICALLY DRIVEN LAUNDRY MACHINERY.—The Hurley Machine Company, 21-39 South Clinton Street, Chicago, is sending out attractively illustrated circulars showing applications of the Thor electric laundry machines for private residences, apartment houses, public institutions, etc. One motor is connected to washing machine and wringer, so that washing and wringing may be done at the same time.

BUSINESS NOTES.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, of Chicago, has been incorporated to manufacture and sell electric fixtures and specialties. The incorporators are: E. O. Immel, George N. B. Ives and Lester L. Falk.

THE B. F. STEVENS STAVE COMPANY, of Martinsville, Va., has bought the insulator pin and bracket business of the Pilliod Lumber Company, of Swanton, Ohio, and is now prepared to furnish oak pins [illegible] in large quantities.

REWINDING OF TRANSFORMERS.—Owing to the Sanitary District of Chicago having changed its lighting distribution from 12,000 volts to 440 volts, the Pittsburgh Transformer Company will rewind 20 transformers for the new service, the sizes varying from 5 to 50 kw.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, has taken the agency for the Everson Manufacturing Company vacuum cleaning machines, of which demonstrations will be made at the Metropolitan main store, 180 West Lake Street, and branch store, 6 East Jackson Boulevard.

PRIZE FOR KNIFE SWITCH "SLOGAN."—[illegible] offered as a prize by the Mutual Electric & Machine Company, Wheeling, W. Va., for a "slogan" for "Bulldog" knife switches will be announced the first week in September. The Mutual company states that thousands [illegible]

MR. HARRY J. MARKS will hereafter act as the sole agent in the Metropolitan district for the American Engine Company, Bound Brook, N. J. Mr. Marks has installed a large number of American-Ball engines, including both simple engines and the American-Ball Angle compound engine, under a great variety of conditions and for different services.

THE CUTLER-HAMMER MANUFACTURING COMPANY has added 70,000 sq. ft. of manufacturing area to its Milwaukee factory, through its extension across the street to a large modern two-story building formerly occupied by a woodworking establishment. A number of improvements are also being made in the buildings which form the principal group of the Milwaukee factory.

FEDERAL UTILITIES, INCORPORATED.—Messrs. James M. Rhett, formerly with R. L. Day & Company; Bayard C. Hopping, formerly with Post & Flagg and Lee, Higginson & Company, and Wallace L. Durant, formerly with Millet, Roe & Hagen, have become associated with Federal Utilities, Inc. These gentlemen will act as representatives of the company in negotiating securities.

THE W. K. PALMER COMPANY, of Kansas City, Mo., has recently contracted with the Texas, Gulf & Northern Railway Company for all surveys, reports and other engineering work required in connection with this company's proposed new line from Tucumcari, N. M., to San Antonio, Tex., a distance of between 500 and 600 miles. Engineering corps will be put in the field at once and the work pushed to completion as rapidly as possible.

TAYLOR STOKERS—The American Ship Windlass Company reports two notable orders just received for Taylor stokers. The first is for twelve stokers for the New York Edison Company, making a total installation in the Waterside station of Taylor stokers for 52,650 hp of boilers. The second is for five Taylor stokers for the United States naval gun factory at Washington, D. C. These stokers are to be used under 300-hp water-tube boilers.

W. IRWIN CHEYNEY, Philadelphia representative of the Diehl Manufacturing Company for the past nine years, has resigned his position and will represent another company in the same territory with a complete line of apparatus, at a location to be announced later. Mr. Cheyney has an extensive acquaintance throughout Pennsylvania, New Jersey, Delaware and Maryland, and has been in the electrical machinery business for the past twenty-two years.

PITTSBURGH TRANSFORMERS.—A sectional catalog issued by the Delta-Star Electric Company, Chicago, is devoted to an exposition of the Pittsburgh Weatherproof transformers for use in securing new business along transmission lines. Recommendations are made as to the best method of installation, lightning protection and grounding of the secondary system. A complete description is also given of Delta-Star high tension specialties for both indoor and weatherproof mounting.

COLUMBIA LAMP MAIN SALES OFFICE.—The main sales office of the Columbia Incandescent Lamp Company, which has been located for the past nine years with the works at 2115 Locust Street, St. Louis, will be moved about Sept. 1 to the fifth floor of the Equitable Building, northwest corner Sixth and Locust Streets, St. Louis, Mo. This removal will bring the sales office of the Columbia company to the center of the business activity of the city, making it more convenient for visiting customers.

HICKS' VOLTAGE REGULATOR FOR AUTOMATIC HYDROELECTRIC SERVICE.—M. A. Hicks, Springfield, Vt., has received an order from Lewisburg, W. Va., for a direct-current relay mounted in a cabinet, together with a set of worm gear, worm friction clutch, etc., for a voltage regulator to control a small hydroelectric plant which will operate automatically. This is a duplicate of apparatus supplied by Mr. Hicks in 1905 to a plant in Hartland, Vt., which was described in these columns, and which continues to operate successfully without regular attendance.

THE KNICKERBOCKER CONSTRUCTION COMPANY, with offices in the Hudson Terminal Building, New York City, has opened a Chicago office at 912-913 Medinah Building, in charge of Mr. Russel N. Edwards, as Western manager and chief engineer. Mr. Edwards was graduated from Purdue in 1903 and served four years with the Arnold Company, following which he was associated with Mr. R. S. Feurtado, consulting engineer, also of Chicago. The Knickerbocker Company acts as engineer, constructor and operator of electric railways, electric-lighting plants, transmission systems and other public utilities.

GENERAL MOTORS COMPANY'S ENGINEERING LABORATORY.—Arthur D. Little, Inc., chemists and engineers, Boston, Mass., have been selected to organize and direct an engineering department for the General Motors Company, Detroit, Mich. Mr. D. T. Randall, the resident director, has been connected with the former organization for some years, and has had extended experience in engineering problems as well as in the equipment and direction of several testing laboratories. Mr. Randall was formerly professor of mechanical engineering at the University of Illinois, and later was in charge of the fuel investigations and producer and gas-engine tests carried on by the United States government. He will be assisted in his new position by several men detailed from the Arthur D. Little, Inc., organization.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 11, 1911

Prepared by Robert Starr Allyn, 16 Exchange Place, New York

997,262. ELECTRIC TROLLEY WHEEL; W. H. Mean, Ferndale, Pa. App. filed Dec. [illegible], 1910. The grooved hub has a limited rocking motion while the extended flanges run true.

997,280. ELECTRIC CONTROLLER; A. C. Eastwood, Cleveland, Ohio. App. filed Sept. 24, 1910. A master controller and resistance cut-outs with windings to prevent operation of the master while a resistance cut-out is closed.

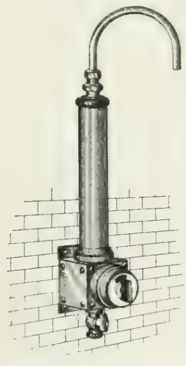
997,282. INTERIOR-CONDUIT DISTRIBUTION; F. W. Erickson, New York, N. Y. App. filed Oct. 14, 1910. "Sheet-metal-molding" joint, fitting or connection.

997,288. CONNECTING CIRCUIT FOR TELEPHONE EXCHANGES; E. D. Hall, New York, N. Y. App. filed Dec. 8, 1910. A connecting circuit for uniting lines of different character, having manual and electromagnetic means independently governing the inclusion of inductive means.

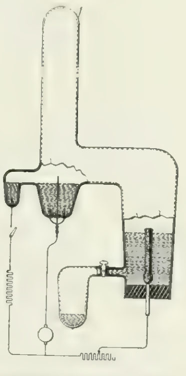
997,295. SMOOTHING DEVICE; A. Hofheimer, York, Pa. App. filed Dec. 8, 1910. A die supported by an angular hood and with a burner beneath. For ironing down an insulating coating on an electrical conductor.

997,308. TRANSMITTING APPARATUS FOR WIRELESS TELEGRAPHY; G. Marconi, London, England. App. filed July 15, 1910. A battery of low resistance in an oscillation circuit has moving terminals and bridging pieces rotated rapidly between them.

997,316. ELECTRIC SWITCH; J. Morse and F. T. Kaelin, Montreal, Canada. App. filed June 17, 1909. A knife switch for large capacity, with a lock.



997,670—Electric Water Heater.



997,882—Electric Furnace.

997,332. CIRCUIT-BREAKER; W. M. Scott, Philadelphia, Pa. App. filed May 25, 1910. A sensitive lock for a non-closable switch. A laminated main contact, a metallic shunt contact and a carbon shunt contact.

997,337. MAGNETIC SHIELDS FOR ELECTRIC MACHINES; C. H. Smoot, Chicago, Ill. App. filed Feb. 16, 1907. Stationary cylindrical shields of magnetic material surround the end portions of the rotor and cover the metal retaining bands. For high speed.

997,339. OZONIZER; Jan Steynis, New York, N. Y. App. filed Sept. 15, 1909. A hollow electrode containing an insulating liquid and a cooling pipe therein. One side of the high-tension circuit and the cooling device are grounded.

997,397. CIRCUIT CONTROLLER; A. C. Livermore, Edgewood Borough, Pa. App. filed March 16, 1911. Operated conjointly by switch-operating mechanism (see Patent No. 329,643) and by switch rails. Means for moving the contacting members and for holding them.

997,406. KEY-SOCKET SWITCH MECHANISM; H. J. Morey & F. A. Brogden, Syracuse N. Y. App. filed March 1, 1911. Rotating key and cam for moving a metal yoke into contact position and a spring for lifting. Double make and break for incandescent lamp sockets.

997,413. ELECTRIC INCANDESCENT LAMP; H. C. G. Remané, Berlin, Germany. App. filed Oct. 3, 1905. A metallic member has a smooth globular portion in which the filament is embedded by fusion and sudden cooling.

997,458. ELECTRIC BRAKE; J. N. Mahoney, Wilkinsburg, and W. M. Austin, Swissdale, Pa. App. filed Aug. 29, 1908. The running controller of a car is also employed for breaking by moving the handle backward from the usual "off" position. The axis of the handle is eccentric to an axis of rotation.

997,463. ELECTRIC HEATER; F. P. Mies, Chicago, Ill. App. filed Jan. 25, 1910. A heating conductor is wound on the blades of a fan in a casing. A switch automatically closes the circuit when the fan reaches a predetermined speed.

997,467. ELECTRIC COOKER; W. Nichols, Denver, Col. App. filed March 11, 1910. A combined heater and "fireless" cooker. Heating coils are arranged in a disk (on legs) to be inserted in a non-heat-conducting receptacle.

997,515. SIGNALING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Nov. 15, 1910. "Wireless" transmitter. A link circ having inductance and substantially no capacity transfers ene from a high-frequency oscillation producer to a radiating conduct

997,516. RECEIVING APPARATUS; H. Shoemaker, Jersey City, N. App. filed Nov. 15, 1910. "Wireless" receiver. A division fro Patent No. 997,515. A link circuit having inductance and su stantially no capacity is in inductive relation with an aerial receivi conductor and a receiver circuit.

997,[illegible]. CONTROLLER; M. S. Towson, Cleveland, Ohio. App. fil May 19, 1909. A motor having two sets of field-coil sections and controller having means for varying the relation of the sections one set with respect to one another and for varying the number effective sections of the other set.

997,576. TROLLEY FOR ELECTRIC RAILWAY; J. H. Mountai Terre Haute, Ind. App. filed March 31, 1911. A "harp" yielding held against rotation in a tubular pole. Tubular bosses for t wheel engaged by springs.

997,579. DYNAMO-ELECTRIC MACHINERY; C. A. Parsons and H. Law, Newcastle-upon-Tyne, England. App. filed July 9, 190 Auxiliary conductors in the air gap (of a rotating armature) co nected in parallel with embedded conductors to reduce tendency spark.

997,589. MIXTURE FOR COATING ELECTROTYPE-MOLD FORM; A. J. Williams, Washington, D. C. App. filed Dec. 14 191 Graphite, lampblack and alcohol. The wax impression surface first coated with graphite and alcohol.

997,590. INDICATOR-ACTUATING MECHANISM; T. P. Wilson, L Angeles, Cal. App. filed March 14, 1910. A track switch for ele trically actuated station indicators. A depending arm from the car forced into contact with the rail.

997,594. TELEPHONE REPEATER; W. Anderson, Longdale, Okl App. filed Nov. 12, 1909. For long-distance work. Two transmi ters, two receivers and two inductoriums.

997,597. CURRENT COLLECTOR OR TROLLEY; W. Arter, Ric mond Hill, N. Y. App. filed Dec. 28, 1908. A contact roller jou naled in the ends of a resiliently supported frame, resilient suppo ing arms for supplemental conductors mounted between parall plates on the frame.

997,598. LOCK FOR SOCKET SHELLS; T. A. C. Both, New Yor N. Y. App. filed April 29, 1911. Locking bolts parallel to t axis pass through flanges in the body and screw into a flange the cap. For use in "husks."

997,610. PROCESS OF MAKING ONE-PIECE RADIATOR SECTION; F. A. Feldkamp, Vailsburg, N. J. App. filed Sept. 15, 1910. Tv deposits are electrolytically made on a core and the core removed.

997,651. TELEGRAPHIC RECORDING APPARATUS; T. McClella De Bingham, London, England. App. filed July 22, 1910. T rays of light from a meniscus in a capillary tube pass through microscope and are received on a photographic plate.

997,670. ELECTRIC WATER HEATER; J. H. Hallberg, New Yo N. Y. App. filed Jan. 31, 1908. A tapered heating coil is position in the heater so that water may flow therethrough. Attached the base of the faucet.

997,681. COMBINED THROTTLE AND AUTOMATIC STOP VALV A. W. Lenderoth, Stapleton, N. Y. App. filed Nov. 19, 1910. F protecting steam engines (etc.) from overspeeding in case governor failure.

997,692. SIGNALING APPARATUS; C. P. Nachod, Philadelphia, P App. filed Oct. 13, 1908. Railroad block light and disk in casing.

997,756. TELEPHONY; G. C. Cummings, Western Springs, Ill. Ap filed Oct. 14, 1909. Connection between substation and central st tion. The telephone receiver at a called station constitutes t signal receiver.

997,759. ELECTRIC SWITCH; C. W. Denny, Kennsington, Londo England. App. filed July 30, 1910. Automatic tumbler for lighti or small power circuits.

997,768. PROCESS OF MAKING ONE-PIECE RADIATOR SE TIONS; F. A. Feldkamp, Vailsburg, N. J. App. filed Sept. 1 1910. Division from Patent No. 997,610. Metal is deposited on t surface portion of the core within the opening and outwardly.

997,838. THERMO-ELECTRIC CIRCUIT-BREAKER; E. W. Leep Chicago, Ill. App. filed May 28, 1904. A toothed wheel is secur by a heat-susceptible compound on a resistance rod. A sprir controlled mechanism controls catch and tends to turn the rod.

997,879. TREATMENT OF REFRACTORY MATERIALS; E. Wei traub, Schenectady, N. Y. App. filed Dec. 4, 1906. Impure bor is heated in a mercury-vapor arc. The product is washed a decanted.

997,880. TREATMENT OF REFRACTORY MATERIALS; E. We traub, Lynn, Mass. App. filed Dec. 4, 1906. Division of Pat No. 997,879. A conducting body is treated as an anode in mercury-vapor arc operating in hydrogen.

997,881. APPARATUS FOR THE TREATMENT OF REFRACTO MATERIALS; E. Weintraub, Schenectady, N. Y. App. filed D 4, 1906. Division of Patent No. 997,879. A mercury-arc co tainer serves as a furnace.

997,882. ELECTRIC FURNACE; E. Weintraub, Lynn, Mass. App. fil July 2, 1906. A furnace charge serves as anode for heating arc in sealed envelope. Division from Patent No. 997,883.

997,883. TREATMENT OF REFRACTORY MATERIALS; E. We traub, Schenectady, N. Y. App. filed July 2, 1906. A powder (su as tantalum) is compressed unto a coherent body and used as anode in an envelope with a mercury arc.

997,897. ELECTRIC RAILWAY SWITCH-OPERATING MECHA ISM; H. L. Blattle, Providence, R. I. App. filed Dec. 27, 19 The switch tongue is thrown automatically by the use of elect magnets controlled by the motorman.

997,924. THERMO-ELECTRIC CIRCUIT-BREAKER; E. W. Leep Chicago, Ill. App. filed May 28, 1904. Division from Patent 997,838. Self-soldering; may be used also as a push-button swi

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A NOTABLE RAILROAD ELECTRIFICATION.

Switzerland has been the scene of so many notable feats in electric-power utilization that one is not at all surprised at new evidence of activity. An article published in our columns this week shows how the work of electrification of railways is proceeding in that country, unhampered by those obsessions of standardization that have blocked progress in some other countries that might be mentioned. The road in question is the Loetschberg line, which forms a part of the communication through the Alps to Italy, running from Spiez to Brigue, where it joins the Simplon line that reaches through the great tunnel to Milan. The line through the tunnel is, as our readers will remember, an electric one worked with three-phase locomotives, which have proved highly successful. The present system, in all 40 miles in length, is a fine example of heavy mountain work, devoted in the main to through traffic and having many severe grades and sharp curves. At present the completion of the line awaits the finishing of the Loetschberg tunnel, but one section is already in service and the steam locomotives have been replaced by electric ones. These are two in number at the start, one of 2000 hp and the other of 1600 hp. The larger of the pair, which we fully illustrate, is of more than usual interest as being a recent example of the best European single-phase practice. The best-known single-phase locomotives in this country are greatly handicapped by the necessity of a complete double equipment outside of the motors to meet the necessity of working on direct current at the terminus. Freed of this difficulty, the single-phase machine is much simpler in its connections and, in general, much more advantageous. The present example is a 90-ton machine, with twelve driving wheels under a pair of three-axle bogie trucks. The striking feature of the motor drive, well shown in one of the cuts, is the ingenious way in which one motor rigidly geared to a countershaft drives all three axles on its bogie by means of connecting rods. Every ounce of weight thus becomes available for traction, and it is not surprising therefore to find a drawbar pull rising to 28,000 lb.

The motors, on account of the nature of their work, are not designed for high speed, the maximum required being only 43.5 miles per hour and the ordinary running speed being only about two-thirds of this. Each motor weighs a little less than 10 tons, so that the output with respect to weight is excellent and this advantage seems to have been gained without any material sacrifice in electrical qualities, since the motor efficiency is found to exceed 90 per cent at one-half to full load and the power-factor at anywhere near the normal speed is above 95 per cent. The motor voltage is about the same as in American practice, being 440 at the maximum, the line voltage is 15,000 and the periodicity 15. The overhead work is the customary catenary con-

struction, and the trolley the usual pantograph and bow. The details of the control seem to be very thoroughly worked out, and the whole equipment seems very business-like. The choice of the single-phase system for this mountain line is quite in accordance with recent foreign practice, the European engineers having with few exceptions looked with little favor on the third-rail equipment with its costly distributing system, especially since most lines so far electrified have been characterized by somewhat moderate traffic. What the European choice would be for fast trunk-line service remains to be seen, but we think it safe to predict that it would not include a direct-current feeding system. It is rather interesting to speculate, by the way, upon the probable effect upon electric traction should the high-output mercury rectifier be brought successfully through its experimental stage, as now seems quite likely. Would the third-rail brigade still stand by their intrenchments, or would they execute a sudden change of base and trust to outflanking the alternating-current hordes by working a transformation upon the locomotive itself? Certainly things would begin to happen in very short order. In any event, such a system as we are here considering is able to give a good account of itself in any company, for it is skilfully designed and executed in a most workmanlike manner

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APPROXIMATE METHOD OF DETERMINING POWER-FACTOR.

The usual method of measuring power-factors in single-phase circuits is to measure the volt-amperes by the product of the simultaneous readings of a voltmeter and an ammeter, and the watts by a wattmeter in the same circuit. The ratio of the watts to the volt-amperes is the power-factor of the circuit beyond the point of measurement. This method involves, however, the simultaneous use of a voltmeter, an ammeter and a wattmeter, each adapted in range to the particular conditions under observation. In the article which appears on page 273 Prof. C. M. Jansky points out a useful method of measuring power-factors on two-phase or three-phase circuits of properly balanced voltage, involving only the use of a pair of ammeters and the ratio of their simultaneous readings. With suitable switching connections a single ammeter inserted successively in two branch circuits can be made to serve, thus reducing the instruments required to one ammeter, the switches and two banks of lamps.

The principle of deriving any required difference in phase from two-phase or three-phase circuits in this way has been known for some time, having been first set forth in an article by Dr. Kennelly in our columns in the issue of Aug. 10, 1899, but its adaptation by Professor Jansky to the measurement of power-factors with a single ammeter is ingenious and seems to be new. It is not claimed, of course, that this double-ammeter method is more precise than the voltmeter-ammeter-wattmeter method, when carefully calibrated instruments are available; but that in small stations, with limited instrument equipment, it is much more probable that a suitable ammeter will be available than the three instruments of the ordinary test. Moreover, even if the three instruments are forthcoming, but are not in accurate calibration, it is likely that the ratio of tw readings on one and the same ammeter will be more near correct than the ratio of one reading on a wattmeter to tl product of an ammeter and a voltmeter reading. Inciden ally, it may be observed that substantially the same pl may be carried out, with only a little more complicatio by employing two successive readings of a voltmeter acro resistances, instead of two successive readings of an ar meter in the circuits; so that the principle of the meth may still be employed when a voltmeter, instead of an ar meter, is the only measuring instrument available. Wat hour meters are held up to more rigid specifications accuracy at the present time than they were expected meet a few years ago. A commercial watt-hour met registering under full load on a circuit at 50 per ce power-factor, or less, is placed at a considerable disa vantage, and it is behaving well if its indications a within 4 per cent of the truth under these conditions. (course, carefully calibrated new instruments can, and c register more precisely than this; but the instrume which has been long in service and has suffered so deterioration is the one apt to fail under such tests.

THE ENGINEER AND PUBLIC-SERVICE COMMISSIONS.

Three of the papers presented at the Chicago conventi of the American Institute of Electrical Engineers show the importance of the position occupied by the public-se ice commissions as intermediaries between the consumi public and the public-service corporations. In his presid tial address Professor Jackson emphasized the need of policy of fairness toward both interests, and the parti pation by the engineer in the future relations between companies and the consumers upon whose patronage former thrive, which latter point was reiterated later by M John W. Lieb, Jr. Perhaps if there had been more gineering and less promotion and speculative banking in affairs of these companies in the past, the public would have been so insistent on rigorous legislation for the regu tion of public-service corporations. However that may the established properties require now a wholesome ch acter of business management, to which the engineer contribute in a great and increasing degree, and the sp of the times makes it logical for the engineer to assum leading place in the management of public utilities. questions of capital value and the life of materials, a lateral part of the study of depreciation, are in partic issues for the engineer and the accountant to meet, and t involve the very life of the companies. Among the comp relations with which the engineer and the commission ar deal, these two questions stand forth to demand earnest just consideration. The full and frank public statements financial results which Professor Jackson recommends help in making fair decisions and a public spirit un which these questions will lose their threatening aspec

In discussing at length the subject of appraisals, Byllesby makes a plea that the commissions be compose men who are conversant with the business over which t hold jurisdiction. Some of the commissions have one m ber who has had practical experience in a branch of on

he several classes of public utilities, but this is held to be nadequate representation, and the attempt to overcome the efect is generally limited to the employment of experienced ssistants. In the make-up of the commissions it has been ssumed, as a rule, that these bodies were constituted to rotect the public from the ravages of the corporation; but ince the corporation needs protection from certain elenents of the public, the commission, whatever training its nembers may have had, should exact justice without partiality. One objection to service as a member of a commission is that the salary is usually smaller than that which can e secured from a corporation in a position of corresponding esponsibility. Another is that tenure of office is uncertain whether the service rendered has been faithful or otherwise, nd this consideration repels good men. New York State, for instance, has only recently furnished two examples of ne retirement of thoroughly competent commissioners, one f whom was a specialist in transportation matters, to make lace for political favorites. Still another reason, which e think ought to have no foundation in actual experience, r the idea that if a man leaves a corporation and goes to commission, he is making unfair use of his experience and ill harass corporate interests in the future. A competent nan should be able to keep his self-respect and serve either ne corporation or the commission, passing from the one to ne other. Mr. Floy in his paper on depreciation wisely advocates the uniform use of terms and an equally thorough onsideration of all phases of public-service problems. That his is a duty which engineers should not ignore every one who is familiar with current court and commission decisions will admit. The engineer and the corporation should not eave the study of principles entirely to the commission. Having a direct interest in the solution of the problems, they hould investigate to the fullest extent that their means will ermit, and by advocating reasonable and satisfactory ourses they should lead, rather than be led by, the commisions.

ARM-WEATHER SUGGESTIONS.

The recent long-continued period of unusually warm eather over a large portion of the United States emasized the fact that electrical energy offers a convenient ethod of alleviating summer temperatures in several direcons. These advantages are exploited by the larger and ore enterprising electric-service companies, but there are obably thousands of the smaller companies that do not easure up to their opportunities in pressing home to conmers—almost literally striking while the iron is hot—the arm-weather benefits that may be had by the public genally by the varied uses of electricity. Six weeks of mmer still remain, probably, and now is the time for the ant manager to convince his present or prospective cusmer, while the recollection of temperatures of from 90 g. to 100 deg. is still fresh in his mind, that he and his mily, or his employees, can work or play with greater ficiency and comfort by taking advantage of electrical encies. This is in particular an excellent time for the lesman to direct attention to the fact that, of all forms commercial illuminants, electric lamps dissipate the least eat. The merchant should be in a receptive frame of mind just now to consider the tungsten cluster for his store rather than the gas "arc" or other forms of lighting; and after the recent "hot spell" the slight increase of cost—should there be any, and there may not be—may not look so formidable.

Ice was in almost unprecedented demand during the warm-weather period and the importance of methods of refrigeration also was greatly accentuated. In many localities there was fear of ice famine, and in numerous instances ice companies raised their prices 50 per cent or more. The ice situation is one to which the central-station company should give the most careful study. This journal has made an especial effort during the last two years to point out central-station possibilities in relation to ice-making and refrigeration. A mass of information has been presented which should be of especial value at the present time. Many electric-service companies may engage profitably in ice making direct. Others may find it more practical to sell electrical energy to outside ice producers. In addition, there is the supply of electrical energy to refrigerating plants, from the large systems used in warehouses and stores to the small domestic sizes adapted to houses and apartments. The probability of a notable electrical expansion in the direction of ice making and refrigeration seems to be most promising, and few, if any, central-station companies can afford to neglect to give the subject careful attention. Of course, the comforting electric fan has been an alleviator of summer weather conditions for many years, but this year the demand in cases far exceeded the supply, although unusual preparations had been made before the season began. Aside from the increase in connected load, the little rotary fan is one of the best possible advertisers of electricity. "You realize the convenience of the electric fan," says the enterprising solicitor; "why not use electricity also to drive the sewing machine or to operate a vacuum cleaner or a washing machine?"

Electric heating and cooking devices are particularly appreciated in warm weather. Consider that boon to housewives, the electric flatiron, making possible ironing on the porch, upstairs in the sewing-room, or in any place that is cool or convenient where an electric outlet is within practicable distance of a connecting cord. Parenthetically, this is a good season to call the attention of owners and architects to the advantages of baseboard outlets in new apartment buildings and residences. The convenience of the electric toaster and the electric coffee percolator are apparent for light summer breakfasts. The servant problem, when mistress and maid may have divergent vacation plans, is often more acute in summer, and electrical domestic conveniences may enable the woman of the house to dispense with an unsatisfactory servant during the lighter household demands of the warm months. To electrical men there is nothing novel in the recital here presented. But we are convinced that very many electric-service companies do not make the most of their warm-weather opportunities. If this belief is correct, the present propitious season is the time to begin a local campaign in hundreds or thousands of American cities and villages, when Old Sol has softened the possibly hitherto refractory disposition of the prospective customer.

Members of Wire Manufacturers' Associations Fined.

On July 25 Judge Archibald, of Pennsylvania, sitting on the criminal bench of the United States Circuit Court of New York, disposed of the cases against the members of the seven wire manufacturers' associations who were indicted on June 29 for combination in restraint of trade. A fine of $1,000 was imposed for one indictment against each member and $100 for each additional indictment, the individual fines thus ranging from $1,000 to $1,700. When the case was called thirty-seven of those indicted and present entered pleas of *nolo contendere,* those who had originally pleaded not guilty substituting this plea. Most of the remaining eighty-three men who were indicted on June 29 are abroad, and it is understood that these and others now on vacation will, as they return home, enter the same plea and be subjected to the same fine.

United States District Attorney Wise opposed the reception of the plea offered, stating that under general legal practice the plea of *nolo contendere* is in the nature of a compromise between the District Attorney and the defendant and that such a compromise had not been entered into in the present cases. "Here are," he said, "a group of men who represent practically the entire industry in this country—practically 95 per cent of that industry—who have entered upon an agreement which upon its face was as clear a violation of the law as has ever come before me. I do not wish it to appear that the District Attorney has a part in this agreement, and I am not willing to have this precedent established in this court. *Nolo contendere* is a plea accepted in mild misdemeanor cases, while the offense here is punishable as a felony."

In reply Judge Archibald said that the plea *nolo contendere* is a well-established plea. "It results in a sentence, and in that respect entirely fulfils the law. All the government asks is that the law shall be vindicated and the sentence shall be appropriate to the offense. I do not understand that the plea represents any compromise between the government and the defendants. It is virtually a concession so far as results are concerned." The plea was then ordered to be entered, and in passing sentence Judge Archibald said:

"This is what you might call a trade offense. It is an offense which by an act of Congress is against the interests of the business world. Congress has declared that combinations in restraint of trade shall not exist. It seems to me that I am not going out of the way when I say that just what is meant by this law has remained in considerable uncertainty up to this time. We now know exactly, or very nearly, what it means, and from this time on there will be no excuse; but I feel justified in looking upon what has occurred in the past in this light, and, therefore, I certainly regard this as calling for nothing except a proper vindication of the law by a fine. The extent of that fine is somewhat difficult for me to fix, but it should be a substantial fine and I will impose $1,000 in this case on each defendant. Let him pay the costs and a fine of $1,000 in this case. I cannot bring myself to put a fine of $1,000 in each of these cases where the defendant has pleaded and been sentenced to a fine of $1,000, and in the second case I shall modify it to $100."

New Bureau of New York Edison Company.

To the already large number of bureaus established by the New York Edison Company for the purpose of increasing the efficiency of its service there has just been added a Bureau of Large Building Oversight, organized primarily for the purpose of bringing about an economy in consumption by large users of the electric light.

A corps of men will be maintained who will do nothing but keep a general supervision over the manner in which electricity is used in large buildings. They will see that lamps are not left burning when they are not actually re-quired, will keep oversight that an economical lamp which has burned out is not replaced with a lamp that has less efficiency, and wherever possible will recommend changes in the style of lamps used in order that the customer may effect a reduction in his lighting bills.

It often happens that when a private generating station has been closed down the New York Edison Company installs a complete equipment of tungsten lamps. It then begins to educate the owners and tenants in the ways of economy. Often the lesson is a hard one to teach, for in the days of the private plant it made very little difference whether a lamp burned all night and whether several lamps burned when there was really no need for them. There was a fixed sum appropriated for the maintenance of the plant and a few lamps more or less made little difference. Tenants, of course, used electricity on an extravagant scale. With the electricity to be paid for at so much per kw-hour it has made all the difference in the world whether the lights were turned off when not required or were burning. When the cost of energy used was compared with the cost of maintaining a plant the central station was bound to appear in an unfair light.

With the new bureau it is expected a great change will be brought about. The "economy men" will spend their time in the buildings, and as has been said before will see that lamps are promptly switched off when there is no need for them. They will also take care that carbon lamps are not substituted when a tungsten lamp burns out, and make whatever suggestions may seem practicable as to the arrangement of lighting fixtures. They will take daily meter readings for charting as a record to show the consumption from day to day, the weather conditions as to light and darkness being also recorded.

Economy men are now keeping the record of current consumption in the American Surety Building, 100 Broadway; the Holland House, at Broadway and Thirtieth Street; the Lotos Club, in Fifty-seventh Street, and Murray's Restaurant, in Forty-second Street.

Electrical Laboratory Equipment of the New York Public Service Commission, Second District.

Among the apparatus in the electrical laboratory of the New York Public Service Commission, Second District, is a double motor-generator set for obtaining alternating current of various frequencies and power-factors, consisting of a 40-cycle induction motor driving two shunt-wound direct-current generators. These generators are each controlled by a Tirrill regulator. One of the generators supplies current for all fields, while the other supplies current for the armature of a direct-current motor which drives the second unit. This latter consists of the shunt-wound, direct-current motor mentioned, which drives three alternators. Two of these alternators are four-pole machines, rated at 110 volts and 220 volts, three-phase; the other 15 volts, three-phase. The rotors of these machines are keyed on the shaft in the same position. The stator of the 110-volt machine is movable with respect to the rotor, and by exciting the potential coils of wattmeters from this machine and the current coils from the 15-volt machine artificial power-factor may be obtained for testing purposes. The third machine is an eight-pole, single-phase generator. The speed of the second unit may be altered from 650 r.p.m. to 2400 r.p.m. by altering the field or armature excitation on the direct-current motor, which gives a frequency from 22½ cycles to 140 cycles. There is also a control switchboard for this set equipped with frequency indicators and voltmeters.

Two sets of batteries are used for testing purposes, one rated at 15 amp, eight-hour discharge, 20 volts; the other at 160 volts, ¾ amp. These batteries are charged from a

[me]rcury-arc rectifier panel operated from the 40-cycle sup[pl]y service of the Municipal Gas Company. The commiss[i]on has, also, as laboratory instruments, a General Electric [po]tentiometer with galvanometer, lamp, scale, volt box and [re]sistances; six Weston standard cells; one Weston labora[to]ry standard voltmeter with resistances, and one Westing[ho]use precision wattmeter, range 5 amp to 100 amp. The [se]condary standards include wattmeters, millivoltmeters [an]d shunts, and ammeters. A decade box is used in meas[ur]ing resistances. The entire cost of this equipment was [ab]out $7,000.

Convention of Ohio Electrical Association.

By Telegraph.

The seventeenth annual convention of the Ohio Electric [Li]ght Association was opened by President E. H. Beil, [o]f Youngstown, Tuesday afternoon, July 25, at beautiful [Ce]dar Point on Lake Erie. A 40-mile gale on the lake [du]ring several days preceding the convention had some[wh]at interfered with the passenger schedules of lake ves[sel]s, and acted to withdraw most of the water from San[du]sky Bay, so that the Cedar Point ferries were for a t[im]e unable to run, lending a touch of adventure to the [ex]periences of those who arrived for the first day of the s[es]sions. The registration the first day was 350.

In his official address, after referring to the arrange[me]nts for the convention, President Beil spoke of the s[tre]ngth of the Ohio Association, which now numbers [ni]nety-three active members, out of 160 central-station c[om]panies in the State, and eighty-two associate members. T[o]uching on the legislative enactment converting the State [Ra]ilroad Commission into a body with powers to regulate a[ll] public utilities, the speaker declared that, while the S[ta]te law is not all that the companies might desire, it n[ev]ertheless contains many fair provisions.

Major C. B. Wilcox, of the Sandusky Gas & Electric C[o]mpany, welcomed the convention to Cedar Point in a g[ra]cious speech, which he closed with a reference to the a[t] first slow, but now rapid, growth of the electrical art, c[o]ncluding with the advice that the public should receive m[o]re enlightenment on central-station problems. Wher[ev]er trouble occurred between the public and corporations i[t] may be traced, declared Major Wilcox, to the public's [la]ck of understanding of the problems of the latter, and h[e] urged the association to prosecute a vigorous campaign o[f] education.

The report of Secretary D. L. Gaskill, of Greenville, r[e]ndered an itemized account of treasury transactions s[ho]wing a substantial balance to the credit of the associa[ti]on. The secretary also presented the names of a number o[f] new members and commended the work of the president a[n]d committees of the association.

[I]n his paper entitled "Why the Central Station Should [T]ake Over the Isolated Plant" Mr. Waldo Weaver, chief e[n]gineer for the Detroit-Toledo interurban railway, pointed o[u]t the limitations of isolated-plant operation and the s[up]erior advantages in economy, reliability, convenience a[n]d safety of central-station service. The subject of re[pla]cing isolated plants was further discussed by Messrs. B. H. Gardner, of Dayton; C. I. Crippin, of Youngstown; D. L. Gaskill, of Greenville, and W. C. Anderson, of C[a]nton. Mr. O. B. Reemelin, of Dayton, then presented h[is] paper on "Record Systems for Modern Central Sta[tio]ns," which included reproductions with explanations of t[he] various blank forms used in the work of the Dayton C[om]pany, covering customers' data, inspection permit, serv[ic]e order, pole records, meter orders, transformer records, m[e]ter records, complaint sheets, etc. The subject of orders w[a]s further discussed by Mr. J. T. Kermode, of Cleveland, a[n]d Messrs. J. G. Gilmartin, of Toledo; C. C. Smith, of Bradford, and J. C. Martin, of Wilmington, recounted their own practice in removing service drops when disconnecting premises.

On Tuesday afternoon the ladies were entertained at a musicale and card party at "The Breakers" hotel, and in the evening there was an informal dinner tendered all members of the convention, followed by dancing. Dips in the lake provided diversion for all during odd hours. A number of elaborate exhibits were arranged by the manufacturers in the building where the sessions were held, and a feature of this display of electrical apparatus was the booth of the meter committee, of which Mr. J. G. Gilmartin, Toledo, is chairman. A wide assortment of electrical measuring instruments was shown and attendants were on hand to explain their use to inquirers.

The session of Wednesday morning, with Vice-president W. C. Anderson, of Canton, in the chair, was opened by Mr. J. T. Kermode, of Cleveland ,who presented a paper entitled "Application of Mercury-Arc Rectifiers Installed on Central-Station Lines," which was discussed by Messrs. G. H. Stickney, R. E. Russell and W. S. Culver, of Schenectady, N. Y., and W. C. Anderson, of Canton. Mr. A. M. Seeger, of Toledo, next read a paper entitled "Limiting the Energy Demand and Voltage Variations of a Circuit by Floating a Flywheel Motor-Generator on the Line," reporting the results of operating such a set in connection with the Toledo ore-dock unloaders, described in the issue of the *Electrical World* dated Feb. 23. The paper was discussed by Messrs. O. H. Hutchings, of Dayton; W. S. Culver, W. C. Anderson, J. G. Gilmartin, J. T. Kermode, T. I. Buckwell, of Toledo, and W. C. Anderson. Mr. G. A. Doeller, of Dayton, closed the morning's program with a paper on "Boulevard Lighting Systems," in which methods of arc and incandescent street lighting were described, typical installations being cited and forms of agreement for such lighting reproduced. This paper was discussed by Messrs. G. H. Stickney, W. S. Townsend, of East Liverpool; D. L. Gaskill, W. D. H. Garner, T. D. Buckwell and C. S. Davidson, of Newark.

The chairman of the committee on motors, Mr. B. H. Gardner, submitted a report calling attention to the interesting characteristics of the new unity power-factor Wagner single-phase motor, which was described in the *Electrical World* in the issue of June 1. Mr. C. N. Jewett, of St. Louis, Mo., also discussed this device. During Wednesday morning the ladies of the convention were entertained at a bowling party and in the afternoon were taken for a launch ride on Sandusky Bay. Later the central-station men challenged the associate members present to a ball game, and in the evening an informal banquet was tendered to all members of the convention in the dining hall.

Another Report Coming on St. Louis Rate Situation.

Mr. W. J. Hagenah, chief statistician for the Wisconsin Public Service Commission, who recently served as expert for the city in the Chicago telephone and gas rate controversies, has been engaged by the Union Electric Light & Power Company, of St. Louis, to make a study of its property investment and operating costs, bearing upon the determination of a fair and equitable schedule of rates for the sale of electric energy in St. Louis.

As has been reported in these columns, the Union Electric Company is now contesting a recent city ordinance limiting its charges to 9½ cents per kw-hour. This ordinance will become effective in October, six months from the date of its signing last April, but by a clause in the enabling act creating the St. Louis Public Service Commission the company has availed itself of its right to appeal and a review of the case is promised for the fall term of the local circuit court. The company declares that the

rate fixed is too low and is disproportionate to the actual cost of delivering the service. The status of the ordinance is also to be attacked on legal grounds. Meanwhile Mr. Hagenah and his corps of assistants are now in St. Louis studying the valuation of the company's property, its operating costs, rates, etc., and the findings resulting from this investigation are promised in a report to be made public about Sept. 1.

Toledo Rate Situation.

Judge Johnson in the Common Pleas Court at Toledo, Ohio, has overruled the demurrer of the Toledo Railways & Light Company to the petition of the city for the enforcement of an ordinance fixing the rate to consumers at 8 cents per kw-hour, with a discount of 1 cent. Judge Johnson said that the court cannot compel the company to accept that rate, but that it must either accept it or give up the use of the streets. It can withdraw from the city whenever it pleases, but so long as it occupies the streets it must conform to such regulations as the city may make so far as the rate is concerned.

It seems that the court overruled the company in almost every material contention. Its demurrer was based upon the ground that an action of this kind cannot properly be brought before a court of equity and that the petition and ordinance did not constitute an adequate cause for action. The court held, however, that it retained its jurisdiction in cases involving the validity of ordinances regulating public utilities which were passed before June 30, 1911.

The court held the contention of Attorney Barton Smith that the discount of 1 cent is illegal to be unsound. The fixing of a discount, he said, is part of proper rate regulation. The court, however, expressed some doubt as to the city's rights to fix a minimum payment of 50 cents a month and require the company to furnish meters free of charge. The city will, therefore, ask for a restraining order to prevent the company from charging more than 8 cents per kw-hour, with a discount of 1 cent, until the final hearing of the case, which will not take place for about six weeks.

Attorney Barton Smith assured the court that no consumer's service will be discontinued because of insistence on the payment of the rate fixed by the city, but that receipts will not be given for payment in full of the bills. The payments will be credited on account pending the final termination of the suit.

Ohio Public Utility Law.

At the meeting this week of the Ohio Electric Light Association Mr. D. L. Gaskill, secretary of the association and president of the Greenville (Ohio) Electric Light & Power Company, presented a paper entitled "The Utility Law of Ohio and Its Application to Electric-Light Companies," which gives an analysis of the provisions of the act.

In opening, Mr. Gaskill pointed out that the Ohio Electric Light Association was probably the first body of its kind to recognize the desirability of a utility law properly drawn and administered, and controlling the public functions exercised by public-service corporations of the State. Upon invitation eleven years ago one of the Massachusetts Public Service Commissioners addressed the association, then in session in Cincinnati, and later some effort was made by its officers to procure public-service legislation modeled somewhat after the Massachusetts law. The central-station men of Ohio were then willing to give the State control of the rates and service in return for protection from ruinous and sometimes dishonest competition, but the public was not at that time sufficiently educated in the matter of public-utility regulation. In taking up the Ohio public-utility bill recently passed, Mr. Gaskill declared that while of some benefit both to the public and to the central stations, it is far from satisfactory owing to much of it being "the handiwork of the demagogue and lobbyist."

The Ohio Public Service Commission consists of five members, who are prohibited from being in any way interested in any public utility, a provision which Mr. Gaskill says will generally insure inexperienced men poorly fitted for the offices they are to fill. The members are given power and jurisdiction to supervise and regulate public utilities and to regulate the mode and manner of making all tests, valuations and inspections, all their investigations and hearings being open to the public. They have the right to examine any official, employee or agent of any utility under oath and to invoke the authority of any Common Pleas judge to compel the giving of testimony upon any matter upon which he may be lawfully interrogated; to examine all books or contracts or records of any utility; to examine and keep informed of the condition of any utility, its capitalization, management, franchi[se], accommodations afforded by its service to insure the sa[fety] and security of the employees and the public; to have o[ver]sight of the manner of carrying out the terms of its fr[an]chises and charter requirements; to require any pu[blic] utility to file with the commission any contract which [it] may have with any other public utility relating in [any] way to the business; to establish and classify a system [of] accounts to be kept by the public utility and to presc[ribe] a form, and may order changes at any time in any [ac]counts that are being kept either in form or in the it[ems] thereof.

Section 14 provides that "Every public utility shall [fur]nish necessary and adequate service and facilities wh[ich] shall be reasonable and just, and every unjust or un[rea]sonable charge for such service is prohibited and declared to be unlawful," while Section 15 provides that "Every public utility shall furnish with respect to its business s[uch] instrumentalities and facilities as shall be adequate [and] in all respects just and reasonable. All charges made [or] demanded for any service rendered shall be just and [rea]sonable and not more than allowed by law or by order [of] the commission. Every unjust or unreasonable cha[rge] made for any service, or in connection therewith, or [in] excess of that allowed by law or by order of the comm[is]sion, is prohibited and declared to be unlawful."

These sections, Mr. Gaskill says, are sweeping in their nature. What is necessary and adequate service is a very much disputed question. What would be adequate service for one would be entirely inadequate for another, [and] what would be reasonable in some conditions would [be] unreasonable in others. It is probable, however, that [the] commission will apply these two sections in a spirit [of] fairness rather than on a level, arbitrary rule which would suit no one and work irreparable injury.

Section 16 provides that no public utility shall dire[ctly] or indirectly, or by any special rate, rebate, drawback [or] other device or method, charge any person a greater or [less] compensation for any services rendered, except as [pro]vided in the act, than it charges any other person for [do]ing a like and contemporaneous service under the sa[me] circumstances and conditions. Nor shall free service [or] service for less than actual cost be furnished for the [pur]pose of destroying competition. Section 19 provides that nothing in the act shall be taken to prohibit a public utility from entering into any reasonable arrangement with its customers or employees for the division or distribution of its surplus profits or providing for a sliding scale of charges; or providing for a minimum charge for service to be rendered, unless such minimum charge is made or provided for by the terms of the franchise or ordinance under which such public utility is operated; or prohibit a classification of service based upon the quantity used, the time when used, the purpose for which used, the duration of use, and any other reasonable consideration; r

providing any other financial device that may be practicable or advantageous to the parties interested. No such arrangement, sliding scale, minimum charge, classification or device shall, however, be lawful unless filed with and approved by the commission. Every public utility is required to conform its schedule of rates, tolls and charges to such arrangement, sliding scale, classification or other device, which arrangement shall be under the supervision and regulation of the commission, and subject to change, alteration or modification by it.

These two sections Mr. Gaskill considers of positive benefit to the central stations of the State in that they give a valid argument against a party who insists upon a special rate, and allow any reasonable classification of business so that competition can be made upon a fair and even ground.

While under Section 18 rates in force July 1, 1911, must be filed with the commission by Oct. 1 and a printed copy of such rates shall be placed in such manner as the commission may order, Mr. Gaskill is of the opinion that this need not be done until the commission actually makes the order that it shall be done.

Section 20 prohibits any discrimination in a class or schedule adopted for any particular class of business, which prohibition, Mr. Gaskill says, extends to the utmost limits of imagination; and where discounts have been allowed for the payment of bills within a specified time these discounts must be enforced or else done away with entirely. That is, if the ten days have expired, where such a rule is in force, no discount can under any circumstances be allowed if payment is made after said period has elapsed.

Where contracts have been made and are not terminable by notice they may be carried out. Where rates have been filed and it is desired to change the same it may be done by giving thirty days' notice to the commission. New schedules must be filed, but the consent of the commission is not required to make such change. Where, however, complaint is filed against any rate by any one or upon the initiative of the commission the utility shall have fifteen days' notice and thereafter a hearing had upon the complaint. After the hearing the commission shall make such order as it believes to be proper, taking into consideration the value of the property of the utility under consideration, excluding the value of the franchises, but including the amount needed for surplus, depreciation and contingencies and all other matters that should be considered proper expenses and charges in the operation of the utility, and after considering all these things, fix a proper rate to be charged by the utility. A rehearing is provided for upon the application of either party, and the costs may be apportioned or adjusted against either party at the option of the utility commission.

Mr. Gaskill believes it is reasonable to expect that central stations will experience little interference with their rates from these hearings, if any are held, as the nature of the business is such that where interest upon the investment, surplus, depreciation and the thousand and one expenses incidental to the operation of an electric-light property are taken into consideration by the commission they will have to find, in all fairness, that the rates as charged throughout Ohio are too low to provide for all these items. He concludes that it is probable that central stations will experience little trouble from this direction, especially if the commission is filled by men of good judgment and sound discretion.

Commenting on Section 30, which provides that the commission may after a hearing order such improvements and repairs to a public utility as will promote the convenience and welfare of the public, Mr. Gaskill asks what would happen if the commission should make such an order and the utility should be financially unable to carry it out, and adds that this section will probably be observed more in the breach than in its fulfilment.

Section 45 provides for a rehearing upon any order made if application for the same is made within thirty days from the time the order is made, and additional evidence may be brought out at such hearing. Section 46 provides that the council of any municipality may at any time within one year from the expiration of a contract heretofore made fixing the rate at which the utility would sell its product proceed to fix such rate; and if unsatisfactory to the utility, it may within sixty days file complaint before the commission, or if unsatisfactory to the electors of the municipality, 1 per cent of the same may file complaint in such time and a hearing shall be had thereon after thirty days' notice. If the rate fixed by the council is considered by the utility as satisfactory and it has accepted the same, then 3 per cent of the electors may within sixty days file a complaint upon which the usual hearing will be given. The filing of a complaint by a utility shall be held to be a consent of the utility to continue to furnish its product during the entire time fixed by the ordinance after the hearing is had thereon. Mr. Gaskill says that this section was due to the natural gas companies and will be declared invalid as soon as the courts get at it. Where complaint is made to the commission by the utility of a rate fixed by the council, it may elect to charge the rate in force immediately prior to the new rate so fixed, but an undertaking must be given to refund to the consumers the overplus charged if the complaint is decided against the utility. Mr. Gaskill's comment is that about the only comfort to the electric-light companies of the State in this section is a provision for an appeal, for it is to be presumed that the commission, being required to take into consideration all the elements that enter into the cost of operating a station, will allow a fair and adequate rate to companies for service.

Section 50 of the law provides for an annual report to be made by every utility which report shall cover any subject desired by the commission. Mr. Gaskill believes that if prepared by technical experts with no particular knowledge of the business reports may be expected similar to that required by the Tax Commission of Ohio, which consumed a good part of the time of the central-station men during all the last winter and spring to make out, and he suggested that the association appoint a committee to present its views to the Utility Commission, as it is possible that the commission would welcome suggestions as to what should be covered in the report.

Section 52 provides that every utility shall carry a proper and adequate depreciation or deferred maintenance account, unless the commission, after investigation, shall determine that a depreciation account cannot be reasonably required. This requires affirmative action on the part of the commission and the present system of accounts need not be changed until it makes such order. When made, Mr. Gaskill says, the commission should immediately determine what shall be proper and adequate charges for the depreciation of the several classes of property for each public utility, the charges to be such as will provide a sufficient sum over and above the costs and expenses to maintain and keep the product of the public utility in a state of efficiency corresponding to the art or industry. If a narrow or strict construction is placed upon this provision every electric-light company will, he believes, eventually be compelled to quit business or to give such service as will cause the commission to put it out of business under the adequate-service clause of the law. To central-station men it is a well-recognized fact that depreciation on different classes of property is radically different. Under a strict construction of this clause the commission might fix different rates of depreciation and consequently different funds for each particular class of equipment, such as electrical, steam, buildings, pole line, etc., and the central station would be prevented from drawing on any one of these funds to take care of any equipment needed in any other class. As an example, one might

have ample funds in the steam-equipment depreciation fund, but would have to borrow on short-time notes to pay for equipment needed in the electrical department. Still more startling is the requirement that the depreciation fund must be fixed at an amount that will provide sufficient over and above the cost and expense of maintenance to keep the property of the utility in a state of efficiency corresponding to the progress of the art or industry. The progress of the electrical industry is so very rapid that a station is scarcely completed when it is time to tear it down and rebuild, and if limited to the amount that must be set aside in the depreciation fund progress of the industry will stop. Progress means increase in business as well as improvements in methods, and any amount that the commission would fix as a proper depreciation charge would be much less than would be required to keep up with the progress of the industry. The hope is expressed that the commission will take a broad view of the whole situation and arrive at a rate that will be just and equitable, and that the depreciation fund created may be used for new construction, extension or additions, or for renewing, restoring, replacing or substituting depreciated property in order to keep the plant in a state of efficiency.

Section 53 gives an appeal to the commission from an order of the council ordering or requiring extension of lines, and after hearing upon such an appeal the commission may confirm the order of the council or may set it aside, after taking income and the costs of such extension into consideration.

Section 58 permits utilities to borrow money on notes not running longer than one year without the consent of the commission. This is about the only act, Mr. Gaskill says, that can be done without first getting consent. Provision is made for consolidation of utilities by the consent of the commission, but, except as to telephone companies, there is no provision in the law which will prevent the establishment or granting of franchises to competitive companies, whether honest or otherwise, without the consent of the commission.

Section 72 provides that any public utility dissatisfied with an order of the commission fixing or confirming any rate or any regulation, practice, act or service, or any finding, determination or requirement of the commission, may commence an action in the Common Pleas Court of Franklin County, Ohio, or in any county in which is located the principal office of the public utility, within sixty days after such order is made, against the commission as defendant, to vacate and set aside such order on the ground that it is unlawful or unreasonable, in which action summons may be issued in any county in the State and there served upon the adverse party. If such action is taken the commission shall cause a certified transcript of all proceedings had and the testimony taken to be filed with the clerk of the court of the county in which such action is pending and file its answer, and on leave of court any interested party may file answer within ten days after service. Such action has precedence over civil cases of a different nature pending in such court, and shall be tried and determined as are other civil actions, and a party may introduce original evidence in addition to the transcript of the evidence offered by the commission. If upon the trial of such actions the evidence introduced by the plaintiff is found by the court different from that offered upon hearing before the commission, or additional thereto, the court before rendering judgment shall transmit a copy of such evidence to the commission and stay proceedings in the action for fifteen days from the date of such transmission. Upon receipt of the evidence the commission shall consider it and may alter or modify its rulings and shall report its action to the court within ten days. If the commission rescinds the order complained of the action shall be dismissed, and if it alter or modify the order the judgment shall be rendered as though made by the commission in the first instance within sixty days after the judgment of the cour Either party may appeal or take the case up on error any other civil action and be heard as other civil caus upon the calendar.

The penalties for disobedience to the orders of the con mission are severe. Any officer or employee who violat or wilfully fails or neglects to obey the lawful orders of th commission is subject to a fine of from $100 to $1,000 imprisonment of not more than two years.

In conclusion Mr. Gaskill says that, taking the law as whole, it is a disappointment to the utilities. It does n protect from competition, but regulates services and rate It is, he considers, unfair in its provisions and will ha to be amended before it will either protect the consum or the utility. It will be well to remember, he says, that was intended for the benefit of the politician at electi time rather than the public, and that in its application i teeth may be found to be less sharp than its langua would indicate.

New York Commission News.

The Public Service Commission, Second District, is receipt of an application for approval of consolidati under the name of Upper Hudson Electric & Railro Company of the Schoharie Light & Power Company, t Catskill Illuminating & Power Company and the Upp Hudson Electric & Railroad Company, the consolidated co pany having an authorized capital stock issue of $500,0 and intending to execute a mortgage securing an issue bonds in the amount of $1,000,000. The application, granted, will tie together in one system of service the v lage of Catskill and the hamlet of Leeds, now supplied wi electricity by the Catskill Illuminating & Power Compan the Catskill Mountain district comprising the communiti of Schoharie, Hunter, Tannersville, Onteora Park a Haines Falls, now supplied with electricity by the Schoha Light & Power Company, and the villages of Coxsack Ravena, Coeymans and Athens, now furnished with electi service by the Upper Hudson Electric & Railroad Compar

It is also proposed to include in the consolidated co pany the work, system and franchises of the former Cai Electric Light & Power Company, which is dissolved a whose property recently was sold at a receivers' sale to t Schoharie Light & Power Company. As part of the a plication the Schoharie Light & Power Company asks f approval to consummate the contract of purchase and to p for the property with the stock and bonds of such consc dated company when issued, the purchase price bei $80,000, the amount of the capital stock of the Cairo co pany formerly outstanding, and in addition the consc dated company to assume a bonded indebtedness of t Cairo company in the amount of $80,000.

Of the authorized capital stock of $500,000, the consc dated company asks approval of the issue of $330,000 sto 40 per cent of which shall be distributed pro rata among t holders of the capital stock of the Upper Hudson Elect & Railroad Company; 38 per cent among the holders of t capital stock of the Schoharie Light & Power Company, cluding the equity in the property of the Cairo Light Power Company; and 22 per cent among the holders of t capital stock of the Catskill Illuminating & Power Co pany. This proposed issue of stock does not exceed in value the aggregate capital stock at present issued and o standing of the constituent companies, including the equ in the Cairo company.

Under the mortgage securing the issue of $1,000, bonds the consolidated company asks leave to issue bonds the amount of $420,000, of which $297,000 bonds will used to refund the outstanding bonds of the constitu companies in the same amount; $84,000 to discharge floating indebtedness of the constituent companies, and

[ba]lance of the proceeds to the extent that same may be [av]ailable to meet expenses of organization, discounts and [ot]her contingencies.

At an informal hearing of the Public Service Commis[si]on, First District, a representative of an electrical audit [an]d rebate company, appearing for a wholesale customer [o]f the New York Edison Company, stated that his client [ha]d not been notified by the New York Edison Company [of] the issuance of a new form of contract, and claimed that, [ha]ving been kept in ignorance of the new rate, the customer [w]as entitled to a rebate for a period which dated from the [ti]me the change of contract was made. After hearing [fu]rther testimony from both sides, Commissioner Maltbie [re]viewed the fact that the Public Service Commission is[su]ed an order several years ago requiring every electrical [co]rporation within the First District of New York to stand[ar]dize, publish, file with the commission and post in every [of]fice of the corporation where contracts are made a full [an]d complete list of all rates, forms of contract, riders, etc. [Th]e commissioner stated further that the purpose of this [or]der was that every customer who wished to take rea[so]nable care could make inquiry at any office of the com[pa]ny or at the office of the commission to ascertain the [ra]tes that were in effect and determine for himself what [ra]tes were adapted to his circumstances. In the case in [po]int it was ruled that the complainant had reasonable op[po]rtunity to ascertain the rates in effect from the beginning [of] the time claimed for rebate, and that if he did not [se]cure the best rate, for the present conditions, he was re[sp]onsible for such failure.

Application has been made by the Wynantskill Hydro[el]ectric Company for permission to begin construction of [a]n electric power plant at Wynantskill Creek, in the town [o]f Sand Lake, for authority to exercise franchises within [th]at town and for permission to issue $7,500 capital stock. [W]ithin the vicinity of Wynantskill there are many villages [an]d summer resorts which the company proposes to supply [wi]th electricity for light anl power purposes. Some of the [co]mmunities which it intends to serve are West Sand Lake, [Sn]yder's Lake, Reichard's Lake, Averill Park, Sand Lake, [Cr]ooked Lake and Burden Lake. At the present time elec[tri]c service can only be secured by these communities from [Tr]oy. The company now has contracts for the supplying [o]f over 400 lights.

A hearing will be given on the application of the Rock[la]nd Light & Power Company for authority to issue $100,[00]0 in 5 per cent mortgage bonds. With the proceeds the [co]mpany intends to pay for extensions to its gas-distributing [sy]stem to the villages of South Nyack, Grand View and [Pi]ermont, purchase a gas holder and an auto truck, con[st]ruct reservoir and cooling plant at its Orangeburg plant [an]d also install additional electric equipment.

Maryland Commission News.

The Lawrence Coal Company has complained to the com[mi]ssion that the service it is receiving from the Maryland [Te]lephone Company is very poor and there seems to be [n]o disposition to remedy it. The commission asked for an [ex]planation and the telephone company replied that the [La]wrence company's telephone was out of service in June [o]n account of cable trouble due to storm damage and that [th]e trouble was repaired June 28; the line was then in serv[ic]e until July 12, when it was again in trouble and was re[pa]ired July 14.

The commission last week began an investigation to de[te]rmine the reasonableness of the prices which are being [ch]arged by the Consolidated Gas, Electric Light & Power [Co]mpany. The next hearing will take place within the next [si]xty days, at which time the representatives of the com[pa]ny will be expected to file answers to a long list of in[te]rrogatories from the commission, which asks for information regarding everything connected with the capitalization of the company and the cost and distribution of both gas and electricity. City Solicitor Edgar Allan Poe was present at the meeting of the commission to represent the city of Baltimore, and former State Senator Putzel represented the association which filed the original complaint relative to the alleged discrimination between the prices which the company charges for electricity when furnished to small and when furnished to large consumers. Stating that it is strictly a business matter and that it should be handled by business men, the company dispensed with the services of its various attorneys, and Vice-president Charles M. Cohn, who is in charge of the gas division of the company, and Vice-president Herbert A. Wagner, who is in charge of the electrical division, will handle the entire matter for the company. Mr. Wagner made a statement to the effect that it is the policy of the company to make reduction in the prices of its various commodities whenever it is justified in so doing, and that it will be glad to furnish the commission with all the information in its possession showing just when reductions can be made. He also defended the prices at which electricity is furnished to small consumers, and said that charges for this branch of service are based on a reasonable return for the service involved, coupled with the cost of producing and distributing energy. He was very emphatic in saying that it was absolutely unfair to attempt to determine the reasonableness of the price of electricity by the cost of production, as many other things must be taken into consideration. Following is the information requested by City Solicitor Poe:

Present capitalization of the Consolidated Gas, Electric Light & Power Company. Gross receipts from sale of gas for the year ended July 1, 1911. Gross receipts from sale of electricity for the year ended July 1, 1911. Cost during said period of manufacturing and distributing gas. Cost during said period of manufacturing and distributing electricity. Amount of gas supplied by the Maryland Steel Company and the cost of same. Price at which electricity is supplied to the company by the Susquehanna Power Company. Market value of the bonds and stocks of the various component companies prior to consolidation and the par value of the same. Amount expended since final consolidation on mains, service pipes and other property used in supplying gas. Amount expended since final consolidation of the electrical service of the company.

The following information was asked for by the accounting department of the commission:

History of the formation of the Consolidated Gas Company, giving the names of constituent companies, the amount of the capital stock, and funded and unfunded debt of same. What property was taken over with the constituent companies, the amount of capital stock and funded debt of the new company, showing the amount of new securities issued and how these securities were distributed and to whom they were issued. History of the formation of the Consolidated Gas, Electric Light & Power Company, giving same information as called for regarding the Consolidated Gas Company. Capital expenditures for the last five years. Increase of capital stock and funded debt in the last five years. Revenue and expenses for the last five years, each being set up separately. The output and sales of gas and electric energy during the last five years, this to show quantities made, used and sold, and cost of production, also kind and quantities of materials used in production.

The following is a summary of the information asked for by the engineering department of the commission:

Book values of the elements going into making up the total valuation of the plant and property operated by the electric division of the company other than used for municipal street lighting. Book values of the municipal street-lighting plants. Operating income and expenses of the electric division. Data in respect to production and distribution of

electricity. Book values giving the valuation of the separate items in the gas divisions of the company. Operating income and expense of the gas division. Data in respect to manufacture and distribution of gas.

It was suggested that the inquiry be directed to cover the entire electric and gas system separately.

New Jersey Commission News.

The Board of Public Utility Commissioners, having been advised of several instances where contracts with public-utility corporations have been terminated on the allegation that the terms of the contracts constituted discriminations, has notified each public utility in the State to report to it all changes made in rates to customers receiving service at other than the regular schedule of rates, and also to report whenever any contract with a customer at a special rate is terminated and the charge to the customer is changed to the regular schedule of rates. The board has approved the proposed issue by the Middlesex Electric Light & Power Company of 5 per cent bonds to the amount of $5,000.

Wisconsin Commission News.

In a decision recently announced by the Wisconsin Railroad Commission the Beloit Water, Gas & Electric Company has been ordered to put into immediate effect a revised and reduced schedule of rates for electric lighting and motors. The former net rates for electric lighting varied from 15 cents net per kw-hour for the first twenty-five hours' use per month to 6 cents for all over 75 kw-hours per month, with a minimum bill, including meter rental, of $1.10 per month. The table of unit costs for electric service as determined by the commission is as follows:

Hours Daily Operation.	Capacity Cost in Cents.	Output Cost in Cents.	Total in Cents.
½	17.88	1.7	19.58
1	8.94	1.7	10.64
2	4.47	1.7	6.17
[illegible]	1.79	1.7	3.49
10	.89	1.7	2.59

The schedule of rates for electric lighting, based upon the above table, is as follows: For residence and business lighting Classes A, B and C, a primary rate of 12 cents net per kw-hour for energy used equivalent to or less than the first thirty hours' use per month of the active connected load; a secondary rate of 7 cents net for additional energy used equivalent to or less than the next sixty hours' use per month of the active connected load, and an excess rate of 4 cents net for all energy used in excess of ninety hours per month. In Class A, consisting of residences, etc., where the total connected load is equal to or less than 500 watts, 60 per cent of such total connected load is to be considered active. Where the installation exceeds 500 watts, 33⅓ per cent of such part of the total connected load over and above 500 watts is to be considered active. In Class B, consisting of business houses, offices, stores, theaters, depots, etc., where the total connected load is equal to or less than 2½ kw nominal rated capacity, 70 per cent of such total connected load is to be considered active. Where the installation exceeds 2½ kw capacity 55 per cent of such part over and above the 2½ kw is to be considered active, provided that lamps used exclusively in space devoted to the storing of goods are placed at 20 per cent active and not included in the 2½ kw specified above. In Class C, consisting of federal and county buildings, churches, hotels, factories, warehouses, etc., where the total connected load is equal to or less than 3 kw, 55 per cent of such total connected lo is to be considered active. Where the installation excee 3 kw 40 per cent of the excess is to be considered acti In the case of Beloit College 30 per cent of the total cc nected load is to be active. For all signs and window ligl ing, on a yearly contract basis, a charge of 5 cents net p active 50-watt equivalent per month, plus 5 cents net p kw-hour consumed, is to be made. The load is to be co sidered as 100 per cent active. The minimum bill is fix at $1 net per month.

The schedule of motor rates ordered by the commissi is as follows: A maximum charge of 25 cents net per acti horse-power capacity per month plus 4 cents net or 5 ce gross per kw-hour. The following percentages of the to rated capacity are to be considered active: Installatio under 10 hp and only one motor, 90 per cent; under 10 and more than one motor, 80 per cent; between 10 hp a 20 hp, irrespective of number of motors, 70 per cent; l tween 20 hp and 50 hp, yearly contract basis, 60 per ce between 50 hp and 100 hp, 55 per cent; over 100 hp, 50 p cent, and on less than a yearly contract basis, 70 per ce Minimum bill, $1.25 net per month.

The company owns and operates two plants, one a ste plant and the other a combined steam and hydraulic pla The tentative appraisal of January, 1909, gave the to physical valuation of the company as $811,820, of whi $364,882 was apportioned to the electric plants. The co pany's alleged valuation, of June 30, 1910, was $1,896,0 This figure included among other things an item of $35 000 classed as promotion service expense. Relative to tl the commission says: "The facts in regard to the financi of the present organization, value of tangible and intangil property, etc., make it appear that the costs shown by t books of the company do not meet the situation and ca not be regarded as of the greatest importance in these p ceedings." Each department of the company is to be p mitted to earn a fair rate of return upon the proportion the physical valuation devoted to that particular branch the service. A total of $40,000 was allowed for working ca ital. The company claimed an allowance of $150,000 the value of the water-power controlled and used by it. T city insisted that $50,000 was the maximum that should allowed. Several methods of determining the value of t water-power were discussed and analyzed in the opini It is pointed out that from a point of view of public poli it is questionable whether the allowance should exceed t cost of development and value of the physical prope utilized. The investigation has shown that the developm of the company's business is comparatively poor. This w shown to be due largely to the design of the rate schedu previously in force. Large users have been encouraged rates which were so close to, if not below, the actual c of production as to make it necessary to burden the smal consumers with high rates in order to secure a reasona return upon the investment as a whole. This policy has turn tended to discourage the small user and has prevent a reasonably good saturation of territory and that devel ment of the business which would justify the investm made and reduce the unit cost and thereby the rates f service. The company apparently had overlooked the fa so strikingly brought out in other cities, that the business the small-residence consumer if properly managed a developed through the granting of reasonable rates one which will pay a large return upon the investment a should be the most profitable end of the business. analysis of the consumer data reveals the fact that Bel has a comparatively high average installation per co sumer, but that the saturation of territory is poor and t small-consumer field poorly developed. Beloit has lighting consumers per 100 of population. The average the State is 8.43, with a minimum of 3.57 and a maxim of 14.35 (Madison). From past experience and from careful study of conditions in Beloit the commission is c

lent that the reduction in lighting rates will result in a ry material increase in the residence-lighting business, hich, with the low unit output cost, will enable the company to enjoy a greater rate of return than existed previous the order, and to such an extent that a further rate reduction can be made and still permit the company to earn fair and reasonable rate of return.

Canadian Hydroelectric Commission News.

At a meeting of the Village Council of Mimico, Ont., the fer of the Hydroelectric Commission to furnish electric ergy was rejected on the ground that the municipality as not large enough to undertake the project at present. he commission's representative in making the offer stated at it would cost the village from $2,000 to $3,000 per ar for thirty years to maintain a plant, this amount including interest on $7,500, which was the estimated cost of stalling the civic plant.

URRENT NEWS AND NOTES.

N. E. L. A. MEMBERSHIP.—The National Electric Light ssociation this week reached a total of 9300 members of rious classes. The Michigan Electrical Association has ted for affiliation as a geographic N. E. L. A. section.

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N. E. L. A. COMMITTEE ON ORGANIZATION OF THE INDUSTRY.—Following the suggestion of the chairman, Mr. H. Scott, the name of the membership committee of e N. E. L. A. has been changed to the committee on ganization of the industry.

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WATER WIRELESS.—Habibur Rahman Khan, deputy perintendent of telegraphs, Allahabad, India, in a mphlet recently issued describes experiments on the use streams of water as a substitute for the wire conductor the ordinary telegraph system. With an ordinary Carew vibrator and six dry cells communication was maintained by means of a river over a distance of 25 miles.

* * *

OFFICERS OF THE NEBRASKA ELECTRICAL ASSOCIATION.— the recent annual meeting of the Nebraska Electrical ssociation, which is affiliated with the National Electric ght Association, the following officers were duly elected r the coming year: President, Mr. H. A. Holdrege, maha; vice-president, Mr. F. H. Brooks, Lincoln; secretary-treasurer, Mr. S. J. Bell, David City. These officers ve now entered on their duties.

* * *

EXAMINATION FOR ELECTRICAL ENGINEER AND DRAFTSMAN.—The United States Civil Service Commission will ld an examination on Aug. 23-25 to secure eligibles for e position of electrical engineer and draftsman at $1,200 r annum in the office of the supervising architect of the reasury Department at Washington. Full information is ven in Circular No. 629, a copy of which may be obtained on application to the commission at Washington, D. C.

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IMPORTATION OF ELECTRICAL ENERGY FROM CANADA.— mong the matters which have been referred to the public licy committee of the N. E. L. A. is a suggestion that tion be taken to induce the United States to prohibit the portation of electrical energy from Windsor, Ont., to etroit, Mich. The Ontario Hydroelectric Commission is ported to be unwilling to build a transmission line to indsor unless permitted to supply energy also to Detroit. e project is meeting with opposition from certain local ntral-station companies in Canada, which would be involved in financial and political difficulties if the line were built through their territories.

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TUNNEL UNDER ST. LAWRENCE RIVER.—It is proposed to construct a tunnel under the St. Lawrence River between Montreal and the South Shore, and it is stated that for this purpose some land and options on other tracts have been obtained by the Montreal Street Railway Company. It is also stated that the Canadian Northern Railroad and the Delaware & Hudson Railroad are interested in the project. A route map has been filed at Ottawa.

* * *

NEW OFFICERS OF ST. LOUIS N. E. L. A. SECTION.—The Union Electric Light & Power Company Section (St. Louis) of the National Electric Light Association has elected new officers. Mr. Burt Crouch, assistant sales manager, was chosen president; Mr. D. A. Scullin, of the meter department, treasurer, and Mr. H. G. Kislingbury, company statistician, secretary. Messrs. E. H. Tenney and Orrin Hull were elected vice-presidents. The next regular meeting of the section will be held in the fall, but an outing of some kind is promised for August, probably taking the form of a boat ride on the Mississippi River, under the auspices of the section.

* * *

FREQUENCY IN ELECTRIC RAILWAY WORK.—At the July meeting of the executive committee of the N. E. L. A. communications relative to the two frequencies now employed in the transmission of energy for railway service were read from Mr. B. F. Wood, of the Pennsylvania Railroad, and Mr. Henry L. Doherty, of New York. Mr. Doherty stated that the association should endeavor to establish the electrification of main lines of railroads in directions that would be of value to the central stations of the country. He expressed the opinion that it would be best and preferable to use 60-cycle current for railway work. The matter was referred to the committee on apparatus.

* * *

HAMILTON, ONT., TO BUILD MUNICIPAL PLANT.—The election held in Hamilton, Ont., on July 25 to vote on a by-law to issue debenture bonds for $500,000 for a municipal light and power plant resulted in a majority vote of 418 in favor of the project. Hamilton was the last of the large cities in the Province of Ontario to resist municipal ownership and the aggressive Hydroelectric Power Commission of the Province of Ontario. The Dominion Power & Transmission Company, which controls the railway and lighting properties in Hamilton and vicinity, fought the measure by a publicity campaign in which it was encouraged by the support of the leading daily papers; and although it succeeded previously in keeping the local government from contracting with the Hydroelectric Commission for full service on the strength of the excellence and cheapness of its own, it could not stem the tide for municipal ownership which had already engulfed Toronto, London, Ottawa, Winnipeg and other large cities of the Dominion. The company has a very efficient hydroelectric development at De Cew Falls on the Welland Canal which it is at present enlarging, together with steam auxiliary stations at Hamilton and Brantford and hydroelectric auxiliaries at Brantford and St. Catharines. The head at De Cew Falls is 269 ft. and the cost of generating energy at that place is said to be as low as, if not lower than, that at any other plant in America, so that competition should be keen. Engineer Sifton, who prepared the estimate for the municipal plant, will immediately draw up the specifications. According to the provisions of the by-law presented to the taxpayers the sum of $29,213.45 must be raised annually by special rate on all the taxable property in the municipality to pay interest on the bonds and to create a sinking fund to retire them at the end of thirty years.

Electric Pumping for Parks.—The City Council of Chicago has granted the South Park Commissioners of that city authority to install two electrically driven pumps, each having a rating of 2,500,000 gal. in twenty-four hours, at the shaft leading to the city water tunnel at Sixty-eighth Street and Yates Avenue. The park commissioners may by this means pump water for park purposes at their own expense, as they are to pay for the equipment and the electrical energy, the latter being supplied from the Chicago Drainage Canal.

* * *

Convention of Colorado Electric Light, Power and Railway Association.—The next meeting of the Colorado Electric Light, Power and Railway Association will be held at the Hotel Colorado, Glenwood Springs, Col., Sept. 13 to 15 inclusive. The program includes the following papers: *Lamp Efficiency*, by Mr. S. E. Doane, Cleveland, Ohio; *Welding by the Oxyacetylene Process*, by Mr. K. L. Brackett, Denver, Col.; *Electricity for Advertising Purposes*, by Mr. G. E. Williams, Denver, Col., and *The Sale of Electric Power for Mining Purposes*, by Mr. Franklin P. Wood, Cripple Creek, Col. Mr. F. D. Morris, Colorado Springs Light, Heat & Power Company, Colorado Springs, is secretary.

* * *

A 1-Cent Telephone Call Suggestion.—Alderman Herman J. Bauler, of the Twenty-second Ward, Chicago, has attracted some attention by proposing that the Chicago Telephone Company be required to give prepaid telephone calls at 1 cent each, the present rate being 5 cents. The alderman suggests that there be an annual service charge ranging from $10 a year for two-party residence lines to $35 a year for business service. In addition a charge of 1 cent would be made for each outgoing call. Although Alderman Bauler is a member of the City Council committee on gas, oil and electric light, which has in charge the revision of telephone rates, it is not believed that the committee will indorse the suggestion.

* * *

Maine Electric Association.—The third annual meeting of the Maine Electric Association was held at Augusta, Maine, Thursday and Friday, July 27 and 28, with headquarters at the Augusta House. On Thursday morning there was a meeting of the executive committee and for the registration of members and guests. The afternoon session was devoted to the reading and discussion of papers, followed by a business meeting and election of officers. In the evening special cars were provided for a trip to Island Park, where a supper was served. Friday was given over to a trip on a special boat down the Kennebec River to one of the islands for a clambake. Mr. W. S. Wyman, Waterville, Maine, is secretary.

* * *

Corraling Eels with Electric Light.—The Danish government, under the direction of its biological department at Copenhagen, has undertaken to aid the fishermen of the Baltic Ocean by preventing the migration of eels from that arm of the sea into the outer ocean. The means employed is a barrier of light, formed by placing fifty electric lamps along a submerged cable between the island of Fano and the coast of Funen. The eels migrate only during the dark hours, and, accordingly, as soon as darkness begins in the season of migration the lamps are illuminated and a wall of light is thus interposed which the eels are fearing of passing. A similar plan, using submerged lamps, is said to be a favorite resort of Italian fishermen to keep eels from leaving the shallow waters.

* * *

Wireless Studies in the Tropics.—A Marconi telegraph operator who was sent to the Congo especially for the purpose of studying conditions relating to wireless telegraphy in the tropics reports that certain atmospheric conditions at night and the apparent effects of the sun's rays at certain times by day make long-distance communication impossible in that region of the tropics. There are times, however, notably at about 5 a. m. or 6 a. m., when these disturbances are at a minimum and long-distance messages can be received without difficulty. Stations at Boma and Banana are now in operation and have succeeded in establishing communication with each other, a distance of 55 miles, and with vessels at a considerable distance at sea. Stations at Leopoldville and St. Paul de Loanda are expected to be in operation shortly. Two companies are represented in the Congo, the Telefunken, of Berlin, and Radio-Télégraphie of Paris.

* * *

McCall's Ferry Power at Baltimore.—The United Railways & Electric Company of Baltimore is now operating its cars by power from the Pennsylvania Water & Power Company, which is brought from McCall's Ferry. Under the contract between the United Railways and the Pennsylvania Water & Power Company, which was entered into last February, both corporations have since been engaged in installing necessary cables, switching apparatus and other instruments for the transmission and reception of the hydro-electric energy. According to President House, this work was not expected to be completed until next September. It is not proposed to discontinue entirely operations at the Pratt Street power station, but to utilize the river power in conjunction with that generated at Pratt Street. The power is transmitted from the Orangeville substation to the Pratt Street power station, where it is distributed to the substations of the United Railways. At these stations it is "stepped down" from 13,000 volts and transformed into direct current.

* * *

Installation of Lightning Conductors.—Rules for the installation of lightning rods issued by the Phœnix Fire Office, England, deal with methods of protection, material of conductors, earth connections and special risks. It is pointed out that the only way to secure absolute protection against the disruptive form of lightning discharge is to inclose the building in a metal framework, constituting what is termed the "bird-cage" system of conductors. Under proper supervision this can be accomplished generally by utilizing the rain pipes and gutters as part of the system. "The ordinary conductors must be used in addition, and the whole system should be effectively connected to earth in a number of places. The material of the conductor should be of copper tape, measuring at least 1 in. x 1/8 in., or, if copper cable be adopted, it should not consist of less than seven strands, each 1/8 in. in diameter. Soft iron may be used in place of copper, and except for chemical reasons and for permanence the sectional area need not be greater than in the case of copper. Conductors should be kept a certain distance away from walls so as to prevent the accumulation of dirt, but they must not be insulated. If a copper plate is used for each earth connection it should be not less than 3 sq. ft. in area and 1/8 in. in thickness, and should be adopted only where it will always be in water or moist earth, otherwise connection should be made to the water mains or the "tubular" system should be employed. The number of connections depends on the ground area of the building, but there are few structures where less than two are necessary. The elevation rod for factory chimneys should be a circular band placed round the top of the shaft, with points fixed at an angle of 45 deg. and extending outward, or an arch of metal provided with points may be fixed across the mouth of the chimney. To these rules may be added the remark that an excellent ground may be made by placing the copper plate at the bottom of a well about 6 ft. deep filled with stone and cemented over near the surface, to which a house leader is connected. During a thunderstorm the water carried to the well will make a wet ground.

HYDROELECTRIC TRANSMISSION SYSTEM FOR QUARRY AND MILL WORK.

Generating Stations and Substations of the Vermont Marble Company.

By C. F. Maynak.

In the spring of 1910 the Vermont Marble Company acquired the water rights on Otter Creek at Huntington Falls, 4 miles north of Middlebury, where there is a drop of 40 ft. and a flow which it is estimated will give in extreme dry periods from 1000 hp to 1200 hp.

Immediately upon acquiring these rights the engineers of the Vermont Marble Company began plans for a hydroelectric development to operate in parallel with the older transmission system and for the construction of substations along the new transmission line.

In order more fully to understand the existing conditions a brief description of the older system will be given. At Proctor three 1200-hp turbines, direct-connected to three 750-kw generators, work under a head of 120 ft. This plant is about 30 miles south of the Huntington Falls station and on the same stream. The power is generated at 480 volts and from 750 kw to 1000 kw is used at this voltage in the Proctor mills and shops. The balance is stepped up to 10,000 volts by three 500-kw water-cooled transformers and delivered to West Rutland and Albertson, where the company operates extensive mills and quarries. The Albertson substation is of 300-kw rating and the West Rutland substation of 900-kw rating. At West Rutland, on the 3300-volt side of one of the banks of transformers, there is a 500-kw steam plant which, since its installation three years ago, has run in parallel with the Proctor station during the low-water periods. At Proctor, West Rutland and Albertson motor-generator sets are installed for supplying direct current for numerous cranes, hoists and some quarry machinery. The standard shop and mill alternating-current voltage is 440, and for direct-current and alternating-current quarry work 220 volts has been adopted. However, at West Rutland three 3120-volt synchronous motors aggregating 550 hp are used for mill work. The quarries were formerly operated by steam hoists, channelers, drills and pumps from isolated boilers. The great inefficiency of these isolated steam plants and the success of electricity for quarry work, as demonstrated at West Rutland during the past few years, convinced the marble company of the advisability of connecting its large chain of quarries and shops to an electric system. The new transmission line passes north and south along the

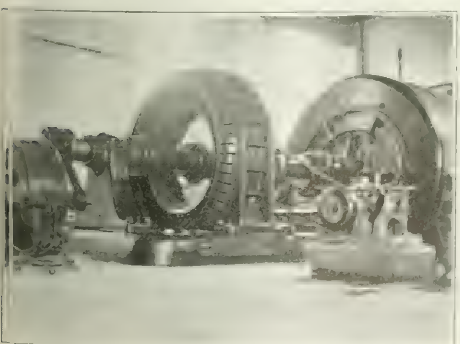


Fig. 1—Generating Unit at Huntington Falls Power Station.

marble vein, consequently energy can be taken at any point on the line for any new quarry without running the line any great distance. There are at present on the system three generating stations, one tying-in station and four substations. Two more substations are to be built this summer. There is a connected load of 7000 hp, made up by 250 motors. Of this 2000 hp is in direct-current apparatus of the shunt and series type. Squirrel-cage-type in-

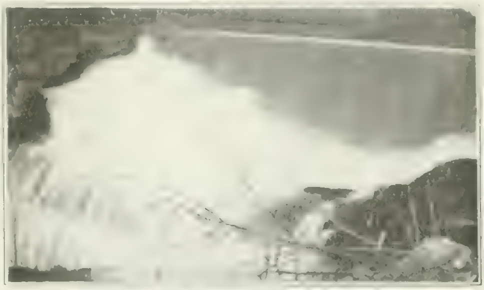


Fig. 2—Huntington Falls.

duction motors are used for shop and mill operation and the rotor-resistance type for hoist and quarry work.

TRANSMISSION SYSTEM.

The line starts at Huntington Falls and goes in a southerly direction east of Middlebury, through Brandon and Fowler to West Rutland, where it terminates in a tying-in station a few feet away from the West Rutland substation. The line is 34 miles long and passes for the most part through farm and pasture land, although 5 miles of it traverses in a diagonal direction a rough mountainous country.

The conductor is No. 3 bare medium hard-drawn copper supported on 50,000-volt slate glaze Thomas insulators. Cedar poles ranging from 35 ft. to 45 ft. in length with 7-in. to 9-in. tops are used. The conductors are spaced on a triangle 4 ft. 6 in. on the sides and 5 ft. on the bottom. The cross-arms are of unbled hard pine 5 ft. 10 in. x 4¾ in. x 6¼ in. All gains and tops are painted with

Fig. 3—Transmission Line with Telephone Crossing Protection.

Avenarius carbolineum. The top pins are of galvanized-iron pipe and the cross-arm pins are of the Lee type, consisting of a cast-iron cone 20½ in. x ¾ in., a rod threaded both ends, and a thimble which is screwed on the rod.

The thimbles were all cemented in the insulators at the factory. The cross-arm braces are 30 in. x 1½ in. x ¼ in. and are not toe-lagged in the pole, as is usually done (experience showing that this work is never well done by linemen), but are toe-bolted to the pole. The line crosses the

Fig. 4—Standard Horn-Gap Support and Roof Entrances at West Rutland.

Rutland Railroad at Brandon and Beldens and steel towers are to be erected at these crossings. There are five transposition poles, giving the line two complete twists.

Seven feet below the lower wires a telephone line is carried on two-pin cross-arms, and this line is transposed every third pole. Two poles each side of all telephone and telegraph crossings the pins are grounded; ground wires are fastened across the large arm and up each side of the pole above the arm. A galvanized-pipe lightning rod extends 3 ft. above the top transmission wire. Each insulator on these crossing poles has a cast-iron cap and an extra serving of wire 2 ft. each way from the center of the insulator. Over the more dangerous crossings and one span each side No. 1/0 stranded copper cable is used for the transmission wires. The standard pole spacing is 150 ft., but many spans are less. There are no curves in the line, but where a turn is necessary it is made in most cases on a double-pole construction with two arms and two sets of insulators. Less abrupt turns are made on two standard poles about 15 ft. apart. Dead ends are made with three 12-in. strain insulators in series. Just north of the Brandon substation line switches have been installed. These switches are about midway between Huntington Falls and West Rutland and are used for making the north end of the line dead if necessary or to assist in locating trouble. The work of cutting out a path for the line began last July and the line was completed late in December.

GENERATING STATION AND SUBSTATIONS.

The Huntington Falls station is built on concrete foundations resting on bedrock and has a brick superstructure. The high-tension compartment is 11 ft. 6 in. x 42 ft. and two stories high. In the transformer-room space for six transformers is left on a raised pier next to the generator-room. The space in front of the transformer pier is for a car so that any transformer can be run out on this car to one end, where an opening in the floor above and an I-beam 30 ft. above the first floor enable transformers to be handled readily. Three 500-kw water-cooled transformers stepping up the voltage from 2300 to 44,000 make up the present installation. The second floor of the high-tension compartment contains the aluminum-cell lightning arresters, ,e 44,000-volt oil switch, disconnecting switches, choke c s, outgoing line and operating stand for the arrester h gaps, which are on the roof.

The generator-room contains two 1200-hp S. Morg Smith turbines direct-connected to two 750-kw, 2300-v t, 60-cycle, 300-r.p.m. generators; two improved governs, the main switchboard and two 30-kw, 125-volt excit s, chain-driven from the generator shafts. Provisions e made so that by increasing the head to 65 ft. and chang g the turbine runners and guides the turbines will del r 2400 hp each. In this case one 750-kw generator wo d be placed in tandem with the other and a 1500-kw gen tor direct-connected to the other turbine, giving a p t rating of 3000 kw. A 10-ton traveling crane is insta d above the generator-room floor.

The main switchboard contains six panels of selec d marble carefully matched. There is one panel for each the exciters and generators, one regulator panel and station panel. One other panel, mounted on the wall b of the main switchboard, contains the 2300-volt disconn ing switches for making each unit dead back to the 2 volt busbars. Two 10-ft. penstocks embedded in the crete forebay dam, each about 30 ft. long, rise sharply f the ends of the turbine casings to the forebay. The n dam is of crib fill and is the same that was used by the p mill which formerly occupied the site.

SUBSTATIONS.

At Brandon, where the company operates a mill quarries, the energy is stepped down to 2300 volts. present installation consists of two 150-kw oil-cooled tr formers with space for four more. The mill, close by driven by a 100-hp, 2200-volt induction motor. Energy 2300 volts is also transmitted to the quarries, where i transformed to 230 volts.

The substation is 29 ft. x 16 ft. 6 in. inside and ha second floor at the back end 17 ft. x 11 ft. 6 in. The m incoming and outgoing oil and disconnecting switches d transformers are installed on the first floor. The lightn arrester tanks are installed in the second story, with horn-gaps and operating stand on the low roof. This s station, like the others, is constructed of marble bl with concrete floors.

The Hollister substation is a duplicate of the one Brandon and contains one 100-kw, three-phase and 250-kw. three-phase oil-cooled transformer, operating

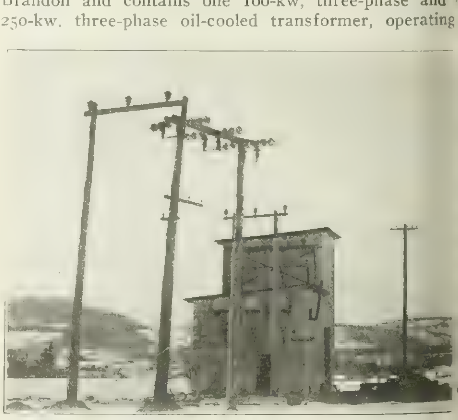


Fig. 5—Brandon Substation and 44,000-Volt Line Disconnec Switch.

parallel and stepping down to 230 volts. The 230- energy is used by quarries very near the station, the of it being used in another station 100 ft. away, where t are two 165-hp and one 112-hp hoist motor, two 12 compressor motors and one 100-hp motor driving a 75

rect-current generator. The energy used in the quarry is or drills, channelers and pumps.

A mile south of the Hollister substation another substation is to be built to accommodate five 300-kw transformers for operating the Rutland-Florence mills and quarries recently acquired by the Vermont Marble Company.

The largest and most important transformer station is located at West Rutland. This station is 43 ft. 6 in. x 26 ft. and two stories high. The present rating is 1500 kw in three water-cooled units of 500 kw stepping down from 44,000 volts to 10,000 volts. Space is provided for three more units. Each floor has one room 31 ft. x 24 ft. and another ? ft. x 24 ft. The larger room downstairs is for the six transformers and the smaller is used as a storeroom. The large room upstairs contains the 44,000-volt switches, incoming line and lightning-arrester tanks. The smaller room on this floor contains the 10,000-volt switches for paralleling the old and new systems, also the station panel. This panel has a wattmeter, which indicates in what direction the energy is being sent, a voltmeter, a synchronizing meter and the operating handle of the 10,000-volt phasing switch. From this room two selecting 10,000-volt lines go out, so that the new system can be run in parallel with Proctor, West Rutland or both, the latter being ordinarily ...

The transformer-room is designed to facilitate handling of the transformers. A pit 18 in. deep is built between the two banks of transformers and in this pit a car travels the

6—View of Transmission Line Showing Standard Corner Construction.

length of the room. The transformers being mounted on wheels, trucks may be run out on rails built on this car and the car then run out to one end. At this end there is a 6-ft. open space the full width of the station. In the second floor, 24 ft. above the first floor and extending directly over the center of this opening, there is a trolley traveling the full width of the station, enabling a transformer to be lifted from the car or taken apart.

The incoming 44,000-volt line enters through wall bushings protected on the outside by galvanized-sheet-iron hoods. Taps from the main line, outside the station, pass the lightning-arrester horn-gaps on the station roof and from the horn-gaps the line enters through roof entrances the arrester tanks in the room below. The 44,000-volt conductors are all of copper tubing.

Electricity was first turned on the new line at full voltage on March 12 from the Proctor station, stepping up from 10,000 volts to 44,000 volts at West Rutland, and soon after load was put on at both Brandon and Hollister substations. The Huntington Falls station was first phased in on May 17.

The system was designed, constructed and put into operation by the Vermont Marble Company. The electrical equipment was furnished by the General Electric Company.

SINGLE-PHASE LOCOMOTIVE EQUIPMENT FOR THE LOETSCHBERG LINE IN SWITZERLAND.

By M. P. Misslin.

THE general electrification of main-line railways in Switzerland has been hastened by the decision of the Compagnie du Chemin de Fer des Alpes Bernoises, Berne-Loetschberg-Simplon, to adopt electric traction for operating the whole line, 40 miles in length, with single-phase current at 15,000 volts and 15 cycles, which corresponds to the system employed on the Seebach-Wettingen line of the Swiss Federal Railways. This decision was the result of exhaustive studies carried out by Mr. L. Thormann, consulting engineer at Berne, who was also intrusted with the supervision of the work in connection with the electrification.

The line starts at Spiez on the lake of Thoune and at Brigue joins the existing Simplon route, leading to Milan, thus forming a direct connection between the eastern parts of France and Italy—that is, between Paris and Milan. As it will have to deal mostly with through traffic and passes through a very mountainous district, it encounters in many points conditions similar to those of the St. Gothard route, and the experiences gained on the Loetschberg line will therefore prove of great benefit at the time of electrifying the St. Gothard route.

Only a portion of the whole line, leading from Spiez to Frutigen, of a total length of 13.5 km (8.5 miles), is at present opened to traffic; the remainder will follow in from one to two years' time after completion of the Loetschberg tunnel. The section from Spiez to Frutigen, formerly operated by steam locomotives, has been electrified and serves for the present as an experimental line.

The maximum gradient of this section is 1.5 per cent and the average gradient 1.117 per cent, whereas the continuation of the line will have a maximum gradient of 2.7 per cent. About 40 per cent of the total length of the experimental line is in curves, of which the smallest has a radius of 1000 ft.

The track on the open line consists of rails each 12 m (39 ft.) long, weighing 75 lb. per yard, and laid on oak sleepers; in the tunnels a new system of fixing the rails, such as is employed on the Austrian State Railways, will be used. The section from Spiez to Frutigen comprises about 14 miles of track, all fitted with overhead construction of the catenary suspension type.

The first equipment designed to deal with the traffic on the experimental line consists of two locomotives and three motor cars. The latter and a 2000-hp locomotive were ordered from the "Elektrische Bahnen," Zurich (the joint office for the electric traction on standard-gage lines in Switzerland of the Maschinenfabrik Oerlikon and the Siemens-Schuckert Works), whereas a 1600-hp locomotive was supplied by the Allgemeine Elektricitäts Gesellschaft, of Berlin. After opening the whole line, the motor cars, which have been in service since the first of November, 1910, will deal with the suburban traffic between Spiez and Kanderstag, whereas the locomotives, which at present are engaged in hauling freight trains from Spiez to Frutigen, will haul trains up to Brigue.

The 1600-hp locomotive is fitted with two Winter-Eichberg motors, each driving through connecting rods two axles, combined with one pony axle fitted to one bogie truck. The normal output developed by this locomotive enables it to haul a 250-ton train at a speed of 25 miles per hour up gradients of 2.7 per cent.

In the following is given a short description of the 2000-hp locomotive, which was placed on the line first. The electrical equipment of this unit was designed and supplied by the Maschinenfabrik Oerlikon, whereas the framework and other non-electrical parts were supplied by the Swiss Locomotive Works, of Winterthour.

The specification required the locomotive to be able to

haul trains of 310-ton (weight of locomotive not included) at a speed of 27 miles per hour up gradients of 2.7 per cent, and, with the same speed, trains weighing 500 tons up gradients of 1.55 per cent. The starting acceleration at these loads required a drawbar pull of 22,000 lb. When

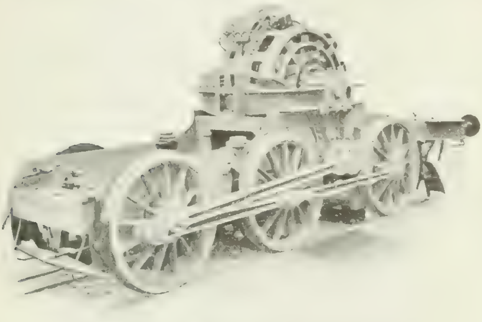


Fig. 1—Truck with Motor for Electric Locomotive.

starting on gradients a drawbar pull of 28,000 lb. was required. The maximum speed demanded was fixed at 43.5 miles per hour, while the maximum weight per axle allowed was 15 tons. It was further stipulated that the locomotive had to be arranged to take curves 590 ft. in radius. By a series of exhaustive trial runs it has been ascertained that the locomotive, as supplied, fully meets the conditions of the specification. Considering further the high working pressure and the wide range of speed regulation for which the locomotive has been designed, still adhering to normal axle pressures and adhesion weights, the locomotive constitutes the lightest electric locomotive yet built.

The following are the principal data of the locomotive an illustration of which is given in Fig. 2.

Mechanical data, in mm:	
Gage of track (4 ft. 8½ in.)	1,43
Length over buffers	15,02
Width of cab	2,95
Height to top of cab	3,74
Height of cab floor over rail	1,50
Distance between centers of bogies	5,20
Total wheel base	10,70
Wheel base of each bogie truck	4,05
Diameter of driving wheel	1,35
Width of rim of driving wheel	14
Electrical data:	
Line voltage	15,00
Number of motors	
Frequency, cycles per second	1
Normal total rated hp.	2,00
Normal speed, km per hour	4.
Maximum speed, km per hour	7
Normal drawbar pull, kg	10,00
Maximum drawbar pull, kg	13,00
Gear ratio	1:3.2
Coefficient of adhesion at normal drawbar pull	1:
Coefficient of adhesion at maximum drawbar pull	1:
Weights, in tons:	
Mechanical equipment, including brakes	4
Electrical equipment	4
Total	
Weight available for adhesion	
Maximum weight per driving axle	1
Weight of one bogie truck, without motor	18.
Weight of one motor	9.
Weight of one transformer	5

MECHANICAL EQUIPMENT.

The locomotive is composed of two six-wheel bogie trucks, each truck being fitted with one motor. Each motor drives through a single reduction gear a countershaft which, by means of a crank pin and connecting rod, operate the coupled driving wheels, as shown in Fig. 1. The bogie frame is supported on the axles by large elliptic springs of great elasticity. The suspension gears of the two inner axles are connected together by means of spring-borne supports in order to distribute uniformly the total weight on the different springs.

All the coupling and pulling gear has been fixed to the truck framework, so that the cab itself is freed from any mechanical strain.

Fig. 2—2000-hp Electric Locomotive.

The two motors and their reduction gear, which [illegible] forms an integral part of the motor, are rigidly fixed on the frame, above the two outer road wheels they have to drive, so that the shaft carrying the large spurwheel may well be considered the motor shaft.

The pinion of forged Siemens-Martin steel has been

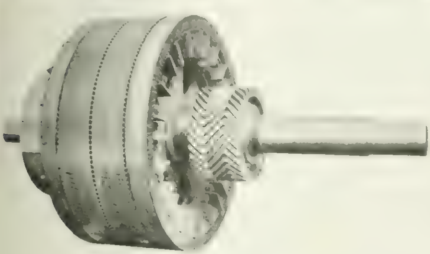


Fig. 3—Armature and Pinion Mounted on Shaft.

pressed on the shaft with a pressure of about 40 tons, and is placed between the armature and the bearing opposite the collector. The rim of the spurwheel consists of rolled Siemens-Martin steel, and is fixed to the cast-steel spider in such a way that it can easily be dismounted. The reduction gear has been supplied by A. Citroën & Co., of Paris. The wheels are 250 mm wide and have pitch circle diameters of 447 mm and 1453 mm, corresponding to a gear ratio of 1:3.25. The teeth are of wave-like shape, the wave being composed of three legs joined together at angles of 45 deg. and having rounded vertex, Fig. 3.

In spite of the high circumferential velocity (22 m per second as a maximum) and the great stress to which the material employed is subjected (maximum 260 kg per sq. cm), the running of the reduction gear is perfectly regular and silent, attributable to the special design and machining of the teeth and to the absolutely rigid method of supporting the shafts of the reduction gear.

The height of the motor shaft above rail is 1.80 m. The shaft carrying the spurwheel is fixed 265 mm above the proper driving axles and operates the three coupled running axles by means of cranks and connecting rods 2.7 m in length. The two crank pins on either side of each bogie truck are displaced against each other by 90 deg., and the rotating masses are perfectly balanced.

The cage of steel rests on each bogie on two seats, fixed to the outer frame. The bogie journals, which have ample sideways play, are guided by a strong longitudinal beam, forming at the same time the connecting link between the two bogie trucks. This beam carries also the heavy parts of the electrical equipment—the transformers and auxiliary apparatus—whereas the framework of the cage itself is kept as light as possible, without interfering with the mechanical strength of the structure.

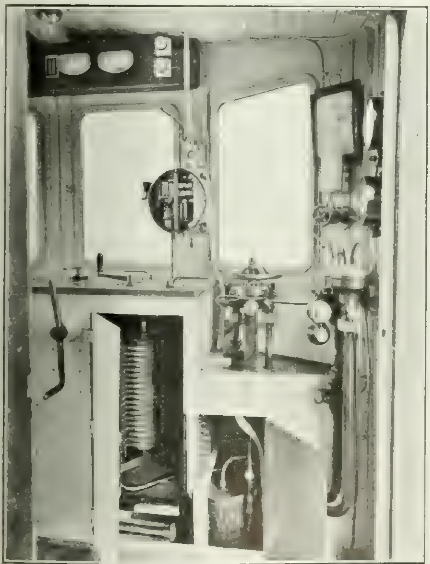
Two iron partitions divide the cage into three compartments—one at either end of the locomotive, for the driver, and one machine-room. A passage leading along one side of the machine-room connects the two driver compartments.

The floor consists of iron sheeting, covered with pitch-pine and linoleum, wherever possible. Around the motors suitable openings have been left in the floor covering. To enable easy inspection and access to the motors, the motors are left practically uncovered, even during travel. The compartment in which the high-tension switch gear and the transformers are placed is screened in by suitable iron guards, which can be opened only when the energy collectors have been taken off the line. The moment the guards are removed the high-tension line is automatically grounded; the trolley can be brought to contact with the overhead line again only when the above-mentioned guards are again shut.

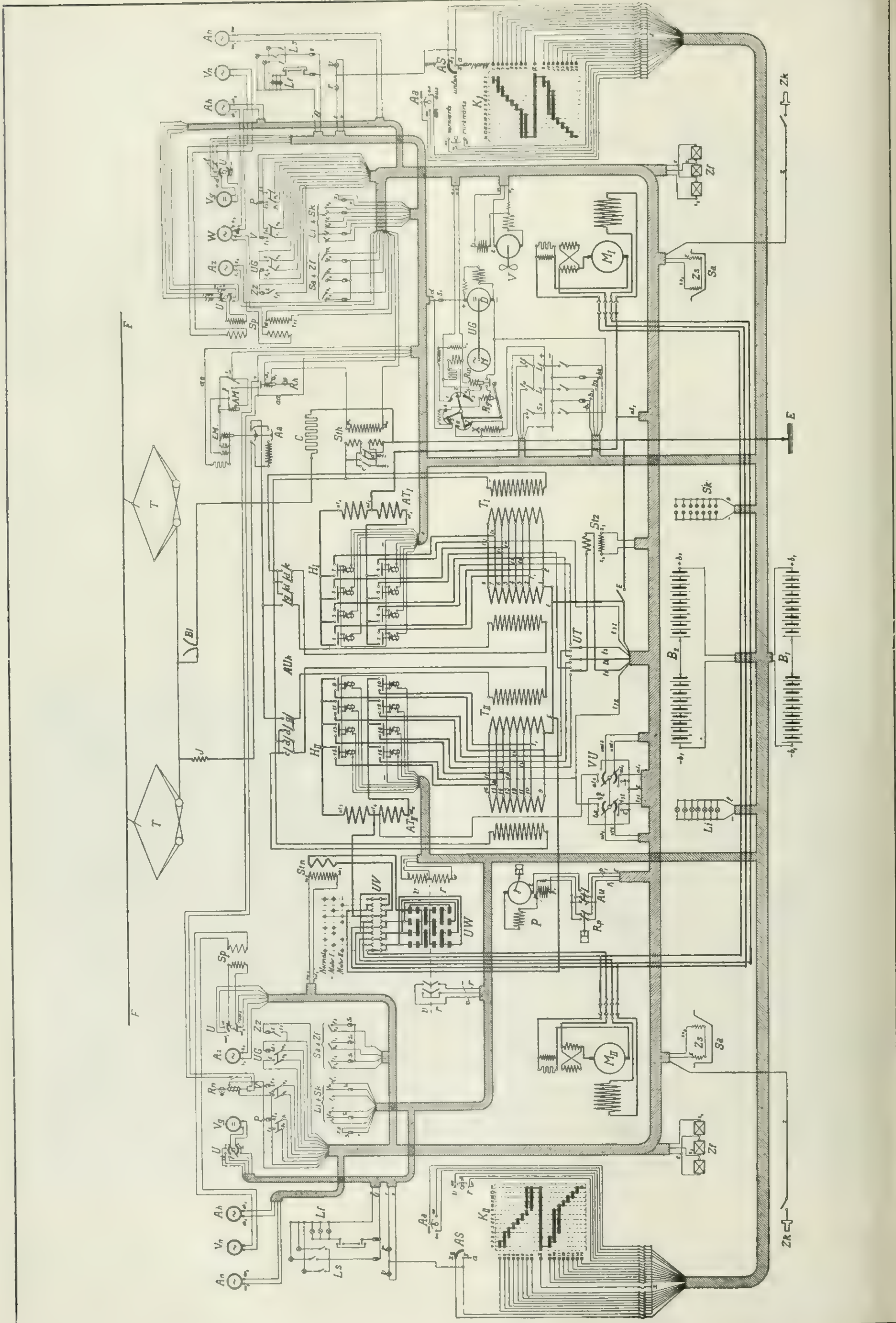
Three large openings, closed by rainproof flap covers, are provided in the roof of the cage for permitting the removing of motors, transformers and auxiliary apparatus.

The machine room is provided with twelve large windows, of which eight can be opened. The ventilation of the machine room is effected by means of these windows and the shutters provided for in the monitor roof of the cage.

Each of the two spacious driver compartments is accessible by two side doors and one front door, leading to a



Figs. 4 and 5—Driver's Compartment.



ptform, from which one can cross over to the car att:hed. The side doors are provided with shutters and fitboards.

A folding ladder fitted on each platform provides access t the cage roof for inspection. These ladders are conn:ted with an air valve in such a way that as soon as a ldder is put up the air contained in the pressure cylinders, o:rating the current collectors, discharges, whereby the c-rent collectors are automatically taken off the line, even sould this have been overlooked by the driver before ascding the roof.

The equipment of each of the two driver compartments is intical. As shown in Figs. 4 and 5, each is fitted with a citrol desk comprising the necessary gear for changing t: running direction, for regulating the motor voltage, for c:rating the current collectors, the high-tension switches, t: brakes, the sanders and the signal whistle. The contilling instruments, such as tachometer, voltmeter and ameter, are fixed above in front of the control desk. In t: rear of each driver's compartment is fixed a marble lard, which contains the switches for the lighting and ltting and the auxiliary machinery, and a number of r asuring instruments.

Besides the ordinary hand brake each bogie is fitted with o: automatic and one hand-operated Westinghouse brake. Ich bogie truck carries one brake cylinder, and in operang the brakes only the brakes on the same bogie can be bought into action. Each bogie has six brakeshoes and c: electrically heated sander with four distributing pipes.

The compressed air required for the manipulation of the crent-collecting gear, of the whistles, of the brakes and t: sanders is supplied by an electrically driven plunger

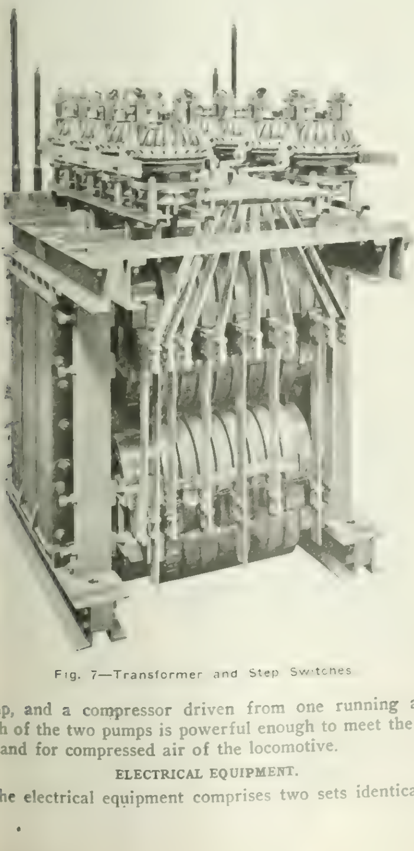


Fig. 7—Transformer and Step Switches

imp, and a compressor driven from one running axle ach of the two pumps is powerful enough to meet the full mand for compressed air of the locomotive.

ELECTRICAL EQUIPMENT.

The electrical equipment comprises two sets identical in their essential parts, each set consisting of one current collector, one transformer with high-tension apparatus, one motor and one controlling gear outfit.

The diagram of connections is shown by Fig. 6; the arrangement is such that the locomotive can if necessary be

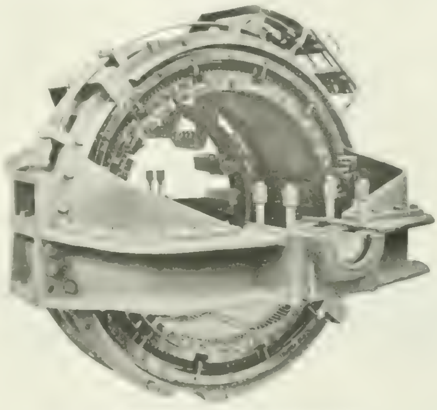


Fig. 8—Motor with Armature Removed.

run with only one motor, one transformer and one controller.

The current is taken from the line by means of two Siemens scissors bow collectors *T* and passes through a choking coil *J* to the high-tension oil-switch *A a*. From there the current passes to the commutating switches *A U h* through the high-tension windings of the transformers, connected in parallel, through a series transformer *S t h* feeding the high-tension ammeter *A h* and the current coil of the wattmeter *W*, and then to earth, through slip-rings fixed to two bogie axles. A shunt to the high-tension line is formed by a line branching off immediately beyond the current collectors and leading to earth through a lightning arrester of the horn type *B*1, fixed on the cage roof, and a resistor *C*, having a total resistance of about 3500 ohms and composed of a number of constantan asbestos strips immersed in an oil-bath.

The current collectors *T* are of the pantograph or scissors type, as employed by the Siemens-Schuckert Works. They have a total width of 1200 mm and are kept against the overhead line wire by means of springs, brought into action by compressed-air cylinders. The collectors are self-reversible and are specially designed to allow for the extreme differences of level of the contact line without appreciable variations of mechanical pressure on the wire. The difference between the highest and lowest position of the collector bows may be as great as 2550 mm.

The high-tension main switch *A a* is of the oil-break type, and fitted with an auxiliary contact which inserts a resistance before the switch can be closed completely. The high-tension main switch is operated from the driver's compartments by means of remote-control gear supplied with direct current. In case of excess current or no voltage the switch is automatically opened by means of time-limit and no-voltage relays. In case of emergency, the switch can also be operated by the use of a suitable key.

Each of the two transformers (Fig. 7) is designed for a continuous rated output of 1000 kva, when artificially air-cooled. They furnish the energy required for the motors, the auxiliary machinery and the heating of the cars. They have been so liberally dimensioned that even should the artificial cooling be interrupted they still can be left under pressure and give their full output for a considerable length of time. The artificially air-cooled transformer has been

preferred to the oil-cooled type owing chiefly to its lighter weight (5500 kg per transformer) and greater accessibility. The efficiency of the transformers, at all loads varying from 200 kva to 1300 kva, exceeds 95 per cent. The two iron cores of each transformer are placed horizontally side by

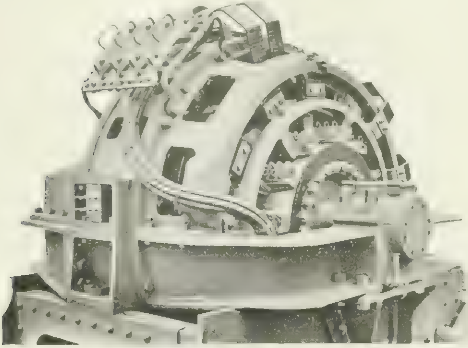


Fig. 9 Motor Mounted on Truck.

side. The low voltage winding on each core consists of one inner and one outer cylindrical winding, divided up in eight coils. Between the two low-voltage windings is placed the high-tension winding, which consists of two sections which may be connected in series or in parallel, so that, if necessary, the locomotive may also be run with a line pressure of 7500 volts. On the top of each transformer are fixed eight "step switches"—Nos. 1-16 in the wiring diagram—operated by direct-current remote control, which are connected with the low-voltage coils and which permit taking from the transformers sixteen different voltages, ranging from 0 to 420 volts. Normally the low-voltage transformer windings and the motors are connected in series, through the above-mentioned step switches. The line connecting the low-voltage windings of the two transformers is grounded, so that the difference in pressure between motor and earth cannot exceed 420 volts. Slots and ducts left in the iron cores and windings of the transformers insure uniform cooling.

The step switches mounted on the transformers are arranged in groups and are interlocked in such a way that only one switch of each group can be closed at a time. By this method the short-circuiting of transformer coils is excluded. To avoid interruption of the current supply when changing from one voltage to the other, the step switches are connected with an auto-transformer *A T*, from which the current passes through the controller to the motor. Each step switch consists of a pot-shaped magnet, the armature of which falls back by gravity.

The copper contact fingers are arranged above the magnet, the contacts of each pole forming a semi-circle. The circuit is closed by an iron cone fixed to the magnet armature spindle. The contacts are fixed by a bayonet-joint, thereby enabling a quick and easy replacing of any worn parts. Besides the above-mentioned contacts, each step switch has been provided with auxiliary contacts, which lead when closing and lag when opening the motor circuit and which are fitted with electromagnetic blow-outs.

The direction of running is controlled by a separate switch *U W* of the barrel type, operated by direct-current solenoids or, if necessary, by hand. The position of this switch is indicated in each driver's cabin by a pair of signal lamps, *v* (forward) and *r* (reverse), controlled by auxiliary contacts fitted on the reversing switch. A set of isolating links *U V* is further provided to effect the necessary changes in the connections should only one transformer and motor set remain for service.

The motors are shown in Figs. 8 and 9,. They are pole Oerlikon compensated series machines with ou phase commutating field.

The frame is of cast steel and made in two parts, so in lifting the upper part the rotor may be uncovered. design of the frame is such that cooling air from all finds easy access to iron, windings and to the commut so that effective ventilation is assured even without ficial cooling. The rise in temperature, ascertained full-load test run of one hour (420 volts, 2100 amp) without artificial cooling, amounted to 62 deg. C. on collector, 52 deg. C. on the iron, 60 deg. C. on the st windings and 75 deg. C. on the rotor windings. With ficial cooling the motor can give the above output tinuously.

The stator windings comprise the exciting winding, w produces the magnetic field and which is connected in se with the rotor, and the compensating winding. Both w ings consist of copper tape, insulated by mica and bedded in the uniformly distributed half-closed slots the stator. The exciting and the compensating wind overlap by half a pole distance. Inside the compensa winding and inclosing one tooth is arranged the comm ing-field winding, the current of which is caused to out of phase with the armature current by a non-induc resistance connected in parallel. This resistance is f directly below the motor on the bogie truck.

The exciting winding is calculated for starting motors with the maximum torque without exceeding a p sure of 4 volts between adjacent commutator segm The brushes cover as a maximum three commutator ments and do not cause any dangerous sparking.

The design of the rotor is indicated in Fig. 3. Th are no resistances between the commutator and the ar ture windings. The connections consist of very large per strips, dimensioned with a view to obtaining as g a mechanical strength as possible.

The brush holders are fixed to a ring-shaped sup which by means of pinion and gear wheel rim can be c pletely turned round the collector so that all brushes easily be controlled and replaced.

The motors have a radial air gap of 3 mm (⅛ in.). bearings are provided with ring lubrication and fitted journals having a 2-mm lining of anti-friction m Even should this lining be worn completely, the rotor never touch the interior stator facing. The spur gear referred to above, is fitted between the rotor and the mo bearing opposite the collector.

Tests carried out have shown that the motor efficien between half and full load are 90 per cent and over,

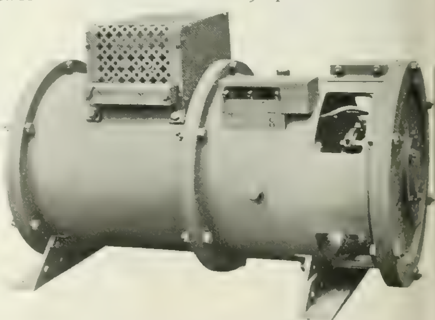


Fig. 10—Motor-Generator Set.

that the power factor, at speeds above 30 km per h exceeds 0.95.

Among the auxiliary equipment carried by the loco tive may first be mentioned a complete direct-current p comprising a motor-generator *U G* of 1.2 kw output (

[illegible] and a storage batter[illegible] 18 cells, [illegible]ng a total rated output of 81 amp-hours. This plant sup[illegible]s the direct-current energy required for operating the [illegible]gnet coils of all the high-tension switches, and also for [li]ghting the locomotive. The converter starts automatically [a]nd puts itself in parallel with the battery as soon as the [lo]comotive is under pressure. The battery is also auto[m]atically charged. The employment of direct current for [o]perating the magnetic coils of the switch gear greatly [si]mplified the construction of the regulating and the auto[m]atic switches.

The compressed air required for manipulating the cur[re]nt collectors, the Westinghouse brakes, the whistles and [t]he sanders is furnished by a small air compressor set P, [co]mprising a Westinghouse air compressor, driven through [sp]ur gearing by a 9-hp single-phase series motor. This [se]t also starts automatically a switch $R\,p$ opening and clos[in]g the motor circuit according to the pressure of the [a]ir contained in the pressure reservoir. This switch can [be] short-circuited in case it should fail to act. The pres[su]re pump can in this case be operated by hand from the [dr]iver's cabins.

The cooling air required for the transformers and if [ne]cessary also for the motors is supplied by a low-pres[su]re Sulzer fan V, driven by a 10-hp single-phase series [mot]or.

The motors of the compressor set and of the low pres[su]re blower are supplied with energy at 150 volts, whereas [th]e motor of the motor-generator obtains energy at 300 [vo]lts taken from the secondary windings of either trans[form]er.

The heating of the locomotive is done with energy at 300 [vo]lts taken from the secondary transformer windings. In [ea]ch driver's cabin are placed three radiators, consuming [?]o watts each. The heaters in the sand boxes consume [ab]out 100 watts. The heating of the complete train can [al]so be effected with 300 volts energy, and for this purpose [su]itable single-pole heating couplings, capable of transmit[ti]ng up to 100 kw, are fixed on either end of the loco[mo]tive.

The measuring and controlling gear comprises the fol[lo]wing instruments, distributed in the two driver's cabins: [tw]o high-tension ammeters $A\,h$, connected to high-tension [se]ries transformers $S\,t\,h$; two low-tension ammeters $A\,n$, [co]nnected to the low-tension series transformers $S\,t\,n$; two [lo]w-tension voltmeters $V\,n$, fed from the shunt transformer [S]p. By means of a number of change-over switches U [an]d $V\,U$ the shunt transformers may be so connected that [wi]th the voltmeters $V\,n$ the secondary transformer voltage, [or] the pressure of the motors, singly or of both sets to[ge]ther, may be ascertained. In one cabin there is fitted a [wa]ttmeter connected to a series transformer $S\,t\,h$, and to [a] shunt transformer connected to the secondary windings [of] the main transformers. The remaining instruments are [tw]o direct-current voltmeters with voltmeter-change-over [sw]itches for measuring the generator, battery and lamp [vo]ltage; two ammeters with series transformers $S\,t\,z$ for [the] heating system; two Hasler tachographs, and four [br]ake manometers.

The starting of the locomotive is effected as follows: [W]hen both current collectors are pulled down, that is, [ta]ken off the supply line, one of them is brought into con[tac]t with the overhead feeder by an air-pump operated by [ha]nd. By bringing switch $A\,a$, fitted on the control desk [in] the driver's cabin, to position $a\,c$, the high-tension main [sw]itch can be closed. This is, however, only possible when, [by] turning the valve of the air cylinder commanding the [po]sition of the current collectors to the "up" or "down" [sw]itch, the controlling current switch $A\,S$ which is con[ne]cted to the above mentioned valve is closed. The trans[fo]rmers are then under pressure and the motor-generator, [th]e air-compressor set and the ventilator can be started.

The air-compressor and the motor-generator afterward require no further attention, as they are controlled automatically. The second current collector is now brought in contact with the line by putting the air valve connected to switch $A\,S$ on the "up" position. For running the locomotive, the master controller switch $v\,r$ is put in the direction of running desired, whereby the commutating cylinder of switch $U\,W$ is also operated and its position is indicated by one of the signal lamps r or v. The switch cylinder K of the master controller can now be manipulated. To pass from one running position to another, the switch cylinder must be turned around 360 deg. The position of the switch cylinder is shown by an indicator pointing to a dial plate numbered from 1 to 14. After the switch cylinder leaves the "off" position, the throwing over of the reversing switch is rendered impossible by a mechanical interlocking arrangement.

As the switch cylinder is turned the different electromagnetic switches are operated successively and the motors started. For stopping the locomotive the electro-magnetic switches are operated in the opposite succession by reversing the switch cylinder. If it should be desired to interrupt the supply suddenly, the high-tension main switch must be opened. The latter cannot be closed again before the switch cylinder has been put to the "off" position. The high-tension main switch may be opened either through switch $A\,a$, or through an overload time-limit relay $R\,h$, or a no-voltage relay $R\,n$. The overload relay is supplied with energy through the series transformer $S\,t\,h$, which is so arranged that it can equally well be used for the line emf of 15,000 volts or 7500 volts; the no-voltage relay interrupts the supply in case of default of the line pressure.

The official tests with this locomotive gave results that were satisfactory in every respect. The locomotive hauled a useful load of 481 tons on a gradient of 15 per cent, at a speed of 42 km (26 miles) per hour. The train, having been stopped on the grade, regained an equal speed after two minutes. If the speed at which the normal drawbar pull was required were nearer the maximum speed attainable with the equipment, the locomotive could, without necessitating an increase in weight and with only an unimportant modification of the secondary transformer winding, develop 3000 hp for one hour, at a speed of 60 km (37 miles) per hour.

AN APPROXIMATE METHOD OF DETERMINING POWER-FACTOR.

By C. M. Jansky.

In testing watt-hour meters it is often advisable to determine their accuracy at power-factors other than 100 per cent. The meter committee of the National Electric Light Association recommends that acceptable alternating-current watt-hour meters shall not be in error by more than ± 4 per cent on light load or full load the power-factor of which is 50 per cent, and not more than ± 2 per cent on loads the power-factor of which is 75 per cent. Determining the accuracy of watt-hour meters at these different power-factors necessitates some means of at least approximately calculating the power-factor at which the meter is tested.

The usual ammeter, voltmeter and wattmeter method of determining power-factor is used to a very limited extent in the smaller plants. The simple method discussed below is practically as accurate as this method at low power-factors. In plants using two-phase or three-phase generators the method will undoubtedly prove useful and accurate enough for commercial purposes. However, the method can be used only where two-phase or three-phase circuits are available.

Two-Phase Circuits.—The connections for testing the watt-hour meter on a two-phase, three-wire circuit are shown in Fig. 1. The series coil of the watt-hour meter carries the vector sum of the two currents in the different phases. When the shunt coil of the watt-hour meter is connected as indicated in the diagram the power-factor is the cosine of the angle between the series current and potential across AO. Thus, in Fig. 2, let OE represent the voltage between mains 1 and 2 and OE_2 the voltage between mains 2 and 3.

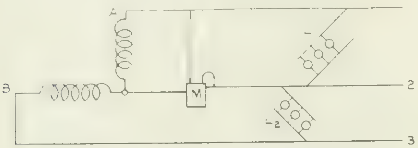


Fig. 1—Three-Wire, Two-Phase Circuit.

Since the load is supposed to be non-inductive OI_1 and OI_2 may be considered as representing the currents in the separate phases. The current in main 2 is the vector sum of OI_1 and OI_2, and is, therefore, represented by OI or by the dotted line OI_0. The power-factor of the load registered by the watt-hour meter when connected as indicated in Fig. 1 is cos θ, where θ is the angle between OE_1 and OI. The value of θ is determined by the relative values of currents in lamp banks L_1 and L_2. That is, if I_1 is the current in load L_1 and I_2 in load L_2, the power-factor is

$$\cos\theta = \frac{I_1}{\sqrt{I_1^2 + I_2^2}}$$

and, hence, can be determined from the readings of two ammeters, one placed in main 1 and the other in main 3.

Since $\sqrt{I_1^2 \times I_2^2} = I$, the current in the series coil of watt-hour meter, an ammeter placed in main 2 will indicate $\sqrt{I_1^2 + I_2^2}$, or I. The power-factor then reduces to

$$\cos\theta = \frac{I_1}{I}$$

When $I_2 = 0$, or the total load is on L_1, $I_1 = I$ and $\cos\theta = 1$.

When $I_1 = 0$, the total load is on L_2 and $\cos\theta = \frac{0}{I_2} = 0$.

Hence, by adjusting the load between L_1 and L_2 any power-factor between 0 and 1 can be approximately obtained and determined. According to the foregoing discussion two ammeters are needed; later it will be shown that the connections may be so made that one ammeter will suffice.

In case the generator is so wound as not to permit three-wire connection, which the foregoing method presupposes, a three-wire circuit can be obtained by connecting two transformers as shown in Fig. 3. The primary circuits of the transformers are connected to the separate phases of the generators and the secondaries are interconnected as shown.

Three-Phase Circuits.—In plants having three-phase alternators the same general plan may be used. When the series coil of the meter to be tested is connected to the middle wire, as indicated in Fig. 4, and the shunt coils across E_1 the power-factor is

$$\cos\theta = \frac{1}{2}\frac{I_3 - I_2}{\sqrt{I_2^2 + I_2 I_3 + I_3^2}} = \frac{I_3 - I_2}{2I}$$

where I, I_2 and I_3 are currents in middle and outside w[ires] respectively.

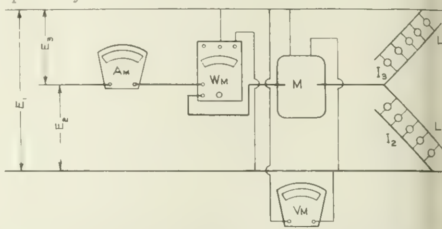


Fig. 4—Three-Wire, Three-Phase Circuit.

When the shunt circuit is connected across E_2 the pow[er-]factor is

$$\cos\theta = \frac{1}{2}\frac{2I_3 + I_2}{\sqrt{I_2^2 + I_2 I_3 + I_3^2}} = \frac{2I_3 + I_2}{2I}$$

These formulas can be derived as follows: Assum[ing] the time-phase displacements of the emfs of the th[ree-]phase generator to be 120 deg., the quantities involved [may] be represented as in Fig. 5. From this diagram i[t is] plainly evident that both the magnitude and the time-ph[ase] of I with reference to E_1 depend upon the relative ma[gni]tudes of I_2 and I_3.

Let θ be the angle between E_1 and I, then the angle [be]tween I_3 and E_1 is 60 deg. when the load is non-induc[tive]. Hence,

$$\cos\theta = \cos(y + 60\text{ deg.})$$
$$= \tfrac{1}{2}\cos y - \tfrac{1}{2}\sqrt{3}\sin y$$

From the triangle whose sides are I, I_2 and I_3

$$I_3 : I_2 :: \sin(60\text{ deg.} - y) : \sin y.$$

Whence

$$\sin y = \tfrac{1}{2} I_2 \sqrt{\frac{3}{I_2^2 + I_2 I_3 + I_3^2}}$$

and

$$\cos y = \frac{1}{2}\frac{2I_3 + I_2}{\sqrt{I_3^2 + I_2 I_3 + I_2^2}}$$

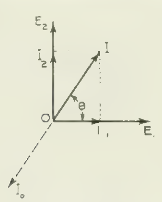


Fig. 2.—Vector Relations in Two-phase Circuit.

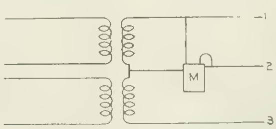


Fig. 3—Three-Wire Circuit Obtained by Transformation.

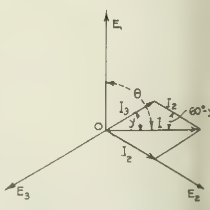


Fig. 5—Vector Relations in Th[ree-]Phase Circuit.

Substituting these values in the expression for cos θ [and] reducing,

$$\cos\theta = \frac{1}{2}\frac{I_3 - I_2}{\sqrt{I_3^2 + I_3 I_2 + I_2^2}}$$

But

$$\sqrt{I_3^2 + I_3 I_2 + I_2^2} = I$$

Hence,

$$\cos\theta = \frac{1}{2}\frac{I_3 - I_2}{I}$$

When $I_2 = I_3$, or when both phases are equally loa[ded], $\cos\theta = 0$. When $I_2 = 0$, $I_3 = I$ and $\cos\theta = 0.5$, and w[hen] $I_3 = 0$, $I_2 = -I$ and $\cos\theta = -0.5$. Hence by such a [con]nection the power-factor can be varied between -0.5 and $+0.5$.

When the shunt circuit is across E_s it can readily be shown that the power-factor

$$\cos\theta = \frac{1}{2}\,\frac{2I_1 + I_2}{\sqrt{I_1^2 + I_1 I_2 + I_2^2}} = \frac{2I_1 + I_2}{2I}$$

when $I_2 = 0$, $I = I_1$, and $\cos\theta = 1$. When $I_1 = 0$, $\cos\theta = 0.5$. That is, when all the load is on L the power-factor is 1, and when all the load is on L' the power-factor is 0.5.

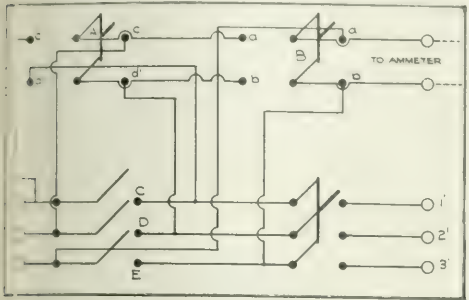


Fig. 6—Switchboard Connections.

The advantage of this method lies in the ease with which both the connections and calculations may be made. The ordinary ammeter, voltmeter and wattmeter method necessitates three instruments, and it is well known that at low power-factors the inductance of the shunt coil of the wattmeter introduces an error which is proportional to sin θ. This error may be as great as that due to the unbalancing of pressures in the method under consideration. The fact that one ammeter is sufficient makes this method especially advantageous for small power plants where the supply of instruments is limited.

TABLE I.—COMPARISON OF METHODS OF MEASURING LOW POWER-FACTORS.

I_1	I_2	$I_1 - I_2$	I	E	Watts.	$\frac{W}{I \times E} \times 100$	Cos θ per Cent.	Difference
[illegible]	[illegible]	4.2	10.0	109.0	250	23.0	21.0	−2.0
[illegible]	[illegible]	2.15	12.4	109.0	55	4.0	8.7	+4.7
[illegible]	[illegible]	0.1	13.75	109.0	0	0	0	0
8.1	12.0	−3.9	17.25	109.0	−200	−10.6	−11.3	+1.3
[illegible]	[illegible]	−6.2	19.5	109.0	−350	−16.5	−15.9	−0.6
10.[illegible]	15.5	−5.25	22.25	108.0	−300	−12.4	−11.8	−0.6
10.[illegible]	18.0	−7.75	24.75	117.0	−450	[illegible]	−15.75	−1.2[illegible]
[illegible]	[illegible]	−12.7	29.00	110.0	−750	−23.5	−22.00	−1.5
[illegible]	[illegible]	−15.15	31.90	110.0	−950	−27.0+	−24.0	−3.0
[illegible]	[illegible]	3.00	25.00	110.0	+ 50	1.8	6.00	+4.2
[illegible]	[illegible]	5.75	27.50	108.5	−200	6.7	10.6	4.[illegible]
20.[illegible]	12.75	8.00	29.5	107.0	300	9.5	13.5	4.00
[illegible]	[illegible]	10.25	31.90	107.0	400	11.8	16.05	4.25

In order to use only one ammeter a polyphase switchboard must be provided. Fig. 6 shows the connections of such a board which is used in the electrical laboratory of the University of Wisconsin. The three mains are connected to binding posts 1′, 2′, 3′, and the three load terminals to posts 1, 2, 3, while the ammeter is connected to the leads indicated. An examination of the diagram will show that when the three-pole and the three single-pole switches are closed the ammeter will register no current. When, however, both double-pole, double-throw switches are closed to the left, and the single-pole switch C is opened, the ammeter will register the current in lamp bank between mains 1 and 2. An examination of the diagram will make clear the operation necessary to ascertain the current in the other lamp bank and that in the middle wire.

Comparison of Methods.—In order to know something of the accuracy of the method a comparison was made between power-factors calculated from ammeter readings and from the ordinary three-instrument method. For this purpose a 11-volt, 96-amp, three-phase generator was connected to two lamp banks. The instruments were of the ordinary laboratory type that had been used for some time by students in experimental work. The accompanying data show clearly the maximum error that one may expect with commercial, inaccurate instruments. The writer has not had the time to compare results obtained by the two methods when accurate instruments are used.

TABLE II.—COMPARISON OF METHODS OF MEASURING HIGH POWER-FACTORS.

I_1	I_2	I	E	Watts.	$\frac{W}{I \times E} \times 100$	Cos θ × 100	Difference.
5.3	7.72	11.50	110.0	1100	[illegible]	90.0	+3.0
[illegible]	9.65	14.25	110.0	1440	[illegible]	92.0	0.0
4.45	9.78	12.50	111.0	1300	[illegible]	96.0	+2.0
[illegible]	[illegible]	[illegible]	111.5	1150	97.0	99.0	+2.0
0.0	9.95	10.00	112.5	1150	102.0	100.0	−2.0?
[illegible]	[illegible]	16.00	110.0	[illegible]	86.7	89.0	+2.3
[illegible]	[illegible]	15.75	111.5	1350	77.0	[illegible]	+2.0
[illegible]	[illegible]	[illegible]	113.5	425	[illegible]	50.0	+3.75
[illegible]	[illegible]	10.25	112.5	[illegible]	46.85	50.0	[illegible]
18.00	0.0	18.00	111.0	[illegible]	[illegible]	50.0	+4.5
20.50	0.0	20.50	110.5	1025	[illegible]	50.0	+4.7
[illegible]	[illegible]	38.75	106.5	3650	91.0	92.0	+1.0
20.6	20.5	35.50	108.0	[illegible]	86.0	86.7	+0.7

Tables I and II show that the greatest difference is not over 5 per cent. Since in one case the three-instrument method indicated a power-factor of 102 per cent it is safe to say that the results are probably not greatly in error. Since a difference of 5 per cent in power-factor will have very slight effect upon the registration of watt-hour meters, it seems that the method is accurate enough for commercial work.

UNIQUE MOTOR-DRIVEN WATER-SUPPLY AND FIRE-PROTECTION SYSTEM.

Boyne City, Mich., is a town of 2000 population near the northern end of the lower peninsula of the State. Its water supply is derived from a well, and is pumped by means of an air lift, delivering into a low-level receiving basin from which the high-duty pumps force the water to the reservoir on a hilltop 250 ft. above the town. The main supply to the town is through a 12-in. pipe in which, at the city limits, is inserted an electrically controlled gate, by-passed by a pressure-reducing valve. Normally the gate valve is closed, passing the town water supply through the reducing valve and so lowering its pressure from 115 lb. to 40 lb. per square inch for domestic use. In case of fire in the town the electrically operated gate valve can be opened from the fire-department office, at once impressing the entire 115-lb. pressure of the reservoir onto the town mains. With this pressure no fire engine is needed to throw a good stream over any house in Boyne City.

Motor-Driven Pump and Central Panel, Boyne City, Mich.

The main lift pump is of the triplex-plunger type driven by a slip-ring induction motor. The pump delivers directly into the 12-in. main pipe between the gate valve and the reservoir. When in operation this pump supplies a greater volume of water than the town demands at any time, so that the pump is continually making delivery to the reservoir. When the level of the reservoir has risen to a predetermined height the pump is automatically shut off, being again started when the reservoir falls a given amount.

This automatic control of the pump motor is effected by a float at the upper reservoir controlling the circuits of the automatic starting panel in the pump house half way down the hill. On account of the exposed position of the float and the severe climate to which it is exposed a pilot pipe filled with oil has been provided in which the float moves. This pipe is tapped from the lowest level of the reservoir so as to be unaffected by ice on the surface. The oil line is also so arranged that in case the reservoir be drained the oil will not be spilled. Normally this float contact controls the pilot circuit of the Cutler-Hammer full-automatic self-starting panel for the pump motor, but if desired the float control can be cut out by opening a double-pole s... leaving the motor to be started from the panel by ... The latter feature makes it possible to keep the motor off the line during hours of heavy load on the generating station. The Westinghouse motor driving the high ... pump is protected by an oil switch, which also serves ... circuit-breaker. The Laidlaw-Dunn-Gordon air com... sor used for blowing the well is driven by an Allis-Chalmers squirrel-cage motor. The attendant in charge of the station visits it during a short time each day to inspect ... operation of the equipment.

Central Station
Management, Policies and Commercial Methods

SMALL-RESIDENCE LIGHTING.

An interesting discussion of small-residence lighting as a profitable central-station load will be found in the account given under "Wisconsin Commission News" of a recent decision of that body affecting the Beloit Water, Gas & Electric Company.

MOVING WINDOW DISPLAYS.

A prize of $10 will be awarded for the best suggestion for a moving window display which can be used in one of the windows of the Electric Shop of the Commonwealth Edison Company, Chicago. All suggestions must be sent to the manager of the Electric Shop before Aug. 1. A drawing and a full explanation are asked, any employee of the company being eligible to take part in the competition. Moving window displays of electrical apparatus prove a decidedly popular attraction, and a recent display of electric laundry machinery of this character in the windows of the Electric Shop attracted wide attention.

TAKING ADVANTAGE OF FRUIT-PRESERVING TIME.

During the fruit-preserving season the Electric Shop of the Commonwealth Edison Company, Chicago, issues an attractive booklet entitled "The Corcorans' House Party," obtaining its title from a little bit of fiction which forms the major part of the book. However, a number of gummed preserving labels for strawberries, cherries, chili sauce, etc., are included in the book, and no doubt housewives will find these very convenient, as it is only necessary to moisten and attach them to jars or jelly glasses. Attention is also attracted to the electric sealing-wax pot, which is very convenient during "putting-up" season, as it furnishes a practical and easy method of using sealing wax.

"RE-CONNECT" POST CARDS FOR VACANT HOUSES.

When a salesman or representative of the Union Electric Company, of St. Louis, has occasion to visit a vacant house the wiring of which has been temporarily disconnected and the meter removed awaiting reoccupancy he is instructed to place somewhere in full sight of those ... ing the building a special printed post card, which, ... filled out, instructs the company to call and make re-co... tions. The card gives the name and address of the ... tomer, and space is left for inserting the number of ... which are required. The presence of these cards i... lieved to serve as a useful reminder in having the re-... lishment of service ordered without delay.

THE ELECTRIC-LIGHT EMPLOYEE AND TH... PUBLIC

To the public and to the consumer of central-station ... ice the expression and behavior of every employee o... company become directly representative of the poli... the company itself. For this reason care must be take... all members of the organization, from manager to ca... and meter-reader, be imbued with the idea of unfailin... and courtesy in handling customers. As a reminder ... employees' duties to those outside the organizatio... North Shore Electric Company, of Chicago, has cause... following notice, signed by Vice-president Frank J. B... to be posted in its offices:

To Employees:

Don't forget that you are in the service of the publi...

Treat all customers politely and courteously.

Don't try to be smart.

Don't misrepresent anything.

Don't think that you are doing the company any fav... beating a customer on a deal.

The motto of this company is, "A Square Deal t... Public." See that you help us live up to it.

ST. LOUIS CENTRAL-STATION SERVICE SU... PLANTS LARGE ISOLATED PLANTS.

The Union Electric Light & Power Company has ... taken over two of the largest remaining isolated plants in St. Louis, the Cupples Station and the Grand Leader department store. The central-station company will furnish the department store with service from its Ashley Street station six months in the year, during the winter months, taking over the operation of the store steam plant as an auxiliary to its steam-heating system. The Cupples Station system will receive central-station service from May to October, again running as an isolated plant in the s...

…g season. The Cupples Station has a city franchise …supplies electricity and heat to 26,000,000 cu. ft. of …ings covering fourteen city blocks. The sixty-six …ic elevators in these buildings will be converted to … drive, making seventy electrically operated elevators … group. The power plant … central-station … is substituted comprises two 125-kw turbine gen…s and engine-driven units, bringing the total rating up … kw. The Grand Leader department store, occupying … city block, also has generating equipment aggre…,00 kw. This store has contracted to use 1,500,000 …000 kw-hours of electrical energy annually. A …en-story building belonging to Schmitz & Schroeder … recently been converted from isolated-plant to …l-station service. The foregoing contracts were taken … standard schedule of rates of the Union Electric … & Power Company.

…OW AN ELECTRIC-VEHICLE LOAD WAS CREATED AT SPRINGFIELD, ILL.

U…til a year ago Springfield, Ill., had practically no elec…ric vehicles. Realizing the value of such a charging load … point of load-factor, the local central-station com… began an extensive advertising campaign in the …ld newspapers. In these half-page and full-page …ments the general advantages of electric vehicles … forth without particular reference to any manu… the display closing with the names and addresses … electric-automobile representatives in town. In …91 the company expended $300 in this educational pub…ic…, and during the first three months of 1911 a similar … of space was used. Besides the newspaper adver… carefully prepared circular matter was sent to a … list of local people whose circumstances justified …ase of electric machines.

…n hardly more than a year from the beginning of the campaign there are to-day fifty vehicles in Springfield, … city of 50,000, and the presence of these cars is attributed … to the publicity work done. The expenditure for … according to Mr. C. L. Owen, new business … for the company, has proved an excellent invest…ment. Other vehicles are being rapidly added to the pres…nt number, and the income from these cars provides a good …turn on the initial outlay.

The majority of the electric vehicles in Springfield are …leisure vehicles and are housed in private garages. Charg…ing service is supplied through a separate meter under off-…peak conditions at 4½ cents per kw-hour.

ELECTRICAL ENERGY FOR ICE MAKING.

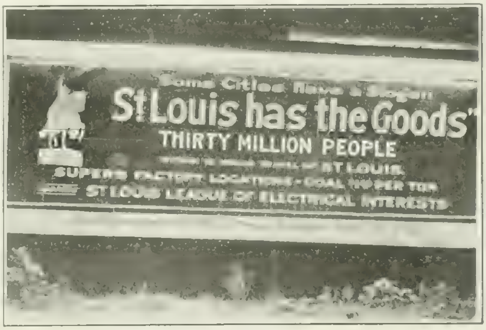
Very few electric-service companies sell electrical en…ergy to outside customers engaged in the manufacture of …rtificial ice. It is, therefore, of interest to note that the …ommonwealth Edison Company of Chicago has two cus…… of this description on its circuits at the present … will soon have a third one. The Lincoln Ice …ompany, which has a plant at Carolina and Elizabeth …treets, has an installation of about 450 hp in alternating-…urrent motors used to drive compressors, pumps, hoists, …tc. This plant has a capacity for producing 120 tons of …ce every twenty-four hours, and it is operated throughout …y electrical energy. Filtered water from Lake Michigan …s used to make the ice, so that the method is essentially a …aw-water ice proposition, in which central stations are …articularly interested, because it is difficult to sell elec…tric energy for ice manufacture where a steam plant must … used to make distilled water.

…Anderson & Goodman have an 80-ton plant at South …ta and Forty-third Streets. Here the electric-motor …quipment has a rating of about 350 hp. Both plants operate twenty-four hours a day at this time of the year. They buy electrical energy from the electric-service company on what is known as the "off-peak schedule," by which a reduced rate is offered in consideration of the fact that the consumer agrees not to take electricity between the hours of 4 p. m. and 8 p. m. during the months of November, December and January. By reason of the continuous demand and the concessions made in the off-peak schedule, the ice makers are able to obtain a very low rate for electrical energy, being, in fact, in the neighborhood of 1 cent a kw-hour. The annual load-factor of this class of customers will figure out about 70 per cent. In view of this high load-factor, although the consumer gets such a low rate, the business is satisfactory to the central-station company and constitutes a very desirable summer load.

The Knickerbocker Ice Company, one of the well-known ice producers of the country, will place in operation an electrically driven 80-ton ice plant at Marshfield Avenue and West Van Buren Street, Chicago, very soon, buying energy from the Commonwealth Edison Company.

ADVERTISING A CITY COUNTRY-WIDE WITH ELECTRIC SIGNS.

To remind folk in other cities of St. Louis' advantages as a manufacturing center, and to advertise its telling



Electric Sign Advertising St. Louis.

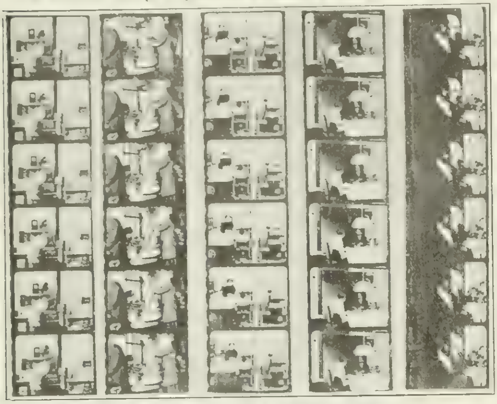
motto, "Some Cities Have a Slogan, St. Louis Has the Goods," the St. Louis League of Electrical Interests, composed of local electrical men, has had electrically lighted signboards erected in a number of Eastern cities, similar to the St. Louis display herewith reproduced. These signboards are 12 ft. high and from 50 ft. to 25 ft. long, and have already been placed in New York, Chicago, Philadelphia, Boston and Buffalo.

In addition to the illuminated signboards at St. Louis the Union Electric Light & Power Company is arranging to erect a huge display sign containing 500 lamps and letters 4 ft. high on the St. Louis armory building. This sign will bear the words "St. Louis Has the Goods" and will be constructed and operated entirely at the company's expense as a matter of public enterprise.

SOLVING THE SERVANT PROBLEM WITH ELECTRICITY; A MOVING-PICTURE DRAMA.

The accompanying illustrations show several sections of the moving-picture film to demonstrate central-station service now being exhibited nightly by the Commonwealth Edison Company of Chicago at its White City auditorium. The simple but engaging plot of this little domestic drama, "Solving the Servant Problem," was outlined on page 457 of the *Electrical World* of June 1.

The strip of pictures at the left is one of the opening scenes of the sketch, and shows the untidy servant girl in her ludicrous efforts to get breakfast on the smoking coal stove, while the family waits hungrily in the dining-room. The second strip depicts the head of the house in the



The Servant Problem on a Moving Picture Film.

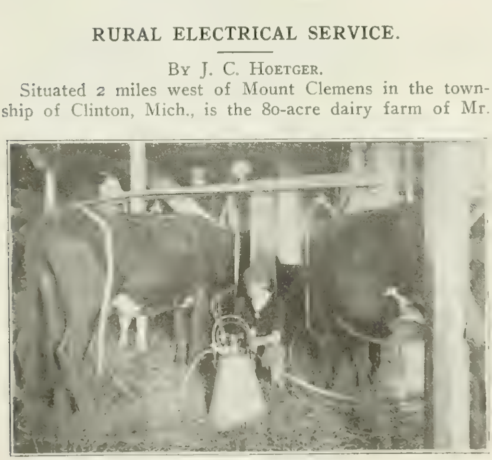
electric shop of the Commonwealth Company making his selections of electric household appliances. These purchases, which include a complete electric kitchen and laundry, are shown in the third strip, while in No. 4 are seen the happy couple enjoying their first electrically prepared meal. The film, which is 1500 ft. in length, closes with a series of character studies of the man of the house, his cigar and his electric cigar lighter.

The Commonwealth Edison Company last year employed moving pictures to demonstrate the use of electric appliances, but these earlier films, which showed mere operations only, lacked popular interest. In the present series, however, the numerous electrical incidents have been gathered together in the form of a connected story which holds attention and interest throughout the exhibition of the film, and no spectator ever leaves the White City exhibit hall until the last picture has been run off.

RURAL ELECTRICAL SERVICE.

By J. C. Hoetger.

Situated 2 miles west of Mount Clemens in the township of Clinton, Mich., is the 80-acre dairy farm of Mr.



Vacuum Milking Machine.

Frank G. Hacker, the show customer of the rural districts covered by the Eastern Michigan Edison Company, St. Clair Division.

Two years ago Mr. Hacker, after careful investigation, adopted the vacuum milking system and installed a 6-in. x 6-in. x 3½-in. vacuum pump, operated by a 5-hp motor. There are two milk receptacles with attachments for milking four cows at a time. Forty cows are the average number kept on the farm, and by using the two milking machines, drawing on four cows at the same time, the entire forty are gone over by one man in two hours. Mr. Hacker soon after installing his milking apparatus saw great possibilities ahead for other uses for his vacuum system and his electric motor. He now has his farm residence piped in connection with the vacuum pump for cleaning the carpets, rugs, mattresses, etc., the dirt being drawn by suction through these pipes to the cellar.

The electric motor has been made to take the place of the windmill, and by simply turning a switch the motor pumps water for the house, for the stock and the gar[den]. The motor is also utilized for grinding corn, runnin[g] grindstone and sawing wood. Mr. Hacker says he can saw enough wood in one hour for a week's supply, w[hich] before the work was a long daily task. In the two y[ears] electricity has been used for power on the Hacker farm the average cost has not been over $10 per month.

The St. Clair division of the Eastern Michigan Edison Company has another stretch of rural customers betw[een] Port Huron and St. Clair, Mich. They are supplied fr[om a] 15,000-volt transmission line from Port Huron for a distance of 4 miles, where a transformer, boxed and fastened on a pole, steps down to 2300 volts. The 2300-volt lin[e is] extended for 8 miles and is now furnishing current for l[ight] and power to twenty-five customers, and it is expecte[d to] add twenty-five more shortly. A number of customers have motors from 1 hp to 5 hp connected for pumping water, feed grinding, etc.

NEW-BUILDING PROMOTION WORK.

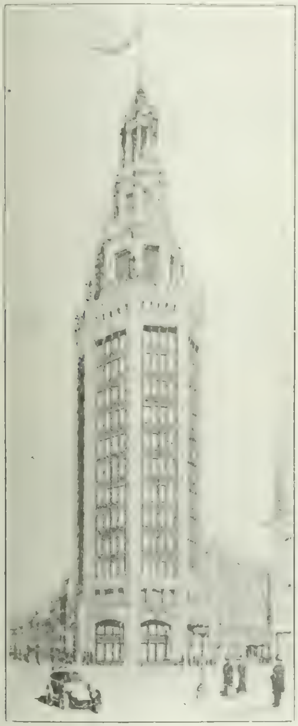
With an eye to the future the Commonwealth Ed[ison] Company of Chicago sends out letters to owners and ar[chi]tects of new apartment buildings calling their attentio[n to] the advantages of an electric laundry in the building. [It] is pointed out that the advantages of an electric laundry [are] very obvious, being of real assistance to housekeepers [and] giving the renting agents a good talking point which [will] assist them in securing good tenants. The cost of instal[ling] an electric washing machine and an electric mangle in [the] laundry of the apartment building is really as nothing c[om]pared with the benefits to be derived from the installat[ion].

Attention is also directed to the matter of placing [the] necessary baseboard outlets for the use of portable vac[uum] cleaners in the different rooms of the various apartme[nts] as well as an outlet for the attachment of an electric iron in the kitchen. These outlets are very essential n[ow]days, when electricity is being used for so many diffe[rent] purposes in the home. If the work is done before the bu[ild]ing is completed much annoyance and expense can [be] saved both by the owner and tenants. If desired, an [in]stallation may be made for a stationary vacuum-clea[ning] system by installing a riser under each floor and placing [a] vacuum machine in the basement with a plug attachn[ent] so that each tenant may attach the cleaner motor to [his] own meter.

NEW BUILDING OF THE BUFFALO GENERA[L] ELECTRIC COMPANY.

The contract for the construction of the new buildin[g of] the Buffalo General Electric Company was recently le[t to] John Gill & Company, of Cleveland, Ohio. The wor[k of] erecting this building is now under way, and the buil[ding] will be ready for occupancy by May 1, 1912. The buil[ding]

located at the intersection of Genesee, Washington and Huron Streets, will be 300 ft. in height, the tallest building in the city. The lower portion will be of granite, with the upper stories of brick and terra cotta. The first two floors, covering the entire site, will be occupied by the Buffalo General Electric Company and the third floor by the Cataract Power & Conduit Company. The upper floors in the tower will be rented for office purposes. The interior finish will be of mahogany. On the first two floors of the



Buffalo General Electric Company's Building.

building will be located the general offices of the Buffalo General Electric Company, contract department, construction department, meter department, etc. In the basement will be a large display-room. A rotary-converter substation and a large storage battery will also be located in the basement. The top floor of the building will be used for an assembly room for employees of the company. The plans for the illumination of the building are in the hands of Mr. W. D'A. Ryan, illuminating engineer of the General Electric Company.

PRIZES FOR EMPLOYEES' HINTS AND IDEAS.

In the business office of the Springfield (Ill.) Light, Heat & Power Company a special letter box has been put up bearing the words "Brighter Springfield," and into this box employees and others are urged to place, in written form, all ideas or suggestions that will benefit the service. To its employees the company has also issued numbered books of blank forms, and for the best suggestions received cash prizes are offered. The awards are made every three months and consist of four prizes of $5, $2.50, $1.50 and $1 respectively. All of the company's street-railway, gas-department and electric-lighting employees are eligible in the prize contests, although, of course, the greatest interest has been displayed by the office staff itself.

The scheme was inaugurated six months ago and immediately began to show results. The suggestions received have included many hints for the improvement of office and plant routine, but the results of chief value have come in the form of "tips" regarding prospective customers, present consumers who plan extensions in equipment, customers complaining of service, etc. These hints on the location of "prospects" enable solicitors to be dispatched to the addresses given without delay, and they usually close with the customer before his mood changes. One instance showing the value of the suggestion box was in the case of a customer who felt dissatisfied with his service and planned to put in a gasoline plant. A central-station employee having no direct connection with the sales department heard of the contemplated change and explained the situation on a slip in the suggestion box. A solicitor immediately called on the customer and by his arguments was able to induce him to continue to use electric service.

The contents of the suggestion box usually cover a wide range of subjects—"prospects," dissatisfied customers, consumers ready to buy apparatus, wires down, lamps out, services interrupted, inoperative apparatus, etc., and, while some chaff is necessarily uncovered, on the whole a great deal of valuable material is contributed as long as interest is kept lively in the suggestion box.

Wiring and Illumination

REFLECTING GLASSWARE.

By J. R. Cravath.

One of the effects of the illuminating engineering movement of the past six years has been an increased interest in glassware which combines reflecting and diffusing properties in such proportions as to fit it for reflectors for incandescent lamps. In the ordinary use of incandescent lamps it is desirable to employ reflectors which will reflect into the lower hemisphere a certain proportion of the light from the lamp and allow some light to pass through the reflector for the illumination of ceilings and walls.

The oldest variety of translucent glassware meeting these requirements was opal, which has in it a large number of suspended reflecting particles. The light which passes through opal glass is thoroughly diffused because of being reflected from one particle to another, and not passing straight through as in the case of clear glass. At the same time many of these particles reflect the light back to the side of the glass whence it came, and some light is also reflected from the polished surface of the glass. If opal were patented and could be pushed by some one company as a specialty or novelty at a good margin of profit without danger of competition, it would doubtless be much more popular than it is at present. Unfortunately it is so staple and well known that no manufacturer has seen fit to spend much money in pushing reflectors of plain opal for the simple reason that no exclusive trade can be built up with it.

Of the translucent reflectors the prismatic type has been most extensively sold during the past few years. These depend on the principle of total reflection with 90-deg. prism for reflecting the light, while sufficient light passes directly through the reflector at the apexes and bottoms of the prisms to bring these reflectors into the translucent class. When built of clear glass prismatic reflectors have a very low absorption; that is, a very small amount of light is lost either in the process of reflection or in passing through the glass. The prisms render them more difficult to clean than plain, smooth reflectors.

Glass which has been roughened by sand blasting or acid etching has been used to a limited extent for reflectors. Such glass allows a larger percentage of light to pass through than does opal or prismatic. The general effect is pleasing, but the impossibility of cleaning after dirt has once been rubbed into the roughened surface is a serious objection.

Recently a large number of new kinds of glass have been brought out under various trade names for use as tungsten-lamp globes and reflectors. This fact indicates commendable enterprise and investigation on the part of glass manufacturers, and it is hoped that the good work will continue. In the numerous varieties of reflecting glassware recently brought out there is not as much essential difference as the large assortment of trade names would indicate, but there is one movement in glass manufacture which is especially worth noting at this time, namely, the production of a translucent glass with a smooth surface which presents some of the pleasing appearances of sand-blasted or etched glass, together with the smooth, easily cleaned surface of opal and reflecting qualities of opal. Most of these new varieties of glass give light distribution very similar to opal when made up in similar shapes of reflectors. When made up in thin globes the effect is very similar to sand-blasted or acid-etched globes and the total absorption of light in passing through the globe is about the same, but opal possesses the important advantage of having no roughened surface to become filled with dirt.

Another line of development has been the production of opal glassware with the surface modified in some way so as to produce a slightly different effect from regular opal. All of these efforts are commendable as they place at the disposal of the purchaser a much larger selection of good reflecting glassware than was possible a few years ago. Some manufacturers have gone into the matter of scientific design of the shape of the reflector very fully, while others have apparently simply copied other designs with modifications to produce something slightly different in appearance, which modifications have not always been for the best. Apparently there has not yet been produced a glass of low absorption, like acid-etched or sand-blasted glass, which can be obtained in plate form for use in sky-windows, lanterns, etc., but will have the smooth finish which makes effective cleaning possible. Practically all of the plain diffusing glass now obtainable has such a rough surface that cleaning is difficult, or else the absorption is so great that it is almost prohibitive with artificial light. There is good reason to suppose, however, from the work already done with reflecting shades that plain plates can be obtained combining low absorption of light with smooth surface suitable to cleaning and sufficient diffusion to avoid showing the lamp filament through the glass.

ILLUMINATION AT ROCHESTER, N. Y., IN HONOR OF MYSTIC SHRINERS.

An account was published in these columns on July 15 of the electrical decorations in Rochester, N. Y., for the convention of the Imperial Council, Ancient Arabic Order, Nobles of the Mystic Shrine, held July 10 to 13 inclusive. The two engravings published herewith show portions of Main Street during the celebration. The canopies, the colored lamps in which do not show in the engravings, are suspended from cables at the intersections of the principal thoroughfares and also between blocks. Each holds about 1500 30-watt lamps and is a permanent feature for the rest of the season.

Rochester has become quite a convention city, and in order to avoid the expense of erecting and removing the canopies for the various large gatherings arrangements have be made to retain the chief decorative features of the illun nating scheme on the main thoroughfare of the city. Ma Street is the great business and shopping thoroughfare

Fig. 1—Main Street, Rochester, During Shriners' Convention.

Rochester, no other street sharing the honor; so that it the center of activity by night and by day of the Flow City.

The avenues leading from the five stations of the trur lines reaching the city were decorated with stringers fe tooned from pole to pole parallel with the sidewalk from th stations to Main Street. In all 5 miles of festoons we required for this work. Various emblems of the orde such as the star and crescent, camel, etc., were outlined light in many places, and on Main Street there were tw

Fig. 2—Main Street, Rochester, During Shriners' Convention.

large animated signs hung across the thoroughfare, on depicting a camel walking and the other a man climbing rope. The significance of both are known to members c the order.

ELECTRIC ILLUMINATION FOR RELIGIOUS FESTIVAL.

The New York Edison Company has developed a uniqu field of celebration illumination on the upper East Side i the section known as "Little Italy." Here some 200,00 Italians come together every year from all over Americ to celebrate the festival of Our Lady of Mount Carmel. I is utterly impossible for this great body of people to fin lodgings among the residents of the section, so many thou

ends sleep in Thomas Jefferson Park, which extends from East 111th Street to East 114th Street, and from First Avenue to the East River. The pilgrims come from distant Winnipeg, in Canada, from the South and the West and all parts of the United States, to do homage to Our Lady of Mount Carmel.

The celebration lasts for three days, July 15, 16 and 17, though the sixteenth is the real day of the festival. The devotees show their religious gratitude by marching for hours barefooted and carrrying can dles in a long procession that winds its way though the streets of "Little Italy." Finally they lay their candles and other offerings at the foot of the shrine of Our Lady of Mount Carmel, in

Fig. 1—Illumination on First Avenue, New York.

the church at 447 East 115th Street. This is the largest Italian church in New York.

Until four years ago the streets were meagerly illuminated for the celebration with little kerosene oil lamps in colored-glass cases. It was four years ago that Mr. Meara, manager of the Harlem district for the New York Edison Company, and Mr. Friend, his assistant, went into "Little Italy" and showed the residents what could be done in the way of electric illumination, and since then thousands of lamps have been used every year.

This year the front of the church was festooned with lamps, the American and Italian flags were reproduced in electric lamps, and Our Lady of Mount Carmel was pictured in the light of 300 lamps in Jefferson Park. First Avenue was illuminated from 106th Street to 116th Street, and 114th and 115th Streets were illuminated from First Avenue to Pleasant Avenue. The illumination extended all the way around Thomas Jefferson Park.

For the celebration lighting in the streets 6000 8-cp lamps were used, together with 200 32-cp lamps. More than 3000 lamps were used on the front of private property outside

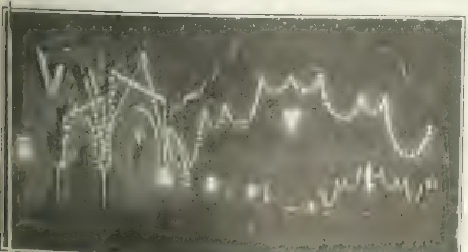


Fig. 2—Illumination on East 115th Street, New York.

of the street illumination, and it is estimated that altogether fully 10,000 lamps were in use. They were lighted from 8 o'clock until midnight on the three nights of the celebration, and the illumination thus afforded, which far surpassed that given by the crude methods at first in vogue, aroused much enthusiasm among the impressionable dwellers in the district.

SPECTACULAR ILLUMINATION AT RICHMOND, IND.

During the recent encampment of the Grand Army of the Republic at Richmond, Ind., Main Street was handsomely

Main Street, Richmond, Ind., During G. A. R. Encampment.

decorated with bunting and flags and in addition the Richmond Light, Heat & Power Company arranged spectacular illumination of the thoroughfare at night. Incandescent lamps were festooned across the roadways, as indicated in the engraving herewith, and at the corners four illuminated columns were provided besides the two stringers of lamps which crossed diagonally from curb to curb. The court house and high school were outlined in red, white and blue lamps and the contrast of the vari-colored lamps with the green leaves was strikingly beautiful. The decorations were arranged by Mr. Fred Schornstein, the manager of the lighting company, and the veterans are said to have expressed much pleasure with the display made in their honor.

RECENT TELEPHONE PATENTS.

LOCK-OUT PARTY SYSTEM.

A lock-out party-line system of the sectional-line type forms the subject of a patent granted to Mr. H. J. Roberts, of Evanston, Ill., and assigned to the Homer Roberts Telephone Company. With this system it is necessary to build up the line from the central to the calling station. This is accomplished through the agency of an impulse current. When a call is sent in over the continuous side of the line and the operator responds a single pull upon her "running" key will supply a sufficient number of impulses to build up the line to the calling station. Impulses to the called line are impressed manually, so that the particular station desired may be selected. There is a third key, a "passing" key, which serves when the desired station is on the same line as the caller. In this case when the nearest of the two stations is reached and has answered the "passing" key is operated and affords the means to lease this station on the line even though the line be built up farther out.

COMBINED WIRE AND WIRELESS SYSTEM.

Mr. M. B. Johnson, of San Antonio, Tex., has conceived the idea of so combining wire telephone circuits with wireless that a short gap may be overreached wirelessly where inaccessible for wires. For instance, a wire telephone circuit might be terminated upon the bank of a river or upon the brink of a chasm in a wireless telephone outfit.

A continuation of this line might begin upon the other side, this being similarly equipped with wireless apparatus. The inventor contemplates also the use of through-signal transmitting devices. Mr. Johnson has obtained two patents relating to this system and he has also applied the same idea to telegraphy.

AUTOMATIC SYSTEM.

An automatic exchange system is patented by Mr. W. H. Matthies, of Antwerp, Belgium, the patent being assigned to the Western Electric Company. The sending device is set up for all digits before the transmission of the call is begun. When the call is originated the calling line is picked up by a finder and then the selecting is initiated by starting the sender. The digit wheels return home one at a time in proper sequence and by so doing furnish the necessary impulses to operate the selector switches at the central and to perform the switching of the control circuit from one selector to the next, as well as to lock each selector in position as desired. The return of the receiver to the hook restores the finder switch, which in turn releases all selectors simultaneously.

REPEATER

Two patents have been granted to Mr. E. F. W. Alexanderson, of Schenectady, for a telephone relay or repeater and for a repeating system. The system depends primarily upon a high-frequency alternator. This alternator is so arranged that the same winding serves for field and armature, there being a rotating inductor with many poles. The armature terminals are connected to condensers or otherwise tuned to resonance. The field currents are greatly reinforced by armature reactions under these conditions. Therefore, if a telephone current be used in the field coils a reinforced current will be generated by these reactions. This high-frequency reinforced current may be rectified by mercury-arc converters and thus a reinforced telephone wave of direct current produced. The patents for this system are assigned to the General Electric Company.

LETTERS TO THE EDITOR.

Nomenclature of Instrument Transformers.

To the Editor of Electrical World:

SIR:—Your comment appended to a letter appearing in the issue of July 22 relative to the names of instrument transformers appears to have aroused some controversy. Will you, therefore, permit me to speak a word in the interest of simplicity and directness in our nomenclature?

No one believes more firmly than I in accuracy of expression, but when accuracy resolves itself into academic purism I would say that it is time for us to find something brief and to the point in good old English. I am also a believer in giving specific names to specific things when the specific thing is of sufficient importance to deserve a name. In that case the name should be terse, and at the same time descriptive.

The instrument transformer is a highly specialized piece of apparatus designed for a specific purpose. It is distinctly different from anything else we have, and it is used in such large numbers as to require a distinctive name. When you speak of a "shunt transformer" you include not only the little switchboard instrument, but also thousands of other transformers used for an entirely different purpose. If we are to adopt this name we must add to it another word to show that we are speaking of a shunt *instrument* transformer and not of a shunt *power* transformer. Similarly, the term "series transformer" includes a variety of devices used for quite different purposes.

But why should we take so much trouble? A transformer is a thing that transforms. A "current transformer" is thing that transforms current for the purpose of measuri current, and for no other purpose. If it also transforn voltage this fact is insignificant since the voltage is simp a by-product which is neglected. Similarly, a "volta transformer" is a thing that transforms voltage (*not* pote tial) for the purpose of measuring voltage and for other purpose. The names are terse, descriptive and no ambiguous.

One is reminded of an incident which is said to ha occurred when Adam and Eve were naming the anima When they came to the toad Adam was sorely perplexe But Eve solved the difficulty with masterly directness saying: "Well, it looks like a toad, it hops like a toad, a it is not like anything else I have ever seen. Why not c it a toad?" Will you permit me to say in like manner— looks like a current transformer, it works like a curre transformer, and it is not like anything else in general u in the electric arts, so why not call it what it is—a *curre transformer?* Also, in like manner, the *voltage transform*

New York. FREDERICK K. VREELAND.

To the Editor of Electrical World:

SIR:—Your dicta in the issue for July 22, 1911, page 2 in which you criticise the use of the terms "voltage" "potential" and "current" with reference to instrum transformers, and virtually accuse those who use su terms of taking unwarranted liberties with the Engl language, would be more convincing if some really cog reasons were given for the usage which you uphold. Yo statement that "the qualifying words 'series' and 'shu describe properly the types of transformers used with struments" is, to my mind, accurate only in so far as it plies to "series" transformers. To call a transformer "shunt" transformer is by no means to designate its ty in an unambiguous manner, unless a special convention understood with reference to the usage. The term "shu was used originally in connection with a by-pass on galvanometer, the by-pass taking a portion of the curr which otherwise would go through the galvanomet Starting from that significance, the term "shunt" has co to apply to a resistance connected in series with the and having leads going to a current-measuring instrume This is a very distinctly different thing from a resistance reactance across a constant-potential line, which is the co nection employed in voltage transformers.

I am quite aware that it is common usage, especially England, to speak of the "shunt" windings of a wattme or a watt-hour meter, meaning thereby the windings wh take a current proportional to the voltage on the consta potential line. A similar usage prevails with respect to a lamp voltage windings. It seems to me that in view of historical and actual use of the term "shunt" this usag not justifiable and that for the same reason to speak o "shunt" transformer is not good usage. If the "shu transformer is a shunt on anything it is a shunt on all the other receiving apparatus on the constant-potential li From this point of view the term has no significance wh ever. Common usage in speaking of a shunt-wo dynamo or motor may be cited in defense. However, is not a parallel case since in the generator or the mo the field actually does constitute a shunt on the armat and the armature is connected across the line. With resp to watt-hour meters the misuse of the term "shunt" is p ticularly apparent and may lead to decided confusion. T the case of a meter in which an actual shunt is used to ca part of the current so that all of it does not go through current windings of the meter. If this meter has a volt winding also, which is the "shunt" winding? This is no means an impossible case.

To sum it up, it seems to me that to speak of a "shu transformer or of the "shunt" winding of a meter is because inaccurate and confusing. The series transfor

p forms the ordinary functions of an instrument shunt, a l to call the voltage transformer a "shunt" transformer a once complicates the matter greatly.

To the use of the word "series" in connection with transformers I have no objection *per se*, but, as has been pointed o , if we speak of voltage transformers we must also speak of current transformers. Since we cannot without confusion speak of "shunt" transformers, we cannot use t corresponding term "series" transformers; or if we must employ the term "series" transformers, which is unobjectionable, we should use as the counterpart of that the term "multiple" transformer rather than the term "shunt" transformer, and this usage is favored by no one.

As between "potential" and "voltage" as applied to transformers undoubtedly the term "voltage" transformer is to be preferred. A transformer does not transform potential in any sense of the word—it does transform the voltage of the circuit.

... York. CLAYTON H. SHARP.

[... argument against the use of the word "shunt" in connection with an instrument transformer, in that the term does not distinguish between transformers used with voltage-measuring instruments and those employed for carrying heavy loads, could be used equally well against the term "voltage transformer" or "potential transformer," but without convincing those who mentally insert the word "instrument" with "voltage transformer" or "potential transformer," but not with "shunt transformer." Usage can hardly be accepted as a criterion of accuracy, although it frequently determines the choice when accuracy is not involved or considered. The attention of those who place predominating importance on usage should be called to the well-established term "constant-potential transformer," which would seem to be just as accurate or inaccurate as the term "potential transformer," which may or may not be synonymous with the term "voltage transformer," but is frequently used as its equivalent in designating a "shunt-instrument transformer." This latter term appears to be the proper complete one to use, but in cases where the word "instrument" will naturally be inserted mentally by the reader this word can well be omitted in writing. Ed.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

...-Phase Series Motor.—F. W. SCHMIDT.—A discussion of the principles of the three-phase series commutator motor and its speed-regulation methods, with a development of its characteristic diagram.—*Elek. u. Masch.* (Vienna), May 7.

Two-Phase to Three-Phase Transformation.—M. VIDMAR.—An illustrated description of a new method of transforming a three-phase into a two-phase system, for which certain advantages over the well-known T-method are claimed. Use is made of a single transformer with three legs, as shown in Fig. 1. The two outer legs have equal cross-section, the middle leg has a cross-section $\sqrt{2}$ times that of each of the outers. The primary (three-phase) windings on the two outer legs have the same numbers of turns, while the ratio of the number of primary turns on the middle leg to the number of primary turns on each of the outer legs is 0.366. The three secondary windings (on the two-phase side) have equal numbers of turns. Any symmetrical non-inductive or inductive load is transferred as symmetrical load from one side of the transformer to the other side. This is the case for the new method of transformation as well as for the T-connection. But an advantage is claimed for the new method over the T-connection in so far as the stray fluxes in the latter are considerable. If from the transformer when supplied with three-phase currents on the primary side two-phase currents are to be taken off from the secondary side in such a way that each of the two phases is distributed independently of the other, each by means of two wires (for instance, in order to lead two arc-lamp lines in different connections), use is made of the arrangement of Fig. 2, in which an auxiliary circuit (indicated by the dark line) is employed. Further advantages claimed for the new arrangement are the smaller space requirement and in many cases also a smaller requirement of active material.—*Elek. u. Masch.* (Vienna), June 11.

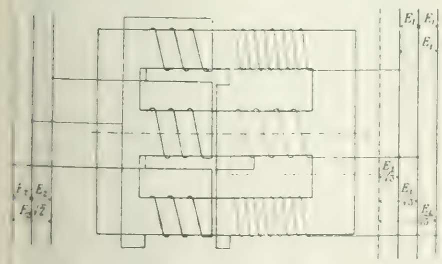


Fig. 1—Two-Phase to Three-Phase Transformer.

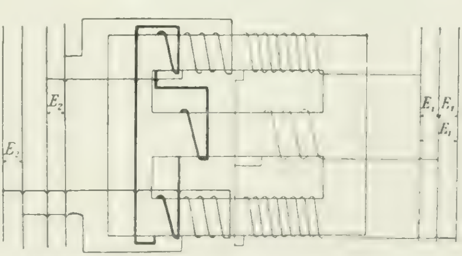


Fig. 2—Two-Phase to Three-Phase Transformer.

Lamps and Lighting.

Alternating-Current Arc Lamp.—A note on a recent British patent (No. 6336, June 8, 1911) of Korting & Mathiesen Akt.-Ges. It is known that an alternating-current arc sometimes acts as a converter to direct current, which affects the magnetic system in the case of lamps fed mechanically by an armature and a solenoid and renders the control of the lamp difficult. This is remedied by connecting the solenoid to the secondary of a small transformer, the primary being connected across the lamp. The advantage of using the transformer is that the secondary pressure can be selected as required, and the solenoid winding need not be calculated in regard to the lamp pressure, but can be identical for various types of alternating-current arc lamps. —Lond. *Elec. Eng'ing*, June 15.

Street Lighting.—L. CROUCH.—The concluding instalments of the author's illustrated serial on electric street lighting, presenting a general review of the subject, includ-

ing various standard data commonly required. In these instalments are discussed the characteristics of metallic-filament and carbon-filament lamps; the illumination required in street lighting; the candle-power of various units; the areas lighted by various lamps; the power consumption per ft.-candle per square foot; the use of globes and lanterns; poles and fittings, and annual costs of various systems of street lighting.—Lond. *Elec. Review,* June 16 and 23.

Globes, Shades and Reflectors.—C. TOONE.—An illustrated serial on the characteristics of globes, shades and reflectors. The features discussed are the brightness of luminous sources, the desirable illumination in various services, coefficients of direct and diffuse reflection, globe material, effect of dirt upon the absorption coefficients, subsidiary means of securing diffusion. In the accompanying tables are shown the percentage of light absorption by various clean materials and the per cent of loss of illumination due to dirt.—Lond. *Elec. Review,* June 16, 23 and 30.

TABLE I.—PERCENTAGE ABSORPTION BY CLEAN MATERIALS.

Material	Average Absorption
Clear glass	10
Clear arc globe. .	30
Clear arc globe. .	45
Prismatic glass. .	15
Light alabaster. .	20
Heavy alabaster.	[illegible]
Light sand blasted	20
Ground glass.	25
Frosted	11
Opal (dense)	30—50
Opal (thin)	55
Milky glass	35
Opaline	35
Translucent	20—40
Clear-stained Glass:—	
Canary yellow	20
Deep green	60
Deep ruby	90
Deep cobalt blue.	95

TABLE II.—PER CENT ABSORPTION DUE TO DIRT.

Particulars of Case.	Per cent loss of Illumination Due to Dirt.
"Alabaster" glass globe (Nernst) mean.	6 } per 100 hrs
"Alabaster" glass globe (Nernst) maximum	12 } service
Acid-frosted glass bulbs.	6 per 600 hours
Acid-frosted glass bulbs.	10 per 2 months
Prismatic glass shade.	13 per 1 year
Nernst lamp globe (various)	5 to 10 or 15
Filament lamp and globe, dirty.	14
Globe alone, dirty.	9
Arc lamp globe (opal) (bad case).	20
Prismatic reflector (for glow lamp), dirty.	35 per 6 weeks
Prismatic reflector (for glow lamp), after dusting. . . .	20
Enameled metal reflector (over machine tool) finger-marked	20
Enameled metal reflector (over machine tool), finger-marked, old reflector, oil spattered.	45
Enameled metal reflector (over machine tool), finger-marked over drilling machine, old, dirty.	70
Desirable maximum deterioration, due to dust and dirt, between cleanings.	5 to 10 per 30 to 60 days

Calculating Illumination.—L. S. TWOMEY.—A paper presented before the San Francisco Section of the A. I. E. E. giving outlines of the established methods for calculating illumination, including the Rousseau diagram, the Kennelly diagram, the fluxolite diagram and the point-by-point method.—*Jour. Elect., Power and Gas,* July 1.

Generation, Transmission and Distribution.

Convention of Municipal Electrical Association.—The sixteenth annual convention of the (British) Incorporated Municipal Electrical Association was opened at Brighton on June 27. In his presidential address Mr. J. Christie stated that the membership consists of 168 municipal, 187 engineer, forty-eight associate and four honorary members, and the capital invested in the machinery and plant under the control of the members is about $205,000,000. Councilor Leese, chairman of the Stoke-on-Trent electricity committee, presented a paper entitled "Electricity Supply Viewed from the Municipal Committee's Standpoint," which he discussed a few of the points with which an el tricity committee has to deal, including extension, size plant, profits, cost of supply, showrooms and tend "Modern Wiring Practice" was the title of a paper by J. W. Beauchamp, chief electrical engineer, Tunbri Wells, in which it was suggested that the wiring regulati should be as simple and light as possible, but their enfor ment should be stringent. After analyzing the various isting regulations and pointing out the desirable featu the author discussed cheaper wiring methods and tabula the costs of various systems. Diesel oil engines were cussed in a paper by Mr. H. L. Howard, chief electri engineer, Barking. After outlining the features of engines the author considered the question of oil supply the cost of operation, the items of fuel, labor, repairs maintenance being treated separately. Taking the exist installation at Brighton as an example of a steam-driv station, the first costs of corresponding stations equip with Diesel plant and gas plant were given. The Die installation showed to advantage in this case, as well as a number of figures given for Continental installatio The use of Diesel engines in substations was recommend and the author predicted striking developments in the n few years. Gas engines and producer plants were de with in a paper by Mr. R. M. Carr, chief electrical en neer, Leek. The author gave a number of figures as to first cost of steam-driven and gas-engine stations. Th show that below 1000 kw the gas-engine station costs than the steam plant. After giving particulars of the L electricity supply station he next compared the works c of gas and steam stations under 1000-kw rating. A sta ment of the capital and running costs of a gas-driven tion of 1000-kw rating is given. Discussion on the top "The Purchase of Fuel" and "Street and Store-Fr Lighting" were opened respectively by Mr. C. E. C. Sha field, Wolverhampton, and Mr. A. H. Seabrook, St Mar bone.—Lond. *Electrician,* June 30.

Continuity of Electric Service.—R. P. JACKSON.— ninth and concluding article of a series on the general s ject of continuity of service in transmission systems. the present instalment are discussed the elements contri tory to interruption of service, including external cau internal causes and inability of operating force. The aut remarked that there is no panacea for the troubles transmission systems, nor can any equipment or installa be worked out so completely as to eliminate accident or "personal equation." The best designed and best conduc systems will meet with accidents at times, but on the wh if proper care is taken and the best skill employed in m ing up the material equipment, and if eternal vigilance preparedness are insisted upon, the return will be in form of increasingly reliable service.—*Elec. Jour.,* July.

Fuel Economy.—C. E. C. SHAWFIELD.—Emphasis placed on the importance of determining by calcula what the specific consumption of any chosen station sh be and then carrying out tests to insure the consumpt approaching this figure. Notes are given on the operat of the engine-room equipment, more particularly steam t bines, and the operation of the boiler equipment. author recommends a bonus scheme for the boiler-ho staff, based on the evaporation of water per pound of f —Lond. *Electrician,* June 23.

Traction.

Mercury-Contact Treadle for Railway Signals.— illustrated description of the Siemens mercury-con treadle arranged automatically to close or open an electr circuit by the passage of a train at a given point on a r way line. The treadle is supported solely from one rail tween two adjacent ties and is actuated by the deflectio the rail between the two ties due to a passing wheel, slight movement obtained being transferred to the e

trical contacts, as indicated in the cross-sectional view of Fig. 3. The treadle is in the form of a strong iron casting A, which, by means of the clamps *B B*, is firmly bolted to the bottom flange of the rail. In the center is a circular shallow recess *C*. A thin steel diaphragm *D* is clamped between the rim of the recess and the cover *E* by the bolts. In the center of the cover *E* are the steel plunger *F* and plate G resting on the diaphragm *D*. An india-rubber ring *H* laid in a groove in the cover *E* surrounding the plunger *F* makes an elastic contact joint which is both waterproof and

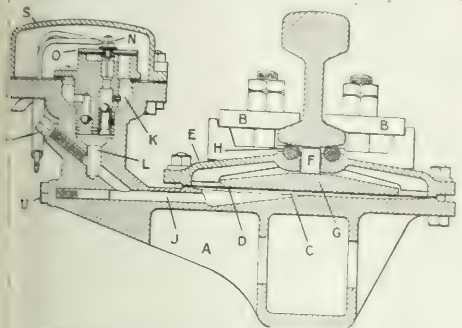


Fig. 3—Cross-Section of Treadle Bolted to Rail.

...roof between the treadle and the under surface of ...ail. The passages *J* and *L* connect the recess *C* with the contact device inserted into the mercury chamber *K*. The contact pins *N* are supported by, but insulated from, the cover *O* of the contact box. The contact device consists of a cast-iron box having valves and passages, the action being similar to that of a pump. According to the type of contact for which the device is arranged mercury is either forced into or withdrawn from the contact box. When the rail experiences a slight deflection between the points of attachment of the treadle, due to the weight of a moving vehicle, the plunger *F* communicates the deflections, however slight, to the diaphragm *D* and thus displaces the mercury confined in the recess below. The ratio between the area of the recess and that of the contact chamber is about 1500 to 1, so that sufficient mercury is displaced to insure the making of a good electrical contact.—Lond. *Electrician*, July 7.

Detroit River Tunnel Electrification.—W. M. RENNIE.—A descriptive article giving details of the electrical equipment of the Detroit River tunnel between Detroit, Mich., and Windsor, Ontario. Steam trains are drawn through the 2,783-ft. tunnel by 1200-hp direct-current locomotives receiving energy from a three-phase, 4400-volt transmission system through synchronous motor-generator sets.—*Michigan Technic*, June.

Installations, Systems and Appliances.

Switch Handles.—S. LEES.—A note calling attention to the lack of protection afforded by the handles of knife switches and starting rheostats, the badly proportioned varieties being termed of an "apologetic character."—Lond. *Elec. Review*, June 30.

Exhibition of Domestic Uses of Electricity.—C. PAULUS.—At this year's annual convention of the German Association (Verband) of Electrical Engineers, in Munich, there will be a symposium of papers on domestic uses of electricity. In connection with this a quite extensive exhibition has been arranged illustrating the domestic uses of electricity and its uses in small shops and in agriculture.—*Elek. Zeit.*, June.

Minimizing No-Load Transformer Losses.—A note on a British patent (No. 12,926, June 22, 1911) of Mr. G. Berry relating to the inventor's series transformer method for minimizing the no-load losses of a constant-potential transformer. The patent covers a scheme for preventing the switch mechanism, after acting automatically to short-circuit the supplementary transformer upon failure of the main transformer during low load, from being afterward automatically moved into a position to open the short-circuit when the relay reassumes the position corresponding to low load. For this purpose, one winding of the main operating solenoid is arranged to be closed by a relay through a circuit that will be rendered non-effective upon failure of the main transformer, by being arranged to be closed across the secondary of the main transformer between the ends thereof and the fuses in the conductors connecting such ends to the secondary mains. The other winding is connected across the low-tension circuit, and the fuses for the primary and secondary of the main transformer are weaker than those of the spare transformer.—Lond. *Elec. Eng'ing*, June 29.

Wires, Wiring and Conduits.

Wiring in Earthquake Countries. RUTTOLO.—During the earthquake in Sicily in 1908 the author found that overhead electric wires aided the destruction of buildings. He recommends to arrange the ends of the wire, where they are connected with an insulator, in spiral form and to fix the spiral to the insulator by means of an auxiliary

Fig. 4—Auxiliary Support for Transmission-Line Wire.

stretched steel wire, as shown in Fig. 4. In case of a sudden strain due to an earthquake, the auxiliary steel wire breaks and the spiral of the copper conductor can extend freely so that it will not cause a destruction of the building.—*Assoc. Elettrot. Italiana*, No. 2, 1911; abstracted in *Elek. u. Masch.* (Vienna), April 16.

Suspension Insulators.—A note on a British patent (No. 27,174, June 22, 1911) of the Société Vendonelli, Priestley & Cie., covering a chain for the suspension of high-tension insulators, in which each porcelain insulator has a core perforated by two holes at right angles to each other and has downwardly sloping wings. The insulators are connected by rings of iron wires, so that the wings of one insulator react between those of the next below, giving protection against rain and minimizing leakage.—Lond. *Elec. Eng'ing*, June 29.

Electrophysics and Magnetism.

Electric Transients.—C. P. STEINMETZ.—An article devoid of theoretical mathematics dealing with the origin, general characteristics and numerical relations of transient phenomena in electrical transmission systems. The author explains, first, the storage of energy in magnetic and dielectric fields and shows that in high-potential systems the dielectric energy may equal or exceed the normal magnetic energy. When the two energies are of the same magnitude dangerous electrical transients may be produced by a surge of the stored energy between its two forms. The "natural impedance of the circuit" is defined by the writer as the relation between the maximum value of the oscillating current and the maximum value of the oscillating voltage. The natural impedance is numerically equal to the square root of the ratio of the line inductance to the line capacity and is usually between 200 ohms and 600 ohms in transmission lines. An example of the application of this relation is given in the calculation of the maximum current that a lightning discharge can produce in a line the insulation of which will withstand a maximum of 150,000 volts. With a natural impedance of 400 ohms the maximum discharge current is 375 amp, which the lightning arresters must allow to pass without damage. Similarly if a load current of, say, 283 amp is suddenly interrupted the maximum oscillating emf would be $283 \times 400 = 113{,}200$ volts. In case of a short-circuit current five times as large the oscillating emf would reach 566,000 volts, which is far beyond the possible insulation strength of the line.—*Jour. Franklin Inst.*, July.

Electrochemistry and Batteries.

Two-Phase Arc-Type Furnace.—An illustrated description of a 3-ton steel-smelting electric furnace of the arc type using two-phase current. The two terminal electrodes enter through the roof, while the neutral return is a carbon electrode embedded in the bottom. The arcs form from the top electrodes on to the slag and metal, the current passing through the metal and the refractory lining of magnesite or dolomite to the neutral electrode. It is stated that, unlike either a single-phase or a three-phase arrangement, the two-phase scheme results in both horizontal and vertical movements in the bath, thereby minimizing the local heating and the energy consumed.—Lond. *Elec. Review*, July 7.

Units, Measurements and Instruments.

Tension and Sag of Overhead Wires.—A. Mueller.—An article, illustrated by numerous diagrams, on the determination by a graphical method of the tension and sag of overhead wires, with special consideration of the influence of temperature variations and of additional loads due to snow, ice or wind. The principle of the method is described and a numerical example is given.—*Elek. u. Masch.* (Vienna), April 30 and May 7.

Measuring Apparatus.—T. Bruger.—An illustrated paper read before the Frankfort Electrical Society on several new measuring instruments of Hartmann and Braun. They are a bridge with sliding contact for measuring insulating resistances from 100,000 ohms down to a few hundred ohms, a bridge for comparison of potentials and of coefficients of self-induction, and a testing apparatus for lightning rods which permits one to read directly the resistance to earth without any calculations.—*Elek. Zeit.*, May 25.

Resonance Curves.—F. Kock.—The author shows that the use of a rotating Geissler tube is a simple means for determining resonance curves with damped and undamped oscillations. With a sufficiently large Geissler tube the phenomena in oscillating circuits can be demonstrated in a lecture-room.—*Phys. Zeit.*, May 15.

Telegraphy, Telephony and Signals.

Energy Losses in Telephoning.—F. Breisig.—The first part of an account of extended experiments in which the different losses in telephone apparatus were determined. For the tests a permanent alternating current of a frequency of 800 cycles per second was used. The telephone was used in such a way as it is employed in practice, namely, the receiver being taken off during speaking. The connections of the central battery system were used. It was found that during receiving out of the total electrical energy received 70.5 per cent was lost in the microphone, 1.6 per cent in the bell, 18.4 was supplied to the telephone, the loss in the primary winding was 3.4, that in the secondary winding was 3.4 and the losses in the other coils 2.7. The chief source of loss is in the microphone, and, since it is entirely unnecessary while speaking, it might be short-circuited at that time, but this would cause trouble on account of its high resistance. To avoid this trouble and to reduce the alternating-current impedance a condenser of 2 mf was connected in parallel with the microphone when receiving. When speaking it was disconnected by means of a simple switch. With this arrangement the above figures of losses were greatly changed. The loss in the microphone was now only 12.1 per cent, the loss in the bell 1.1, while 57.2 per cent of this was delivered to the telephone and 29.6 was lost in the coil. The influence of the microphone may also be reduced successfully by using a higher number of turns for the primary coil. The author then passes over to a discussion of the telephone as transmitter. The article is to be concluded.—*Elek. Zeit.*, June 8.

Miscellaneous.

Engineering Education.—Report of a conference organized by the (British) Institution of Civil Engineers on the subject of the education and training of engineers. The conference was divided into sections dealing with gen[eral] education, scientific training and practical training. In [his] opening remarks President Alexander Siemens, of [the] Institution of Civil Engineers, said that a young engi[neer] should be educated so as to become a dividend earner [for] his employer, for this is the most reliable indication of [his] merit, and the corresponding reward will not be want[ing]. For the same reason he should possess some knowledge [of] business methods and of law, not with a view of becom[ing] his own lawyer, but in order to be able to judge when le[gal] advice is needed. Sir William White expressed the h[ope] that the conference would endeavor to find the golden m[ean] between too great theory and too great practice in the ed[u]cation of engineers. Sir John Wolfe-Barry remarked [that] an engineer should be given the general education of [an] accomplished gentleman with a theoretical and practi[cal] knowledge of his profession. At a joint meeting of [the] general education and scientific-training sections Chairm[an] A. G. Lyster said that education to be of real value sh[ould] not only furnish information and knowledge, but sh[ould] also train and expand the intelligence and develop that [type] of character which fits a man to lead the best and most [use]ful life. In a paper entitled "Literary Education and E[ngi]neering" Rev. James Gow claimed that most of the [mis]chief that is done in life is done in leisure, and the ratio[nal] enjoyment of this time is the real object of general ed[uca]tion. The best plan is to give a boy a general educat[ion] mainly literary, until he reaches the age of sixteen and [then] to watch him closely and allow him to continue his stu[dies] along the lines best suited for him. Prof. S. P. Thom[pson] read a paper discussing the extent to which mathema[tical] and scientific subjects should share with other subject[s of] literary education the attention of schoolboys who in[tend] to enter later the engineering profession. The author [held] that the fossilization of science-teaching is the thing most to be feared. The object of science-teaching at sc[hool] should be not to impart the facts or data of science, [still] less to systematize their rediscovery, but to evoke inte[rest]. Professor Thompson said that any specialization in sci[entific] subjects before passing the stage of matriculation is es[sen]tially out of place and harmful. The distaste for ma[the]matics on the part of the students is attributable mor[e to] bad teaching than anything else. When mathema[tical] teaching is dull the fault is with the teacher. He said [that] nowadays boys are less capable of following a susta[ined] train of thought than they used to be. Of vastly more [im]portance in the ultimate making of a professional engi[neer] than the acquisition of a hoard of scientific facts are c[ulti]vated precision in the use of words and cogency in m[ethods] of thought. Prof. A. Schwartz read a paper on the [ques]tion of specialized entrance examinations for universit[y and] college courses of study in engineering science, with a [view] to the curricula to be followed and also the inclusion i[n the] latter of courses in modern languages. The author [ex]pressed the opinion that the matriculation examination [of a] university should be essentially a test of general educa[tion] and should draw upon all mental faculties. In a pap[er on] the apportionment of training between practical work [and] scientific study, with some suggestions applying to ap[pren]tices in or on works far distant from their homes, M[r.] F. Yarrow claimed that colleges should endeavor to [ar]range their engineering courses of study so as to allow students to spend six summer months in the shops at [prac]tical work and six winter months in the college at the[ore]cal study. The requirements of practical training in w[orks] with the necessary complement of scientific study, [were] treated in a paper by Mr. W. H. Allen. Two paper[s on] the practical training in workshops or on works of [con]struction, with special reference to training in the [engi]neer's office, were presented by Messrs. W. B. Worth[ing]ton and H. F. Donaldson. Among other subjects disc[uss]ed were the relation of engineering employers and col[leges] from the point of view of the practical training of [engi]neers and the relation of practical training to college s[tudy].

The value of a university degree in engineering science in relation to professional competence was the subject of two papers by Profs. S. M. Dixon and C. F. Jenkin. Three papers on the position and uses of engineering laboratories in relation to education at college were read by Profs. W. E. Dalby, John Goodman and Bertram Hopkinson. The relation of engineering employers and colleges from the point of view of the practical training of college students was discussed in two papers by Prof. J. E. Petaval and Mr. J. W. Horne. The relation between practical training and college study was treated by Profs. Archibald Barr and Henry Louis. Workshop training as a preliminary to practical training in other branches of engineering was the subject of three papers by Messrs. J. A. Brodie, J. M. Moncrieff and J. W. Welch.—Lond. *Engineering*, June 30 and July 7.

Fire Alarms.—VON MOLTKE and ANHAGAN.—An article on electric fire-alarm systems, on the use of the loud-speaking telephone for such purposes, and on the use of electric automobiles for the engines, etc. *Elek. Zeit.*, June 1.

Book Reviews.

ELEKTRISCHE BELEUCHTUNG. By Dr. Berthold Monasch. Second and enlarged edition. Hanover: Dr. Max Jänecke. 331 pages, 112 illus. Price, 9.20 marks.

In this, the second, edition there has been added to the contents of the first edition an extension of 102 pages, bringing the contents of the book up to date and thus putting virtually two volumes into one binding. The second volume relates to advances in the art of electric lighting during the last five years.

Reference is made to the new international candle, which is admitted to simplify international photometry, although the value assigned thereto is 0.9009 hefner instead of the 0.9 valuation taken by the three contracting countries. Three units of luminous intensity are considered as remaining in official existence; namely, the hefner, the international candle and the carcel. In regard to illumination five units are claimed to exist; namely, the meter-hefner, the ft.-hefner the international ft.-candle, the international meter-candle and the meter-carcel. Two of these claim to be called the lux.

The book is a good compendium of electric lamps and lighting under up-to-date middle European conditions.

LIGNES ÉLECTRIQUES. Vol. I, Lignes Électriques Aériennes, by Ph. Girardet. Vol. II, Lignes Électriques Souterraines, by Ph. Girardet and W. Dubi. Paris: Gauthier-Villars. 181 pages, 13 illus.; 208 pages, 48 illus. Price, 5 francs.

Two thoroughly practical and carefully written volumes on the purchase, installation, equipment and repair of overhead and underground lines, especially for electric power distribution. The volume on overhead lines is particularly instructive as giving many details concerning the construction and erection of wooden, iron and reinforced-concrete poles. The books will be useful to constructing electric light and power engineers interested in recent French practice.

LECONS SUR L'ÉLECTRICITE. By Eric Gerard. Paris: Gauthier-Villars. Vol. I, 975 pages, 458 illus. Vol. II, 989 pages, 489 illus. Price, 24 francs.

The eighth edition of an excellent textbook intended primarily for the students of the Montefiore Electrotechnic Institute, enlarged and brought up to date. One is struck in reading these volumes by the large field which they so effectively and conscientiously embrace. It is almost impossible to find an electrical engineer of the last decade's training who attempts to cover so wide a field. Vol. I deals with the theory of electricity and magnetism and with the theory and design of electric generators. It takes up dynamo design in considerable detail. Vol. II deals with transformers, the distribution of power, telegraphy, telephony, power transmission, traction, electrometallurgy and industrial chemistry. The treatment is very clear, the diagrams good. The book is best from the viewpoint of the teacher, but will be of interest to advanced students of electrotechnics who wish to be familiar with principles and design as taught in Belgium.

New Apparatus and Appliances

DEMAND FOR ELECTRIC SHOVELS.

In the course of a recent talk before the Electric Club of Chicago Mr. George Patnoe, who is general superintendent of the Dolese & Shepard Company, of Chicago, made some interesting observations on steam versus electric shovels. Mr. Patnoe is a practical quarryman of wide experience and is in charge of the Gary (Ill.) plant of his company, which is no doubt the largest electrically equipped quarrying and stone-crushing plant in the country. He said that the use of electric shovels is desirable in such plants, but he regretted to say that those designed for his company's use at Gary were a failure, being too slow in operation for practical requirements. They possessed only 60 per cent of the speed of steam shovels.

Mr. Patnoe thinks that the trouble in designing electric shovels has been that the electrical man does not know enough about shovel mechanism and the shovel man does not know enough about electrical equipment. However, there is a real demand for an electric shovel, as many troubles are experienced with steam shovels. Mr. Patnoe thinks that a successful electric shovel can be made and eventually will be made. It would seem to be desirable to have the motor run continuously and to apply the power as needed by some system of gearing. If a practical electric shovel can be designed its cost of operation will be less than that of the steam shovel, and it will have a number of advantages in quarry operation, where, in general, electrical distribution of power is greatly to be preferred to the transmission of steam or the operation of a number of scattered boiler plants.

HANDLING FREIGHT BY ELECTRICITY AT ST. LOUIS, MO.

The Missouri, Kansas & Texas Railway Company has recently completed its new freight terminal at St. Louis, which is equipped with what is probably the most extensive motor-driven telpherage system ever installed, having a capacity to handle more than 1,000,000 lb. of freight in "less-than-carload" lots in five hours.

The building is a two-story steel structure, 232 ft. x 400 ft. in plan, and its first floor is occupied by sixteen tracks aggregating nearly a mile in length and capable of holding

117 cars. The second story is taken up with the receipt, delivery and storage of freight matter. From its ceiling the elaborate system of telpherage runways is suspended, and through hatches in the second-story floor the island platforms of the track level below are reached.

At least 75 per cent of the freight passing through the St. Louis terminal is outbound, destined for the great Southwestern country, of which St. Louis is the gateway. The problem of handling the virtual deluge of "less-than-carload-lot" (or, in railroad vernacular, "L C L") freight which pours through this distributing point demanded the most modern and dependable conveying equipment, and after careful study by the engineers in charge the problem has been solved by the application of motor-driven telphers, jib cranes and gantries, using central-station service.

Taking advantage of the slope in the ground at the terminal, wagons loaded with freight for shipment drive directly from the street to the second-story level of the building. Within boom radius of these driveways are seventeen jib cranes on the columns of the building, and by means of these cranes merchandise from the wagons is deposited directly onto flatboards or scales, where it is weighed for determination of charges. After being weighed the loaded flatboards, each of 2 tons capacity, are picked up by the telphers and carried to the hatches corresponding to the platform entering the cars. An automatic trip releases the telpher cable as soon as it becomes slack after having deposited its load on the platform. This obviates the service of a ground man and releases the telpher car for other duties as soon as its mission in any hatchway is accomplished. The car then proceeds to the main runway and finds an unoccupied branch, in this way keeping all runs automatically refilled as fast as emptied. After being deposited on the island platforms between tracks the truck can be trundled into the cars. The platforms are 11¼ f[t.] wide, sufficient to allow two trucks to pass.

The telpher runways, twelve in number, suspended from the second-story ceiling, are placed at right angles to the line of the track. Ten of these runways serve the island platforms, while the two extra runs are used for car storage and are equipped with pits for making repairs when necessary. The runways are built up of 24-in. I-beams, on the lower web of which light T-rails are mounted on wooden blocks, which serve to deaden the sound. The two trolley wires supplying the 230-volt direct current, with underground return, are carried on insulators supported from the I-beam structure.

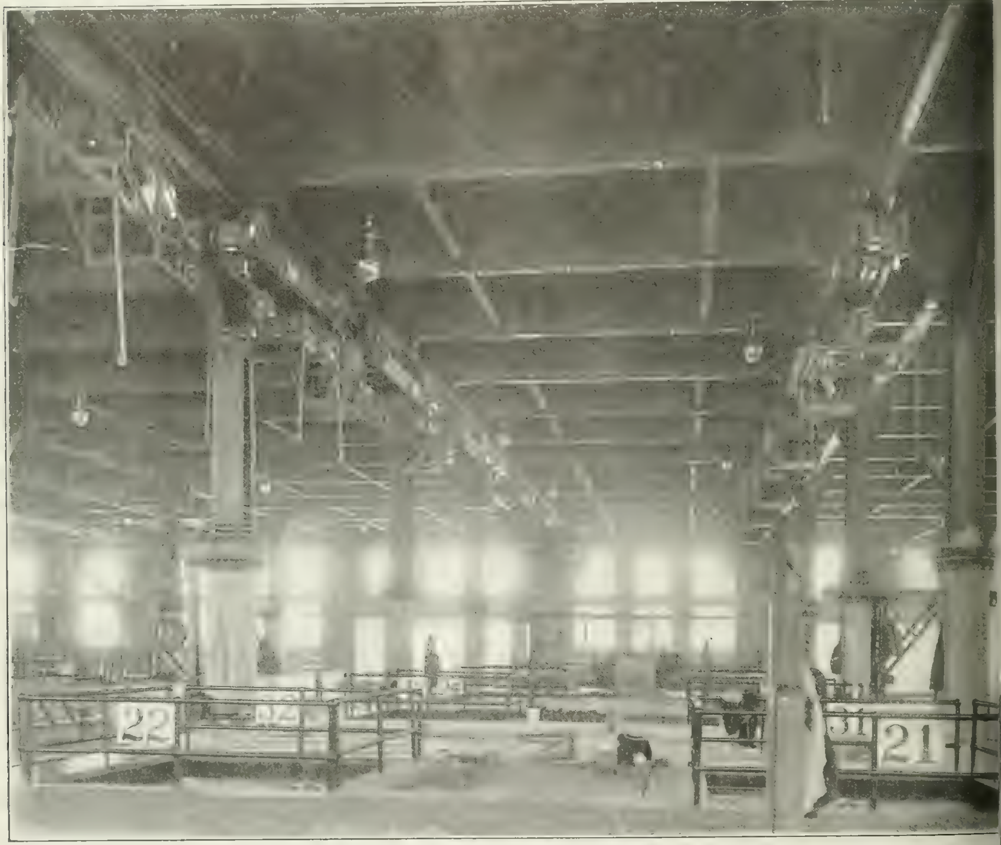


Fig. 1—General View of the Motor-Driven Freight-Handling Installation.

Eighteen telpher cars are now in use. Two of these have a capacity for handling 6 tons each, while the remainder are of 2-ton rating. The larger machines are equipped with 15-hp series direct-current motors for the travel motion and 25-hp hoist motors. They are operated along the overhead rails at a track speed of 500 ft. per minute. The hoist mechanism is adapted to raise its rated load at 60 ft. pe[r]

:nute, but can lower at 120 ft. per minute. The two ɒtors of each car are equipped with rheostatic control, ınipulated by the operator in the cab.

Direct-current energy at 230 volts for the telpher contact ɒlleys is furnished by a duplicate pair of 100-kw, three-re, 230-115-volt motor-generator sets, the motor ele-ents of which are 4000-volt, 60-cycle synchronous ma-

Fig. 2—Motor-Driven Telpher.

c nes, operated from the transmission lines of the Union ctric Light & Power Company of St. Louis, which sup-s all electrical energy for lighting and motor purposes i he freight terminal. The motor-generator sets, together w the eight-panel controlling switchboard, are installed i he southwest corner of the basement of the building. T Union Electric Company furnishes its own main-line switch, primary meters and instrument transformers.

he terminal building is lighted by 126 multiple, 115-volt a lamps controlled from a panelboard which is equipped w an annunciator and signal circuits from twenty-six p h-button stations on the main floor and in the basement the building. In case an employee requires light for s e purpose on one of these floors he pushes a nearby but-t which sets up an indication on the annunciator as a

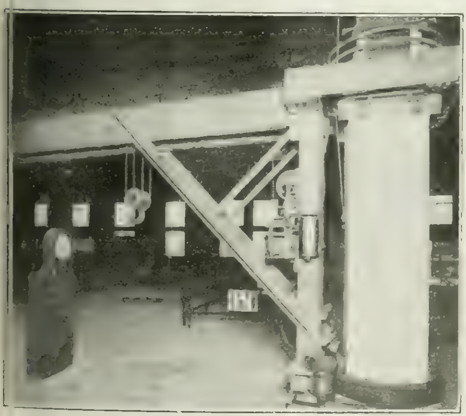


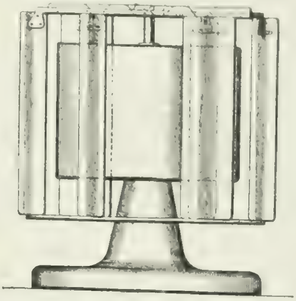
Fig. 3—Motor-Driven Crane.

si al to the attendant to turn on the corresponding lamp ci uit at the switchboard.

he telpherage equipment was furnished by the Sprague tric Works, General Electric Company, New York. entire freight-handling installation was designed and installed under the direction of Mr. S. B. Fisher, chief engineer of the Missouri, Kansas & Texas Railroad, and Mr. A. T. Vick, electrical engineer.

VERTICALLY MOUNTED FAN.

The vertically mounted circulating fan herewith illustrated is especially constructed for use upon the hotel, restaurant or household dining table. The fan in width or horizontal diameter is only 7 in. and its height over all is

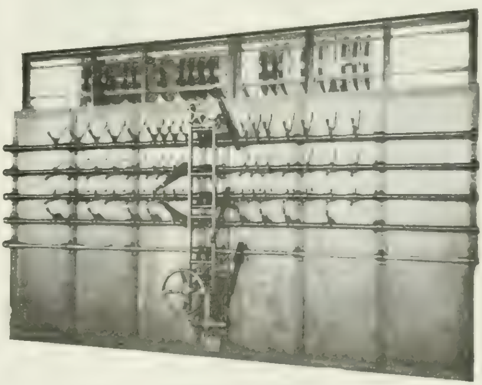


Vertical Shaft Fan.

less than 9 in. The entire blading and rotating parts are protected by a well finished bell-shaped wire meshing which envelopes the entire fan and is fastened to the base of the motor. The disposition of the blading is such that each person at a dining or library table receives the breeze in the face, and the usual discomfort of having the air thrown on the top or side of the head in full force, while a table companion may be receiving little or no benefit, is obviated. The fan illustrated is made by Mr. Hartwell Jalonick, El Paso, Tex.

THEATER DIMMERS FOR RUSSIA.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has just shipped from its factory a large dimmer bank for a theater in St. Petersburg, Russia. This equip-



Theater Dimmers.

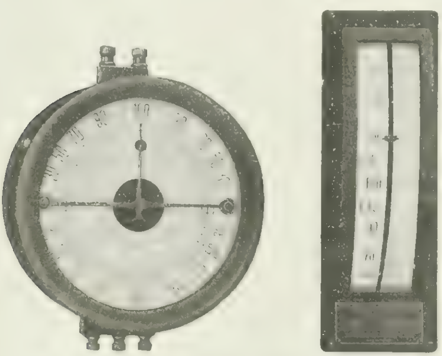
ment has several unique features. It is built so that it can be shipped in standard cars, the dimmers being mounted in unit banks and both front and rear frames being made so that they can be taken apart and easily reassembled. The framework consists of I-beams and channels fastened with

reamed bolts. It is usual to mount all parts on a wooden templet and install the marble switchboard at the theater. In this case a marble switchboard will not be used, but paneled sheet steel instead. These panels, which were mounted at the factory, will stand the long journey and will not warp.

The apparatus is designed to have an ultimate equipment of 140 dimmers, but for the present fifty-four dimmers were furnished. Tantalum lamps are to be used. There is one controlling shaft for each color—white, red, blue and green. It is planned to add orange lamps at a later date. The hand wheel shown at the bottom of the front view moves the two rods vertically in opposite directions through worm gear and bell cranks. The master levers may be set so as to interlock with either of the rods, dimming or brightening as desired. Dimming of one color and brightening of another can be accomplished noiselessly, conveniently and with fine gradations of light intensity. For further convenience each dimmer plate is provided with its own individual operating lever. Master levers for each color are also provided. Cutler-Hammer simplicity type dimmers have been installed in several European countries during recent years, displacing the water-rheostat dimmer and other large resistance banks that have been in use in Europe.

POWER-FACTOR METERS.

The accompanying illustrations show four types of direct-reading power-factor meters manufactured by the Westinghouse Electric & Manufacturing Company. These meters indicate on a graduated scale the power-factor in the circuit to which they are connected, and operate on the rotating field principle. A rotating field is produced by the current of the metered circuit passing through angularly placed coils. In this rotating field is situated a pivoted iron vane or armature, magnetized by a coil whose current is in phase with the voltage of one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the series coils, it will take up a position where the zero of the rotating field occurs at the same instant as the zero of its own field. Thus its position will always indicate the phase angle between the voltage and current of the circuit. The pointer attached to the armature therefore indicates



Figs. 1 and 2—Switchboard Power-Factor Meters.

this angle, and by marking on the scale the cosine of the angle shown by the graduation the power-factor is read directly. In the three-phase meter the rotating field is produced by three current coils spaced 60 deg. apart, and in the two-phase meter the position of voltage and current coils is interchanged and the rotating field is produced by means of a split-phase winding.

Fig. 4 is a sectional view of the movement of a power-factor meter. The winding shown within the iron ng is the stationary winding of the series or current cls. Inside this are the stationary voltage winding hd the pivoted armature. The laminated iron ring surrod-ing the winding is provided as a return circuit for the ix of the pivoted armature, so that the reluctance of ie armature magnetic circuit is low and uniform in all pi-tions.

Fig. 3—Portable Power-Factor Meter.

An aluminum disk at the front of the meter se as a damping disk, moving in the concentrated of the two permanent magnets at the bottom of the mecl ism. These magnets and disk have no effect whatever the electrical operation of the meter. They serve to pre oscillations of the pointer and thus make the read "dead-beat." It is claimed that more efficient dam is obtained with this electromagnetic device than is pos with air-damping devices, unless a delicate and easily ranged adjustment is resorted to.

It will be noted that in this form of power-factor m no connection is required between the fixed and the mo elements. There being no movable coils used, there are delicate flexible connecting strips, nor is any control sp necessary, as the controlling force is electromagnetic. moving element is therefore very light, and the friction bearing jewel wear a minimum.

All the Westinghouse switchboard types and the p phase portable types are arranged to read lagging or lea power-factor on the upper half of the scale and for

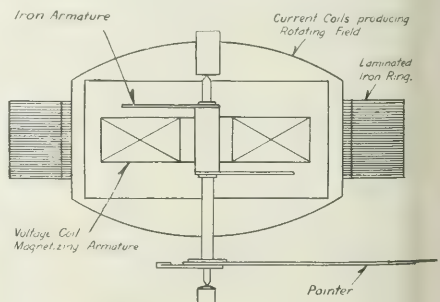


Fig. 4—Cross-Section of Meter.

versed power on the lower half. The switchboard types adjusted for one standard frequency; the polyphase p ables are adjustable to any frequency between 25 cycles 60 cycles. The single-phase portables indicate for 60 cy s on one-half the scale and for 25 cycles on the other h. The portable meters are very convenient for investiga g the power-factor of motor loads and may assist very m-rially in improving the operation of the system.

Industrial and Commercial News

The Week in Trade.

Growing confidence is shown in nearly every section of the country, and the volume of business has increased slightly over that of the preceding week. Much of the advancement has been due to reassuring crop reports. The government's weekly weather report gave news of more rains and lower temperatures in many sections. Now that the West has recovered from the crop scare, sentiment has made a decided change for the better, merchants and manufacturers are now looking for resumption of trade in the majority of industries, while the Western railroads are reporting tonnages in excess of those for this period in the previous year. Owing to the low stocks that have been carried during the past few months, it is expected that the buying movement when once under way will be widespread and will be continued well into the end of the year. Iron and steel trades show further progress, the pig-iron market, especially, being rather active during the week. Contracts were made in the Pittsburgh district for over [illegible]00,000 tons of iron, most of which was taken by steel-making concerns. Decline in cotton has resulted in lower prices for certain grades of cotton goods, and the trade is slightly unsettled. Demand for leather continues fairly brisk as a result of resumption of business by shoe factories. Retail trade has been affected to some extent by unsettled weather conditions, while buyers for dress goods and furnishings are still purchasing in limited quantities and chiefly for filling-in purposes. The statement of foreign trade for the fiscal year ended June 30, 1911, was a most satisfactory feature of the week, exports showing a total of $2,048,691,392, an increase of 17.3 per cent over the figure for the previous year. Imports were [illegible]527,985,088, showing a decrease of 1.8 per cent from the [illegible] total of 1910. Business failures for the week ended [illegible] 20, as reported by *Bradstreet's*, were 239, as compared with 196 for the previous week, 215 for the same week in 1910, [illegible] in 1909, 263 in 1908, and 155 in 1907.

The Copper Market.

Buying of refined copper by domestic and foreign interests was on a very narrow scale during the week, and prices became slightly lower. Sales of a few million pounds of lake and electrolytic for August and September shipments were made, with some electrolytic disposed of at prices under 12½ cents. Foreign statistics show a reduction in stocks abroad during the first two weeks of July of some 5,000,000 lb., but, in spite of this, no increase in the buying movement was induced. Prices abroad have been on a slightly higher level in the past few weeks, and inquiries are said to be on a fair scale, in spite of the few sales made. Foreign orders will undoubtedly contribute the sustaining portion of July business, for domestic consumers, judging from present conditions, are unlikely to be in the market for much copper aside from current needs. Improvement in general trade will naturally direct more business to copper users, and it is hoped that the copper trade on this account will be in a better condition in the fall. Production continues on a large scale, and there is likelihood of further increase within a short time from several newly developed properties. Since there are no prospects at this time for curtailment of output, it seems as though the only manner by which the situation can be improved is by an increasing demand. However, as some little time will be needed for such demand to reach effective proportions, it would appear that the present stagnation is likely to continue for several months at least. Exports for the month, including July 25, aggregate 24,841 tons, indicating that the total will exceed that for the month of June. The daily call on the Metal Exchange, July 25, quoted copper as per the accompanying table.

[illegible]	Bid.	Asked.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible] market, July 25, was [illegible]

	Noon.	Closing.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible] fluctuations for the year [illegible]

	Highest.	Lowest.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Industrial and Commercial Notes.

Fight for Westinghouse Control.—A dispatch received from Pittsburgh at 9 o'clock on Thursday morning states that the checking of proxies, which was carried on through the preceding night, has resulted in getting through the letter E only. At this rate the work of tallying the full vote may cover several days. The management when it reconvened at 2 o'clock on Thursday was to state officially the vote up to that time, and a further adjournment seemed probable. The statement of Mr. Westinghouse at the meeting, beyond expressing gratification at the large number of proxies he had received, did not contain any new features.

Westinghouse Orders.—Among recent large orders for self-starting rotary converters received by the Westinghouse Electric & Manufacturing Company is one from the Philadelphia Rapid Transit Company for two 3000-kw, one 2000-kw and two 1500-kw converters, all of the six-phase, 25-cycle, self-starting type, to deliver direct current at 600 volts. The transformers for supplying these rotaries were also ordered from the same company and include six 1100-kw, three 750-kw and six 375-kw air-blast transformers, 25 cycles, for 13,200 volts on the high-tension side. Among other orders is one from the City & County Contract Company for one 80-ton switcher locomotive with quadruple equipment of single-phase, alternating-current motors and unit-switch control for the New York, Westchester & Boston Railroad. The frame and running gear will be built by the Baldwin Locomotive Works. Among export orders is one from the Demarara Electric Company, of British Guiana, South America, for railway motors and control apparatus for the same. Other orders include one for thirty double-equipments of single-phase, alternating-current motors, for motor cars on the New York, Westchester & Boston Railroad, with unit-switch control. From the Capital Traction Company, of Washington, D. C., an order for twenty double-equipments of interpole railway motors and control apparatus. From the Columbia Railway, Gas & Electric Company, of Columbia, S. C., for double equipments of interpole railway motors and control apparatus. From the Pueblo (Col.) Suburban Traction & Light Company, through H. M. Byllesby & Company, of Chicago, three 500-kw, oil-insulated, water-cooled, 44,000-volt transformers. From the city of Barnesville, Ga., for one substation equipment consisting of three 150-kw, oil-insulated, self-cooling, 6600-volt transformers, and one two-panel switchboard. From the Gainesville (Ga.) Railway & Power Company, for two 125-kw, oil-insulated, self-cooling, 11,000-volt transformers, one switchboard and two regulators, constituting a complete substation equipment. From the Cataract Power & Conduit Company, of Buffalo, N. Y., three 300-kw, oil-insulated, water-cooled, 22,000-volt transformers.

United States Telephone Company.—At a meeting of directors of the United States Telephone Company late last week the following officers were chosen: President, Frank A. Davis; vice-president, E. R. Sharp, president of the State Savings Bank & Trust Company, Columbus; secretary and counsel, W. L. Cary, Columbus; treasurer, H. B. Taylor, Columbus; general manager, Gansey R. Johnson, general manager of the Columbus Citizens' Telephone Company, Columbus. All are re-elections excepting that of Mr. Sharp. Mr. Davis is president of the Columbus Citizens' Telephone Company. The regular quarterly dividend of 1½ per cent was declared on the preferred stock, payable Aug. 15 to stockholders of record of July 29. Reports of officers show the affairs of the company in good condition with satisfactory earnings.

Large Railway Motor Orders.—The General Electric Company has received an order for 300 four-motor car equipments from the Chicago Railways Company. This order calls for 1200 35-hp motors and 600 controllers with auxiliary equipment for 300 cars. Among other large orders received by the same company for railway equipment are the following: From the Chattanooga Railway & Light Company, for one 1000-kw motor-generator set, four 1500-kw transformers and a switchboard. From the Pacific Railway Company, Los Angeles, for four 1000-kw motor-generator sets; three 600-kw motor-generator sets; eighteen 450-kw transformers and fifty four-motor 70-hp car equipments with Sprague-General Electric control. From the Portland Railway Company, of Portland, Maine, for one 500-kw and one 300-kw motor-generator set and a switchboard. These units will be installed in new substations and will be supplied with power purchased from the lighting company. The installation of these rotaries will improve voltage conditions and relieve the main power house in Portland. An order has also been placed by the Philadelphia Rapid Transit Company for thirty two-motor car equipments for use on its elevated division and fifty two-motor equipments for use on the surface division. The equipments for the elevated division consist of two 125-hp motors with Sprague-General Electric control, while those for the surface lines consist of two 60-hp, 500-volt motors. The International Railway Company, of Buffalo, has also placed an order for sixty equipments, each consisting of two 60-hp, 500-volt motors.

Electricity on the Catskill Aqueduct.—Mention was made in these columns last week of two large contracts aggregating 7500 hp signed by the New York Edison Company with contractors engaged on the work of the Catskill Aqueduct in New York City. Since that time the New York Edison Company has contracted with Holbrook, Cabot & Rollins, Thomas B. Bryson and George F. Fry for a total of 2250 hp on this work. The Edison Electric Illuminating Company of Brooklyn has also contracted with the foregoing for 1500 hp to be used on the Brooklyn section of the Aqueduct, extending under the East River from Delancey and Allen Streets, Manhattan, to Lafayette Avenue and Fulton Street, Brooklyn. On the Brooklyn section of the work there will be four motor-driven air compressors, each driven by a 200-hp motor, and there will be a number of motor-driven hoists, pumps and concrete mixers. The energy furnished by the Brooklyn company will be 6600-volt, three-phase, 25-cycle, and this will be transformed to 440 volts for the smaller motors. All metering will be done on the 6600-volt side, and the rate of charging, by both the New York and the Brooklyn companies, will be $20 per year per kilowatt of maximum demand and 1 cent per kw hour. The New York Edison Company is also furnishing 2000 hp to George B. Jackson, Inc., the contractor on the Yonkers section of the high-pressure tunnel, and 700 hp to the Thompson-Starrett Company, which is constructing the Woolworth Building in New York City.

Canadian Properties Merged.—A consolidation embracing a number of important Canadian central-station and traction companies has been effected by Sir William MacKenzie and R. J. Fleming, who is manager of the Electrical Development Company, the Toronto Power Company and the Toronto Railway Company. Consummation of the merger will give them control of the following properties: The Toronto Railway Company, the Toronto Power Company, the Electrical Development Company, the Toronto Electric Light Company, the Metropolitan Railway Company, the Toronto & Scarboro Railway Company, the Mimico Electric Railway and the Toronto & Suburban Railway. The MacKenzie interests are also behind the projected Toronto & Eastern Railway, which will be in operation between Toronto and Niagara Falls, in conjunction with the Canadian Northern Railway. It is considered probable that the People's Radial Railway Company, which has been planned to operate in Western Canada, will become part of the MacKenzie-Mann holdings. Mention of the price that the Toronto Power Company, a subsidiary of the Toronto Railway Company, is to pay for the stock of the Toronto Electric Light Company was given in the issue of July 22.

Arc-Light Equipment for Chicago.—The Sanitary District of Chicago has definitely decided to install immediately for street lighting 500 flaming-arc lamps of the long-burning type. Of these, 250 will be of a type used in street lighting in Europe and supplied by the Stave Electrical Company, of New York, and 250 of an American type, developed by the General Electric Company. After sixty days of operation, the rest of an equipment of 4000 lamps will be awarded to the concern whc lamps give most satisfaction, and eventually 15,000 lamps the kind selected will be installed. Both lamps are of the 1 ampere type and are to operate 100 in series with 55 volts the arc. As this is the first municipal installation in tl country of flaming arcs on a large scale, a successful outcoı of the Chicago test will have a wide influence on future stre lighting throughout the country.

Westinghouse Turbine for Flour Mill.—Recent exte sions and improvements in the power equipment of the Pill bury Flour Mills, Minneapolis, Minn., have included, amoı other things, a more general application of electric drive their milling operations, and to meet this additional electric load, an order has been given for a 2000-kw Westinghouse tu bine of the high-speed, double-flow construction. The co densing equipment, also designed and built by the Westin house Machine Company, is of the Leblanc barometric typ which will maintain a vacuum range from 28 to 29 inches, d pending upon the temperature and quantity of cooling wat used. The turbine is to drive a Westinghouse generator, n mally rated at 2500 kw, delivering three-phase, 60-cycle cu rent at 2200 volts.

Pacific Gas & Electric Company Increases Output.—A nouncement is made that the Pacific Gas & Electric Compaı will spend about $10,000,000 in increasing the capacity of i hydroelectric stations by 71,000 hp. The plans provide for tl erection of two hydroelectric plants, one of which is to ha a capacity of 50,000 hp and the other of 21,000 hp. Provisi for increasing the present water storage in Nevada and Plac Counties is to be made by the erection of a dam in the canyc of the South Yuba River. With the new additions to the st tions, these will be rated at close to 260,000 hp. The compaı has about 1100 miles of high-tension lines and serves an ar of 33,000 miles in central California.

American Cities Completes Traction Merger.—The pu chase of the subsidiary companies of the American Cities Rai way & Light Company and those of the New Orleans Railwa & Light Company has been completed by the American Citi Company. With these acquisitions the American Cities Con pany now owns 87 per cent of the total capital stock of tl Birmingham Railway, Light & Power Company, Knoxville Rai way & Light Company, Houston Lighting & Power Compan Memphis Street Railway Company and the Little Rock Rai way & Electric Company, and 93 per cent of the stock of tl New Orleans Railway & Light Company.

Leblanc 12,000-kw Condenser.—The Westinghouse Ma chine Company has received from the Rhode Island Compan Providence, an order for a No. 20 twin-type Leblanc cor denser, consisting of a combination of two No. 20 standar Westinghouse Leblanc outfits, equipped with two sets of ai and circulating pumps mounted on a common shaft. Coupling at each end of the latter provide for either turbine or moto drive. The condenser is designed to handle approximatel 8,000,000 lb. of water per hour, and will operate in connectioı with a 12,000-kw turbine in the Manchester Street plant of th Rhode Island Company.

Quarterly Earnings of Steel Corporation.—The earning of the United States Steel Corporation for the quarter ende June 30 were $28,108,520, showing an increase of $4,589,31 over the returns for the quarter ended March 31, and $12, 062,440 under those for the same quarter in 1910. The balanc available for dividends was $14,527,877, as compared with $12, 689,855 in the previous quarter. The surplus for the quarte was $1,869,177. The earnings for six months were $41,627,723 as compared with $77,787,835 for the corresponding period i the previous year.

Long Acre Electric Light & Power Company.—J. D Maguire, a former consulting engineer for the Long Acre Elec tric Light & Power Company, who secured a judgment agains the company for $25,175 for services rendered, has been re strained by an injunction secured by the company from col lecting the judgment or from examining officials of the compan in supplementary proceedings. The injunction also restrains Mr Maguire from applying for a receiver for the company, oı assigning the judgment. The company has notified the Secre tary of State of an increase in capital stock from $50,000 to $2,500,000.

Aluminum Notes and Prices.—The aluminum market is quiet, with ingots for remelting held at 21@21½ cents, spot No 1, the base for large ingots, with rods and wire at 31 cents, anc sheets at 33 cents, prices being those of July 25.

Financial.

The Week in Wall Street.

DECIDED improvement was made in trading on the New York market in the past week, and both activity and tone were greatly broadened. General advances were made after the forward movement of the local traction shares mentioned in the preceding issue, and the higher prices were maintained up to the close on Saturday. Trading on Monday of this week was on a very narrow scale, with the market irregular and declines registered in nearly all of the leading stocks. Further decline in railroad stocks took place on Tuesday upon news that the Interstate Commerce Commission had ordered reductions of freight rates of nearly all the railroads of the country, based upon the Spokane cases. These decisions are the first announced by the commission to contain a definite course to be followed with respect to the long-and-short-haul provision. The reduction will affect the rates on nearly all commodities in interstate commerce. The Union Pacific, Southern Pacific, Northern Pacific and other large transcontinental roads were the defendants in the cases, so that

NEW YORK

	July 18.	July 25.	Shares Sold.		July 18.	July 25.	Shares Sold.
[illegible]	8½*	8½*	100	Int. Met., pf.	55	51	70,950
[illegible]	28*	28*	—	Mackay Cos.	87*	86	350
[illegible]	69¾	68	16,500	Mackay Cos., pf.	74	74	[illegible]
[illegible]	20½*	20½*	—	Man. Elev.	140	137	[illegible]
[illegible]	41	40¾*	1,500	Met. St. Ry.	15*	15*	
Loco., pf.	108*	108*	200	N. Y. & N. J. Tel.	[illegible]	13[illegible]	
[illegible] & C.	80*	80*	—	Steel, com.	79	79	18[illegible],450
[illegible] & T.	137⅜	136½*	8,246	Steel, pfd.	118	119	6,335
[illegible]	83	82	46,170	W. U. T.	81½	80	[illegible],200
[illegible]	161½*	163	500	West'h, com.	75	75	[illegible]
Met.	19¾	18	20,450	West'h, pfd.	119*	119*	—

PHILADELPHIA.

	July 18.	July 25.		July 18.	July 25.
[illegible]	44*	44	Phila. R. T.	21	22¼
[illegible] A.	12¼	12¼*	Phila. Elec.	17⅞	17¾
[illegible] Rys.	54½*	55¼	Phila. Trac.	87	86¾*
[illegible] Rys., pf.	30*	30*	Union Trac.	52	52¼

CHICAGO.

	July 18.	July 25.		July 18.	July 25.
City Ry.	186	186*	Chi. Tel. Co.	123*	123
Rs., Ser. 1	90*	97*	Met. El. Co.	27*	27*
Rs., Ser. 2	27⅞	28¼	Met. El., pfd.	75*	75*
Edison	136⅞	135⅞	Nat'l Car	113	112½
Subways	3¾	4	Nat'l Car, pfd.	119*	118½*

BOSTON.

	July 18.	July 25.		July 18.	July 25.
T. & T.	137⅜	136⅝	Mex. Tel.	4	4*
[illegible]	158*	157⅜	Mex. Tel., pfd.	6½	6¾
Edison E. Ill.	282	285*	N. E. Tel.	146	146
[illegible] Elec.	161¾	163	W. T. & T.	20½	21½
[illegible] Ry.	23⅝*	22⅞	W. T. & T., pfd.	97½	98½
Mass. E. Ry., pf.	93½*	93			

[illegible] quoted.
[illegible]es sold for the week, July 17 to July 22.

practically all of the transportation business between the Eastern and Western coasts will be affected by the change in rates. The extent to which the roads can meet water competition will be more limited than heretofore. In addition to the unfavorable effect exerted by these decisions, the market was also influenced on Tuesday by disquieting news in regard to the Moroccan situation. Favorable crop reports telling of rains in the corn belt were reflected in declines of about 1½ cents per bushel in corn and slight declines in wheat and oats. The bond market continues firm, and investment offerings are being freely absorbed. The reports of several of the railroads show increases in gross earnings, the gains being considered as signs of general advancement. The ease in the money market is unchanged, as indicated by decreased loans shown by bank statements together with gains in surplus reserve. Rates July 24 were: Call: 2¼@2⅜ per cent; ninety days, 2¾@3 per cent. The quotations in the tables are those of the close July 25.

Financial Notes.

Reorganization of Platt Iron Works Company.—The proposed plan adopted by the creditors' committee for readjustment of the affairs of the Platt Iron Works Company provides for a complete reorganization of the company, and also makes arrangements for relieving the reorganized company of a floating indebtedness, and supplying it with sufficient working capital. In keeping with the plan, receivers have been appointed, and are now in charge of the properties, with full authority to carry on and conduct the business. The receivers have been authorized by the court to borrow a sum sufficient to permit the complete operation of the property, and the committee has arranged for such loan. The plan proposes that the committee acquire, as soon as practicable, the business, assets and good will of the Platt Iron Works by purchase from the receivers, subject to a mortgage, dated November 1, 1904, from the Platt Iron Works Company to the Cincinnati Trust Company, of Cincinnati, Ohio, securing $800,000 par value of first mortgage forty-year gold bonds, of which $798,500 par value will be outstanding. If the purchase is effected, the plan includes a transfer of the business, assets and good-will of the Platt Iron Works Company, subject to the mortgage, to a new corporation to be organized under the laws of Ohio, which shall have a name as similar to the Platt Iron Works Company as practicable. With the quick assets of the present company, and $150,000 cash capital which the committee plans to secure for the new company, for which the latter shall issue long-term securities, the new company should have some $780,000 of quick assets, of which $150,000 will be actual cash. The floating debt, which amounts to approximately $1,368,000, will be converted into securities of the new company. All stock which comes into the possession of the committee will, before distribution to the creditors who have deposited under the creditors' agreement, be subject to a voting trust for a period in the discretion of the committee. Copies of the creditors' agreement for execution may be obtained upon application to Messrs. Sullivan & Cromwell, 49 Wall Street, New York City.

Merger of Northern Illinois Electric-Service Companies.—Messrs. Samuel Insull, Henry A. Blair, Frank G. Logan, Charles H. Randle and H. M. Byllesby constitute the committee in charge of arrangements for the consolidation of the North Shore Electric Company, Economy Light & Power Company and the Illinois Valley Gas & Electric Company, all operating under the direction of Mr. Samuel Insull as president in northeastern Illinois. Mr. John H. Gulick is secretary of the committee, and Isham, Lincoln & Beale are counsel. The plan proposed, to which reference has been made heretofore in these columns, is that the $5,000,000 of North Shore stock shall go in at 120 in common stock of the new corporation, the $3,000,000 stock of the Economy company shall go in at 75 in common stock of the new company, the $3,250,000 of the common stock of the Illinois Valley company shall go in at 25 in the new common stock and the $763,000 of Illinois Valley preferred stock shall go in at 100 of the preferred stock of the new company. Thus the new company will have not less than $9,062,500 of common stock and $763,000 of 6 per cent preferred stock. The Illinois Trust and Savings Bank is the depositary under the agreement for a consolidation which has been drawn up by the committee. The working out of the consolidation will not be undertaken by the committee until two-thirds in par value of the stock of each of the companies has been actually deposited under the agreement. It is understood, however, that more than this amount of stock has been deposited, and there seems to be no doubt that the consolidation will be effected.

Lincoln Gas & Electric Financing.—The Nebraska Public Service Commission has approved the plans for rehabilitating the Lincoln Gas & Electric Company. A. B. Leach & Company have purchased $500,000 6 per cent three-year notes of the company and will offer these, Aug. 1, on a 5½ per cent basis. The proceeds will be used to meet $333,000 6 per cent bonds which mature Sept. 1, and to liquidate floating indebtedness. The plans further provide for an issue of $750,000 8 per cent preferred stock, of which $500,000 is to be used to retire the above-mentioned notes, and the remaining $250,000 will be offered to present stockholders in exchange for $750,000 of the existing common stock, which will reduce this issue to $1,500,000. As a result of these changes, the capitalization of the company will be $2,250,000, as at present, but will ultimately be composed of $750,000 8 per cent preferred stock and $1,500,000 common stock.

Earnings of Cities Service Company.—The statement of earnings of the Cities Service Company for the nine months ended June 30, 1911, shows that earnings on stocks of subsidiary companies owned by this company were $659,286. Miscellaneous earnings were $28,606, and expenses were $19,355, leaving net earnings for the period of $668,537. Dividends amounted to $477,729, of which $371,155 was paid on preferred stock and $106,574 on common stock, which left a surplus of $190,808.

Texas Telephone & Telegraph Company Sold.—Announcement is made that the Texas Telephone & Telegraph Company has sold its 500 miles of toll lines and physical property to the Southwestern Telephone & Telegraph Company, which is a subsidiary of the Bell interests. The consideration was $100,000.

Cleveland Electric Illuminating Company Buys Cuyahoga Lighting Company.—It has been announced that the Cleveland Electric Illuminating Company, Cleveland, Ohio, has purchased the physical property of the Cuyahoga Lighting Company, a concern started four years ago at the instance of former Mayor Tom L. Johnson, who had at that time declared war against the larger company. He desired this to be the nucleus of a large company which would furnish competition to force the Cleveland Electric Illuminating Company to come to terms with the city. Under the terms of this franchise the company was required to file a bond for $25,000 to insure protection against damage to the streets. When the company was first organized this bond was provided, but in 1909 when an extension ordinance was granted the bond was not renewed. For this reason the franchise is not effective at this time, so that the purchase involved only the physical property. The company was organized in 1907 and its franchise covered but a limited territory, its business being confined to furnishing energy to buildings in the neighborhood of the public square. John C. Keys was the organizer and president of the company until about a year ago, when he resigned. The money was furnished by New York men. L. D. West was secretary and manager at the time the sale was made. He states that the sale is the natural result of the duplication of capital in an effort to establish competition in this public utility.

Kings County Electric Light & Power Earnings.—The report of the Kings County Electric Light & Power Company for June and the six months ended June 30 shows that gross earnings of the company for the month were $23,235 in excess of those for the same month in the previous year, and that those for the six months show an expansion of $235,001 for the period. Special power earnings increased 45 per cent, and gross power earnings increased 14 per cent in the six months. The showing is especially noteworthy in view of the revenue lost by the destruction of Dreamland, Coney Island, by fire. Expenses increased $25,433 in the month of June and $168,435 in the six months, as compared with the same period of the previous year. Earnings for the half year were at the rate of 5 per cent on the $10,000,000 stock, indicating at least 10 per cent for the year. Prior to the Coney Island fire mentioned above the company had expected that earnings for the year would show nearly 12 per cent.

Pennsylvania & New York Telephone Company Sale.—The special meetings of stockholders of the Bell Telephone Company of Pennsylvania and those of the Pennsylvania & New York Telephone & Telegraph Company, announced in the May 18 issue for July 18, were held on that day, and the sale of the capital stock, franchises, and corporate property of the latter corporation to the former was ratified. It is announced that the merger is part of the reapportionment-of-territory policy arranged two years ago by the American Telephone & Telegraph Company for its subsidiaries. As a result of the merger the Bell Telephone Company of Pennsylvania now owns and operates the entire Bell system in Pennsylvania east of the Alleghany Mountains.

New Haven Road Sells Bonds of Electric Subsidiary.—The New York, New Haven & Hartford Railroad, it is said, has arranged for the sale of $17,200,000 4½ per cent first-mortgage bonds of the New York, Westchester & Boston Railway Company to New York and Boston bankers. These bonds are a portion of an authorized issue of $20,000,000 which have been held in the treasury of the New Haven road and guaranteed by the parent company, which owns nearly all of the $5,000,000 outstanding stock of the New York, Westchester & Boston. The latter is now building a four-track electric road from 138th Street, New York City, to Port Chester, N. Y., with a branch to White Plains.

Triumph Electric Company to Retire Indebtedness.—Preparations are being made by the Triumph Electric Company, of Cincinnati, Ohio, to place on the market the remainder of its treasury preferred stock for the purpose of securing funds to retire the indebtedness on the new plant at Oakley. It now has $217,300 preferred and $546,400 common stock outstanding, with a surplus and reserve of $107,973. The preferred is 6 per cent cumulative stock. The new plant at Oakley cost about $200,000 and the building loan stands at $107,500. Five new lines have been added to the company's output within the past year.

Asks Receiver for Winona Railway & Light Company.—The Old Colony Trust Company, of Boston, as trustee for the bondholders of the Winona Railway & Light Company, of Winona, Minn., has begun action for the appointment of a receiver. The company is controlled by the La Crosse Water Power Company, of La Crosse, Wis., which passed its bond interest due April 1, as mentioned in the issue of March 3 and which was explained by the abnormal drought in the Sta in 1910. The present action is brought in default of intere due July 1 on $495,500 outstanding 5 per cent bonds. A hea ing has been scheduled for July 27.

Rocky Mountain Bell Telephone Company Sold.—Reference was made in the previous issue to the merger of the Tr State Telephone Company with the Colorado Telephone Company and to the possibility that the latter would acquire tl properties of the Rocky Mountain Bell Telephone Compan It is now learned that the merged companies will be known the Mountain States Telephone & Telegraph Company, with capitalization of $50,000,000, and that the latter has acquir the Rocky Mountain Bell company. The Rocky Mounta Company has a debt of some $6,500,000. The officers of tl Mountain States company are E. B. Field, president; E. Field, Jr., secretary; J. E. MacDonald, auditor, and E. Burgess, general manager. Mr. Field states that the new co pany will operate its exchanges and toll lines over a vast ar in the West, and that it is hoped to meet the telephone nee more intelligently and extensively with a single company th could be expected with three separate corporations.

United Railways of St. Louis.—The report of the Unit Railways Company, of St. Louis, for June, and six mont ended June 30, shows favorable gains in the business of t company. Gross earnings for June increased about $34, and surplus available for dividends increased about $14,3 During the six months the gross earnings expanded $223,1 while the surplus available for dividends was increas $146,600. From present indications the company will have difficulty in acquiring a surplus sufficient to meet the 5 per c cumulative dividend on its preferred stock.

Home Telephone & Telegraph Expenditures in Spoka—According to Thaddeus S. Lane, president of the Home Te phone & Telegraph Company, over $1,250,000 has been sp to date by the company on the automatic system and static of the company. The company has about 1060 miles of lo distance connections. It is organizezd under the laws of Wa ington, with an authorized capital of $1,500,000 of comn stock.

Cumberland Telephone & Telegraph Earnings.—Gr earnings of the Cumberland Telephone & Telegraph Comp for the month of June were $606,026, an increase of $40, Operating expenses were $356,844, an increase of $37,437. earnings were $249,182, while fixed charges were $50,044, le ing a surplus of $199,138, an increase of $1,605.

DIVIDENDS.

Amalgamated Copper Company, one-half of 1 per cent, p able Aug. 28.

Butte Electric Power Company, quarterly, preferred, 1¼ cent, payable Aug. 1.

Fairmont & Clarksburg Traction Company, semi-annual, p ferred, 2½ per cent, payable Aug. 1.

National Lead Company, quarterly, preferred, 1¾ per c payable Sept. 15; common, three-quarters of 1 per cent, p able Sept. 30.

North American Company, quarterly, 1¼ per cent, pay Oct. 2.

Omaha Electric Light & Power Company, semi-annual, p ferred, $2.50 per share, payable Aug. 1.

Pacific Power & Light Company, quarterly, preferred, per cent, payable Aug. 1.

Western Telephone Company, semi-annual, preferred, per cent, payable Aug. 1.

REPORT OF EARNINGS.

Period	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	N Surpl
AMERICAN LIGHT & TRACTION COMPANY.					
June, 1911	$313,662	$8,890	$304,772	......	..
" 1910	286,209	12,047	274,161	......	..
HUDSON & MANHATTAN RAILROAD COMPANY.					
June, 1911	$375,870	$162,502	$213,368	$212,293	[illegible]
" 1910	324,169	133,469	190,700	191,357	[illegible]
KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.					
June, 1911	$376,142	$199,834	$176,308	$114,242	[illegible]
" 1910	*352,906	172,712	180,194	103,672	[illegible]
6m., June, '11	2,342,062	1,165,548	1,176,514	674,822	[illegible]
" " '10	2,107,060	997,112	1,109,948	610,698	[illegible]

*Deficit.

General News

Construction News.

[illegible]MINGHAM, ALA.—The Birmingham Water, Light & Power Company [illegible] reported to be preparing plans for the development of water [illegible] the proposed government locks [illegible] [illegible] plant will be equipped with [illegible] Electricity generated at the plant will be transmitted to Bir[illegible] Bessemer, Ensley and other cities in the Birmingham district.

[illegible]MINGHAM, ALA.—The report submitted by [illegible] [illegible] to make investigations of the municipal light and [illegible] North Birmingham with a view of making improvements for the purpose of supplying light and water to Greater Birming[illegible] that the cost of rehabilitating the combined water and [illegible], exclusive of pumping station, would cost approx[illegible] and if the water works were sold, the cost of the power plant would be $170,901. He suggests that the water [illegible] sold for $70,000, making the total outlay for the electric plant [illegible] The estimates of the cost of the distributing system are as [illegible] For 6786 poles, at $6.50 each, $44,100; for installation of [illegible] system, $22,685, and for transmission and distributing sys[illegible]roximately $35,353. He estimates an annual saving of about [illegible] the cost of the electrical service by the installation of the [illegible]

[illegible]AND, ALA.—The contract for improvements to the municipal [illegible]ght plant and water-works system is reported to have been [illegible] the J. B. McCrary Company, Empire Building, Atlanta, Ga., [illegible]

[illegible]BILE, ALA.—An ordinance was introduced at the last meeting of the [illegible] Council providing for placing all electric wires under ground in [illegible] business and residence districts of the city.

[illegible]NIX, ARIZ.—The Water Users' Association will receive bids [illegible] 8 for the construction of power house at Arizona Falls. [illegible]f the equipment of the plant is estimated at $30,000, bids for [illegible] be called for later. About 900 hp will be developed.

[illegible]NIX, ARIZ.—The United States Reclamation Service [illegible] [illegible]onstruct a cross canal, three miles in length, near Scottsdale. [illegible] the benefit of the [illegible] [illegible]d the money will be furnished by the Salt River Valley Water [illegible]sociation. The cost of the canal is estimated at about $150,000. [illegible] plant capable of developing 7000 hp will be installed, which, [illegible]ted, will bring an annual income of $350,000 for the association.

[illegible]RADO, ARK.—The El Dorado Light & Water Company is [illegible] to have been granted a new franchise in El Dorado. The fran[illegible]s for the erection of a power house equipped with two sets of [illegible] and extension of water mains.

[illegible]N, ARK.—It is reported that plans are being made for the [illegible]ction of a concrete dam and hydroelectric power plant on the Li[illegible] Red River, near Higden, about 55 miles from Little Rock. Sur[illegible] the proposed plant are being made by Dickinson & Watkins, en[illegible]ers, State National Bank Building, Little Rock, Ark.

[illegible] BLUFF, ARK.—Plans have been perfected by the Pine Bluff [illegible]on for doubling the output of its electrical plant. It is said th[illegible] number of manufacturing concerns are equipping their plants for ele[illegible] operation.

[illegible]XARKANA, ARK.—The capital stock of the Texarkana Gas & [illegible] Company has been increased from $200,000 to $500,000, the [illegible] to be used for extensions and improvements to its system. [illegible]pany has recently issued $3,000,000 in bonds to secure funds [illegible]sions and improvements to its street-car system. The com[illegible] [illegible] operates natural gas lines from the [illegible]

[illegible]KERSFIELD, CAL.—A movement has been started by local mer[illegible] toward the installation of a municipal electric plant to supply [illegible]city for lighting the business section of the city.

[illegible]LTON, CAL.—The South California Edison Company, it is re[illegible], is contemplating the erection of a large power plant to be [illegible] at M and Eleventh Streets.

[illegible]COTO, CAL.—Preparations are being made to install a street-light[illegible]stem in Decoto. The Pacific Gas & Electric Company will supply [illegible]

[illegible]S ANGELES, CAL.—The Board of Supervisors has given instruc[illegible] for the installation of an electric transmission line between the K[illegible] River station of the Pacific Light & Power Corporation, near E[illegible]ake Park and the County Hospital, to utilize the 50 hp due the co[illegible] under its franchise.

[illegible]S ANGELES, CAL.—It is reported that final arrangements have be[illegible] made for the consolidation of the Pacific Light & Power Company, of [illegible]s Angeles, Cal., and the San Joaquin Light & Power Company, of [illegible] [illegible] of a large hydroelectric development on Big Creek near Shaver, which when completed, will develop about 300,000 hp. The company will practically control the entire electrical business in southern California. The deal involves an ultimate bond issue of $50,000,000. The headquarters of the company will be located in Los Angeles.

NORTH COLUMBIA, CAL.—Plans are being made by the St. Gothard Consolidated Mining Company, which operates the Delhi Mine, for the installation of an electric plant. The company owns water rights in Bloody Run, which it proposes to develop, for which surveys are now being made.

PASADENA, CAL.—The City Council is reported to have decided to install a fiber-conduit system for carrying electric wires and a vitrified conduit system for telephone wires, work on which has begun. The conduits are to be owned by the city and the companies using the conduits are to pay the city rental for same. The cost of the system is estimated at $45,000. Plans are being made by the city to erect new bronze electroliers, each carrying 80-cp incandescent lamps, the cost of which is estimated at about $30,000.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company has applied to the Board of Supervisors for franchises covering three extensions through the suburbs of Sacramento.

SACRAMENTO, CAL.—The Citizens' Light & Power Company has closed a contract with the Great Western Power Company whereby the latter company is to supply electricity to the former for local consumption. Part of the service will be supplied from the plant at Big Meadows and the remainder from a steam auxiliary to be erected near Sacramento. George W. Peltier is president of the Citizens' company.

SACRAMENTO, CAL.—Arrangements are being made by the Citizens' Light & Power Company, a subsidiary of the Great Western Power Company, for installing an electric system in Sacramento, at a cost of about $1,500,000. The company will build an underground conduit system for distribution of electricity. Electrical energy for operating the system will be supplied by the Great Western Power Company. Articles of incorporation will soon be filed by the company. The capital stock is placed at $5,000,000.

SAN FRANCISCO, CAL.—Plans have been prepared by the Pacific Gas & Electric Company for an additional hydroelectric development of 71,000 hp, to cost about $10,000,000. The plans provide for the erection of two plants in the canyon of the South Yuba River, the first having a head of 1647 ft., which will develop 50,000 hp; the second will use the water again and will have a fall of 750 ft. developing 21,000 hp. The overflow of water will be used for irrigation purposes. The company now serves about 33,000 square miles in central California and has about 1100 miles of high-tension transmission lines.

STOCKTON, CAL.—The Santa Fe Railroad, it is reported, is planning to install an electric-light and power plant at its new terminal at Riverbank, Cal., 30 miles west of Stockton. The new shops of the company, it is said, will be located at that place.

VALLEJO, CAL.—Announcement has been made by the City Commissioners that the franchise which the Vallejo Electric Light & Power Company is operating under will not be renewed. The company has been operating under a fifteen-year franchise which will expire on Aug. 15. It is stated that the company will have to operate under the state law until such time as the voters decide whether they wish to own and operate a municipal plant. It is expected that the proposition either to purchase the present plant or to build an entirely new plant will be submitted to the voters.

GREEN MOUNTAIN FALLS, COL.—Electrical service is now being furnished in Green Mountain Falls by the Empire Water & Power Company. The plant is located on Crystal Creek and receives its water supply from the above stream through a pipe 8-in. in diameter, the head upon the single Pelton wheel employed being 490 ft. Energy is generated by a 150-kw, 2300-volt, three-phase, 60-cycle alternator, direct connected to the water wheel. The pipe line is 1026 ft. long. The plant is located about one-half mile from the town and at present is supplying commercial and residential lighting service on the basis of a flat rate. The street-lighting system includes 60-watt tungsten lamps operated on a 110-volt circuit. The plant was planned under the direction of E. L. Benton and George B. Tripp, of the Colorado Springs Light, Heat & Power Company.

GUILFORD, CONN.—The question of installing an electric-light system in Guilford is under consideration. At present the streets are lighted by kerosene lamps.

WINDSOR LOCKS, CONN.—A bill has been introduced in Congress by Senator McLean, of Connecticut, granting the Northern Power Company permission to build dams and develop water power in the Connecticut River in the vicinity of Windsor Locks, Conn. The Northern Power Company is to appropriate all the power created by the dam, [illegible]

lock to be [illegible] for [illegible] purposes. The United States is [illegible] at the lock.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Aug. 16 for furnishing and installing lighting fixtures in the United States buildings at Asbury Park, N. J.; Bradford, Pa.; Beverly, Mass.; Chambersburg, Pa.; Chelsea, Mass., and Greensburg, Pa., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 8 for furnishing the various navy yards the following supplies: Brooklyn, N. Y., Schedule 3781—2000 ft. lead-covered cable. Portsmouth, N. H., Schedule 3787—8020 lb. copper pipe. Bids will also be received at the same place until Aug. 15 as follows: Newport, R. I., Schedule 3779—Furnishing and installing a fire-alarm system. Application for proposals should designate schedules desired by number.

MIAMI, FLA.—The Miami Electric Light Company is installing new machinery in its power house, which will double the output of its plant. Preparations are being made by the company to extend its service to Cocoanut Grove, a distance of 6 miles; later the transmission lines will probably be extended as far north as Little River.

PABLO BEACH, FLA.—The installation of an electric-light plant at Pablo Beach is under consideration. If a franchise is granted by the Council steps will be taken at once to install a plant. It is proposed to use a compressed-air machine, invented by H. C. Busby, to generate electricity. C. H. Mann has offered a tract of land for use of the demonstration plant.

PALATKA, FLA.—Bids will be received by the City Council until Aug. 22 for lighting the streets of the city for a period of five years. The specifications call for twenty or more 2000-cp arc lamps and 100 or more 30, 40 or 60-cp tungsten incandescent lamps.

PALATKA, FLA.—The City Council has granted C. S. Hammatt a thirty-year franchise to construct and operate an electric-light plant in Palatka. Under the terms of the franchise the company is to install a plant with an output of 225 kw. The company also agrees to supply electricity for commercial lighting at 12 cents per kw-hour with a discount of 10 per cent for prompt payment. The minimum charge is placed at $1.50 per month. The rate for water service is 4, 5 and 7 cents per kw-hour according to the quantity consumed. The ordinance also provides that the company shall pay the city beginning Feb. 15, 1923, 1 per cent of its receipts until the expiration of the franchise, or until the city takes over the plant by purchase, which it has a right to do at periods of ten, twenty and thirty years, by giving the company three months' notice.

COLQUITT, GA.—The J. B. McCrary Company, of Atlanta, Ga., is reported to have been awarded the contract for improvements to the municipal electric-light plant and water-works system to cost about $15,000.

COLUMBUS, GA.—The Columbus Electric Company is reported to be preparing plans for extensive improvements to its system as follows: To raise the impounding dam at Goat Rock, located 15 miles above Columbus, on Chattahoochee River, to secure a head of 70 ft.; the construction of power house with an initial installation of 3000-kw generating unit with switchboards, transformers and erection of transmission lines necessary to tie the new plant in with existing distributing system, and also to extend transmission lines north to West Point, La Grange and Newman. It is estimated that 15,000 hp can be developed at Goat Rock. The Stone & Webster Engineering Corporation, of Boston, Mass., has charge of the work.

DARIEN, GA.—The City Council, it is reported, has granted a thirty-year franchise for the installation of an electric-light plant in Darien.

DUBLIN, GA.—The Carey-Stephensville Telephone Company, recently incorporated with a capital stock of $12,000, is contemplating the erection of a telephone system through Laurens, Wilkinson, Twiggs and Pulaski Counties.

GAINESVILLE, GA.—The Gainesville Railway & Power Company has been granted a franchise by the City Council to use the streets and alleys for the erection of transmission lines to distribute electricity generated at its plant, located on the Chestatee River.

WASHINGTON, GA.—At an election held recently the city voted to issue bonds to the amount of $30,000, the proceeds to be used for reconstruction of electric-light plant and installation of filter plant. Westinghouse, Church, Kerr & Company, 10 Bridge Street, New York, N. Y., are engineers.

HAILEY, IDAHO.—An agreement has been reached between the Cramer Electric Company and Robert Lansdon, receiver of the Cramer Water Company, whereby the Cramer Electric Company is to supply energy to operate the pumps of the water-works system, under the terms of which the water company is to pay the Cramer Electric Company $125 per month.

ALTON, ILL.—The City Council has appointed a committee to make investigations in connection with the installation of a municipal electric-light plant and to secure estimates of cost of same. The franchise of the Alton Gas & Electric Company, which supplies electrical service in Alton, will expire in November, 1912.

CHICAGO, ILL.—The Chicago Suburban Edison Company, recently organized, has taken over the plant and holdings of the Kankakee Gas & Electric Company, of Kankakee, Ill. The Kankakee company is capitalized at $600,000 and has bonds outstanding to the amount of $700,000. The Chicago Suburban Edison Company was recently formed by a consolidation of the Economy Light & Power Company, of Joliet, Ill.; the North Shore Electric Company, of Chicago, Ill., and the Illinois Valley Gas & Electric Company, of Streator, Ill.

CHICAGO, ILL.—Sealed proposals will be received at the office of the business manager of the Board of Education, 730 Tribune Building, Dearborn and Madison Streets, Chicago, Ill., until Aug. 2, for electric work, telephones and bells in Burke School, Fifty-fourth Street and South Park Avenue, and in Haugan School, Hamlin, Wilson and Su[illegible] side Avenues, Chicago, Ill., in accordance with plans and specifications prepared by A. F. Hussander, acting architect, and N. L. Patterson, engineer, which may be seen at the office of the architect, Room [illegible], Tribune Building, Dearborn and Madison Streets, Chicago. Proposals must be printed on the regular printed forms, to be obtained at the office of the architect.

EAST DUBUQUE, ILL.—The question of discarding the municipal electric-light plant in East Dubuque and entering into a contract with the Union Electric Company, of Dubuque, Ia., for street lighting is under consideration by the City Council. The municipal electric [illegible] is not able to meet the demands made upon it and it will require [illegible] an expenditure of money to equip the plant and bring it up to [illegible] A large number of citizens are in favor of discarding it and [illegible]necting up with the Union Electric Company's system and receiving [illegible] same service as given in Dubuque.

OTTAWA, ILL.—Arrangements are being made to incorporate a company to be known as the Chicago, Marseilles & Peoria Railway to build a railway from Chicago to Peoria by way of Marseilles [illegible] Streator. The company will be capitalized at $5,000,000. Charles Nichols, of New York, N. Y., is promoter.

PEORIA, ILL.—The contract for installation of the light, heat [illegible] power plant at the Bradley Polytechnic Institute is reported to [illegible] been awarded to Walter Benson. The cost of the plant is estimated about $25,000.

ROCK ISLAND, ILL.—The Eighteenth Street Improvement Association, of Rock Island, has been organized for the purpose of establishing and maintaining an ornamental street-lighting system on Eighteenth Street, between First and Fourth Avenues. It proposed to remove [illegible] present lamps and install standards carrying a cluster of five lamp[illegible]

STRONGHURST, ILL.—The local electric-light plant, owned [illegible] Steele Brothers, is reported to have been purchased by M. F. Sc[illegible]baum, of Okawville, Ill. A ten-year contract, it is said, will be awa[illegible] to the new owner of the plant for lighting the streets of the city.

SUMNER, ILL.—The City Council is reported to have grant[illegible] franchise to Edward A. Dreiman to install and operate an electric [illegible] plant in Sumner.

COLUMBUS, IND.—The City Council is considering the installation of a new street-lighting system. It is proposed to replace the arc l[illegible] now in use with cluster lamps.

INDIANAPOLIS, IND.—The Board of Public Works has autho[illegible] the Indianapolis Light & Heat Company to erect electric lamps on [illegible] teen streets, which will require several hundred new lamps.

JASONVILLE, IND.—The Reliance Engineering Company, [illegible] operates the local light and water plants, has decided to improve [illegible] two plants. New machinery will be installed in the electric plant [illegible] additional wells will be driven for the water-works system.

LINTON, IND.—The City Council has decided to issue $10,00[illegible] bonds, the proceeds to be used for extensions and improvements to [illegible] municipal electric-light plant. It is proposed to remove the plant [illegible] its present location to another site on the railroad. In addition t[illegible] stallation of new machinery, about seventy additional lamps wil[illegible] added to the street-lighting system.

MARTINSVILLE, IND.—The City Council has appropriated $[illegible] for improvements to the street-lighting system. It is proposed to i[illegible] ornamental lamp standards.

MITCHELL, IND.—It is reported that the local electric-light [illegible] has been purchased by James S. Goodrich, of Winchester, Ind. [illegible] new owner is said to be preparing plans for the installation of a [illegible] works system to be operated in connection with the electric plant.

PETERSBURG, IND.—The Town Trustees of Petersburg would [illegible] to receive bids from responsible parties for lighting the streets o[illegible] town for a term of ten years. An exclusive franchise wil[illegible] given. The town has a large commercial business.

VALPARAISO, IND.—The power house of the Valparaiso & [illegible]ern Railway Company was destroyed by fire recently.

CORNING, IA.—At an election held recently the proposition [illegible] the city purchase and operate the local electric-light plant was defeat[illegible]

DES MOINES, IA.—The Urbandale Improvement League ha[illegible] pointed a committee to take steps to secure the installation of an el[illegible] light system in Urbandale.

DES MOINES, IA.—The State Fair Board has entered into a [illegible]tract with the Des Moines Electric Company to supply electricit[illegible] lamps and motors for the State Fair grounds. It is not expecte[illegible] many improvements will be made this year. It is planned by [illegible] year to erect a system of electroliers along the principal avenues [illegible] lar to those used in the city of Des Moines.

PERRY, IA.—The citizens have voted to grant a franchise to [illegible] ...enbeck, of Perry, to construct and operate an electric street railway in this town.

CHAPMAN, KAN.—Preparations are being made for the construction of an electric-light plant and water-works system in Chapman. ..ns and specifications for which are being prepared by Burns & Mc... ..onnell, engineers, Scarritt Building, Kansas City, Mo.

..ESS CITY, KAN.—The City Council has decided to call a special ..tion to vote on the proposition to issue bonds to the amount of ..0,000, the proceeds to be used to build an electric-light plant in Ness ... It is proposed to take over the distributing system of the Ness ... Mill, Light & Ice Company. The electric plant of the company [illegible] ..estroyed by fire on June 23.

..LOMON, KAN.—The installation of an electric-light plant in ..olomon is reported to be under consideration, plans for which are being ..epared by Burns & McDonnell, Scarritt Building, Kansas City, Mo., ..nsulting engineers.

SYRACUSE, KAN.—The Council has engaged the J. S. Worley Com... of Kansas City, Mo., to prepare plans for the proposed electric... [illegible] and water-works system in Syracuse. At a special election ... July 14 the proposition to issue $40,000 in bonds was carried; of ... proceeds $33,000 will be used for water-works system and $10,000 ..r installation of an electric-light plant.

TOPEKA, KAN.—Plans are being made by the City Commissioners ..r the installation of an ornamental street-lighting system in the busi..ss portion of the city, for which proposals have been asked.

TOPEKA, KAN.—Bids will be received by the State Board of Con..ol, Topeka, Kan., until Aug. 2, for furnishing electric-light globes to ..e State Charitable Institutions for Kansas for a period of one-year ..om date of contract. The contract will be awarded on a basis of ..00 lamps as ordered by the chief executive of the following insti..tions: Topeka State Hospital, Topeka, Kan.; Osawatomie State Hos..tal, Osawatomie, Kan.; State Hospital of Epileptics, Parsons, Kan.; ..ate Home for Feeble-Minded, Winfield, Kan.; School for Deaf, ..athe, Kan.; School for Blind, Kansas City, Kan.; Kansas State Or..ans' Home, Atchison, Kan.; Boys' Industrial School, Topeka, Kan.; [illegible] Industrial School, Beloit, Kan. H. C. Bowman is chairman of [illegible] and Charles W. Gibbs, secretary.

..NVILLE, KY.—Plans are being prepared by a syndicate of Boston ..pitalists to develop the water-power of Dix River, at Kennedy's Mill, ..here it is estimated that at least 6000 hp can be developed. The ..ans call for the construction of a concrete dam 110 ft. in height, ..out 1 mile above the mill. Electricity generated at the plant will be ..ansmitted to Richmond, Harrodsburg, Stanford, Lancaster, Danville ... Nicholasville. The cost of the proposed plant is estimated at [illegible]

NEWPORT, KY.—Steps have been taken by the City Council to ask ..r bids for lighting the streets of the city at the rate of $55 each ..r year for arc lamps and $24 each for incandescent lamps. The ..nion Light, Heat & Power Company has offered to furnish the service ..t $65 and $27 each per year respectively. The Council is also con..dering the abolishment of the minimum charge of 85 cents per month ..r private customers.

BANGOR, MAINE.—Plans have been prepared by the Bangor Rail..ay & Electric Company for the construction of a new substation in ..angor, work on which will begin in the near future.

BANGOR, MAINE.—The hydroelectric plant of the Bodwell Water ..ower Company at Old Town and Milford, Maine, on the Penobscot ..iver, has been purchased by John R. Graham, president of the Bangor ..ailway & Electric Company. It is understood that it is proposed to ..nstruct a dam across the Stillwater branch of the river, thus complet... the original project. The price paid for the plant is said to be ... $500,000.

PORTLAND, MAINE.—Extensive improvements are contemplated by ... New England Telephone & Telegraph Company to its local system, ..ich will involve an expenditure of about $250,000 and include the ..ection of the new exchange building, now under construction, to cost ..out $100,000, the installation of new switchboard and equipment at ..00,000, and $50,000 for cable work preliminary to the removal of the ..change from its present location on Exchange Street to the new ex..ange on Forest Avenue.

FT. HOWARD, MD.—Contracts for the installation of an electric..ht plant and system at Ft. Howard, Md., have been awarded as fol..ws: For wiring and repairs to buildings, to S. J. Watson, Jr., of ..mpton, Va., for $7,931; for poles, lines, switches, etc., to the National ..ectrical Company, of Washington, D. C., for $4,861; for meters, ..ansformers, switchboard and engines, to Thomas C. Bassbor Com..ny, of Baltimore, Md., for $7,523, and to L. B. Jacobs, of Newark, ..l., for building, for $2,020.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and ..cks, Navy Department, Washington, D. C., until Aug. 19 for six ..itchboard feeder panels for the navy yard, Boston, Mass. The feeder ..nels are to be used on a 125-250-volt, three-wire, direct-current sys..m. Plans and specifications can be obtained on application to the ..reau or to the commandant of the navy yard named. R. C. Hollyday ... chief of bureau.

GREENFIELD, MASS.—The large elevator and power plant located ..ween Cheapside and East Deerfield on the Deerfield River, owned by the Massachusetts Power Company of Boston, [illegible] destroyed by fire July 16, causing a loss of from $10,000 to $15,000.

GREENFIELD, MASS.—The State Board of Gas and Electric Light Commissioners has approved of the petition for the consolidation of the Greenfield Electric Light & Power Company, of Greenfield; the Shelburne Falls Electric Light & Power Company, of Shelburne Falls, and the Colrain Electric Light & Power Company, of Colrain. The board has also granted the consolidated company permission to issue $175,000 in additional capital stock.

HUNTINGTON, MASS.—The Huntington Electric Light Company is contemplating a change in the location of its power plant, placing it about 200 ft. up the river. The installation of a new waterwheel, etc., is also contemplated. E. E. Stanton is superintendent.

MEDFORD, MASS.—The Malden Electric Company has applied to the Board of Aldermen for permission to install underground conduits in Salem and High Streets.

RANDOLPH, MASS.—The Randolph & Holbrook Electric Light Company has submitted a proposition to the Selectmen offering to install cluster tungsten lamps in place of the arc lamps along the main streets of the town.

SALEM, MASS.—Announcement has been made by the Salem Electric Company of a reduction in the price of electricity from 13 cents per kw-hour to 12 cents per kw-hour, to take effect from Aug. 1, 1912. The reduction was voluntary on the part of the company.

STERLING, MASS.—The question of extending the electric-lighting system from Sterling Center into the Redstone district and other farming sections is under consideration.

NILES, MICH.—Sealed bids will be received by the Board of Public Works, of Niles, Mich., until Aug. 15 for two 300-kva, three-phase, 60-cycle, 600-r.p.m., belted generators, complete with slide rails, pulley and field rheostats; two 10-kw, 125-volt, 1600-r.p.m., type "S" belted exciters, complete with slide rails, pulleys and field rheostats; also two switchboards to control the above generators. Hermann Roebeck is city clerk.

MINNEOTA, MINN.—The installation of an electric-light plant in Minneota is reported to be under consideration. The cost of the proposed plant is estimated at $10,000.

MORA, MINN.—The Eastern Minnesota Electric Light & Power Company, it is reported, has been granted a franchise to supply electricity for lamps and motors in Mora.

MORRIS, MINN.—A committee, consisting of C. A. Dushek, P. R. Putnam and others, has been appointed to make investigations to secure the cost of the installation of an ornamental street-lighting system in Morris.

ST. PAUL, MINN.—The installation of a new street-lighting system is said to be under consideration by the Board of Public Works. The specifications for street lighting will be ready for examination for contractors interested in the street-lighting contract to go into effect Jan. 1, 1912. The cost of installing new arc lamps for street lighting is estimated at about $50,000.

TOWER, MINN.—Contracts have been awarded for the construction of the municipal electric plant, bids for which were opened July 18, as follows: To the Bowe-Burke Company, of Duluth, Minn., for erection of power house, at $13,000; for electric and hydraulic equipment to the Dwyer-Field Company, of St. Paul, Minn., for $5,280, and to the Western Missabe Company, of Duluth, Minn., for erection of transmission system, at $4,827. D. A. Reed, of Duluth, Minn., is consulting engineer.

WINONA, MINN.—Action has been brought by the Old Colony Trust Company as trustee for the bondholders of the Winona Railway & Light Company, of Winona, Minn., asking for an appointment of a receiver. The action is brought in default of interest on outstanding bonds of $495,000, amounting to $12,500, due July 1.

BETHANY, MO.—Burns & McDonnell, Scarritt Building, Kansas City, Mo., engineers, are reported to be preparing plans for water-works purification system and for improvements to municipal electric-light plant, to cost about $30,000.

BOONVILLE, MO.—The power plant and laundry of the Missouri Training School are reported to have been badly damaged by fire recently, causing a loss of about $20,000. It is understood that the plant will be rebuilt at once.

CAPE GIRARDEAU, MO.—Plans are being considered by the Cape Girardeau-Jackson Interurban Railway Company for the construction of a new substation in Cape Girardeau, contracts for which will be awarded within the next six months.

LAMAR, MO.—It is reported that plans and specifications are being prepared by Rollins & Westover, Beals Building, Kansas City, Mo., consulting engineers, for improvements to the electric-light system and water works. The cost of the proposed work is estimated at about $75,000.

LIBERTY, MO.—Sealed proposals will be received by the board of trustees of the Odd Fellows' Home, Liberty, Mo., until Aug. 4 for furnishing material and constructing additions to the Old Folks' Building, power plant and pump houses. Separate bids to be submitted for installation of power plant equipment and heating and plumbing apparatus. Plans and specifications for the entire work are on file at the office of the board and at the office of J. H. Felt & Company, architects, Kansas City, Mo., where copies of plans may be secured.

MEXICO, MO.—The City Council has granted the Mexico Power Company a franchise to install and operate a central heating plant for a term of thirty years. The company owns the water-works system, electric-light plant and gas plant in Mexico. It is proposed to utilize the exhaust steam from the electric plant for the heating system. The Mexico Power Company supplies electricity for lamps and motors in Centralia, Mo., 14 miles distant.

MEXICO, MO.—The City Council has adopted a resolution to increase the price for electrical service supplied by the municipal electric plant. The rate for electricity for lamps will be increased from 6 cents to 7 cents per kw-hour; the rates for motors will be as follows: For the first 200 kw, 5 cents per kw-hour; for the next 300 kw, 4 cents per kw-hour and for all over 500 kw, 3 cents per kw-hour. A. L. Nichols is superintendent of the municipal electric-light plant.

RUBY, MONT.—It is reported that the Madison River Power Company contemplates extending its transmission line to Twin Bridges.

GRAND ISLAND, NEB.—The Grand Island Electric Company, it is reported, is planning extensive improvements to its plant, including the erection of a concrete smoke stack 172 ft. high and 12 ft. in diameter, contract for which has been awarded. The company has also placed contracts for a 500-kw turbine, which it is expected will be installed this fall, and also boilers with a rating of 200 hp.

FALLON, NEV.—Bids will be received by the United States Reclamation Service, Department of the Interior, Fallon, Nev., until Aug. 1, for furnishing and delivering one revolving-type drag line scraper excavation machine, built and equipped for electrical operation, with three-phase, 60-cycle alternating current at 440 volts, the base frame and boom to be of steel construction. D. W. Cole is engineer.

ATLANTIC CITY, N. J.—The Pennsylvania Railroad Company is reported to have purchased the old power plant of the Atlantic City Electric Company, located at Kentucky and Baltic Avenues, in this city.

FREEHOLD, N. J.—William J. Lansley, of Perth Amboy, N. J., has purchased the property of the Manalapan Light Company, which operates electric plants in Freehold and Englishtown, at a receiver's sale. The power plant is located in Englishtown. Arrangements are being made by the new owner to increase the output of the plant. The plant of the Jamestown Light & Water Company, of Freehold, N. J., was purchased by Victor P. Christofferson, of Perth Amboy, N. J. Both plants were purchased by parties representing the bondholders.

HACKETTSTOWN, N. J.—The Council has renewed the contract for street lighting with the Hackettstown Electric Light Company for one year at $2,800. Under the new contract the arc lamps now in use on Hope and Main Streets from the Lackawanna station to the junction at Mill Street will be discarded and clusters of four 60-cp incandescent lamps substituted and between each of these two lamps of the same power will be erected; 240 incandescent lamps will be installed where ten arc lamps have been used.

HARRISON, N. J.—The citizens of Harrison, East Newark and Kearny are contemplating the establishment of an electric plant erected by private capital to supply electricity for street lighting and for private consumers unless the Public Service Electric Company makes a further reduction in the price of street arc lamps. The company has offered to supply 144 or more 2000-cp arc lamps at $80 each per year, which is $5 less per year per lamp than the town is paying under the present contract.

KEYPORT, N. J.—The Board of Public Utility Commissioners has given its approval to the proposed issue of $5,000 in bonds by the Middlesex & Monmouth Electric Light, Heat & Power Company, of Keyport, N. J.

PATERSON, N. J.—It is reported that the Society for Establishing Useful Manufactures, which controls the water-power at Passaic Falls, is planning to build an electric power house at Passaic Falls, work on which will begin next spring. The initial installation will have an output of 2000 hp, which later will be increased to several times that amount. Richard Rossiter is secretary of the company and John H. Cook, chief engineer.

TRENTON, N. J.—Plans are being considered by the Trenton-Mercer County Traction Company for increasing the output of its plant in Trenton by 750 kw.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has agreed to make extensive improvements in its plant to meet the requirements of the proposed new street-lighting system if awarded the contract for lighting the city for a term of years. The present contract expired July 14, but the company will continue the service until other arrangements are made.

BINGHAMTON, N. Y.—The question of asking proposals for street lighting is under consideration by the City Council. Propositions will be submitted by the Binghamton Light, Heat & Power Company and the Binghamton Gas Company. To carry out the contract either company will require six months to install the lighting system. The Binghamton Light, Heat & Power Company, it is said, will submit prices on arc lamps of not less than 500 watts each; 60-cp tungsten lamps, 100-cp tungsten lamps and 100-watt tungsten lamps. Prices will also be submitted for supplying electricity for lamps and motors in the city buildings. The gas company will submit proposals for furnishing incandescent gas lamps and naphtha gas lamps.

LESTERSHIRE, N. Y.—Plans are being considered for improving the street-lighting system in Lestershire. It is proposed to make th change first in the business district and then extend it to the residenc portion of the town.

LONG ISLAND CITY, N. Y.—The Public Service Commission ha given its approval of plans for equipping the Port Washington branc of the North Shore division of the Long Island Railroad for electric operation. The cost of the work including equipment is estimated a about $3,000,000.

NEW YORK, N. Y.—Bids will be received by Arthur J. O'Keef Commissioner of Department of Bridges, 13 to 21 Park Row, Ne York, N. Y., until Aug. 3 for furnishing and installing electrical feede cables on the Williamsburg Bridge. Blank form and specifications ma be obtained at the office of the Department of Bridges.

NEW YORK, N. Y.—Bids will be received at the office of the Supe vising Architect, Treasury Department, Washington, D. C., until Aug. 1 for the installation of a vacuum cleaning system for the new Unite States post office building in New York, N. Y., in accordance wit drawings and specifications, copies of which may be obtained at the abov office or at the office of McKim, Mead & White, 160 Fifth Avenue, Ne York, N. Y. James Knox Taylor is Supervising Architect.

NYACK, N. Y.—The Rockland Light & Power Company has applie to the Public Service Commission, Second District, for authority issue $100,000 in bonds, the proceeds to be used for extensions to i gas-distributing system in the villages of South Nyack, Grand View ar Piermont, for purchase of gas holder, auto track, construction reservoir and cooling plant at its Orangeburg plant and the installatic of additional electric equipment.

PERRYSBURG, N. Y.—The contract for the construction of tl power house of the J. H. Adam Memorial Tuberculosis Hospital, beir erected in this village by the city of Buffalo, has been awarded Charles A. Hager, of Perrysburg, N. Y.

ROCHESTER, N. Y.—Plans have been submitted to Mayor Edgert by Thomas H. Yawger, superintendent of the Rochester Railway Light Company, for lighting Exposition Park. It is proposed to inst a series of the opalescent lamps such as are used in the downtov sections.

SAND LAKE, N. Y.—The Wynantskill Hydro-Electric Company h applied to the Public Service Commission, Second District, for pe mission to begin work on construction of an electric power plant Wynantskill Creek in the town of Sand Lake and for authority to e ercise franchises within that town and to issue $7,500 in capital stoc The company proposes to supply electricity for limps and motors West Sand Lake, Snyder's Lake, Reichard's Lake, Averill Park, Sa Lake, Crooked Lake, Burden Lake and other towns and villages in tl vicinity.

UTICA, N. Y.—Under a decree granted by order of Judge W. Ray, the United States District Court at Utica, Senator H. D. Hinman, Binghamton, N. Y., as special master, will sell the plant and oth properties of the Madison Gas & Electric Company, at Wampsville, Aug. 21. The decree also provided for the sale of the properties the Hudson River Water & Power Company, of which the Madis County company is a subsidiary, at Balston Springs, on Aug. 29. Char W. Andrews is one of the receivers of the Hudson River Water Power Company.

ASHBORO, N. C.—The City Council is reported to have awarded co tracts for improvement to electric-light plant and water-works syst to the J. B. McCrary Company, Empire Building, Atlanta, Ga. T cost of the work is estimated at about $10,000.

GRAND FORKS, N. D.—The City Council, it is said, is consideri the construction of a dam in Red Lake River.

AKRON, OHIO.—Proposals will be received by the Board of Edu tion, Akron, Ohio, until Aug. 7 for furnishing and installing light tures in the South High School, schedules for which may be seen the office of the clerk of the Board of Education and at the offices Harpster & Bliss, architects, Nantucket Building, Akron, Ohio. Fra Fiebeger is president of board.

CINCINNATI, OHIO.—The contract for installation of additio steam and electrical equipment and switchboard at the City Infirm at Hartwell, Ohio, has been awarded to the General Electric Compa of Schenectady, N. Y., for $3,000.

CLEVELAND, OHIO.—The plant and holdings of the Cuyahoga Li Company have been sold to the Cleveland Electric Illuminating Compa The Cuyahoga company was formed in 1907 to furnish electrical serv in the downtown business section of the city. L. D. West is secret and manager of the Cuyahoga company.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Comp has announced another reduction in the price of electricity to take fect from July 1. Under the new schedule the price per kw-hour been reduced from 12½ cents to 10 cents for the minimum number units fixed by the company for each house. All energy consumed o the minimum amount will be charged at 5 cents per kw-hour.

COLUMBUS, OHIO.—An ordinance has been introduced in the C Council providing for the issue of $265,000 in bonds, to provide fu for extensions to the municipal electric-light system in order to ena the plant to enter the commercial field.

DEFIANCE, OHIO.—Work has commenced by the Auglaize Power mpany on the construction of a dam across the Auglaize River three iles south of Defiance, in connection with its proposed power plant. e dam will be 700 ft. long and 30 ft. high. It is expected to have e plant ready for operation in the spring. The proposed plant will ve an output of 6000 hp, of which about 1500 hp will be utilized in ance and the remainder in Toledo. Later work will begin on two her plants by the company.

MOUNT VICTORY, OHIO.—The local electric-light plant, owned by enry Conklin, has been purchased by the Mount Victory Bank Com ny. The plant has been closed down and the town has been without ectrical service for several months. It is expected that a new com ny will be formed to operate the plant.

RIDGEWAY, OHIO.—The Mount Victory Bank Company has pur ased the local electric-light plant, which has been out of service for veral months. A new company, it is expected, will be formed to erate the plant.

ST. MARYS, OHIO.—The City Council has engaged the W. K. lmer Company, engineer, of Kansas City, Mo., to take charge of pro sed improvements and extensions to the municipal electric-light plant d water-works system. C. F. Lambert is chief engineer of the W. K. lmer Company, engineer.

AWHUSKA, OKLA.—At an election held recently the proposition issue $60,000 in bonds, the proceeds to be used for extensions to electric-light plant and water-works system, was carried.

SENTINEL, OKLA.—It is reported that all bids for equipment for electric-light plant were rejected. The city, it is said, will rchase equipment and material for plant. F. Murch & Company, of nton, Okla., are engineers.

ADAMS, ORE.—The Pacific Power & Light Company, of Portland, re., is contemplating extending its transmission lines to Adams, Ore.

HILLSBORO, ORE.—The Tualatin Valley Electric Company has exe ted a mortgage in favor of the Merchants' Savings & Trust Company, Portland, Ore., covering its plant and real estate in Sherwood, to ure a bond issue of $20,000.

NORTH BEND, ORE.—T. B. Nolan, of Omaha, Neb., is negotiating r the purchase of the property of the Flanagan & Bennett Water Power mpany. The deal is held in abeyance pending the granting of a anchise. If the deal is closed extensive improvements will be made by e purchaser, including the construction, of a new reservoir.

PENDLETON, ORE.—It is reported that plans have been prepared W. C. Knighton, of Salem, Ore., state architect, for the installation a power plant for the new State Insane Hospital to be erected in n.

BLOOMSBURG, PA.—The Borough Council has adopted an ordi nce under which the Columbia Power, Light & Electric Railwayys Com ny will be charged $500 per year to operate in this borough. The mpany recently increased its rates for electrical service in Bloomsburg.

CHESTER, PA.—The City Council is considering the question of im proving the street-lighting system and the installation of ornamental mps on the principal thoroughfares in the city. The street-lighting ntract will soon expire and it is proposed to make arrangements to prove and extend the street-lighting service under the new contract. e Beacon Light Company supplies electrical and lighting service in ter.

EPHRATA, PA.—The City Council has awarded the contract for the stallation of a 150-hp boiler at the municipal electric-light plant to e Coatesville Boiler Works, for $1,000.

FAIRVIEW, PA.—Sealed proposals will be received by the Pennsyl nia Commission to Erect a State Hospital for the Criminal Insane, re of H. G. Ashmead, secretary, 608 Real Estate Trust Building, iladelphia, Pa., until Aug. 8 for the construction of new buildings own as dining-room building K, kitchen building L, bakery building M, undry building T, power building V, ice house W, reservoir, system r sewage disposal and equipments for kitchen, bakery, laundry and wer building pertaining to the State Hospital for the Criminal Insane, Fairview, Pa. Drawings, specifications and form of proposal may be d on application at the office of J. M. C. Shirk, architect, 518 Phila lphia Bank Building, Philadelphia, Pa. Henry F. Walton is chairman.

HARRISBURG, PA.—It is reported that the property and holdings the Harrisburg Light, Heat & Power Company have been purchased Bertron, Griscom & Jenks, Philadelphia bankers. Application has en made at the State Department for a charter for the Harrisburg ectric Service Company, which will take over the plant and holdings the Harrisburg Light, Heat & Power Company. The new company, is said, will have affiliation with interests controlling the McCall's rry plant, and it is proposed eventually to secure energy from that ant to operate the local system. E. Z. Wallower is president of the arrisburg Light, Heat & Power Company.

PHILADELPHIA, PA.—The issuing of a $15,000,000 mortgage by e Connecting Railway Company to the Girard Trust Company is re rted as a preliminary step in the plans of the Pennsylvania Railroad mpany to equip its suburban railways out of Philadelphia for electrical eration. The Connecting Railway is a subsidiary of the Pennsylvania mpany with more than 30 miles of track in this city, which is used by e latter company to connect with its branches.

SHARON, PA.—The Republic Railway & Light Company, recently incorporated with a capital stock of $17,000,000, to take over the property and holdings of the Mahoning & Shenango Valley Railway & Light Company, is contemplating extensive improvements and extension of lines in this vicinity, which will involve an expenditure of about $3,000,000. The local power house will be enlarged and new equipment installed.

WILLIAMSPORT, PA.—The Scootac Power Company has applied to the City Council for a franchise to supply electricity in Williamsport. It is understood that the company has also applied for franchise in Bellefonte and Milton. The company is planning to erect a large electric power plant at Scootac, 7 miles west of Lock Haven.

CHARLESTON, S. C.—The City Council has engaged Lamar Lyndon, of New York, N. Y., consulting engineer, to make investigations and submit report on the advisability and cost of the city installing a municipal electric-light plant.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12, for a 12-in. electrically driven suction dredge for the United States navy yard at Charleston, S. C., plans and specifications for which may be obtained on application to the above bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

MINOT, S. D.—It is reported that preliminary plans have been prepared by Burns & McDonnell, Scarritt Building, Kansas City, Mo., consulting engineers, for the installation of an electric-light system in Minot.

PLANKINTON, S. D.—The City Council has granted W. A. Kuntze a franchise to install and operate an electric-light plant in Plankinton.

CHATTANOOGA, TENN.—It is reported that the Georgia Power Company, which is building a hydroelectric plant at Tallulah Falls, is seeking a franchise to enter Chattanooga to supply electricity.

McKENZIE, TENN.—The date for receiving proposals for the construction of the proposed electric-light plant and water-works system in McKenzie, Tenn., has been extended from July 27 until Aug. 3. For further information address F. D. Walpole, recorder.

AUSTIN, TEX.—The Southwestern Telephone & Telegraph Company has purchased the plant and holdings of the Texas Telegraph & Telephone Company. The system acquired embraces about 500 miles of toll lines and exchanges at Llano, Mason, Fredericksburg, Marble Falls, San Saba and Austin. The consideration was about $100,000.

BROWNSVILLE, TEX.—The San Benito & Rio Grande Railway Company has applied to the City Council for a franchise to construct and operate a gasoline motor railway system in Brownsville. S. A. Robertson is president of the company.

CLEBURNE, TEX.—The Gulf, Colorado & Santa Fe Railway Company has awarded contract for construction of a power house in Cleburne, to cost about $13,000, to H. D. McCoy, of Cleburne.

DALLAS, TEX.—A proposition has been submitted to the Dallas Chamber of Commerce by C. H. Alexander to supply electricity in Dallas from the hydroelectric generating plant at Marble Falls, Tex.

FLORESVILLE, TEX.—The installation of an electric-light plant and ice plant in Floresville is under consideration. J. H. Bell, of San Antonio, is interested in the project.

FT. WORTH, TEX.—The Ft. Worth Power & Light Company, recently incorporated with a capital stock of $3,560,000, it is said, will take over the property and holdings of J. R. Nutt, of Cleveland, Ohio, who is constructing a plant in Ft. Worth. The incorporators are: J. R. Nutt, George Holbrook and others, of Cleveland, Ohio; George T. Reynolds, T. B. Yarbrough and others, of Ft. Worth, Tex.

MENARD, TEX.—The installation of an electric-light plant in Menard is reported to be under consideration. E. C. Clark, of Chicago, Ill., is interested in the project.

MISSION, TEX.—The Mission Land Improvement Company is preparing plans for the construction of an electric plant and ice plant and water-works system in Mission. The water-works system will include the construction of a 50,000-gal. reservoir and a steel standpipe having capacity of 50,000 gal. A pumping plant will also be installed.

SAN ANTONIO, TEX.—Dr. F. S. Pearson, of New York, N. Y., and associates, who are interested in the Medina Irrigation Company, which is constructing a large dam across the Medina River, near San Antonio, are reported to be considering the construction of an electric interurban railway to extend from San Antonio to the site of the reservoir and down the valley of the Medina River, where it is proposed to reclaim more than 100,000 acres. The proposed railway will be about sixty miles in length, for which preliminary surveys are being made. Plans are being made to build a large hydroelectric plant at the dam, which will supply electricity to operate the railway and for other industrial enterprises.

TENAHA, TEX.—The City Council has granted a franchise to C. C. Swindell to install and operate an electric-light plant in Tenaha, work on which will begin at once.

PARK CITY, UTAH.—The City Council has granted the Knight Power Company a franchise for a term of fifty years to erect and maintain a 44,000-volt transmission line from Park City to Mill Creek over property owned by the city, under the terms of which the company is to pay the city $300.

PROVO, UTAH.—The Knight Power Company has decided to make extensions to its transmission lines and connect up its different power

The company will erect a new line from the Murdock power plant on ... Midvale. The cost of the work is estimated at $50,000.

CLARENDON, VT.—The Clarendon Power Company, recently incorporated with a capital stock of $500,000, is making arrangements for the erection of a power plant at Clarendon gorge on the Mill River. It is proposed to develop about 6000 hp at an estimated cost of about $500,000. The company has applied to the Board of Aldermen of Rutland for the appointment of a committee to locate poles for wires for its transmission lines in that city. It is expected to have the plant in operation and supply electricity in Rutland by Jan. 1, 1912. L. B. Dow, of Boston, Mass., is president of the company and F. C. Davis, of Springfield, is secretary.

FT. ETHAN ALLEN, VT.—The contract for building an addition to pump house and installing electrical pumping machinery and remodeling electric-light system at Ft. Ethan Allen has been awarded to L. B. Jacobs, of Newark, Del., for $18,396.

ALEXANDRIA, VA.—The Alexandria County Electric Lighting Company has executed a mortgage for $1,000,000 in favor of the Philadelphia Trust Safe Deposit & Insurance Company, of Philadelphia, Pa., to secure an issue of the same amount in bonds, of which $300,000 are to be issued at once. The balance are not to be issued until improvements or extensions have been made and actually paid for and must aggregate 15 per cent more than the amount of bonds issued at that time. The proceeds of the $300,000 are to be used for the installation of new equipment in the company's plant on the river front and for extension of its service into adjacent territory not now served by the company. The company is a reorganization of the Alexandria Electric Company. Leo P. Harlow is vice-president and F. R. Willer, general manager.

MARCUS, WASH.—Work has commenced on the construction of the new electric-light and water systems being promoted by H. V. Gates, of Hillsboro, Ore. Electricity for operating the electric plant will be transmitted from Meyers Falls. The cost of the electric system is estimated at $10,000 and that of the water works at $25,000.

ZILLAH, WASH.—The Zillah Light & Water Company, organized by local men, is planning to install an electric-light plant to furnish electricity to light the town and for manufacturing plants.

MORGANTOWN, W. VA.—The Cheat River Development Company, recently incorporated with a capital stock of $50,000, is planning extensive developments along the Cheat River for which surveys are now being made. The work will include the erection of a dam and large power plant. Charles W. Held, W. L. Hyatt, John M. Gleason, Frank P. Weaver and Glenn Hunter, all of Morgantown, W. Va., are interested in the project.

MENDOTA, WIS.—Bids will be received by the State Board of Control, Washington Building, Madison, Wis., until Aug. 2, for construction of central heating and power station at the Wisconsin State Hospital for the Insane, at Mendota, Wis., according to plans and specifications prepared by H. J. Thorkelson, consulting engineer, Madison, Wis., which are on file at the office of the State Board of Control, office of the superintendent of the State Hospital for the Insane; Builders and Traders' Exchange, Milwaukee, Wis., and the office of the consulting engineer, Madison, Wis. W. H. Graebner is president State Board of Control.

ST. NAZIANZ, WIS.—The Oslo Dam Electric Light Company, it is reported, is planning to supply electricity in St. Nazianz, and will also furnish electrical service in Cato and Whitelaw.

VANCOUVER, B. C., CAN.—Arrangements have been made by the British Columbia Electric Railway Company to export electricity from Canada into the town of Sumas, Wash., under an agreement to furnish electrical energy to the municipality of Sumas for a term of ten years. The taxpayers have voted to appropriate funds necessary to erect the transmission line and distributing system for electrical service in that town.

BRANDON, MAN., CAN.—The date for receiving tenders for two 2,000,000-gal. variable-speed pumps and other machinery necessary to equip the municipal pumping station to be operated by electricity, and to be installed so as to permit the present steam plant to be used as a duplicate, has been extended from July 17 to Aug. 7. Tenders will also be received for a Diesel gas engine of same capacity. Harry Brown is clerk of City Council.

WINNIPEG, MAN., CAN.—Announcement has been made by Mayor Evans, of Winnipeg, that the city of Winnipeg has decided to purchase the property of the Winnipeg Electric Railway Company, which includes an electric railway system, with franchise of fourteen years to run, power plant, located 60 miles east of the city, and an electric plant and gas plant. The consideration is said to be $15,000,000.

MIMICO, ONT., CAN.—The Village Council has rejected the offer of the Hydro-Electric Commission to supply electricity on the ground that the municipality was not large enough to undertake the project at present. The Council has decided to enter into a contract with the Erindale Power Company, of Erindale, Ont., to supply fifty street lamps for a term of three years, at $600 per year. At the expiration of the contract it is expected that the municipality will be in a position to enter the Hydro-Electric power union. The proposition submitted by the Hydro-Electric Commission would cost the town from $2,000 to $3,000 per year to install and maintain a plant, this amount including interest ...,000, which was the estimated cost of installing the municipal plant. It is understood that the rate for private consumers for domestic lighting will be either 6 cents per kw-hour or the Toronto hydro rate of 4 cents per hundred square ft. of floor area, plus ... cents per kw-hour for all energy consumed.

ORILLIA, ONT., CAN.—The ratepayers on July 17 voted in favor of the by-law appropriating $80,000 for enlarging the municipal electric-light plant.

PORT STANLEY, ONT, CAN.—A by-law appropriating $12,750 for the installation of hydroelectric power, to be supplied by the Hydroelectric Power Commission, will be submitted to the ratepayers about Aug. 9. The cost of the entire project is estimated at about $20,000; the amount over $12,750 will be advanced by the Hydroelectric Power Commission. The local electric plant and distributing system, owned by Walter Mitchell, will be taken over by the city at a cost of $6,8... As soon as the work is completed a transmission line will be extended to Sparta to supply electricity to farmers and residents in that district.

STRATFORD, ONT., CAN.—The Stratford Light and Heat Commission is considering a proposition submitted by the H. W. Johns-Manville Company to utilize the boilers in the municipal plant for steam heating purposes. The local system is operated by electrical energy supplied by the Hydro-Electric Commission, the local plant being maintained for emergency purposes.

TORONTO, ONT., CAN.—Announcement of a reduction in the rate for electricity has been made by the Toronto Electric Light Company to meet the prices of the Hydroelectric system. Under the new schedule there will be no minimum charge and no charge will be made for lamp renewals, and the rates for electricity for lamps are as follows: For four, five and six-room house, the first 10 kw-hours will be charged at the rate of 8 cents per kw-hour, after that 3 cents per kw-hour; for seven and eight-room houses, the first 15 kw-hours the charge will be 8 cents per kw-hour, all over that amount 3 cents per kw-hour; for nine and ten-room houses, first 20 kw-hours, 8 cents per kw-hour, over that 3 cents; for eleven and twelve-room houses, first 25 kw-hours, 8 cents per kw-hour, over that 3 cents. Larger houses will be charged a special rate, according to installation.

TORONTO, ONT., CAN.—It is reported that plans have been completed by Sir William MacKenzie and R. J. Fleming for the consolidation of the following companies: The Toronto Railway Company, Toronto Power Company, the Electrical Development Company, Toronto Electric Light Company, the Metropolitan Railway Company, Toronto & Scarboro Railway Company, the Mimico Electric Railway Company and the Toronto & Suburban Railway. In addition to above companies the projected Toronto & Eastern Railway, in which Sir MacKenzie and Mr. Mann are interested, is to be operated in connection with the Canadian Northern Railway. The Toronto & Eastern Railway is an electric line extending from Toronto to Niagara Falls over the right-of-way of the Electrical Development Company. Negotiations are said to be under way for taking over the People's Radial Railway Company, which proposes to operate through middle-western Ontario. R. J. Fleming, manager of the Electrical Development Company, the Toronto Power Company and the Toronto Railway Company, which controls the Toronto and York Radial Railway Company, it is stated, will soon become manager of the Toronto Electric Light Company.

MONTREAL, QUE., CAN.—Announcement has been made by the Grand Trunk Railway system that it will adopt the telephone system for train dispatching over its entire system. The cost of installation of the telephone system is estimated at $500,000, and will include three circuits. W. W. Ashald, of Montreal, Que., Can., is superintendent of telegraph.

NORIA, SONORA, MEX.—H. A. Smith, of Tucson, Ariz., it is reported, is planning to erect a large power plant near Noria, Sonora, Mex., for the purpose of supplying electricity to the mines and smelter in this vicinity and also for lighting the town of Llano.

OAXACA, MEX.—The installation of a large hydroelectric plant in Tomellin Canyon, in the State of Oaxaca, is being promoted by Maurice Clark. A large number of provisional contracts have been placed by Mr. Clark in the mining districts within a radius of ... miles of the proposed plant.

PACHUCA, HIDALGO, MEX.—Plans are being prepared by Andrew Mackenzie for the installation of a large hydroelectric plant in the State. It is proposed to utilize the water powers of the Tula and Moctezuma Rivers to generate electricity for transmission to the Zimapan district, where it will be used to operate the machinery in the mines and mills.

New Industrial Companies.

THE BIJUR MOTOR LIGHTING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $375,000 by George Engelhard, 17 East Ninety-seventh Street, New York, N. Y.; Chester Mann, of 20 Conklin Avenue, Brooklyn, N. Y., and Marian I. Dempsey, 28 St. Nicholas Place, New York, N. Y. The company proposes to manufacture electric apparatus, lighting apparatus for autos and manufacture and deal in auto supplies, etc.

THE INTERNATIONAL FRITCHIE COMPANY, of Wawarsing, N. Y., has been chartered with a capital stock of $500,000. The incorporators are: D. O'Connor, A. Sheard and H. A. Fluckiger, of New York, N. Y. The company proposes to manufacture motor vehicles,

HE LAMONT POWER PRODUCER & ECONOMIZING DEVICE MPANY has filed articles of incorporation under the laws of the [illegible]e of Delaware, with a capital stock of $[illegible]. The incorporators [illegible]: S. Lamont, S. E. Chadwick and C. R. M. Pye, Trenton, N. J.

HE McCUE COMPANY, of Buffalo, N. Y., has been incorporated [illegible] W. [illegible], [illegible] Gleason, E. H. Beat, H. A. [illegible], of [illegible], N. Y., and [illegible] Mc[illegible] of [illegible]. The company is [illegible] at $[illegible],000 and proposes to [illegible] vehicles.

HE NEW YORK FRITCHIE COMPANY, of [illegible], N. Y., [illegible] articles of incorporation with a capital stock of $200,000 for the [illegible]pose of dealing in all kinds of motor vehicles, etc. The incorporators [illegible]: D. O. O'Connor, A. Sheard and H. A. Fluckiger, all of New [illegible]rk, N. Y.

HE OIL POWER COMPANY, of New York, N. Y., has been [illegible]rtered with a capital stock of $100,000 for the purpose of manu[illegible]turing oil and other engines. The incorporators are: L. Wygodsky, [illegible]L. C. Keating, G. W. Bunnell, of New York, N. Y.; J. E. Parsons, [illegible] Mariners Harbor, and W. F. Turner, Jr., of Jersey City, N. J.

HE PHILADELPHIA MOTOR COMPANY has filed articles of [illegible]rporation under the laws of the State of Delaware, with a capital [illegible]k of $100,000. The incorporators are: J. F. Green, of Philadelphia, [illegible] J. L. Wolcott and H. R. Martindale, of Dover, Del.

HE PORTLAND ELECTROCHEMICAL COMPANY, of Portland, [illegible]ine, has been incorporated with a capital stock of $200,000 to manu[illegible]re and sell electrochemical and electrothermal machinery and [illegible]ducts. S. Wilson is president and clerk, and E. M. Dyer treasurer, [illegible] Portland, Maine.

HE PROTECTION DEVICES COMPANY, of New York, N. Y., [illegible] been incorporated with a capital stock of $25,000 by Colcord Upton, [illegible] Madison Avenue, Baltimore, Md.; C. H. Briscoe, 2588 Bedford [illegible]nue, Brooklyn, N. Y., and James A. McNelus, 404 Sixth Avenue, [illegible] York, N. Y. The company proposes to manufacture safety de[illegible]s, etc.

HE J. A. SEITZ COMPANY, of Syracuse, N. Y., has been chartered [illegible]h a capital stock of $50,000 by J. A. Seitz, B. M. Seitz and J. W. [illegible]tz. The company proposes to manufacture motors, engines, etc.

HE SMITH-DELAHANTY ELECTRIC PUMP COMPANY, of [illegible]tford, Conn., has been incorporated under the laws of Connecticut. [illegible] company proposes to make a specialty of a rotary pump that it [illegible], and also a piston for automobile engines, for which a [illegible]ent has been issued. The company will also manufacture electric [illegible]nors and electric switches.

HE STANDARD CEMENT POLE COMPANY OF AMERICA, of J[illegible]ey City, N. J., has filed articles of incorporation with a capital stock o[illegible] $300,000 for the purpose of manufacturing cement poles known as "[illegible]bello-Santi' reinforced cement poles. The incorporators are: John S[illegible]ti, 10 Wall Street; Samuel Weiner and V. C. Bogardus, 150 Nassau S[illegible]eet, all of New York, N. Y.

HE STANLEY DIFFERENTIAL HUB COMPANY, of Logansport, I[illegible], has been incorporated by E. D. Morgan, G. W. Stanley, Zachary T[illegible]lor and Joseph Taylor. The company is capitalized at $60,000 and p[illegible]poses to establish a plant to manufacture parts of machinery used in a[illegible]mobiles and electrical devices and supplies of all kinds.

HE STATISTICAL SERVICE COMPANY, of Jersey City, N. J., [illegible] been chartered with a capital stock of $100,000 by A. R. Smart, [illegible] [illegible] and J. R. Turner, of Jersey City, N. J. The company [illegible] to perform tabulations and calculations by use of mechanical o[illegible] electrical devices, etc.

[illegible]ICHARD H. THOMAS, Inc., of New York, N. Y., has filed articles [illegible] incorporation with a capital stock of $12,000 for the purpose of [illegible]ufacturing and dealing in gas engines, mill supplies, etc. The in[illegible]corporators are: J. M. Shellabarger, 30 Church Street, Charles B. [illegible]lker, 176 Centre Street, and E. M. Hardy, 30 Church Street, all [illegible] New York, N. Y.

[illegible] WARD EQUIPMENT COMPANY, of New York, N. Y., has [illegible] a charter with a capital stock of $1,000,000 to manu[illegible]ture contracting machinery, tools, supplies, railway construction sup[illegible]s, etc. The incorporators are: L. F. Purtill, U. D. Thomas, both [illegible] New York, N. Y., and W. S. Woodrow, of Brooklyn, N. Y.

HE WILSON STORAGE BATTERY COMPANY, of New York, N. [illegible] been incorporated with a capital stock of $200,000 by F. D. [illegible]derwood, J. C. Stuart, of New York, N. Y., and D. H. Wilson, Jr., [illegible] Meadville, Pa. The company proposes to manufacture storage bat[illegible].

New Incorporations.

[illegible]AN FRANCISCO, CAL.—Articles of incorporation have been filed [illegible] the California Consolidated Light & Power Company, with a capital s[illegible]k of $5,000,000, by C. S. Goodrich, J. T. Pigott, T. E. Palmer, [illegible] O'Conner and G. R. Ray.

[illegible]EROY, ILL.—Articles of incorporation have been filed for the Leroy [illegible]ephone Company with a capital stock of $15,000 by B. F. Baker, Celia [illegible] Baker and A. J. Keenan.

[illegible]ETERSBURG, ILL.—Articles of incorporation have been filed for the People's Telephone & Telegraph Company, of Menard County, with a capital stock of $100,000 by D. W. Frackelton, A. J. Parsons and Henry H. Colby, all of Petersburg.

SHERIDAN, IND.—The Bakers Corner-Horton Telephone Company has filed articles of incorporation with a capital stock of $6,000. The incorporators are: Charles B. Jones, Frank M. Folk and Ernst Hodson.

WISCASSET, ME.—The Wiscasset Electric Light & Power Company has been granted a charter with a capital stock of $10,000. The company proposes to supply electricity in the town of Wiscasset for lamps and motors. Electricity for operating its system will be secured from the Portland Power & Development Company's plant at Damariscotta Mills. Herbert W. Hawes is president of the Wiscasset Electric Light & Power Company, and A. R. Smith is treasurer.

Personal.

MR. MARTIN A. OBERLANDER, of the Western Electric Company, New York, returned last week from Europe after an absence of [illegible] months.

MR. R. E. T. PRINGLE, who formerly represented the Moloney Electric Company, of St. Louis, in Montreal, has been appointed manager of the company's new plant at Windsor, Ont.

MR. D. A. HEGARTY, whose association with the New Orleans Railway & Light Company was noted in this column last week, will be general manager for that company of its railway operating department and the commercial electric department.

MR. VAL. A. FYNN, well known for his writings and inventions relating to alternating-current commutator motors, has returned to London, England, after spending considerable time in this country developing new types of motors for the American market.

MR. THOMAS DOWNS has been appointed by the Illinois State Board of Administration consulting engineer to have charge of electrical work and mechanical work at the seventeen State charitable institutions, with headquarters in the offices of the board at Springfield.

MR. CHARLES A. RICHARDSON, of the Boston office of the Postal Telegraph Company, has been advanced to superintendent of the New England section. For ten years Mr. Richardson, who started with the company as an operator, has been manager of the Boston Postal office.

MR. E. E. WALLACE, for some time past in the service department of the General Vehicle Company, in Boston, has been promoted to the head of his department. He will have charge of all installations and mechanical details for the General Vehicle Company of New England.

CAPT. D. DE KHOTINSKY, who will be remembered by older readers as one of the earliest European incandescent lamp makers, has been appointed curator of the Kent Chemical Laboratory at the University of Chicago—a position for which his unusual experience in both mechanical and chemical work fits him admirably.

MR. CHARLES R. UNDERHILL has been appointed electrical engineer for the Acme Wire Company, with offices at New Haven, Conn. Mr. Underhill was until recently superintendent and chief engineer for the American Electric Fuse Company of Muskegon, Mich. He is the inventor of a number of signaling and wireless-telegraph devices and is the author of a work on electromagnet windings in which a number of original formulas are given.

MR. THEODORE H. CURTIS has been appointed mechanical engineer of the Chicago Association of Commerce's committee of investigation on smoke abatement and electrification of railroad terminals. He has been superintendent of motive power and machinery of the Louisville & Nashville Railroad. Like Mr. Burt, the chief engineer of the committee, Mr. Pattison, the electrical engineer, and Mr. Evans, the terminal engineer, Mr. Curtis is a practical railroad man.

MR. M. S. SEELMAN, JR., of the Edison Electric Illuminating Company of Brooklyn, has resigned as editor of the N. E. L. A. *Question Box*, which will hereafter be edited by Mr. Ernest A. Edkins, of the Commonwealth Edison Company. The work on the *Question Box* is a labor of love and has been ably handled by Mr. Seelman, who made an enviable record as editor. Mr. Edkins is not without editorial experience, however, having edited the *Edison Round Table* for some time.

MR. C. S. RUFFNER has opened an office for the Mississippi River Power Distributing Company in the *Post* Building, St. Louis, preparatory to the construction of the transforming substation which will receive 100,000-volt hydroelectric energy from the Keokuk development, distributing it among the local power companies for augmenting their steam-station output. Although but thirty-one years of age, Mr. Ruffner has enjoyed unusual experience in large power-transmission work with the Telluride Power Company and the Central Colorado Power Company in the West. He is a graduate of the University of Missouri and is a member of the American Institute of Electrical Engineers

MR. PUTNAM A. BATES has been appointed director of agricultural engineering and machinery exhibits for the American Land and Irrigation Exposition, which is to be held in Madison Square Garden next November. This exposition has on its advisory and governing board the Governors of over twenty States and the presidents of several of the largest railroad systems, including the New York Central, Pennsylvania, Burlington and Union Pacific. It is the intention of Mr. Bates to give particular attention in his department to electrical applications, which

are now multiplying so rapidly in the rural districts. At the present moment he is engaged with Mr. I. C. Martin in the issuance of a series of articles in a popular periodical on the utilization of central-station circuits for country properties and small farms within striking distance of central power houses.

MR. JOHN L. FAY has resigned as superintendent of construction of the overhead system of the Union Electric Light & Power Company, St. Louis, to become general sales engineer of the firm of W. N. Matthews & Brother, of the same city. The departure of Mr. Fay from the central-station company was marked by a farewell banquet tendered by Chief Engineer S. B. Way, and on July 15 the electrical department of the Union company also gave a banquet at which sixty-eight former associates were present, and during which a diamond ring was presented to the guest of honor. Mr. Fay entered the electrical field in the early eighties, his first experience being in connection with the Vanderpoele series arc system. After serving in the operating branch of the Elgin Arc Light Company, Elgin, Ill., he joined the National Electrical & Manufacturing Company, of Eau Claire, Wis., to take charge of the construction of small central stations throughout the country. In 1891 he went with the Tucker Electrical Equipment Company, of New York City, with which he had charge of field work in the construction of isolated plants, and two years later joined the Dundee Electric Light Company and Dundee Electric Railway Company as superintendent of construction. From 1897 to the present Mr. Fay has been superintendent of overhead and underground construction with the Laclede Power Company, the Imperial Electric Light & Power Company and the Union Electric Light & Power Company. He is the inventor and patentee of a number of electric devices, among others being the Fay insulator, which eliminates the use of a tie wire.

Obituary.

WILLIAM PENN HAZELTINE, for many years electrical superintendent of the Lynn Gas & Electric Company, died July 18 in Lynn, Mass., after a protracted illness. He was a native of New Hampshire and for a time was principal of the evening drawing school in Lynn. He was one of the first constructing engineers of the Thomson-Houston Electric Company and in 1890 became connected with the Lynn Gas & Electric Company. He was a graduate of the Lynn High School and of the Friend School in Providence. A widow and four children survive him.

Trade Publications.

RUBBER PACKING.—The Mechanical Rubber Company, Cleveland, Ohio, has issued Section D of its loose-leaf catalog devoted to rod packings, sheet packings and gaskets. Those illustrated are intended for ordinary service.

DIRECT-CURRENT INTERPOLE MOTORS.—Veritys Ltd., of Birmingham, Eng., has issued publication No. 634 on direct-current interpole "Aston" motors. The publication consists chiefly of a schedule of outputs and prices.

ENGINE-TYPE GENERATORS.—The Lincoln Electric Company, Cleveland, Ohio, has issued a bulletin describing its engine-type generators, which are built in ratings ranging from 37½ kw to 300 kw. The make-up of the machines is described in detail.

RHEOSTATS.—The American Fuse Company, Muskegon, Mich, manufacturer of the Allen-Bradley type of rheostats, starters and controllers, has issued a loose-leaf price list on its compression rheostats for alternating-current and direct-current work, including battery-charging work.

AUTOMATIC SECTION INSULATORS.—A folder, No. 4206, on Westinghouse automatic section insulators has been issued by the Westinghouse Electric & Manufacturing Company. The folder gives the applications with style numbers, sizes of wire and cross-sectional views.

MAZDA LAMPS.—Bulletin No. 4850, recently issued by the General Electric Company, describes the new drawn-wire tungsten filaments with which "Mazda" lamps are now equipped. The bulletin states that the pressed tungsten filaments formerly made were inclined to be delicate; the drawn-wire filaments now used in these lamps do not suffer from this disadvantage, inasmuch as they are many times stronger at all periods during life.

AUTOMOBILE INSTRUMENTS.—The General Electric Company has recently issued Bulletin No. 4848, describing its new combination ammeter and voltmeter. This instrument is inclosed in a dust-proof and moisture-proof aluminum case, and is designed to withstand the constant vibration and exposure incident to service on electric vehicles. The publication contains dimension and connection diagrams and illustrations in actual size of the scales.

SINGLE-PHASE INDUCTION MOTORS.—Bulletins Nos. 3142 and 3143 issued by the Emerson Electric Manufacturing Company, St. Louis, Mo., are devoted to descriptions of single-phase induction motors of the full-load-start clutch type, back-geared with countershaft, in sizes ranging from ⅓ to ½ hp, and without back gear in sizes ranging from 1-20 to ½ hp respectively. Although built in frames familiar to small motor users for some years, the motors embody improvements in design.

AVERAGING INSTRUMENT FOR CIRCULAR CHART RECOR-.—The Bristol-Durand radii averaging instrument for circular chart r ords is described in Bulletin No. 147A issued by the Bristol Comp , Waterbury, Conn. It can be applied to records of any kind on circ charts of uniform graduations, such as records of watts, amperes, sure, etc., making recording instruments equipped with circular ch available for a number of applications for which it was previously tho necessary to use instruments using straight-line or striped-record ch:

MOTOR CONTROL IN NEW YORK CITY.—A handsomely exec booklet entitled "Cutler-Hammer Control in New York City" has bee sued by the Cutler-Hammer Manufacturing Company, Milwaukee, \ illustrating and describing installations of its motor and lighting contr New York buildings, which include a number of interesting features. map of the city bound into the booklet proved especially useful at the of the volume's appearance during the recent National Electric Association convention, as copies were sent to members and visitor attendance.

TOBIN BRONZE.—The Ansonia Brass & Copper Company, York, has issued a booklet on tobin bronze which is a combina of copper and other metals. Its tensile and transverse strengt the same as ordinary mild steel and it is adapted for a variety purposes where a strong, non-corrosive metal is required. When ished it has a bright golden color. Its specific gravity is 8.379. W used in the form of rolled plates, bolts and rivets in contact salt water it has given favorable results. In weight it is slightly than copper.

SWITCHING APPARATUS AND MEASURING INSTRUMEN —Dr. Paul Meyer, A. G., Berlin, Germany, has issued an attra catalogue on switching apparatus and switchboard instruments high-tension work up to 25,000 volts. The catalogue is divided eight chapters devoted to oil switches for switchboards; switch cabir fuses and protective devices; instruments; ground detectors synchronizing apparatus; lightning arresters; switch pedestals, b boards, etc., and the final chapter gives the dimensions of the var apparatus described.

PORCELAIN DECORATIVE SOCKETS AND RECEPTACLE Pass & Seymour, Inc., Solvay, N. Y., have issued Form No. 670. scribing their ready-wired porcelain receptacles and their applicat The receptacles are designed to be attached to a building or any st ture desired to be outlined in electric light. They carry the wires from the wall and carry the screws 2½ in. apart on centers. wires are sealed and every connection between the terminals and wire is soldered. Ready-wired receptacles may be supplied in strea of any length up to 1,000 ft.

ELECTRIC CRANES AND CONVEYORS.—The Pawling & Harn feger Company, Milwaukee, Wis., has issued an attractive new 48 catalogue, "The Plant and Its Products," covering the subjects o products, which include electric cranes, traveling hoists, lumber conve drills, boring machines, grab buckets, etc. The company manufactur own motors and controllers for its hoisting and conveying equipn Several pages of the catalogue are given over to description and illu tions of the very complete mechanical plant of the company overloo the Menominee Valley at Milwaukee.

STEEL CABINET.—The Agutter-Griswold Company, Seattle, W has issued a leaflet on its steel gutter box, which has been devel for porcelain cut-out installations. A 2.5-ft. gutter is provided around, with liners of steel instead of slate. Standard knock-out are punched in both the box and the liners, and the insertion of porc bushings in these holes gives a most satisfactory job. The style of struction makes the low-priced article suited especially to class of wiring work which is too good for ordinary steel boxes yet is not good enough to warrant panelboards in plate-lined cabine

FIXTURES.—The F. W. Wakefield Brass Company, Vermilion, has issued Catalog No. 10, devoted to electric fixtures for tung lamps. A new commercial-type, round, patented fixture has been bro out, which is especially adapted for lighting public buildings, of stores, auditoriums, etc. The body is constructed on the same prin as the company's square type, that is the arms are held in plac clasping them between two castings in the body. The arms are i changeable, and any stem can be used for either two, three, four or lamps, including the bottom lamp. The fixtures are said to be eas wire and to hang, and to possess plenty of room for wire connection

ARC-WELDING DYNAMO.—The Lincoln Electric Company, C land, Ohio, has issued a bulletin on its arc welder. The latter is fu mentally a variable voltage machine, the voltage at the arc depe entirely on the amount of current flowing. There is no ohmic resist used on the usual work, and since there is but one machine, the no losses are said to be small compared with those of a motor-gene set. Where the supply is alternating, a motor-generator set is requ but in this case the company claims to be able to eliminate the use of resistance, so that the efficiency of the output remains high, and regulation is said to be as good as it is when the supply is fr a direct-current source.

COMPARATOR.—The potentiometer has for many years afford a ready means for the standardization of direct-current ammeters and meters, and previous to the introduction of the "comparator" re were no means comparable with the potentiometer, from the stand nt of simplicity, for the calibration of alternating-current ammeters nd voltmeters. With the comparator such instruments can be calib ed

pidly and accurately from 1/20 amp up and from 5 volts up. alternating-current-direct-current comparator is described in Catalog No. 72 issued by the Leeds & Northrup Company, Philadelphia. It is an instrument in which the alternating current or voltage being measured is compared directly with a direct current which can be accurately measured. Its action is the same whether currents be direct or alternating.

BUSINESS NOTES.

MR. C. H. CLARK has been appointed to take charge of the advertising department of the Goulds Manufacturing Company, Seneca Falls, N. Y.

THE NORTHWEST ELECTRICAL EQUIPMENT COMPANY, manufacturers' agent, formerly at 530 Lumber Exchange, Portland, Ore., has moved to 7 North First Street, where it occupies ground-floor offices. Mr. Banes, formerly with the J. C. English Company, is manager of the firm.

CUTLER-HAMMER, PORTLAND (ORE.) OFFICE.—Because of increasing business in the Northwest, Otis & Squires, the Pacific Coast agents of the Cutler-Hammer Manufacturing Company, of Milwaukee, have established a branch office in Portland, Ore., in charge of Mr. G. L. Priest, located at 229 Sherlock Building.

THE YOUNGSTOWN ARMATURE & CONSTRUCTION COMPANY has received an order from the City Investment Company, of Cleveland, for a five-panel combination lighting and motor-control switchboard, and an order for a seven-panel switchboard from the Republic Rubber Company, of Youngstown, Ohio.

CUTLER-HAMMER OUTING.—The fourth annual outing of the Cutler-Hammer Manufacturing Company, of Milwaukee, was held on July 22 at Waukesha Beach. There were a baseball game, races and athletic contests, a guessing contest for ladies and a grab-bag for the children. A basket luncheon was eaten in a grove, and the picnic proved to be a thoroughly enjoyable one.

MUNNING-LOEB COMPANY.—A. P. Munning and W. L. Loeb announce the establishment of a new company, with main office and works at Matawan, N. J., to be devoted exclusively to the design and manufacture of electroplating and buffing equipment and supplies. The company has a large and modernly equipped plant under the supervision of experts of long experience in the industry.

FAN-MOTOR WARMTH BLAST.—The Central Electric Company, of Chicago, is marketing a new fan motor "Warmth Blast," a protected heating element being attached to the blade guard of the fan motor and connected to the lead wire which supplies electric current to the motor itself. The fan blowing air through the heated coil warms the air, which in turn warms cold rooms, dries wet clothing and hair and keeps the show window free from frost.

THE MORRIS IRON COMPANY, of 88 West Street, New York City, reports an increased business in the ornamental lighting field. Although the company manufactures a large number of designs, the principal calls are for five-lamp standards with four inverted and one upright globe; for poles for luminous or magnetite arc lamps, and combination trolley and lighting poles. Recent orders include five-lamp standards to be installed at Marshal, Mich., and Richmond, Va.

CLEVELAND TWIST DRILLS.—At the Atlantic City convention in June of the Railway Master Mechanics and Master Car Builders' Association the Cleveland Twist Drill Company gave a demonstration of the capabilities of its drills for high-speed and heavy work. The highest record of drilling speed known, it is stated, in machine shop practice was attained by a 1¼-in. "Paragon" flat-twist drill, which removed 70.35 cu. in. of cast iron in one minute, and repeatedly cut through a billet at the rate of 57½ in. per minute, or almost 1 in. per second. In another test a 2½-in. milled drill cut sixty-eight holes through a billet of machinery steel 4¼ in. thick without being reground.

THE U. S. ELECTRICAL MANUFACTURING COMPANY, Los Angeles, Cal., reports the sale and installation of U. S. motors for individual drive during the month of June to the following southern California concerns: Los Angeles Manufacturing Company, six motors, total 75 hp; Washington Iron Works, twelve motors; Roberti Brothers, twelve motors; Western Sanitary Enameling Company, seven motors; Brenan Shoe Company, twenty motors; Artistic Hardware & Fixture Company, nine motors; San Francisco Elevator Company, eight motors; Diamond Laundry Company, seven motors; Royal Laundry Company, six motors; Charles C. Chapman, four motors; Brock & Feagans, four motors.

ASHLEY P. PECK, for six years identified with the Allis-Chalmers Company as sales engineer, connected with its New York office, has recently associated himself with the Terry Steam Turbine Company and A. L. Ide & Sons as district sales manager for each firm in the Middle West, with offices at 814 People's Gas Building, Chicago, Ill. Mr. Peck was prior to 1902 actively connected with the machinery sales field of Chicago, and since that date, for three years, was manager of the Milwaukee district sales office of the National Electric Company, going from Milwaukee to the Allis-Chalmers Company at New York in 1905. He was graduated from Purdue University in the class of 1892, with the degrees of B.M.E. and E.E., and is an associate member of the American Institute of Electrical Engineers.

BUSCH, SULSER BROS., DIESEL ENGINE COMPANY.—A list of some of the users of Diesel Oil Engines has been distributed by the Busch, Sulser Bros., Diesel Engine Company, St. Louis, Mo. The list contains the following names and ratings of engines: Sherman, Tex., Gas and Electric Company, (675 hp); South Norwalk, Conn., Electric Works, (675 hp); Bellefontaine, Ohio, Electric Light Plant, (450 hp); Atlantic Light and Power Company, Coeymans, N. Y., (240 hp); Mansfield, Mass., Electric Light Company, (465 hp); Citizens' Electric Light and Ice Company, Lebanon, Ind., (570 hp); Effingham, Ill., Electric Light and Power Company, (465 hp); Camden, N. Y., Electric Light Plant, (170 hp); Westerly, R. I., Light and Power Company, (1125 hp); Abilene, Tex., Light and Water Company, (450 hp); Camden, S. C., Ice and Light Company, (395 hp); Pittsfield, Mass., Electric Company, (450 hp); Claremont, N. H., Power Company, (900 hp); Bryan, Ohio, Light and Water Works, (450 hp); Gloucester County Electric Co., Pitman Grove, N. J., (225 hp); Ennis, Tex., Ice, Light and Power Company, (350 hp); Cleburne, Tex., Gas and Electric Company, (450 hp); Robinson, Ill., Light, Heat and Water Company, (225 hp); Key West, Fla., Electric Company, (825 hp); Thibodaux, La., Electric Plant, (240 hp); Menasha, Wis., Water and Light Works, (150 hp); Baldwin Locomotive Works, Philadelphia, Pa., (1350 hp); International Time Record Company, Binghamton, N. Y., (120 hp); Kent Manufacturing Company, Clifton Heights, Pa., (225 hp); Samson Cordage Works, Shirley, Mass., (900 hp); Trinity & Brazos Valley Railway Company, Teague, Tex., (465 hp); Grinnell Mills, New Bedford, Mass., (450 hp); Ball Bros. Glass Manufacturing Company, Muncie, Ind., (675 hp); Knabe Piano Company, Baltimore, Md., (225 hp); Gorham Manufacturing Company, Providence, R. I., (450 hp); Airedale Mills, Pittsfield, Mass., (120 hp); Prairie Pebble Phosphate Company, Mulberry, Fla., (3600 hp); Texas & Pacific Railway Company, Marshall, Tex., (225 hp); American Optical Company, Southbridge, Mass., (1350 hp); Grant Yarn Company, Fitchburg, Mass., (450 hp); Fisher Manufacturing Company, Fisherville, Mass., (450 hp); United States Naval Torpedo Station, Newport, R. I., (225 hp); Kimberly-Clark Company, Neenah, Wis., (1020 hp); Columbia Worsted Mills, Wallingford, Pa., (170 hp); Anheuser-Busch Brewing Association, Bronx Ice Plant, New York, N. Y., (570 hp); United Verde Copper Company, Jerome, Ariz., (450 hp), and United Gas Improvement Company, Philadelphia, Pa., (825 hp).

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 18, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

997,953. ELECTRIC GARMENT PRESSER; J. Bloch, Cincinnati, Ohio. App. filed Oct. 17, 1910. A pair of tubes for containing incandescent lamps. The article to be pressed is drawn between the tubes.

997,954. ELECTRIC PRESSER FOR NECKTIES AND OTHER ARTICLES; J. Bloch, Cincinnati, Ohio. App. filed Oct. 17, 1910. A tube for an incandescent lamp and a curved presser plate. The article to be pressed is drawn between the tube and plate.

997,957. TROLLEY HEAD; P. Brandell, Wichita, Kan. App. filed April 23, 1910. The wheel is mounted in bearings on a semi-rotatable support, capable of limited lateral oscillation on the pole. Waterproof bearing.

997,984. ELECTRIC STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed Dec. 13, 1907. Inert material, such as lampblack and clay, is incorporated in the active material of a negative plate by precipitation from a deflocculated condition.

997,987. SAFETY SIGNALING DEVICE FOR GAS CONNECTIONS; F. Ferry, Cleveland, Ohio. App. filed Nov. 2, 1910. An inflatable bag operates electric contacts when the pressure gets low.

997,990. ELECTROMECHANICAL SELECTOR; E. G. Godfree, Hampton, Australia. App. filed May 7, 1910. For party line and intercommunication telephones. To prevent interruption. Clockwork transmitter; plug controlled signal; electromagnetic receiver.

997,993. RAIL JOINT; G. C. Hager, Danbury, Conn. App. filed Sept. 24, 1910. Interlocking rail heads with a chamber formed between them containing a flexible rail bond.

998,016. RECORDING MECHANISM FOR METERS; R. C. Lanphier, Springfield, Ill. App. filed March 22, 1911. Distant-operated indicating hand for showing the record of a storage battery on electric vehicles, etc. The hand moves more rapidly on discharge than on charging to compensate for losses.

998,026. PRODUCTION OF PREDETERMINED DISTRIBUTION OF MAGNETIC FLUX IN ELECTRIC MOTORS, GENERATORS AND OTHER APPARATUS; R. D. Mershon, New York, N. Y. App. filed April 11, 1907. A motor is provided with leads for connection with an external alternating-current circuit at a plurality of points for each of one or more poles, the points being located with respect to the arc or arcs embraced thereby to produce a desired distribution of flux.

998,034. SIGNAL SYSTEM FOR ELEVATORS; D. M. Perine, Pitts-

[illegible] of ... on a predetermined ... [illegible]

998,040. TELEPHONE SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed May 16, 1910. Three operative talking circuits from two metallic circuits.

998,043. TELEPHONE SYSTEM; R. C. Smith, Homer, Mich. App. filed Oct. 26, 1910. Substation circuit and apparatus. A manual switch controls the energizing circuit of the transmitter in conjunction with the contacts of the usual switch hook. Party line.

998,063. ELECTROLYTIC CELLS FOR THE ELECTROLYSIS OF ALKALINE SALTS; M. Wildermann, Ealing, London, Eng. App. filed Dec. 10, 1910. Improvement on Patent No. 741,864. Small weights for preventing the carbons floating on the mercury on the cathode side from rising over a certain height and ribs for preventing wave motion of the mercury.

998,067. TERMINAL FOR INCANDESCENT CONDUCTORS; A. C. Appelberg, Schenectady, N. Y. App. filed July 2, 1906. A tungsten resistance stick is held in a tungsten block by a sintered residue of [illegible]

998,073. ELECTRIC INSULATOR; G. W. Chaffin, Dayton, Ohio. App. filed Feb. 13, 1911. A screw-threaded supporting pin has a longitudinal opening closed on one side at the end to allow expansion and still preserve strength.

998,112. SUPPORT FOR ELECTRICAL CONDUCTORS; T. E. Murray, New York, N. Y. App. filed April 5, 1911. A V-shaped bar supported in a notch in an upright.

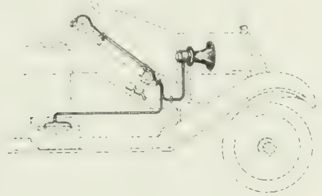
998,117. TEMPERATURE REGULATOR; A. N. Ozias, Minneapolis, Minn. App. filed July 20, 1910. The tension of the movable member of a thermostat may be adjusted to vary the operating temperature. For controlling motor circuits for ventilation and heating.

998,119. ELECTRIC-SWITCH RECEPTACLE; J. G. Peterson, Hartford, Conn. App. filed March 22, 1910. A face plate for a snap wall switch with concealed means for fastening it in position on the receptacle.

998,147. ALTERNATORS; S. B. Allen and E. T. King, Cambridge, Mass. App. filed Aug. 11, 1910. Two contact arms are electromagnetically oscillated to convert direct current into alternating current of high frequency for wireless telegraphing, etc.

998,161. MAGNETIC TELEPHONE; W. W. Dean, Elyria, Ohio. App. filed March 29, 1909. A receiver having its flux conductor made up of E-shaped punchings.

998,162. WARNING-SIGNAL DEVICE; W. W. Dean, North Ridgeville, Ohio. App. filed May 1, 1911. A noise "horn" with vibrating diaphragm and an outlet for foreign matter; adjustable around the periphery.



998,162.—Warning Signal Device.

998,175. METHOD OF AND APPARATUS FOR STARTING AND OPERATING MERCURY-VAPOR APPARATUS; P. C. Hewitt, Ringwood Manor, N. J. App. filed Sept. 15, 1908. A platinum conductor extends above and below the mercury surface so as in effect to provide a turned-up meniscus and facilitate starting at a lower voltage.

998,197. FIRE-ALARM APPARATUS; G. T. Moore, Marlboro, Mass. App. filed June 11, 1909. A sending device having contact plate with a V-shaped slot, a contact arm carried by a rotative shaft and means for adjusting the time of passage of the arm over the slot.

998,212. ELECTRIC-ARC LAMP; S. Szubert, Pankow, Berlin, Germany. App. filed Oct. 18, 1909. A spindle rotated by the current moves a system of levers so as to feed the carbons straight forward and maintain their angle of relative inclination.

998,223. ELECTRIC MERCURY-VAPOR LAMP; J. M. Anck, Philadelphia, Pa. App. filed Dec. 14, 1904. The container has mercury in both ends and is bowed in the center and is rotated on its longitudinal axis for starting.

998,245. CONTROL SYSTEM FOR ELECTRIC MOTORS; J. H. Hall, Cleveland, Ohio. App. filed March 18, 1910. For hoists, etc. The armature and field may be connected in parallel. Two resistances in the armature branch in parallel and means for throwing portions of one resistance over into the field branch and short-circuiting the other.

998,252. AUTOMATIC HIGH-TEMPERATURE-ALARM APPARATUS; J. V. Ludstrom and K. Nielsen, Schenectady, N. Y. App. filed Feb. 16, 1910. A thermometer with terminal adjustable for different temperature limits.

998,260. AUTOMATIC TRAIN-STOPPING DEVICE; E. A. Pierce, Wheeling, W. Va. App. filed March 30, 1907. The main reservoir pressure effects the exhaust of the train-line pressure and the exhaust action cuts off the main-line pressure.

998,269. ELECTRIC HEATING APPARATUS; A. Trepreau, Joinville-le-Pont, France. App. filed Oct. 25, 1910. A series of open glass tubes and resistance wire passing through the tubes.

998,272. COLLECTOR BRUSH FOR TORSION METERS; A. Barr and W. Stroud, Anniesland, Glascow, Scotland. App. filed July 9, 1910. An assemblage of rods, each having straight inner and outer end portions and a bend between.

998,299. ELECTRIC SIGNALING SYSTEM; J. G. Nolen and J. E. Shepard, Chicago, Ill. App. filed May 9, 1908. For watch service and fire alarm. A single telephone or telegraph transmitter serves a building or [illegible]

998,301. ELECTRIC SWITCH; C. A. Pfanstiehl, Highland Park, Ill. App. filed Aug. 22, 1907. A disc-like casing with a movable contact arm inside and a forked operating key insertable through the wall. For automobile ignition system, etc.

998,302. FIELD MAGNET FOR ELECTRIC MOTORS AND GENERATORS; A. E. Reimers, Kansas City, Mo. App. filed April 8, 1906. Series field coils are wound grooves in yoke arms and series field coils are wound over the arms. To prevent sparking, distortion of the field and avoid cross connections in the series windings.

998,304. TERMINAL CLAMP; J. D. Robertson, Toledo, Ohio. App. filed Aug. 5, 1910. A wire loop with bent ends held in a socket by a pin which may be the terminal of a spark-gap.

998,343. PROTECTIVE DEVICE; V. Karspetoff, Ithaca, N. Y. App. filed June 28, 1909. A time-limit device self-restoring if the abnormal condition ceases within the limit. The speed of a motor varies as the current and the motor is reversed when the current falls.

998,3[illegible]. HIGH-VOLTAGE INSULATOR; F. M. Locke, Victor, N. Y. App. filed Feb. 26, 1907. A series of insulators arranged in sequence and connected by metal hangers, each secured to the center of an insulator and passing around the edge and secured to the next.

998,361. MOTOR CONTROLLER; C. E. Lord, Milwaukee, Wis. App. filed Oct. 25, 1909. For starting polyphase induction motors by varying the potential impressed on the primary windings. Has a transformer surrounding and mounted on a shaft and a drum on the shaft.

998,364. ELECTRICAL REGENERATIVE CONTROL APPARATUS AND SYSTEM; J. C. Macfarlane and H. Purge, Chelmsford, [illegible] App. filed Feb. 7, 1910. A safety winding consisting of a s[illegible] field winding is provided on the generator element of the m[illegible] generator in the "Ward-Leonard" system to limit the current [illegible] from the mains.

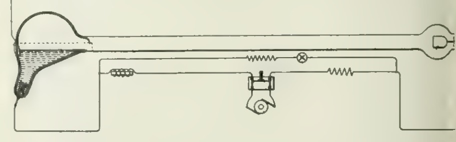
998,379. PROCESS OF ELECTROLYTIC REFINING OF ZINC; [illegible] Namekawa, J. Miyazawa, K. Miyabara and E. Emura, Tokyo, J[illegible] App. filed March 1, 1911. A lead anode in a zinc sulphate solu[illegible] Current is passed from the anode to the cathode through the [illegible] tion and at intervals a current is passed from the solution t[illegible] anode to improve the conductivity.

998,386. COMMUTATOR FOR DYNAMO-ELECTRIC MACHI[illegible] C. A. Parsons and A. H. Law, Newcastle-upon-Tyne, England. [illegible] filed April 19, 1909. The ends of the commutator are support[illegible] their diaphragms connected to the shaft to allow for longitu[illegible] expansion.

998,391. INDICATOR FOR HOTELS AND OTHER PLACES; [illegible] Powell, New Orleans, La. App. filed April 4, 1911. The [illegible] "records" certain facts as to the different rooms and may di[illegible] all the "records" by operating a key.

998,392. DYNAMO-ELECTRIC MACHINE; H. H. Ralston, Nor[illegible] Ohio. App. filed Oct. 6, 1909. A brush yoke and a single [illegible] of radial arms having brush rods for direct-current machine.

998,419. SYSTEM OF MOTOR CONTROL; H. A. Steen, Milwa[illegible] Wis. App. filed Sept. 22, 1910. A separately actuated contact [illegible] of controller has an actuating circuit for each contact cont[illegible]



998,175.—Method of and Apparatus for Starting and Operating [Mer]cury-Vapor Apparatus.

by an adjacent contact. A master switch controls the operati[on of] the contacts.

998,435. FUSE SWITCH; A. L. Weekes, Harpenden, England. [App.] filed May 3, 1910. A fuse member is attached at right angl[es to] a switch arm.

998,453. CLAMP; I. Beilis, San Francisco, Cal. App. filed Nov [illegible] 1910. A wire device for temporarily holding conductors in a [illegible] ing while the molding cap is being put up.

998,467. ELECTRIC SWITCH; A. W. Clauder, Bridgeport, [illegible] App. filed Feb. 15, 1911. Rotary snap for lamp sockets. A [illegible] part spindle, a cut-out, block thereon having ratchets and indepe[illegible] contact members co-operating with the ratchets.

998,485. AUTOMATIC ALARM; A. C. Farley and W. B. McD[illegible] Shinglehouse, Pa. App. filed June 3, 1910. Adjustable therm[illegible] control.

998,486. ELECTROMAGNETIC SIFTER; T. T. Fauntleroy, Sta[illegible] Va. App. filed April 1, 1911. A vertical hollow magnet, a s[illegible] and a conical deflector for removing steel particles from flour.

998,493. LOCK FOR FIRE-ALARM BOXES; A. Glock, San Fran[illegible] Cal. App. filed Sept. 13, 1910. To be opened by a "perma[illegible] or a removable key.

998,494. GUARD FOR FIRE-ALARM-BOX-DOOR KEYS; A. G[illegible] San Francisco, Cal App. filed Sept. 13, 1910. A swinging [illegible] operated from inside the door holds the glass door plate in pla[illegible]

998,551. TERMINAL CLAMP; J. D. Robertson, Toledo, Ohio. [illegible] filed Aug. 5, 1910. A wire loop having its ends coiled to enga[illegible] conductor and its insulation.

998,552. ELECTROMAGNET; H. O. Rugh, Sandwich, Ill. App. [illegible] March 15, 1910. An armature under the influence of an actu[illegible] coil controls means for establishing a closed circuited seconda[illegible]

998,564. ELECTROMAGNETIC CUTTING TOOL; Le Roy T. Bo[illegible] Charleston, W. Va. App. filed March 22, 1909. A coal pick, [illegible] dem solenoids, with a switch in a recess between the coils.

998,567. SIGNALING BY ELECTROMAGNETIC WAVES; R[illegible] Fessenden, Washington, D. C. App. filed Dec. 17, 1906. [illegible] antenna has a horizontal portion extending backwardly in the [illegible] of propagation of the message to protect the support from [illegible] absorption of waves.

998,580. CIRCUIT-BREAKER; A. L. Horton, Beachmont, Mass. [illegible] filed July 18, 1906. Double-throw oil-tank switch for heavy cu[illegible] The movable contact is always horizontal. Interlocking device [illegible] the levers. An automatic overload trip and a hand trip.

998,588 FIRE-PROTECTION SIGNAL SYSTEM; J. G. Nolen a[nd J.] E. Sheppard, Charlottesville, Va. App. filed April 25, 1904. [For] use in conjunction with a fire extinguisher system of Patent [No.] 993,293. The alarm instrument transmits an "O. K." signal [wh]en normal conditions are restored.

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SOME PHENOMENA OF WIRELESS SIGNALS.

The valuable paper by Messrs. Dolbear and Proctor printed elsewhere in this issue deals with a subject which is, as intimated in a recent editorial, of particular interest and importance. The general fact that wireless signals over any considerable distance are more effective by night than by day is a very familiar one. That this difference is on the whole less marked when sending long wave lengths than when sending short ones, and also less marked when sending north and south than when sending east and west, are facts which were well brought out in the lecture by Mr. Marconi, to which we referred in a recent issue. The present paper deals with the further and quantitative examination of some of these phenomena and throws considerable light on their underlying causes, although, as the authors very properly indicate, there are many irregularities in wireless sending of which no rational account can yet be taken. The main phenomena brought out in their investigations are the extraordinary and abrupt variations of the strength of signals which occur at sunrise and sunset. In their experiments the signals recorded between Glace Bay and Boston were practically obliterated at a period usually about five minutes after sunset or sunrise and then within a few minutes recovered almost their normal intensity. The signals by night were, on the whole, although irregular, stronger than those by day, but the change between night and day was small compared with the violent variations which occurred when the point of sunset or sunrise fell in longitude between the stations or close to either of them. It is substantially the same phenomenon shown in Mr. Marconi's lecture, but much more vividly here, perhaps on account of the fact that the stations under investigation differed so little in longitude, approximately twenty minutes of time. There is also shown a distinct difference between the duration of the sunset and sunrise periods of weak signals, the former being always the wider. As Messrs. Dolbear and Proctor remark, the general phenomena may be explained in a fairly satisfactory way by the ionization of the air by sunlight, producing a dissipation of energy by air conduction through the ionized space. It may be pertinent, therefore, to inquire into the cause of the ionization and its probable location in the atmosphere.

It is well known that the solar wave lengths less than about 300 $\mu\mu$ are practically obliterated by the absorption of the atmosphere. This absorption is certainly accompanied by powerful ionization, since rays of this wave length and less are well known to produce this effect in the laboratory. The absorption and incidentally the ionization increase rapidly as the wave length diminishes. The most active effects are produced by wave lengths of less than 200 $\mu\mu$, such as are absorbed by a few meters or even

decimeters of air at atmospheric pressure. None of these particular waves from the sun get anywhere near the earth, as has been well shown by the researches of Cornu and others regarding the extent of the solar spectrum at high altitudes. Even at heights of 12,000 ft. or 15,000 ft. no perceptible wave lengths less than 290 $\mu\mu$ get through, so that all the shorter wave lengths are absorbed above this level. In a very rare atmosphere, such as exists at extreme heights, the absorption is much less rapid than near atmospheric pressure, so that into the thin upper regions the extreme ultra-violet waves can penetrate for a considerable distance and produce strong ionization and conductivity. This is very well exhibited by the conditions which exist during auroral discharges, which seem commonly to occur, according to recent investigations, at a height somewhat in excess of 100 km above the earth's surface. In this region the effect of ionization is very marked in easy conductivity. How much further down it extends and what is the distribution of ionized material it is impossible now to say, but the condition which exists when the ultra-violet solar rays strike the atmosphere is certainly one which in the higher atmospheric strata would favor the rapid dissipation of energy by conduction. The extreme outer layers from their low density would be less effective in dissipating energy than those lying at some point lower down at which the conductivity due to ionization would become a maximum. Below this again the conductivity would diminish owing to the lessened effect of the rays that get through, and finally a condition of relative stability would be reached at some point not many kilometers above the earth's surface. As sunrise draws near the upper strata of the atmosphere are rendered strongly conducting and the rays finally break through into visible sunrise, leaving behind them and above the point of sunrise a great conducting mass of ionized air, extremely heterogeneous in conductivity owing to the effects of rarefaction and varying absorption of the rays. In a gaseous mass of this character the distortion of the wave front suggested by Fleming must almost certainly take place, as in the case of every wave front which impinges upon a region of varying dynamical constants. It is not perhaps so much reflection or refraction in the ordinary sense as general distortion owing to the irregular dissipation of energy.

When the whole region between the sending and receiving station is light, the distribution of conductivity, while irregular in altitude, should be fairly homogeneous, so that while the signals may be attenuated the wave fronts are not so distorted and broken up as in the previous case. At sunset the conditions of distortion recur again, but in the reverse direction in space, so that one would naturally expect a difference in the phenomena, and such a difference, indeed, appears in the data before us. The sharp rise in the strength of signals shortly after the sunrise and sunset minimum would suggest that the maximum wave distortion occurs just as the area of maximum disturbance is passing over the station, and that the earlier condition is resumed after the storm has passed, so to speak, to be thereafter more slowly changed by the general increase or decrease in ionization in daylight or darkness. The data so far presented seem therefore to fit excellently well the ionization theory often pro[...] There are, of course, many details as yet unexp[...] such admirable experimental researches as those [...] Dolbear and Proctor will, if continued, throw a [...] of light on these extremely interesting phenome[...] may even enable us to learn something more [...] tribution of the atmosphere above the earth and [...] its electrical conductivity.

THE PRESERVATION OF EYESIGHT.

The recently formed American Association fo[...] servation of Vision has cut out for itself a [...] formidable task in attempting to reach the n[...] causes of injury to vision. The purely medica[...] with which it has begun operations are alrea[...] themselves felt, and we hope as much for th[...] which are to be directed toward the amelioration [...] conditions. Just what the function of the assoc[...] be in respect to lighting reform it is perhaps a lit[...] say, but it can at least prove immensely useful [...] clearing house for data and for co-ordinating t[...] of other societies and committees working al[...] lines. One thing at least is certain—that there [...] bad illumination which needs reform—and if the [...] does nothing more than to find out and classif[...] of bad lighting and bring them up to organ[...] persons capable of dealing with them, it will st[...] a large work of humanity. The amount of ignor[...] well-educated people regarding the fundamenta[...] hygiene, particularly with respect to the use [...] light, is almost unbelievable. If the agents o[...] of the new association want to find startling [...] utter disregard of the basic principles of artifi[...] we would recommend them to the palaces [...] rather than to the hovels of the poor. The latte[...] only feeble and somewhat smelly kerosene lam[...] are at least steady and generally shaded, w[...] former one may find the most offensive incande[...] thrust out of more or less decorative but enti[...] able shades, or glaring through shades which s[...] been devised with special reference to giving [...] of light with a maximum of glare. We som[...] that the quality of fixtures for the purpose of [...] some sort of inverse function of their cost. [...] certainly seems as if the ornate and expensive [...] often been designed in contemptuous defianc[...] thing that has been taught the world regardin[...] use of light.

If one passes from dwellings and consider [...] factories, the conditions of illumination are perh[...] rather for the better than the worse. The fa[...] the advantage of being freed from the mon[...] bronze and crystal sometimes inflicted upon [...] holder, but they are in perpetual need of som[...] to preach the gospel of suitable lighting for [...] the workman. Such a missionary force we tr[...] ciation for the Conservation of Vision will se[...] industrial conditions when once recognized c[...]

y remedied. The "efficiency engineer" is, or ought e, horoughly appreciative of the importance of good in in facilitating rapid and thorough work. Indeed, ay the greatest difficulty will be found in breaking workman himself of some of the common and crude n regarding lighting. Need of activity there assured-, d we hope that the new organization will serve as fi nt directive force in carrying on in systematic and sp ad form the work which has already been inaugu- l ong many lines which need only to come to a com- m ting point and to merge their efforts for a common s

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MI AL STREET LIGHTING.

e port of the National Electric Light Association's nite on ornamental street lighting is an excellent na of accomplishment. It sets forth, with brief com-, hat has actually been done in the way of the more ra and spectacular efforts at street lighting, which b n numerous in the past few years. It is gratifying cd the steadily increasing interest that has been n improved street lighting. The public awakening e eeds of the modern city in this particular is most ar ing as showing the civic evolution which has been g in many phases of public affairs. Plenty of en- h been displayed, sometimes, it is true, misdirected, alys auguring well for the standards of the com- ty The lighting classified by the committee as orna- al alls naturally into three groups, arc lighting, the o ystem of incandescent lighting and the more recent m e successful lighting by ornamental posts with ps f metallic-filament lamps.

r ards arc lighting, there is very little which should erl be classified as ornamental. The fixtures employed at r better than has been common in this country, but er he fixtures nor the illumination would strike a ng reigner familiar with street lighting in Continen- ti as implying anything more than a workmanlike at- t t furnish adequate illumination in streets deserving He ight regard it here and there as rather overdone t standpoint of judicious expenditure, but never as n a special effort at artistic effect or extraordinary ci l activity in providing street lighting. There are d ery few arc installations in this country which ld roperly be classified as ornamental lighting save ol d spots. Many of the installations cited by the nit were never intended to be anything more than cla lighting installations suitable for the busy streets hi they are placed. The lighting, for example, in cu N. Y., or Baltimore, Md., is brilliant and well bud, but no more elaborate than might reasonably xp ted in the important streets where it is installed. fla -arc lighting in Boston is purely utilitarian, being ly n example of thoroughly good lighting of public res fter methods already familiar on the Continent. m therefore, pass by the arc-lighting matter as ly nbodying vigorous efforts in the right direction out any sense entering the field of decorative light-

The street lighting with incandescent lamps now practised in perhaps a hundred American cities is of a more ambitious character, the decorative effect being always in mind and efficiency being in most cases obviously a secondary consideration. Some of the artistic results obtained are unquestionably admirable, while in other instances the effect is altogether garish and out of keeping with the environment. This latter criticism applies with particular force to much of the festoon lighting. A score of cities employ it in various forms. Considered as a method of street illumination it is neither successful nor economical. From a decorative standpoint it is better adapted for temporary than for permanent use, since there are very few places, and these only in a few important cities, where the environment justifies illumination of this particular kind. It should be installed only where the supporting structure can be made decorative by day as well as by night and in surroundings that make a festal aspect appropriate. Arches of iron pipe spanning a street of cheap and perhaps tawdry blocks may serve a useful purpose for some temporary civic celebration like the twenty-fifth anniversary of the granting of the city charter, but they are not harmonious or appropriate as permanent methods of street lighting, either decorative or utilitarian. We are glad to note that the festoon is tending to pass out of use and to be replaced by well-spaced lamps upon appropriate posts.

Groups of metallic-filament lamps on ornamental or at least inoffensive posts are in use in about eighty cities scattered widely all over the country. The usual installation is three to five lamps on the post according to design, with ratings varying from 40 watts to 100 watts, generally, we are glad to say, installed in diffusing globes. The usual spacing is from 50 ft. to 100 ft. apart, in rare instances less, in a few more. At the shorter spacings, say, 40 ft. to 60 ft., these clusters give an excellent illumination and the effect is upon the whole very pleasing. In a few instances arc lamps in diffusing globes have been installed in a similar way, and these, too, may, if spaced closely enough, be regarded as highly successful both from utilitarian and artistic standpoints. In the majority of cases the abutters, either as tenants or owners, have paid a large part of the installation and operating cost, sometimes the whole. In a number of instances the installation cost has been so paid and the city has assumed the cost of operation. The system has not been worked out to its ultimate form, and there is much still to be done regarding the design of suitable posts and the selection of proper sizes and number of units for obtaining the best results. Generally speaking, such installations would be improved by more posts and fewer units on each post, an arrangement which would somewhat increase the cost of installation but lower the operating expense. It is possible that both arc and the larger incandescent lamps can be made exceedingly useful in this particular type of lighting. It is never economical for the production of a brilliant effect as at present installed, but it is very suitable in many places, and from an artistic standpoint is certainly a great improvement on the creaking mast arms and sputtering arc lamps on street corners that have been too characteristic of American street lighting in the past.

Federal Suits Against Incandescent Lamp Companies.

It is reported that terms have been agreed upon by the United States Attorney-General and the incandescent lamp manufacturing companies indicted on March 3 at Cleveland, Ohio, for alleged violation of the Sherman anti-trust law. No confirmation of this report could be obtained from the Department of Justice in Washington nor from a legal representative in New York of the lamp companies. An official at the Department of Justice stated that during the past week there had been no new developments in the cases, which are under the direct charge of Mr. Wade H. Ellis, representing the government.

According to the newspaper reports attorneys for the companies have submitted to Attorney-General Wickersham a decree which the companies are willing to have entered in settlement of the case, and it is stated that this, with some modifications, will be accepted by the government. The decree, it is further stated, is regarded by the Department of Justice as largely a formality, as the alleged combination began to dissolve after the government filed suit and was followed by the voluntary dissolution of sixteen other pools alleged to control prices and restrict competition of practically all modern electrical apparatus. Reports to Attorney-General Wickersham are to the effect that all trade restrictions have been removed, and that in the case of incandescent lamps prices have been reduced 33⅓ per cent, a total annual reduction of $7,000,000.

Westinghouse Annual Meeting.

The annual meeting held last week in Pittsburgh of the Westinghouse Electric & Manufacturing Company was the scene of a hotly fought contest for the control of the corporation between Mr. George Westinghouse and those who have had predominating influence in the management of the company the past several years. The result was a majority vote of the stockholders in favor of the latter element. At a meeting of the board of directors following the election Mr. Edwin H. Herr, first vice-president, was elected president of the company, succeeding Mr. Edwin F. Atkins, of Boston, who had requested to be relieved of the office, which he had accepted last year with the understanding that his incumbency would be temporary. Mr. Robert Mather, representing the controlling financial interests, remains chairman of the board of directors.

Mr. E. M. Herr, the new president, was born at Lancaster, Pa., May 3, 1860, and began his career as a telegraph messenger and then as an operator in Denver, Col., later becoming station master and operator at Deer Trail, on the Union Pacific Railway. While in this service he prepared for college and was graduated from the Sheffield Scientific School of Yale College in 1884. After graduation he became a special apprentice of the Chicago, Milwaukee & St. Paul Railway in the motive-power department at West Milwaukee, and later entered the motive power department of the Chicago, Burlington & Quincy Railroad as mechanical draftsman and test engineer. Owing to his former experience he was finally made superintendent of telegraphs of the C., B. & Q. system, and his work in this department, especially during the Burlington strike, brought him to the attention of the operating department and led to his appointment as division superintendent of the Galesburg Division of the line. In 1890 he went with the Chicago, Milwaukee & St. Paul Railroad as master mechanic, which position he held until 1892, when he was called to the superintendency of the Grant Locomotive Works at Chicago. In 1895 he was sent to Europe by financial interests to report upon and establish locomotive works in Russia, upon the completion of which mission he became, in 1896, general manager of the Gibbs Electric Company, of Milwaukee, and shortly af[ter ac]cepted the position of assistant superintendent of t[he mo]tive power department of the Chicago & North[western] Railroad. In 1897 he went to St. Paul as superin[tenden]t of the motive power department of the Northern [Pacific] Railroad, which position he retained until 1899, w[hen h]e went to Pittsburgh to take the position of assistant [gen]eral manager of the Westinghouse Air Brake Compan[y, late]r becoming general manager of that company. In 1[9]... was appointed first vice-president of the Westi[nghouse] Electric & Manufacturing Company, which position ... occupied continuously up to the present, having ha[d in] charge during this period of all manufacturing an[d com]mercial operations of the company. President H... appointed Mr. Calvert Townley as his assistant. ... P. Davis, of East Pittsburgh, who has been assis[tant to] the first vice-president and manager of engineeri[ng, was] elected to succeed Mr. Herr as vice-president.

Ohio Electric Light Association.

A telegraphic account of the first two days' sess[ion of] the Ohio Electric Light Association at Cedar P[oint,] Lake Erie, was given in last week's issue of the *El[ectrical] World*. The third session, that of Thursday morni[ng, July] 27, was opened by Secretary D. L. Gaskill with a r[eport on] the insurance rates charged electric-light compa[nies in] Ohio. The sixty-one stations reporting, it was ... had paid out $16,411 in premiums during the peri[od ...] to 1909, and in this time collected $60 damages ... single indemnity was due to a tramp's setting fi[re to a] packing box which burned up a couple of window ... Large profits for the underwriters were similarly ... from the liability insurance returns. Secretary Ga[skill ad]vised that the subject of mutual insurance among ... selves be investigated by the electric-light compan[ies ...] the subject was discussed further by Messrs. C. W... send, of East Liverpool; J. C. Martin, of Wilming[ton ...] A. Bechstein, of Sandusky, and C. V. Hard, of W...

The subject of pumping water for municipalities ... irrigation was next discussed in a paper by Mr ... Gardner, of Dayton. Mr. Gardner referred to the ... long-hour nature of the pumping load, and cited th[e ...] to which electric pumping is done by the Norther[n Colo]rado Power Company, as reported by the *Electrical* ... which he quoted. The author pointed out the value ... gation even for ordinarily humid ground, and g... figures for flowing water onto the surface. The pa[per was] discussed by Messrs. R. S. Graves, of Schenectady ... C. C. Smith, B. H. Gardner, C. W. Townsend, J. ... tin, C. H. Culver, J. T. Kermode, W. C. Anderso[n ...] Gaskill and J. A. Stewart.

Mr. John Gilmartin, chairman of the meter co[mmittee,] then submitted his report, which considered under ... topics the importance of meter testing, proper i... therefor, tabulation of results, definitions, accura[cy,] jewels, excess indicators, etc. The report suppleme[nted an] exhibit made by the committee, which included a ... of different types of meters arranged for testing a[nd a] collection of the various record and office forms ... companies in the State. The discussion of the re[port was] opened by Mr. W. L. Cook, of Columbus, who cited ... ber of objections to the testing of meters on cu[stomers'] premises, and was continued by Mr. R. S. Graves [and M]r. G. R. Smith, of the New York Edison Company.

A review of the new utility law of Ohio in its [applica]tion to electric-lighting companies was next pres[ented b]y Secretary Gaskill, who is president of the G[reenvill]e (Ohio) Electric Lighting & Power Company. T[he short]comings of the bill as enacted were pointed out, [a seriou]s omission being the lack of any provision for p[rotectin]...

going concerns against competing utility companies. The present utility law was thus characterized as of little benefit to the people it should serve and was declared to have been originated largely for political purposes. The subject of the new law was then discussed warmly in executive session.

Vice-president Anderson in the chair opened Friday's session with the reading of his paper on "Motor-Driven Refrigeration." Consumption figures from a number of installations were cited, showing the advantageous annual load-factor of the motor-driven compressor outfit. The subject was discussed briefly by Messrs. W. S. Culver, J. C. Martin, C. I. Crippen, W. S. Townsend and Mr. Taylor, of Norwalk.

"The Use of Tungsten Lamps in Sign and Outdoor Lighting" was the subject of a paper by Mr. W. B. Goudey, of East Liverpool, Ohio. After noting the improvement of tungsten lamps over carbon-filament lamps the author reported difficulties experienced in burning sign lamps in series. Messrs. G. H. Stickney, W. Benedict, C. I. Crippen, J. T. Kermode and O. B. Reemelin also discussed series connection of sign lamps.

A paper by Mr. P. L. Miles, of Cleveland, on "Progress of Electric Heating Devices in Ohio," was next read by Secretary Gaskill in the author's absence. Campaigns in a number of Ohio cities were reported, the general tendencies of the electric heating art were reviewed, and the Cleveland continuously connected cookstoves (described in the *Electrical World*) were explained and illustrated.

The report of the nominating committee, presented by Chairman S. M. Rust, was unanimously adopted, officers and committees being elected as follows:

President, Mr. W. C. Anderson, Canton; vice-president, Mr. J. C. Martin, Wilmington; secretary, Mr. D. L. Gaskill, Greenville.

President-Elect W. C. Anderson.

Executive Committee—Messrs. E. H. Beil, W. S. Townsend, W. E. Richard, O. H. Hutchings and L. G. White.

Advisory Committee—Messrs. Samuel Scovil, F. M. Tait and D. L. Gaskill.

Finance—Messrs. J. T. Kermode, F. O. Plymole and B. H. Gardner.

Publicity—Messrs. W. P. Engle, C. M. Lott, Elam Fisher and Robert N. Hodson.

Electric Transmission—Messrs. W. S. Townsend, J. T. Kermode and M. H. Wagner.

Membership—Messrs. W. J. Hanley, E. Van Winkle, F. C. Colwell, George Vail, W. A. Benedict, P. J. Williams and N. C. Catabish.

Meters—Messrs. John Gilmartin, H. Cook and J. T. Kermode.

Insurance—Messrs. D. L. Gaskill, J. C. Martin and C. V. Hard.

Motor Applications—Messrs. E. A. Bechstein, C. I. Crippen and W. F. Hubard.

Committee on Costs—M. E. Turner, B. H. Gardner and J. D. Lyons.

ENTERTAINMENT.

Thursday afternoon a baseball team composed of central-station men lined up against a picked nine of associate members and beat them, 9 to 5, winning a handsome silver cup donated as a trophy by the Duncan Electric Manufacturing Company, of Lafayette, Ind. The personnel of the teams was as follows:

Active Members	Position	Associates
D. A. Gaskill	First Baseman	[illegible]
Cook	Second Baseman	[illegible]
[illegible]	Shortstop	[illegible]
[illegible]	Third Baseman	Graves
Kermode	Left Fielder	Mueller
[illegible]	Center Fielder	Strasburg
Sloan	Right Fielder	Reynolds
[illegible]	Catcher	Parke
Gardner	Pitcher	Howland

The ladies were meanwhile entertained at a musicale and card party, and in the evening there was another informal dinner for all as guests of the association, followed by a creditable special vaudeville entertainment.

The total registration at the Ohio convention reached nearly 400, including the central-station men (many of whom brought their families), associate members, manufacturers, etc. Although the Ohio association is one of the largest of the state organizations, its convention was made notable by the liberality of entertainment accorded to all who came. There was a completely appointed informal dinner or banquet each evening, followed by music, magic and vaudeville. Each lady attending the banquet was presented with flowers, and hand-painted china plaques were provided for members' families. Handsome prizes were awarded at the ladies' card parties. The cost of holding the convention at Cedar Point this year, reaching nearly $2,500, is met from the association treasury. The resort on Lake Erie in itself proved an equally ideal convention spot for recreation during off hours, with its big hotel and dining-rooms, splendid bathing beach, amusement park, natural woods, lagoons, etc.

The Beloit Rate Case.

Very thorough preparation was made of the "Beloit case" presented to the Wisconsin Railroad Commission by the city of Beloit on March 30, 1908, and decided July 19, 1911. The city asked for a full investigation of the rates of the Beloit Water, Gas & Electric Company, and in the issue of last week, page 262, was given a summary of the decision as it affected the rates for electricity. Changes were also made by the commission in the gas and water rates. A rather formidable group of experts was retained on each side. The city spent between $10,000 and $11,000 in the presentation of its side of the case, while the company expended about $30,000 on its defense. Legally the city's case was placed in charge of Mr. H. W. Adams, city attorney, and Mr. Thomas S. Nolan, of the firm of Nolan, Adams & Reeder, of Beloit and Janesville, Wis. The city then engaged Mr. Frank F. Fowle, of Chicago, as electrical expert and general technical adviser. Likewise the services of the following-named gentlemen were secured: Mr. C. H. Evans, of Chicago, as gas expert; Mr. G. W. Sturtevant, of Chicago, as water-works expert, and Mr. W. H. Wheeler, of Chicago and formerly of Beloit, an experienced water-works contractor and one of the early officers of the Beloit Water Works Company. The city also retained the services of Prof. E. T. Smith, of Beloit College, and Professor Russell, dean of the School of Agriculture at the University of Wisconsin, who testified in relation to water supplies.

The electrical expert for the company was Mr. L. G. Van Ness, of Memphis, Tenn.; the company's gas expert was Mr. A. E. Forstall, of New York City; its experts on water-works and water-power were Prof. D. W. Mead, of

the University of Wisconsin, and Mr. Benezette Williams, of Chicago. Considerable testimony was also introduced by Mr. C. B. Salmon, president, and Mr. B. F. Lyons, assistant general manager, for the company.

Both the city and the company carried on elaborate investigations and prepared separate inventories and appraisals. For the city Mr. Fowle prepared an exhaustive report of nearly 300 pages dealing with valuations, capitalization, operation and operating efficiency, examination of books and accounts, statistics of production and sales, water-power, going value, depreciation and rates. The other experts for the city prepared appraisals of the physical property. These reports were all introduced at the hearings as evidence for the city. Under the direction of its experts the company prepared an inventory and appraisal, which was substantiated by the testimony of the company's experts at the hearings.

Commission of Subway Engineers for Chicago.

Authorized by the local transportation committee of the City Council to appoint three engineers to recommend a system of passenger subways for Chicago, Mayor Harrison has acted on the suggestion promptly and has named on this commission Mr. John Ericson, city engineer; Mr. E. C. Shankland, designing engineer, and Mr. James J. Reynolds, operating engineer. Mr. Ericson, who has paid much attention to the subway problem, is appointed especially for his practical knowledge of underground utilities in Chicago. Mr. Shankland is a well-known authority on Chicago building foundations and subsoil conditions. Mr. Reynolds, who is a railroad man, is appointed as an engineer especially familiar with transportation questions.

Mr. Bion J. Arnold, who was the city's chief subway engineer during the last administration, is not appointed on this commission. It is said that Mayor Harrison does not favor the double-deck subway or a subway extending from building line to building line. utilizing the space under the sidewalks, as suggested by Mr. Arnold. The present Mayor is said to be desirous of seeing the subway built or at least begun during his administration, and is reported to favor a modest beginning of a system of relief for traffic congestion in the central business streets. The recently appointed subway advisory engineers will receive annual salaries of $12,000, an allowance being made to the city engineer to bring his present salary of $8,000 up to that amount during his service on the subway board.

Fire Drills Adopted by New York Edison Companies.

The Edison Electric Illuminating Company of Brooklyn and the New York Edison Company have made contracts with the Croker National Fire Prevention Engineering Company, founded a short time ago by Mr. Edward F. Croker, ex-chief of the New York Fire Department, for supervision and instruction in fire drills. The inspectors of the company will act with ex-Chief Croker in the fire department and make it their business to see that employees are efficiently drilled in the proper methods of leaving a building in an orderly manner in the event of fire and that the fire appliances are thoroughly cared for and kept in proper condition, also instructing employees in the use of these appliances. Thorough inspection of buildings, exits, etc., is also part of their work. In buildings containing a large number of employees the inspectors arrange these in several fire divisions under a leader and designate the stairways to be used by each division. As a result of long experience with fires the inspectors of the Croker company prohibit the use of elevators in emergency. The first inspection of the Duane Street building of the New York Edison Company was made July 14, and the first drill was held July 19. At the Duane Street building of the New York Edison Company employees on each floor were divided into three sections, and an explanation was given of what was to be done when fire signals were given. The inspectors made it clear that the success of the work depends upon cool, prompt and orderly procedure. The first duty of each employee was quickly to place in safety as much of the valuable property in his charge as possible, this applying more particularly to the bookkeeping department, which has metal desks. At the recent drill signals were given on each floor separately, and instructions were carried out to the satisfaction of the inspectors. The bookkeeping department was vacated in twenty seconds.

Massachusetts Commission News.

An important decision on the petition of the Selectmen of the town of Plymouth, Mass., complaining of the price of electricity for street lighting supplied by the Plymouth Electric Light Company was rendered by the Massachusetts Gas and Electric Light Commission on July 28.

Prior to August, 1907, the company was supplying for street lighting about 339 incandescent carbon-filament lamps and eight arc lamps rated at "1200 cp." Three of the incandescent lamps were of 32-cp and the others of 25-cp rating, and all operated on a midnight-moonlight schedule. In that month the company began the replacement of these incandescent lamps with 40-cp tungsten-filament lamps. Later the arc lamps were replaced by clusters of five 40-cp and a few 200-cp tungsten incandescent lamps were installed. All the arc and carbon-filament lamps have thus been replaced by incandescent lamps.

Before and since the above changes the company charged the town $21 a year for the 32-cp, $20 for the 25-cp incandescent and $125 a year for the all-night arc lamps and $85 a year each for those operating until midnight. Prior to the town meeting, 1909, the company offered to supply, on a five-year contract, on moonlight schedule the incandescent lamps until 12 midnight at $18 a year and for all night at $21 a year, with a uniform price of $105 per year for the arc lamps, all the incandescent lamps to be 40-cp tungsten units. No action was taken until a year later, when the town authorized its Selectmen to make a five-year contract on such terms as they should deem proper, but also instructed them to enter a complaint to the Board of Gas and Electric Light Commissioners as to the quality and price of service furnished by the company.

The lamps in present use are 336 40-cp, 50-watt tungsten, three 250-watt tungsten and eight clusters of five 40-cp lamps each. All operate on a moonlight schedule until midnight, except seven of the clusters, which operate all night. The lamps, however, are billed to the town in the same way as in August, 1907, that is, bills are made for 336 25-cp lamps at $20, three 32-cp at $21, seven arc lamps at $125 and one arc lamp at $85 a year.

In August, 1907, the price of energy for commercial lighting was 20 cents a kw-hour, with discounts of 5 per cent and upward according to size of the bill. Prior to the petition these prices had been reduced to a minimum rate of 18 cents, with a sliding scale to 10 cents, according to the amount used monthly, and a discount of from 10 per cent to 20 per cent according to the number of nights' use each week.

Under the scale of prices for commercial lighting the company received during the fiscal year of July 1, 1909-June 30, 1910, for all electricity sold for this purpose only a little more than 8 cents per kw-hour. The complaint originally framed related to commercial prices as well as those for public street lighting, but this part of the petition was finally waived by the Selectmen. It was contended in

support of the claim that the price charged for incandescent lamps is too high; that, irrespective of prices charged in other cities of the State for 25-cp carbon-filament lamps, the price for tungsten lamps now in use should be less because the latter, though of higher candle-power, consume less energy than the former, and that compared with prices charged by the company to its other consumers the price for street lighting is too high.

It was contended that the price for street lighting should be based on a theoretical consumption of energy by the lamp either at the average rate charged for commercial lighting or at the average for all lighting, commercial and public, or upon the same schedule as commercial lighting, all the street lamps being regarded as the installation of a single commercial customer with an annual bill.

The company contended that the candle-power is the true measure of the value of the street lighting to the town and a proper basis for the price. The commissioners' decision states that while price charged for street lighting in other communities is not without weight, it cannot be held to be controlling. Such comparisons, it says, must usually be made with prices charged for carbon-filament lamps, and that until very recently in fixing prices for street lighting no consistent theory has been followed either by the companies or by the public authorities, save a purpose on both sides to make the best trade possible.

"It must be conceded," the commissioners say, "that based upon cost alone the street lamps of the tungsten type and of the same or even of a somewhat higher candle-power can be supplied at a less price than the carbon-filament lamp until recently exclusively used because of their lower cost to maintain and operate, but it is by no means clear that such reduction in cost is proportional to the difference in the amount of energy consumed in the lamp. Neither those investment, distribution and management costs which necessarily enter into and constitute a substantial share of the total nor, for that matter, certain of the costs of producing the electricity seem to be in any degree reduced by the substitution of tungsten for carbon-filament lamps. Coal, and possibly repairs and maintenance, with some minor supplies at the station, appear to be the only items of street-lighting cost of which it may safely be claimed that they vary according to the quantities of energy made and used. The actual saving to the company in these items, due to the less amount of energy required for the tungsten as compared with the carbon street lamps in Plymouth, based upon the figures of the fiscal year ended June 30, 1910, appear to be somewhat less than $1 a year for each lamp, although the reduction in energy used in the lamp is more than 40 per cent. Indeed, the tendency of the introduction of tungsten lamps is to increase the cost per unit because of the reduction in the total units sold without any reduction in costs outside the generating station—a tendency which obviously can be overcome to a large extent by the general development of the business and by other factors of importance.

"However, unless the prices charged or offered for carbon-filament lamps are assumed to be reasonable, the inquiry as to the amount of reduction justified by the substitution of tungsten lamps offers no real solution of the problem as to what price the town should in fairness pay.

"The proposition that the price of street lamps should be based strictly on the amount of energy required to operate the lamps and should be made upon the same or as advantageous terms as are offered to private consumers is more fundamental. Just why any more weight should be given to the suggestion of an average price received rather than any other price in the company's varied schedule was not fully explained. The average price which is determined by dividing the total receipts from all customers by the total kw-hours sold is not, unless by chance merely, the price offered to any customer. It may be that no customer ever pays exactly that price, and it is difficult to see why, if the street lamps are to be governed by the commercial schedule, that price rather than some other of the numerous prices which it contains should be adopted. That it is a very attractive proposition to the town is evident because it would result in an exceptionally low price for the street lamps, the average price received by the Plymouth company for commercial lighting being lower than in most companies of its size in the State. It is important also as a general proposition, because if applicable to Plymouth it is difficult to see why it might not be applicable to all other communities.

"The board is unable to agree with the contention that the energy used in all of the lamps should be combined and treated as the energy supplied to a single consumer; in other words, that all the lamps should be taken together and considered as a single installation to a large consumer. It is quite true that the billing and collection costs are minimized under the conditions of street-lighting supply and become those of a single customer, but the numerous and widely scattered installations and the investment and maintenance charges give to each lamp or group of lamps many of the characteristics of an individual customer of small size if the commercial scale of charging is to be applied."

The commission states that companies should more fully recognize the reasonableness of the claim that towns and cities should fare as well for public as for private lighting. "Street lighting," it says, "should bear its reasonable proportion of all necessary costs, but its fair price is not necessarily determined upon the commercial rates, especially if these happen to be unreasonably high or low." Its decision goes on to say that the methods used to determine public and private lighting prices must be directed to a single end—to determine what is a fair price under all the circumstances of the case.

The commission says that the company's burden of debt justifies it in an endeavor to eliminate in a reasonable time that part of its indebtedness which represents the depreciation of the plant for which provision has not been made hitherto. Under the existing circumstances the board considers the following rates fair, and recommends as follows:

That on and after Aug. 1, 1911, the prices for moonlight lighting substantially as heretofore shall not exceed the following: For 50-watt, 40-cp tungsten lamps operating until midnight, $16 a year; for 50-watt, 40-cp tungsten lamps operating all night, $20 a year; for 250-watt, 200-cp tungsten lamps or equivalent in clusters of five 50-watt, 40-cp lamps operating until midnight, $71 a year; for 250-watt, 200-cp tungsten lamps or equivalent in clusters of five 50-watt, 40-cp lamps operating all night, $89 a year.

New York Commission News.

A complaint has been received by the Public Service Commission, Second District, from the Board of Supervisors of the County of Orleans and the board of trustees of the village of Albion protesting against the increase in rates by the New York Telephone Company in Albion and vicinity. The complaints state that the company has raised the telephone rental for business places from $2 to $2.50 per month and for residences from $1 to $1.25 per month, and that the service furnished is unsatisfactory and does not warrant the increase in rates.

The commission this week will hear the petition of the Hartwick Power Company for permission to exercise a franchise for the furnishing of electricity in the town of Hartwick, Otsego County, and the application of the Wynantskill Hydroelectric Company for permission to exercise franchises in the villages of Sandy Lake and North Greenbush, Rensselaer County, and for authority to issue stock to secure funds for the construction of its plant.

After a controversy extending over a period of nearly seven years the application of the Long Acre Electric Light & Power Company to issue additional bonds for raising funds for the erection of a lighting plant was granted on July 28 by the Public Service Commission for the First District of New York. Permission was given to the company to make a new mortgage for $50,000,000, under which $2,000,000 of bonds may be sold when $1,000,000 of new stock has been subscribed and paid for. The order of the commission provides that an additional $2,000,000 of bonds may be disposed of when another issue of $1,000,000 stock has been absorbed, and further issuance will be allowed in this ratio. A prior mortgage authorizing $1,000,000 bonds must be either canceled or subordinated to the new mortgage before the latter can be made, and the $400,000 bonds authorized under the prior mortgage and $100,000 additional bonds under this mortgage, held by various interests as collateral, must be canceled before the new securities can be issued. The application of the Long Acre company was at first denied by the commission on the ground that the necessity for an additional lighting company in the districts named in the franchise of the company was not proved. The case was then taken to the Appellate Division of the Supreme Court, the decision of the commission was reversed and a rehearing was ordered. At subsequent hearings much opposition was made by attorneys of the New York Edison Company against the rights claimed by the Long Acre company to operate under its franchise. In the issue of June 1 announcement was made that the Public Service Commission would proceed to consider the amount of securities that the company would be permitted to issue and the terms under which the securities would be approved.

Mr. Ralph W. Pope.

At the Chicago convention of the American Institute of Electrical Engineers a committee consisting of Messrs. John J. Carty, chairman, George A. Hamilton and D. B. Rushmore was appointed to prepare for presentation to the board of directors resolutions expressing the appreciation felt for the services of Mr. Ralph W. Pope, who had tendered at Chicago his resignation as secretary of the Institute, and later was appointed honorary secretary without reduction in salary. The report of the committee is as follows:

"For more than twenty-six years Mr. Ralph Wainwright Pope has faithfully and loyally served the American Institute of Electrical Engineers as secretary, and for the twenty-seventh consecutive year he has again been elected to the office of secretary. The board of directors and the membership at large are of the opinion that by his continuous and honorable service he has attained such a position in the regard and affections of the members of the Institute that he is entitled to some relief from the active executive duties of his arduous position. Therefore, to carry out his own expressed wish his resignation as secretary has been accepted. In accepting his resignation the board of directors in order to give expression to its own feeling of gratitude as well as the feeling of the membership at large, and in order to reward such long and distinguished service, has appointed him to the position of honorary secretary, in which capacity the Institute may still have the benefit of his long experience in its affairs.

"In thus complying with the natural and just desire of Mr. Pope, the board of directors has thought it well to mark this change by this minute expressing its good will and appreciation, and by pointing out that the term of Mr. Pope's service in the Institute covers many of the most important developments in electrical engineering, and that this period has witnessed the growth of the Institute from the humblest beginning to its present flourishing condition.

"At the time when the art of electrical engineering was practised principally in connection with the telegraph Mr. Pope was a pioneer, having in the year 1858 mastered the working of the Hughes printing telegraph. In 1861 he had charge of the Morse telegraph office at Great Barrington, Mass., in which town he was born in 1844. In 1862 and 1863 he was in the service of the American Telegraph Company in its New York, New Haven and Providence offices, and in 1865 he was one of that band of telegraph pioneers who went into the wilds of British Columbia to establish an overland telegraph system with Europe by means of Alaska and Siberia. In 1867 he was with the Bankers & Brokers' Telegraph Company until 1872, when he became an inspector with the Gold & Stock Telegraph Company. While with this company he was promoted to the position of deputy superintendent in 1880, at which time the apparatus used by the Gold & Stock Telegraph Company was considered by many as representing the highest development then reached by the electromechanical art. While in the service of the Bankers & Brokers' Telegraph Company in 1867 he was also assistant editor of *The Telegrapher*. In 1882 he became manager of the Union Electric Manufacturing Company, of New York. In 1884 he was associate editor of *The Electrician and Electrical Engineer*. In that same year the American Institute of Electrical Engineers was formed. The next year Mr. Pope was elected its secretary, which position he is about to relinquish. In 1890 he founded the monthly periodical *Electric Power,* and in 1891 he became editor for electrical terms in the 'Standard Dictionary.' In 1893 under direction of council his quarters as secretary were established in the rooms of the American Institute of Electrical Engineers in the Electrical Building at the Columbian Exposition, and he was appointed on the committee of judges for the Department of Electricity. While at the exposition in Chicago he personally met more than two-thirds of the members of the Institute at that time. Ever since Mr. Pope has kept up his large personal acquaintance among the members, which is of great importance to a headquarters official.

"During the administration of President Stillwell Mr. Pope visited a majority of the sections and many of the branches of the Institute and made a study of their development and needs. All of these activities have eminently prepared him for the position of honorary secretary, giving special attention to the organization and the interest of the sections and branches."

CURRENT NEWS AND NOTES.

Electric Club of Chicago.—At the last meeting of the Electric Club of Chicago it was decided to hold no further meetings until Sept. 13. The club also voted not to give a picnic this year.

* * *

Electrical Banquet in Winnipeg.—The city light and power department of Winnipeg, Manitoba, of which Mr. James G. Rossman is general manager, gave an electrically prepared banquet to the Mayor and members of the City Council of the city in the "Home, Sweet Home," exhibit at the Canadian Industrial Exhibition on July 22. The dinner consisted of soup, fish, chicken, vegetables and coffee, besides many dishes that did not require heat, as fruit and salad. It was cooked on a large "navy range" secured through the courtesy of the Canadian General Electric Company from the Chicago office of the General Electric Company. This range weighs about 2000 lb. and was equal to the occasion in every respect. The table was set for a party of about twenty, and the electrical preparation of the food was carried out, as planned, without a hitch.

Gift to McGill University.—Sir William Macdonald has presented to McGill University a large tract of land adjoining Mountroyal Park, which will be used as a campus and for residence plots. The purchase price was over $1,000,000.

* * *

Heating Value of Fuel Oil.—In consequence of the success that has attended the use of heating value specifications in buying and selling coal, the Bureau of Mines, Washington, D. C., has drawn up similar specifications for the purchase of fuel oil. These are contained in technical paper No. 3 issued by the bureau.

* * *

A Novel Hydroelectric Taxation Case.—The right to tax ground forming a made channel for a stream of water used for power purposes is to be tested at South Bend, Ind. The stream is 720 ft. long and 40 ft. wide, running through that city, and has never been assessed for taxation. The South Bend Hydraulic Company is resisting the attempt on the part of the tax board to list the property for taxation.

* * *

Garage Transformed for Electric Service Exclusively.—The People's Garage, of 339 East Garfield Boulevard, Chicago, is equipping its present automobile station, which is 130 ft. long and 60 ft. wide, for the exclusive service of electric cars. Two motor-generating charging sets will be installed, one rated at 50 kw and one at 25 kw. Electrical energy is purchased from the Commonwealth Edison Company. A new building for the gasoline garage will be erected on a nearby location.

* * *

Sons of Jove at Cedar Point, Ohio.—At the rejuvenation of the Sons of Jove, held the evening of July 26, during the convention of the Ohio Electric Light Association at Cedar Point, Ohio, a class of thirty-four candidates was initiated into the mysteries of the order. Messrs. R. L. Janes, of Pittsburgh, statesman for Pennsylvania, and A. C. Beattie, of Cincinnati, Ninth Mars, presided at the ceremonies, the work of which was in charge of National Secretary E. D. Strickland, of Chicago.

* * *

Counting Telephones.—City Electrician Carroll, of Chicago, is engaged in the task of counting the subscribers of the Illinois Tunnel Company, the receivers of which are operating, or are beginning to operate, a competing automatic telephone system in Chicago. Mr. Carroll's task is to determine whether the automatic company had 20,000 bona fide subscribers on June 1 last. The list of subscribers offered by the company is first checked up and then each one listed is called up on the automatic telephone.

* * *

Electric Trucks for Navy Yards.—The United States Navy Department has bought twelve electric trucks for the use of the Bureau of Yards and Docks. Eight of these are 5000-lb. trucks, the other four being standard 5-ton trucks, and all are equipped with lead batteries. The distribution will be as follows: To the Boston Navy Yard, one 5000-lb. truck; to the Portsmouth (N. H.) Navy Yard, one 5-ton truck; to the New York, Norfolk and Mare Island navy yards, one of each size; to the Philadelphia, Charleston and Puget Sound yards and Public Works Officer, island of Guam, one each of the 5000-lb. size.

* * *

Power-House Dam Said to Cause Mosquitoes.—Residents of the village of River Forest, a suburb of Chicago, are said to hold the North Shore Electric Company largely responsible for a plague of mosquitoes that has afflicted the village this summer. Not long ago the company built a higher dam in the Desplaines River in connection with its generating station at Maywood, and this dam, by covering lowlands with stagnant water, is held to be the cause of the abnormal number of mosquitoes by providing breeding places. The village trustees have asked the company to remove the dam.

* * *

Automatic Telephones for England.—The British post office will install two experimental automatic telephone exchanges, one at Epsom on the Strowger system, and the other at Caterham on the Lorimer system. Each will be equipped for 500 stations. An automatic system for 400 stations will also be installed at the post office headquarters in London, this exchange to serve the official departments. The Lorimer differs from the Strowger system in that the exchange mechanism is in continuous motion whether calls are being made or not, while in the Strowger system no movement is made until a subscriber calls.

* * *

Engineering Education in Great Britain.—The British Institution of Civil Engineers, which in recent years has several times given considerable attention to the subject of engineering education, recently held a conference on that subjct in which leading engineers and educators of Great Britain took part, the electrical industry and profession being well represented. A large number of papers were presented and discussed, and the result of the conference was embodied in a short resolution, the principal feature of which is renewed indorsement of the time-honored British "sandwich" system of alternate training at school and in the workshop, the specific recommendation being six months alternately in each. There was a preponderance of opinion that British engineers do not have sufficient training in English and along general cultural lines, and the hostility of the old-time British engineer and manufacturer to what they consider highly scientific instruction frequently cropped out. The German and American systems of engineering education, judging from absence of reference to them, are apparently not considered applicable to British conditions.

* * *

Proposed Gas Rates in Chicago Attacked in the Courts.—Following the adoption by the City Council of Chicago of an ordinance fixing the rates for gas, for a five-year period, at 75 cents for the first year, 70 cents for the second and third years, and 68 cents for the fourth and fifth years, the People's Gas Light & Coke Company has begun suit in the Circuit Court of Cook County to set aside these rates as unjust and unreasonable. The present rate is 85 cents and the company contends that the new rate of 70.2 cents, which is the average for the five-year period, is due to politics and not to a fair and disinterested study of the situation. The petition to the court points out that the report of Mr. W. J. Hagenah, the expert first employed by the city, who recommended a rate of 77 cents, was ignored by the committee of the City Council which took charge of the matter when the city administration elected on the "70-cent gas" issue came into office. Thereafter Mr. Edward W. Bemis was employed by the committee as an expert. The company charges that Mr. Bemis is neither an engineer nor an accountant and has no knowledge of the cost of manufacturing and distributing gas, except such as he may have gathered from reading the published reports of gas companies or the testimony in other rate-regulating investigations. The misstatements made by Mr. Bemis in his report are said to be grotesque. The company contends that it must be allowed a 7 per cent dividend rate, and it is asserted that if the rate of 75 cents had been in force during the last three years the company could not have paid 5 per cent dividends on its stock. It is assumed that the court will refer the petition to a master in chancery to investigate and report.

Los Angeles Telephone Rates.—The City Council of Los Angeles has failed to adopt the new schedule of telephone rates recommended by the Board of Public Utilities on the report of Mr. K. B. Miller, retained as an expert. This schedule increased the existing rates somewhat. The Council has voted that the old rates shall prevail. There are two telephone companies in Los Angeles, and the rates of the Home company are a little lower than those of the Bell company. Mr. Miller proposed to equalize the rates. The companies may ask the courts to compel the city to adopt the increased rates.

* * *

Work Started on New York's New Subways.—On Monday last, July 31, ground was broken by Chairman Willcox, of the Public Service Commission for the First District of New York, for the new tri-borough subway system. The ceremonies were held at Sixty-seventh Street and Lexington Avenue, and speeches were made by a number of city officials and Mr. Frank Bradley, president of the Bradley Contracting Company, which has the contract for a number of sections of the new system. The first spadeful of earth was removed by Commissioner Willcox with a silver shovel and placed in a receptacle for preservation by the Bradley company, and the second spadeful of earth was reserved in a similar way for the Public Service Commission.

* * *

A New Complaint Against the Gasoline Automobile.—An Iowa reader of *Telephony*, speaking as a telephone manager, presents a new indictment against the excesses to which the use of the gasoline automobile seems to lead many persons. A large number of telephone subscribers have automobiles, and it is asserted that some of them take the batteries off the telephones and use them on the automobile for the sparking outfit, replacing them with inferior cells at the telephone. Complaint is then made to the telephone company that the telephone is out of order and the company is compelled to send a man to replace the defective cells of battery with new ones. This operation consumes needless time and money and makes an unfair complaint of poor service, and the telephone manager is righteously indignant.

* * *

Industrial Demand for Electricity in Southern California.—Southern California is not considered a manufacturing community, and yet Mr. John B. Miller, the president of the extensive Southern California Edison Company, says that more electrical energy is sold by that company for motor operation than for lighting. Since 1904 the power business of the company has been gaining on the lighting business, and in May, 1911, the revenue from energy sold for motors exceeded that for lighting for the first time in the history of the company. Electric pumping for irrigation accounts for a large percentage of the output, while the electrical operation of oil wells and refineries has lately become a conspicuous factor in the demand. Until recently the manufacture of cement was the leading industry in the consumption of electrical energy.

* * *

Irrigation and Hydroelectric Projects in Spain.—To improve the conditions in the agricultural districts of Spain, plans have recently been accepted and the preliminary work has been begun on a large irrigation project. The main canal, which will probably be completed in about six years, will have a length of over 50 miles and the total length of main artery and branches will exceed 150 miles. This work is only part of a plan which calls for the irrigation of an area of about 300 sq. miles on the left bank of the Guadalquivir River, whose waters, at Palma del Rio, will be utilized. For additional water supply when the river water fails six reservoirs with a combined capacity of 68,684,000,000 gal. of water are planned for neighboring valleys. At present, however, only one of these reservoirs is to be built, having a capacity of 21,661,000,000 gal. A project for utilizing this tremendous water-power by the installation of electric power stations along the canal has been laid aside for the present unless some responsible syndicate acquires the rights.

* * *

Mexican Guayule-Rubber Industry.—The guayule-rubber industry is being seriously hampered and damaged by labor and political troubles that are now more general and of greater seriousness than during the period when the recent revolution was actually in progress. The factory of the Intercontinental Rubber Company at Torreon is closed on account of a strike of several hundred employees. The men demand an increase of wages which the company does not feel justified in giving. None of the men receive less than $1 Mexican money (49.2 cents gold) per day, while the ruling wages in other factories range from 50 cents to 75 cents, Mexican. It is announced that unless an early settlement of the strike is reached the factory will be kept closed until Jan. 1, 1912, or longer. Mr. E. Delafond, a Frenchman, who owns several guayule-rubber factories in the States of Coahuila, Zacatecas and San Luis Potosi, recently made a trip of inspection of his property. His factories suffered much damage at the hands of rebel bands. Mr. Delafond was at his factory in a remote part of the State of San Luis Potosi when it was attacked by rebels, who first demanded of him the payment of $6,000. When he refused to comply with their demands they tore down the French and American flags that floated from the buildings and then attempted to destroy the plant. Mr. Delafond made his escape in an automobile and reached the nearest railroad station, 60 miles away, without further adventure. Owing to the present unsettled condition of the guayule-rubber industry the output of crude rubber for the latter half of the present year will be very small.

* * *

Brains, Labor and Capital.—During the recent Chicago convention of the American Institute of Electrical Engineers Mr. H. M. Byllesby gave a dinner at the Chicago Club to about sixty gentlemen to enable some of the prominent engineers to meet a few of the leading financiers of Chicago. In introducing the speakers of the evening the host gave the keynote of the occasion by referring to existing conditions of industrial unrest and expressing the hope that by a sincere effort to solve the problems of modern civilization a condition characterized by greater tranquillity and greater humanity will be evolved. In concluding his speech Mr. Byllesby said: "I believe it has become the duty of every serious-minded man, no matter in what calling in life, no matter in what walk of life his activities may find themselves, seriously to consider the present condition and to do everything that in him lies toward a fair and just and wise solution of the problems of the times. By doing this we can hope to better the conditions which surround our civilization. If we fail to make the effort, we shall have no one to blame but ourselves if in the undirected trend of passion resulting from ignorance or injustice, misapprehension or selfishness, our country drifts to the cataclysm of an economic or social revolution. We can view this situation as we please; we can adopt the doctrine of *laissez faire;* we can adopt the selfish doctrine of each man looking after his immediate interests; or we can adopt the far manlier and more worthy course of recognizing these problems and difficulties of the times and by drawing closer together the three great moving forces of modern life—labor, brains and capital—endeavor to direct thought and legislation and to bring about a condition more worthy of the great opportunities possessed by civilized humanity to-day."

MAIN SUBSTATION OF THE METROPOLITAN ELECTRIC COMPANY AT READING, PA.

Problems Involved in Converting an Old Generating Station into a Substation Without Interfering with Service.

THE combined lighting and railway equipment of the Metropolitan Electric Company, of Reading, Pa., one of the underlying companies of the Interstate Railways Company, was described in a general way in connection with the illustrated description of its new generating station which appeared in these columns on Nov. 17, 1910. At that time the distribution system was also given attention; but the substation was merely mentioned as a part of the whole. The substation has just been completed and, on account of the problems involved in its construction, its size, and the variety of its distribution, a more extended account of it is here given.

ORIGINAL USE AS A GENERATING STATION.

The old power plant of the Metropolitan Electric Company consisted of three buildings on Seventh Street near Franklin Street, containing the engines, generators, switchboards and regulators, with a large building in the rear extending to Lemon Street containing the boilers. The engineer's office, etc., was located in an adjoining building and another building was used to house the storage battery. The old arrangement is shown in Fig. 7. Building No. 1 was equipped with six small, horizontal, high-speed engines on the first floor, each belted to two small generators on the second floor. In addition a line of shafting on the first floor, driven by a Hamilton Corliss engine in an adjoining structure, drove two rows of dynamos and arc machines on the second floor. The equipment at the time of the rebuilding comprised fourteen 60-kw, 125-volt Edison bipolar machines; eighteen Brush, American and Wood arc machines; six small engines and one Corliss engine, with a rated output of 1200 hp and supplying the three-wire system and arc circuits. Switchboards for the entire three-wire system and generators, series arc circuits and series incandescent system were also located on the second floor. In an extension at the rear a 350-hp Green Corliss engine was added, belted through a jack shaft to a 2300-volt, 60-cycle, two-phase alternator. The switchboard for this unit was located near the end of the jack shaft. In 1894 building No. 2 was erected, in which were installed three vertical cross-compound engines, direct-connected to railway generators with a total rating of 1600 kw, a vertical cross-compound engine direct-connected to two 100-kw, 125-volt direct-current machines, and the railway switchboard. Further growth is represented by the erection of building No. 3, containing at first two Ide engines, one belted to a Short railway generator and a Westinghouse 2300-volt, 60-cycle, two-phase generator, the other belted to a Jenney multipolar generator and a Thomson-Houston railway generator. Later the direct-connected units, an Allis-Chalmers cross-compound engine driving a 500-kw railway generator and two Harrisburg cross-compound engines, one direct-coupled to a 350-kw Stanley, 2400-volt, 60-cycle, two-phase alternator, the other direct-coupled to two 300-kw, 125-volt direct-current generators, were installed. Other additions were three boosters and a railway battery and two 400-kw, 25-cycle Stanley rotaries, running inverted and supplying energy to two 300-kw substations through step-up transformers and a 15,000-volt transmission line. The final rating of the station was 7800 boiler-hp and 5000 kw of generators.

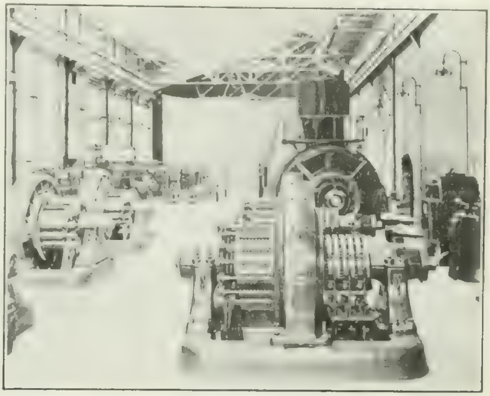


Fig. 2—Section Containing Lighting Rotators Before All Old Units Were Removed

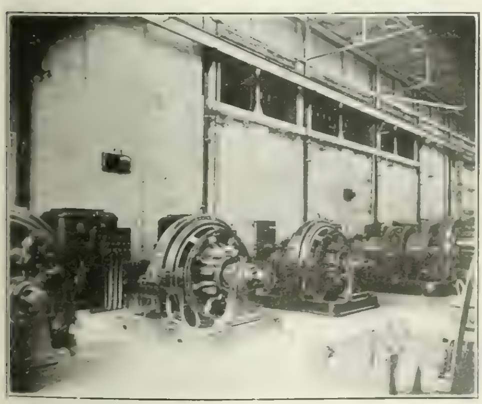


Fig. 1—Railway Units in Rebuilt Station

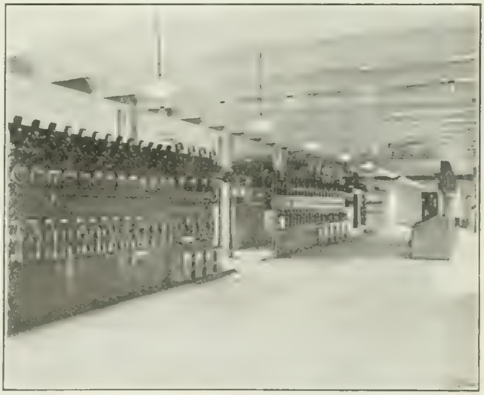


Fig. 3—General Arrangement of Switchboard Gallery

RECONSTRUCTION FOR USE AS A SUBSTATION.

The first undertaking was the reconstruction of building No. 1 without interrupting the operation of the apparatus. Reference to the photographs will show that it was possible to put in a single row of steel columns down the middle, which would support steel floor beams laid above the old wooden floors, so that the old floors should serve as forms for the new concrete floors, the machines being raised to the new level one at a time, the belts being lengthened and belt holes left in the new concrete floor to be closed up after the removal of all the old apparatus. The third floor being

built furnished protection to the apparatus, so that the old wooden roof could be removed and a concrete slab roof supported by steel trusses erected.

The lean-to structures on the side and rear end, which contained respectively the step-up transformers and the Green-Corliss engine, were torn down, giving more yard room for the pole lines and improving the appearance of the property.

To give space necessary for the new equipment in building No. 2 an addition was made, extending into the old boiler house, the rear end wall being moved back. It will be seen that the rearranged plant, having 50 per cent greater capacity, occupies only 41 per cent of the ground space taken by the original plant.

In both buildings No. 1 and No. 2 the ground floors were practically a solid mass of concrete foundations for the engines, shafting and generators which had been installed from time to time. Along the walls, however, there were trenches for steam pipes which, with a slight amount of additional work, could be used for the air tunnels over which the air-blast transformers were placed. In order to install the fiber conduits connecting the transformers and rotaries to the high-tension switching system it was necessary to raise the floor levels of both buildings sufficiently to permit these conduits to be laid on the top of the old engine-room floor, and this resulted in the switch-cell compartment floor being higher than the rest of the floor in building No. 1, which was made level with that of building No. 2, where formerly there was a difference of 9 in. in their elevations.

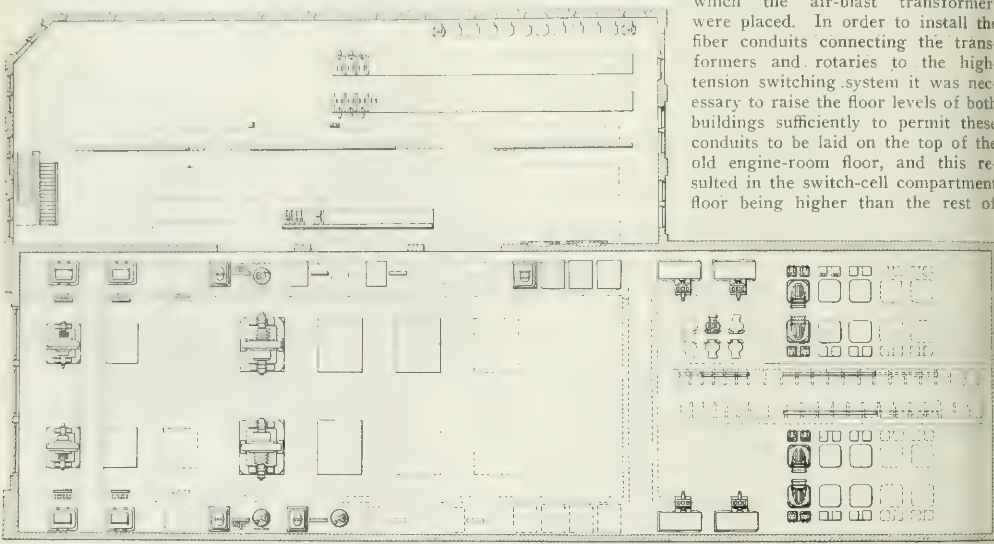


Fig. 4—Plan View of Station as Rebuilt.

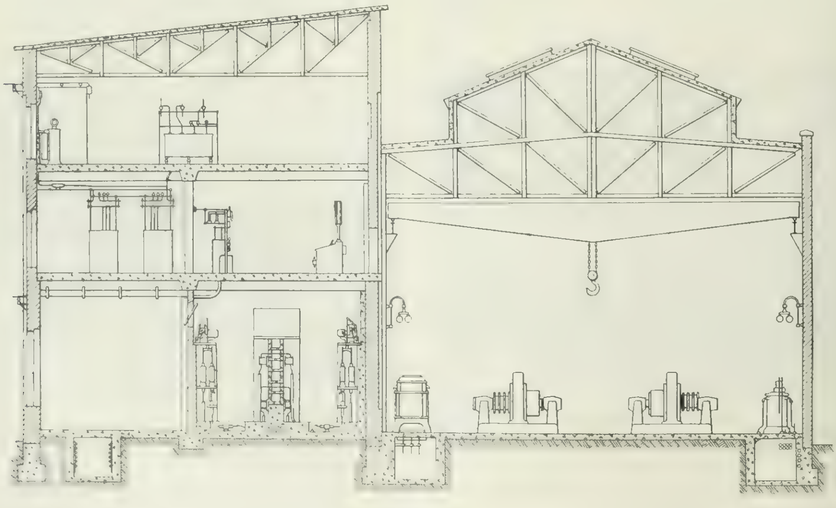


Fig. 5—Elevation of Main Portion of Rebuilt Station

NEW INSTALLATIONS.

The substation receives high-tension current at 13,200 volts, 60 cycles, three-phase, through underground cables from the new generating station. Provision is made for connection to six of these cables and six high-tension switches were accordingly installed, four for present use and two for future needs.

From the substation energy is distributed for railway eeders (600 volts), direct-current three-wire system (125-50 volts), motor circuits (2300 volts, 60 cycles, three-hase), lamp circuits (2300 volts, 60 cycles, single-phase), ries mercury arc and series tungsten street-lighting sys-

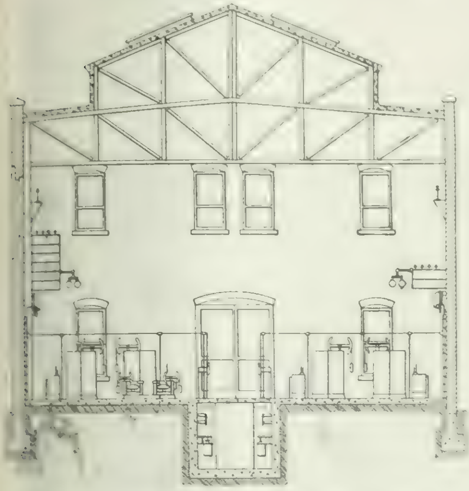


Fig. 6—Elevation of Street-Lighting Section of Station.

em. The rating of the equipment at present is 8000 kw. rovision is made for future installations amounting to 000 kw, making the ultimate rating of the substation 1,000 kw.

BUILDING NO. 1.

The first floor of building No. 1 contains the high-tension witches and busbars, office of the engineer in charge and he arc-lamp and meter-repair department. The second

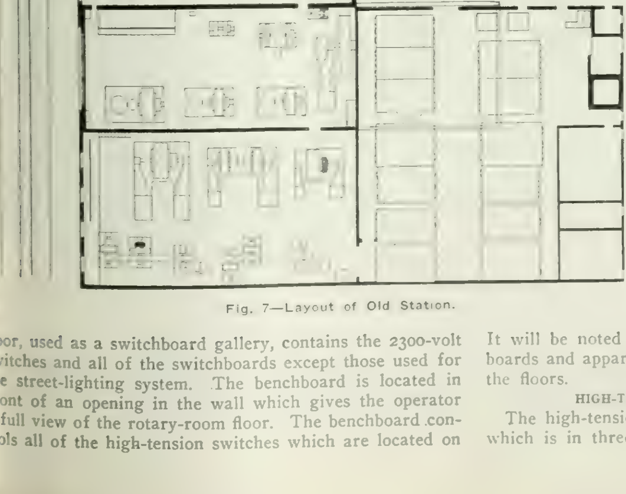


Fig. 7—Layout of Old Station.

oor, used as a switchboard gallery, contains the 2300-volt witches and all of the switchboards except those used for he street-lighting system. The benchboard is located in ront of an opening in the wall which gives the operator full view of the rotary-room floor. The benchboard controls all of the high-tension switches which are located on the first floor, and the 2300-volt switches located on the second floor for the control of the low-tension side of the distribution transformers. The switchboard for the 2300-volt system is a vertical board controlling all the outgoing 2300-volt circuits. These switches are of the remote-control solenoid-operated type arranged in two banks. Over each bank is located a set of three busbars. This arrangement provides a duplicate system of switches. Normally, one bus is to be used for three-phase motor feeders and the

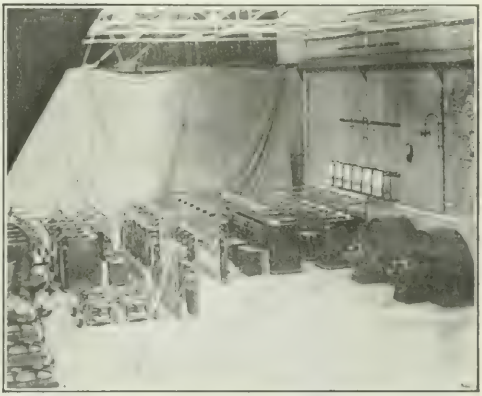


Fig. 8—Tungsten and Arc Boards for Street-Lighting Circuits.

other for the single-phase lamp feeders, connected to separate transformers, so that the irregular motor loads cannot affect the lighting. In case of trouble either bus can carry either the lamps or motor feeders, or both, and any transformer can supply either bus or both. The switchboard for the direct-current three-wire system is composed of rotary panels and feeder panels. The same arrangement is carried out in the railway switchboard. These three boards are arranged in one line facing the benchboard, so that everything is in full view and easy reach of the operator. Sufficient space is left between the vertical boards for future extension in the number of panels for feeders as well as for rotaries.

BUILDING NO. 2.

This building contains the railway rotaries and transformers, lighting rotaries, transformers and regulators, 2300-volt transformers, blowers for cooling all of these transformers and regulators, the tungsten and arc regulators and switchboards. Underneath the switchboards for the arc and tungsten systems is a tunnel which contains the 13,200-volt bus supplying these systems and, in compartments, the oil switches which are operated by connecting rods carried up through the floor to the back of the panels. It will be noted that all connections between the switchboards and apparatus in this building are in conduit under the floors.

HIGH-TENSION SWITCHES AND BUS SYSTEM.

The high-tension switches are connected to a main bus which is in three sections and an auxiliary bus which is

in two sections. By this means, and the use of two bus-section switches, it is possible to isolate any line which is carrying a badly fluctuating load, and, if necessary, this line may be isolated to the main bus in the generating station, or still further, by means of the auxiliary bus, to one generating unit in the main station.

Two auxiliary switches are provided which will, by means of the auxiliary bus, replace any regular switch which may be out of commission, thus doing away with the necessity of providing duplicate feeder and transformer switches. This saved space and first cost.

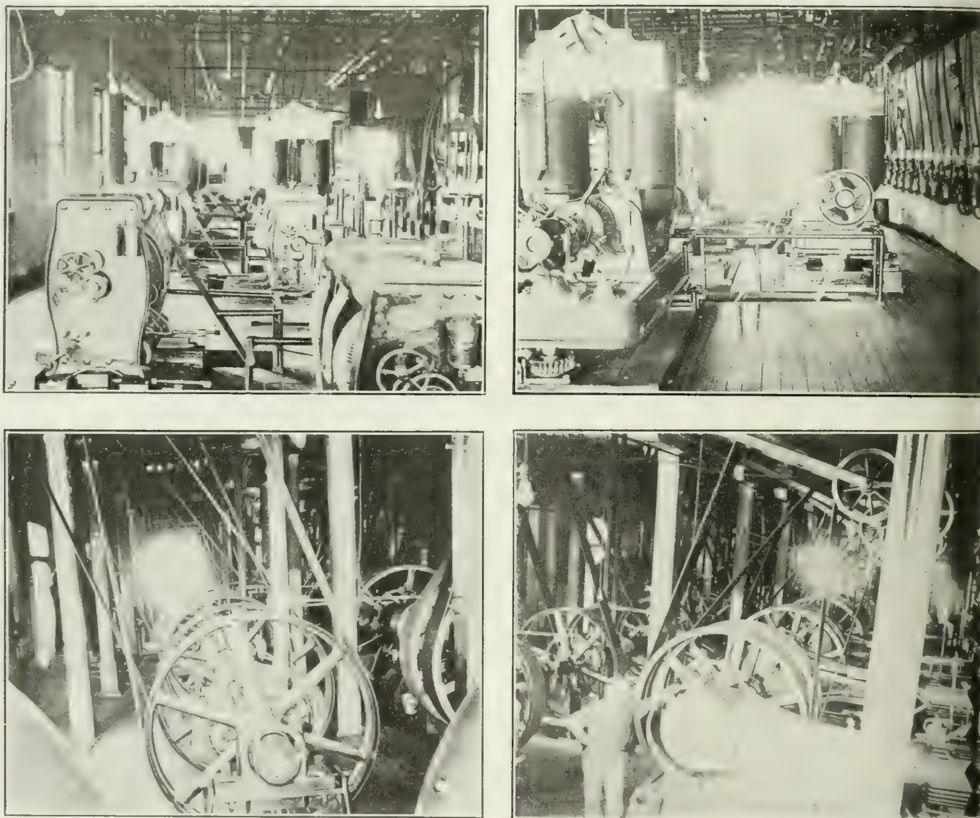
OUTGOING LINES.

At present the railway, lighting and motor feeders are taken out of the side of building No. 1 and the street-lighting circuits out of the Lemon Street end of building No. 2; all circuits being overhead. The railway ground enters with the high-tension underground conduits at the front of building No. 1, where it is connected to a bus in a manhole under the floor. The negative of each railway rotary is connected to the ground bus. The neutral for the direct-current three-wire system is connected to a bus in the tunnel. From here separate cables are connected to the low-tension side of the rotary converters feeding the lighting load by means of switches on the rotary starting panels. Only the positive and negative leads are carried to the distributing switchboard on the second floor.

A tunnel running from front to rear under the floor of building No. 1 provides connection to a future underground direct-current three-wire system. This tunnel can be extended to Lemon Street and Seventh Street, which will th[e] be the trunk of the underground system.

OPERATING DETAILS.

All rotaries are of the six-phase type and start from t[he] alternating-current side, through low-voltage taps, witho[ut] reactances. They are arranged with speed governors. T[he] 2300-volt lines and the street-lighting lines inside the bui[ld]ings are, with their lightning arresters, supported on pi[pe] framework so that they present a neat appearance and a[re] easily accessible. Lighting rotaries are regulated on t[he] alternating-current side by six-phase, induction-type, a[ir-]blast, motor-operated regulators controlled from the switc[h]board gallery. The 2300-volt, single-phase feeders a[re]



Figs, 9, 10, 11 and 12—First and Second Floors of Station Before Changes Were Made.

automatically regulated by oil-cooled, motor-operated regu[-]lators controlled by contact-making voltmeters. The serie[s] mercury-arc and tungsten circuits are regulated by air[-]cooled, constant-current transformers in which the movabl[e] coils are balanced by weights.

The electrical equipment and the architectural an[d] structural changes were designed by Mr. Walter J[.] Jones, consulting engineer, 30 Church Street, New Yor[k] City, who also supervised the construction and the proces[s] of dismantling the old apparatus and installing the new[.] All switchboards, switching and controlling apparatus[,] lighting rotaries, transformers and regulators were fur[-]nished and installed by the General Electric Company. Th[e] rotaries and transformers for the railway systems wer[e] furnished by the Westinghouse Electric & Manufacturin[g] Company.

HYDROELECTRIC DEVELOPMENT IN THE BLACK HILLS.

MEN who were boys twenty years ago can remember the glamour that surrounded the Black Hills and the thrilling tales of the Deadwood coach. The Black Hills are still notable for their mining development, gold and other metals and minerals being found there; but the western portion of South Dakota, in the neighborhood of Rapid City particularly, is experiencing a marked era of industrial development.

The Dakota Power Company of Rapid City, S. D., is building an interesting hydroelectric development on Rapid Creek, which rises in the Black Hills, and, after passing through Rapid City, empties into the Cheyenne River, which, in turn, finds its way to the Missouri River. The company controls the water rights on Rapid Creek from Pactola, at an elevation at the headgates of the reservoir there of 4440 ft. above sea level, to the eastern limits of the Black Hills forest reserve, which is the terminus of the company's water-power rights and is at an elevation of 3300 ft. In addition a 30-ft. fall in the creek at Rapid City is utilized.

Above Pactola, which is west of Rapid City and upstream, the area drained by Rapid Creek is about 410 sq. miles. The source of the creek is found in a large number of springs, the flow of which, excepting during flood conditions, is very constant. Records taken for twenty years past show a minimum flow of 60 cu. ft. per second. This flow can be very materially increased by the use of storage reservoirs. A small reservoir is now formed at the headgates at Pactola, and is shown in Fig. 2 of the accompanying illustrations. It is proposed to form other reservoirs at the various water-power developments down the creek.

Fig. 1—Trestle and Rock-Cliff Construction of Flume.

These reservoirs will be of ample capacity to carry the peak load over a considerable period. As soon as all the available power is contracted for a much larger storage reservoir can be constructed at comparatively small expense.

At Pactola the company has installed a substantial rock-filled pile-and-crib dam properly aproned both above and below, which turns the water into a well-constructed waterway, three miles of which is completed. The greater part of this waterway consists of a wooden flume 6 ft. wide and 4 ft. deep, the remainder being open ditch or cuts through

Fig. 2—Storage Reservoir at Pactola, S. D., on Rapid Creek.

the rock. In Fig. 1 there is shown a view of the trestle and rock cliff construction that was adopted in building the flume.

At one place it is necessary to carry the waterway through a 700-ft. tunnel cut in the rock, and work on this tunnel is now under way. From the mouth of the tunnel the water will be carried through a 62-in. wooden pipe line to a forebay 6250 ft. distant. This forebay is formed by erecting a small concrete dam across the mouth of a draw, thus providing a storage of 700,000 cu ft. of water. From near the bottom of this dam the water will be conducted in another wooden pipe line 3250 ft. long to a steel penstock and through this to the waterwheels in power house No. 1, at an elevation of 4140 ft., the effective head being 270 ft.

Power House No. 1 will be located at Big Bend, on Rapid Creek, about 12 miles west of Rapid City. The power-house foundations and floor are of concrete and the walls of brick. The main building will be 70 ft. long and 35 ft. wide, with a transformer room 35 ft. square. Contracts have been entered into with the S. Morgan Smith Company for three 800-hp turbine waterwheels of the Francis type and two turbine waterwheels of the same type rated at 70 hp each. These waterwheels will drive three 500-kva, 2400-volt alternators and their exciters. The generators and the necessary switchboards, transformers, etc., will be supplied by the Westinghouse Electric & Manufacturing Company and both the electrical and hydraulic machinery have already been shipped.

After the Big Bend power house is completed a second development will take the water just below the tailrace of the first plant and carry it to an elevation of 3890 ft., where, with an effective head of 225 ft., 1225 hp can be developed at the minimum flow of the creek, or 2040 hp at peak load. It is proposed to erect further developments down the creek in the same way, and thus an additional 2718 hp at low water and 4530 hp at peak load may be obtained.

The Dakota Power Company is now operating one steam plant and one combination steam and water-power plant at Rapid City. The steam plant consists of three 300-hp horizontal tubular steam boilers and two 200-kw De Laval steam turbines connected to 2400-volts, three-phase generators. The building in which this apparatus is installed, as well as a separate building for 24,000-volt transforming apparatus, is of concrete and cement-block construction. This plant was erected by the company during the summer

of 1910. The combination steam and water-power plant, which was purchased from the Rapid City Electric and Gas Light Company, contains one 150-hp register gate Victor waterwheel, to which is belted a 100-kw three-phase Westinghouse 2400-volt generator. Here, also, is a 150-hp Corliss engine, with the necessary boilers and other steam auxiliaries. These plants are furnishing energy to 700 customers. The annual income from the sales of electrical energy amounts to a little over $50,000.

At present the company is operating a 7-mile transmission line from Rapid City north. As soon as the Big Bend power station is in operation a 30-mile transmission line southwest of Rapid City will be built to furnish energy to several mines for motor applications and to light several villages and small cities. In the immediate vicinity of Rapid City are large gypsum beds, and two plants for the manufacture of this mineral into plaster are already in operation. Another use for electrical energy from the hydroelectric plant will be in the lime, cement and brick plants which are using the native rock and clay just north of Rapid City. A still further opportunity for the use of electricity is afforded by irrigation projects, as there are between 200,000 and 300,000 acres of land east and south of Rapid City which can be irrigated to good advantage when electrical energy for pumping is available.

The Dakota Power Company is incorporated under the laws of South Dakota, and its officers are as follows: President, Mr. John C. Haines, Rapid City, S. D.; vice-president, Mr. F. M. Stewart, Buffalo Gap, S. D.; secretary and treasurer, Mr. G. R. Mansfield, Rapid City, S. D. Mr. W. R. Putnam is the general manager.

APPLICATION OF MOTOR DRIVE TO BRICK PLANTS.

By Gordon Weaver.

THE application of electric-motor drive to machinery used in the manufacture of bricks presents a comparatively new and interesting field. As this is essentially a summer load, the business is particularly attractive from a central-station standpoint. The question of steam for heating purposes rarely, if ever, is presented, and where steam is used in the manufacture of bricks it may be economically supplied at low pressure.

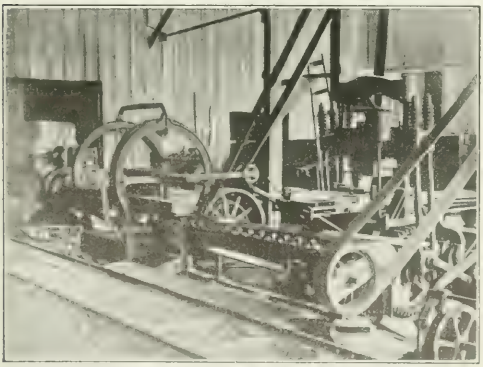


Fig. 1—Wire-Cut Brick Machine Belted to Line Shaft.

The power required to drive different machines varies considerably, depending largely upon the kind of clay used. For rough estimates it is fair to assume a connected load of 20 hp for each 10,000 bricks capacity per day. In plants having a capacity of 20,000 per day or less it rarely pa[ys] to install more than one motor, as practically all the ma[-]chines operate at the same time. Figs. 1 and 2 show p[art] of the machinery of a brick plant belted to line shaft d

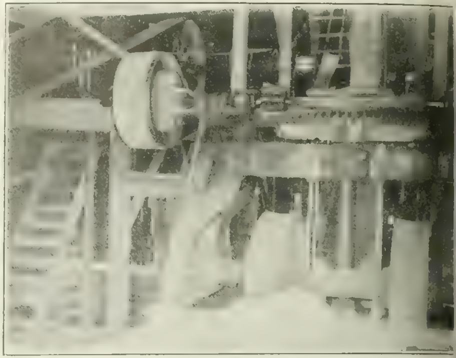


Fig. 2—Frost Dry Pan Belted to Line Shaft.

operated by one motor. In large plants (i. e., over 20, capacity) diversified motor application is very practical gives satisfactory and efficient service.

Machine	Demand in Kilow[atts]
Forty-inch disintegrator	50.4
Pug mill	44.
Wire-cut brick machine, 50,000 brick per day	64.
Four mold dry press	6.

Where a number of motors are to be used the dema[nds] tabulated above, as found by actual test, may prove use[ful] in the selection of the proper sizes of motor.

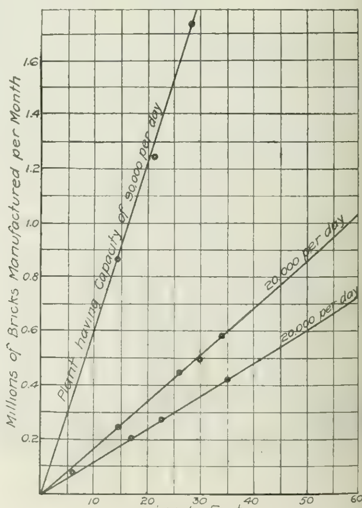


Fig. 3—Diagram Showing Variation in Load-Factor with Out[put]

These demands are all in terms of the actual power [re]quired, the motor efficiency not being taken into acco[unt].

If it seems advisable to run the elevators by separ[ate] motors the energy required to drive them may be ea[sily]

calculated in foot-pounds. One cubic foot of clay weighs 12 lb. The horse-power thus calculated will be about 50 per cent of that actually needed.

he monthly load-factor varies with the monthly output,

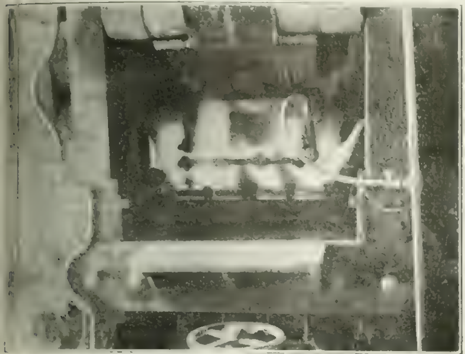


Fig. 4—Brick Press Having Dies Heated by Gas Flame.

capacity of the plant and the character of the clay. Fig. 3 shows the variation in a plant having a capacity of 90,000 bricks per day, and also shows the effect that different kinds of clay have on the load-factor of two plants, each having a capacity of 20,000 bricks per day. The load-factor in these diagrams is calculated on the basis of 720 hours per month and a five-minute demand.

When a central station approaches on the subject of motor drive a brick company that is operating by steam the

BRICKMAKING DATA.

		Maximum Demand Kilowatts.	Kw Hours, Output.	Thousands of Brick.	Load-Factor, 24 Hours.
... 90,000	April	116	23,900	1,744	28.6
per day	May	107	19,900	1,636	825
... load.	June	96	16,250	1,249	23.5
... 4 mo	July	96.5	9,900	871	14.2
12.7 kw.	August	88.24	13,290	1,025	20.9
per 1,000					
... ng 20,000	March	25	4,980	336	27.8
... per day.	April	25	4,640	435	35.8
... load.	May	25	6,310	426	35.0
(1 motor)	June	25	6,390	432	35.6
kw hours per	July	25	4,060	274	22.5
... ricks					
	August	25	4,470	302	24.8
	September	25	4,190	282	23.3
	October	25	3,070	207	17.1
	November	25	1,070	76	5.9
	December	25	.....	...	.
	January	25	.	...	
	February	25	4,610	310	25.7

DRYING.

... a ca	April	48.5	24,950	1,090	71.
90,000	May	50.3	22,900	1,266	63.
...onnect-	June	47.4	21,025	905	61.5
...0 hp on	July	43.7	10,175	380	32.[illegible]
...system	August	49.4	12,670	576	35.5

company will assert that steam is needed to heat the dies on the brick press. It is true that the dies must be heated, but there are three different ways whereby this is now being done, each of which has its advantages and will prove the most economical in some localities.

The first method which logically suggests itself is that of applying steam from a small auxiliary boiler at low pressure. This is being done in quite a number of places and is proving very satisfactory. A boiler of this sort requires very little attention, as almost anyone around the place can do the little firing necessary. In a plant having a capacity of 20,000 bricks per day about 50 lb. of coal will be used per day in heating the dies. The second method is to have the heat supplied by a gas flame coming in direct contact with the dies. Fig. 4 shows the arrangement of the gas pipes on a four-mold dry press with the gas lighted and ready for operation. The gas actually used during one day was 600 cu. ft. in molding 18,000 bricks. The third method is to have the dies heated electrically. In at least one place this is being done successfully, flatiron cartridge heaters being used on each die. The energy used on a four-mold dry press will be about 40 kw-hours per day of ten hours.

Aside from the motors used in driving the machinery that makes the brick, motors are frequently used to drive a blower in connection with the drying system. The hot air is taken from the kilns which are cooling (in a large plant there is almost always a kiln in the process of cooling) and forced in through a drying-room where the bricks are tempered before being put into the kiln for burning.

The accompanying tabulations will give some idea of the maximum demand, kw-hour consumption, number of bricks manufactured and the monthly load-factor.

THE EFFECTS OF SUNLIGHT ON THE TRANSMISSION OF WIRELESS SIGNALS.

By B. L. Dolbear and J. A. Proctor.

SINCE the early days of wireless telegraphy it has been well known that the night is a much more favorable time than day for the reception of signals from stations over 150 miles distant. The difference between day and night intensity is not measurable at 100 miles, but at greater distances the night intensity is often as great as 100 times that of the day. Besides this day-night difference, another interesting phenomenon presents itself, namely, the rapid change of energy received from moment to moment. An inaudible signal will often be multiplied to 100 times audibility within the space of a few seconds; sometimes it remains so for several moments, sometimes for only a few seconds, but eventually disappears as suddenly as it appeared. This phenomenon is called "swinging," and while formerly it was thought to be due somewhat to local conditions at the transmitting station, it is now explained by the constantly changing conditions of the atmosphere, which vary the percentage of atmospheric absorption of the incoming signals. The reason why "swinging" is hardly noticeable at distances under 100 miles may be attributed to the fact that any marked changes in percentage of ionization due to irregularity of the sun's emission probably take place at quite an appreciable altitude. Hence, only the wave-fronts which have traveled some distance (probably corresponding to the minimum distances at which "swinging" is noticed) and which have reached an altitude which includes the ionized portion will be subject to absorption or loss of energy.

Until recently no data have been published showing definite measurements of the relative intensity at different times of day and night. At Amesbury, Mass., in 1909 Mr. Greenleaf W. Pickard carried on a series of measurements on intensity of signals as received from the Marconi transatlantic station at Glace Bay, Cape Breton. This station is about 700 miles from Amesbury, and at the time Pickard took his readings the radiating wave-length was approximately 4000 m. Fig. 1 shows the plotted results of Mr. Pickard's measurements. Owing to lack of data between the hours of 5 a. m. and 3 p. m. of July 26 points were plotted from two days' readings. It will be noted that the normal night-time intensity is between thirty and forty times that of the normal daytime intensity.

Last March the authors carried on another series of similar observations of the Glace Bay station signals as received at Revere and Somerville, Mass., each place about 4 miles from Boston. These observations covered six

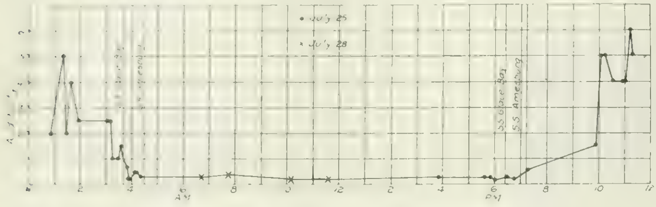


Fig. 1—Curve Taken by Pickard at Amesbury, 1909.

entire days within a period of two weeks, and on some of the days simultaneous measurements were made at both stations. As the stations at Revere and Somerville are only 5 miles apart, it would be supposed that the relative energy received at each station would be the same, which proved to be true as curves taken simultaneously check each other very satisfactorily. Figs. 2 and 3 show typical curves as taken at the two stations.

By far the most striking feature of these curves is the effect of sunrise and sunset on the intensity of signals. In the early days of wireless telegraphy Marconi noted a difficulty in communicating over long distances at sunrise and sunset during the experiments in transatlantic communication carried on between the steamship *Philadelphia* and Poldhu, England. Pickard's curves of 1909 show a slight dip at these times, especially at sunrise. Pickard found the point of lowest intensity about midway between sunrise time at Glace Bay and sunrise time at Amesbury. However, in Figs. 2 and 3 it is interesting to note that the points of minimum intensity occur at sunrise at Glace Bay and sunset at Boston. Two things should be taken into consideration in comparing Pickard's curves with the authors'. First, his readings were taken in July and the authors' in March, and, second, the transmitting station was employing a 4000-m wave-length in 1909 as compared to a 7100-m wave-length at the date of the authors' measurements. The latter fact might explain the absence of such wide fluctuations of intensity from minute to minute during the night in Figs. 2 and 3 when compared with Fig. 1. It is well known that longer wave-lengths are less subject than shorter wave-lengths to loss of energy by atmospheric absorption.

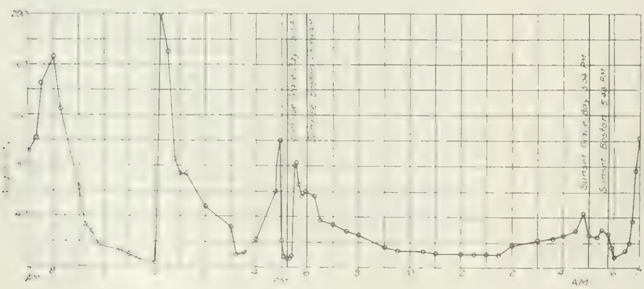


Fig. 2—Curve Taken by Proctor at Revere, March 13-14, 1911.

A general average of all the curves is shown in Fig. 4, which embodies other interesting features. There appears on many of the curves a slight rise of intensity bet en noon and mid-afternoon. Corresponding to this bet en midnight and 2 a. m. there is almost sure to be a s rp rise, followed by a gradual decline, until shortly before n- rise at Glace Bay. Just before k- ing the plunge preceding, and in at the recovery of intensity after n- rise and sunset, there is usual a quick oscillation of intensity un is- takably noticeable on nearly al h curves. Besides this single flu ta tion there are often others prece ng and following it. Still an e noticeable feature is the rel ve width of the sunrise and sunse le- pressions, the latter always bein th broader. The minimum points o in- tensity will generally be found to lag behind the actual m rise or sunset time by some five minutes. The reco of intensity after sunrise is perhaps the most surpr n feature. In one case this recovery represented the i mum intensity for the whole twenty-four hours.

It seems impossible with the meager data on ha t give a fully satisfactory explanation of these various a- tures. It has been suggested by some that the low da m intensity is due to ionization of the atmosphere b he sunlight, which causes a dissipation of energy by co n tion in the space between the transmitting and rece n

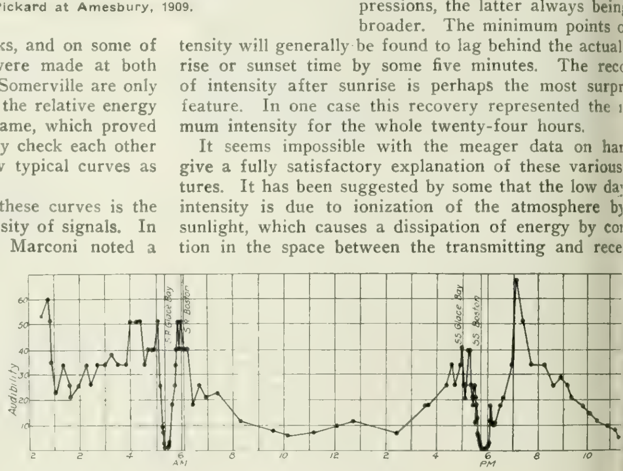


Fig. 3—Curve Taken by Dolbear at Somerville, March 11, 1911.

stations. This appears to explain in a general way he phenomenon, but when it is considered that only the ra- violet component of the sunlight produces ionization t ny degree, and that these ultra-violet rays penetrate o short distance into the atmosphere, it becomes evident only the higher altitudes of the air are ionized, and is should not affect that portion of the wave traveling b w this stratum unless it be proved that there is an up rd passage of energy to compensate for the conduction l Neither does ionization satisfactorily explain the rec of intensity after sunrise or before set. However, this sunrise-sunset may be due to entirely different c and the ionization may be respo for the effects which take place tween sunrise and sunset.

Others have contended that the stratum of ionized air may reflec electromagnetic waves. However, definite line or surface of division exist between substances having d ent physical properties in order reflection may take place, this theory es not seem possible. There are no ea- sons to suppose that such a line sts under the ionized stratum. Fl ing has pointed out that there may a gradual refraction upward of the wave front, which ght produce distortion of the wave.

If it were known that there was such a thing as er- ference between ether waves traveling in the same ne. a possible explanation of the sunrise-sunset effect mig he

gen, but as two rays of light may be made to cross each other at any angle without the slightest displacement or refraction it hardly seems likely that any such action could take place with the electromagnetic waves.

An attempt was made to obtain information regarding possible changes of transmitting conditions at Glace Bay, such as variation of power transmitted at different times of day, but without success up to the time this article was written. Without such data and more curves taken at other times of the year it hardly seems wise to enter into an elaborate discussion of possible causes, and, as it is believed that others have as yet unpublished theories to offer, it is hoped that this article may prove an inducement for these persons to give their opinions.

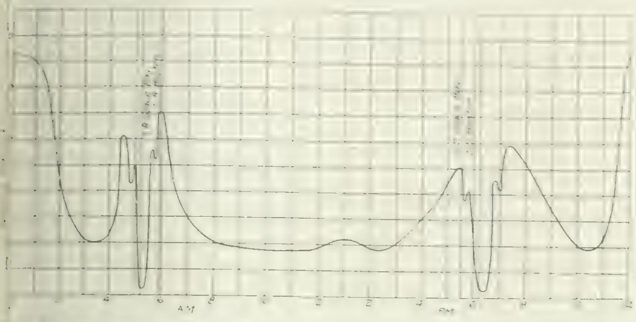


Fig. 4—General Average of All Curves Taken at Somerville and Revere, March, 1911.

The method employed in obtaining these readings is that of shunting the signals in the telephones to an audibility of unity. This is done by connecting a simple resistance box across the telephone terminals and by manipulating the plugs till a value of resistance is found at which the shunted signal is just audible. The greater the incoming energy at the receiving station, the louder the signal, and hence the less the shunt resistance required to reduce it to an audibility of unity. From resistance-audibility curves drawn for the particular telephone used, the value of audibility may be scaled, given a shunt resistance. With a little practice such readings may be confined within 10 per cent error, as shown when checked by galvanometer.

In taking such readings it is, of course, necessary that all inductances, capacities, couplings and adjustments should remain fixed and constant throughout the test. Once adjusted the inductance, capacity and inductive couplers will remain so unless intentionally changed, but the detector is subject to loss of adjustment from strong atmospheric disturbances and sometimes from slight mechanical jars. To retain equal sensitiveness at each adjustment a different method was employed at each station.

At Somerville a low-voltage 60-cycle current was employed in connection with a galvanometer. It is known that the efficiency of a detector of the solid rectifier type, such as used in radio-telegraphy, is independent of the frequency used. When an alternating emf of a few hundredths of a volt is impressed on the detector circuit, and a galvanometer is connected in place of the telephones, a maximum deflection of the galvanometer, obtained by adjusting the detector, indicates maximum efficiency of rectification. The galvanometer and source of supply may then be cut out and the telephones replaced ready for reception of signals.

At Revere a simpler yet very reliable method was used employing a special form of test buzzer with platinum contacts. Across the contacts of the buzzer was connected a condenser of about 0.5 microfarad in series with a single turn of inductance, thereby producing an oscillatory circuit. This loop of wire was placed some 4 ft. from the receiving oscillation transformer, and at such an angle that with the buzzer in operation the oscillations set up in the loop of wire were just audible when the detector was adjusted to its highest point of sensitiveness. It is known that there is a limiting point of sensitiveness to every detector, and it is on this adjustment only that the buzzer is heard. The buzzer should, of course, be carefully muffled in some soundproof material.

The solid rectifier used in these observations was that combination of zincite and bornite known as the "perikon" detector.

The value of resistance corresponding to a given value of audibility depends upon the telephones used—that is, upon their impedance. The current divides at the shunt according to the impedance of the two circuits. The impedance of the telephones used in these tests was approximately 10,000 ohms to the detector currents, while the impedance of the shunt resistance, being non-inductive, is its true resistance. Thus a signal just audible with a 10,000-ohm shunt indicates an actual audibility of 2; with a shunt of 5000 ohms the audibility is 3, etc. A curve showing the relation of audibility to resistance offers a means of rapidly ascertaining audibility from shunt readings. A better method is that of constructing a resistance box with a dial switch graduated to read directly in terms of audibility.

The results of these observations have brought forth some very novel and interesting features, and it is the hope of the authors that at some later date, with more data at hand, the phenomena will be more fully discussed.

DEPRECIATION.

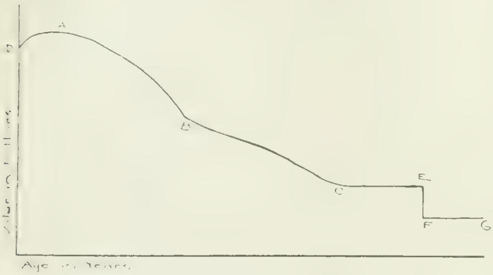
BY H. G. D. NUTTING.

The paper presented at the recent Chicago convention of the American Institute of Electrical Engineers by Mr. Henry Floy on "Depreciation" is a comprehensive summary of the best ideas on depreciation. It brings forth those of so many authorities that, after studying it, the reader is somewhat at a loss to realize what depreciation is, after all. He is, however, quite sure to realize that depreciation exists and that if the investment is to be preserved intact a depreciation reserve fund, accumulated from income, must be carried. The great value of this conclusion lies in the protection of the investor in public-utility securities against loss of principal brought about by fictitious and unearned dividends.

As is stated in Mr. Floy's paper, the total depreciation or the rate of depreciation in any given case depends upon specific conditions. He shows six possible ways in which property depreciates. History of apparatus shows that there may be an indefinite number of ways in which it may depreciate. This is proved by the accompanying statistics, which give the actual history of many pieces of machinery collected while the writer was inspector for the Wisconsin Railroad Commission.

It is necessary, when making practical use of depreciation, to know what the object is. It is plain that if an appraisal is being made the past history of the plant and the business is known, and fairly accurate estimates of the future can be made. If it is a question of fixing upon a depreciation reserve, that is, if the depreciation is to be estimated from the accountant's standpoint, it is a much more difficult matter to be certain of the results. It is safer to charge to depreciation a conservative average fraction of the investment in the plant than to try to estimate

to any degree of accuracy the life of each individual class or piece of apparatus, although, of course, such estimate should be at least tentatively made in order to determine what is a conservative average rate of depreciation on the whole plant. There should be no fear that this rate figure will be too large, as the hazard is likely to be greater than expected; and, while the public must meet the charges in



Curve Showing Depreciation of Apparatus.

the long run, the public gains by better service and finally better rates due to the good condition of the business.

The writer has noticed one item of inaccuracy, or rather incompleteness, in connection with Mr. Floy's table of ap-

HISTORY OF MACHINERY SHOWING DEPRECIATION.

Boiler No. 1.—Age 20 years. Rebuilt when 11 years old. Carries 110 lb. pressure.
Boiler No. 2.—Age 18 years. Used only for heating system. Not safe to carry high pressure. About to be removed.
Boiler No. 3.—Age 8 years. Still in good condition. Has had new set of tubes. Used only for reserve.
Boiler No. 4.—Age 16 years. Apparently in good condition. This boiler was replaced one year later on account of being too small.
Boiler No. 5.—Age 16 years. Carries 100 lb. pressure and runs all the time.
Boiler No. 6.—Age 19 years. Carries 100 lb. pressure and runs most of time.
Boiler No. 7—Age 37 years. Taken out of electric-light plant and now carrying 95 lb. pressure in manufacturing plant.
Boiler No. 8.—Age 23 years. Carries 85 lb. pressure. Apparently in good condition.
Boiler No. 9.—Age 20 years. Carries 95 lb. pressure, operating continuously.
Boiler No. 10.—Age 35 years. Taken out for lack of capacity. Run several years without washing.
Boiler No. 11.—Age 18 years. Run one year in electric plant, stored 14 years and then put in water-works. Carries 130 lb. pressure.
Boiler No. 12—Age 19 years. Run two years and reset. Now carrying 85 lb. pressure.
Engine No. 1.—Age 6 years. In good condition, but used as reserve for larger unit.
Engine No. 2—Age 15 years. Taken out on account of being too small. Now for sale. Overhauled three months before removal.
Engine No. 3.—Age not known. Bought second-hand and taken out because engineer thought cylinder was cracked.
Engine No. 4.—Age 26. Runs 12 hours a day and still in good condition.
Engine No. 5.—Age 19 years. Still running in good condition.
Engine No. 6.—Age 1 year. Gas engine. Used to carry peak only.
Engine No. 7.—Age 11 years. Apparently in good condition, but not in use. Bought second-hand and discarded because too small. For sale.
Engine No. 8.—Age 17 years. In fair condition. Has had new cross-head and has been rebored.
Engine No. 9.—Age 16 years. Still running. Has been rebored. New valves and valve gear, new cross-head and bearings.
Engine No. 10.—Age 22 years. Dismantled five years ago (age 17 years). For sale.
Engine No. 11—Age 18 years. Partly rebuilt two years ago. In good condition, but used as reserve in plant now turned into high-tension substation.

proved rates used in estimating theoretical depreciation. The practice of the Wisconsin Railroad Commission in making a valuation is not to use the straight-line method, but rather a "4 per cent compound interest depreciation curve." Further, the condition of the apparatus appraised is noted; that is, with respect to whether it is in good, fair or poor condition. If in good condition, 100 per cent of the condition per cent on basis of life is taken; if in fair condition 90 per cent of its life per cent is taken, and if in poor condition only 80 per cent is taken. Whether the apparatus is in good, fair or poor condition is necessarily determined by the inspector, who must check his conclusions by the use of a fair degree of common sense and good judgment.

If the history of any given piece of apparatus is studied, it will be noted that its life curve is not a regular cu dropping according to any one algebraic equation. T curve reproduced shows roughly what takes place in the l of the average piece of apparatus. For example, assume ordinary Corliss engine has been installed. Point *D* r resents its value in dollars at the time of installati Shortly after installation, when it is working in good c dition, it actually experiences a slight increase in value to the fact that it has accomplished the purpose for wh it was intended; that is, the element of uncertainty as whether or not it was the proper apparatus to inst, whether it is of good design and construction, wheth properly installed, etc., makes it of slightly more value th the mere cost of the apparatus plus its installation c This peak is more prominent in some pieces of appara than in others and may even disappear in certain ca The apparatus then depreciates according to the curve *A*, which is assumed to be a 4 per cent compound inter curve. At the point *B* another critical turn in its hist is passed, which is the point when it becomes too small be run continuously and is used only for reserve for n and larger apparatus. Section *BC* of the curve is lik to be much longer and flatter than section *AB*, its len depending in a measure upon the apparatus for which i being used in reserve. At *C* another slight change is m and the life curve takes the form of a straight line para to the base. This is the line of minimum service value marks the limit of useful value of the machine, terminat at *E*, when its life as a machine is ended and it is scrapp Manifestly, it can never be worth less than scrap va represented by *FG*, which continues indefinitely.

It cannot be said that all pieces of apparatus follow curve exactly. The curve does, however, represent i general way the history of the average piece of appara working under normal conditions.

It is rationally impossible, therefore, to use any method of depreciation for all kinds of physical prope regardless of conditions. However, it is probably t that the result of using such a method on the appraisal c public-service property with its diversified physical eq ment will result in a reasonably correct figure for pres value.

AMMETER TESTING.

By G. C. Cassard.

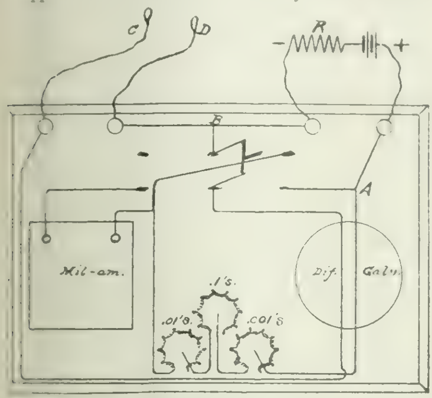
There are two generally recognized methods of c brating direct-current switchboard ammeters under ope ing conditions. In the first, or "direct," method a sta ard ammeter (or shunt and millivoltmeter) is connec in series with the shunt of the meter to be tested, and reading of the latter is compared directly with that of standard. In the second, or "potentiometer," method drop across the shunt is measured by using a potentiome and the corresponding current is taken from a table pr ously compiled and compared with the reading of switchboard meter.

The writer has no intention of comparing the merits these two methods, but would point out that any met necessitating connections directly to live copper and depe ing for its load variation on manipulation of the outgo current is objectionable and should not be tacitly accep without an effort to substitute something more efficient.

If it were possible to measure the small shunted curr in the instrument itself, for instance, and to know w scale deflection such current would produce, it would quite practicable to substitute this current by using a sn battery and rheostat, and thus to make the test in a p tion as remote from the switchboard as desired. The s eral resistance factors involved would have to be kno however, to accomplish this result, taking account,

course, of the actual temperature at which any test might be made.

As an imaginary case, suppose that, instead of using a shunt, the ammeter leads have been simply tapped to the outgoing copper at points 3 ft. or 4 ft. apart to provide the necessary drop. This introduces a temperature coefficient in this part of the circuit and is assumed simply to present a case involving this factor. To measure the resistance of the copper section it will be necessary to disconnect the



Ammeter Testing Set.

ammeter leads and measure the drop between these points with a potentiometer. At the same time the current is measured by means of a portable ammeter connected in series. Thus, from Ohm's law, the resistance of this copper or "shunt" at the observed temperature of the test is obtained. Now by applying a temperature constant, as given in standard tables, this resistance may be immediately reduced to its value at a standard temperature of 75 deg. Fahr. Thus, calling the latter resistance R and X the resistance at an observed temperature of, say, 66 deg., $R = 1.02\,X$, since 1.02 is the constant indicated at this temperature. This value R is then stamped on the shunt, and, since it is unchangeable, it constitutes a permanent record.

To measure the resistance of the ammeter leads it is then necessary to attach a bridge to their lower ends and to remove the upper ends from the meter and bolt them together. This observed resistance is then reduced to its standard resistance at 75 deg. just as was done with the shunt, and this standard, r, is then noted on a tag and tied to the leads.

It will be understood that the above work is preliminary and need be performed only once, so long as absolutely reliable results are secured. The values obtained are obviously unchangeable and may be used in testing for an unlimited period. There remains then only one resistance to be measured—that of the ammeter itself—and this measurement must necessarily be made every time the meter is checked; indeed, every time the tester changes the internal calibrating coil, which is usually of a metal having a zero temperature coefficient and is included in the circuit of the copper coils of the instrument. This fact has no bearing on the results, however, since the total resistance in series is used at the observed temperature of the test, and is, therefore, not to be affected by a constant. R and r, on the other hand, must be reduced to the room temperature before being used, and since they were multiplied by a factor before to bring them to a resistance at 75 deg. it will be necessary to divide them by a factor.

By reason of the constant relation that the shunt and meter bear to each other at all loads, and by the simple law of two multiple circuits, $\frac{R}{K} : \left(\frac{r}{K} + r_1\right) = i : I$, in which R is the shunt resistance at 75 deg. Fahr.; r is the resistance of the ammeter leads at 75 deg. Fahr.; r_1 is the observed resistance of the ammeter; K is the temperature factor at observed temperature; i is the current in the meter circuit, and I is the current in the shunt.

From the above proportion $I = \frac{i\,(r + r_1 K)}{R}$ is obtained as the value of the current in the shunt, but, as the current through the meter is too small to be read on its own scale, this value may be taken for the total current external to the shunt. The tester may, therefore, take the meter from the board and after connecting up to a suitable bridge and milliammeter, and measuring the resistance and current, the meter may be calibrated by above formula.

In applying a system of testing such as this it is evident that recourse must be had to an instrument of special design, which, while possessing a reasonable degree of simplicity, will lend itself readily to the measurement of both the resistance and the small meter current, and this without undue manipulation. These considerations were applied in designing the testing set described herewith, which may be made up in a form compact enough to fit into a small suitcase.

It will be seen by referring to the accompanying drawings that the double-throw switch provides for the uses mentioned by changing the arrangements of the circuits. The measurement of resistance is made with the switch thrown to the right. In this position there are two subcircuits. Starting from the positive side of the battery one of these circuits passes through the right side of the differential galvanometer, the resistance dials, the upper blade of the switch and returns to the battery. The other circuit, starting from the positive side, passes through the lower blade of the switch, the left side of the galvanometer, the terminals C D (supposing the terminals to be bolted together) and back to the battery. The two circuits from the junction A to the junction B are of equal resistance when the three resistance dials are set at zero; therefore, any outside resistance connected between C and D may be accurately measured to thousandths of an ohm by balancing the galvanometer by the dials. By attaching these terminals to the binding posts of the meter its internal resistance is first measured. Since this same connection is used for the current measurement the tester may proceed by simply throwing the switch to the left. Now there is only one circuit, starting at positive, right side of galvanometer, resistance dials, milliammeter, lower blade of switch, left side of galvanometer, ammeter on test and back to the battery. In this position the galvanometer is not in use, but the milliammeter is, and it is found desirable to pass the current through the galvanometer twice for three reasons: First, since the current is the same in the two coils it will not deflect the needle; second, the increased resistance of the series connection added to that of the milliammeter which has just been switched in reduces the current flow when calibrating, so that greater battery strength may be used to give the galvanometer greater sensitiveness when balancing, and, third, with the series connection the galvanometer itself may be checked as to whether or not it is perfectly differential.

In the calibrating position of the switch it makes no difference in the accuracy of the ammeter how much resistance is in circuit, provided the resistance of the calibrating coil inside the ammeter is not changed. This seems inconsistent until it is remembered that a change in the calibrating coil means a change in the ratio of the meter to its shunt—that is, a change in the value of one factor (r_1) of the formula, which change should only be made in changing the calibration. So for varying the load the dial resistances are varied, but not read, the actual checking being made by the reading of the milliammeter as compared with the ammeter.

"BY-PRODUCT" ELECTRIC-LIGHT PLANTS.

Prof. George H. Morse, of the department of electrical engineering at the University of Nebraska, read a paper on "Electric Lighting By-products" before the Nebraska Electrical Association at Lincoln recently. This paper aimed to give a résumé of the various ways in which an electric-lighting company may improve the character of its load-factor without greatly increasing its equipment or the size of its operating staff. He defined the ideal by-product as one necessitating the least outlay for additional apparatus, the least expert knowledge different from that required for the main output of the company, the least money tied up in raw material, least attention from the technical staff and the fewest obligations to the trade supplied.

The 80 or 90 per cent of heat energy going to waste in exhaust steam cannot be used to produce electricity, and hence must find application in some lower order of by-products. For the use of this the manufacture of artificial ice seems the best application. In general the operation of cold storage does not commend itself, because of the great responsibility and the careful and costly supervision necessary. The use of the exhaust steam for heating involves an outlay of capital and a public obligation equal to if not more than that required of the electric-lighting plant.

There is perhaps no industry in which a suitable by-product is so much needed as in electric lighting. The plant equipment and organization are highly specialized, and yet for the major portion of the time are bringing in no adequate return on the investment. If there were a reasonably cheap means of storing electrical energy all efforts could be directed to the production of this one commodity. The plant would then go on doing its work the same at all hours, all fluctuation in demand being met from the stock of electrical energy in storage. Storage batteries do not meet the requirement on account of their high cost, low efficiency and high rate of depreciation.

The special encouragements offered to off-peak consumers of electricity tend to produce a market for what may be termed by-product energy, since it is often sold at or near cost. Electric flatiron load is off the peak and very desirable. Electric cooking load seems to offer less inducement, because of its tendency to come on about the time of morning and evening lighting. It is also in competition with cheaper sources of heat.

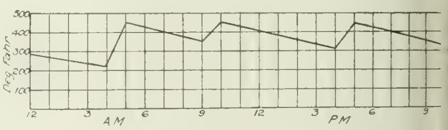
Local thermal storage on a small scale may be made to solve the problem of supplying off-peak energy for cooking. The idea is to supply electrical energy to consumers at desirable hours; that is, hours desirable from the standpoint of station operation. The energy thus supplied is stored for use as heat in a well-insulated receiver on the premises of the consumer. A clock would be used to switch the energy flow on and off at the desired hours.

In connection with the paper a fireless cooker with a vacuum jacket was shown. The walls of this cooker are in the form of an air-tight metallic chamber filled with a powdered material. Twenty-five pounds of water (12 quarts) at 212 deg. Fahr. were placed in the cooker. At the end of fifteen hours the temperature had fallen to only 140 deg., the outside temperature being about 70 deg. This equals a rate of heat loss of 1.13 thermal units per hour per degree difference of inside and outside temperature. From these data the curve shown herewith was plotted. This curve was based on the use of a piece of soapstone weighing 70 lb. as a heat retainer. One may think of the stone as a cylinder 10 in. in diameter and 9 in. high, and provided with some form of electric-heating coil. The whole would be placed in a vacuum-jacket cooker. Referring to the curve, electricity is turned on at 4 a. m. and supplied at a rate of about 1 kw. At 5 a. m. a temperature of 450 deg. is reached. Energy is turned off at 5 a. m. and again turned on between 9 a. m. and 10 a. m., and also between 4 p. m. and 5 p. m. These are the hours during whic station load is light. Under these conditions the tem ture within the cooker as calculated from the rate of ing in the experiment above referred to would at no sink below 218 deg. Fahr., which latter temperature occur at 4 a. m. At all times it would be hot enoug most kinds of cooking. Of course, some allowance need to be made for heat loss in heating up cold ar to be cooked, especially if the top were left open an coffee-pot set to boil. The kw-hours supplied daily to the temperature at points shown in the curve is only The monthly bill for this service at a 3-cent rate wou $2.18. The consumer would have at hand day or ni hot oven ready to cook food. A large cooker would rapidly increasing economy compared to the space able within it for cooking. Increasing the thickne insulation would also reduce the cost of operation.

Following are some of the common temperatures n sary for cooking. A potato will bake in 0.75 hour a deg. Fahr. It will harden on the outside and almost at a temperature of 400 deg. Fahr. in 20 minutes. A deg. from 1.25 to 1.5 hours are required to bake a p

Bread in small loaves should be baked at 360 deg 30 minutes. Frying is cooking in fat at a temperatu 350 to 400 deg. An 8-lb. turkey with stuffing shoul into an oven at 400 deg. for 0.5 hour and then bake a deg. for 2 hours longer.

Bleaching liquor prepared by the electrolysis of con brine is coming to be considered superior to that obt chemically from bleaching powder. The Pullman pany has installed electrolytic apparatus for this pu in its numerous laundries, and finds the liquid pro



Suggested Operation of Cooker.

also well suited to washing and disinfecting car f There are at present in the United States two comp manufacturing and selling electrolytic bleach machin the laundry trade. These machines consist of little than a mixing tank for the brine, an open electrol tank, numerous carbon electrodes and a storage tan the completed bleaching liquid. The relative cost o electrical and chemical systems of producing bleachin lutions appears to be an unsettled question, with no de advantage in favor of either method over the other electric energy is obtainable at the usual rates.

The author said that the harmful effects of the el bleach and the chemically prepared bleach of the laur appear to be about the same when the chemical blea very carefully prepared and handled. However, in p cal operation the carelessness with which the che bleach is ordinarily prepared causes it to destroy clo at a much greater rate than electric bleach, since th only a small opportunity for the latter to go wrong. claimed that knitting mills and artificial silk and w goods manufacturers are installing electrolytic blea equipment in large quantities. Great steamship lines used such apparatus for six years past. It appears well-informed people will ultimately demand the trolytic bleach in laundries.

Electrolytic sodium hypochloride, which is the che name for electrolytic bleaching liquor, is a powerful ilizing agent, and is used for the purification of dri water and for other disinfecting purposes. On the the supplying of energy for laundry bleachers or the plying of bleaching and disinfecting liquor in carbo the lighting plant appears to be a promising and legit

enterprise, which offers opportunity for improving the load factor at considerable profit if properly handled. Many enlightened households would eagerly seek an opportunity to obtain such a disinfectant in quantity at reasonable price.

By replacing the simple open electrolyzing apparatus just considered with one in which the products set free at the positive and negative electrode are kept separated by a porous diaphragm or by other means, caustic soda, free chlorine and free hydrogen are produced. The liquid surrounding the electrodes must be rapidly exchanged, otherwise these several chemicals will react upon one another to form the sodium hypochlorite or bleaching liquor, as in the open electrolyzer. These three products are prepared for the market in several ways. The chlorine may be absorbed by lime, which is placed on leaden shelves in an absorbing chamber. The caustic soda is recovered by evaporation and the hydrogen is either wasted or collected and sold. Another procedure is to permit the free chlorine and hydrogen gases to mix and subject this mixture to some physical influence, as for instance light, whereupon a chemical combination sets in which produces hydrochloric acid. The Niagara Alkali Company prepares all of these products in this manner. The processes yield about 1 lb. of bleaching powder and 0.5 lb. of caustic soda per hp-hour, which at the present market would produce a gross return of about 5 cents per hp-hour.

The author mentioned the use of cheap electrical energy for producing nitric acid for fertilizer manufacturers. He estimates the gross return for this purpose at from 2.5 to 3 cents per hp-hour.

Ozonized air is at present used in Germany for the sterilization of the water supply of several cities. The cost of treating water in these plants has been found to be about 0.5 cent per 1000 gal. It requires a little less than one hp-hour to sterilize 1000 gal. of water.

Another method of water sterilization in large quantities for municipal plants has recently come to the front in which ultra-violet rays of light obtained from the mercury-vapor lamp are used. In this process the lamp is made of a quartz tube instead of glass. The energy consumption in this process is 136 watt-hours per 1000 gal. Two lamps are sufficient to treat 10,000 gal. per hour.

BY-PRODUCT ICE.

Professor Morse gave estimates on an assumed case of an electric-lighting plant operating with and without an auxiliary ice plant. The conditions approximate closely those found in a certain lighting plant in Nebraska. The company serves a town of 5000 inhabitants. Coal costs $4 per ton, and water must be paid for at the rate of 7 cents per 1000 gallons. The plant cost $40,000, including distribution system. The peak load is 90 kw, and the yearly output 306,000 kw-hours. The plant runs twenty-four hours per day. The daily output in summer is 770 kw-hours, and in winter 930 kw-hours. The plant has compound condensing engines of the high-speed type and a cooling tower is employed for cooling the condensing water. The average coal consumption per kw-hour is 10 lb. when running condensing and 12 lb. non-condensing. The plant labor consists of one night and one day engineer in summer and a third engineer in winter. These men do their own firing. The yearly expenses of operating this plant considering, including one manager at $2,000 and all labor on line and in plant, together with water, oil, waste, plant repairs, taxes, fire, boiler and employer's liability insurance, office and legal expenses, are as follows:

Expenses as above	$10,000
1,530 tons of coal at $4	6,120
Depreciation on $40,000 at 8 per cent	3,200
Total	$19,320

The yearly receipts from all sources are $25,000. The plant, therefore, returns a net income on the investment of 14.2 per cent. He then assumes that a 10-ton by-product ice plant is added, which in the latitude of Nebraska will be used to make ice for six months in the year, remaining idle the succeeding six months.

A 10-ton exhaust-steam ice plant complete with machinery and chemicals in place, including a one-story brick building, 24 ft. x 53 ft., and an ice-storage room for two days' supply, will cost about $15,356. The only difference in the cost of operation so far as the lighting plant is concerned will be the two extra pounds of coal per kw-hour made necessary through operating the engines non-condensing. This extra coal he charges against the ice plant. The quantity of coal thus consumed during six months will be 131 tons, which at $4 per ton will be $524. The items of cost involved in the operation of the ice plant are as follows.

131 tons of coal at $4	$524.00
Annual depreciation on $15,356 at 10 per cent	1,535.60
7,200 gal. of cooling water per day for 180 days at 7 cents per 1,000 gal.	907.20
One night and one day attendant in ice plant for 180 days at $2.50 each	900.00
Two teams and two drivers, 180 days at $5 each	1,800.00
Four distributers of ice from wagons, 180 days at $2.50 each	1,800.00
Taxes and insurance	350.00
Rent of ground at $20 per month	240.00
Management and clerical work	1,000.00
Total	$9,056.80

Gross income from 1800 tons of ice, at 40 cents per 100 lb., $14,400. Annual cost of operating the combined lighting and ice plant, $28,376.80. Yearly receipts of combined plant, $39,400. Net annual income on total investment of $55,356 in combined plant is 20 per cent, as compared with 14.2 per cent from lighting plant alone.

Discussion.

Mr. L. J. Schwingel, of Holdredge, Neb., who operates a by-product ice plant with exhaust steam, led the discussion and expressed the opinion that an ice plant of the kind described in the paper should have considerable ice-storage space. He had tried operating without storage, but it did not work well on account of the variable demand for ice. The cost of maintaining the ice in storage is a deduction of one ton in the daily ice-making output of the plant. His plant is rated at 10 tons daily output, but is operated at 12 tons. The electrical energy required for operating pumps in the ice plant is 14 kw-hours per ton of ice made, which is high on account of the depth of 160 ft. from which cooling water must be pumped.

Mr. J. R. Cravath, of Chicago, said that he operates a combined electric-light, water-works and ice plant at Harrisburg, Ill. Of the three branches of the business he considered the ice business to return the best profit on the money invested. The design of combination of electric-light and ice plant calls for considerable study and engineering judgment as to the best kind of plant to install for a given set of conditions. Where cooling water is plentiful an absorption ice plant working on exhaust steam, like the one operated by Mr. Schwingel at Holdrege, Neb., is doubtless the most economical that can be installed. When, however, cooling water is limited or high in temperature there is a point where an exhaust-steam plant taking the exhaust from large engines will no longer be economical. It is then necessary either to install a compression plant, operated by an ammonia compressor, or an absorption plant using high-pressure steam. High-pressure steam can either be obtained from the exhaust of the pumps in the plant or as live steam from the boiler. If the plant is to be of the compression type, the question of motive power for the compressor is important. In some cases motor-driven compressors can be operated with the existing generating equipment of the electric plant without exceeding, during the summer peak, the maximum demand for lighting and motor service only in mid-winter. That is, the electric-plant equipment which would otherwise be idle in the summer can be used to drive the ice machine. Where a larger ice machine than this is neces-

sary it is advisable to install a steam-driven compressor.

Mr. C. C. Smith, of Exeter, told of some experiments made by putting electric heating units in common fireless cookers. These had given very good results. Mr. H. A. Holdrege, of Omaha, said that it is the duty of the manufacturer to develop the fireless cooker for electric uses, there being at present nothing really practical on the market.

Mr. G. A. Seabury, of the General Electric Company, said that his company has been working on cooking devices depending on the fireless-cooker, heat-storage principle for several years. A number of these are now in use at Detroit on trial, and from the results so far it looks as if something practical has been developed. These cookers require about 40 watts. Mr. Cravath expressed the opinion that the solution of electric cooking will be through the use of the heat-insulating principle of the fireless cooker and suitable heat storage so that electrical energy can be drawn from the lines in small quantities twenty-four hours per day, thus doing away with the necessity of high maximum-demand service charges. By drawing energy continuously instead of intermittently, as indicated by Professor Morse's curve, the cooker can be kept hot, and at the same time the actual demand will be very low. Mr. Seabury in answer to a question said that the cooker being developed by his company is along the lines indicated by Mr. Cravath. President B. C. Adams suggested that a very low rate can be made because of the low fixed charges by drawing a small amount of energy at a time and storing the heat. Professor Morse suggested that use can be made of a clock which will automatically turn the energy on to the cooker at hours when it is not being used for any other purposes in the house. He also suggested that if the temperature required is not over 212 deg. Fahr. the use of water will be better than soapstone for storing heat, as it stores more heat-units per pound than any other substance.

In discussing the storing of artificial ice Mr. Schwingel said that he had tried storage without refrigerating the storage. The results were not successful on account of the excessive melting. In one storage house of distilled water ice which he had filled the ice was honeycombed when the house was opened. His company now has a refrigerated storage room, kept cool by the ice machine, in which ice is stored as fast as made during seasons of the year when there is no demand for ice. Mr. R. E. Berger, of Fremont, formerly of Joplin, Mo., said that the ice and electric company at Joplin has storage for about 10,000 tons of ice. The cost of handling the ice and refrigerating this storage was found to be a large proportion of the cost of manufacture.

ELECTRICALLY OPERATED EMERGENCY DAM AT THE "SOO" LOCKS.

To protect its important ship locks at Sault Ste. Marie, Mich., from accident due to carrying away of the gates, such as occurred in the locks on the Canadian side of the "Soo" rapids two years ago, the United States government has just completed a modern electrically operated emergency dam of the swing-bridge type near the head of the lock canal, replacing the lighter protective dam formerly installed there.

The new dam structure is 308 ft. between centers of shore abutments, and is pivoted on a central island pier, giving a 108-ft. clear channel on each side. In general appearance the emergency dam resembles a swing bridge except for the extraordinarily heavy construction of its steel members and the presence of the wicket winding drums and mechanism on its deck. The structure is 25 ft. wide between truss center lines and weighs complete 2100 tons.

In case of accident to the gates of either the Poe or Weitzel locks, permitting the discharge of the flood on Lake Superior to the river below the locks, under the -ft difference in level, the emergency gate, located in the u er canal approach to the locks, is arranged to be swung a oss the channel and locked into the shore abutments, while on

Fig. 1—Emergency Dam at American "Soo" Locks in Position.

its deck thirty-two wickets, each 6 ft. 6 in. wide, are dr in succession until the channel flow is entirely shu The wickets provided for this purpose are mounted t on rollers between steel girders hinged from the stream chord of the structure, but normally folded up the bridge. Before dropping the girder frames the w are first run out to the upper or hinge end of the fr which are then lowered and seat themselves again 12-in. x 12-in. concrete-anchored oak sills at the bott the channels. After the empty frames have been dr into position, the sliding wickets are then lowered frames, gradually arresting the flow of the water. new emergency dam has been tested out under flood tions almost equivalent to breakdown of the lock gate a 20-ft. head and has shown itself fully capable of trolling and stopping the flow.

Electrical energy for operating the swing motio wicket mechanism is obtained from the water-power of the Edison Sault Electric Company in the rapids St. Mary's River, ½ mile distant. The 60-cycle, phase energy is transmitted at 2300 volts, brought th ugh cables in a shaft tunnel beneath the north channe and

Fig. 2—Clutch Mechanism and Hoisting Reels for Wicke and Frames.

stepped down to 440 volts by three 100-kw transfo ners mounted on a concrete base near the center pier on th mid-channel island. This tunnel was constructed for the wer cables, instead of employing submarine lines acro the channel, in order to permit access to the dam for op ting

[illegible]t case of flood. The tunnel, which is reached by vertical [illegible]ts at its ends, is 3 ft. wide and 6 ft. high, and its floor is [illegible]out 33 ft. below the water. The tunnel is kept free of [illegible]age water by a float-controlled, motor-driven pump.

[illegible]he swing motion of the dam is operated through gear-

[illegible] —Dam in Position, Showing All Frames Lowered and Wickets Being Closed.

[illegible] two 52-hp motors, either one of which is sufficient to [illegible] the structure in a heavy wind. Either or both motors [illegible] manipulated from one or both of the duplicate con-[illegible] provided by changing the position of a double-[illegible] switch. The sixteen frame and wicket mechanisms [illegible] half of the dam are operated from a pair of line [illegible] extending out across the spans from the central deck [illegible]. Through clutches each shaft is driven by a 150-hp, [illegible] induction motor, a third clutch serving to inter-[illegible] the two shafts so that either or both motors may be [illegible] work the entire gate mechanism. The girders [illegible]wickets are operated from these shafts by lever-con-[illegible] clutches.

[illegible]e entire gate structure can be swung across the stream [illegible]s than ninety seconds and it is estimated all of the [illegible]ts can be lowered in less than sixty seconds more, [illegible] is the least time in which it would be practicable to [illegible]upt such a flood of water.

[illegible]e work at St. Mary's Falls Canal is in charge of Col. [illegible]cD. Townsend, Corps of Engineers, United States [illegible]. The dam was designed in the Sault Ste. Marie office [illegible] the direction of Mr. L. C. Sabin, general superinten-[illegible] his assistants, Messrs. I. DeYoung, C. A. D. Young [illegible] M. Edmands, being mainly responsible for the de-[illegible] The dam was built under contract with Mr. Lawrence [illegible]eaning, Variety Iron & Steel Works, Cleveland, [illegible]vorked out the details of trusses and machinery.

[illegible]H PRESENT STATUS OF THE LIGNITE GAS PRODUCER IN TEXAS.

[illegible]ghout the Southwest, and particularly in Texas, [illegible]nite occurs in vast deposits, the development of a [illegible]ry gas producer capable of handling low-grade [illegible] has been looked forward to with the keenest interest [illegible] operators, especially in the smaller stations. Dur-[illegible] last four or five years manufacturers have been [illegible] experimenting with Texas lignites in their own fac-[illegible], and two years ago several different producer plants [illegible]anteed to handle low-grade fuels successfully were [illegible] on the market by their respective makers.

N[illegible] after about two years' practical experience with the [illegible] gas produced in use it is interesting to note the varied results obtained in the Southwest with these new prime-mover units. Certain operators continue really enthusiastic at the results of producer operation; others insist that from its present form the apparatus will have to be much improved before the producer outfit will become a real competitor of the boiler plant. In several stations, at least, where producer-gas engines were installed this equipment has been ripped out bodily, presumably on account of dissatisfaction with its operation. In these cases steam engines supplied from lignite-burning boilers have replaced the producers. In some other former lignite-producer plants bituminous coal has now been wholly or partially substituted for the lignite. Several manufacturers have also practically withdrawn their lignite producer equipment from the market until its defects can be remedied.

The chief objection urged against lignite as a fuel material is the varied range of moisture which successive shipments from the same mine may carry. This lack of uniformity in the lignite results in inequalities in the gas given off and in other difficulties in producer operation. Trouble is also reported from producer plants required to meet rapid changes of load. The response of the producer to an increased demand for gas production if the load rises suddenly is generally quite sluggish and the engine may go dead from insufficient fuel supply. As most of the producers installed have been of the suction type, it seems out of the question to attempt to provide fuel-gas reservoir or storage capacity to meet sudden changes in load. This characteristic of the lignite producer to balk under irregular load-curve conditions ill adapts the producer engine to applications for electric-railway purposes in many cases where its low fuel cost and other advantages would make it very useful.

In discussing the lignite producer before the recent Southwestern Electrical Association convention at Houston, Tex., Mr. W. B. Head, general manager of the Stephenville (Tex.) Light & Water Company, recounted his own highly satisfactory experience during four years' operation, twenty-four hours daily, of a 100-hp up-draft producer plant doing both electric lighting and water pumping. The performance of this equipment Mr. Head characterized as unqualifiedly successful, whatever troubles were met with having been of a purely mechanical nature such as might occur with any internal-combustion engine. The Stephenville plant is run continuously twenty-four hours per day except Sundays, when it is shut down twelve hours for overhauling. The cost of fuel at 80 per cent load-factor has averaged under 5 mills per kw-hour. Mr. Head pointed out that, unlike steam plants of equivalent sizes, producer plants of even very small ratings share the high efficiencies and the economies of the larger sizes. While there are some cases, said the speaker, where he would not recommend lignite producer-plant installations, as for electric-railway work, yet in general he referred to the lignite producer as the coming form of power in the Texas district and declared that a dollar's worth of lignite contains more available potential energy than any other form of fuel.

Dr. A. C. Scott, of the University of Texas, remarked that the lignite producer may make possible electric service in many small communities where the operation of a steam plant would be out of the question. Dr. Scott also reported some analyses which were made on the moisture content of lignite samples. No sample taken from the cars showed more than 30 per cent moisture, he said, while lignite purposely soaked in water absorbed only 32 per cent of its weight. Dr. Scott recommended storing the lignite before use, allowing it to dry before firing into the producer.

In the discussion which ensued it was brought out that lignite producer-engine plants are operating successfully at Smithville, Mart, San Angelo, Blooming Grove and Corpus Christi, Tex.

GAS-PRODUCER PLANT EXPERIENCE AT HURON, S. D.

The Huron (S. D.) Light & Power Company has in operation a 450-hp producer-gas-engine plant which has now been in service a little over a year. The equipment comprises Muenzel producer-gas engines driving 2300-volt, three-phase, 60-cycle Fort Wayne alternators. A 300-hp twin engine drives a 200-kw generator, and a 100-hp single-cylinder engine, to be twinned later, drives a 100-kw generator. The fuel gas for these sets is obtained from a group of three 150-hp producers, equipped with wet and dry scrubbers, and so arranged that any of the producers or scrubbers can be used, as the station demand requires.

In describing his experience with these producer engines Mr. A. W. Wagner, manager of the Huron company, during a recent discussion, pointed out also some of the conditions required for successful producer-plant operation.

In planning a gas-engine plant, said Mr. Wagner, there are several items to which particular attention should be given. The foundations for the engines must necessarily be heavy. Some installations have suffered much, due to the fact that their foundations were not adequate. The same holds true of the building. Owing to the sudden air pressures a frail building would soon show the effects of operating gas engines. Good ventilation should be supplied for the comfort of the operators and for cleanliness.

The piping should be accessible, especially the exhaust pipe to facilitate replacing. Care should also be exercised to obtain sufficient gas for all engines under the most severe conditions. Neglect to do this will cause trouble due to engines robbing each other of gas, both in starting and during heavy loads.

The exhaust of gas engines will prove annoying if not properly taken care of. The introduction of water into the exhaust pipe will eliminate the noise, but should be barred on account of the deteriorating effect on the pipe and the danger of having an exhaust pipe filled with water. A properly constructed underground chamber, probably with baffling walls, will effectively eliminate exhaust noises. Any muffling device installed should be of sufficient size to prevent back pressure.

When the Huron plant was started the engines were subjected to operation under various loads, taking indicator cards to determine the load. The engines are rated in brake horse-power and guaranteed for 15 per cent overload. This is really a normal rating at the most efficient point of operation. It is not thought advisable to figure on operating the engines on overload, although during the test the engines carried considerable overload with uniform operation [illegible] drop in speed. The installation has now been in operation for thirteen months. "We have had our troubles, be sure," said Mr. Wagner, "but they have been less than we anticipated." Most of the trouble was with oiling devices and bearings. When the load is heavy there has been trouble with pre-ignition, due, no doubt, to the higher compression in the cylinder. This, however, can be prevented by more careful attention to the mixture of gas and air as the load comes on. There was also trouble with the engines and gas when the supply of water was inadequate. [illegible] remedy for this was obvious. With proper attention to the governor, the regulation of the engines is good, and especially good with the twin engine.

The quality of gas affects the operating results. Un[illegible] and good gas requires good coal. The Huron plan[illegible] used anthracite pea coal only. Good results have bee[illegible] ported from the use of a mixture of pea and buckw[illegible] and also straight buckwheat. The coal should be stor[illegible] it will not become wet; and if it is dirty it shou[illegible] screened. During the winter there is no trouble in obta[illegible] clean, dry coal at Huron, but toward spring the coal bec[illegible]

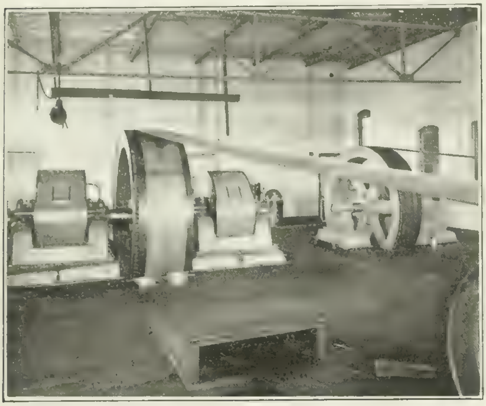


Fig. 1—Producer-Gas Engine in Huron (S.D.) Plant.

Fig. 2—300-hp Twin Gas-Engine-Driven Generator S[illegible]

quite inferior, showing as large a difference as 25 pe[illegible] in thermal value.

Very good results have been obtained with bitum[illegible] coal and even lignites, using special producers and [illegible] bers, as there are more impurities (especially tar) in [illegible] coals. However, local conditions, as to cost of coal [illegible] ered and cost of handling, should determine which st[illegible] producer should be installed to obtain the best econo[illegible]

At Huron the attendant pokes the producers, shak[illegible] grates and replenishes the coal about every three [illegible] The ashes and clinkers are removed from the bottom [illegible] fire every twenty-four hours. The producer men soo[illegible] that they can supply good gas only by careful handli[illegible] the producers. If the poking is not done properly [illegible] leave channels in which the passage of gas and the [illegible] bustion of coal will localize. If the fuel is not well poked and distributed it will not support itself long enou[illegible] to remove the ashes and clinkers in the daily cleaning. The formation of clinkers, due to poor fuel or improper cleaning and poking, has been the cause of much trouble with gas-producer plants. The vaporizer should be washed out about once a month. No repairs have yet been made on the Huron producers. After thirteen months' operation they appear to be in as good shape as when started. The excelsior in the dry scrubbers has been replaced, as should be done about twice a year. The wet scrubbers should have the coke replaced about once a year, depending upon the

...uity of coal used and the temperature to which the gas is cooled. For washing and cooling the gas and cooling the engines about 20 gal. of water per hp-hour is required. The consumption of lubricating oil for gas engines is ar... However, with care and the use of a good quality of oil it has been possible to reduce the oil bills materially.

Before going into the cost of operating gas engines the position which the gas engine takes in South Dakota should be pointed out. The water there is about as bad as can be found for boiler-feed purposes. It seems almost impossible to get rid of the scale, and hence the cost of maintaining boilers is high. On the other hand, the area in which flowing wells can be obtained is large, giving an abundant supply of cylinder-cooling water at no cost for pumping.

During the past year the Huron plant has operated at a ... load-factor of about 20 per cent on the ratio of ... output to the twenty-four-hour capacity of the plant. ... anthracite pea coal costs $8.40 per ton in the bin, the freight rate being $2.80 per ton. The monthly salary of the ... men employed is $335. As the company has its own flowing well there is no charge for water, the first cost of the well being included in the cost of the plant. The original

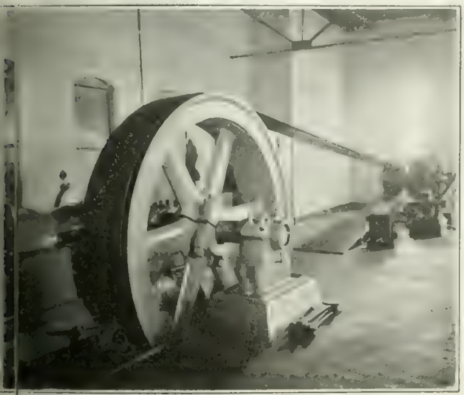


Fig. 3—100-hp Single Gas-Engine Set.

...al Huron installation included a gasoline engine for operating the air compressor and the blower for the producers. The engine has been replaced by an electric motor, retaining the engine as an auxiliary. This has considerably decreased the cost of blowing the producers and compressing the air for starting the engines. The labor charge is probably no more than it would be for a steam plant of the ...an rating. Charges for oil and waste are considerably larger than for a steam plan, probably twice as much, while the costs of packing, etc., are considerably ...

The results at Huron during the past year show a consumption of about 1.75 lb. of anthracite pea coal per hp-hour at the switchboard. Assuming the average efficiency from wheel to switchboard to be 50 per cent, this would be equivalent to a consumption of 1.4 lb. per brake hp-hour. The operation of the producers is found to be most economical when well loaded, while the engines work most satisfactorily with a surplus capacity of producers. This fact, and the time required to put into operation producers that have been standing by, brings up the question of gas storage. Local conditions determine the advisability of installing a tank for storing gas, but in all cases assist in making the installation more reliable. The objection, however, to having a supply of city gas available is that the operators, knowing that they have something to fall back on, may neglect their producers more than were they entirely dependent upon them.

In closing Mr. Wagner remarked that the reliability of a gas-producer plant depends upon its construction and the attention paid to it in operation. Without exaggeration, he said, he thought that with due attention a properly installed gas-producer plant will prove to be almost as reliable as a steam plant.

DEVELOPING MISSISSIPPI RIVER WATER-POWER AT KEOKUK, IA.

After six years of disappointing delays actual work on the great water-power dam developing the Des Moines Rapids in the Mississippi River near Keokuk, Ia., began in earnest with the present year, and the engineers in charge now confidently promise completion of the first 120,000-kw installation by July, 1913.

The Keokuk development, as outlined in the *Electrical World* of May 19, 1910, will comprise the construction of a concrete dam 4700 ft. long and 35 ft. high, flooding the present Des Moines Rapids and thus creating a head of from 25 ft. to 32 ft. for the power house, which is designed for an ultimate capacity of 200,000 kw. The building, which is on the Iowa side, running at right angles to the main dam, will be 1400 ft. long and 125 ft. wide. The construction of the dam will improve navigation in the Mississippi, replacing the present government canal and three locks around the rapids by a single lockage into the broad, deep lake created.

Preliminary work preparatory to the construction of the dam and power house is practically completed, and work is already well advanced on the Illinois end of the dam proper and on the wheel-pit excavations beneath the future power house. Protected by a cofferdam of rock-filled cribs, 36 acres of riverbed on the power-house site have been bared and pumped dust-dry, while an air-compressor power plant, electric-light plant, repair shop, offices, railroad drawbridge, concrete plant, steam shovels, conveyor hoists, etc., are already installed on the Iowa side. The work of excavating for the wheel pits is shown in Fig. 1. Already a prism 100 ft. wide, 30 ft. deep and 300 ft. long has been removed, and a similar section to the south is half completed.

Compressed air is used as motive power for all drilling operations and for the gantry cranes and hoists, dam traveler, etc. This air is piped from the compressor plants located on each side of the river, and is supplied to the movable structures through hose couplings which permit a few feet of movement without repiping. In Fig. 1 the compressed-air cranes are shown hoisting the stone spoil and dumping it onto cars, which haul it to the fill required by the relocation of the Burlington railroad tracks, whose present level will be submerged by the upper pond. The stone is loosened by drilling and blasting, while a steam shovel loads the material onto the crane spoil boxes, as shown in the picture. At the left and background of the illustration, inclosing the excavation, is seen the cofferdam which holds back the waters of the Mississippi.

On the east or Illinois side of the river construction of the dam itself is well advanced, as shown in Fig. 2, from a photograph taken July 13. Steel forms are used, the concrete being poured from the cantilever arm of the huge traveler crane which rests on the finished work. The small crane in the foreground is used for erecting the forms, and just behind the traveler is a similar small crane for dismantling the forms from around the finished arches. The concrete is mixed in the construction plant on the shore and loaded into 4-ton buckets on narrow-gage trains running out onto the work. Hoists pick the buckets from the cars and carry them on the trolleys to the point where pouring is being done. The operators for the three main trolleys are in cabins at the base of the cantilever and

manipulate their controllers under instructions by telephone from the pouring gang. Compressed air is used as the motive power for all this work. Twenty-two of the 36-ft. arches are now completed. The work is electrically lighted

Fig. 1—Excavating Power-House Wheel Pits in Riverbed near Iowa Shore.

throughout from engine plants in the two construction groups.

The building of the Keokuk dam and water-power plant is being carried out by the Hydraulic Engineering Company of Maine, a subsidiary organization of the Mississippi River Power Company, which owns the development and which succeeds the former Keokuk & Hamilton Water-power Company. When the project is completed it is understood that the Stone & Webster interests will operate the plant.

Transmission lines will be built to a number of nearby towns and cities, which have contracted for power. The principal line, however, will be the 100,000-volt transmission to St. Louis, 140 miles distant, where 66,000 hp has already been contracted for. Four circuits on two separate pole lines will probably be provided to the city limits, where the energy will be delivered to the substation of the Mississippi River Power Distributing Company, a North American Company subsidiary, for distribution to the local power-using and distributing companies.

The officers of the Mississippi River Power Company are: President, Mr. Edwin S. Cooper; vice-presidents,

Fig. 2—Traveler Crane Pouring Concrete on Illinois End of Dam.

Messrs. Hugh L. Cooper and Charles F. Wallace; treasurer, Mr. Henry B. Sawyer; secretary, Mr. Clement R. Ford. Mr. Hugh L. Cooper is chief engineer of the company and is in general charge of the work at Keokuk.

NEW TURBINE STATION FOR LACLEDE GAS COMPANY, ST. LOUIS.

The Laclede Gas Company, St. Louis, which has 00 electrical customers, is completing its new 9000-kw steam-turbine station at its North Side gas-making plant, the turbines to use boiler equipment in conjunction with the water-gas generators. For several years, since the destruction of its former power plant, the Laclede company has purchased its electrical energy from the Union Electric Light & Power Company.

The new station contains eight 500-kw boiler units, which will furnish steam jointly for the water-gas generators and turbine plant. Four of these boilers are equipped with chain grates and four with inclined grates and all are arranged with superheaters. The boiler-room is surmounted by four steel stacks, 110 ft. in height. 1000-kw and two 4000-kw horizontal Curtis steam turbine sets are installed, driving 2300-volt, 60-cycle alternators. For supplying 500-volt direct-current energy the Laclede company's power circuit, to which a number of elevator motors are connected, a pair of 500-kw synchronous motor-generator sets have been provided in engine-room. These machines, together with a 30 rotary converter driven by an exhaust-steam turbo-alternator at the gas company's South Side plant and a 50 motor-generator in an outlying substation on the west, feed into the local 500-volt "power" network. The Worthington condensers for the turbines are supplied with Mississippi River water through a pair of 20-in. pipes paralleled, and discharge into the river through a newly laid 30-in. main. Boiler-feed water is obtained from city supply. The switchboard for the station is mounted on an overhead gallery, carried by the concrete oil-switch and busbar structure. Mr. George B. Evans is chief engineer for the Laclede Gas Company and Mr. William laher is electrical superintendent.

ADDITIONAL LARGE BOILER AND TURBINE UNITS IN DETROIT'S DELRAY STATION.

The third 14,000-kw vertical steam-turbine set has been placed in service in the new addition to the Delray generating station of the Detroit Edison Illuminating Company. Further extensions to the capacity of this plant then be made by replacing the original installation of 3000-kw turbo-units with 8000-kw sets. The Delray plant is located on the shore of the Detroit River several miles below the city, where it was originally placed with the idea to utilizing its exhaust steam for evaporating the salt brine mined in this locality, but with the advent of high condensing turbine efficiencies this plan has not been carried out. The output of the station, as three-phase, 60-cycle energy, is transmitted to the several stations at 20,000 volts through underground cables, eral trunk lines of which are each 7 miles in length.

The Detroit Edison Company has recently attracted particular interest by its use of very large steam boilers. Several of these nominal 2300-hp units have, on test, carried to steam outputs of nearly 8000 kw each, and a pair of the boilers show no difficulty in furnishing steam to a fully loaded 14,000-kw turbine set. The design of the boilers and settings for these 2300-hp units, several additional batteries of which have just been installed at Delray, was worked out by Mr. Alex. Dow, president and general manager of the Detroit company, in conjunction with the representatives of the manufacturers and engineers, and some recent tests of these huge boilers are said to have divulged such surprising results of efficiency and output that the investigators rechecked their instru-

points and repeated the tests with the same results. The conclusions reached by a study of these boilers are promised in a paper to be read before the American Society of Mechanical Engineers this fall by Dr. Jacobi.

PRACTICAL DEVICES FOR SAVING LABOR IN THE OPERATION OF STEAM TURBINES.

By L. B. Webster.

In the modern power plant the change from the reciprocating engine to the high-speed condensing turbine has resulted in greatly reducing the quantity of oiling, cleaning and wiping necessary in the engine-room. The reason, of course, is the absence on the turbine of most of the [illegible] work and small rapidly moving parts found on reciprocating engines. In many plants, however, the substitution of the turbine for the engine has not resulted in any reduction of the engine-room working force, which most engineers would suppose to be the natural consequence of reducing the quantity of working parts to be cared for.

The reason for keeping more men in the engine-room than actually necessary to do the routine work is because the auxiliaries of the turbine must be constantly watched to prevent any shut-down by them for a period long enough to cause a stoppage of the turbine itself. A removal of the pressure from the oil step bearing or a filling of the surface condenser so that the condensed water is carried over into the air pump causes such serious damage that engineers, as a rule, feel that they cannot take chances by letting the turbine's auxiliaries go unattended for any great length of time. Such auxiliaries as the oil pumps or the wet-vacuum pump are often tucked away in corners where their movements cannot be readily observed. Unless an oiler pays special attention to them he cannot tell in his trips around the engine-room if they are working properly or not.

The accompanying sketches show how the engineers in some modern turbine plants have dealt with the problem of being able to tell just what the various troublesome auxiliaries are doing and how they are working, without going to the expense of keeping a man constantly on watch over them.

Fig. 1 shows an accumulator, which keeps constant pressure in the oil step bearing, connected to the spare oil pump. By means of a weight A, attached to a cord B, which is run over a pulley C, and wound around a spool D, which in turn operates the steam inlet valve of the extra

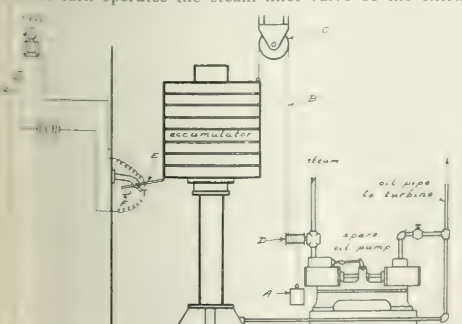


Fig. 1—Arrangement of Accumulator for Constant Oil Pressure.

pump, this extra pump is thrown into service whenever the failure of the regular pump to maintain sufficient pressure allows the accumulator to fall. In order to notify the engineer on duty whenever the accumulator falls enough to throw the extra pump into service, an electric circuit, containing a bell and a red lamp, is closed by the accumulator itself pressing down on a wooden strip E. To this strip E is fastened a counterweight F, so as

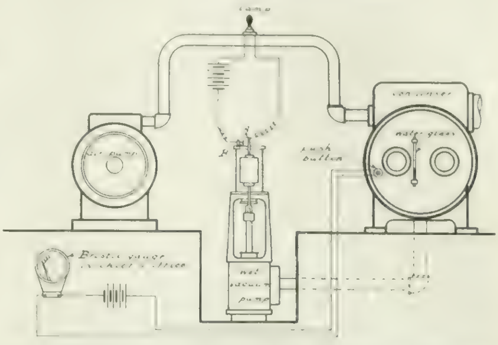


Fig. 2—Arrangement for Checking the Quantity of Condensed Water in a Condenser.

to prevent a contact being made until the accumulator has fallen a certain predetermined amount.

Fig. 2 shows a vertical-lift, wet-vacuum pump, which at times would stick and allow the condensed water to rise too high in the condenser, thereby endangering the air pump. A red lamp on a suitable electric circuit was made to flash intermittently by attaching one side of the circuit to a contact point A, which was fastened to an extension of the slide valve and moved up and down with it, and the other side to a strip of copper B so fixed that the contact point would rub across it twice during each complete stroke of the pump. Whenever the lamp either failed to burn at all or else burned continuously, the engineer knew the pump had stopped working. As long as the lamp kept up a regular flickering the engineer on duty knew that everything was all right.

In another plant, where the same danger of the condensed water in the condenser rising high enough to be pulled over into the air pump was present, a watchman's time detector in the shape of an old Bristol gage was rigged up as shown in Fig. 2. By calculation and test it was found that under ordinary load conditions the quantity of condensed water which could collect in fifteen minutes would not be sufficient to fill the condenser high enough so that the water could be drawn over into the air pump. A push button was placed beside the water glass on the condenser and the oiler on duty was instructed to press it every fifteen minutes. Connecting this button with the Bristol gage, which was placed in the chief engineer's office, made possible the collection of permanent records showing that the oilers had inspected the condenser as often and as regularly as required to insure the safety of the apparatus.

ELECTRICAL OPERATION OF QUARRY AND STONE-CRUSHING PLANT.

Mr. George Patnoe, general superintendent of the Dolese & Shepard Company, which has a large electrically equipped limestone quarry and stone-crushing plant at Gary, Ill., addressed the Electric Club of Chicago on July 19 on "The Use of Electrical Energy in Stone Crushing and Quarrying." The plant described is a new one, and Mr. Patnoe took up the various applications of electricity in it. In relation to the drilling of the rock for blasting experiments have shown that electrically driven well drills will do 25

per cent more work than steam drills at 50 per cent of the cost. Experience at this quarry has demonstrated that electric drills are a great success.

After the rock is blasted out it is transferred to the crushing plant by means of semi-automatic electric tramways. Twenty-five cars are used on several lines of tramways and they are operated by two men in signal towers. These cars have a maximum carrying capacity of 40,000 lb. each. It would take at least seven steam locomotives to do the work of this electric tramway system, which has proved very efficient. The cars are individually equipped and are not operated in trains, thus insuring more uniform feeding of the crushers.

The rock is dumped into a crusher at the rate of 15 tons a minute. All the machinery used about the plant is electrically driven, the motors ranging in size from 5 hp to 300 hp. It is important in stone-quarry operation by electricity to allow a liberal margin in selecting the size of the motors. To wash the crushed stone intended for use in concrete a plant has been installed. This washing plant is a recent adjunct and the flexibility of electric drive is conspicuously illustrated by it, as the power requirements for the new plant are easily taken care of.

Electrical energy is purchased from the Economy Light & Power Company, of Joliet. The operating cost for electrical energy is about the same as for steam operation, being 3⅝ cents to 3¾ cents a cubic yard of crushed stone produced. This figure includes all power-operating costs except for the steam shovel which is used. However, the electric drive has manifest advantages over steam operation in enabling labor to be used more economically in case it is desired to shut down a portion of the plant. When this is considered, and also the interest and depreciation on the steam plant displaced, the cost of electrical energy for operating the establishment is really less than the corresponding cost using steam engines. Mr. James H. Delany presided at the meeting, and Messrs. John W. Mabbs and C. W. PenDell also took part in the discussion.

IMPROVING A BELT LINE.

By W. H. Wakeman.

Fig. 1 illustrates a belt drive which was installed in a certain shop several years ago and has proved satisfactory ever since, so far as the machinery is concerned, but owing to local conditions a change is now desired. The flywheel of an engine is shown at 2, which is belted to the main pulley on a jack shaft, 3. Near the other end of this shaft there is a larger pulley which drives a dynamo, 4. Between these two pulleys a smaller one is located, and this drives 5, which is on a long main-line shaft extending down through the shop.

The objections to this drive are as follows: The jack shaft 3 occupies floor space that is now required for other purposes. While it is high enough for a man to walk under, still it renders the floor space under it practically useless, and indirectly it interferes with the use of floor space beyond it. The horizontal belt extending to 5 is also objectionable. Taking these two features into consideration, a comparatively large amount of floor space is rendered useless. The pulley 5 includes a clutch, and therefore it is possible to stop the line shaft at pleasure so far as this feature is concerned. But two other departments are driven from this shaft, and if power is not wanted in these, either one may be stopped by means of a clutch, which is not shown; while this is satisfactory, if power is wanted in one department, 5 must be run to supply it.

The main-line shaft which carries 5 also carries 56 other pulleys and belts. As power is not wanted every hour in this department, the manager wishes to shut it down at times, but cannot do so because power is required in one or both of the departments beyond this, which would be stopped if the clutch at 5 was pulled out. One of these is to be operated by electricity at some future time, which disposes of that part of the problem, and an improved plan for driving the other will be explained below.

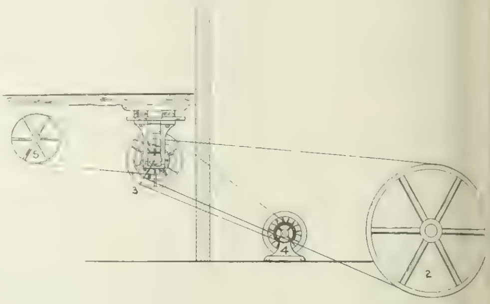


Fig. 1—Belt Drive with Jack Shaft Located at Ceiling.

Fig. 2 shows the same flywheel 2, but the jack shaft 3 is now located in the basement, where it occupies room that cannot be utilized for other purposes, leaving the floor space above entirely clear. The dynamo 4 is driven practically the same as before, and 5 is operated by a vertical belt which occupies but little floor space, especially as it runs near one of the large posts which support the floor above. It can be boxed in and rendered noiseless.

Another belt is laid on top of the driver of 5 and extends to 6, thus turning shafting in the department above. The idlers 7 and 8 guide these belts and hold them in place. Bearing in mind that both 5 and 6 are clutch pulleys, it will be seen that either department may be stopped at pleasure without interfering with the other. There are always objections to a vertical belt, but they do not apply in this case, because the same belt that runs vertically also runs nearly horizontally, forming what may properly be called an "angle belt"; hence, it can be operated in a loose condition and still transmit the required power. Belts that are to be used under these conditions should always be made endless, as any kind of lacing is objectionable.

The hangers which support the jack shaft 3 in Fig. 1 are also used in Fig. 2, but they are reversed or converted

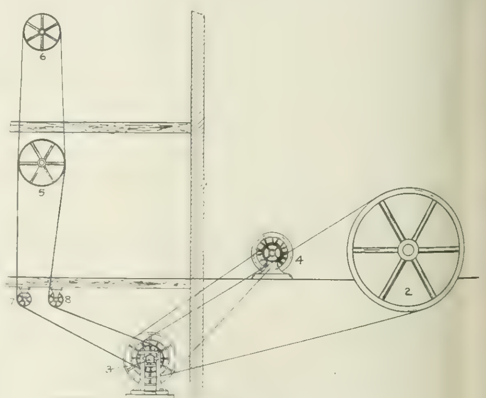


Fig. 2—Jack Shaft Located in Basement.

into floor stands. The boxes are changed in order to keep the slots on the upper side when the hangers are turned over. These hangers might have been hung to the floor timbers directly over their present position, but this would bring the main belt too high.

LETTERS ON PRACTICAL SUBJECTS

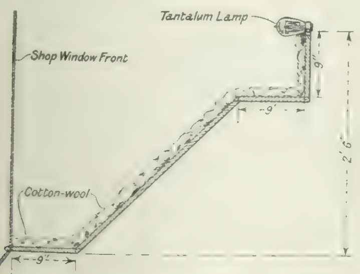
COUNTING SHAFT REVOLUTIONS.

When one wishes to know the speed of a revolving shaft ıd no speed indicator or tachometer is at hand, the num- of revolutions may be found by holding the finger or pencil against a key-seated portion of the shaft and count- g the number of times the keyway passes under the finger. his familiar method is good enough for speeds below 200 p.m., but when the speed is greater than this it is still ssible to count the revolutions by considering the blows the keyway against the finger as occurring in groups of o or three, and counting only every second or third blow. y counting in triplets and multiplying the result by three eeds considerably higher than 500 r.p.m. may be ascer- ned with little difficulty.

Newport, Ky. EDWIN C. WRIGHT.

DANGER OF BROKEN LAMP NEAR INFLAMMABLE MATERIAL.

The accompanying illustration shows a diagram of a ow window lighted by tantalum lamps, the breaking of e of which caused a fire resulting in loss both of life ıd property. Two shelves were joined together by a pping board surmounted by a vertical board 9 in. high. ll the shelves and boards were covered with cotton wool on which were displayed celluloid combs, jewelry, etc. n the top of the vertical 9-in. board were clamped lamp lders arranged so that the lamps would be at right angles the board and projecting over it into the window. Where e lamps projected the cotton wool was cut away in a rcle. There were in all about twenty 16-cp tantalum mps connected two in series across a 240-volt circuit by eans of flexible wire. The lamps were spaced about 1.25 between centers. While reaching into the window con- ning the lighted lamps a clerk is supposed to have broken e of the lamps and the hot filament ignited the cotton and lluloid and within a minute the whole window was ablaze. s to the actual cause there appears to have been some ubt, but experiments conducted subsequently showed that e supposition was tenable and that incandescent lamps in- lled under the conditions mentioned are a source of nger. In one experiment a lamp was suspended a dis- nce of 3 in. over dried cotton wool and the bulb broken a hammer. The broken filament instantly ignited the tton wool and no fuses were blown. In another experi- nt a lamp was suspended 3 in. above cotton wool thinned t on which rested a celluloid telephone mouthpiece. On



Dangerous Show-Window Arrangement.

eaking the lamp both the wool and the celluloid immedi- ely caught fire. The incident shows the danger of bring- g flimsy decorative material near lamps, especially in ventilated windows where the heat ordinarily would use the material to dry thoroughly and make it more of a menace than one would suppose. The Underwriters have ruled against flexible cord in show windows, and if the installation had been made in accordance with the rules it is safe to say no fire would have resulted. Persons are too prone, however, to underestimate the amount of heat given off by an incandescent lamp, some going so far as to imagine that the heat is negligible. If such persons would step inside the ordinary show window which is lighted by lamps placed in reflectors over the window and closed at the rear they would be instantly convinced of the fact that incandescent lamps give off considerable heat.

Toronto, Can. I. CLYDE.

TRANSFORMER MOUNTING FOR MILL SERVICE.

The accompanying illustration shows the mounting of two transformers arranged to supply energy to 220-volt,

250-kw Transformers.

three-phase motors having an aggregate rating of 110 hp. The motors are installed in a grain elevator and used in connection with corn shellers and feed mills. They range in rating from 5 hp to 25 hp. The energy is supplied from the mains of the Denison Light & Power Company, of which Mr. W. A. Everett is secretary and general manager. The wiring is in conduit and the job was installed by the lighting company. The poles are 35 ft. high with primaries on top on double cross-arms. The transformer platform is 15 ft. from the ground and is made of two pieces of angle iron with pieces of 2-in. x 12-in. boards placed on top. The second set or lower cross-arms are about 6 ft. above the transformers and one side is reserved for the primaries and the other side for the secondaries, with fuse blocks for the primaries at the left-hand end. The primary circuits consist of No. 6 wire, and the secondary circuits are made up of 500,000-circ. mil cable. Altogether the job has proved very satisfactory and constitutes a means for mounting transformers not often used.

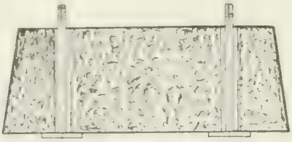
Denison, Tex. O. P. SAMMONS.

METHOD OF SETTING FOUNDATION BOLTS.

It is often convenient to have a little adjustment to foundation bolts, as where the fit is close it is apt to be difficult to get a machine in place. This end can be accomplished by placing tin tubes around the outside of the bolts, as shown in the accompanying illustration, the tubes being about twice the diameter of the bolts. The bolts are held in place while building the foundation by a wooden template. After the foundation has set and the template has been removed the foundation bolts have a lateral movement in any direction equal to the difference in diameters between the bolts and the inclosing tubes.

When it is desired to bolt a piece of machinery to an old foundation it is usual to drill holes in the foundation

for the bolts and fasten them in with melted lead, sulphur or cement. To avoid the trouble of building an accurate template the bolts should be about 1 in. too long and the machine itself used for the template. The foundation bolts are put in the holes drilled for them and the machine then



Method of Setting Foundation Bolts.

set in place, keeping it about 2 in. off the foundation with some strips of board. A tin trough that will go between the base of the machine and the foundation is then used in pouring the lead or other material into the bolt holes. After the lead has set around the bolts the machine can be let down on the foundation and if it is found that the bolts stick up too far they can be cut off with a hack saw.

Kenyon, Pa. F. M. NICHOLS.

A PECULIAR CRANE-MOTOR ACCIDENT.

A rather unusual accident has twice occurred to a crane motor in a large shipbuilding plant not far from Boston. This motor is rated at 45 hp, being the bridge motor on one of the largest gantry cranes in the country. The crane moves along a 500 x 150 ft. wharf, straddling practically the whole width. The motor stands on a small platform near where the rear legs join the main bridge and drives one wheel on each rail by means of shafting extending down the legs, fitted with bevel gears. One of the main features of this crane is an 80-ft. boom which can be lowered to a horizontal position and is used to place material aboard ships lying at the dock. This boom, together with all the top-work of a structure that can handle 80 tons or more at a load, makes up a surface which offers considerable resistance to the wind. On a morning when a heavy gale was blowing down the wharf the crane, when moving in the same direction, blew out fuses and circuit-breaker and came to a sudden stop. Investigation showed the banding wire on the motor armature broken and the windings spread and badly torn. So tightly was the armature wedged against the pole-pieces that it had to be driven out. The wind had not only relieved it of all load, but had probably actually aided its rotation. Several months later, during a storm coming from the opposite direction, this accident was repeated. No break is employed on the bridge drive. While any series motor might, perhaps, be apt to do this if run without load, in this case the type of motor contributed largely to the accident. This motor is of standard make and of the iron-clad type quite generally employed on cranes in the smaller sizes, but is not of the railway model ordinarily furnished for heavy work. The armature diameter is too large for any speed above 950 r.p.m., and the ratio of the gearing had evidently been designed for a very easy drive under all conditions.

Taunton, Mass. R. P. IRVING.

REPAIRING FAULTY CABLE BY MEANS OF A TRANSFORMER.

A small intercommunicating telephone installation gave considerable trouble, and an investigation and test with a Wheatstone bridge indicated very plainly that the trouble lay in the cable connecting the various telephones. The test showed the insulation resistance between the various wires to be quite low, and a careful examination led to the conclusion that moisture had accumulated in the cable. The cable consisted of No. 18 wires covered with double cotton and paraffine—the ordinary annunciator wir These wires were laid together and the whole covere with a thick braid of cotton, also thoroughly paraffinec It was the kind of cable used several years ago for sma telephone installations and annunciator systems. As had been installed while the building was being erected, was impossible to remove it from the walls, and it woul have caused considerable trouble and damage to the build ing to have installed a new cable, so an attempt was mad to dry out with hot paraffine the accessible portions of th cable, especially at the outlets where the end of the cabl was exposed. This was only partially successful, fo while some of the wires were cleared, still a number re mained crossed, and the insulation resistance of all o them was too low to promise continued service. It wa therefore, decided to dry out the cable by means of elec tricity passed through it. It was feared that energy a lighting potential would be unsafe on account of the lia bility of 110 volts to puncture the damp cable where came in contact with grounded metal—portions of the cabl running through steel conduit. It was decided to use th ordinary lighting current and to reduce it from 230 vol to 23 volts. A 3-kw transformer was used, being the onl one available. A larger size would have been preferabl as the resistance of the secondary winding, together wit the resistance of the wires in the cable, held the curre down to a rather low value. No alternating-current vol meter reading such a low voltage could be obtained, so tl voltage was tested by the means of several miniature lamp such as are used in flash-light batteries and series Chris mas-tree outfits. These lamps of different voltage enable rough determination of the voltage to be made. The cu rent was determined by inserting fuses in the circuit, b ginning with a small fuse and gradually increasing the si of the fuse until one was reached which did not blow. was found that something like 10 amp was the heavie current which could be sent through the cable. Two wir of the cable were connected to the transformer, then tl ends of these wires at the far end of the cable we twisted together—it being easy to select them by means the spark. Several thermometers covered with wrappin to prevent loss of heat were placed on the cable in i exposed parts. In the course of about forty-five minut the temperature would reach a maximum varying fro 50 deg. C to 60 deg. C., the temperature of the air beir about 20 deg. C. The transformer was then removed, tl wires untwisted and tested. This treatment was repeat on each pair of wires. After treating all the wires in tl cable a test showed them to be entirely free from leakag A larger transformer and a higher temperature would ha been quicker and probably better, and it would seem e tirely possible to raise the temperature sufficiently high melt the paraffine or other insulation and thus repair a actual break in the insulation, should such exist.

Staunton, Va. P. N. TROUT.

A SAFETY PANEL FOR CRANES.

In an endeavor to prevent the accidents which contin ally occur through careless handling of cranes in a lar mill the following control panel has been designed to r place the usual panel furnished in the cage of a brid crane. The new panels have not been in use a sufficie length of time to prove that they will accomplish the purpose without failure, but there is every reason to belie that they will do so to a very great extent. It is intend to prevent such accidents as are caused by the operation the cranes by unauthorized persons, by the unintentional accidental manipulation of a controller while some pers is working on or about the crane under the impression th it will not be operated, by a "dead" supply becomi "alive" while a controller may be in an "on" position wi no one in the cage, and by various other unexpected con tions. It is almost beyond belief that such accidents as

ccur can happen at all, and it has become absolutely neces-ary not to rely on the operator or others whose duties equire them to be about the cranes if it can be avoided. ig. 1 is a diagram of the connections of the panel and ig. 2 a front view of the panel as mounted in its box in

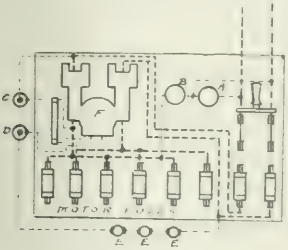


Fig. 1—Diagram of Connections.

e crane cage. The main service switch is provided prin-ipally to satisfy the insurance requirements, and as it is resent it has been considered advisable to provide the pening in the panel-box door, through which it may be perated, as an additional means of opening the main cir-uit in case of emergency. All ordinary main-line control by the push buttons C and D operating the magnetic witch F, C being used to close and D to open the switch, s indicated in the diagram. It will be seen that the oper-ting coil of this switch is so connected that when the witch is open the coil circuit is open. As the switch is eld closed by the energized coil, any break in the coil rcuit or failure of voltage therein will allow the switch o open. As long as there is no voltage in the main circuit e switch will remain inoperative, but if the main circuit alive the switch may be closed by pushing button C, hich shunts the break due to the switch being open. utton D being pushed opens the coil circuit and allows the witch to open. If any of the safety plugs E be removed e switch must remain open until they are returned, as eir absence opens the circuit and the switch cannot be erated. The object of the plugs E is that anyone hav-g one of these plugs in his possession may be assured at the crane is inoperative until he replaces it. The mp A indicates by its incandescence that the trolleys are ive, and the lamp B indicates in like manner that the nel is alive on the load side of the magnetic switch. ig. 2 illustrates the appearance of the completed panel x as mounted in the crane cage. The box is of sheet

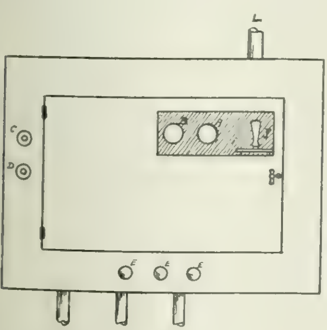


Fig. 2—Front View of Panel.

eel following standard panel-box construction with the ception of depth, which is made great enough to ac-commodate the magnetic switch. The door is locked and ntrol of this magnetic switch is had by the push buttons fore mentioned, which are mounted at one side of the door. The window in the door is designed to allow the indicating lamps to be seen and the handle of the service switch to be reached. Other parts of the panel are inaccessible to any one but the electrician who carries the key. The three plugs E have a round-knob head painted bright red and on the door above, with an arrow pointing to them, is a notice directing any person working on the crane to remove and keep in his possession one of these plugs until his work is completed and he is leaving the crane, and all employees whose work brings them on or about the cranes are personally instructed to the same effect. Three plugs are considered sufficient, but, of course, more can be added if thought necessary. Suppose that an electrician and a machinist are sent to work on a crane, the crane runway or some other apparatus where the crane might interfere with them. One arrives and removes a plug, puts it in his pocket and goes to work. Soon the other arrives and in turn takes possession of another plug. At the completion of his work each one replaces his plug. From the time the first plug is removed until the last is replaced the crane cannot be operated. In this way it is hoped in the future to avoid accidents due to carelessness and definitely to place the responsibility for any such as may occur.

Waterbury, Conn. F. L. THORNE.

INDUCTION MOTOR SLIP.

Irrespective of the name and nature of the several emfs and counter emfs active in the circuit of an induction motor in operation, the fact remains that the motor runs because of an emf applied to the primary in producing a secondary current that reacts upon the primary field, thereby producing the attracting forces that cause rotation. In a direct-current motor the counter emf generated, as soon as the motion of the armature enables its conductors to cut the magnetic lines of the field, helps to limit the current flow, and at full speed is the only current-limiting agent aside from the negligible internal resistance of the machine, and the greater the counter emf the smaller the current flow. In this case the emf generated in the armature rotor is due to conductors cutting lines of force. In the case of the rotation of the rotor secondary of an induction motor, instead of conceiving rotation to be due to the rotating magnetism of a stationary field structure, it is easier, for present purposes, to conceive the rotation to be due to the magnetism of a field structure separately excited and rotating at synchronous speed. In other words, conceive the rotor and stator to have independent bearings and the stator to be belted to an outside driving source able to rotate it around the rotor. When the stator with its defined poles is rotated its magnetism cuts the rotor conductors and in them generates an emf and hence produces current that reacts upon the moving field of the rotating stator. The result of this reaction is that the rotor too begins to rotate and soon acquires a speed almost equal to that of the belt-driven stator. The difference between the rotor speed and stator synchronous speed at any time is called the *slip*, and the greater the mechanical load, hence drag, placed on the rotor the greater will be its slip.

As most of the interesting induction motor facts rest in mathematical seclusion, many have obtained the wrong impression once held of the counter emf of a direct-current motor, namely, an unavoidable feature that might well be eliminated; but a direct-current motor that could develop no counter emf could not start, because for every conductor tending to produce rotation in one direction there would be a similar conductor with equal tendency to produce rotation in the other. Moreover, slip is just as necessary to an induction motor as counter emf is to a direct-current motor, for it is the slip that enables the motor to take current according to the demand of the load. In an actual induction motor conditions are magnetically similar to those just outlined except that the cutting of the rotor conductors by the stator magnetism is due to

the magnetism rotating around the stator instead of the stator rotating bodily. In either case the emf set up in the rotor depends upon the speed with which the stator lines cut the rotor conductors, and this speed in turn depends upon the relative speeds of the rotating stator magnetism and the rotor rotated by it. In an induction motor with emf applied to primary winding on the stator and the rotor secondary stationary the speed of the rotating magnetism in r.p.m. is the frequency of the applied emf in complete alternations per minute divided by the number of poles, and the speed of the rotor is zero. Therefore, the slip, the rate at which magnetic lines of force cut the secondary rotor conductors and the resulting secondary emf are a maximum and, unless measures are taken to prevent it, the secondary current will also be a maximum. When the rotor begins to move, however, as it travels in the same direction as the rotating magnetism, the moving lines of force cannot cut the moving conductors as fast as they did the stationary ones, and hence the secondary emf and current decrease; if the rotor secondary conductors could ever reach the speed of the rotating magnetism and they would travel along together, the slip would be zero, there would be no cutting of lines of force and the secondary emf and current would become zero. Just so soon as this condition would obtain, if it could, the turning power would become zero (except for inertia), the rotor speed would decrease, thereby introducing slip, lines of force would once more cut rotor conductors and rotor current would flow and provide torque, and the slip would be just sufficient to admit the current required to support existing load conditions. It is thus seen that to have torque there must be slip. If the motor is operating at a load that is suddenly increased, the rotor speed is almost as suddenly checked, the slip thereby increased and more current is admitted to sustain the increased load.

The phenomenon of slip is therefore closely related to the automatic regulation of the difference in the speeds of the rotor and the rotating magnetic field, and without such slip the rotor secondary current would be nil.

Schenectady, N. Y. E. C. Parham.

SOME PROBLEMS INVOLVED IN REBUILDING A GENERATING STATION.

From time to time during the past two years descriptions have been given of the improvements made to the Colfax Avenue plant of the Indiana & Michigan Electric Company, at South Bend, Ind. The power house has been entirely rebuilt without stopping for a single day. At present further extensive improvements are well under way and excavations have been made for two very large smokestacks and for a mammoth hot well. The stacks are to be 225 ft. high and the flue opening will be 11 ft. in diameter at the top. Each stack is to be built of reinforced concrete. In addition to the smokestacks extensive condensing arrangements which are under way call for water to be brought from the St. Joseph River from 500 ft. and 600 ft. through a tunnel and discharged again into the river through another tunnel. The intake will be located about 100 ft. up stream from the discharging end of the tunnel. The tunnels are to be constructed of reinforced concrete tile, 3 ft. in diameter, made up in sections about 3.5 ft. long, the sections being molded upon a vacant lot close by. The regulation type of sewer pipe is used for these tunnel sections, which will be laid in an open cut from the hot well to the river, the bottom of the tunnel being nearly 20 ft. below the surface of the street. The river ends of these tunnels have presented several engineering problems. Double rows of interlocking sheet piling are driven about 12 ft. apart around that portion of the river bank where the tunnels enter and discharge. The space between the rows of piling will be puddled to prevent the ingress of water. The bottom of the tunnel will be about 12 ft. below low-water level and, as stated, about 20 ft. below the street surface. A pile driver placed upo a scow was used for driving the sheet piling. It chance that the inlet tunnel was located just above the Colfa Avenue bridge, while the outlet tunnel came just belo or to the north of the bridge. The pile-driver scow ther fore was underneath the bridge nearly all the time, and provide a supply of fuel the engineer rigged an ash chu underneath a hopper about 4 ft. in diameter, the hopp being attached to the hand rail of the sidewalk on tl bridge, and some old 10-in. sheet-iron pipe was connecte from the hopper to a point 4 ft. above the water lin Whenever coal was to be sent aboard the pile driver th scow would be warped beneath the ash chute and the co dumped into the hopper on the bridge. At the site of tl concrete stacks and the hot well some difficulties we encountered. At one point a water main broke and quick transformed a stratum of fine material into first-class quicl sand, through which tools and timber found their way lil a hot wire through grease. Several additions of pilir had to be driven to stop the flow of alluvial quicksan but after the water pipe was repaired the trouble pra tically disappeared. About 8 ft. from the surface blue cla was encountered, which ran down through the rest of tl excavation. The stacks will be built upon blue clay, whic is worthless for pottery or brick-making purposes. It wa necessary to excavate for the hot well to a depth of 21 f Necessarily, as the stack is adjacent to the hot well, i foundation had to be excavated to a similar depth. Th necessitated an excavation over 100 ft. long by from 60 t to 80 ft. wide and 21 ft. in length. The nature of the so was such that a very complex system of timbering had be installed, and even when great strength and rigidi were given to the timbering the immense pressure at tl outside corners of the clay nearly succeeded in forcing tl sheet piling into the excavation. As the digging proceed it was necessary to drive other piling inside the first, ar complex timbering also extended to these lower levels sheet piling. To handle the excavated material properl and the concrete material as well, a large stiff-leg derric was erected with a boom which commanded the entire ar of the excavation. A great deal of ingenuity was exercis by the engineers in the construction of the stiff leg. F the foundation three large telegraph poles were utilize They were formed together like the letter A. The hoistir apparatus was placed upon the crosswise portion of the the mast with its bull wheel was placed upon the apex ar a heavy cob-house structure filled with earth was plac on either foot of the letter A. Two other poles we utilized to form the stiff-leg portion of this derrick. The poles were bolted to the feet of the A-frame in the mid of the cob-house construction noted above. The arrang ment proved very simple and adequate, and evidently r sulted in a saving on the cost of the installation of co ventional derricks built of massive yellow pine timbe One of the derricks was erected at the site of each smok stack, and, while one was operated by the regulation tw drum hoisting engine, the other derrick was operat entirely by electric motors, two of which were installe one of the railway type, with a regulation controller, bei attached to a regulation two-drum hoist, and the oth being attached by pulley direct to a small ordinary dru around which a turn was given to the wire cable leadi to and from the bull wheel. To move the derrick in o direction a double-pole switch above the bull-wheel mot was thrown in a certain direction, and the power of t motor was applied through a pulley and a friction clut to move the winding drum which turned the bull whe When it is necessary to move the bull wheel in the opp site direction the switch is opened, the induction mot stopped and the switch closed in the opposite directic This causes the motor to run in an opposite directic thereby enabling the bull wheel to be revolved as desired.

South Bend, Ind. James F. Hobart.

QUESTIONS AND ANSWERS

Given an eight-pole, revolving-field alternator, if two adjacent poles ... removed and the r.p.m. remain ... the ... being undisturbed, would the frequency be changed? W. T. W.

When two of the eight poles of a revolving-field generator are removed and the other poles are not redistributed the frequency of the delivered emf will be the same as formerly. The only change will be that the delivered emf will be decreased by 25 per cent. The voltage regulation of the generator would also be poorer than formerly.

In changing over some old meters, the magnets were removed and small ... attached to them. The magnets were then remounted at right angles to their former position. What effect does this produce? E. C.

The object of such a change is to prevent the meters from running fast after being subjected to heavy overloads or short-circuits. With the magnets in their former position the stray flux produced by short-circuits tended to demagnetize the drag or braking magnets, causing the meter to register more than the true energy. By causing this stray flux to travel across instead of along the magnets this effect is minimized, hence the change in the disposition of the magnets.

What would be the objection to starting a 30-hp induction motor on ... voltage?

Even if such a motor were thrown across the line without load the magnetic attraction and repulsion between conductors would tend to tear the ends of the coils out of place. Moreover, the starting currents would be so heavy that they would render service on any distribution system unsatisfactory, so much so that no central station would tolerate a motor starting under such conditions on its lines.

Is there any advantage to be derived in building two generating stations, each to relay the other, and dividing the load between both? O. C. D.

The trouble with such an arrangement is that neither station would carry sufficient load to give reasonable economy in operation. The relaying feature in case one station were disabled is the only point in favor of such a plan. It has been found by experience that a well-designed station suitably safeguarded against breakdown by accident to machinery and equipped with duplicate feeders will give almost uninterrupted service. Any interruptions occurring will be infrequent and short, and service can be restored in less time than full relief could be obtained from a second plant. About 98 per cent of service interruptions are due to causes extraneous to the station.

Is it a fact that the fumes from direct-connected gas-engine sets attack the insulating materials on the generator windings, thus causing ... from grounds? F. M. J.

Opinions of this kind have been often expressed, but cases which have been investigated do not always confirm them. Surface creepage usually takes place from the commutator necks across the under side of the insulated ends of the coils to the armature core owing to the formation of a conducting surface. By heavily varnishing the commutator necks and the armature core the trouble may be remedied for a time or until the varnish cracks at the points where the coils leave the slots. Another remedy which is said to be efficacious is to break up the exposed under surfaces of the winding by insulating barriers so arranged as to prevent the formation of an unbroken layer of conducting deposit. The troubles are mainly confined to armatures of machines subject to chemically active fumes such as are met in alkali works, chemical works, gas works, etc.

In testing ... what size of apparatus is usually employed? For instance, suppose it was desired to test the insulation of a 75-kw transformer, would a 600-watt transformer wound for 100 volts primary and 4000 volts secondary be large enough to test the transformer mentioned, which is wound for 2000 volts primary and 200 volts secondary? S. W. H.

According to the standardization rules of the American Institute of Electrical Engineers a testing transformer should be of such size that its ratio of transformation does not vary more than 10 per cent when delivering the charging current required by the apparatus under test. This may be determined by short-circuiting the secondary or high-voltage winding of the testing transformer and supplying 0.1 of the primary voltage to the primary winding under this condition. The primary current that flows under this condition is the maximum which should be permitted in regular tests for insulation strength. It would seem that a 0.6-kw transformer should be large enough to test the insulation of the 75-kw transformer, unless the test is made at an exceptionally high emf.

In the accounts of the electrical equipment of the new steamship *Olympic*, it is stated that the energy is distributed over a single-wire system at 100 volts. Kindly explain this system. T. Y.

Two methods of wiring steamships are at present in vogue, single wire and double wire. In the former one conductor only is employed, the return lead being soldered to a brass screw which is tapped into the framework of the ship, thus making the hull of the ship itself the return circuit. The double-wire system is similar to that used in land practice, and is preferable to the single-wire plan, which is open to serious objections. With the single-wire system it is necessary oftentimes to double-wire the ship for a radius of from 15 ft. to 30 ft. from the compasses or else to wire the forward part of the ship from a line 30 ft. aft of the compasses on the double-wire system. The joints of the return leads cause trouble since electrolysis is apt to arise and the insulation of the single wire must be nearly doubled because the ship is virtually grounded at all times. In the case of a ship the size of the *Olympic* no doubt there is a considerable saving by employing the single-wire system, but the practice is a poor one.

Is there any objection to placing a twin-conductor, lead-covered cable in a fiber or iron conduit? It is proposed to run a number of iron ducts parallel to each other and in contact; and each duct will carry a twin-conductor, 2200-volt, single-phase cable. How can the size of transformers required to make a test for dielectric strength in underground cables be determined? It is common for us to take two ordinary transformers connected in series and subject a short length of twin conductor cable to 2000 volts pressure between the conductors and from the conductor to the sheath. How does the capacity of the cable affect the load on the test transformers? M. H.

No possible trouble could arise from installing twin-conductor cables according to the method outlined. The dielectric strength of underground cables can very conveniently be tested by means of two ordinary transformers connected in series, just as you have done. Probably your attention should be called to the fact that it is preferable to separate the transformer cases from each other and thoroughly insulate each case from the ground. It is customary in selecting the transformers to use units having a large rating in comparison with the volt-amperes taken by the cable. If, as you state, only a short length of cable is tested at any one time, the capacity current of the cable can safely be neglected. Where possible to do so it is best to increase the voltage impressed upon the cables slowly rather than to subject a cable instantaneously to the maximum emf or remove from the cable the maximum applied emf. A gradual increase in applied emf can be obtained by means of a motor-starting rheostat connected in the low-potential circuit of the transformer. This rheostat should be used just as one would use such a device when starting a shunt-wound motor.

Central Station
Management, Policies and Commercial Methods

BUTCHERS' MECHANICAL REFRIGERATION SAVES TRIMMING OF MEATS.

Motor-driven refrigeration for butchers' cooling boxes has many advantages over ice, since, as often pointed out in these columns, a lower temperature is attainable, the cold is dry and in many instances a substantial saving in cost is made by the use of mechanical refrigeration. Butchers who have had experience with both icing and refrigeration further declare that the saving in the trimming of meats which results from a dry, low temperature is actually enough to pay the cost of running the plant, disregarding all other savings. In the moist cold atmosphere present with ice meat blackens rapidly, and from 8 per cent to 10 per cent must be trimmed from it before it is fit to be brought out onto the counter for the customer's inspection. With the intense, dry cold of mechanical cooling there is practically no loss or necessity for trimming, and butchers having mechanical refrigeration often declare they could not afford to return to the use of ice, even if the latter were obtainable free of cost.

HYDROELECTRIC POWER IN UTE PASS, COLORADO.

Service has recently been inaugurated at Green Mountain Falls, Col., a rapidly growing summer resort near the head of the celebrated Ute Pass, by the completion of a small hydroelectric plant under the auspices of the Empire Water & Power Company. The installation illustrates the facility with which even a small power may be applied to the needs of a flourishing community. The company's plant is located on Crystal Creek at an altitude of 8750 ft. above sea level, and receives its water supply from the above stream through a steel-pipe line 8 in. in diameter, the head upon the single Pelton wheel employed being 490 ft. Energy is generated by a 150-kw, 2300-volt, three-phase, 60-cycle alternator direct-connected to the waterwheel. The pipe line is 1026 ft. long. The service includes street lighting by 60-watt tungsten lamps operated in multiple on a 110-volt circuit, the lamps being provided with radial-wave reflectors. The plant is about half a mile from the center of the town, and is at present supplying commercial and residential customers on the basis of a flat rate. The plant is about 15 miles from Colorado Springs, and was laid out under the direction of Messrs. E. L. Benton and George B. Tripp, of the Colorado Springs Light, Heat & Power Company.

CLEVELAND COMPANY OFFERS 10 PER CENT BONUS FOR HOUSE-WIRING CONTRACTS.

The Cleveland Electric Illuminating Company has now removed all of its solicitors from the work of securing house-wiring contracts, turning this function over to the contractors of the city, who are offered a bonus of 10 per cent on all wiring jobs in houses on the company's lines. The minimum bonus the company will pay is $5 and the maximum $10 per house. The same offer of reward will later be generally made to any person who secures house-wiring contracts, provided he secures the wiring of at least five houses, such an outsider not being paid, however, until he has turned in his fifth contract. This pro-vision is designed to prevent owners or tenants collecting bonuses on their own houses. When an outsider obtains the contract the wiring contractor, of course, receives no bonus, but has his usual profit under the unit system of computing wiring costs specified by the Cleveland company. All employees of the illuminating company are excluded from the bonus award, but may receive $1 commission for service-connection contracts brought in by them. Under the new agreement thirty-six contractors in the city share in the distribution of house-wiring work.

The cost of wiring has also been reduced 15 per cent below the former Cleveland unit scale on all outlets in excess of the first ten. As before, the wiring contractor allows ten months for the payment of the wiring cost, although the illuminating company does not enter into this transaction. Where the newly wired house is on the company's distribution lines 15 per cent of the wiring schedule cost is credited on the customer's future lighting bills as before. These recent changes in house-wiring schedules have been made the subject of "Illuminating Dialogues" in the company's display-advertising space in the local newspapers, wherein the gist of the house-wiring offer is tersely stated in catechism form. Mr. M. E. Turner is contract agent for the Cleveland Electric Illuminating Company and has been in charge of the unusually successful wiring campaigns carried out in that city.

TURBINE OPERATION WITH REDUCED CONDENSER SURFACES AT ST. LOUIS.

The last of four 12,000-kw vertical steam-turbine units is now being installed in the Ashley Street station of the Union Electric Light & Power Company, St. Louis, bringing the total plant rating up to 68,000 kw, which classes it among the very large power stations of the country. The 12,000-kw units are mounted on 18-ft. centers, and represent the concentration of 48,000 kw of prime movers in a space only 70 ft. x 15 ft. in area, which for density of rating is probably unequaled in any other plant.

The Union company has just completed the installation of two smaller 4000-kw horizontal Curtis turbine-generators at Ashley Street, replacing its former 1500-kw vertical type units. In the case of these machines, as for the 12,000-kw units which replace four 5000-kw sets formerly installed, the original condenser equipment has been retained and is worked successfully at a surface intensity more than twice that for which it was designed, 4 sq. ft. per kilowatt of rating. During seven months of the year this condenser equipment is found ample to carry the full rating of the machines, although during the summer, when the temperature of the Mississippi River circulation water mounts to 87 deg. and above, the output of the units is reduced by 10 per cent or 20 per cent at 28-in. vacuum. This reduction occurs during the summer period, of course, when the demand on the plant is least, and the saving in condenser investment and replacement has been considerable.

In addition to its turbine units the Ashley Street station contains 12,000 kw in vertical, cross-compound, engine-driven equipment. These reciprocating units may later be arranged to exhaust into low-pressure turbines as has been done at the Commerce Street station in Milwaukee. Through the installation of a 1000-kw motor-generator set at the St. Charles Street plant it has now been possible to

shut down the Lewis Street station, which will be operated only to carry the extreme peak of the winter load if necessary. Mr. John Hunter is chief engineer of steam plants for the Union Electric company, and Mr. S. B. Way is chief engineer of the electrical department.

FESTIVAL OF LIGHT AT DENVER, COL.

In connection with the visit of an editorial representative of this journal a Festival of Light was held in Denver, on the evening of July 29. Through the co-operation of the daily press arrangements were made for the com... lighting of the entire business district, including ... interior, window, sign, billboard and outline illumination between the hours of 8:30 p. m. and 9:30 p. m., with the object of displaying the facilities available to a staff of photographers located on the balcony of the Daniels & Fisher campanile at a height of 270 ft. above the street. The accompanying photographs show the illumination of the city as viewed from the campanile, the office building of the Denver Gas & Electric Light Company being outlined by lamps aggregating a total installation on both faces of the structure of 72,000 cp. Among other important buildings illuminated specially for the occasion were all the principal office buildings in the business area, the State Capitol, Court House, Auditorium, Princess and Isis Theaters, with the addition of practically all the mercantile establishments in the downtown district.

Widespread publicity given to the carnival led a crowd of many thousands of people to gather on the streets during the hour of the special illumination, and great interest was aroused in the display. Among the special features were the outline lighting of the campanile by temporary incandescent service, the use of searchlights at strategic points on roofs, and the burning of red and green fire on the tower and on the deck of a 3.5-ton electric truck occupied by personifications of the Evil One and his mother-in-law. The truck was lighted by 1200 cp in incandescent lamps, and from it were distributed pasteboard models of incandescent lamps giving data as to the amount of lighting connected in Denver. In some instances the cards were redeemable in money at the office of the Denver

Fig. 1—Denver by Night Showing Illumination of Denver Gas & Electric Light Company's Building.

Fig. 2—Denver Street Illumination Looking Down Sixteenth Street.

Post. It is estimated that over 2,000,000 cp in electric lamps was visible from the campanile during the display, a large part of which is in regular service every evening.

MOTOR-DRIVEN CRACKER FACTORY.

By R. B. Mateer.

With the idea of supplying the local demand for biscuits previously obtained from distant manufacturers, some merchants of Denver organized and established the "Merchants' Biscuit Company of Denver." An old structure, three stories in height, was purchased, an oven built, and

Fig. 1—View Showing Baking Oven and Cutting Machine.

dough mixers, rolling and cutting machines were installed, the machinery being operated by an electric motor. The energy was supplied by the Denver Gas & Electric Company at 220 volts, 60 cycles, three-phase.

Prosperity rewarded the effort made, and the plant has been enlarged to three times its original size. Wherever possible a polyphase motor was installed for the operation of each machine. There are now in use the following machines: An 1800-lb. dough mixer operated by a 10-hp, 1200-r.p.m. motor; a roll operated by a 5-hp, 1200-r.p.m. motor; a cutting machine operated by a 5-hp, 1800-r.p.m. motor. Silent chain drive instead of gear and pinion or belt is used for connecting the motor to the cutting machine. The huge new oven is of the rotary type, the wheel

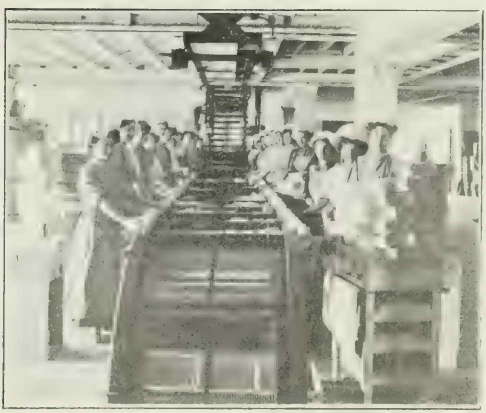


Fig. 2—View Showing Conveyor and Collecting of Crackers.

being connected to a 3-hp, 1200-r.p.m. G. E. motor. The machinery above described is located on the fourth floor of the new structure and, with the exception of the motors, was built and installed by Thos. R. Green & Company, of Indianapolis, Ind.

On the third floor are the copper agitators and jam ke tles, four icing mixers, a steam cooker, a fruit grinder a trolley, arranged for group drive and operated by a 10 motor. Two nailing machines made by the W. S. D Company, of Brooklyn, N. Y., are driven by a 5-hp, 17 r.p.m motor. Two boxes per minute are assembl stamped and sealed by means of this expeditious process. modern conveyor and packing machine is operated by 10-hp motor; a six-barrel mixer and one of two and a ha barrel capacity are operated by means of a 20-hp mot Polyphase electric elevators, manufactured by Nock Garside, of Denver, facilitate the rapid handling of both raw and finished foodstuff.

The step from the old bakery to that of the mode sanitary type is no less remarkable than the change fr steam drive to motor drive. The elimination of long l shafting and greasy belts by the installation of the in vidual drive, with either gear and pinion or silent cha was possible only when the superior advantages of electric motor were apparent to those interested in baking industry.

HOW THE ELECTRICITY-USING HABIT GROW

A complaining customer sometimes comes into the lig ing company's office and as proof that his last bill is high exhibits the bill of a year before, declaring that is "using no more electricity this year than last."

But the fact is that the average consumer, all unknown

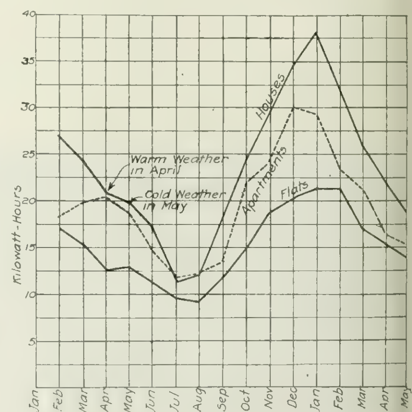


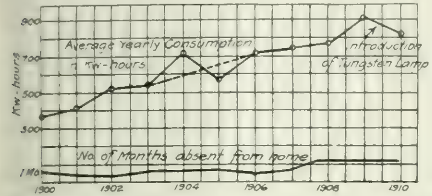
Fig. 1—Average Monthly Consumption of New Reside Customers.

himself, does actually use an increasing quantity of e tricity from year to year as he discovers the many c veniences and comforts which central-station serv affords. The new customer will consume more kw-h the second year than the first, and this effect shows up the increase of his monthly bill over that of a year bef to his own innocent surprise.

Some figures obtained by Mr. H. G. Kislingbury, stati cian for the Union Electric Company, St. Louis, on monthly variation of the consumption of residence cust ers of different classes afford some interesting sidelights this growth of consumption during the first year. classification purposes residence installations in St. L are divided among "houses," "apartments" and "flats." apartments represent a better class of dwellings than flats, which latter chiefly rent at rates less than $25 a mo The apartments are principally in large buildings in f ionable sections of the city. Fig. 1 shows the consump

uring a number of months of representative installations n these three classes. In each instance the data relate to ew customers who had service installed during the preceding January, so that at the beginning of the record, in 'ebruary, they had just got fairly launched in the use if electricity.

The curve for the house customers represents the average of sixty consumers, each installation having about wenty-five lamps. The second curve shows the average ionthly consumption of forty apartment houses, each having an average connected load of seventeen lamps. The owest curve is based upon the results from 100 flats, averging fourteen lamps each. As already stated, all of these ustomers were connected up during January, and the billing periods for the various months have been carefully corected so that they are representative of the month eferred to.



g. 2—Increase in Consumption by Average St. Louis Family.

Especially in the case of apartments and flats the curves iow that the customers had learned to use much more ectricity during the second February period than during ie first month when new to electric service. The apartent-customer curve, as well as the monthly bills on which is based, shows unmistakably how these good people had ot learned the full advantages of electric service until the iortening days offset their increasing requirements for ectricity.

The effect of a warm, early spring, followed by a cold iell in May, is also clearly reflected by the humps in all iree curves for this spring period.

Fig. 2 shows the average kw-hours used each year by venty St. Louis customers among the better class of resience consumers. The records of these twenty installations ere available throughout the entire ten years, and with ie or two exceptions the same families occupied the wellings over the whole period. The customers' annual onsumption, plotted as a curve, shows the increasing use f electricity until the banner year of 1909 brought the ingsten lamp into household use and consumption consetently decreased as indicated. At first it was thought that me difference in the mode of living of the people might ive contributed to this increase of consumption, and an fort was made to find the length of time these customers ere absent from home, traveling, etc. These results, otted as a second curve, show, however, that the number f months spent in traveling has been increasing during the cade, so that the growth in consumption of electricity is, a monthly basis, in fact, even slightly greater than the oper curve reveals.

XCESSIVE INSURANCE RATES CHARGED ELECTRIC-LIGHTING STATIONS.

Central-station men have long entertained the idea that modern electric-lighting station, with its contents, should considered a preferable risk, but the insurance companies have always classified these properties as extra zardous and have charged accordingly—some companies en going so far as to place them upon the prohibited list. iat such properties have been wrongly classed by the insurance companies is evident from the returns received by Secretary D. L. Gaskill, of the Ohio Electric Light Association, from a number of Ohio central-station men and reported by him at the association's Cedar Point convention July 27.

In response to a circular inquiry sent to 150 Ohio plants sixty-one replied giving the various details asked concerning the amount of insurance carried upon buildings and machinery, the rates charged for such insurance, the amount of premiums paid in 1909, the losses incurred on buildings and machinery for each of the five years preceding the year 1910, whether protection was given from fire caused by electric current, the kind of buildings, kind of roofs, kind of fire protection, and whether stations were without attendance during any part of the day.

While it is to be regretted, reports Mr. Gaskill, that all of the Ohio central stations did not fill out and send back the blanks sent them, the replies so far as received were startling, and prove conclusively that the central-station men were correct in their claim that, instead of central stations being classed as extra-hazardous, they should have a class to themselves, with an AA1 rate, or one somewhat better than limestone under water.

The tabulated figures of the replies are as follows:

Amount of insurance carried on buildings reported	$380,853
Amount of insurance carried on machinery reported	982,577

Upon this insurance there was paid in 1909 $16,411 in premiums. The losses for the five years 1905 to 1909 reached the grand total of $60 in all the sixty-one stations reported. This occurred in one station and was caused by a tramp setting fire to a packing box outside of the station, burning out the window frames of two windows.

"The rates charged the different stations for fire protection have a wide range, running from eight-tenths of 1 per cent to 4 per cent per annum. Nineteen of the stations reporting carried no insurance at all, nearly all stating that the rates were so high that they preferred to carry their own risks. Thirty-two stations reported adequate fire protection and nearly all some protection. Eight stations out of the sixty-one are closed part of the day with no one in attendance; all of the rest have men in charge for the twenty-four hours.

"These figures are startling," repeats Secretary Gaskill. "Taking the amount paid in premiums in 1909, $16,411 (and it is safe to presume that for each of the years 1905 to 1908 as much was paid each year), this would make a total paid for the five years of $82,059, for which the companies returned to these central stations in payment of losses the sum of $60.

"Rates are entirely unequal, ranging from eight-tenths of 1 per cent to 4 per cent per annum, and seem to bear no relation to the kind of risk or its fire hazards. In one instance a frame building with a paper roof had the rate of 1 per cent, while in another a brick station with metal roof had a rate of 3 per cent. In one large city station with every fire protection known the rate is 4 per cent per annum, and this station reports that it never had a fire.

LIABILITY INSURANCE.

"Thirty-eight stations out of the sixty-one reported that they did not carry liability insurance. Ten stations reported the premiums paid by them in 1909 to aggregate $5,919. These ten stations reported losses in the past five years on employees, $255, on public liabilities, $5,225, the losses being confined largely to three of the stations reporting. Assuming that the amount paid in premiums by these ten stations in 1909 was the same as the amount paid for the four years previous would make the amount paid out by these ten stations in five years $29,595, with total aggregate losses, both public and on employees, of $5,450. This shows a very nice margin of profit to the companies on that class of insurance. The remaining number of the sixty-one companies reporting made no reply upon the liability insurance inquiries.

"It is very evident from the figures given in these replies and the totals in this report that insurance, both fire and liability, is being carried at entirely too high a rate and that insurance companies are using the bugaboo of electric current as a means of getting a high rate for the safest kind of service. In nearly every instance the companies reported that their policies did not cover loss on machinery from fire caused by electric current whether generated within or from natural causes without the station. This exception practically takes away all of the increased risk, if any exists, from electric current."

It was suggested at the last annual convention that the electric-light companies of Ohio might well organize their own insurance company on the mutual plan, as permitted by the laws of the State. Such a company, adds Secretary Gaskill, should have at least $500,000 of insurance and no risk should be taken at a greater sum than $3,000 on any one property. If such an amount could be procured there is no doubt that the company would be a success, and to the extent of $3,000 insurance, at least, on each station the costs would be materially reduced. In closing the author urged the association to have a committee appeal to the insurance companies for reclassification, as well as to investigate the possibility of a mutual company.

Mr. J. C. Martin, of Wilmington, Ohio, remarked that the power to amend present insurance rates lies within the electric companies themselves, and declared that unless a mutual insurance arrangement is insisted on the companies will continue to rob the central station by an unfair rate. Mr. E. A. Bechstein, of Sandusky, said that individual companies can usually effect an improvement by taking up the case with their own inspectors. The rate on the Sandusky station was reduced 30 per cent as the result of such a conference. Mr. Marden, of Springfield, said the greatest handicap was due to the incompetent character of the inspectors employed by the insurance companies.

PROMOTING CENTRAL-STATION BUSINESS IN A SMALL TOWN.

Considerable attention was attracted at the recent Michigan Electric Association convention by the paper on "Promotion of Business in Small Towns," prepared by Mr. George D. Slaymaker, of Rochester, Mich., and read in his absence by Mr. E. Coe, of Detroit. Mr. Slaymaker's paper was an unusual and accurate characterization of the conditions obtaining in small communities, such as his own place of 2000 inhabitants.

In towns of 5000 and less, wrote the author, the problem of the promotion of business must be faced sooner or later. "We of the small towns," he added, "have not the advantages of our city friends. We have not a growing city which taxes our facilities to the limit in merely keeping up with its natural growth. We have not a prosperous and progressive clientèle. Our problem is essentially different. We attempt to do business in a semi-rural community where the in-moving of a new family marks an epoch; where the population has a large proportion of farmers who have moved into town to die and small merchants doing a hand-to-mouth business; where an installation of twenty 16-cp lamps is considered the height of luxury, and where a small motor is rare or else unknown. A company operating in such a town, I say, inevitably reaches the point where it can see no more business ahead—all available residences and stores being lighted by electricity and there being no chance for a motor load because there are no industries. In such a case we are confronted by the alternative of standing still or else of making a new market for our commodity. The former alternative is untenable. Then how to accomplish the latter—the procuring of new business—is our problem."

Rochester's population of 2000 inhabitants is composed retired farmers and small merchants. For industries th are one knitting mill, a small paper mill, a flour mill and t small machine shops.

The present lighting company entered the town a lit more than a year ago, and at once began offering custom reliable twenty-four-hour service at low rates. These a vances met with instant response in that practically all the well-to-do householders wired up immediately and m of the stores scrapped their gas plants. It can be seen, ho ever, that very soon the company would have been faci the problem of "standing still" or else "making its o market." Foreseeing this condition, the company has tri to forestall it and now hopes never to have to face it.

"In the first place," said Mr. Slaymaker, "our invaria policy of utmost liberality and fairness to customers won once most of the available business. Free lamp renew prompt response to trouble calls, generosity in the matter repairs, cheap wiring payable on a dollar-per-week basis all of these things contributed. A solicitor, as such, is e nomically impracticable and is unnecessary in a town this size. All of the company's employees act as solicito The meter reader inquires at each house if the service satisfactory, leaves a flatiron on thirty days' free trial, su gests a washing machine and hands the mistress a pamph descriptive of sewing-machine motors, toasters, heaters what not. The bookkeeper tells his grocer, while purch ing a pound of butter, about the new coffee grinders, or explains to the butcher the advantages of tungsten lamps, suggests a meat chopper. So we find our soliciting ca paign is simplicity itself. Every one knows every one e Every one knows every one else's business. Every talks about one's neighbor. Consequently every emplo of the company is ex officio a solicitor of new business

"By these methods and in this way we soon had alm every house and store in town (where such expense was prohibitory) using electricity not only for lighting but a for small motor service and appliances.

"Although our business increased and is still increas handsomely, with a constantly improving load-factor, it plainly seen that if we did nothing more than this end was not far off. We would ultimately reach the sta ing-still stage, for the simple reason that there would be more business to be acquired.

"Therefore we boom our towns. In the case of the to we are speaknig of we aided the start of a Board of Co merce for the purpose of attracting new industries. Pr tically all of the business men in town became memb An attractive pamphlet descriptive of our town was p lished and sent to all parts of the United States. Adver ing matter was placed in newspapers. By means of c pings, prospects were found and closely followed up by c respondence. We solicited and received help and le from similar organizations in neighboring cities and tow Soon people began to hear about Rochester. Scarcely week passes that we do not receive one or more inqui from industries starting up or desiring a new locati Some we have declined; a great many have refused What matter? We are accomplishing our end just the sa

"And what does all this mean right here in town? means that we have an enthusiastic body of men who beli in their town—a bunch of boosters in the place of disco aged knockers. We have a body of men every one of wh is a walking advertisement of our town. We have so thing before us all the time—matters to discuss—busines attend to. And the result is an awakened town.

"We offer no bonuses. We do not promise exempt from taxation. We do offer an ideal town for a good dustry to locate in. And we believe this is enough. B ness men are quick to see the advantages of a small to situated as is Rochester. Grafters don't see these adv tages so readily.

"But what has all of this to do with the lighting company? Simply this. In a town of this size the lighting company is usually the only public-service corporation except the interurban street car company. Therefore, the lighting company, being in touch with the entire population, is the logical one to lead in such a move. By so doing we lay ourselves open to the criticism of self-interest. Well, if our motive is selfish it is not unworthy. What though we do count on increasing our business by the addition of new industries? Does not also every other merchant in town? Our company believes that everything which will benefit the town helps the company. To this end we freely furnish rooms where the board may hold its meetings and even allow our salesroom to be used for the demonstration of gasoline engines. At the present time the writer, as an officer of the Board of Commerce, is attempting to induce to come to town a concern manufacturing gasoline engines for the use of farmers, even though by so doing we warm a viper in our bosom. For we confess to a particular 'hankering' for that farmer business ourselves.

"In conclusion allow me to repeat:

"To obtain new business we make all employees solicitors and depend on low rates, fair treatment and invariable courtesy to do the rest.

"To obtain new industries we organize a Board of Commerce or a Board of Trade, advertise as extensively as possible, watch trade journals and newspapers for notices of prospects, and boost. And we see that the whole town is back of us and boosts too."

RATES FOR ELECTRIC SERVICE.

BY H. C. ABELL.

Assuming that a plant is built and a distribution system installed adequate for a certain period of time, as the plant and lines become loaded, the output curve becoming an average for an electrical plant, the expenses per unit sold will decrease until it becomes necessary to install additional apparatus and at the same time probably add to the working force, organization, etc., at which time the expenses may be somewhat increased, so that in the average plant the cost per unit sold may make a curve somewhat resembling a saw tooth, each tooth covering a period of from one year to four or five years. When the plant is large in proportion to the added increments of equipment and organization the total cost per unit sold is not so variable, unless it should become necessary to make some extensive investments, such as a large installation of underground distributing systems to replace an overhead system, a new generating plant or some large expenditure. In the case of the new plant the decreased output cost to generate by later and more efficient apparatus may partially offset the increased cost due to the increased investment.

When taking on large consumers whose demands would take up fairly large percentages of the equipment it is essential to consider all the costs to the company, including the equipment necessary due to the proposed consumers' demand and load-factor.

The following will show some of the methods of analysis which were used in an actual case: A load curve was plotted which approximated that of the average electric plant. As the plant in question had a load approximating this the actual load curve was used for the analysis. The expenses were obtained which were common to consumers only, the fixed expenses which were not common to consumers or varied with the output, which expense is usually called equipment, then the variable expense which was not a consumer expense and which is proportional to the energy sold usually termed "output expense." To each of these three expenses are added the rate of return on the value of the property and the depreciation in proportion to the subdivision of expenses.

The following figures were obtained: Consumers' expense, \$31,883.68; equipment expense, \$36,458.91, and output expense, \$74,633.54. There were 2900 average customers. The maximum demand for these customers was 1200 kw and the sales were 1,560,753 kw-hours per annum. The consumers' expense amounted to 91 cents per consumer per month; the average consumers' demand, relative to the maximum station demand, was 4/10 kw, which amounted to \$1 per month, and the output cost per kw-hour sold was 4¾ cents. The consumers' active loads or demands were assumed as a percentage of the connected ratings varying with the various classes of consumers. (The writer will not go into these subdivisions, as they have been referred to in various articles in the *Electrical World* and under the headings of the reports of public service commission news for the different states.)

For this particular company the rates charged were 14 cents per kw-hour for the first thirty hours' use per month on the estimated demand of the connected load; 8½ cents for the next sixty hours' use, and 5 cents per kw-hour for all in excess of the first ninety hours' use per month. When reductions are to be made it is hoped that they will first come on the last step, then on the second step, until finally the actual rate will more closely approximate the average cost curve.

For comparative purposes the writer has taken the average of all classes of consumers which has been previously referred to. Curve "A" shows the price received per unit sold for a variable number of hours of use per day on monthly average by any consumer. It is based on the step system of 14 cents, 8½ cents and 5 cents and a demand of 4/10 kw. Curve "C" shows the amount of the consumer's monthly bill estimated on the various hours of use based on cost curve "A." Curve "B" shows the cost per unit for energy used during the month when assuming the same demand as curve "A." Curve "D" shows the consumer's monthly bill for the various hours of use per day based on cost curve "B." From these curves it can be seen that "B" crosses "A" at about two and three-quarters hours' daily use on the demand taken.

In the illustration which is taken in this article 84 per cent of the energy was sold during the first two hours per day on the demand, or less time. Curve "B" shows that energy sold to a consumer who uses less than an average of eighty hours per month, on the rates of curve "A," does not pay to the company his average cost, which includes interest and depreciation.

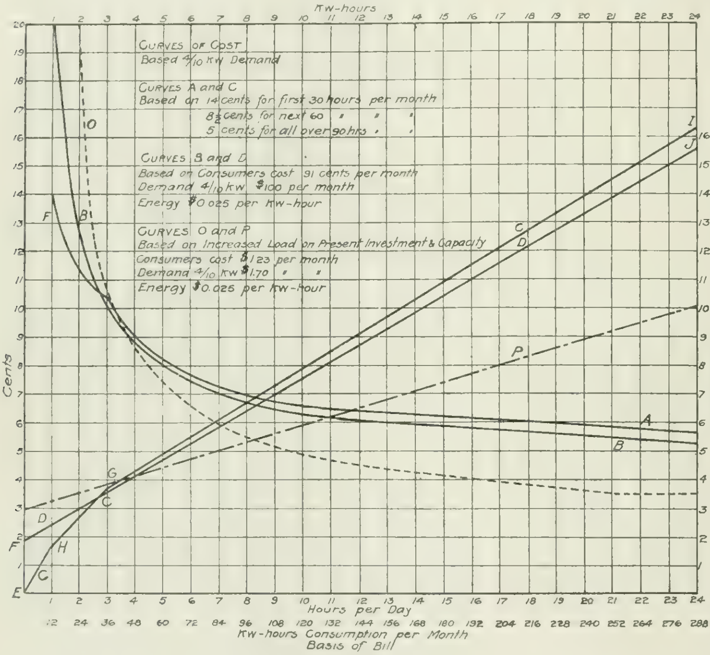
If the company had two consumers with the demand of 4/10 kw and one consumer used energy for an average of only two hours per day on his demand, he would be short 35 cents per month of meeting his proportion of the expense curve "B" when paying by the rate shown by curve "A." The other similar consumer would have to use energy eleven hours per day when the same rate is applied in order to cover the cost of service of both consumers. The pecuniary loss in the sales of energy below cost to many short-hour consumers has to be made up, in order that the company furnishing service may meet its obligations. As it was shown, when a customer uses energy for two hours per day on his actual demand the shortage cannot be made up on a like average consumer unless he should use energy for eleven hours per day. It is therefore necessary with the type of step rate here shown to have some larger long-hour consumers who pay a rate sufficiently high to cover their cost plus the deficiency of many short-hour users.

As previously stated, the curves "C" and "D" show the amounts of the consumers' monthly bills. The length of the ordinate between curves "C" and "D" inside of space E, F, G, H, E shows the loss on any consumer having a demand of 4/10 kw who uses energy from an average of no

hours per day to two and three-quarter hours per day. The difference between the two curves vertically inside the space G, I, J shows the amount the long-hour consumers pay more than they would on the cost curve "D," but which is necessary to make up for the losses represented by the space E, F, G, H, E.

The lower the initial rate is made the higher the long-hour consumer's average rate will have to be until the two ends, maximum and minimum, are brought together and the schedule becomes one straight horizontal rate. It has been demonstrated by practice that such a rate does not develop the electric sales of energy to the company's and consumer's mutual benefit. It is then necessary to make an analysis and endeavor to classify the consumers somewhat in proportion to their cost.

Another method of analysis is to estimate the actual output cost on the basis of the present plant with increased load-factor. There are then certain items which would not vary much with the increased sales, such as organization expenses, labor, etc. Repairs would not increase in proportion, as each piece of apparatus would have a larger load to carry instead of running light part of the time, and the maintenance would not be on an additional machine. The above class of expense mentioned would then have a larger percentage fixed, and the output expense would then become more one of actual material used to generate electricity, such as coal, water, etc. The probable increased cost due to additional apparatus, etc., would not be considered, but the cost would be taken at one point in the saw-tooth curve.



Cost of Electric Service.

The following segregation of expenses is based on this assumption. The proportion of the rate of return and depreciation is subdivided in proportion to the expense and added, as previously stated in the other example. The consumers' expense would then become $42,795.42; the equipment expense $61,161.91, and the output expense, $39,018.82.

The average consumer cost per year would then become $14.75 instead of $11, the equipment expense $51 per year per kilowatt demand coincident with the maximum station demand instead of $30, and the output cost of energy $0.5 per kw-hour instead of $0.0475. Curve "O" is the unit c t curve similar to curve "B," and curve "P" the consum s monthly bill with the same hours of use as shown in cu e "D."

This analysis would be incorrect for a physical and - vestment growing property except for off-peak busin. It would increase the cost of energy to the short-hour u r enormously, and not in the proper proportion, as the pl t increases. The analysis is, however, useful in order to - tain a figure per unit of increased sales on the present pl for a long-hour consumer, one who adds materially to e load-factor and does not absorb much of the available - pacity, but pays a fair proportional rate of return and - preciation on the actual use of energy. Such a consum r on a hydroelectric plant might be very profitable, especi when water is running over the dam.

In fact, the cost to the company might under certain c ditions be extremely low, the rate of return and de ciation could not be equita subdivided in the way stat but a larger percentage of th two costs would be added better the load-factor, in or to make the price to be more in proportion to the of other sources of power (the value of the service to consumer). This method w not be detrimental to maxin development of sales, would have a tendency to the short-hour consumer lower rate by reason of interest and depreciation ea per kw-hour by the long-h off-peak consumer, and still tain the proper net earni Another method which is is to assume that the prop consumer is being served rate which is considered to the company and all its sumers, then to assume service would be disconti to the consumer and esti the loss or benefit to the pany and its other consu from an operating cost and the change of cost service to the other sumers of the company, in relation to the price

The following is an example of a method used at same plant: A long-hour customer was to purchase en eighteen hours per day at the station switchboard. demand was to be about 24 per cent of the maximum tion demand; besides, some special investment had t made to provide the service. It was found from a ca analysis that this customer would increase the load-f for the eighteen hours very materially, thereby incre the general efficiency of the plant. Energy could be on the basis estimated for approximately 2 cents per hour, and at that rate the consumer would pay his expense, interest and depreciation and the plant as a w be benefited. It was assumed that this customer wou be unprofitable and should not be connected; but afte the analysis the contract was consummated and the actu re- sults substantiated the estimates.

Of course, no example will fit all cases, but general in- ciples can be arrived at and then each specific case c be worked out more easily. No doubt when the questi of

...cis generally better understood the public will be satis-d to leave the destiny of a property to its logical man-er as long as it is known that the public is receiving good ...ve at a proper price.

...POOR ECONOMY OF UNDERLOADED ENGINES.

...r of the commonest mistakes made in purchasing appa-u for small electric power plants is to select engines of ...h large size that one of the engines must be operated at ...ve small fraction of its rated load for a large per-...t:e of the time. Non-technical owners and engineers ...l ited operating experience often fail to realize how ...ck coal is wasted in this way.

...illustration of this was recently obtained in a small ...til station which contains one simple Corliss engine ...vi a 90-kw generator and one compound condensing ...speed engine driving a 175-kw generator. The ...generator is operated alone except during the peak-...riod. Even this small unit is only about one-quarter ...d during daylight hours. On one occasion recently ...er it became necessary to operate the large unit for ...n-four hours the coal per kw-hour immediately in-...as about 25 per cent over the ordinary running con-...

...iring and Illumination

...E DANGER IN IMPERFECT GROUND CONNECTIONS.

...le the importance of grounding secondary circuits in ...er to render them safe against the possibility of acci-... nection with high-tension wires is fairly under-... is generally practised by the large electric-light ...p ies of the country, there is perhaps an insufficient ...re ation of the necessity for having ground connections ...pe ect condition. A poor ground connection is worse ...n one at all on account of the sense of false security ...ich it inspires. Whenever there is a connection between ...-tension lines and ordinary lamp circuits there is a ... condition because of the possibility that some ...dy may complete the connection between high-...sio lines and ground. The possibility of such acci-...ts increased when in addition to the accessible lamp ...ds nd switches there is added a ground wire run-...g wn a pole to an imperfect ground, the wire being ...os so that it is possible for persons or animals to ...ne contact with it.

...ro rods or plates in dry, sandy or rocky soil are of ...y certain value and should not be depended upon. ...erer possible ground connections to water pipe should ...sec ed. The ineffectiveness of ground connections in ... sdy, rocky soil has been many times tested and a ...st plorable practical test of the poor quality of such ...ne ons was recently made by a central station operat-... in northern Michigan. This company grounded its ...onc y wires to a guy wire, the anchor of which was ...ug to be buried in the ground far enough so that a ...d ound connection was secured. An accidental con-...tio between high-tension and low-tension wires oc-...red thereby rendering the guy-wire ground connection ...re cause there was insufficient contact with moist ...th cause the fuses on the high-tension line to open. ...calf as killed by coming in contact with the guy wire. ...vete nary surgeon coming along later to investigate the ...diti of the calf leaned against the guy wire and was ... ki d.

THE CONTRACTOR AND THE CENTRAL STATION.

In reviewing the relation between the contractor and the central station under the general conditions prevalent in large cities, Mr. Arthur Williams, of the New York Edison Company, in a paper presented at the recent annual convention of the National Electrical Contractors' Association, grouped contractors as a whole into three classes. He stated that the relation of each one of these classes toward the central station differs materially, but that in every case considerable light is shed on the reason why a central station is so willing to meet the contractor more than half way.

The first class mentioned comprises contractors who constitute in reality engineering firms. They, as well as their financial resources, are so great as to enable them to enter upon operations requiring large outlays of capital. The work performed by them, such as the wiring of large office buildings, hotels, department stores, etc., is of a size to bring up the question whether the energy should be supplied from a private plant or purchased from the central station. This question is, of course, settled by the owner, acting under the advice of his consulting engineer, but Mr. Williams contended that, even if the character of the service be decided before letting the contract for the electrical work, the contractor himself will often exercise a wide range of influence. The influence, indirect though it may be, is distinctly weighty, and to have a firm of some standing look unfavorably upon central-station service augurs ill for that service. In installations where the conditions mentioned do not exist contractors' recommendations for or against the central-station service very often largely influence the decision.

The second class of contractors referred to by Mr. Williams usually do business on a considerably smaller scale than the first class and limit their range of activity to a single city as a rule, or in the direction of residences, apartment houses or loft buildings. The offices of these contractors are frequently used for display purposes, and they promote in no small degree the many uses of electricity which naturally redound to the profit of the central station. Moreover, from this second group the great engineering contractors develop, so that the service any one of them gets from the central station at first has much to do with his opinion when his business expands.

The third kind of contractor is usually found in a less prosperous neighborhood than the other two, and his work in the main is confined to small lines of installations, consisting chiefly of the small stores and cheaper dwellings. Much of this work is secured through personal solicitation, and many of the persons thus often brought to be fairly large users of electricity could hardly have been successfully approached by a central-station agent. Many contractors notify the central-station company when they are asked to bid on isolated-plant installations, and many central stations in turn refer people who come for wiring to a number of good contractors in their locality. Mr. Williams said that when it is considered that from one of the branch offices of a large lighting company about 2000 contractors are dealt with, and these are located so closely together that within eight blocks may be found more than a dozen, it becomes sharply evident how much good feeling means to the central station. Granting the value of the contractor to the central station, Mr. Williams maintains that the latter should for its part concede freely his due.

For business reasons, as well as for abstract justice, Mr. Williams said that the central station should afford contractors fair and generous treatment, and if this is done the contractor will in almost every case pass on to his customers the impression that they too may expect fair dealings from the central station and proper adjustment of whatever difficulties may arise. The central station, according to Mr. Williams, also owes it to the local con-

tractors to keep good, straight, competent agents in the field. The contractor in building up his own trade brings in business to the central station, and obviously the latter should do its part in reciprocating the favor. As a part in fulfilling this obligation, the central station should do a certain amount of advertising advising the use of electrical energy which, although of a general nature, brings in returns to the contractors throughout the entire territory. It is also due to the contractors that the central station have a fair, clear and impartial schedule of rates, such that the contractor can hope to obtain business under them.

Pointing out means by which the contractor and the central station can co-operate to the benefit of both, Mr. Williams stated that the contractors would find it greatly to their advantage to maintain showrooms, where all kinds of devices suitable for the home or business use of the locality could be displayed. The contractor being more closely in touch with his neighborhood, his display will be more effective than one undertaken by the central station, since the contractor is aiming to meet and stimulate a very local rather than a general demand. Mr. Williams stated that there is abundant opportunity for enormously enhanced growth and the application of more efficient methods in the electrical field. There are also a very broadening range of appliances by which electricity can be advantageously utilized and a growing interest in and appreciation of their practical benefit. He felt that the contractors should do their share toward accomplishing this growth, and from their activities in the past he was confident of the ultimate result.

ONE-PIECE VERSUS TWO-PIECE PUSH SWITCHES.

By Eugene E. Smith.

In electrical installations careful study should be made of all points in connection with the materials used and their maintenance. Each article selected should be analyzed as to its good and bad points in cost, construction and maintenance. In this connection the flush push-switch problem is often overlooked, and the cheapest article is often selected, with bad results. The field of push switches is wide, and prices and results vary. The switches are divided into two general groups, the one-piece and the two-piece switch; by this is meant one in which the mechanism is permanently fastened to its shell and one in which there is a detachable mechanism. The one-piece switch has been in existence since the beginning of electrical control, and has been improved upon from time to time, until improvement had to take a long jump and the detachable-mechanism switch was evolved, with many points in its favor. Granted that the action of one mechanism is as good as the other under conditions that are ideal but which seldom obtain, the danger of damage in the case of the one-piece switch is often detrimental to the proper action of the mechanism. A favorable point to the credit of the one-piece switch is its first cost. The cost to install each switch is equal, but the mechanism of the one-piece switch is liable to injury from all sources, while in the two-piece switch the shell can be installed independently of the mechanism; that is, the wires can be permanently connected and a protecting sheet placed in the shell. The mechanism is thus not liable to damage by plaster, paint, water, etc., present in both new and old buildings. These points are very often overlooked, while they are very important to switch maintenance. Complaints are very often lodged against a non-operating switch, and in the majority of cases defective operation is due to damage caused by plaster getting in the mechanism, or paint causing the push points to stick, or water or dampness causing the mechanism to rust. These defects are likely to present themselves in the one-piece switch, because of the necessity of installing the switch before work is finished in the building, so as to complete the electrical contract on time. The use of the two-piece detachable-mec ism switch avoids all this trouble, because of the insta of the shell only, thus saving the mechanism from p damage by the causes given. The installation o mechanism calls for so little additional labor that no ac need be taken of it. The replacing of a switch mech that has given out by hard usage is a big item to b sidered when making the initial installation. Thi seem a consideration that is a great distance off, but can judge the actual operation of any movable mech as can be seen by the guarantees that are given, whi dom run over two years. The installation of a push is often made with the idea that it will last as long building; but that is poor judgment, and the quest replacement should be taken seriously. The replac of the one-piece switch means labor and cost equal first installation; that is, purchasing a complete mec and shell, disconnecting wires and switch and recon wires and switch, with the possible breaking of wire bending and handling, thereby shortening them and ing a new circuit or tap, which means added labor a pense. The replacement of a two-piece switch mea removal of the plate, the pulling out of the de mechanism, the insertion of the new mechanism a replacement of the plate, all of which is done in le than it takes to write about it. The cost for repla is in favor of the two-piece, detachable-mechanism In making replacements damage done to the surro walls has to be considered, if it is done in a plac looks count for something, as in a hotel, residence, hall, school, office, etc. The detachable-mechanism which requires little labor and that of a clean natur scores a point. Another point that may not be but is worthy of consideration, is the element of tim a replacement is to be made, say, in a guest's roo hotel. There need nothing be said regarding which s more advantageous under these conditions. The inst of a one-piece switch under similar conditions woul that the electrician would have to take tools, an ex lamp cord and a one-piece switch. Arriving at the he would have to disconnect the defective switch connect the new switch, always taking the precaut to soil the walls. There are a number of instanc could be cited to the credit of the two-piece deta mechanism switch.

ELECTRIC LIGHTING FROM THREE-PH CIRCUITS.

By G. P. Hoxie.

It is prevalent practice to distribute electrical en industrial plants by means of the three-phase syste

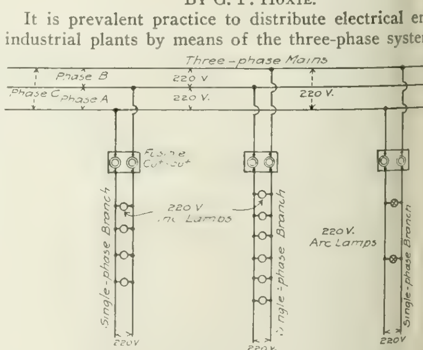


Fig. 1—Multiple Single-Phase Circuits from Three-Phase Circuits.

cipally because of the simplicity and reliability of the induction motor. Although other voltages are used, and 440 are the most common. Usually the proportion of the

tal energy generated required for lighting is small. Most of it is utilized for motor circuits and its adaptability for electric lighting is of secondary importance. Practically all lighting equipment operates only from single-phase circuits; but as a rule it is not advisable in industrial plants to generate single-phase current solely for lighting service. So some plan must be adopted whereby single-phase circuits for the operation of lighting equipment can be arranged from three-phase circuits. In this article some methods of doing this are discussed.

One of the simplest schemes for lighting from a three-phase circuit is suggested in Fig. 1. Single-phase branches

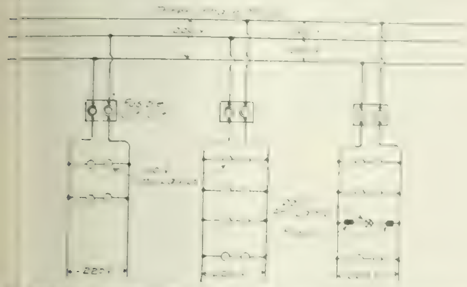


Fig. 1—Series-Multiple Single-Phase Circuits from Three-Phase Circuits.

are tapped from the three-phase main and the voltage across each branch will be the same as that between any two wires of the main. In arranging circuits after the manner shown, the loads on the branch circuits should be so divided that each of the three phases will be about equally loaded. That is, mains A, B and C (Fig. 1) should each serve groups of lighting appliances of approximately equal inputs. Fusible cut-outs should be inserted in each branch circuit where it is tapped from the mains.

In Fig. 1 the mains have a potential of 220 volts, therefore 220-volt incandescent and arc lamps can be fed from the mains. With 440-volt, three-phase mains it is not usual to connect single-phase lighting circuits direct to the mains. Some type of transforming device is interposed between the mains and the branch lighting circuits, as will be hereinafter described.

Carbon-filament incandescent lamps for 220 volts cost more than do similar lamps for 110 volts and they have shorter lives and are less efficient than are 110-volt lamps. Consequently in some installations, where three-phase energy is distributed at 220 volts, 110-volt carbon incandescent lamps are operated two in series as indicated in Fig. 2. In these installations multiple arc lamps are used that are built for operation on 220 volts. Metallic-filament lamps for 110

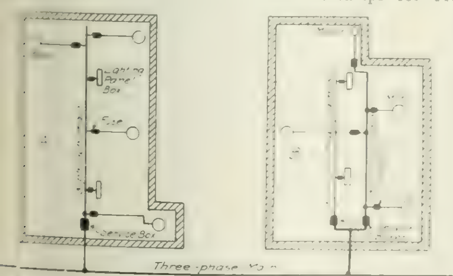


Fig. 3—Wiring from Three-Phase Mains.

volts are cheaper, more efficient and have longer lives than similar ones for 220 volts and have more rugged filaments. They are less liable to breakage. For these reasons metallic-filament lamps are sometimes connected as outlined in Fig. 2. When ordering metallic-filament incandescent lamps that are to be operated two in series it should be specified in the order that the lamps are for series operation so that they can be especially selected for this service. Metallic-

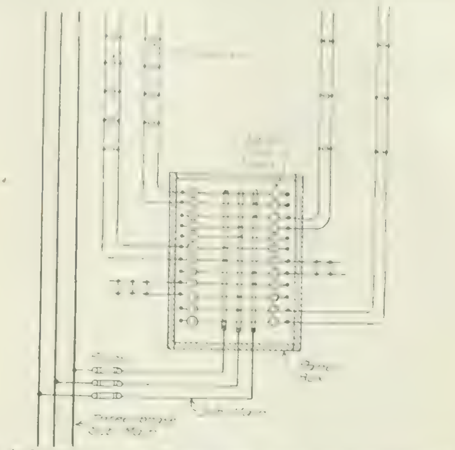


Fig. 4—Three-Phase to Single-Phase Panel Box for Lighting System.

filament lamps are designated by their nominal inputs in watts and two lamps of the same nominal input may vary considerably in actual input. If two such lamps, having different inputs, are connected in series across a circuit of twice their nominal voltage, one of the lamps may be considerably overloaded and will have a correspondingly shorter life.

Two plans for wiring buildings for motors and lamps using three-phase sub-mains are shown at A and B, Fig. 3. The lighting panel box used is shown in Fig. 4. Both of the buildings are served from the three-phase main in the street in front of them. In the plan A energy for both lamps and motors is taken from the same sub-main which traverses the center of the building, while at B individual sub-mains are arranged for lamps and for motors. Where it is essential that the wiring be installed economically and the motors served are of small size the plan indicated at A can be used; but where a first-class installation is desired it is better to divide the lamp and motor sub-mains as suggested at B. The disadvantages of plan A are (1) that the heavy momentary currents, drawn by the motors at times

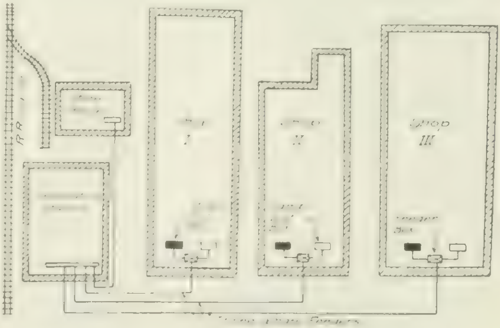


Fig. 5—A Three-Phase Distribution System.

of starting or of changes in load, may cause poor voltage regulation and the consequent unsteadiness of light, and (2) that trouble on the motor circuits may melt the main fuse and extinguish all of the lights. It is assumed for plans A

and B that the voltage regulation on the main in the street is good. With plan B conditions on the motor circuits cannot to any extent affect the regulation on the lighting sub-main, as it is independent and the fuses protecting the motor

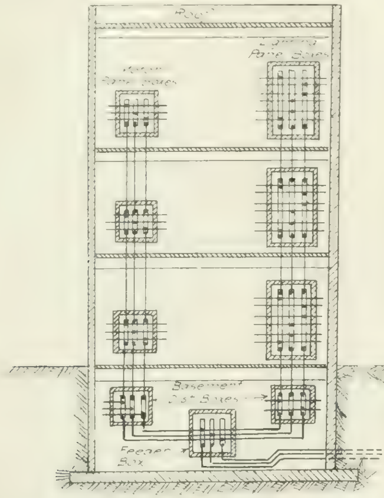


Fig. 6—Plan of Wiring for Building of Several Stories.

sub-main can melt without extinguishing the lights, because only energy for motors feeds through them.

In Fig. 4 is delineated a method of arranging a panel box that might be used in plan A or B, Fig. 3. Three conductors are "tapped" to the three-phase sub-main and carried, through fuses, to the three busbars of the panel box. In the panel box the single-phase branch circuits are connected successively across each of the phases, in rotation, so that the lighting load will tend automatically to balance itself. Edison plug cut-outs are interposed between the busbars and the terminals of the single-phase branch circuits. The scheme of connections indicated in the panel box of Fig. 4 is merely an elaboration of that suggested in Figs. 1 and 2. In Fig. 4, if the sub-mains operated at 220 volts, 220-volt incandescent lamps would be used, or 110-volt lamps might be used in groups of two in series like the arrangement of Fig. 2. If the sub-main pressure was 110 volts, 110-volt lamps would be used on the branch circuits. If the voltage on the sub-main was 440, some other method would be utilized as hereinafter outlined.

A three-phase distribution system for an industrial plant

into a distribution box for motor circuits and into one lamp circuits. The storehouse is served by a small feec terminating in a lighting distribution box. If the buildir have but one story, motor branch circuits might feed dir from the distribution boxes, or mains might be carried fr them the length of the buildings and motor branch circu would be connected to the main as outlined at B, Fig. Lighting circuits, if the buildings of Fig. 5 were all of c story, might be arranged as detailed in Fig. 3B and Fig. If the buildings were of more than one story, the plan Fig. 6 could be adopted. In this diagram fuses and switc are not indicated. From the feeder box mains are carr to the distribution boxes, for motor and for lamp circu which are located in the basement. From the distribut boxes risers are carried through the floors above and pa boxes are located on each floor. Only one set of risers a panel boxes is indicated in Fig. 6, but with a building c ering a large area several sets, duplicates of those sho might be necessary. The distribution boxes in the basem

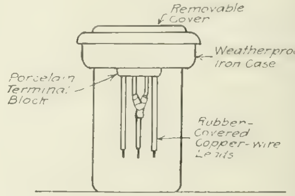


Fig. 8—Auto-transformer.

would, in such a case, be so arranged that all of the riser which would be mains—would feed from them. It migh desirable in some instances to carry individual mains fi one of the distribution boxes to each of the panel bo or to a group of two or three panel boxes. This plan wo probably be followed, particularly with the electric-l circuits, if a building of six stories or over were being wi The reason for this is that circuits can be designed to vide closer voltage regulation if small groups of box rather than large groups—located reasonably close toget are each fed with an individual main.

Because they are very economical of copper and pe the use of individually fed 110-volt incandescent la (instead of two 110-volt lamps in series) 110-220-volt th wire circuits are very extensively used for distributing e tical energy for interior lighting. Three-wire, 110-220- alternating-current circuits can be obtained from 220- single-phase, alternating-current circuits with an auto-tr former as shown in Fig. 7. How this principle is applie three-phase circuits will be shown later. Auto-transfo ers for this and similar services are regularly manufact

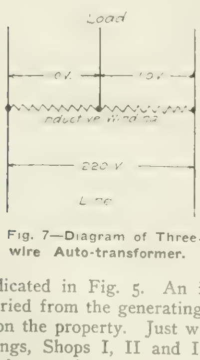


Fig. 7—Diagram of Three-wire Auto-transformer.

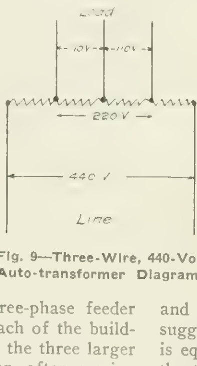


Fig. 9—Three-Wire, 440-Volt Auto-transformer Diagram.

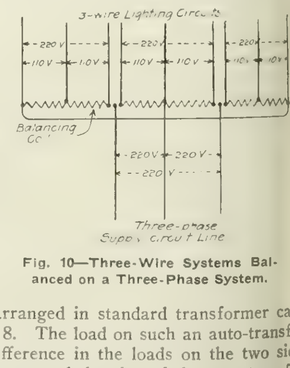


Fig. 10—Three-Wire Systems Balanced on a Three-Phase System.

is indicated in Fig. 5. An individual three-phase feeder is carried from the generating station to each of the buildings on the property. Just within each of the three larger buildings, Shops I, II and III, the feeder, after passing through a service switch and fuses, is divided and carried

and are usually arranged in standard transformer cas as suggested in Fig. 8. The load on such an auto-transfo er is equal to the difference in the loads on the two sid of the three-wire system and the size of the auto-transfo er to be used can be determined accordingly. For exam le:

the load on one side of a three-wire system, like that Fig. 7, were 100 amp and the load on the other side were 50 amp the auto-transformer would be loaded with but 50 — 100 = 50 amp. The amount of unbalance that should provided for in each case—hence the size of the auto-

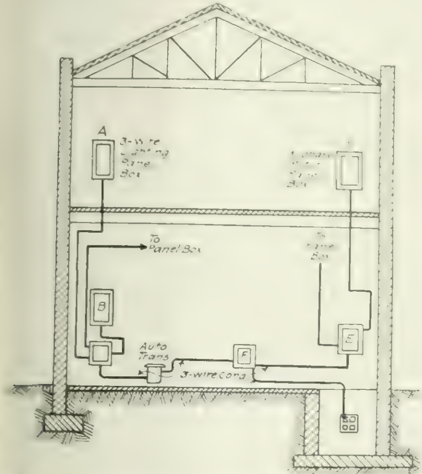


Fig. 11—Auto-transformer for Lighting of Factory Building.

transformer—is determined by local conditions. If there is probability of great unbalance and if the lamps must be kept burning at any reasonable cost, it should be assumed that one side of the three-wire system may be fully loaded while there is no load on the other side. This would mean that the auto-transformer should have a rating equal to the entire load on one side of the three-wire system. However, in practice the amount of unbalance does not, where branch circuits are carefully laid out, often exceed 10 per cent of the total load. On this basis the rating of an auto-transformer should be 10 per cent of the total load to be connected to it. In some installations the amount of unbalance on a three-wire system is very small, not exceeding 5 per cent at any time. But in other cases the unbalance may be as high as 15 per cent or even 30 per cent. A 10 per cent unbalance is probably a fair average working amount.

If an auto-transformer is selected on the basis of slight unbalance, say 10 per cent, and the unbalance becomes excessive, there is not very much that can happen if all cir-

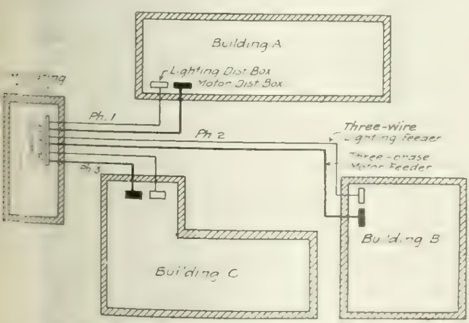


Fig. 12—Lighting and Motor Feeder Lay-Out.

cuits are properly protected by fuses. Voltage above normal may for a time be impressed on the lamps on one side of the three-wire system if a fuse is melted by overload, or currents may flow that are great enough to melt fuses, extinguishing or dimming the lights. But these difficulties reveal themselves, are readily corrected and ordinarily do no serious harm.

Inasmuch as auto-transformers can be purchased that are mounted within weatherproof cast-iron cases they can be arranged on the outside walls of buildings or on poles. Apparently there are no specific rules governing the installation of large auto-transformers, or balance-coils as they are sometimes called in the National Electrical Code. For this reason it would probably be best to confer with the local inspection bureau before making an installation to find just what the district representative would require. It is probable that the rules that govern the installation of transformers would also govern the installation of auto-transformers.

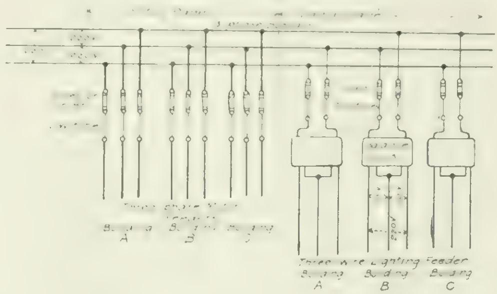


Fig. 13—Three-Wire, Three-Phase Circuit for Motors and Lamps.

That is, they must not be placed inside of buildings, except stations and substations, without special permission, and when they are placed inside of buildings certain precautions must be taken to prevent the spread of fire in the event of the oil in the cast-iron case becoming ignited. A fireproof inclosure of some sort, well ventilated to carry away oil fumes, would probably be required in buildings other than stations and substations.

Three-wire circuits are, with auto-transformers, obtained from 220-volt, three-phase circuits by connecting an auto-transformer, like that of Fig. 7, across any one or across each of two or of the three phases. In Fig. 10 a diagram is shown of three auto-transformers, each serving a three-wire circuit and each connected across one of the three phases. Three-wire 110-220-volt circuits can be obtained from any one of the phases of a 440-volt, three-phase system by using an auto-transformer such as that indicated diagramatically in Fig. 9. Equipment for this service can be purchased from any of the principal builders of transformers.

Transformers can, of course, be used for any application shown herein for auto-transformers. But, as a rule, trans-

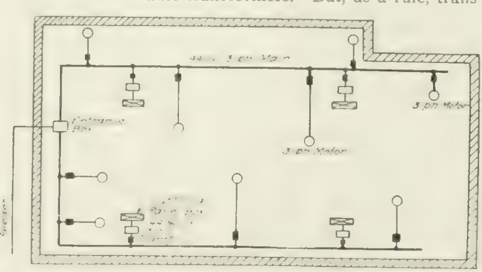


Fig. 14—Lighting Circuits Fed Through Transformers.

formers for a given application will be more expensive than auto-transformers. This is because a transformer has two windings, a primary and a secondary, and because a transformer must always have a rating equal to the full load on the three-wire system. It should be noted that an auto-

transformer, arranged between a single-phase and a three-wire system, must have sufficient rating to accommodate the full load current in the line wires of the single-phase system unless the voltage across the outside wires of the three-wire system is impressed on the auto-transformer. For example, an auto-transformer operating as indicated in Fig. 7 need not necessarily be of sufficient size to accommodate the primary current in the 220-volt line, while the auto-transformer suggested in Fig. 9 must be of a rating to accommodate the primary current in a 440-volt line. Transformers possess one advantage over auto-transformers. With auto-transformers the secondary circuits are electrically connected to the primary circuit and a ground on the secondary circuit may have the same effect as one on the primary circuit. Furthermore the secondary circuits are at primary potential above ground and may give a severe shock to a person coming in contact with them if there is a ground on the primary circuit—and there usually is. With the transformer there is no electrical connection between primary and secondary circuits, so neither of the above objections holds.

When auto-transformers are used on three-phase circuits to feed three-wire systems they should be connected on the three phases as outlined in Fig. 10. The three-wire mains and the branch circuits for lighting should be so loaded that each phase will be almost equally loaded. Some unbalancing will not appreciably affect the operation of the three-phase system. Just the amount of unbalancing that would be permissible is determined by the characteristics of the three-phase generator, the load on it, and by the character of the equipment connected to the three-phase circuits. It is probable that, with the average generator, there can be, when it is operating at about full load, a load unbalance of possibly 25 per cent between the most lightly and the most heavily loaded phases without the voltage regulation being affected enough to make trouble.

Suggested in Fig. 11 is an arrangement of equipment in an industrial building whereby three-wire, 110-220-volt lighting circuits are fed through an auto-transformer from a three-phase feeder. On entering the building from the subway, the three-phase feeder enters a feeder box where mains are branched from it. One phase only, for lighting, continues to the auto-transformer, and the other three-phase branch for motor circuits is carried into the three-phase distribution box. From this box mains are carried to panel boxes located about the building. From the auto-transformer the three-wire main enters the three-wire lighting distribution box. From this box three-wire mains are run to lighting panel boxes situated in the various departments in the structure. From the panel boxes single-phase branches are brought out and to these branches the electric lamps are tapped. The method of Fig. 11 resembles somewhat the scheme indicated in each of the buildings of Fig. 5. The difference is that in Fig. 5 the lighting mains are three-phase while in Fig. 11 they are three-wire.

A single auto-transformer, like that in Fig. 11, on one phase of a three-phase system might unbalance the system excessively, but this can be avoided by installing au-transformers in other buildings on the other phases. The connections for the auto-transformer in Fig. 11 are shown in Fig. 9.

It is, as hereinbefore outlined, often desirable to install individual feeders for lamps and for motors. This applies whether auto-transformers are used or not. In Fig. 1 is shown the feeder layout for a manufacturing plant generating 220-volt, three-phase energy and using separate feeders for motor and for lamp circuits. The pressure on the three-phase motor feeders is 220 volts and that on the lighting three-wire feeders is 110-220 volts. Auto-transformers connected as shown in the feeder diagram, Fig. 13, are utilized to obtain three-wire circuits from the three phases. The notation on this diagram corresponds with that in Fig. 12 and indicates how the motor and the lamp feeders are apportioned.

In at least one factory the method of lighting from th[e] phase circuits shown in Fig. 14 has been used. The th[ree-]phase mains operate at 440 volts and at each lighting p[anel] box a transformer is installed which reduces the pres[sure] to 110 volts for the lighting circuits. Three-phase bus[es], fed by the transformer secondaries, are arranged in [each] box and from these buses single-phase branches are tap[ped]. The connections within the lighting panel boxes are [sub]stantially the same as those indicated in Fig. 4. Th[ree-]phase motors operate from the same mains that supply [the] lighting energy.

Letter to the Editor.

Electrical and Other Causes of Fire.

To the Editor of Electrical World:

It appears to be the rule to ascribe to an electrical c[ause] the origin of a fire when the real cause is not known [A] recent experience of the Terrell Electric Light Com[pany], of which the writer is manager, indicates one of the c[auses] of fire which seem to have been overlooked, and whi[ch in] other cases may be attributed to electric wires. I[n the] morning a fire was discovered in the roof of the b[oiler-]room of the Terrell Electric Light Company and wa[s ex]tinguished before any damage was done. Upon a thor[ough] examination it was found that in four separate p[laces] accumulations of soot and dust, which had settled o[n the] truss joists of the boiler-room and on the iron-stack br[ac]ing, were afire, and there appears to be no doubt tha[t the] origin of the fire was from spontaneous combustio[n in] such a small pocket of soot and dust. This evidence m[akes] it clear that many fires attributed to incendiarism, el[ectric] wires and bad fuses may be caused by an accumulati[on of] old rags and clothing, soot and dust covered, in attic[s and] out-of-the-way places. If attics and closets of resid[ences] were cleaned up occasionally, we should probably [have] fewer fires.

Terrell, Tex. E. D. Kei

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORL[D]

Generators, Motors and Transformers.

Characteristics of the Mercury-Arc Converter.—J. W. Elliott and S. C. Parsons.—A record of experiments made upon a 200-volt, 50-cycle mercury arc, delivering 10 amp direct current at 110 volts. An investigation was made of the changes taking place in the state of the arcs during their passage from the anode to the cathode. Referring to Fig. 4, the interval during which an arc exists between either C_1 or C_2 and D is 0.01 second, which is too short to permit the changes to be perceived by [di]rect vision. The authors adopted a stroboscopic meth[od] of viewing the arcs during their various stages. Fo[r] this purpose a disk of stiff paper having three slits spac[ed] 360 electrical degrees apart was mounted on the shaft [of] the six-pole alternator supplying energy to the converte[r]. By shifting the position of the disk with reference [to] the poles on the alternator, the arcs were viewed in v[ar]ious conditions, just as though each condition viewed re[ma]ined

onstant. Photographs obtained stroboscopically showed hat the time-angles of overlap at the two anodes are videly different, being about 15.5 electrical time degrees it one anode and about 70 degrees at the other anode. Oscillographs taken of the wave-form of voltage revealed a lack of symmetry in the positive and negative half-vaves. The authors expressed the opinion that this re-

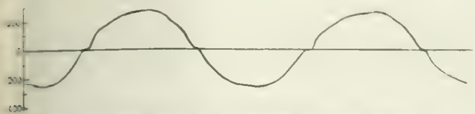


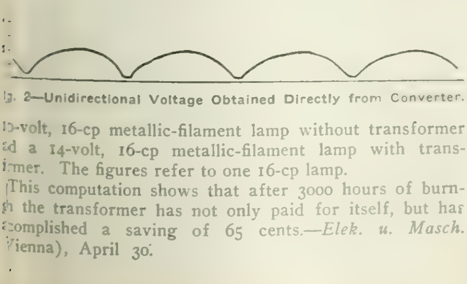
Fig. 1—Wave-Form of Alternator Supply Voltage.

ult was attributable to a difference in the inductance in ne anode as compared with that in the other, due to the osition of the inductance coil in the direct-current cir-uit, which was placed in close proximity to the inductance n one of the anode circuits which is wound on the end of the transformer coil. Fig. 1 is the voltage wave of the lternator when the converter was delivering 9.7 amp to carbon-filament lamp. The unidirectional voltage ob-ained directly from the converter at this load is shown n Fig. 2, while Fig. 3 shows the unidirectional voltage elivered to the load circuit, the effect of the inductance oil *G* (Fig. 4) being very marked in smoothing out the vave-form.—Lond. *Electrician*, July 14.

Transformers for Metallic-Filament Lamps.—F. NIET-AMMER.—An illustrated article on tests of transformers nade by a German company for operating low-tension netallic-filament lamps from commercial supply mains. he transformer is always switched in or out on the rimary (network) side, so that the no-load losses are voided. It is possible to use lamps as small as 5-cp, 4-volt on 200 to 500-volt mains. The price is less, the pecific consumption in watts per cp is less, and the life nuch longer than with ordinary 110-volt lamps. In some ases the watts consumed per cp by such a low-voltage amp, together with transformer, are less than those con-umed by an ordinary-voltage lamp without transformer. The author gives the results of tests of such small trans-

	110 Volts Without Transformer.	14 Volts With Transformer.
[illegible] transformer		$2.25
[illegible]	$[illegible]	0.25
[illegible]	1.1	0.95 primary
[illegible]	[illegible]	1,500
[illegible] for 3000 hours burning	$2[illegible]	$0.50
[illegible] for 3000 hours burning [illegible] per kw-hour	6.60	[illegible]
[illegible] transformer, 100 per cent [illegible]		2.25
[illegible] for 3000 hours	9.10	8.45
[illegible]		0.65

rmers. The efficiency determined for six different sizes aries between 88.3 and 98.9 per cent, figures being also iven for voltage drop, power factor, etc. The author ally gives the accompanying comparative figures for a



ig. 2—Unidirectional Voltage Obtained Directly from Converter.

10-volt, 16-cp metallic-filament lamp without transformer nd a 14-volt, 16-cp metallic-filament lamp with trans-ormer. The figures refer to one 16-cp lamp.

This computation shows that after 3000 hours of burn-g the transformer has not only paid for itself, but has ccomplished a saving of 65 cents.—*Elek. u. Masch.* (Vienna), April 30.

Lamps and Lighting.

Tests of Reflectors.—LEONARD MURPHY AND H. L. MOR-GAN.—A report of candle-power distribution tests made upon a 240-volt, 60.5-watt osram lamp with and without reflectors. The bare lamp gave a mean spherical candle-power of 36.3. When equipped with two types of prismatic reflectors the mean candle-power became 29.5 and 29.8; with a conical opal shade 10 in. in diameter, 5 in. deep, the mean candle-power was 29.8; with an enameled

Fig. 3—Wave-Form of Unidirectional Voltage to External Circuit.

iron shade of the same size and shape, the mean candle-power was 20.95; when inclosed by a silvered glass reflector 8 in. in diameter, the mean candle-power was 29.4. Illumination tests were made with all of these equipments except the last in a room 42.5 x 23.0 x 12.5 ft. high, having light-brown walls and ceiling of poor reflecting quality, use being made of twenty equally spaced lighting units. Defining as the illumination efficiency the ratio of the useful flux at the table level to the total flux produced by the lamps, it was found that the efficiency had the following values: Bare lamp, 32.2 per cent; concentrating prismatic reflector, 46.8 per cent; diffusing prismatic reflector, 43.7 per cent; conical opal shade, 48.8 per cent, and enameled iron shade, 42.8 per cent. As a result of the tests the authors concluded that shades of the opal, prismatic or silvered-glass varieties may be expected to absorb from 17 to 20 per cent of the light; that with bare lamps about 30 per cent of the flux produced is available at the table level; with the most effective shades this may be increased to 50 per cent; that for rooms illuminated from a large number of well-distributed points, the height being great as compared with the distance between them, it is not necessary to use a shade which produces exactly any particular form of candle-power distribution, but the light should be directed generally downward, or upward if a clean, white ceiling is available for reflection. Additional observations relating to the distribution of

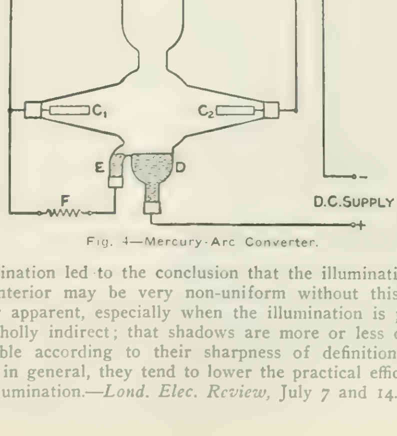


Fig. 4—Mercury-Arc Converter.

illumination led to the conclusion that the illumination of an interior may be very non-uniform without this fact being apparent, especially when the illumination is partly or wholly indirect; that shadows are more or less objectionable according to their sharpness of definition, and that, in general, they tend to lower the practical efficiency of illumination.—*Lond. Elec. Review*, July 7 and 14.

Lighting of Chicago Passenger Station.—C. A. Luther.—An illustrated article describing the electric lighting equipment of the new Chicago passenger station of the Chicago & Northwestern Railway. The station building occupies a ground area of 320 x 218 ft., and contains a main wating-room 100 x 200 ft., with a height of 85 ft. This room is illuminated artificially by reflected indirect light from 420 250-watt tungsten lamps hidden from view behind a ledge, and by direct light from fourteen electroliers suspended between the pillars on each side of the waiting-room. Each fixture is equipped with one 150-watt and twelve 100-watt tungsten lamps. At each end of the room are four standards, each carrying thirteen tungsten lamps. A mailroom on the street level is equipped with mercury-vapor lamps. At all other places tungsten lamps are employed, the ratings varying from 150 watts for general illumination to 25 watts for signs.—*Amer. Gas Lt. Jour.*, July 17 and 24.

Standard Specifications for Street Lighting.—The issue contains answers to a list of queries regarding the framing of standard specifications for street lighting submitted to various authorities in the United States and on the Continent. A summary of the views held by these authorities as given in tabular form is about as follows: The specifications should contain a statement of the electrical energy or gas to be consumed, but not necessarily the amount of light produced. The illumination should be measured in a horizontal plane at a stated height above the ground, measurements being preferably made of both the minimum and mean values. The contract should demand preliminary laboratory tests supplemented by periodical tests of the actual lighting conditions when the lamp is in position. No specific color of the light should be prescribed.—Lond. *Ill. Eng.*, July.

Generation, Transmission and Distribution.

Water-Power Plant for Constantinople.—L. Ostertag.—An article on the possibility of supplying electrical energy for traction and lighting purposes to the city of Constantinople, either by developing on the European side the Maritza River water-power with a transmission line of 200 km (120 miles) or by developing in Asia the Sakaria water-power, with a transmission line of 130 km (78 miles). The latter project, which would represent a very large source of power, is discussed in some detail and believed to be practical, although the time is not yet ripe for its realization.—*Elek. u. Masch.* (Vienna), April 30.

Spontaneous Combustion of Coal.—S. W. Parr and F. W. Kressmann.—Wherever large quantities of bituminous coal are stored the danger arising from spontaneous combustion must be taken into consideration. As a result of fifteen series of tests made upon Illinois bituminous coal, the authors determined the cause for oxidation of the coal in its various stages and suggested the following precautionary methods for minimizing the danger of spontaneous combustion: the avoidance of any external source of heat which may increase the temperature of the mass of coal: the elimination of finely divided coal; maintaining continued dryness in storage, or submerging the coal.—*Bulletin* No. 46, Univ. of Ill.

Traction.

Low-Speed Locomotive.—An illustrated description giving details of a 35-ton, 220-volt direct-current locomotive constructed for hauling coke at the Woodward (Ala.) Iron Works. The motors develop a tractive force of 10,000 lb. at the rated one-hour load, with a speed of 6 miles per hour.—*Elec. Railway Jour.*, July 8.

Railway Telephone and Semaphore.—A description of a combination telegraph and semaphore system which provides a selectively operated semaphore signal for use in connection with the telephone train wire, so that the dispatcher can talk to any train crew.—*Elec. Railway Jour.*, July 8.

Suspended Passenger Cableway to the Aiguille du Midi.—Alfred Gradenwitz.—A description of a passenger-hauling equipment being installed between Chamonix, the foot of Mount Blanc, and the Aiguille du Midi, t difference in elevation between which is 2850 m (9350 ft The suspended cableway is constructed with three cabl the supporting cable serving as runway for the truck ca rying the car, the endless driving cable situated unde neath and a braking cable. Two cars will be operat for simultaneous uphill and downhill travel.—Lond. *El Review*, July 14.

Installations, Systems and Appliances.

Electrolytic Spark-Suppressor.—A note on a Briti patent (No. 14,499, July 6, 1911) of W. A. Price, coveri means for converting direct current into current suital for driving alternating-current motors. Use is made mechanical devices for interrupting the current and r versing the connections and of one or more electroly condensers acting in conjunction with auxiliary inducti and non-inductive circuits to obviate sparking.—Lo *Elec. Eng'ing*, July 13.

Isolating Switches.—A note on a British patent (N 2594, July 6, 1911) of Siemens Brothers' dynamo wo and R. A. R. Bolton, relating to means for preventing t accidental opening of a switch under heavy short-circu The isolating switches are of the ordinary knife for, fitted with a spring-locking catch which can be dise gaged only by a pull on the ring provided to open t switch by a hooked pole or otherwise. The ring is attach to a lever mounted on the blade which pushes up t catch when it is pulled.—Lond. *Elec. Eng'ing*, July 13.

Wires, Wiring and Conduits.

Railless Traction-Wire Support.—A note on a Brit patent (No. 3747, June 29, 1911) of H. Sefton Jon dealing with the suspension and tension of the wires a railless traction system. The conductors are suspen on U-shaped supports, one limb being surrounded with insulated layer and provided with a head-piece, placed a screwed-in protected bell, to prevent it from slipping o the whole being fixed to the stirrup; the other limb is b upward to support the conductor. A special stirrup designed for bends, one side being provided with a proje ing arm in which there are several holes, for a tens wire to be connected, so that an inclined pull can be tained at bends, making it possible to lay one conduc somewhat higher than the other, and so preventing the tr ley from slipping off.—Lond. *Elec. Eng'ing*, July 6.

Design of Transmission Lines.—S. B. Wiggins.—A n mathematical article discussing some of the essentials t must be considered in order to predetermine the charact istics of a transmission line. The features dealt with clude line structure, insulators, conductor material, lig ning protection and transformer connection.—*Michi Technic*, June.

Electrophysics and Magnetism.

Duration of Electrical Contact.—A. E. Kennelly A E. F. Northrup.—The authors have made use of Sabine method of measuring very small intervals of ti by determining the loss of charge of a condenser of kn capacity through a resistor of known resistance closed the brief interval to be measured. Tests made by Kennelly in 1889 with a number of metallic spheres different sizes and substances showed that the duration contact was very nearly proportional to the ball's diame at any given drop or height from which the ball fell u an anvil, and the greater the drop the shorter the du tion. In 1910 Dr. Northrup conducted tests which est lished the fact that the duration of contact varies invers with the one-tenth power of the vertical drop and dire with the diameter of the ball. The harder the metals t their mutually impacting surfaces the shorter the durat The duration is roughly about 20 per cent greater w n a sphere impacts upon an anvil than when it impacts u n a stationary sphere of the same size. The suggestio s

ade that the impacting sphere method may be employed r obtaining definite and predetermined small intervals contact in electric circuits.—*Jour. Franklin Institute* ..y.

Electrochemistry and Batteries.

Tungsten Concentration.—H. C. Parmelee.—The sec nd part of an article entitled "The Problems of Tungsten oncentration." In the present instalment descriptions are ven of the apparatus and operation of mills for the treatment of old tailings and of mills for the treatment of ores. mong the mills described are those of the Primos Milling Mining Company, of Smith & Ardourell and of the Wolf ngue Mining Company. In the Lakewood (Col.) mill the Primos Mining & Milling Company electricity is used th for lighting and motor service, all machinery being electrically driven.—*Met. and Chem. Eng'ing*, August.

The Metallurgy of Wrought Copper.—F. Johnson.—After outlining the recognized properties of copper as compared with other metals, the author discusses the phenomena which occur during the refining of copper and the effect of mechanical work on copper, and describes tests relating to the behavior of copper at high temperatures.—*Met. and Chem. Eng'ing*, August.

Electrically Controlled Constant Temperature Water Bath.—H. C. Gore.—A brief outline with diagrams of an electrothermostat and an electromagnetically operated water valve for maintaining constant temperature in a water bath for an immersion refractometer. The thermostat consists of a mercury-column switch actuated by the heat of the water bath. The valve for admitting cooling or heating water to the bath consists of an ordinary electromagnetic sinder used in connection with a collapsible rubber tube.—*Jour. Ind. Chem. and Eng. Chem.*, July.

Units, Measurements and Instruments.

Plotting Hysteresis Curves.—R. Czepek.—An illustrated description of an instrument for plotting hysteresis curves which is a modification of the Ewing instrument. But, while in the latter adjustable direct current is employed, the author makes the test with commercial alternating current. As shown in Fig. 5, the curve is demonstrated

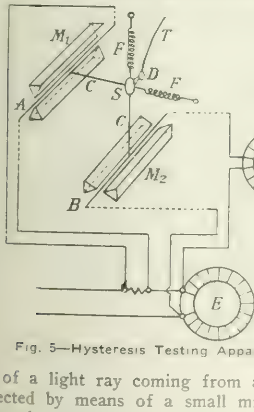


Fig. 5—Hysteresis Testing Apparatus.

by means of a light ray coming from an arc lamp and being reflected by means of a small mirror S which is mounted on the point of the support D and is deflected from its normal position by two wires CF, one being horizontal and the other vertical. One end of each of these two wires is coiled up in spiral form F and connected to a fixed point. The other ends of the wires C are connected with the wires A and B respectively, which move in horizontal and vertical directions respectively, between the poleshoes of the two electromagnets M_1 and M_2. Ewing's instrument is so arranged that the iron sample under test forms the legs of the electromagnet with the poleshoes M_2 and that the adjustable direct current which magnetizes the iron sample is also passed through the wire A. The field of M_1 is excited by the same direct current which passes through wire B. The horizontal oscillations of A are proportional to the magnetizing current; the vertical oscillations of B are proportional to the air induction of the magnetic circuit formed by iron sample, yoke and poleshoes. The author's instrument is quite similar, but all parts are made very small, as in an oscillograph, so that the characteristic oscillation period of the movable system is small compared with the period of the hysteresis curve to be plotted. M_1 and M_2 are the poles of two direct-current electromagnets. The wire A carries the magnetizing current (or a certain part of it), while the wire B carries an auxiliary current, the charge of which in time corresponds to that of the induction in the iron sample. This condition is fulfilled by making use of Degnione's method for plotting magnetic inductions with an ordinary oscillograph. The wire B, in series with an induction coil L, is connected to the terminals of the coil which magnetizes the iron sample E. The required condition, mentioned above, is then fulfilled, if the ratio of the ohmic resistance to the self-inductance L of the auxiliary circuit is sufficiently small. The wire B is part of the circuit which has the ohmic resistance W and inductance L. The rays from an arc lamp, reflected by the mirror S on a plane surface, produce directly the desired hysteresis loop curve.—*Elec. u. Masch.* (Vienna), April 23.

Bureau of Standards.—S. W. Stratton.—A paper describing the work recently accomplished by the National Bureau of Standards, Washington, D. C., and that now under way.—*Proc. Eng. Soc. Western Penn.*, June.

Needle Galvanometer.—W. Volkmann.—A discussion of the most favorable arrangement of the coils and best dimensions of the wires for needle galvanometers.—*Ber. d. Deutsch. Phys. Ges.*, No. 4, 1911; abstracted briefly in *Elek. u. Masch.* (Vienna), May 7.

Telegraphy, Telephony and Signals.

Marine Telephone.—A short illustrated article on the Siemens loud-speaking telephone for marine service, the chief feature of which is that the loud tone is not obtained by the usual method of allowing large currents to pass through the microphone. The current in each microphone is about 0.07 amp. The instruments are arranged for working at 15 volts, which can be obtained either from the ship-lighting mains by means of a potentiometer resistor or from batteries. The microphone and telephone are constructed in a removable capsule form and are perfectly watertight.—Supp. Lond. *Electrician*, July 7.

Book Review.

Factory Organization and Administration. By Hugo Diemer. New York: McGraw-Hill Book Company. 317 pages, 148 illus. Price, cloth, $3.

Until very recently it was generally supposed that science could be applied with success only to inanimate objects and processes. It was considered that a machine might be invented, developed, improved or repaired by the application of intelligence and science to the process and materials in which the machine was engaged and constructed. It was not considered that the same kind of intelligence or science could effectively be applied to the working of the machine for winning profits to the investor or securing comfort to the machinist who worked it. The book is a plea on behalf of the utility and economy of applying science to each step of factory production by the efforts and skill of trained engineers. It deals with the means of eliminating wastes and unnecessary labor, with the acceleration of output, the encouragement of the worker, the selection of the best sites, materials and markets for products. The book will commend itself both to factory owners and engineers.

New Apparatus and Appliances

EXHIBIT AT OHIO CONVENTION.

At the convention of the Ohio Electric Light Association, held at Cedar Point, Ohio, July 25 to 28, inclusive, a number of manufacturers displayed exhibits of their products on the lower floor of the convention hall. Among the exhibitors represented were the following:

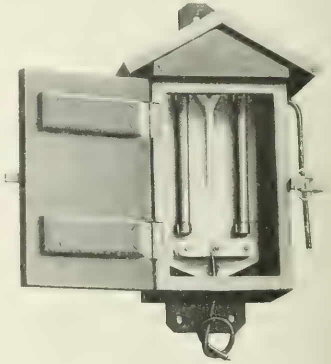
Adams-Bagnall Company, Cleveland, Ohio—Regenerative flame-arc lamps and Jandus fans. Allis-Chalmers Company, Milwaukee, Wis.—Steam turbines, transformers and motors. American Electric Iron Company, Detroit, Mich.—Electric irons. F. Bissell Company, Toledo, Ohio—Motors, time switches, charging sets, etc. Comet Electric Stove Company, Detroit, Mich.—Electric stoves and time switches. Crocker-Wheeler Company, Ampere, N. J.—Motors and transformers. Eclipse Electric Manufacturing Company, Chicago—Flat-rate controllers and sign flashers. Ft. Wayne Electric Works, Ft. Wayne, Ind.—Motors, meters and transformers. General Electric Company, Schenectady, N. Y.—Steam-flow meters, ozonizers, electric ranges, radiators, etc. Hart Manufacturing Company, Hartford, Conn.—Meter-protective devices. Hoover Suction Sweeper Company, New Berlin, Ohio—Electric sweepers. Hughes Electric Cookstove Company, Chicago—Electric stoves and ranges. Machado & Roller, New York—Electrical instruments and meters. W. N. Matthews & Brother, St. Louis, Mo.—Clamp guys, guy anchors, line switches, lamp guards, etc. Mica Electric Sign Company, Cincinnati, Ohio—Colored transparent signs. Northwest Electrical Equipment Company, Brooklyn, N. Y.—Meter-protective devices. Packard Electric Manufacturing Company, Warren, Ohio—Transformers, insulating varnishes, etc. Sangamo Electric Company, Springfield, Ill.—Watt-hour meters. Sterling Electric & Manufacturing Company, Warren, Ohio—Incandescent lamps. Wagner Electric Manufacturing Company, St. Louis, Mo.—Single-phase motors, unity-power-factor single-phase motor, battery-charging rectifiers, etc. Western Electric Company, New York—Lamps, washing machine, etc. Westinghouse Electric & Manufacturing Company, Pittsburgh—Tungsten lamps, transformers, fans, motors, circuit-breakers, etc.

OUTDOOR LIGHTNING ARRESTER.

Lightning arresters must protect apparatus not only against disturbances due to visible atmospheric discharge, but also against stresses caused by induction or surges on the line, or heavily charged clouds of rain or snow drifting across the line. So many and varied are the causes of disturbances and the different conditions under which apparatus must be protected that it is impossible to build a universal lightning arrester or one that will protect all apparatus on various kinds of circuits. It therefore becomes necessary to design arresters for different classes of service.

The Westinghouse Electric & Manufacturing Company has placed on the market a new design in its "Type G" lightning arrester for the protection of apparatus on alternating-current circuits having voltages not exceeding 2500 and power not exceeding 1000 kw. As will be seen from the accompanying illustration, the arrester consists of a series of air-gaps between non-arcing metal cylinders arranged in a row and connected in series with a graphite resistor. The cylinders and resistor forming the unit are mounted on a porcelain base, which, in turn, is mounted within a wooden box as shown in the accompanying illu tration. In a two-pole arrester the unit is mounted on tl back of the box, while with the three-pole and four-po arresters two units are used, one mounted on each side the box. On the three-pole style one of the resistor ro and its clips are omitted from the unit. The box is ma of well-seasoned wood and is entirely weatherproof, e abling the arrester to be mounted out doors in any expos location desired.

On a two-wire circuit the arrester has one wire co nected to the top of each graphite resistor, and the grou wire is connected to the middle gap of the series. four-wire circuits the same scheme of connections is use but two units are necessary and the connections of bo are the same. With three-wire circuits two units are use



Outdoor Lightning Arrester.

and the connections are the same as for four-pole circu except that there are but three line connections inste of four.

The operation of the arrester is as follows: If an cessive potential is developed on the line the electric d charge arcs from between the metal cylinders and excess charge of electricity flows to ground, relieving line of the excessive stress. The resistance offered to flow of current by the carbon resistor prevents an cessive current passing through the arrester to ground, a the tendency for a destructive power arc to follow discharge arc is thus counteracted. The arrester may applied on circuits of which the sources of supply capable of developing any amount of power.

MOISTURE-PROOF DRY CELL.

Where considerable moisture is prevalent it someti happens that the cardboard cartons of dry cells absorb much moisture that when the cells are placed side by or on a metallic base they run down and deteriorate qui ly, thus necessitating frequent renewals and an attend maintenance expense. The Western Electric Company obviate this, has recently placed on the market a moist proof dry battery. This cell has been designed especi for use in mine, railway and general telephone ser where the batteries are subjected to moisture. The cell has the same efficiency, life, voltage and recupera power which characterize the standard "Blue Bell" tery. It differs from the standard cell in that the ca

ɔard carton has been treated with a special impregnating ɔmpound which effectually prevents moisture from reaching the cell proper. This, it is claimed, will give sufficient otection so that the life of the batteries used in damp aces will be as great as that of the batteries used in any her magneto service under ordinary conditions.

NIVERSAL HOLDER SOCKET AND REFLECTOR UNIT.

The great attention given to illuminating engineering in e past several years has resulted in many improvements the details of lamp fittings, shades and reflectors. An teresting example of this advance is furnished by a universal holder socket and a reflector now being placed on e market by the Adams-Bagnall Electric Company, of eveland, the two forming a unit to which the trade name ABolite" has been given. The inventor is Mr. W. C. ine, of Cleveland, who for many years has been prominently identified with the development of lighting fixtures,

g. 1—Cross-Section Showing Positioning Device.

Fig. 2—Ceiling ABolite for Glass Reflector.

al from whom the above-mentioned company has secured exclusive license to manufacture and sell the new fitting d reflector.

Formerly shades and reflectors were designed with little no reference to the proper focusing of the filament of the incandescent lamp inclosed. Moreover, with the introduction of the tungsten lamp the two standard sizes of bulbs of the carbon-filament lamp have been superseded by a number of shapes corresponding to the great range of ratings of the metallic-filament lamp. Owing to this latter consideration and to the scientific design of modern shades and reflectors, which design requires the filament to be properly focused, the use of a variety of socket shade-holder attachments has been necessary in order to secure the proper focusing of the filament within the shade or reflector.

The device here illustrated is designed to displace the unsatisfactory adjusting holders heretofore used. As will be seen by reference to Fig. 1, it includes a U-shaped positioning device inside the shell, carrying the porcelain socket or receptacle. When the positioning yoke is thrown down-

Fig. 3—18-in. Dome ABolite for 250-Watt Lamp.

Fig. 4—60-Watt Bowl ABolite.

ward, and the receptacle attached by its screws, the lamp is in a position corresponding to that given by an "O" shade-holder; and when the yoke is thrown upward, the position of the lamp is that corresponding to the use of an "H" holder. Another adjustment gives the position obtained with the "A" holder. With 2¼-in. universal holders lamps from 25 watts to 100 watts are used, 3¼-in. holders being suitable for lamps of 150 watts to 500 watts. One of each of the above sizes suffices for pendent fixtures and the same number for ceiling fixtures, thus obviating the necessity of carrying a diversified stock of fixture accessories.

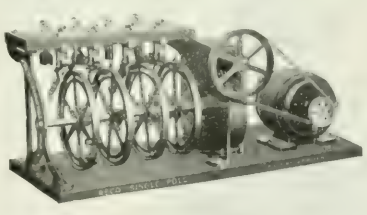
A complete "ABolite" unit consists of a universal holder socket and a scientifically designed steel reflector. The latter are made in a number of shapes, two of which are shown in the accompanying illustrations. The claims made for this unit are as follows:

1. The positioning device provides for three different positions of the filament with relation to a shade or reflector. 2. It eliminates the use of separable holders. 3. There is but one holder socket for all lamps from 25 watts to 500 watts. 4. All weight is borne by the holder socket. 5. The reflector can be removed for cleaning without disturbing the holder socket. 6. Either intensive or extensive illumination can be obtained by simply changing the positioning device. 7. A larger or smaller lamp unit can be substituted for another without replacing the holder socket.

A NEW ELECTRIC SIGN FLASHER.

The Reynolds Electric Flasher Manufacturing Company, of Chicago, has produced a new model in sign flashers, illustrated herewith. In this mechanism the switches are thrown in and out by purely mechanical action. By means of the slots in the wheels holding the rollers which engage a dog and throw the switch in and out, the latter can be shifted or set for long or short flashes. It is often necessary to make a minor adjustment in the flasher after the machine has been set up, and by means of the slotted wheels this can be easily accomplished—a feature that will be appreciated by most electricians who have occasion to install flashers.

In designing this flasher particular attention has been



Electric Sign Flasher.

paid to the roller bearings on which the worm-shaft runs. These are self-contained and require no oiling; the gear drive is inclosed and self-lubricating. There are no parts on the machine to wear out appreciably and the only parts which can burn out are at the switch blades and jaws. The latter are made and attached in such a manner that any person can replace them in a few minutes. Single, double and triple-pole knife-switch types are made.

The motor is mounted on the flasher base, belted, adjusted and ready to connect. The terminals and binding posts are of ample size and convenient, so that the electrical connections may be made readily. Care has been taken to make the machine of rugged construction. Flashers serve the double purpose of making the sign more striking and attractive and of saving electrical energy. The manufacturer of the machine herewith described makes a large variety of flashers, including those intended to produce fancy borders, lightning, crawling-serpent, rat-chaser, skyrocket, fountain-and-flames, as well as to spell out words.

MOTOR-DRIVEN MACHINE TOOLS.

It is a recognized fact that the motor drive for machine tools is of great advantage, and this is especially so in the case of the two grinding machines shown in the accompanying illustrations. Fig. 1 shows a universal cutter and surface-grinding machine that readily grinds all forms of milling cutters ranging in size from 14-in. diameter, 6-in. face, down to the smallest. It will also do surface grinding, covering surfaces 6 in. wide by 9½ in. long. The spindle is of steel, hardened and ground, running in compensating boxes fully protected from floating emery. The motor used, which is a constant-speed machine of ⅙ hp at 1800 r.p.m., is bolted to the column of the machine, with suitable adjustment for keeping the belt under tension. The weight of the machine is 435 lb.

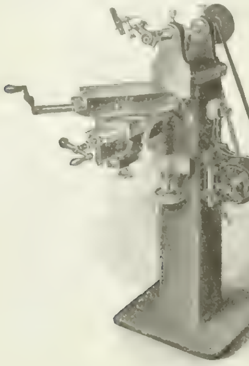


Fig. 1—Universal Cutter and Surface-Grinding Machine.

The surface-grinding machine, shown in Fig. 2, is a standard type with motor mounted on two steel arms bolted to the side of the column. A track for the motor enables the first belt to be adjusted to the proper tension. A looped belt driving to the spindle also has a compensating belt-tightening device. The motor is a constant-speed machine of ½ hp at 1650 r.p.m. The machine, which weighs 400 lb., will grind surfaces 7 in. wide x 9½ in. long and of a thickness from ⅛ in. to 6 in. The adaptation of motor drive is of special value to machines of this character, as they are commonly located in isolated places to which line shafting does not extend. Being portable, they can be set in any position, and having no countershafts they will not discolor the walls or ceilings. The power expense, of course, stops when the machine is idle. The above-described machines are made by the Garvin Machine Company.

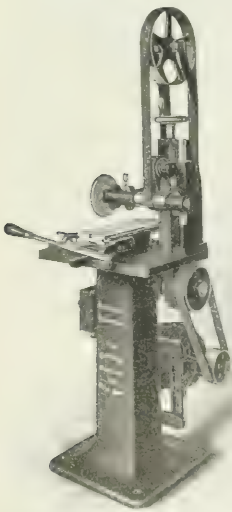
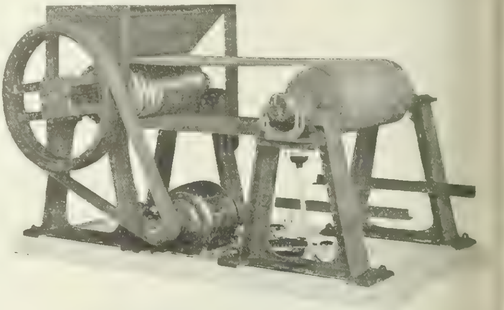


Fig. 2—Surface-Grinding Machine.

MAGNETIC SEPARATOR.

The accompanying illustration shows an improved form of magnetic separator especially designed for removing steel or iron from coal, rock, ore, etc., on its way to be crushed, and for separating iron shot from molding sand, brass chips from machine-shop turnings, magnetic material from ores, etc.

The mixture to be separated is fed onto the moving belt, which runs at a speed of about 100 ft. per minute. The magnetic pulley at the right is made up alternately of steel-disk pole pieces and concentric windings energized through slip-rings outside the bearing. As the material to be separated passes over this pulley, the non-magnetic substances fall directly into a chute provided, while the magnetic material adheres to the belt and is carried further around and under the pulley, where it is precipitated into another hopper. The magnetic substances are thus delivered at a point widely separated from the non-magnetic matter. The magnetic pulley is made rugged and watertight by brass shells which inclose the coils between the poles. These pulleys are regularly built 12 in. in diameter and run at 60 r.p.m. The conducting slip-rings are fitted with self-adjusting carbon-brush holders. The separators have capacities for handling from 1340 cu. ft. to 3000 cu. ft. of material per hour, and are built with magnetic-pulley widths from 16 in. to 36 in., taking from 325 watts to 750 watts on any direct-current voltage. The magnetic pulleys may be furnished in diameters larger than 12 in. if desired. These magnetic separators are built by the Cutler-Hammer Clutch Company, Milwaukee, Wis.



Magnetic Separator.

RUN ON ELECTRIC FANS IN BOSTON'S HOT SPELL

Unprecedented heat in Boston, exceeding all records both in severity and duration, stimulated electric-fan business to an amazing degree. The dealers say that the stock there has been completely exhausted; hardly a fan can be bought in the city to-day. The Edison company has never before experienced anything like the volume of business in that line. It sold more fans during the week of July 3-8 than all of last summer, and could have sold a thousand more during that week and the week following if it could have met the demand. The call is especially heavy for alternating-current fans, for use in the suburbs and country districts. The Edison company has also had an unusual demand for electric ranges and complete cooking outfits.

H. S. Potter, an electrical supply dealer at 24 Commerce Street, spent an hour and a half at the long-distance telephone trying to secure a shipment of electric fans from manufacturers. Finally he was able to secure from a New Jersey concern an invoice which came by express and filled two large delivery wagons. The goods never reached

st'e, but were delivered direct to customers by the re company as soon as they reached Boston. ...gell-Andrews Company, a large supply house re... ts, ; Mr. S. W. Carter, head of the department, that the ... of 12-in. alternating current, 110-volt fans was ...aued in record time; the 12-in. direct-current were not quite so brisk demand, but were quickly taken, and ...r zes are now all sold. This firm's orders for fans ...e n to fifteen times those of normal years, and the ...e as been kept busy constantly since July 3 either ...plyg orders or, later, pacifying customers who could be upplied. The firm had an overstock of electric fans the beginning of July, and had decided that the ...on business in that line was over, when the change ...temperature resulted in upsetting calculations. The ... Fuller Company, Stuart, Howland Company, and ...r alers, report like conditions.

...is to be noted that in spite of the abnormal demand ...es ave been kept down to the regular standards, both the retailers and the jobbers.

DUPLEX WELDING MACHINE PANEL.

The accompanying illustrations show a duplex welding ...hi panel built by the Automatic Switch Company, ...ork City, for use in connection with two 300-amp, ...ol generators. There are five graduated resistors in ...es ith each of the welding tools and also three banks ...es ors, which are cut in across the generator circuit ...n e welding tool is not in contact. This latter opera-

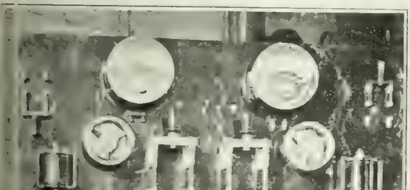


Fig. 1—Front View of Welding Machine Panel.

...is erformed automatically by means of a relay and a ...in nagnet switch, shown in the center of the panel. ...pa el is equipped in addition with a voltmeter and am-...r ith double-throw switches to permit the use of ...r either generator. There are also a field regulator, double-pole, main-line switch with fuses, tubular resistance shown at the base of the panel ... and grid

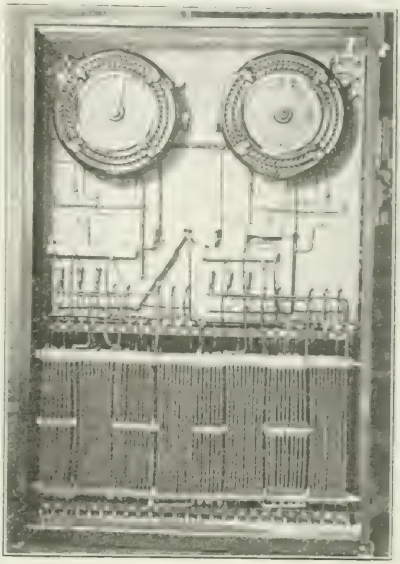
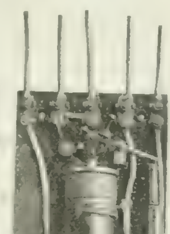


Fig. 2—Rear View of Welding Machine Panel.

resistance back of the panel for the heavier currents in the welding circuit.

MOTORLESS SIGN FLASHER.

The sign flasher shown in the accompanying illustration avoids the cost and disadvantage of a motor-driven device, and requires the minimum of energy for its operation. The flasher, made by the Eclipse Electrical Manufacturing Company, 418 Milwaukee Avenue, Chicago, is in general construction similar to the flat-rate controller made by the same company. The series coil of the controller, however, is replaced by a shunt winding which lifts its core against gravity, closing the circuit to the shunt solenoid which operates the switch. The entire device is immersed in oil, which insulates the parts and prevents sparking at the switch contact. Flashers of this type for either direct current or alternating current can be supplied. The device illustrated is designed for operating successively the two sides of a double sign. Its period of operation can be adjusted by means of the set screw at the top. The flasher mechanism is of polished brass, mounted on ebony-asbestos board, and enamel insulated wire is used in the coils. The solenoid mechanism is insulated from the switch parts by fiber connections. As the controlling force utilized to restore the switch is gravity, there are no springs to weaken or change adjustment with time. The switch



Motorless Sign Flasher.

mechanism is designed to break up to 20 amp, but the period of operation of the solenoid remains unaffected by the number of lamps connected under the switch. The solenoid is said to be very economical in operation.

Industrial and Commercial News

The Week in Trade.

Developments in the business situation indicate that gradual improvement is being made. Output in many lines of industry is being increased, orders for future delivery are on a slightly broader scale, and fewer cancellations are reported from sections where crop prospects were not especially bright in the earlier part of the season. Substantial decrease in the number of idle freight cars is a further sign of the larger volume of business being transacted. Operations in the iron and steel trades are broadening, and many of the mills are increasing their capacity to meet new orders. Reduction in the price of finished products is believed to be forthcoming, with a view to expanding the buying movement, and prospects are good for increased business in August and September. During the week the Standard Oil Company gave official notice of its plan for meeting the dissolution order of the Supreme Court, and the American Tobacco Company issued copies of the bondholders' agreement under which a readjustment plan will be effected. Stockholders of the Standard Oil Company of New Jersey were notified that they will receive a pro rata interest in the stocks of the thirty-three companies owned by the parent company which were co-defendants in the suit to dissolve the trust. Various oil and gas properties owned by the Standard Oil Company of New Jersey will be operated by the latter as a manufacturing company. Improvement in the West shows no signs of abatement, and expectations are general for business revival in the fall. News of crop conditions is encouraging, reports showing cool weather and sufficient moisture, and there is a feeling of confidence that yields will be at least up to the average. There is every reason from the present standpoint to strengthen the belief that the record of the second half of the year will be more satisfactory than was that of the first. Business failures for the week ended July 27 were 241, as compared with 239 for the previous week, 200 for the same week in 1910, 223 in 1909, 275 in 1908 and 142 in 1907.

The Copper Market.

Nothing of importance occurred last week to cause any change in the stagnation of the copper trade. The tone of the market was decidedly weak, and demand from both foreign and domestic consumers was light, while prices were more nearly upon a 12¼-cent basis than upon the recent 12¾-cent scale. The majority of sales were made by second hands, as most of the larger producers remained out of the market in the belief that the July report of the Copper Producers' Association will be favorable to the trade and prices will advance. Business will probably be on a limited scale until the report is made public. Orders for finished material showed no increase during the week. Announcement by the

Standard Copper	Bid.	Asked.	Settling Price.
Spot	12.12½	12.20	....
August	12.12½	12.25	12.20
September	12.15	12.25	12.20
October	12.15	12.25	12.20
November	12.17½	12.25	12.22½

The London market, Aug. 1, was as follows:

	Noon. £	s	d	Closing. £	s	d
Standard copper, spot	56	5	0	56	2	6
Standard copper, futures	56	17	6	56	15	0

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	12.35c.			11.57½c.		
London, spot	£57	10	0	£53	7	6
London, futures	58	2	6	54	0	0
Best selected	61	10	0	57	5	0

Metal Exchange that trading in electrolytic copper in addition to standard contracts would be in order after Aug. 1 was a feature of the week, being of interest to small consumers in the interior, whose dealings are largely through second hands. Action was deferred on that date, however, by the exchange and there is a possibility that the sale of electrolytic copper on call will be further postponed. Estimates of July business place total deliveries at 135,000,000 lb. to 140,000,000 lb., with 75,000,000 lb. of this for export, and indicate that the re[duction] in surplus stocks will approximate 15,000,000 lb. Expo[rts for] the month of July were 34,955 tons. The daily call [of the] Metal Exchange, Aug. 1, quoted copper as per the acco[mpany]ing table.

Industrial and Commercial Notes.

Arbitration of Business Controversies.—The Chamber [of] Commerce of New York State has instituted a system [of com]mercial arbitration for the settlement of business contr[oversies,] thus returning to a line of work which enhanced the us[efulness] of the chamber during more than a century of its ex[istence,] namely, from 1768 to 1874. This arbitration service [is not] limited to the adjustment of differences between mem[bers of] the chamber, nor even residents of New York, but i[s] offered to the entire business world, subject only to t[he] of the committee to determine whether the character [of the] specific controversy is such as to come within the s[cope of] cases acceptable for arbitration. The list of official ar[bitrators] appointed consists of about 200 members of the chamb[er who] have accepted appointment in the spirit of serving a pu[blic] The disputants have various choices in the selection [of arbi]trators, as they may choose one individual as so[le arbi]trator; or they may select two arbitrators, not ne[cessarily] members of the Chamber of Commerce, who in tu[rn] designate a third person from the list of official arb[itrators] or they may call for arbitration service by the co[mmittee] of arbitration of the chamber or a quorum thereo[f.] expense of this arbitration is very small as compar[ed with] the cost of similar litigation in an ordinary court [,] while complications due to purely legal technicali[ties] not intervene. In order to prevent the submission of [trivial] cases a fee is charged, but this is in all instances pr[actically] nominal, consisting of a fee of $10 a day for each a[rbitrator] and payment for stenographic service at the usual mar[ket] Owing to the number of names on the list of ar[bitrators] numerous cases can be carried on simultaneously, thus [leading] to prompt consideration of controversies submitted for [arbitra]tion. An award by the Chamber of Commerce arbitra[tors has] the force of a verdict by the Supreme Court of the [State of] New York.

Present Management Retains Control of Westi[nghouse] Company.—The contest between former Presiden[t West]inghouse and the administration for control of the [company] resulted at last week's meeting in victory for the pres[ent man]agement on all points of contention. The following [directors] were elected: James S. Kuhn, Edwin M. Herr, C[l] Brooker, Edwin F. Atkins and Harrison Nesbit, w[ho] complete an unexpired term. Resolutions of the West[inghouse] faction calling for annual election of directors and f[or cumu]lative voting were not passed. At an organization m[eeting of] the directors, held in New York on Aug. 1, Edwin [M. Herr] was elected president of the company, succeeding E[dwin F.] Atkins, who had requested to be relieved of the offic[e which] he had accepted a year ago with the understanding [that the] appointment would be temporary. Robert Mather was [re-elect]ed chairman of the board. Other elections were as [follows:] Vice-presidents, L. A. Osborne, Charles Terry and [ ] Davis; acting vice-presidents, George W. Hebard an[d] Shute; comptroller and secretary, James C. Bennett; [tre]asur[er] and assistant secretary, T. W. Siemon; assistant [sec]retar[y,] Warren H. Jones; assistant treasurer, H. F. Baet[z;] acti[ng] assistant treasurer, S. H. Anderson; auditor, F. E. Crai[g;] assistant auditor, W. B. Covil, Jr. Calvert Townley [ha]s be[en] appointed assistant to the president.

General Vehicle Electric Trucks for the Nav[y.]—Th[e] Navy Department has ordered eight 5000-lb. trucks [fr]om th[e] General Electric Vehicle Company, one of which w[ill] go [to] the island of Guam and the others to the navy yard[s] at Bo[s]ton, New York, Norfolk, Mare Island, Philadelphia, [C]harle[s]ton and Bremerton.

ield for Electrical Supplies in Valencia, Spain.—A consur report, describing industrial conditions in Spain, says that th lighting of the city of Valencia will soon bear favorable comparison with that of any of the large cities of the world at that electric power has been extended to all tramway traffic ecept in very narrow streets in the older sections of the city. T report says, further, that the demand for gas and steam eines is declining, and that many of the rice-hulling and cning mills, steel works and lumber mills and most of the ne industrial enterprises are now using electricity in place of ahther forms of motive power. The price of electricity for per purposes within the city limits, where competition bween central-station companies is active, is about 3 cents p kw-hour for large consumers, and in outlying townships, wre only one source of supply is available, the cost is 8 cts to 10 cents per kw-hour. The development of the electral industry in the country offers a wide field to manufac- f electrical equipment. Most of the trade in Valencia secured at present by branches which two foreign firms have established in the city. The report states petition in tungsten and metallic-filament lamps was ne in 1910 that the leading makes of lamp from 16 with a guaranteed minimum life, were so to cents at the equivalent of 27 cents each, freight and duty pa. if of foreign manufacture. Two types of lamp are now roduced by Spanish factories, one at Madrid and the Barcelona. The duty on imported lamps is $1.54 per lb.) or approximately twenty to twenty-five lamps

oreign Company to Deal in American Securities.—The inancière de Valeurs Américaines has been organized els with a capital of 30,000,000 francs, to invest prin- railroad, traction and electrical securities in North th America, and in state and city bonds of South countries. Among the banking interests that assisd in the formation of the company are Kuhn, Loeb & Company of New York; the Banque de Bruxelles; the Banque de Pas et des Pays-Bas; the Société Générale de Belgique, the Deutsche Bank, Berlin; F. M. Philippson & Com- ssels; M. M. Warburg & Company, Hamburg; Arthur Company, Paris; the Société Générale pour Favoriser, e Société Française de Banque et de Dépôts; the rançaise pour le Commerce et l'Industrie, Paris, and leming & Company, of London. Baron Janssen, of té Générale de Belgique, is named as chairman of the lirectors and Consul Franz Philippson as vice-presit M. M. Warburg, of Hamburg, and Mortimer L. Schiff, of ew York, are members of the board.

Iew York Edison's New Building.—The offices of the Second District of the New York Edison Company are now loced temporarily at 245 West Forty-second Street, New City, the former offices at 124 West Forty-second Street en vacated in order to tear down the old building re for the new structure mentioned in the issue of The construction department of the company is sink- from the basement of the old building in search of but up to a short time ago at a distance of 17 ft. had ed nothing but dirt. The plot on West Forty-second 25 ft. x 100 ft. and the new building when completed ll contain the offices of the district and the entire contract and inspection departments.

Iew Electric Road for Washington State.—Articles have wn by A. E. Mead, ex-Governor of Washington, for oration of the Bellingham, Mount Baker & Spokane Railroad Company. The company is to be capital- 22,500,000, and is to build an electric road from Bell- Spokane, a distance of nearly 290 miles. It is said m capitalists are interested in the undertaking. The tors include the following: Joseph Morrison, president Mill Company; A. E. Mead, Bellingham; F. Peace, Vancouver, B. C.; W. L. Hart, Blaine; A. C. McLean, Seattle, and C. E. Wingate, Tilden, Wash.

Long Acre Company Authorized to Issue Bonds.—The Public Service Commission for the First District of New York has granted the application of the Long Acre Electric Light & Power Company to issue additional bonds. The commission authorizes the company to make the new mortgage for $50,000,000 referred to in the *Electrical World* July 15, and under this mortgage to issue stock certificates to the amount of $2,000,000 and bonds to the amount of $1,000,000. The plan submitted by the Public Service Commission permits the company to sell $2,000,000 of bonds when it has had $1,000,000 new stock subscribed and paid for, and an additional $2,000,000 when another $1,000,000 of stock has been paid for. The commission orders further that the new mortgage may be made only when a former mortgage authorizing an issue of $1,000,000 bonds has been either canceled or subordinated to the mortgage just authorized. The proceeds of the new bonds will be applied as follows: For the acquisition of new property and the construction, completion and extension of its plant and distribution system, $3,400,000; for the discharge of existing obligations, $200,000; for discount and expenses of the sale, $400,000. J. F. Shaw, president of the Long Acre Electric Light & Power Company, said on Wednesday: "Our engineers are at work on methods for generating the energy required, but just what method will be employed it is not possible to state now. We may purchase waste surplus energy from one of the electric railway systems in the city and charge storage batteries, or we may erect a station in Pennsylvania and transmit energy by high tension to New York City, or we may do both, or we may erect a station on the East River. I venture to say that we can obtain all the energy we want from the surplus capacity of any one of the electric railway systems of the city for 1¼ cents per kw-hour. We have not filed any new schedule of rates with the Public Service Commission in New York, but I may say that our rates will be lower than those of the New York Edison Company. I have no doubt that a representative of a central-station company could, in competition with the New York Edison Company, go out and sell just as much energy as he wants at the same rates as are now charged by the New York Edison Company. Inasmuch as our rates will be lower, it is probable that we will get a fair amount of business." In answer to a question as to the probable outcome of competition with the New York Edison Company, Mr. Shaw said that it is, of course, impossible to predict at this time what the future will bring forth. "Possibly in twenty years we may be purchased by the New York Edison Company, but, on the other hand, we might purchase it. There are several cases where the smaller company has purchased the larger. It is probable that we will be in active operation within the next three months."

Blewitt Falls Hydroelectric Development. — The Yadkin River Power Company has placed an order with the General Electric Company for three 6000-kw water-wheel driven, 4000-volt generators; five 3-phase 6250-kw transformers, 4000-100,000 volts, and four 2500-kw transformers, 4000-22,000 volts. The former transformers are for stepping up the generating voltage to the transmission-line voltage of 100,000, while the latter are for stepping up the voltage to 22,000 for local distribution. The above apparatus is for use in the generating station at Blewitt Falls on the Yadkin River. In addition to this apparatus the order covers a large amount of switching and miscellaneous apparatus for a complete 30,000-hp generating station. The North State Hydroelectric Company, subsidiary to the Carolina Power & Light Company, which is to distribute the Blewitt Falls energy, has purchased for its switching and substation at Method four 2750-kw, single-phase transformers for stepping the voltage down from 100,000 to 60,000 volts, with complete equipment of switches, etc.; also, three 1250-kw, single-phase, water-cooled transformers for the Henderson substation, for stepping the voltage from 60,000 to 22,000 volts for distribution at Henderson.

Stock-Selling Licenses in Kansas.—According to a new law, popularly known as the "blue-sky" law, shares of stock can only legally be sold in Kansas after a license for selling has been procured from the State Banking Department. Licenses are issued only after an investigation showing that the stock approved is a sound investment. Within a few weeks after the passage of the law by the Legislature more than 300 applications for licenses were filed, of which thus far only eighteen have received favorable action.

New Receiver for Wireless Company.—Supreme Court Justice Seabury has signed an order accepting the resignation of Sidney Harris as receiver of the United Wireless Company, and has directed him to deliver all assets of the company to Selden Bacon, who is receiver in bankruptcy.

Aluminum Notes and Prices.—The market for aluminum is dull, with ingots for remelting held at 21@21½ cents spot No. 1, the base for large ingots. Rods and wire are held at 31 cents and sheets at 33 cents, prices being those of Aug. 1.

Financial.

THE WEEK IN WALL STREET.

SECURITIES have been influenced to some extent by numerous matters of [illegible] which have taken place both in this country and abroad. The latter part of the past week was characterized by irregularity, and the tendency inclined toward lower prices, but the quotations of most of the more active issues were but slightly changed at the close on Saturday. Much of the irregularity was due to the critical aspect of the Moroccan controversy, which resulted in sharp selling of stocks for foreign account, and by weakness on exchanges abroad. British consols dropped to 77¾, a record figure. The passage of the Canadian reciprocity act and the report of earnings of the Steel Corporation had no great effect upon the stock market, since the scope of both had been anticipated. Trading on Monday was light, but the tone of the market was strong throughout the day. Prices were irregular and highest in the last hour, and new records were made in Bethlehem Steel shares. Announcement on Monday of the plan of the Standard Oil Company for dissolving in compliance with the ruling of the Supreme Court was not a leading factor in the prices for the day. Business on Tuesday was on a very narrow scale, and prices were unsettled. Reports of monthly earnings of a number of important railroads were probably of more influence upon the market than any other incident of the day, showing losses in gross and net earnings, and efforts to offset losses in gross by curtailment of operating expenses. More rumors were in circulation during the day of the possibility of an investigation into monetary conditions in Wall Street, and the incident was attributed to political action. The financial situation of the early past week was marked by the remittances to banks in the harvesting districts and withdrawals of gold for Canada, and the financing of the cotton crop will, before long, become a matter of moment. The effect of the remittances was a slight hardening of rates in the money market, but ease is still apparent, despite the broadening of demand. Rates Aug. 1 were: Call, 2¼@2½ per cent; ninety days, 3¼@3½ per cent. The quotations in the tables are those at the close Aug. 1.

NEW YORK.

	July 25.	Aug. 1.	Shares sold.		July 25.	Aug. 1	Shares sold.
[illegible]	[illegible]	[illegible]	——	Int. Met., pf.	51	49½	7,550
All. Ch., pf..	28*	[illegible]	— —	Mackay Cos.	[illegible]	86	[illegible]
[illegible]	[illegible]	[illegible]	20,750	Mackay C., pf.	74½*	74	— —
Am. D. T...	20½*	[illegible]		Met. Elev..	[illegible]	[illegible]	100
Am. Loco...	40¾*	[illegible]	800	Met. St. Ry..	15*	15*	——
Am. Loco., pf.	108*	[illegible]	200	N. Y. & N. J. Tel.	[illegible]	[illegible]	--
Am. Tel. & C.	80*	[illegible]		Steel, com...	79⅜	79⅛	192,877
[illegible]	[illegible]	[illegible]	12,600	Steel, pfd....	119	118	[illegible]
B. R. T...	[illegible]	81	[illegible]	W. U. T...	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	16	[illegible]	West'h. com.	[illegible]	[illegible]	4,100
[illegible] Met..	[illegible]	[illegible]	3,000	West'h, pfd..	119*	[illegible]	100

PHILADELPHIA.

	July 25.	Aug. 1		July 25.	Aug. 1
Am. Rys....	44	[illegible]	Phila. R. T.....	22¼	23¾
[illegible]	[illegible]	[illegible]	Phila. Elec.	[illegible]	[illegible]
Elec. St. Bt'y......	55¼	55	Phila. Trac.	86¾*	86½*
Elec. St. Bt'y, pf.	[illegible]	30*	Union Trac.	52¼	52½

CHICAGO.

	July 25.	Aug. 1.		July 25.	Aug. 1
Chi. City Ry.	186*	186*	Com. Edison........	135⅞	135⅞
Chi. Elev. Rys.....		26½	Chi. Subway	4	3⅝
Chi. Elev. Rys.		93	Chi. Tel. Co.......	123	123*
Chi. Rs., Ser. 1...	97*	100	Nat'l Car.	[illegible]	113
Chi. Rs., Ser. 2	[illegible]	[illegible]	Nat'l Car, pfd.	118½*	118½*

BOSTON.

	July 25.	Aug. 1.		July 25.	Aug. 1.
Am. T. & T. ..	[illegible]	[illegible]	Mex. Tel........	4*	4*
Cum. Tel.	[illegible]	[illegible]	Mex. Tel., pfd...	[illegible]	6*
Edison E. Ill..	285*	287	N. E. Tel.......	146	146
Gen. Elec......	163	162½	W. T. & T.....	[illegible]	20¼
Mass. E. Rs.......	22⅞	22¼*	W. T. & T., pfd..	98½	99*
Mass. E. Ry., pf.	93	93			

*Last price quoted.
Shares sold for the week, July 24 to July 29.

FINANCIAL NOTES.

Organization of American Cities Company Completed.—The American Cities Company went into permanent organization in New Orleans on July 25, 1911, and now controls the street-railway and lighting systems of New Orleans, Birmingham, Knoxville and Little Rock, the electric railway systems in Memphis, and the electric lighting companies in Houston. Its capitalization is $10,000,000 in collateral trust bonds, $21,810,083 preferred stock and $16,643,416 common. The officers are: George H. Davis, of Ford, Bacon & Davis, president; George Bullock, of New York, and W. Von Phul, of New O[illegible] vice-presidents; M. McGrath, secretary; R. E. Slade, man[illegible] ager of the New Orleans Railway & Light Company, tre[illegible] urer and assistant secretary; Ira Lockwood, assistant tr[illegible] and assistant secretary; Charles K. Beekman, general c[illegible] The board of directors is as follows: George W. Bacon, m[illegible] ber of the firm of Ford, Bacon & Davis, New York; G[illegible] Bullock, president Susquehanna Railway, Light & Powe[illegible] pany, New York; S. R. Bertron, member of Bertron, G[illegible] & Jenks, New York; E. H. Bright, member of T. & B[illegible] New Orleans; Harry Bronner, member of Halgarten &[illegible] pany, New York; William B. Bonbright, of William B[illegible] bright & Company, New York and London; Lynn H. [illegible] president Interstate Trust & Banking Company, New [illegible] Marshall J. Dodge, member of Bertron, Griscom & Jenk[illegible] York; George H. Davis, member of Ford, Bacon & [illegible] New Orleans; C. P. Ellis, cotton broker and banke[illegible] Orleans; C. L. Edwards, of A. G. Edwards & Company[illegible] ers, St. Louis; Oscar L. Gubelman, of Knauth, Na[illegible] Kuhne, New York; John J. Gannon, president Hiberni[illegible] & Trust Company, New Orleans; R. M. Gannon; [illegible] Godchaux, president Whitney-Central Trust & Saving[illegible] New Orleans; Frank B. Hayne, cotton merchant [illegible] Orleans; A. J. Hemphill, president Guaranty Trus[illegible] pany, New York; C. J. Hardy, temporary, pendi[illegible] turn of C. E. Allgeyer to New Orleans; Charles [illegible] vice-president Canal-Louisiana Bank & Trust Compan[illegible] Orleans; Emil Loeb, capitalist, Birmingham and New [illegible] Fernand Lapeyre, capitalist and stock broker, New [illegible] S. Z. Mitchell, president Electric Bond & Share Compa[illegible] York; J. K. Newman, of Isidore Newman & Son, N[illegible] leans; Maurice Stern, of Lehman, Stern & Company, N[illegible] leans; L. K. Thompson, vice-president Bank of Com[illegible] Trust Company, Memphis, Tenn.; William von Phul, [illegible] Bacon & Davis, New Orleans; R. M. Walmsley, p[illegible] Canal-Louisiana Bank & Trust Company, New Orlean[illegible] Williams, vice-president Whitney-Central National Ba[illegible] Orleans; A. H. Wiggin, president Chase National Ba[illegible] York. The Whitney-Central Trust & Savings Bank, [illegible] Orleans, was appointed transfer agent, and the [illegible] Bank & Trust Company, of New Orleans, registrar. [illegible] nection of William von Phul with the company w[illegible] actively renew his associations with New Orleans [illegible] people whom he knew in 1899 when general superinte[illegible] the Edison Electric Company of that city. Preside[illegible] stated that no changes were contemplated in the local [illegible] ment, with the exception of the appointment of D. A. [illegible] of Little Rock, to a technical and executive positio[illegible] New Orleans Railways Company.

Empire Gas & Electric Bonds Offered.—Francis [illegible] Welsh, of Philadelphia, is offering $1,300,000 joint first [illegible] funding mortgage 5 per cent gold bonds of the Empi[illegible] Electric Company and the Empire Coke Company. [illegible] pire Gas & Electric Company is a consolidation of all [illegible] panies supplying electric light and power in Auburn [illegible] and all the companies supplying gas in Auburn, Gene[illegible] eca Falls and a number of other localities in this se[illegible] New York State, and the Empire Coke Company man[illegible] gas, coke, etc., and sells its gas to the Empire Gas & [illegible] Company. The issue constitutes a direct first-mortgag[illegible] all the properties of the Auburn Light, Heat & Pow[illegible] pany and the Auburn Subway Electric Company, [illegible] collateral trust first lien on the property of a numbe[illegible] gas companies in the cities mentioned. Provision is [illegible] a betterment fund equal to 2 per cent of all bonds of t[illegible] outstanding, to be spent for additions and betterment[illegible] properties. The bonds are offered at 97½ and int[illegible] yield about 5.16 per cent, and are callable at 102 and [illegible] on March 1, 1914, or any interest day thereafter. [illegible] tax exempt in the State of New York, and have been [illegible] by the Public Service Commission for the Second Di[illegible] New York.

Hall Signal Company to Reorganize.—Contracts [illegible] gating $125,000 were closed during the week by Hall Signal Company with a number of railroad companies [illegible] the total of unfilled orders on the books of the comp[illegible] to $575,000, the largest amount of unfilled orders on [illegible] a number of years. The reorganization committee is taking plans for meeting the $100,000 indebtedness which is [illegible] shortly, and for reorganization of the company.

Texas Telegraph Controversy.—Further developments in e strained situation between the telegraph companies operat-g lines in the State of Texas have brought forth a letter from C. Adams, vice-president of the Postal Telegraph-Cable ompany, of New York, to J. P. Lightfoot, Attorney-General of exas, in which the relations of the competing companies are viewed, and the allegation made that Bell interests are seek-g to create a monopoly in Texas and suppress competition in at State by combination and absorbing companies with which e Mackay interests have been long associated. The letter re-rs to the formation of the Postal Telegraph-Cable Company Texas, whose line connected with those of the Mackay sys-m, and says that the Bell Telephone Company, in order to e the poles of the Texas Postal company for extension of s telephone system, purchased the entire capital stock of this mpany. Relations between the Bell and Mackay interests ere amicable until the former purchased control of the West-n Union, which is the greatest competitor of the Mackay stem. The latter interests then stated that they could not, ther from a business or legal standpoint, tolerate a condition here the Western Union and the Texas Postal were under the me control, terminated their contract with the Texas Postal d are building their own lines in the State. Since Bell in-rests retain the name Postal Telegraph & Cable Company Texas, the Mackay interests have called the Texas company hich they are now developing, and whose lines are scheduled reach Galveston and Houston by Sept. 1, the Mackay elegraph & Cable Company. The statement is made that the ell company has absolute control of the board of directors, ecutive committee, policy and operation of the Western nion company, and description is given of the negotiations tween English cable companies and the head of the Western nion company for control of submarine cables by the Ameri-n company. The letter says in part: "The Mackay interests e entirely able to take care of themselves and are strongly trenched in finances, organization and fast service, and are t afraid of what seems to be the crushing-out campaign of e combine. That combine is approaching its Waterloo in finances. It is well, however, for the American people to alize that the American Telephone & Telegraph Company is parently seeking an absolute monopoly in ocean cables and nd-line telegraph and telephone communication in the United tates. It is already far on the way and it will keep right on lentlessly until stopped by the federal and state governments."

Earnings of Mexican Tramways Company.—A surplus ailable for dividends amounting to 8.59 per cent on its 6,487,400 outstanding capital stock was earned by the Mexi-n Tramways Company in the year ended June 30. This mpares with 5.59 per cent earned in the previous year on e same amount of stock, and with 8.03 per cent on the 1,487,400 stock then outstanding. Gross earnings increased ghtly over $600,000. During the year the company issued d sold 50,000 shares of capital stock, the proceeds of which ovided funds for various purposes, which included a num-r of extensions and advances to the Mexican Light & Power ompany, Ltd., to assist in the hydroelectric developments at are being constructed by the latter company. The prop-ties of the Tramways company are reported in good condi-n as a result of the expenditure of $700,000 for main-nance. The financial statement of the company, as of ec. 31, showed cash on hand, $729,936, as compared with 29,802 for the previous year; total capital stock outstanding, 6,487,400, as compared with $11,487,400; cost of property and curities to Dec. 31, $21,071,815, as compared with $20,-0,240; and advances to and from subsidiary companies, 4,358,657, as against $10,695,940 for the previous year.

New York, Westchester & Boston Bonds Sold.—Kissel, nnicut & Company and Harris Forbes & Company have sold e $17,200,000 first mortgage 4½ per cent gold bonds of the ew York, Westchester & Boston Railway Company, to which ference was made in the last issue. The company is subsidiary of the New York, New Haven & Hartford Rail-ad Company, and is building a four-track elevated road from 3th Street, New York City, to Port Chester, N. Y. The nds were offered at 96¼ and interest, to yield over 4.70 per nt, are tax exempt in New York State and have been ap-pved by the Public Service Commission for the Second Dis-ct of New York. In the circular describing the issue, the mmary of a letter by C. S. Mellen, president of the New ork, New Haven & Hartford Railroad Company, states that the payment of principal and interest of the bonds is uncondi-tionally guaranteed by indorsement upon each bond by the New York, New Haven & Hartford Railroad Company, which holds practically the entire capital stock of the New York, Westchester & Boston Railway Company, and states further that the net income of the guarantor for the fiscal year ended June 30, 1910, above operating expenses, taxes, rentals and all interest charges, was $10,796,874. In addition to the guarantee of the New York, New Haven & Hartford Railroad Company, the letter says that the bonds are secured by a direct first mortgage on the entire property of the New York, Westches-ter & Boston Railway, which represented on May 31, 1911, an investment by the parent company of $25,647,004. Applications for these bonds were largely in excess of the amount offered. Application will be made to list them upon the New York Stock Exchange.

Massachusetts Electric Companies.—In the fiscal year ended June 30, 1911, gross earnings of the Massachusetts Elec-tric Companies were $8,881,520, representing an increase of $434,458 over the returns of the previous year. This figure is favorably regarded in view of the dullness in the territory throughout the year and the fact that many of the mills in the section were either closed or operated on partial time. Operating expenses increased $340,735, and an increase of $72,-531 was made in charges and taxes, and the surplus available for dividends increased $21,191, aggregating $1,485,886, the largest total for this purpose in the history of the company. Earnings in the past fiscal period were at the rate of nearly 6½ per cent on the $20,557,400 outstanding preferred stock. The company now supplies electric service to some 100 towns and cities in New England, and the book value of the prop-erties is placed at $49,500,000.

Ft. Worth (Tex.) Power & Light Company.—J. R. Nutt, of the Federal Telephone & Telegraph Company, announces that he and others are the incorporators of the Ft. Worth Power & Light Company, with a capital stock of $3,560,000, to take over the lighting business which has for some time been conducted there by Mr. Nutt individually. All of the capital has been paid in. Mr. Nutt explained that he had simply decided to in-corporate the business and that the other men interested are friends in the bond business.

DIVIDENDS.

Boston Elevated Company, semi-annual, 3 per cent, payable Aug. 15.

Connecticut Railway & Light Company, quarterly, preferred and common, 1 per cent; both payable Aug. 15.

Detroit United Railway Company, quarterly, 1¼ per cent, payable Sept. 1.

Mobile (Ala.) Electric Company, quarterly, preferred, 1¾ per cent, payable Aug. 15.

Tampa Electric Company, quarterly, $2.00 per share, and extra dividend, $1.00 per share, both payable Aug. 15.

REPORT OF EARNINGS.

Period		Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.						
June,	1911	$600,027	$350,844	$249,183	$50,044	$199,139
"	1910	[illegible]	3[illegible],407	245,755	48,221	197,534
6m., June,	'11	3,595,354	2,127,824	1,467,824	307,036	1,160,493
" "	'10	3,366,[illegible]	1,916,044	1,449,965	287,532	1,162,433
DETROIT UNITED RAILWAY COMPANY.						
June,	1911	[illegible]	$563,512	$346,215	$177,178	$169,037
"	1910	831,472	512,996	330,912	168,530	162,381
6m., June,	'11	4,768,049	3,026,290	1,827,210	1,057,277	769,932
" "	'10	4,344,067	2,770,784	1,647,351	973,057	674,293
MASSACHUSETTS ELECTRIC COMPANIES.						
Qtr., June	'11	$2,293,622	$1,410,089	$883,533	$462,234	$421,298
" "	'10	2,130,957	1,340,168	790,788	418,237	372,551
12m., June	'11	8,881,520	5,557,303	3,324,217	1,838,330	1,485,886
" "	'10	8,447,062	5,216,568	3,230,494	1,765,799	1,464,695
MONTREAL STREET RAILWAY COMPANY.						
June,	1911	$430,026	$227,217	$204,809	$63,996	$140,813
"	1910	384,564	198,349	185,715	54,940	130,776
NASHVILLE RAILWAY & LIGHT COMPANY.						
June,	1911	[illegible]	$94,056	$63,514	$48,[illegible]	$14,5[illegible]
"	1910	[illegible]	[illegible]	65,851	48,76[illegible]	17,08[illegible]
6m., June,	'11	952,118	564,045	388,073	292,191	95,882
"	'10	887,953	516,589	371,365	291,195	80,170
NORTHERN OHIO TRACTION & LIGHT COMPANY.						
June,	1911	[illegible]	$134,983	$110,114	$44,333	[illegible]
"	1910	221,673	123,125	98,548	43,375	55,173
6m., June,	'11	1,222,676	697,023	525,653	267,107	259,545
" "	'10	[illegible]	[illegible]	463,105	259,916	[illegible]
PHILADELPHIA COMPANY.						
June,	1911	$1,557,660	$1,020,065	$736,667	$590,633	$146,034
"	'10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

General News

Construction News.

REFORM, ALA.—The Reform Ice & Light Company, it is reported, is contemplating the installation of an electric-light plant in Reform. John Newell is manager.

CLARKSVILLE, ARK.—Plans have been prepared for the installation of electric and water plants and sewer system in Clarksville. The improvements will be extended to all parts of the city. R. L. Goodman, representing a Texas engineering company, has prepared the plans.

HIGDEN, ARK.—Negotiations are under way for financing the project which includes the construction of a concrete dam and hydroelectric plant on the Little Red River, near Higden, 55 miles north of Little Rock. Land for the proposed plant has been purchased. If negotiations are carried through, work will begin at once on the plant. The cost of the work is estimated at about $650,000. Dickinson & Watkins, State Bank Building, Little Rock, Ark., are engineers.

BUTTE CITY, CAL.—The Northern California Power Company, which is erecting a high-tension transmission line from Hamilton City to Princeton, recently established a substation in Butte City and has taken over the local electric plant owned by H. A. Dyer. It is reported that the Northern California Power Company is planning to extend its transmission line south to Maxwell, Williams and other points. The company has also taken over the plant at Williams.

MODESTO, CAL.—The plant and holdings of the La Grange Light & Power Company in Modesto have been purchased by the Sierra & San Francisco Power Company. The consideration is said to be $50,000. It is understood that no other branch of the Whitney Power Company, the holding company of the La Grange company, has been taken over. The La Grange Power Company held the contract for municipal lighting.

RIVERSIDE, CAL.—The Board of Supervisors of Riverside County has awarded the franchise for the erection of a transmission line in Riverside County, for which application was made by F. A. Worthley, to Fred Mechlin. The price paid for the franchise was $150.

SAN FRANCISCO, CAL.—Arrangements are being made by the Great Western Power Company to lay a cable under the bay and supply electricity generated by hydraulic power in San Francisco. The company recently absorbed the City Electric Company, of San Francisco. The company is planning to secure contracts for both light and power service in competition with the Pacific Gas & Electric Company, for both gas and electric service.

SANGER, CAL.—The San Joaquin Light & Power Company is contemplating extending its transmission lines from Sanger to Centerville, for which right-of-way is being secured.

BUENA VISTA, COL.—The old electric-light plant at Buena Vista is reported to have been destroyed by fire recently.

DENVER, COL.—The Colorado Telephone Company and the Tri-State Telephone & Telegraph Company have been consolidated. The new company, which will be known as the Mountain States Telephone & Telegraph Company, is capitalized at $50,000,000 and will operate exchanges and toll lines in Utah, Wyoming, Montana, Idaho, Eastern Arizona, New Mexico and Colorado. The officers of the new company are: E. B. Field, president; Edwin B. Field, Jr., vice-president and treasurer; J. E. MacDonald, secretary, and E. M. Burgess, general manager.

FORT COLLINS, COL.—The city of Fort Collins with a view of erecting a hydroelectric plant on the Poudre River will file on a power plant site 33 miles west of Fort Collins. The proposed plant will be located at the head of the "Big Narrows," on the Poudre River. A proposition to issue bonds to the amount of $150,000 will be submitted to a vote of the people. It is proposed to install a plant with sufficient output to supply electricity to Fort Collins and other cities in Larimer County.

JOHNSTOWN, COL.—The Northern Colorado Power Company is reported to be contemplating extending its transmission lines from Milliken to Johnstown, a distance of 3 miles, to supply electricity in that town.

WILMINGTON, DEL.—Plans have been prepared for the construction of an electric railway along the Delaware River from South Wilmington to connect the system of the Wilmington & Philadelphia Traction Company with the New Castle & Delaware City Railway at New Castle. It is proposed later to extend the railway to Augustine Park, a summer resort located about 8 miles below Delaware City.

WASHINGTON, D. C.—Bids will be received by the Department of the Interior, Washington, D. C., until Aug. 8 for the installation of an electric elevator and the construction of the necessary shaft and penthouse at the Freedman's Hospital Buildings, Washington, D. C., in accordance with specifications and drawings, copies of which may be obtained upon application to the chief clerk of the department. Carmi A. Thompson is assistant secretary.

WASHINGTON, D. C.—Bids will be received at the Bureau of S plies and Accounts, Navy Department, Washington, D. C., until A 15 for furnishing supplies at the various navy yards and naval stati as follows: Newport, R. I.—Schedule 3802, furnishing and install switchboard, panels, etc.; schedule 3810, switch for I-beam troll Brooklyn, N. Y.—Schedule 3800, forced-draft blowers; schedule 38 55,000 ft. interior communication cable; 50,000 ft. night-signal ca 19,000 ft. interior communication cable; 80,000 ft. steel wire, cop clad cable; 50,000 ft. plain double conductor; 50,000 ft. double conductor; 30,000 ft. telephone cord; 75,000 ft. bell wire; 1000 ft. dou conductor diving wire; 64,000 ft. single-conductor wire; 40,000 ft. sin conductor wire; 270,000 ft. twin-conductor wire. Portsmouth, N. H Schedule 3816, one dynamo. Brooklyn, N. Y.—Schedule 3816, ann supply of combination desk and bracket fans. Boston, Mass., and N folk, Va.—Schedule 3816, night-signal keyboards. Newport, R. I Schedule 3779, furnishing and installing fire-alarm system; schedule 38 furnishing speed lights, etc., at the Eastern navy yards and na stations. Applications for proposals should designate the sched desired by number.

LAKE CITY, FLA.—Plans are being made by Mrs. M. M. Jacks owner of the White Springs resort, to install an electric plant to sup electricity for lamps for the Spring House and to light the entire to It is proposed to utilize the overflow from the spring to operate plant.

AUSTELL, GA.—The City Council is reported to be contempla calling an election to submit the proposition to establish a munic electric-light system in Austell to a vote of the people.

HAZELHURST, GA.—The city has voted an additional bond is to the amount of $5,000 for the installation of an electric-light syst The city recently voted to issue $30,000 in bonds for a munic electric plant.

JACKSON, GA.—The City Council has decided to call an election vote on the proposition to issue $11,000 in bonds, the proceeds to be u for improvements to the electric-lighting system and water-works. Of amount $6,000 will be used to secure electrical energy and $5,000 extensions. The city will enter into a contract with the Cen Georgia Power Company for 600 hp. It is proposed to establish a twe four hour service and supply electricity for manufacturing purposes well as for lighting.

BONNERS FERRY, IDAHO.—The Bonners Water & Light Comp has filed a petition with the County Commissioners for permission to tach its transmission line to the bridge across the Kootenai River, in turn for which the company offers to furnish and maintain five arc la on the bridge.

ARENZVILLE, ILL.—An organization of a stock company to su electricity and water for the village of Arenzville is reported to be un consideration. Electrical energy for operating the system may be sec from the Beardstown Electric Light & Power Company, of Beardsto Ill.

BEECHER, ILL.—Plans are being considered for the organiza of a stock company to install an electric plant in Beecher.

CHICAGO, ILL.—The receivers of the Illinois Tunnel Company h been authorized to issue $1,000,000 in notes, payable in one year, proceeds to be used for extensions to the automatic telephone syste

PANA, ILL.—Bids will be received by Harry Stanton, city cl until Aug. 17 for water-works improvements as follows: Contract 1, reservoir, dam and pump tower; 2, water pipe and transmission l 3, pumping machinery; 4, mechanical filtration plant; 5, gas-power tric plant; 6, power house; 7, steam boilers, engine and genera Specifications may be obtained upon application to the city clerk o Arthur Giesler, consulting engineer, Dayton, Ohio.

PINCKNEYVILLE, ILL.—The City Council has decided to purc the local electric-light plant, if it can be bought at a reasonable p or install a new plant.

TAMPICO, ILL.—The Dixon, Rock Falls & Southwestern Rail Company has selected a site on the Jacobs farm, about 2 miles sout Tampico, on which it will erect the power plant for the railway. A 3 miles of the road will be equipped for electrical operation.

MOUNT VERNON, IND.—The new franchise granted the Cumber Telephone Company in Mount Vernon provides for the installation o underground conduit system for its wires, and also provides that company shall connect with the county lines.

SUMMITVILLE, IND.—Owing to the refusal of the Town Boar make further payment on the municipal electric-light plant a new pany has been formed, consisting of the contractors who installed system, to take over the plant, and is now supplying electrical se in Summitville. The plant has been remodeled and a twenty-four l service given the city. The flat-rate system has been abolished and m installed for all consumers. The street-lighting system has not completed and many more lamps will be installed. Electricity for op

... system is obtained from the ... Company. The rates have been slightly increased, but the service is much better.

BELLE PLAINE, IA.—The City Council has appropriated $10,000 for the new municipal electric-light plant now under construction. C. E. Atkinson, of Webster City, has charge of the erection of the building.

CENTRAL CITY, IA.—Work has commenced on the construction of the concrete dam in connection with the proposed municipal electric-light and power plant in Central City. It is understood that contracts have been placed for machinery and equipment for the power house.

...CK, IA.—The St. Louis Rock Island Railway Company is ... a power house at ...

MANCHESTER, IA.—The City Council has granted the petition of the business men to erect electroliers in the business district of the city. ...ss men agreed to pay for the installation of the new system ... city would maintain them after they were erected.

POCAHONTAS, IA.—It is reported that the proposition to issue $11,00 in bonds, the proceeds to be used for the construction of a municipal electric light plant, will be submitted to a vote on Aug. 15.

...ND, IA.—Bids will be received by J. A. Christian, city clerk, until Aug. 15 for the installation of an electric-light plant and water-works system. The Ames Engineering Company, of Ames, Ia., has ... the engineering work.

SIOUX CITY, IA.—The Sioux City Service Company is reported to ... ring the extension of its street railway system to Crystal Lake.

WEBSTER CITY, IA.—The City Council has appropriated $10,000 for the municipal electric-light plant, now in course of construction.

ABILENE, KAN.—Negotiations are under way between the Riverside ... Power Company, of Abilene, and the city of Solomon, ..., whereby the company is to supply electricity in that city. ...for, were recently voted by the city of Solomon for the installation of an electric-light system and water works.

ENGLEWOOD, KAN.—Plans are being prepared by the J. S. Worley ... consulting engineer, Reliance Building, Kansas City, Mo., for ... of water and light systems in Englewood, for which ... the amount of $20,000 have been sold.

HILL CITY, KAN.—The J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., has been engaged to prepare plans ... the construction of the proposed municipal water and ... the cost of which is estimated at $50,000.

...N, KAN.—Proposals will be received at the office of the ... Horton, Kan., until Aug. 8, for furnishing one 100-hp high-speed engine, plans and specifications for which are on file at ... office. G. E. Johnson, of Sabetha, Kan., is engineer, and ... Norris is city clerk.

LA CYGNE, KAN.—The J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., is preparing plans for the construction of the proposed municipal electric-light and water plant, to cost about $30,000. Bids will be received for construction of the plant about Aug. 15.

NICKERSON, KAN.—Plans are being considered for the installation of an electric-light system and water works in Nickerson. Two propositions are under consideration. The first is to have the United Water Gas & Electric Company, of Hutchinson, Kan., extend its transmission lines to Nickerson and deliver energy at the substation. The other for the town to erect the line to Hutchinson. The city will own the local system and install its own water works, the pumping plant ... operated by electricity.

TOPEKA, KAN.—The City Commission has rejected all bids submitted for the installation of an ornamental lighting system on Kansas Avenue from First to Tenth Street. Bids for installing the lighting system have been readvertised.

WATERVILLE, KAN.—Plans are being prepared by the J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., for the construction of the proposed municipal water and light plant, to ... $30,000.

LEXINGTON, KY.—Plans are being prepared by Sargent & Lundy, of Chicago, Ill., consulting engineers, for the power house of the Kentucky Traction & Terminal Company, which recently took over the traction properties in and around Lexington. Contracts, it is said, will be awarded for the erection of the building and installation of machinery in the ...

LOUISVILLE, KY.—The Louisville & Interurban Railway Company has filed amendments to its charter increasing its capital stock from $2,200,500 to $3,750,000. The increase in capitalization is due to the purchase of the Louisville & Eastern Interurban Railway some time ago.

ALGIERS, LA.—The Algiers Railway, Light & Power Company has been notified by the City Council that it must extend its street railway ... to McLeanville and the Mississippi River, in accordance with its ...

BOYCE, LA.—It is reported that the town of Boyce has awarded contract for the construction of a municipal electric-light plant.

SHREVEPORT, LA.—Anderson Offutt, consulting engineer, of New Orleans, La., engaged by the city of Shreveport to prepare an estimate of the cost of installing a municipal electric-light plant, has submitted a report to the City Council, in which he states that a plant could be ... $310,000 and operated at a ... cheaper rate than at present. An election may be called to submit a proposition to issue bonds for construction of a plant to the voters.

BALTIMORE, MD.—Sealed proposals will be received by the Board of Awards at the office of the City Register, City Hall, Baltimore, Md., until Aug. 9 for one 35-kw generator and engine, one 15-kw generator and engine, one switchboard and connections, valves, piping, etc., to be installed in the sewage pumping station, plans and specifications for which are on file at the office of Calvin W. Hendrick, chief engineer of the Sewerage Commission, and can be obtained at the office of the Sewerage Commission, Room 904, American Building, Baltimore, Md. A deposit of $5 will be required for each set of plans, which will be refunded upon return of same.

EMMITSBURG, MD.—Plans are being considered by the town of Emmitsburg to secure electrical service from the power plant of the Frederick Railroad Company and the Hagerstown Railway Company, which will be located at Security.

AUBURN, MASS.—The Selectmen have granted the Worcester Suburban Electric Company a franchise to supply electricity for a period of twenty years in Auburn. Under the terms of the franchise the company is to supply 32-cp incandescent street lamps at the rate of $14 per lamp per year with midnight service; the rates for electricity for commercial lighting are as follows: Primary rate 16 cents per kw-hour and secondary 12 cents per kw-hour. The transmission line of the Worcester Suburban Electric Company will be extended from Millbury, a distance of 1½ miles.

FRANKLIN, MASS.—The plant and holdings of the Union Electric Light Company, of Franklin, Mass., owned by the Stone & Webster Corporation, of Boston, Mass., have been sold to C. D. Parker & Company, who, it is said, are interested in the Massachusetts Lighting Companies. The property of the Foxoboro Electric Company has also been purchased by C. D. Parker & Company and will be operated in connection with the Union Electric Company, with the main office in Franklin.

GLOUCESTER, MASS.—The Gloucester Electric Light Company has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $75,000 in capital stock, the proceeds to be used to place its wires underground in the principal streets of the city and for the erection of an electric-light system in the town of Essex, which includes about 12 miles of public street lighting and 6 miles of streets on the commercial lighting service. The cost of the installation of the entire underground system in Gloucester is estimated at $49,340. Improvements are to be made at the power plant, including the installation of a new coal-conveying apparatus, two 254-hp boilers, with stokers for same, and the erection of addition to boiler-room, which will involve an expenditure of about $26,595. The cost of erecting the system in Essex, including street lighting and commercial service, is estimated at $14,669.

LEICESTER, MASS.—Plans are being considered for the installation of a central heating and lighting plant for the town buildings to be erected on Colburn Court.

LOWELL, MASS.—The lands and building committee is considering the question of installing an electric-light plant in the basement of the City Hall to supply electricity for lamps and motors for the City Hall and Memorial Building.

MILLBURY, MASS.—Plans are being prepared by the Worcester Suburban Electric Company for the erection of a substation in Millbury. A. M. Hall is superintendent of the Millbury district.

NORTH EASTON, MASS.—The Brockton Electric Light Company has presented a petition to the Selectmen of North Easton for a franchise to erect an electric-light system in this village.

SOUTH HADLEY FALLS, MASS.—The South Hadley Falls Electric Light Company is contemplating extending its transmission lines from South Hadley Center by the way of Five Corners to Granby, to supply electrical service in that town.

STERLING, MASS.—At a town meeting held July 19 it was voted to extend the electric-light system to Pratts Junction, a distance of 2 miles, for which $2,000 was appropriated. The proposition to extend the system to Sterling Junction will be voted on later.

WORCESTER, MASS.—The Worcester Suburban Electric Company has petitioned the State Board of Gas and Electric Light Commissioners for authority to issue $125,000 in capital stock, the proceeds to be used to pay floating indebtedness and to make extensions and improvements to its plant.

GRAND RAPIDS, MICH.—The business men's organizations from every section of the city have joined in asking the Council to appropriate $10,000 for the installation of a new street-lighting system on Monroe and Canal Streets to replace the present arches.

HERSEY, MICH.—A new power house is being erected by Frank McIntyre. It is understood that the output of the electric plant will be increased to 300 hp.

BROWN VALLEY, MINN.—At an election held July 25 the proposition to issue $10,000 in bonds, the proceeds to be used for the construction of an electric-light plant in Brown Valley, was carried. L. C. Bigelow is recorder.

MINNEOTA, MINN.—The village has granted a franchise to J. H. Jonathan to construct and operate an electric-light plant in Minneota.

ROCHESTER, MINN.—The contract for the installation of the ornamental street lighting system on Broadway has been awarded to W. O. Hartig, of Minneapolis, Minn., for $8,661. Cluster lamps will be erected.

ST. PAUL, MINN.—The joint city hall and court house commission has awarded the contract for supplying light, heat and power for the city and county buildings for the coming year to the St. Paul Gas Light Company for $13,000, the same as last year. Only one bid was received.

TOWER, MINN.—Bids were opened by the City Council July 18 for the construction of a hydroelectric plant at Pike River Falls, to replace the present steam plant owned by the city. The lowest bid submitted was about $23,000. Bonds to the amount of $16,000 were recently voted for the purpose of building the plant. It is expected that the city will readvertise for bids.

TWO HARBORS, MINN.—Extensive improvements are being made to the municipal electric-light and water plant, including the installation of a [illegible] to operate the Ingersoll-Rand rock drill at the quarry, located a short distance from the electric and water plant. W. R. Coleman is chief engineer.

KANSAS CITY, MO.—The Metropolitan Street Railway Company is planning to remove a 1000-kw generator from its Fifteenth Street station to its station on Fortieth Street. A 3000-kw generator will be installed in the Fifteenth Street station.

KANSAS CITY, MO.—The Commissioners of Kansas City have decided to locate the buildings for the new municipal electric-light plant in front of the municipal water plant at Quindaro. The same boilers will supply steam for operating the generating plant and pumping station.

KIRKWOOD, MO.—A special election will be held Aug. 19 to vote on the proposition to issue $10,000 in bonds, the proceeds to be used for extensions to the municipal electric-light plant.

ST. LOUIS, MO.—The new electric plant of the Laclede Gas Light Company, located at Mound and Mullanphy Streets, St. Louis, Mo., will be completed about Aug. 15. The plant has an output of 8000 kw and cost about $475,000. The original schedule of prices for electrical service of the Laclede Gas Company ranges from 4 cents to 12 cents per kw-hour for lamps and from 3 cents to 10 cents for motors. It is said that a permanent and lower-price schedule is to be prepared and will be made public about the middle of September.

GORDON, NEB.—Sealed proposals will be received by H. D. Huntington, village clerk, until Aug. 10 for the installation of electric-light and sewer systems and extensions to water mains. Copies of plans and specifications can be obtained upon application to the village clerk.

LINCOLN, NEB.—Arrangements have been made by the Lincoln Gas & Electric Company for the rehabilitation of its system. The approval of the Nebraska Public Service Commission has been secured.

OMAHA, NEB.—The Omaha Electric Light & Power Company has secured the contract for furnishing electricity for lamps and motors for the new Union Pacific Railroad Building in Omaha. It will require 500 hp to operate motors, elevators, pumping machinery, heating system and ventilators. About 6000 lamps will be installed.

VALENTINE, NEB.—Plans are being prepared by the J. S. Worley Company, consulting engineer, Reliance Building, Kansas City, Mo., for the reconstruction of the hydroelectric plant in Valentine.

WYMORE, NEB.—Plans have been adopted by the City Council for lighting the streets of the town. The plans call for the installation of twenty-four ornamental lamp standards in the business district and 250 incandescent lamps in the residence portion of the town. The municipal electric plant is nearly completed and will soon be turned over to the city. An electrically driven pump is also to be installed. Bids will be received until Aug. 9 by F. V. Meek, city clerk, for construction of distributing and street-lighting system, including the erection of about 10 miles of wire. The cost of the work is estimated at about $9,000. C. H. Meeker is in charge of construction of both the electric-light plant and water-works system.

KEYPORT, N. J.—Arrangements are being made by the Middlesex & Monmouth Light, Heat & Power Company for the installation of the new street-light system which the Borough Council contracted for some time ago. Tungsten lamps will be installed.

MARION, N. J.—The Public Service Corporation of New Jersey has awarded the general contract for the construction of a power house at Marion to E. M. Waldron & Company, of Newark, N. J. The building will be 100 ft. x 100 ft. and will cost about $40,000.

RED BANK, N. J.—Further steps have been taken by the Commissioners of Red Bank toward equipping the water-works plant as a municipal electric-light and power station. Thomas F. Hylan, of the Blackall & Baldwin Company, contracting engineer, of New York, N. Y., has been engaged to prepare plans and estimates of cost of establishing the proposed plant.

ALBANY, N. Y.—The Albany Electric Illuminating Company has filed plans for the 100 new so-called double Fifth Avenue lamps which the company is to erect on certain streets under the terms of the new street-lighting contract with Commissioner Greenalch, of the Department of Public Works. Under the contract the company pays for both poles and lamps, each pole costing about $157. For all other street lamps in the city the municipality owns the poles and the city furnishes the lamps. The contract calls for new lamps throughout the city, which will mean the installation of about 1000 new lamps. Besides replacing the old arc lamps with new magnetite lamps, the arc lamps in the alleys will be replaced with incandescent lamps. The company is installing underground conduits on several streets in the city.

BROOKLYN, N. Y.—The Public Service Commission, First District, has authorized the Nassau Electric Railway Company to issue 2,000 in bonds.

HARTWICK, N. Y.—The Hartwick Power Company has ap the Public Service Commission, Second District, for permis exercise a franchise to supply electricity in the town of Hartwi

NEW YORK, N. Y.—The Public Service Commission, First District, has authorized the Manhattan Three-Cent Line to issue $5 capital stock.

NEW YORK, N. Y.—Bids will be received by Arthur Commissioner of Bridges, Department of Bridges, 13 to 21 P. New York, N. Y., until Aug. 10, for furnishing and ere duplex, two-stage, motor-driven air compressor at the Willi Bridge in the Borough of Brooklyn, N. Y. Blank forms and tions may be obtained at the above office.

NEW YORK, N. Y.—Bonds to the amount of $17,200,0 stated, have been sold by the New York, New Haven & Hart road Company, for the New York, Westchester & Boston Railw pany, a subsidiary company. The New York, Westchester & Railway Company is building a four-track electric railway f Street, New York, to Port Chester, with a branch from Pelham Vernon and Scarsdale to White Plains and a branch to Clason and Throg's Neck.

NEW YORK, N. Y.—Bids will be received at the office of th vising Architect, Treasury Department, Washington, D. C., until for the installation of a conduit and wiring system for lamps an and conduits for standard clock, telephone, bell, vault protect alarm and telegraph systems in the new United States post offic York, N. Y., in accordance with plans and specifications, copie may be obtained at the above office or at the office of McKim, White, 160 Fifth Avenue, New York, N. Y. James Knox T Supervising Architect.

NEW YORK, N. Y.—Sealed bids will be received by Pa Whitney, Commissioner of Correction, Department of Correct East Twentieth Street, New York, N. Y., until Aug. 10 for f labor, superintendence, machinery, blocks, tackle and other a to lay, draw into ducts and properly connect up a complete feeder system, including covers for manholes for the light power service and a feeder and subsidiary systems for t lighting, including furnishing and connecting up mechanically trically the street lamp-post lanterns, etc., on Hart's Island, N Blank forms and further information may be obtained at the ab

NEW YORK, N. Y.—The Public Service Commission has a the Long Acre Electric Light & Power Company to issue $2,0 capital stock and $5,000,000 in bonds, $4,000,000 of which may upon the acquisition of property, except $600,000, which may for other expenses. No bonds are to be sold until $1,000,00 stock has been subscribed and fully paid for, when $2,000,000 m on the market at not less than 90 per cent of their par value. maining $2,000,000 in bonds to be sold at the same terms whe $1,000,000 of capital stock has been sold. The proceeds to be the acquisition of property, construction, completion and exten improvements to its plant or distributing system.

NEW YORK, N. Y.—The Public Service Commission, Second has granted the New York, Westchester & Boston Railway authority to execute a mortgage on all its property to secure of bonds to the amount of $60,000,000. The company is a to issue at present bonds to the amount of $20,100,000, the to be used to refund at par the bonds of the New York, W & Boston Railway Company to the amount of $16,200,000, to par the principal of bonds secured by the first mortgage of York & Port Chester Railroad Company amounting to $100 for the purpose of acquisition of real estate and constructio branch road of the company from Mount Vernon to White previously authorized by the commission, $3,800,000. Authority $5,000,000 in bonds under the mortgage of October, 1904, is re

ONEIDA, N. Y.—The date for receiving bids for lighting t and public places for periods of one, three and five years extended from July 25 to Sept. 15. Bids are to be subm ninety-two inclosed arc lamps of 350 watts, with all-night and e service. Albert Morris is chairman of Board of Public Works

ONEIDA, N. Y.—The Oneida Railway Company has applie Public Service Commission for permission to exercise its fran construction of a street railway through Madison and Sconondo streets in Oneida. The cost of the work is estimated at about $25, company is now operating over the tracks of the West Shore between Utica and Oneida, which are equipped for electrical operation.

POTSDAM, N. Y.—The placing of all electric wires in underground conduits in the business district of the city is under considerat

WADDINGTON, N. Y.—It is reported that Pittsburgh capitalists interested in the Long Sault dam project and connected with the Pittsburgh Reduction Company have purchased the Waddington holdings of M. W. Ogden, of Washington, D. C. It is also stated that an offer for Point Iroquois, Ontario, has been refused.

CHARLOTTE, N. C.—[illegible] planning to equip the Pearl Cotton Mills and Mill No. 1 for electrical operation.

HUNTERSVILLE, N. C.—[illegible] interested in a project to install an electric-light plant with an output of about 35 kw, which will probably be driven by gas or steam power.

RALEIGH, N. C.—The directors of the State Hospital for the Insane have decided to install an electric-light plant for the institution. Electricity for operating the system will be secured from the Carolina Power & Light Company.

FARGO, N. D.—Plans are being prepared by City Engineer Anders for the proposed municipal electric-light plant and the new city pumping station to be located at the filter plant.

GLEN ULLIN, N. D.—The installation of an electric-light plant in Glen Ullin is reported to be under consideration. C. E. V. Draper, of Mandan, N. D., is engineer.

ASHTABULA, OHIO.—The question of making improvements to the municipal electric-light plant is under consideration. The proposition to issue $25,000 in bonds for that purpose will probably be submitted to the voters at the election in November.

CLEVELAND, OHIO.—Plans have been completed by the Cleveland, [illegible]sville & Eastern Traction Company for consolidating the two power [illegible] and locating the main generating station at Painesville. At present [illegible] Painesville. The former supplies energy for the electric railway extending from Cleveland to Painesville and the latter for operating the cars from Painesville to Ashtabula.

DAYTON, OHIO.—Plans are being made to organize a new light and power company to complete for local business with the Dayton Light & Power Company. The company will be capitalized at $1,000,000 and will [illegible] to the City Council for a franchise in the near future. The Wise-[illegible]ble Company, Fifth and Brown Streets, Dayton, Ohio, is interested [illegible] project. It is understood that the plant of the Wise-Schieble Company will form the nucleus of the new concern.

DEFIANCE, OHIO.—The Auglaize Power Company, of Toledo, Ohio, has awarded the contract for the construction of its hydroelectric plant at Defiance to the Ambursen Hydraulic Construction Company, of Boston, Mass. The dam will be 500 ft. long and the power house 150 ft. in length. About 4000 hp will be developed.

SPRINGFIELD, OHIO.—The City Council is considering the question of establishing a municipal electric-light plant in Springfield.

GROVE, OKLA.—The City Council has sold bonds to the amount of $25,000 authorized for the installation of a combined electric and [illegible] to B. F. Stone, of Oklahoma City, [illegible] the contract for construction of the systems. An injunction has been served on the Council restraining it temporarily from issuing the bonds. The suit was filed by taxpayers who allege irregularities.

BAY CITY, ORE.—Arrangements are being made by the Tillamook Public Service Corporation for the installation of an electric-light plant in Bay City. Contracts for equipment and machinery for the power house have been placed. The city has awarded the company the contract for street lighting, under which it is to supply twenty-five arc lamps. J. H. West is superintendent.

EUGENE, ORE.—At an election held July 18 the proposition to issue $[illegible],000 in bonds, the proceeds to be used for improvements to the waterworks system and for establishing a street-lighting system, was carried. The city already owns an electric plant and it is proposed to install a distributing system.

PORTLAND, ORE.—The plant of the Portland Railway, Light & Power Company being erected on the Clackamas River at River Mill, [illegible] miles above Estacada, was badly damaged by fire on July 17, causing a loss of several thousand dollars. The boiler house, engine-room and tower on the west side of the river were destroyed.

PRAIRIE CITY, ORE.—It is reported that the plant and holdings of the Prairie City Light & Power Company have been purchased by R. C. Reece and associates, of Prairie City and Canyon City. The consideration for the plant, including the grist mill, is said to be $22,000.

BRISTOL, PA.—The Trenton, Bristol & Philadelphia Street Railway Company will purchase a 500-kw generating unit within the next thirty [illegible]

LANCASTER, PA.—Application [illegible] for a charter for eight [illegible] Manor, Manheim, East and West Lampeter, East and West Hempfield [illegible] Warwick Townships.

LEBANON, PA.—The Board of Managers [illegible] United Brethren Campmeeting Association has decided to light the grove this year with electricity. Mr. Laudermilch, a local electrician, has been authorized to install a temporary [illegible] a permanent system will probably be installed.

NANTICOKE, PA.—Arrangements are being made to increase the output of the electric generating station at the Lackawanna collieries in Nanticoke at a cost of about $[illegible] [illegible] boilers will be installed. The Auchincloss, Truesdale, Bliss and Avondale, all with washeries attached, of the Lackawanna collieries, are equipped for electrical operation. It is expected that the Loomis colliery will be put in operation within a short time.

NEWMANSTOWN, PA.—[illegible] supply electricity for lamps and motors in the towns of Newmanstown, [illegible] County. The electric transmission line to carry current across the [illegible]

NEW OXFORD, PA.—[illegible] plant in New Oxford is under consideration.

NEW OXFORD, PA.—[illegible] Pennsylvania on Aug. 15 for a charter for the New Oxford Light, Heat & Power Company. Raymond F. Topper, George J. Benner and Stella I. [illegible]

PHILADELPHIA, PA.—Permits have been granted to the Philadelphia [illegible] ware Avenue, south of Laurel Street, to cost $25,000; also for the erec[illegible]

STOWE, PA.—The power plant of the Schoen Steel Wheel Company's yards in Stowe Township was destroyed by fire on July 22, causing a loss of about $15,000.

TRUMBAUERSVILLE, PA.—The village of Trumbauersville is reported to have decided to install an electric-light plant.

WEATHERLY, PA.—Plans are being considered to enlarge the municipal electric-light plant. In addition to lighting the town the plant will supply electricity for lamps and motors for the Lehigh Valley Railroad shops.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is reported to have awarded contract for the erection of superstructure of power house at the foot of Charlotte Street on Cooper River to J. W. Lindsay & Company, of Philadelphia, Pa. The building will be 120 ft. square, two stories high, of brick or cement; smokestack 200 ft. high. The equipment will include 2640 hp in boilers, one 1000-kw turbo-generator, two 2000-kw turbo-generators, three [illegible] board, exciter, etc., to cost approximately $200,000.

HONEA PATH, S. C.—Plans are being prepared for the installation of a municipal electric-light plant, to cost about $37,000. Bids for the construction of the plant will be called for about Sept. 1. Thomas W. Cothran, of Greenwood, S. C., is engineer in charge.

GETTYSBURG, S. D.—Sealed bids will be received by the Board of County Commissioners of Potsdam Countyy, Gettysburg, S. D., until Aug. 9 for combination gas and electric lighting fixtures for the county court house. Specifications can be obtained on application to L. J. Klein, county auditor, Gettysburg, S. D.

CHATTANOOGA, TENN.—Orders have been placed by the Chattanooga Railway & Light Company with the General Electric Company, of Schenectady, N. Y., for one 1000-kw motor-generator set, four 1500-kw [illegible]

MEMPHIS, TENN.—Plans are being prepared for the installation of an electric plant to supply electricity to light the new union station, yards, terminal and subway, which will form part of the yards, to cost about $40,000.

PULASKI, TENN.—The town of Pulaski has received authority from the State Legislature to issue $20,000 in bonds, the proceeds to be used for reconstruction of the municipal electric-light plant, plans for which are being prepared by C. L. Wheeler, electrical superintendent.

ROCKWOOD, TENN.—It is reported that the owners of the Rockwood Mills are thinking of enlarging their plant and installing a new power plant. The question of equipping the mill for electrical operation is under consideration. If it is decided to use electricity the company will generate its own current.

ROGERSVILLE, TENN.—Application has been made to the Town Council for a franchise to supply electricity for lamps and motors in Rogersville and vicinity. McDonald Brothers and other capitalists are interested in the project. It is proposed to develop water-power in the Holston River, about 3 miles above Rogersville. The initial installation will provide for 250 hp, and as the demand increases the plant will be enlarged. The construction of an electric railway, connecting Rogersville and Hale Springs, is also under consideration.

SOUTH PITTSBURGH, TENN.—The South Pittsburgh Light & Power Company will erect a temporary building to replace the power house recently burned, which later will be replaced by a permanent structure. It is reported that the company is asking for bids on a 50-kw, 2200-volt, 60-cycle generator, with exciter, switchboard, etc. Charles Houston is manager.

ANGLETON, TEX.—The Angleton Gin & Power Company, it is reported, is planning to install an electric-light plant.

BEAUMONT, TEX.—The Stone & Webster Engineering Corporation, of Boston, Mass., has secured an option on the property and holdings of the Beaumont Ice, Light & Refrigerating Company, except its ice and refrigerating plant. The property involved in the pending transaction includes the local electric-light and power plant. The option runs until Oct. 3. It is stated that these will form a nucleus for an extensive railway system in this city and an interurban railway to extend from Beaumont to Port Arthur, a distance of 25 miles.

BONHAM, [illegible] Bonham Gas & Electric Company [illegible]

for bids for the construction of a power house to be erected [illegible] Second Street, Bonham.

BRYAN, TEX.—At an election to be held Aug. 21 the proposition to issue $20,000 in bonds, the proceeds to be used for extensions and completion of electric-light, sewerage and water-works systems, will be submitted to a vote.

COLEMAN, TEX.—Preparations are being made for the construction of a new power house for the municipal electric-light plant.

MEXIA, TEX.—The Mexia Light, Water & Sewerage Company is making arrangements to establish a day service for lamps and fans. It is understood that orders have been placed for additional equipment for plant.

PADUCAH, TEX.—The City Council is reported to have granted a franchise to a company to construct and operate an electric-light system [illegible] Paducah.

STOCKDALE, TEX.—The Farmers' Gin Company, of Stockdale, Tex., is installing an electric-light plant.

BRIGHAM CITY, UTAH.—The Box Elder Power & Light Company, formerly known as the Brigham City Electric Light Company, which operated in this city before the municipal electric plant was put in operation, is offering bonds to the amount of $75,000. The company owns a pipe line and a valuable power house site at Box Elder, where it is estimated that from 700 hp to 800 hp can be developed. John C. Knudson is treasurer of the company.

BOWLING GREEN, VA.—The installation of an electric-light plant in Bowling Green is under consideration, for which bids for franchise are being called for.

FARMVILLE, VA.—The plant and holdings of the Farmville Water, Light, Heat & Power Company have been taken over by the municipality.

LEESBURG, VA.—The Leesburg Telephone Company has increased its capital stock from $10,000 to $25,000, the proceeds to be used for extensions and improvements to its system. M. E. Church is general manager.

BREMERTON, WASH.—Bids will be received at the office of the United States Marine Corps, Mills Building, Washington, D. C., until Aug. 7 for furnishing electric-lighting fixtures for the marine barracks, Navy Yard, Puget Sound, Wash. For further information address the quartermaster, United States Marine Corps, Washington, D. C.

ELLENSBURG, WASH.—The City Council is reported to be considering the question of issuing $100,000 in bonds, the proceeds to be used for improvements and extensions to the municipal water-works system. The proposed work includes extensions to main pipe line, reservoir, two 2,000,000-gal. pumps to be operated by electricity, supplied by the municipal electric plant.

FT. FLAGLER, WASH.—The contract for installing an electric-light system at Ft. Flagler, Wash., has been awarded to the W. E. Chase Engineering Company, of Spokane, Wash., for $29,900.

MEYERS FALLS, WASH.—Surveys are being made by the Stevens County Power & Light Company with a view of extending its transmission line to Marcus, Wash.

PORT ANGELES, WASH.—The Olympia Power Company is reported to have awarded contract for the construction of right-of-way for its proposed transmission line from Port Angeles to Irondale to P. J. Woods. The contract calls for clearing the right-of-way and cedar poles, at a cost of $18,000. The company will erect the transmission line.

PORT ORCHARD, WASH.—The contract for construction of power house at Washington Veterans' Home, bids for which were opened July 24, has been awarded by the State Board of Control to Pauer & Peters, of Seattle, Wash., for $4,620.

RANDALL, WASH.—Preparations are being made by the Valley Improvement Company, of Portland, Ore., to begin active construction work on its proposed power plant to be erected near Randall. It is reported that the proposed development will cost about $15,000,000 and electrical energy generated at the plant will be transmitted to Portland, Ore.

SUMNER, WASH.—Application has been made to the Council by the Puget Sound Company for a franchise to supply electricity in Sumner.

WALLA WALLA, WASH.—The city clerk has been authorized to advertise for bids for supplying electricity for arc and cluster lamps in Walla Walla for both five and ten-year periods.

CHARLESTON, W. VA.—The Appalachian Power Company, recently incorporated under the laws of the State of Virginia, has applied to the Secretary of State for authority to do business in West Virginia. The company is capitalized at $25,000,000 and has taken over the property of the Bluestone Traction Company, of Bluefield, W. Va., and is developing a water-power on New River. It proposes to supply electricity in the Pocahontas coal fields.

DUNBAR, W. VA.—The power plant of the Charleston-Dunbar Traction Company, which proposes to build an electric railway from Charleston to Dunbar, will be located in this town.

KENOVA, W. VA.—The Consolidated Light & Railway Company, it is reported, will make application for a franchise to operate an electric-light system in Kenova. William C. Sproul is president of the company.

RICHWOOD, W. VA.—The Cherry River Boom & Lumber Company has awarded the contract for the construction of an electric-light pl and boiler plant to Shinn Brothers.

ANTIGO, WIS.—The Antigo Electric Company has taken over property of the Antigo Gas Company. The two plants will be opera by the Antigo Electric Company.

BARABOO, WIS.—The installation of a municipal electric-light pl has been recommended by the special lighting committee to the Coun

LIVINGSTON, WIS.—The Council has granted the Mineral Pc Power & Electric Light Company a franchise to erect transmission li in Livingston to supply electricity for lamps and motors in this village

MILWAUKEE, WIS.—An appropriation of $40,000 has been reco mended by Joseph A. Mesiroff, city engineer, to install an elec plant at the refuse incinerator to utilize the waste steam in operat the Milwaukee River and Kinnickinnic River flushing tunnel pump engines. If electric pumps are not installed in the Milwaukee Ri station, the present plant will practically have to be replaced. T station has been in operation for twenty-three years.

OSHKOSH, WIS.—Plans are being prepared by the Northern Hyc Electric Company, of Green Bay, Wis., for the erection of a tra mission line from its power plant at High Falls, Wis., to Oshko At present the company is developing 9000 hp at its plant on Peshtigo River; it is estimated that 14,500 hp can be developed.

STETTLER, ALTA., CAN.—Contracts have been awarded for c struction of the municipal electric-light plant in Stettler as follo For generator to the Swedish General Electric Company at $2,6 for engine to the Robb Engineering Company at $2,425; for boiler the Watrous Engine Works at $1,601; poles to the Western Lum Company, for 35-ft. poles, $4.40 each, and for 30-ft. poles, $2.40 ea pole-line materials and copper wire, transformers and meters to Canadian General Electric Company, and for street-lighting mater to the Canadian Westinghouse Company for $360.

KAMLOOPS, B. C., CAN.—A preliminary report prepared by H. Dutcher, engineer, recommending the development of Paul Creek both water and electrical supply is reported to have been submitted the Council. It is estimated that 1200 hp can be developed at a cost $150,000, which includes a gravity water supply system costing $60,(

VANCOUVER, B. C., CAN.—It is expected that the transmiss lines of the Western Canada Power Company will reach Vancouver the near future; the company expects to be ready to deliver electr energy in this city by Sept. 1. The transmission line will extend fr its power plant on the Stave River to Vancouver, a distance of miles. An agreement has been made between the Western Can Power Company and the Great Northern Railway Company, wher the power company will use the right-of-way of the railway comp from Burnaby to Vancouver to enter the city. Energy will be delive to the Burnaby substation, which is nearly completed, where it will stepped down from 60,000 volts to 13,000 volts for transmission Vancouver.

WARDNER, B. C., CAN.—Announcement has been made by Bull River Electric Power Company that it has secured funds to c plete the installation of machinery at the falls and to erect necess transmission lines. George E. Henderson, of Wardner, B. C., is pr dent and manager.

PORTAGE LA PRAIRIE, MAN., CAN.—The Town Council adopted a resolution to make the Central Electric & Gas Company offer of $110,000 for its plant, subject to ratification by the ratepay It is expected that the offer will be confirmed by the ratepayers.

SELKIRK, MAN., CAN.—It is reported that W. E. Skinner, c sulting engineer, has been engaged by the town of Selkirk in conn tion with either the installation of a municipal plant or making arra ments with the city of Winnipeg or the Winnepeg Electric Rail Company for electrical energy.

FREDERICTON, N. B., CAN.—It is reported that surveys have b completed by the Eel River Power Company of the lakes in the vici of Canterbury and also sites for two dams near Benton. The comp proposes to build a hydroelectric plant to supply electricity in Frede ton, St. Stephen, Woodstock and other towns in this vicinity. The tablishment of a street-car service is also under consideration. John Murchie, George A. Murchie, of Calais, Maine; H. A. Connell George McPhail, of Woodstock, are interested in the project.

MILLTOWN, N. B., CAN.—Application has been made to the to of Milltown for a franchise to establish an electric power and hea plant in this town.

BLYTH, ONT., CAN.—At an election held recently the by-law thorizing the purchase of the local electric light plant by the municipa was carried.

GODERICH, ONT., CAN.—The by-law to ratify an agreement John L. Brodie to supply electrical energy to the amount of 325 hp the town at a cost of $34 per horse-power per year will be submitted the ratepayers on Aug. 5.

HAMILTON, ONT., CAN.—The by-law to appropriate $505,00 install a municipal electric plant to distribute electrical energy supp by the Hydro-Electric Power Commission was carried at an elec held July 25. It is understood that tenders will be called for stallation of the system as soon as plans are prepared.

LINDSAY, ONT., CAN.—It is reported that the question of purc ing the local electric-light plant to be owned and operated by the mu

...ity of granting the Electric Power Company a franchise is under consideration. Before submitting the proposition to the ratepayers careful investigation will be made of the possible development and cost of ...nelon Falls.

SARNIA, ONT., CAN.—It is reported that negotiations are under way for the purchase of the property of the Sarnia Gas & Electric Company by the municipality. It is said that plans will be prepared by the town engineer for the installation of a municipal lighting system.

TORONTO, ONT., CAN.—The Toronto General Hospital Board has decided to install a 400-kw electric plant to supply electricity for lamps and motors to the new hospital buildings being erected on College Street. ...W. Flavelle, of Toronto, is chairman of board.

WALKERTON, ONT., CAN.—Plans are being considered by the Walkerton Electric Light & Power Company for the construction of a dam across the Saugeen River and developing the waterfalls there to generate electricity for transmission to Walkerton.

WILKIE, SASK., CAN.—Bids will be received by T. A. Dinsley, secretary and treasurer, until Aug. 21 for furnishing and installing the following equipment and machinery: Tender A, Electrical machinery—one 60-kw, three-phase, 60-cycle, 2300-volt alternating-current generator, one exciter for above, one marble switchboard, instruments and switches, three 2200-volt motors, back geared to pumps, five transformers for lighting system, series tungsten lamps for street-lighting system, approximately 25 cwt. of weatherproof copper wire (line material, guy wire, arms, pins, insulators, etc.), cedar poles. Tender B—One 100-hp ... combination engine. Tender C—Pumping machinery—One ...king head and deep-well cylinder, one 500-000-gal. pump, one air compressor and necessary shaftings and belting. Tender D—One pneumatic ... tank. Tender E—Cast-iron water pipe. Tender F—Lowing ...-iron water pipe. Tender G—Erection of power house and construction of reservoir. Plans and specifications may be seen at the ... or may be obtained ... on application to McArthur & Murray, ...tomly Block, Saskatoon, Sask., Can., engineers.

New Industrial Companies.

THE EFFICIENCY ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $100,000 to manufacture electrical batteries and supplies. The incorporators are: R. C. Carpenter, C. G. Johnson and V. J. Johnson.

F. G. EVERSON & COMPANY, of Chicago, Ill., have filed articles of incorporation with a capital stock of $40,000 for the purpose of manufacturing gas and electric fixtures. The incorporators are: R. B. Everson, H. V. Willman and C. G. Everson.

THE GRIFFITHS ELECTRIC CONTRACTORS, LTD., of Winnipeg, ... Can., has been incorporated with a capital stock of $500,000. The ...s are: Norton Griffiths, James K. Bock, Edward Paulet, Viscount ... and I. G. Bristowe, all of London, Eng.

THE HEXTER MOTOR TRUCK COMPANY, of New York, N. Y., has been chartered by Arthur A. Alexander, A. T. Rook, Maurice Mili... ... of 51 Chambers Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture motor trucks, cars, ...

E. S. LINCOLN—R. W. P. BROWN, INC., of Brookline, Mass., has filed articles of incorporation with a capital stock of $250,000 for the purpose of doing an electrical engineering business. The incorporators are: Edwin S. Lincoln, Reginald W. P. Brown and Arthur T. Johnson.

E. L. PHILLIPS & COMPANY, of New York, N. Y., has been incorporated by Ellis L. Phillips and Warren M. Heim, both of 50 Church Street, New York, N. Y., and Henry R. Frost, 52 Broadway, New York, N. Y. The company is capitalized at $100,000 and proposes to do a general contracting and engineering business.

THE F. A. SMITH MANUFACTURING COMPANY, of Rochester, N. Y., has been chartered with a capital stock of $35,000 to manufacture oil, gas and electric fixtures and supplies. The incorporators are: F. A. Smith, F. S. Smith and C. E. Furman, of Rochester, N. Y.

New Incorporations.

NIAGARA FALLS, N. Y.—Articles of incorporation have been filed by the Frontier Power Transmission Company with a capital stock of $10,000. The company proposes to generate and sell power in Buffalo, Niagara Falls, Tonawanda, Wheatfield and La Salle. James S. Simmons, of Niagara Falls, is interested in the company.

COLUMBUS, OHIO.—The Radio Manufacturing Company has been incorporated with a capital stock of $50,000 by E. W. Brinker, J. C. Singler, Howard Lewis, Chester C. Moelchert and J. H. Carpenter. The company proposes to establish a plant to supply power for manufacturing purposes.

EBENSBURG, PA.—Charters have been granted by the State Department to seven electric companies to operate in Cambria County with offices at Ebensburg, as follows: Allegheny, Blacklick, Cresson, Gallitzin, Summerhill and Washington, to operate in districts of those names, and the Pioneer, of Portage. Each company is capitalized at $5,000. The incorporators are: Jacob Mann, James Collins Jones and Floyd W. Woodcock, of Philadelphia, Pa.

MENALLEN, R. D. BIGLERVILLE, PA.—The Menallen Electric Company has been granted a charter with a capital stock of $5,000 to operate in Menallen Township. The incorporators are: F. M. Balsinger and G. T. Smith, of Pittsburgh, Pa., and W. H. Larimer, of Wilkinsburg, Pa.

NANTY GLO, PA.—The Jackson Light, Heat & Power Company has been granted a charter with a capital stock of $5,000. The company has been operating a small plant and proposes to increase the output of same, work on which has already commenced. The incorporators are: E. Smith, M. B. Nairn and Thomas P. Burns, all of Nanty Glo.

Personal.

JUDGE DAVID D. HOAG, secretary of the Empire District Electric Company, Joplin, Mo., has returned from a four months' trip abroad.

PROF. J. D. HOFFMAN, of the school of mechanical engineering of Purdue University, Lafayette, Ind., has resigned to take up instructional work in the University of Nebraska.

MR. B. J. DENMAN, until recently senior engineer in the commercial department of the Edison Illuminating Company of Detroit, Mich., has been appointed assistant chief engineer in charge of the company's Delray generating station.

MR. W. K. FREUDENBERGER has been appointed chief engineer of the Public Service Commission of the State of Nevada. Mr. Freudenberger was previously electrical engineer of the Steptoe Valley Smelting & Mining Company, McGill, Nev.

MR. JOHN J. DECK has been elected vice-president of Dossert & Company, of New York, to fill the vacancy caused by the resignation of Mr. Charles A. Flynn. Mr. D. J. Fitch has been elected secretary and treasurer of the same company.

MR. N. A. BURGESS has been appointed attorney in charge of the General Electric Company's patent department at Washington, D. C., succeeding Mr. W. M. Fairfax, who has opened an office as patent expert and attorney in the McLachlin Building.

MR. H. T. PLUMB, formerly associate professor of electrical engineering in Purdue University, Lafayette, Ind., has resigned to join the Denver, Col., office of the General Electric Company, with which he has been associated during the last year on leave of absence.

MR. H. W. YOUNG, president of the Delta-Star Electric Company, Chicago, and sales manager of the Sangamo Electric Company, Springfield, Ill., is making a Western trip investigating the distribution and metering problems of companies selling electrical energy to mines, irrigation projects and small towns located along their high-tension transmission lines.

MR. ROBERT H. KUSS, chief assistant smoke inspector of the city of Chicago, has resigned to accept a position with a private concern. Mr. Kuss was chief assistant under Mr. Paul P. Bird, the former smoke inspector, and was in charge of the department during the interval between the resignation of Mr. Bird and the appointment of Mr. Monnett, the present inspector.

MR. D. A. HEGARTY was the guest of honor at a banquet given by professional and business men of Little Rock, Ark., July 26, as a tribute to his service for the past five years as general manager of the Little Rock Railway & Electric Company. Mr. Hegarty on Aug. 2 became general manager of the railway and lighting department of the New Orleans Railway & Light Company.

MR. GEORGE W. NASMYTH has been appointed instructor in physics at Cornell University. Mr. Nasmyth recently completed an exhaustive investigation of impact excitation phenomena covering the characteristics of short arcs between metal electrodes; the intensity of the Lepel arc oscillations as a function of the arc current capacity and inductance, and the frequency of the Lepel oscillations. The researches were conducted at Cornell University and recorded in the *Physical Review*.

MR. L. D. GIBBS, superintendent of advertising for the Edison Electric Illuminating Company of Boston, delivered an address at the out-door advertising session of the Associated Advertising Clubs of America's seventh annual convention, held in Boston, on Friday morning, August 4. He exhibited special slides showing about twenty of the largest and most distinctive electric signs in Boston in different phases of their flashes, which were thrown on the screen in such a manner as to resemble vividly the signs in actual operation.

MR. ERNEST A. EDKINS, of Chicago, has been appointed editor of the Question Box of the National Electric Light Association. Mr. Edkins is superintendent of the employment bureau as well as secretary of the advisory committee of the Commonwealth Edison Company. He is also editor of *The Edison Round Table*, and, as he possesses conspicuous literary ability as well as wide central-station knowledge, he is sure to perform a useful service for the industry in the arduous task which he has taken on his shoulders.

MR. CALVERT TOWNLEY, who recently resigned as vice-president of the Connecticut Company to become identified with the Westinghouse Electric & Manufacturing Company, has been appointed assistant to Mr. E. M. Herr, the recently elected president of the latter company. [illegible] tion problems of the New York, New Haven & Hartford Railroad, was formerly with the Westinghouse Electric & Manufacturing Company. He is a member of the A. I. E. E. and served as manager from 1905 to 1908, and as vice-president from 1908 to 1910.

MR. WALTER CLYDE JONES, State Senator from the Fifth District in Chicago, has announced his candidacy for the Republican nomination for Governor of Illinois. Mr. Jones, who graduated from the engineering course in Iowa State College, was engaged in electrical enterprises in the earlier part of his career and was at one time president of the Chicago Electrical Association, which was afterward merged into the Electrical Section of the Western Society of Engineers. He was admitted to the bar in 1895 and has been active in politics. He is a member of the American Society of Mechanical Engineers and of [illegible]

MR. R. B. STEARNS, of Chicago, has been appointed assistant general manager of the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company, in charge of the railway departments of those companies. Mr. Stearns, who graduated from Purdue University, class of 1889, served on the engineering staff of the Columbian Exposition at Chicago in 1893. He was engaged in the United States Engineer Service on the Chicago Drainage Canal and the Hennepin Canal during the early history of these works, and from its inception took part in the construction of the Northwestern Elevated R[illegible] and [illegible] extensions to the Lake Street (now Chicago & Oak Park Elevated Railroad), Chicago, as assistant chief engineer and superintendent of construction, subsequently becoming chief engineer and superintendent in charge of the operation of the Northwestern Elevated Railroad. Mr. Stearns was, for a short time before and during the receivership, general manager of the Chicago & Milwaukee Electric Railroad Company.

MR. THOMAS A. EDISON sailed for Europe by the Cunarder *Mauretania* on Aug. 2, accompanied by his son Charles, and will meet Mrs. Edison and their daughter in London. It is over a score of years since Mr. Edison last crossed the Atlantic, although many pressing and urgent invitations have reached him in the meantime, including one from a great English university, which desired to confer a degree on him. Close application to work in his laboratory kept Mr. Edison from taking his usual winter rest at his home in Florida, and for that reason Mrs. Edison was able to prevail on him to join her in Europe this summer. The matter of a large order for his storage batteries to be used on German submarines will also receive attention. The batteries are to be made in Germany, and part of the time will be spent in automobiling in that country. Mr. Edison is planning to return home about the last week in September. The occasion of the last visit of Mr. Edison to Europe was the Paris Exposition of 1889, and during his stay in Paris he was the recipient of almost royal attentions. Upon going to the Opéra one night, the management, apprised of his coming, had the orchestra play "The Star-Spangled Banner" upon his entry, while the audience greeted him with enthusiastic applause.

MR. D. L. GASKILL, President of the Greenville Electric Light & Power Company, of Greenville, Ohio, was re-elected secretary of the Ohio Electric Light Association at its Cedar Point convention, July 2[illegible], in testimony to his active and untiring services to the association. Besides perfecting the numerous details of registration, program and entertainment for the Cedar Point convention, the attendance at which reached 400 persons, Secretary Gaskill presented two of the papers at the convention which attracted the greatest interest, his report on "Insurance Rates Charged Electric-Lighting Companies in Ohio" and his constructive criticism of Ohio's new public-utility law. Mr. Gaskill was also re-elected secretary of the National District Heating Association at the time of the recent convention of that body, which was held in Pittsburgh, Pa.

D. L. GASKILL.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention in November, 1911.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting at Toronto, Canada, September 21-23, 1911.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Next meeting at Philadelphia, Pa., Sept. 5, 6 and 7, 1911.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

Trade Publications.

AUTOMOBILE CHARGING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Folder No. 4201, entitled "Charging the Automobile Battery with Westinghouse-Cooper Hewitt Rectifier Outfits." The folder is well illustrated and describes outfits and accessories.

COPPER-CLAD STEEL WIRE FOR TELEGRAPH SERVICE.—The Duplex Metals Company, Chester, Pa., has issued a bulletin containing a report on copper-clad steel wire for telegraph service. The report summarizes the principal conclusions from an exhaustive investigation on the subject by a well-known engineer.

BUSHINGS.—The Federal Sign System, Chicago, Ill., has sent out a card with a sample of its lock clamp bushings for outlet boxes and all metal work. The bushing, which is made of porcelain, has a non-rusting metal-clamping ring. It is firmly attached by means of a few twists, and is approved by the Underwriters.

SHOP BUILDINGS.—The Stone & Webster Engineering Corporation, Boston, Mass., has issued an ilustrated folder showing two large reinforced-concrete buildings at Schenectady, N. Y., designed and erected for the General Electric Company by it. The buildings were built on a fee basis, and have a total floor space of seven and one-half acres.

INSTRUMENTS OF PRECISION.—A number of leaflets have been issued by H. Tinsley & Company, Eldon Park, South Norwood, England, for standard instruments, such as volt boxes for use with potentiometer, single and polyphase wattmeters, vibration galvanometer, non-inductive, low-resistance, standard shunts, Weston normal cells and universal potentiometers.

ELECTRIC SIGN FLASHERS.—Bulletin No. 14 issued by the Reynolds Electric Flasher Manufacturing Company, Chicago, Ill., contains suggestions and original ideas for spectacular flashing effects. The "Reco" flashers are made in eleven distinct types, and very often all are embodied in the construction of a combination flasher in order to obtain a realistic effect. Electric signs showing steaming tea, dancing bear, flames and pin wheel, bursting rocket, winding and unwinding disk, motion pictures, water effects, etc., are shown.

BUSINESS NOTES.

THE MOLONEY ELECTRIC COMPANY has removed its Chicago offices from the Fisher Building to 332 South Michigan Boulevard (528 McCormick Building).

RUDEL-BELNAP MACHINERY COMPANY.—Mr. L. J. Belnap has resigned as Montreal manager of the Allis-Chalmers-Bullock Company, Montreal, after having been connected with the Allis-Chalmers interests for the past ten years. Mr. Belnap has organized the Rudel-Belnap Machinery Company, Ltd., Canadian Express Building, Montreal. The company will carry general machine shop and contractors' equipments, and have charge of the Montreal office of the Canadian Crocker-Wheeler Company.

PACIFIC COAST AGENCY OF STEEL CITY ELECTRIC COMPANY.—The Steel City Electric Company, of Pittsburgh, Pa., has appointed the Aylsworth Agencies Company, 143 Second Street, San Francisco, Cal., as its sales representative for the Pacific Coast. The Aylsworth company will carry a stock of the various Steel City products, including "Star" bushings, "Steel City" drawn-steel outlet boxes, "Fullman" adjustable and non-adjustable floor outlets, "Universal" insulator supports, "Star" fixture stems, "Superior" fish wire, etc.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, has consummated arrangements with the Mine & Smelter Supply Company by which the latter concern will act as representative for the Wagner company in the territory tributary to Denver, Salt Lake City, El Paso and Mexico City. In each instance the Mine & Smelter headquarters virtually becomes a district office of the Wagner company, and will carry a satisfactory stock and be equipped with the necessary sales and engineering staff to negotiate for the sale and installation of Wagner apparatus. Mr. O. H. Davidson, heretofore Wagner representative at Denver, becomes head of the electrical department of the Denver house of the Mine & Smelter Supply Company. In Salt Lake City Mr. F. E. Marcey, for several years manager of the Salt Lake City office of the Allis-Chalmers Company, is manager of the Mine & Smelter Supply Company's office.

[illegible] Electric Railway Accountants' Association. Secretary, [illegible] Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., [illegible] 13, 1911.

[illegible] Electric Railway Engineering Association. Secretary, [illegible] Litchfield, Interborough Rapid Transit Company, New York. [illegible] convention, Atlantic City, N. J., Oct. [illegible]

A[illegible]rican Electric Railway Association. Secretary, H. C. Donecker, [illegible]ering Societies Building, 29 West 39th St., New York. Annual [illegible]ntion, Atlantic City, N. J., Oct. 9-13, 1911.

A[illegible]rican Physical Society. Secretary, Ernest Merritt, Cornell Uni-[illegible] Ithaca, N. Y.

A[illegible]nsas Association of Public Utility Operators. Secretary, W. T[illegible]pe, Little Rock, Ark.

A[illegible]ciation of Iron and Steel Electrical Engineers. Secretary, [illegible]m Farrington, Steubenville, Ohio.

[illegible] of Railway Telegraph Superintendents. Secretary, P. [illegible] Adams St., Chicago.

[illegible] of Railway Electrical Engineers. Secretary, [illegible] & Northwestern Railway, Chicago. Next annual meeting [illegible] Salle, Chicago), November 6 to 10, 1911. Semi-annual meet-[illegible]gton, 1911.

A[illegible]ciation of Edison Illuminating Companies. Secretary, N. T. [illegible]well, Mass.

[illegible] Electric Light, Power & Railway Association. Secretary, [illegible], 323 Hagerman Building, Colorado Springs, Col. Annual [illegible] Glenwood Springs, Col., Sept. 13-15, 1911.

E[illegible]tric Vehicle Association of America. Secretary, Harvey Rob-[illegible]son, 124 West 42d St., New York. Meetings, fourth Tuesday of each [illegible]

E[illegible]tric Club, Chicago. Secretary, N. F. Obright, 1500 American [illegible]rus Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

E[illegible]trical Contractors' Association of New York State. Secretary, [illegible]eo. [illegible] Russell, Jr., 25 West 42d St., New York.

[illegible] Trades Association of Philadelphia. Secretary, J. W. [illegible] Land Title Building, Philadelphia, Pa. Meetings, second and [illegible]sday of each month.

[illegible]al Contractors' Association of State of Missouri. Secre-[illegible]ry, [illegible]rnest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

E[illegible]trical Salesmen's Association. Secretary, Francis Raymond, 125 [illegible]chigan Ave., Chicago. Annual meeting, Chicago, January each year.

E[illegible]trical Trades Association of Canada. Secretary, William R. [illegible]avey, Royal Insurance Building, Montreal, Can.

E[illegible]trical Credit Association of Chicago. Secretary, Frederic P. [illegible]ose Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, [illegible]11.

E[illegible]trical Trades Association of the Pacific Coast. Secretary, [illegible]lbe H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. [illegible]on[illegible] meeting, San Francisco, second Thursday of each month.

[illegible]al Trades Society of New York (Member National Electrical [illegible]ciation). Secretary, Franz Neilson, 80 Wall St., New York. [illegible] directors meets second Thursday of each month.

E[illegible]re State Gas and Electric Association. Secretary, Charles H. [illegible] C[illegible]pin, Engineering Societies Building, 29 West 39th St., New York.

F[illegible]ida Electric Light & Power Association. Secretary, H. C. [illegible]dar West Palm Beach, Fla.

I[illegible]ois State Electrical Association. Secretary, H. E. Chubbuck, [illegible]

I[illegible]minating Engineering Society. Secretary, P. S. Millar, Engi-[illegible]eer[illegible] Societies Building, 29 West 39th St., New York. Sections in [illegible]ew [illegible]ork, New England, Philadelphia and Chicago. Annual convention, [illegible]ept [illegible]-27, 1911, Chicago, Ill.

I[illegible]pendent Electrical Contractors' Association of Greater New [illegible]ork. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

I[illegible]ana Electric Light Association. Secretary, J. V. Zartman, In-[illegible] Ind. Annual meeting, Aug. 23 and 24, 1911.

[illegible] Combustion Engine Association. Secretary, Chas. Kratch, [illegible]liana St., Chicago. Meetings, second Friday of each month.

[illegible] Association of Municipal Electricians. Secretary, [illegible]. George, Houston, Tex. Next convention at Ryan Hotel, St. Paul, Min[illegible] Sept. 12-15, 1911.

I[illegible]rnational Electrotechnical Commission (international body repr[illegible]nting various national electrical engineering societies contributing [illegible]o [illegible] support). Secretary, C. le Maistre, 28 Victoria St., Westminster, Lon[illegible], S. W., England.

Io[illegible] Electrical Association. Secretary, W. N. Keiser, Dubuque, Ia.

Io[illegible] Street & Interurban Association. Secretary, L. D. Mathes, [illegible]e, Ia.

K[illegible]sas Gas, Water & Electric Light Association. Secretary Jam[illegible] D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept[illegible]1 and 22, 1911.

M[illegible]e Electrical Association. Secretary, Walter S. Hyman, Water-ville, [illegible]aine.

Michigan Electrical Association. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electrical Association. Secretary, T. C. Gordon, Little Falls, Minn.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Spring[illegible], Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., probably first week in June, 1912.

National Electric Light Association, Canadian Section. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

National Electric Light Association, Georgia Section. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

National Electric Light Association, Mississippi Section. Secretary, A. H. Jones, McComb City, Miss.

National Electric Light Association, Nebraska Section. Secretary-Treasurer, S. J. Bell, David City, Neb.

National Electric Light Association, New England Section. Secretary, Miss O. A. Bursiel, 39 Boylston St., Boston, Mass.

National Electric Light Association, Pennsylvania Section. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

National Electric Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electrical Credit Association. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

National Fire Protection Association. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

National Independent Telephone Association. Secretary, Joseph B. Ware, Grand Rapids, Mich.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New Orleans Electrical Contractors' Association. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

Order of Rejuvenated Sons of Jove. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct. 16-18, 1911.

Pittsburgh Electric Booster Club. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

Society for the Promotion of Engineering Education. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

Society of Wireless Telegraph Engineers. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

Southwestern Electrical & Gas Association. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

Street Railway Association of the State of New York. Secretary, C. G. Reel, Kingston, N. Y.

Vermont Electrical Association. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

Western Society of Engineers. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Wireless Institute. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY [illegible].
[Prepared by Robert Starr Allyn, 10 Exchange Place, New York.]

[illegible] GALVANOMETER; [illegible] Evanston, Ill. App. filed Sept. 16, 1910. The permanent magnet is rotarily adjustable with respect to [illegible].

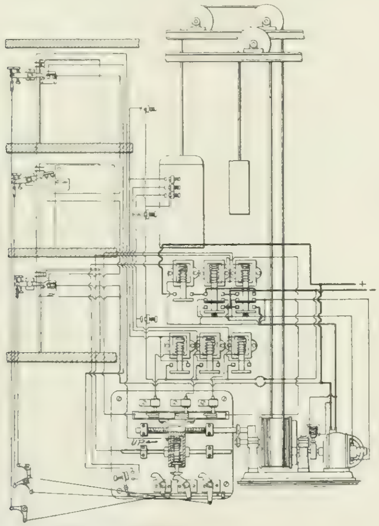
998,618. STEREOSCOPE-PLATE CHANGER; E. W. Kelly, Philadelphia, Pa. App. filed Aug. 1, 1910. A plurality of plate holders and a [illegible]. The holders are opaque to ordinary light and [illegible] X-rays.

998,624. DOOR-LOCK-OPERATING APPARATUS; A. Magnuson, New York, N. Y. App. filed Nov. 14, 1907. For automatically controlled elevator systems. The latch-operating device is automatically operated when the car is opposite the door.

998,635. ARMATURE; B. P. and F. I. Remy, Anderson, Ind. App. filed Aug. 19, 1909. The core is formed in two parts to be clamped on opposite sides of a continuous shaft and each part has a form-wound coil. For magnetic ignition, etc.

998,647. ELECTROMAGNETIC CONTROL SYSTEM; H. L. Smith, Schenectady, N. Y. App. filed Oct. 27, 1909. For automatically filling a tank from which fluid is drawn in large quantities and at frequent intervals.

998,649. INSULATOR BRACKET FOR ELECTRICAL WORK; F. K. Spencer and O. Bennett, Binghamton, N. Y. App. filed Nov. 11, 1910. Vertical and horizontal plates for insulator support.



998,624—Door-Lock-Operating Apparatus.

998,653. FLOOR CONTROLLER; A. Sundh, Yonkers, N. Y. App. filed Nov. 11, 1907. For elevators. This door-lock-operating mechanism is remote from the car and connected mechanically to the locks. Adjustable contacts for varying the position at which the car stops.

998,662. CIRCUIT-CONTROLLING DEVICE; J. B. Wiard, Lynn, Mass. App. filed March 25, 1907. Actuated by fluid pressure to control a single-phase motor for operating blowers, pumps, etc.

998,665. REFINING METALS; W. C. Arsem, Schenectady, N. Y. App. filed Feb. 9, 1910. Silver is distilled from a mixture of gold and silver in a substantial vacuum at about 1300 deg. C.

998,674. GUARD ATTACHMENT FOR TROLLEYS; G. J. Burns, Youngstown, Ohio. App. filed Aug. 17, 1910. Pivoted and weighted angle levers on each side of the wheel.

998,677. DYNAMO-ELECTRIC MACHINE; W. F. Dawson, Schenectady, N. Y. App. filed Dec. 19, 1904. A ring secures the commutator bars in fixed relation to the support. Some bars are short and others long and widened to facilitate connection.

998,687. ARC-LAMP ELECTRODE; E. J. Guay, Lynn, Mass. App. filed June 26, 1909. Titanium carbide containing between 1 per cent and 6 per cent of free sulphur to diminish spitting and prevent the particles from fusing with glass.

998,705. TELEPHONE-EXCHANGE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Feb. 19, 1910. Automatic clear-out set by hanging up the receiver; cut-off relays in the cord circuits, one being a time relay.

998,749. TREATMENT OF PRECIOUS METALLIFEROUS ORES; J. C. Clancy, New York, N. Y. App. filed March 17, 1910. The ore is subjected to a thiocyanate solution containing a soluble cyanide and a soluble iodine compound and electrolyzer.

998,766. ELECTRIC CONDUCTOR SUPPORT; W. E. Foote, [illegible] Mass. App. filed May 11, 1911. A turn-out for an overhead [illegible] wire. The switch member is removable.

998,786. ELECTRIC SWITCH; C. Loeffler, Utica, N. Y. App. [illegible] March 1, 1907. All connections are behind the front pa[illegible] operated by a lever with toggle connections to rods passing [illegible] the panel.

998,810. COMBINED TAPLET OR CROSSOVER AND [illegible]CEPTACLE; J. S. Stewart, New York, N. Y. App. filed M[illegible] 1910. Special-shaped porcelain with grooves to be used wit[illegible] ings.

998,827. FLEXIBLE CONDUIT; U. S. Armstrong, New Ken[illegible] Pa. App. filed Aug. 8, 1910. Two interlocked helical met[illegible] with a gasket strip between the layers.

998,849. ELECTRIC LANTERN; T. M. Jenks and A. W. [illegible] Galesburg, Ill. App. filed April 22, 1910. Has a hinged [illegible] automatic switch for lighting the lamp when the bail is rais[illegible]

998,850. AUTOMATIC STEREOSCOPIC RADIOGRAPHY; [illegible] Kelly, Philadelphia, Pa. App. filed April 5, 1911. Process [illegible] paratus. The source of X-rays and the plate are shifted [illegible] time to produce the effect.

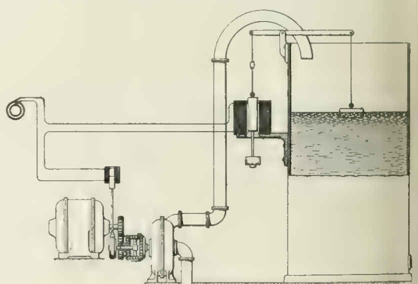
998,865. CAST ELECTRODE; K. Tornberg, Lynn, Mass. A[illegible] Dec. 28, 1910. One or more perforated shells anchoring t[illegible] trode material.

998,868. INDUCTION MOTOR; M. O. Berthold, Indianapol[illegible] App. filed June 5, 1908. Longitudinally extending conduct[illegible] contact with and project beyond short-circuiting rings adja[illegible] the core ends, and conducting rings engage the bar ends.

998,892. SPARK-COIL; A. J. Gifford, J. J. Burns and B. S. T. [illegible] Worcester, Mass. App. filed Nov. 6, 1908. Division from No. 933,246, for gas engines, etc. A spring-pressed plun[illegible] holding unit coils in a receptable. Contact and vibrator det[illegible]

998,895. ELECTRIC LAMP; W. A. Harvey, Scranton, Pa. A[illegible] Sept. 13, 1910. A reflector provides a re-entrant wall spacin[illegible] a number of cells.

998,922. CLAMPING AND SUPPORTING MECHANISM; [illegible] Peck, Wayne, Pa. App. filed Feb. 5, 1910. Two jaws are [illegible] together by a nut for holding a trolley wire.



998,647—Electromagnetic Control System.

998,925. CIRCUIT-CONTROLLING APPARATUS; W. M. [illegible] Philadelphia, Pa. App. filed Nov. 27, 1908. A switch [illegible] operated by a solenoid from a distance.

998,945. STARTING HEATER FOR CARBURETORS; C. W. [illegible] and F. E. Searle, Detroit, Mich. App. filed Nov. 25, 1910. [illegible] heater attachment for supplying the carburetor with hot air.

998,982. METHOD OF PRODUCING HALOGEN-OXYGEN [illegible] POUNDS BY ELECTROLYSIS; M. Pier, Berlin, Germany [illegible] filed April 29, 1911. The evolved chlorine gas escapes and [illegible] sorbed by tetrachloride of carbon and afterward returned to t[illegible] trolyte.

998,987. CARBON CAP; C. Recker, Oakville, Conn. App. file[illegible] 21, 1911. A screw is riveted to a sheet-metal socket.

998,990. CIRCUIT-BREAKER; M. P. Ryder, White Plains, N. [illegible] filed April 9, 1904. For long-continued excess of current. [illegible] circuit-breaker coils and a fuse in shunt relation on the secon[illegible] a transformer.

999,019. COOLING DEVICE FOR TELEPHONE TRANSMIT[illegible] C. E. Eggner and J. G. Holmstrom, Stockholm, Sweden. A[illegible] Nov. 2, 1910. Electrodes in direct contact with a high-re[illegible] cooling liquid, such as alcohol, oil or distilled water.

999,108. MEANS FOR PREVENTING RUST IN BOILERS; [illegible] Hickey. App. filed Dec. 31, 1910. A headed zinc rod is [illegible] in a headed, hollow, threaded bolt and a cap fits over the [illegible] rod. To be used in inaccessible places.

Reissue. 13,277. ELECTROLYTIC CELL; G. O. Seward and [illegible] Kugelgen, East Orange, N. J. and Holcombs, Va. App. fi[illegible] 19, 1911. Original Patent No. 842,256. A plurality of wate[illegible] curtains are insulated from one another to form a non-cor[illegible] partition.

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CONTENTS.

A GOOD EXPORT YEAR.

The figures just available for June, completing the fiscal year of the government, show a very satisfactory condition as to export trade in general and more particularly in regard to electrical exports. In a general way the month itself maintained the advance of the year. The exports of heavy electrical machinery were $825,091, as compared with $586,202, and the exports of electrical instruments and apparatus were $884,839, as compared with $902,503, or a total of $1,709,930, against $1,488,705 in the previous June. The latter average if kept up through the year would mean over $20,000,000, while, as a matter of fact, exports reached $18,727,455. This, however, was a gain of $3,985,060 over 1910. If we could look for an annual increase of $4,000,000 in such exports, which has been had now for two successive years, electrical manufacturers might fairly congratulate themselves.

Looking a little into the details for the year, it is seen that the exports of heavy goods in 1910-11 were $8,024,028, as compared with $6,048,263 in 1909-10, while the exports of instruments, etc., were $10,702,827, as compared with $8,694,132, an increase of nearly $2,000,000 in each class, while, as before, the smaller lines of apparatus are shown to be the more marketable. As to customers, England and France remain among the smallest, with actual declines, while the trade with Germany and Italy is so small as not to appear separately in the returns. Canada looms up splendidly and it will be interesting to see what reciprocity will do in this respect. She took $4,912,189 as against $3,557,954 in the previous year, and it will be noted that the aggregate is 25 per cent of the total electrical exports. Here is certainly a friend and customer to cultivate. But Japan, Mexico and Brazil are also excellent consumers of our electrical wares, taking as follows in 1910-11: Japan, $2,215,173; Mexico, $2,468,888; Brazil, $2,446,041, a total of $7,130,102, or nearly 30 per cent of the trade. Hence it may be said that four countries take about half of our electrical exports. It would seem that some of the others might come in time to the same level if sedulously cultivated, for outside of Europe the conditions of demand and opportunity appear to be pretty much the same everywhere. Of course, when money is secured in any European country for a new trolley or lighting system in Asia or South America or a telephone exchange in Africa it is likely that the apparatus will be bought in the country that is investing, but we can also undertake such financial deals and may be in them again when there is any genuine revival of trade and speculation. Meantime we may regard ourselves as more than holding our own in the markets of the world with a miscellaneous electrical trade over the counter.

THE CALCULATION OF CAPACITIES OF PARALLEL SUSPENDED WIRES.

When a condenser is formed, say, of a square sheet of glass, coated on its faces with tinfoil sheets, and a difference of electric potential, as from storage-battery terminals, is applied to the coatings, the glass is subjected to electric stress exerted through the sheet. Electricity is either actually or virtually driven through the sheet, but only by an elastic yield, assuming perfect insulation in the glass. If we double the impressed potential difference we double the elastic electric transfer. The quantity of electricity which is elastically transferred with unit-impressed potential-difference is a measure of the yieldingness of the glass slab to the stress and is called the capacity of the condenser. The capacity, in the case of a slab condenser, varies directly with the coated surface area and inversely as the thickness. Quantitatively, simple as the capacity of a condenser is, when formed of a dielectric slab, the capacity of a dielectric mass of more complex geometrical form is so difficult to ascertain that only about twenty of the very simplest cases, out of the infinite possible number, have yet been worked out mathematically.

Fortunately, some of the most frequently recurring practical cases of capacities are comprised in those that have been worked out. Among these is the very common case of the capacity of a pair of parallel conducting aerially insulated wires uniform in size and separation. The linear capacity of such a pair or wires, far from the ground and from other wires, has a well-known and relatively simple algebraic expression. When, however, we bring other wires into the vicinity of our first pair, or when we bring the surface of the ground into active consideration, the problem becomes much less simple. The general theory of it was first published by Clerk-Maxwell about fifty years ago, but in a form which did not lend itself readily to computation. Mr. Oliver Heaviside, about thirty-five years ago, brought out a modification of the Maxwell theory which was a little more amenable to arithmetical treatment, and he worked out a few examples.

In the article commencing on page 386 of this number Mr. Frank F. Fowle applies the Maxwell-Heaviside theory to a number of interesting practical cases, and the numerical results which he obtains are of great practical value. In the first place, the article shows that the capacity of a pair of metallic-circuit wires is so slightly affected by the presence of the conducting ground, or the presence of other metallic circuit wires in the neighborhood, that the difference is for ordinary distances practically negligible. This fact, indeed, has long been published. Secondly, a number of new interesting cases are worked out of three and four wires in various generally used groupings. It is shown, for example, that three wires, spaced on the edges of an equilateral prism 5 ft. wide and 25 ft. above ground, will have practically balanced capacities, if operated star three-phase, with the generator neutral disconnected; whereas, if the generator neutral be grounded, the capacity of the uppermost wire becomes less than that of the others and the charging currents of the system become unbalanced, unless the wires are systematically transposed. Another valuable result worked out in the article is the reduction in the effective capacity of a phantom telephone circuit as compared with its resistance and the constants of the two component loops. The article can safely be regarded the best piece of numerical work that has appeared on th subject for a long time.

STREAM FLOW AND FORESTRY.

In another column we present an interesting communic tion from Professor Mead concerning our recent comme on the data in his important *Bulletin* on deforestation ar stream flow. We should ordinarily make very brief fu ther comment, as it is eminently proper for an author reinforce his case in such wise. As the matter is of larg public interest, however, it seems worth while again t call attention to it. Professor Mead's criticism is, i effect, that the fifteen-year periods which we compare would give materially different results were they extende to sixteen or seventeen years, which results he present The discrepancy, such as it is, is wholly due to the fact th the years 1888 and 1889, the sixteenth and seventeent years, were respectively years of extraordinarily high an extraordinarily low water, so that their effect upon the av erage is relatively large. The conclusions as regards lo water remain essentially unchanged whichever period taken; but the thirty-four days of flood in 1888 shift tl totals conspicuously according as they are included in or or the other period. Now, we may first remark that thes very unusual years fall well into the period of extremel heavy forest cutting in Wisconsin. The deeper one goe into this period obviously the less striking the difference between the initial and final stages would be if there wer a marked effect due to deforestation.

Even a more striking comparison is furnished if on examines the earliest part of the record in comparison wit the latest. Professor Mead reckons that the period c heaviest cuttings took place for twenty years or so begir ning with 1880. If one examines the records prior to 188 he finds, in the seven years for which the data are recordec just two days above the 10-ft. stage and none below th 2-ft. stage. Taking now the last seven years of the recor one finds twenty-seven days above the 10-ft. stage an ninety-nine days below the 2-ft. stage. Since Professo Mead has adduced the difference in rainfall as an explana tion of such differences, it should here be noted that durin the last period the annual rainfall was something like 1 per cent below the first period, in spite of which there wer twenty-seven days of flood as against two.

In this connection it is worthy of note that the high water year of 1888 was a year of slightly subnorma rainfall, while the year of heaviest rainfall during th first period, exceeding the record of 1888 by about 1 per cent, produced no days of extreme high water at all We thus have the curious phenomenon at the end of th period of deforestation recorded of repeated floods on de cidedly subnormal rainfall. Further examination does no bear out the comfortable view that difference in rainfal is chargeable with the whole difference in flow. The secon period of seven years of the record, that immediately afte the date stated by Professor Mead as the beginning of th heaviest cutting, happened to be a period of exceptionall high rainfall, 14 per cent greater than in the previous sever

[ye]ars; yet the first period showed no days below the 2-ft. [st]age and but thirty-nine days below the 3-ft. stage, while [th]e second period, of heavy rainfall, gave four days below [2] ft. and incidentally one below 1½ ft. and fifty-four days [be]low 3 ft. It strikes us, therefore, that the appeal to rain[fa]ll is, to say the least, inconclusive. That subnormal rain[fa]ll, other things being equal, tends to low water and ab[no]rmal rainfall to high water admits of no dispute, but in [th]is case other things which have a bearing upon the re[su]lts apparently were not equal.

We refrain, in the absence of longer records than those [be]fore us, from laying much weight on the fact which Pro[fe]ssor Mead has brought out so forcefully, that the latter [pa]rt of the period of deforestation has been pretty consist[en]tly marked by lower rainfall than the earlier period. The [ev]idence to connect actual decrease of local rainfall with [lo]cal deforestation is as yet slender; but cases like that [be]fore us, in which there is a marked difference in the [av]erages taken over fifteen or more years, certainly call for [fu]rther examination. The difference in temperature be[tw]een an area above, say, 1000 square miles of dense for[es]ts with lofty trees and the same area reduced to black[en]ed slashings can hardly be regarded as negligible, and [su]ch temperature differences should, and probably do, pro[du]ce local differences in precipitation. This phase of the [m]atter, however, cannot be settled without even a more [th]orough and protracted examination of local conditions [th]an Professor Mead has given us in his admirable *Bulletin*. [T]o sum up the whole situation, it appears to us after a [p]retty careful examination of the data presented concern[in]g the Wisconsin River that Professor Mead, in an entirely [p]raiseworthy effort to take a cautious and conservative [v]iew of the facts, has considerably undervalued some of [hi]s own important data.

[ELE]CTRIC TRANSIENTS.

An article by Dr. Steinmetz has recently been published [in] the *Journal* of the Franklin Institute on the subject of [tr]ansient phenomena, especially in electric circuits. As the [ar]ticle contains very few and simple equations, it will be [a]ppreciated by many readers. It is a self-demonstrating [bu]t far-reaching fact that energy cannot be made to flow [al]ong an assigned possible path until it has occupied a [re]gion greater than that whence the energy immediately [pr]oceeds. If we are to obtain heat-energy from a hot-[w]ater tank there must evidently be some storage or sur[pl]usage of energy in the tank before we can draw it off. [A]gain, if we want to obtain mechanical energy from a fall [o]f water in a reservoir, or from the movement of a pis[to]n in a pressure-cylinder, there must be a similar stor[ag]e or surplusage of energy in the reservoir or tank be[fo]re it can be drawn off. By suitable design the excess of [st]ored energy over and above the delivered energy may [so]metimes be reduced to narrow limits, but, in general, [th]e storage of energy is an unavoidable concomitant of [th]e transmission of energy. When a sudden change occurs [in] the transmission system changes may be looked for not [on]ly in the delivery stream, or transmission, but also in [th]e storage. The phenomena accompanying the change in the storage may happen to be more important from some viewpoints than those accompanying the change in the transmission.

The article points out that in certain energy systems the change in energy storage occurs in one form only, while in other systems it occurs in more than one form. For instance, if a locomotive is in steady operation hauling a number of cars at a steady rate on a level track, then there will be a storage of mechanical energy in the momentum of the moving system. The only appreciable forces on the drawbars of the cars are those due to the frictions of the wheels, rails and air. If now the engine suddenly accelerates, there will be storage of energy in both engine and cars, whereby the drawbar-pulls become for the moment vastly increased. The transient phenomenon of energy-storage into the train overshadows the steady delivery of energy out of the train, but the storage is in this case of only one type, that is, momentum storage or inertia storage.

As illustrating a different phase of the subject, consider the case of a large mass, like a bass drum, fastened to the end of a long vertical spiral spring and the system placed in motion by being suspended from an elevator car. It is clear that during steady ascent the spring will be extended only by the weight of the drum and by the steady windage-pressure on it of the displaced air. Energy will stream out of the system slowly in windage friction. But energy will be stored in the system in two different ways—first, in the momentum of the drum, and, second, in the elastic extension of the spring. If the rising car suddenly accelerates, there will be a change of energy storage of each kind, and this double change of storage is likely to be accompanied by oscillations of the spring-drum system. The noteworthy feature is that when energy storage in a system is of the single type change in storage occurs steadily, but when it is of the multiple type the change is apt to occur with oscillations.

In the case of a high-tension transmission system before energy can be transmitted from the generator to the motor a certain amount must be stored in the dielectric medium environing the line. The storage occurs in two different ways, namely, electrostatically in electric flux after the manner of a Leyden jar, and magnetically in magnetic flux after the manner of a reactance coil. When the stream of energy flowing over the line is suddenly disturbed, especially in so violent a manner as occurs in a short-circuit, the energy storage of each kind suffers accompanying disturbance, and the process is effected with surges or oscillations. The article discusses these oscillations, and points out that when an oscillation-wave runs from a conductor of lower to a conductor of higher surge impedance it sets up reflections at the junction, so that, although there is no discontinuity of potential at the junction, there is a discontinuity of current and the ongoing current develops a higher voltage as it travels along the second conductor than it was able to develop along the first. Thus a surge running off a line-wire into a transformer may build up a very high voltage at a certain distance beyond the entrance, whence may come breakdown, grief and expense.

Turin International Electrical Congress.

The sessions of the Turin International Electrical Congress will be opened on Thursday, Sept. 7, by an address of welcome from the Italian Minister of Posts and Telegraphs, which will be followed by an address by Prof. Elihu Thomson, president of the International Electrotechnical Commission. It is expected that there will be between sixty and seventy delegates present at the meeting of the International Electrotechnical Commission. There are about twenty countries represented in the commission, Holland, Switzerland, Chili and Uruguay being the latest adherents. It is expected that very shortly Peru, Greece, Portugal and Roumania will be added.

Wire Pool Cases.

On Aug. 4 Mr. Edwin E. Jackson, supervisor of the various wire pools against which federal indictments were found, entered the plea of *nolo contendere* and was fined $45,000 by Judge Archbold, or $5,000 on each of nine indictments. United States District Attorney Wise asked for a prison sentence and vehemently denounced the methods and purposes of the accused, among other statements asserting that the records show that his profits from the wire pools amounted to $211,000 in 1908 and $197,000 in 1909, there being no record available for other years. In reply Judge Archbold said it was not possible at the time to get documentary proof of the assertions of the prosecutor, but that it appeared sufficiently demonstrated that but for Mr. Jackson the illegal agreements could not have been carried out. Inasmuch, however, as others under indictment had been fined, he would eliminate a prison sentence and impose a fine of $5,000 for each indictment, making a total of $45,000. The total of fines thus far imposed in the cases of the thirteen pools is $136,700, with ten members yet to appear before the court.

Upon motion of District Attorney Wise the indictment against Mr. Erskine Hewitt was quashed, the prosecutor informing the court that he was satisfied the indictment was in error. All others, except Mr. Jackson, were fined as in previous cases—$1,000 for the first indictment and $100 in addition for each other indictment. Counsel for several defendants who pleaded *nolo contendere* asked to have the amounts of their clients' fine lessened because they did not wilfully violate the Sherman anti-trust act and because the fine of $1,000 would mean more to them than to others. Judge Archbold said he realized this and was also aware of the great humiliation that was brought on a man when charged with a criminal act that he did not intend to commit, but at the same time he did not see how he could make an exception. In another instance the judge remarked that a good many who have unintentionally violated the law and who have pleaded *nolo contendere* may have received sentences harsher than was fair, but that it was difficult to discriminate.

Organization of Chicago Elevated Railways Merger.

Mr. Britton I. Budd has been appointed president and Mr. E. C. Noe general superintendent of the new Chicago Elevated Railways Company, the merger of the four elevated lines and the Union loop operating in Chicago. Mr. Samuel Insull, chairman of the executive committee, is said to be the dominating figure in the operation of the properties, since it is understood that the Commonwealth Edison Company has virtually guaranteed the securities of the new merger company.

The new Elevated Railways company operates an aggregate of 173 miles of track on elevated structures within the city limits, and represents a capitalization of nearly $100,000,000, this sum being exclusive of franchise value

Under the new plan of consolidated operation Stone Webster, consulting engineers, have declared in a repor that the Chicago elevated roads can be operated at a sav ing of $700,000 a year through the rearrangement of route etc., while the saving in the cost of energy will approximat $350,000 a year.

The board of directors under whose supervision th Chicago Elevated Railways will be operated comprise Messrs. Henry A. Blair, chairman; Samuel Insull and Ir M. Cobe. Mr. Budd, the president of the new compan has been president of the Metropolitan West Side Elevate Company for several years, and Mr. Noe, the new chie operating official, has been general superintendent for th Northwestern Elevated Railroad Company.

Over One Million United States Patents.

The serial number of United States patents passed th 1,000,000 mark in the budget issued on Tuesday, Aug. 8 The present serial numbers, however, date only from Jul 28, 1836, prior to which 9957 patents had been issued Consequently the actual million mark was reached severa months ago, namely, in the budget of patents granted unde date of April 18, 1911. Patent No. 1,000,000 was grante to Mr. Francis H. Holton, of Akron, Ohio, on an automo bile tire, while the real millionth patent was granted t Mr. C. T. Hanson, of Lancaster, England, on a machin for making tubes from fibrous materials. According to a newspaper dispatch, Mr. Holton wrote to President Taf asking that the number 1,000,000 be assigned to his pat ent and the Commissioner of Patents was asked to com ply with the request.

The first patent was issued in 1790, but it was not unti 1854 that the annual issues definitely passed beyond 1000 the 5000 mark being reached ten years later, in 1864. In 1866 the issues jumped from 6616 to 9450, and the follow ing year to 13,015, after which the annual output remaine nearly stationary until 1880, the number of patents issued during that year being 13,947. There were considerable increases in the three following years, the number of issues for 1881-83 being respectively 16,584, 19,267 and 22,383. From 1883 to 1898 there was another stationary period, followed by a considerable jump in 1899—from 22,267 to 25,527—after which there was an irregular growth to 31,965 in 1906, followed by another jump in 1907. The issues for the past four years are as follows: 1907, 36,620; 1908, 33,682; 1909, 37,422; 1910, 35,930.

The receipts of the Patent Office per patent issued have varied little during the past half-century, the figures being as follows for the years given: 1860, $53; 1870, $50; 1880, $54; 1890, $51; 1900, $51; 1910, $56. Practically all of the present Patent Office surplus of about $7,000,000 represents clear profit derived from inventors during this half-century period, the average profit being thus nearly $7 per patent issued. The proportion of applications to patents issued has been, for decades of the fifty-year period to date, as follows, in percentages: 66, 61, 66, 57, 57.

Electrodes for Electric Furnaces.

Two patents were issued to Mr. Carl Hering on Aug. 1 relating to electric furnaces. Of these one covers electric furnace electrodes so designed as to afford the greatest economy in material and least loss in electrical energy. The invention is based on deductions from the laws of electrode losses discovered by the inventor some years ago and described by him at that time in various papers and articles. Briefly, the fundamental principle is as follows: An electrode should be a good electrical conductor to reduce loss of energy due to electrical resistance; on the other hand, good electrical conductors are as a rule also good

heat conductors, thus tending to conduct heat freely away from the inside of the furnace where the heat is wanted. Increasing the cross-section reduces the former loss but increases the latter, while increasing the length does the reverse; the problem therefore is to find the conditions under which the total combined losses are least. This the inventor found is the case when the length and section are made such that the current heats the electrode to such an extent as to raise the inner or hot end to the furnace temperature. Under these conditions no heat will be abstracted by the electrodes from the charge in the furnace, and the entire loss of energy will thus be only the heat generated in the electrode; this, moreover, is the condition under which the total loss of energy will be the least possible, for under any other conditions the total combined losses will be greater and the electrodes will either chill the furnace product or will develop excessive heat where they pass through the walls.

These same laws also lead to economy of the materials of the electrodes, thus reducing their cost. Determinations of physical constants in the application of these laws showed the surprising fact that copper is the best material for electrodes, iron is nearly as good, and that carbon, which was the most generally used electrode material, is the worst, graphite being decidedly better than carbon. In general, the results showed that metal electrodes are cheaper and more economical in energy and should therefore be preferred whenever it is possible to use them.

The other patent of the same date on electric furnaces is for furnaces whose electrodes are designed and proportioned in this way; that is, for combinations of such electrodes with furnaces, more especially with furnaces in which the electrodes are not consumed, as in the one recently devised by the same inventor. When such electrodes are virtually prolongations of the resistors and are of the same material they automatically adjust their length so that the proportions will remain practically correct for different temperatures and currents.

Telephone Rates at Los Angeles.

For the third consecutive year, in two of which a Board of Public Utilities has existed, an attempt to readjust telephone rates at Los Angeles, Cal., has failed. The origin of the present situation dates back a year, when, to assist in fixing a rule equitable to both the company and the consumer, the Board of Public Utilities engaged Mr. W. F. Sloan, a telephone expert of the Wisconsin State Railway Commission, to make an appraisal of the local plants. Based on Mr. Sloan's report of May 26, 1910, the board revised the schedule of rates, reducing or raising the rates for the various classes of service as the information presented seemed to warrant. The Sunset (Pacific Telephone & Telegraph Company, Bell system) and Home (Independent, automatic) telephones were given the same rates.

The City Council, closely following, passed an ordinance embodying new rates, disregarding the suggestions of the board and materially reducing, in almost every item, the charges recommended. The Home Company accepted the new schedule, but the Sunset Company immediately brought suit in July in the United States Circuit Court and was granted a temporary injunction against the enforcement of the proposed rates, thus maintaining its monthly charge for residence telephone at $3, as against the $2 rate of the City Council, the difference being placed in escrow. In its hearing the Sunset Company agreed to accept the appraisement of Mr. Sloan, $4,492,128, although lower than its own, thus sustaining the Board of Public Utilities.

In an effort to dispute the figures of Mr. Sloan and establish a basis for its rates in court, the City Council engaged Mr. Kempster B. Miller, of Chicago, to make another appraisement of this property. The inventory, made entirely independent of the former one, resulted in a valuation of $4,512,092, or about $20,000 more than that of his predecessor. With two distinct appraisements almost identical it seems certain that the city will drop its suit, or that a permanent injunction will be granted the Sunset Company, allowing it to receive about $50,000 of impounded funds.

The Board of Public Utilities began its investigations of rates for the present year at the time that Mr. Miller completed his appraisal for the City Council. Because of his thorough knowledge of the telephone business and his familiarity with the local situation he was engaged by the board to compile data upon which it could base its new rates.

His report, tendered in June, concedes a valuation of the plant of the Sunset Company within the city limits of $5,301,980 in January, 1911, including Hollywood, which was not considered in his appraisal for the City Council, and excluding San Pedro, both recently annexed portions of the city. The earnings of the company for 1910 are placed at $1,111,112 and expenses at $961,998, giving an estimated profit under its $3 rate of $149,114.

Time was not sufficient for Mr. Miller to make an inventory of the Home Company, and the statement of that

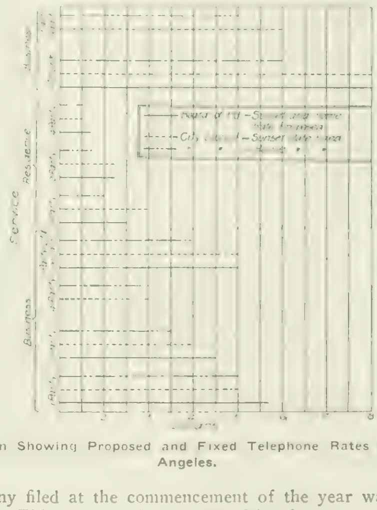


Diagram Showing Proposed and Fixed Telephone Rates at Los Angeles.

company filed at the commencement of the year was employed. This states an investment of $5,764,545.59, neglecting franchise. Earnings are given at $1,022,808.01 and operating expenses at $814,935.72, including a sum of $290,395.72 for depreciation; other expenses are placed at $285,555.97.

Upon these figures and recommendations of Mr. Miller the board established rates for the ensuing year practically identical with those suggested the year previous. These are shown for the important classes of service in the accompanying diagram. Both companies were placed upon an equal footing as to charges, the revenue of the Sunset being increased about $7,400 and that of the Home $21,000 monthly, upon which the rates allowed return of 5.5 per cent and 7.07 per cent respectively. In January, 1911, the total number of telephones within the city limits was 41,056 for the Sunset and 39,423 for the Home.

Many protests from citizens and business interests were filed against the proposed rates with the City Council. Accordingly, that body investigated the issue, appointing a committee of three from its membership to fix the rates from the data available.

The Board of Public Utilities, which has since resigned, defended its position by citing references to sixty different

cities, in ten of which the number of telephones approximates the number in local use. The closest parallel is stated to be Cleveland, with a business rate of $7 and residence charge of $4, comparing with $5.75 and $2.50 recommended by the board for Los Angeles.

On July 25 the City Council authorized, from the findings of its committee, an ordinance drafted establishing rates identical with the present ones, notwithstanding its legal defeat by the Sunset Company. The suggestions of the board and its engineers were disregarded. The ordinance was passed by the body on July 28 and signed by the Mayor, becoming effective Aug. 27. The rates fixed by the Council are shown in the accompanying diagram.

These charges, which again become effective, were established by the companies themselves, the Sunset rate by ordinance No. 17,972 (new series) adopted March 19, 1909, the Home rate by ordinance No. 20,331 (new series) of May 31, 1910.

This leaves the situation the same as before the Board of Public Utilities was created, the expenses which have resulted through investigations and appraisements and the employment of the best engineering talent costing the city many thousands of dollars to no ultimate purpose. It is expected that the Home Company will follow the line of the Sunset in an appeal to the courts asking for an injunction against the fixed rates.

Agitation is in force for an interchange of service between the systems, eliminating the expense of two telephones. Owing to this interesting phase of the problem, and being upon the ground, Mr. Miller offered to investigate this subject for the City Council at a reasonable consideration of $1,000, but the proposal was refused. The Mayor has instructed the new Board of Public Utilities to give its attention to intercommunication possibilities.

Toledo Rate Situation.

The fight being waged by the city of Toledo, Ohio, against the lighting department of the Toledo Railways & Light Company is of about the same nature as that against the street-railway lines. In both cases the city has laid down rates and conditions and is now engaged in an endeavor to force the company to accede to them. Mayor Brand Whitlock, a friend of the late Mayor Tom L. Johnson, of Cleveland, is leading the city's forces, while he has an ambitious lieutenant in City Solicitor Cornell Schreiber. The conditions, so far as the administration is concerned, are similar to those in Cleveland a few years ago, with the exception that force is being applied in a somewhat different manner to coerce the company.

Judge Manton, of the Common Pleas Court, was asked to grant an order restraining the company from demanding or receiving pay for energy for lighting purposes in excess of the rate of 8 cents per kw-hour, with a discount of 1 cent if payment is made within ten days, as fixed by an ordinance recently passed by the Council, but the court took time to think the matter over and then announced that the action would not be taken unless the city furnished a bond sufficient to cover the difference in case the order should be dissolved on final hearing of the case.

Through Attorney Barton Smith the company objected to the restraining order at the hearing last Thursday on the ground that the company could realize little from a bond given by the city, because it would be required to show that it had used every reasonable effort to collect from the consumers before it could look to the bond. The court, however, said the company would not be put to this test, but if the decision should be in its favor there would be no necessity of showing that it had tried to collect more than the ordinance rate before it could demand relief from the bond. Mr. Smith insisted that the Council did not have authority to fix the rate, but the court held that the State laws giv[e] that power. Regarding this point the court said:

"You are doing business under the laws of the State [of] Ohio. The State says that if you want to do business [h]e[re] you must submit to certain regulations. The State has gi[ven] the Council the right to fix your rates. If the Cou[ncil] establishes a rate it is your duty to comply with the regu[la]tion, and then if there is anything confiscatory about it [you] have your remedy in coming into court. Council after p[ub]lic hearings established a rate and we must assume that [the] rate is reasonable, and it is incumbent upon you, upon fi[nal] hearing, to show wherein it is unreasonable or confiscat[ory]. Meanwhile you must comply with the ordinance."

Attorney Smith said that if the order is enforced it [will] be necessary for the company to cut off hundreds of c[on]sumers who would get the benefit of the 50-cent mont[hly] minimum provision. The court stated that this questio[n is] not up and that under any order the court issues now all [the] customers could be shut off without violating the or[der]. City Solicitor Schreiber stated that if any are cut off [the] matter will be taken into court at once.

Mr. Smith declared that the law which allows city co[un]cils to fix the rates is unconstitutional, but said the St[ate] Supreme Court had decided one way and the United Sta[tes] Supreme Court another, and that it will be necessary to [go] to the latter to have the State court set right.

Since the above was written Judge Manton granted [an] order restraining the Toledo Railways & Light Comp[any] from demanding or receiving from consumers more th[an] 8 cents per kw-hour and a discount of 1 cent per kw-ho[ur] with a minimum charge of 50 cents per month, for light[ing] purposes. The court in its decision said that the fa[cts] pleaded in defense do not, under the laws of the St[ate] show any invasion of the defendant's constitutional rig[hts] and the spoliation complained of is not sustained by [the] facts admitted at the hearing.

"It is admitted that only 8 per cent of the current p[ro]duced and sold by the defendant is affected by this or[di]nance and that 92 per cent is sold for less than the pr[ice] fixed in the ordinance. It would appear from these figu[res] which are given by defendant's counsel, that defend[ant] would have no difficulty in adjusting the situation to m[eet] the ordinance rate and prevent loss to itself.

"Taking the difference between the original rate and [the] rate provided for in the ordinance in question as 1 ce[nt] the amount which the company will have to take care [of] and adjust would be $490 per month, or $5,880 per annu[m]. This does not look to me like an act of spoliation, cons[id]ering that a large amount of the output of the defend[ant] company is sold as low as 3½ cents per kw-hour.

"The power of the Council to afford protection to [the] small consumers is undoubted, and the hardship impo[sed] on this corporation to readjust its contracts to avoid [lo]ss does not appear to me to be a very heavy one."

Central-Station Taxation in Ohio.

The Ohio State Tax Commission is now giving attent[ion] to central-station plants. The most interesting case con[sid]ered so far is that of the Cleveland Electric Illuminat[ing] Company, the tentative value of whose property had b[een] fixed at $12,000,000. The valuation a year ago was [fixed] at $3,790,895, the increase being approximately 330 per c[ent]. Vice-president Samuel Scovil was notified to be pres[ent] at a hearing on this valuation late last week, but instead [th]e company sent a brief prepared by Attorney T. H. Hog[sett] in which it was stated that the valuation named by the co[m]mission is entirely too high. The brief mentions that Cle[ve]land has more electric light and power companies [an]d private plants than any other city in the United States [i]n proportion to its population. Most of the large buildi[ngs]

t is stated, have their own plants and not only supply their own tenants, but those of neighboring buildings. This materially reduces the earnings of public-utility companies.

The commission has an interesting case in the Price-Hill Electric Company, of Cincinnati, the value of whose property has been advanced from $36,000 to $125,000. The company operates a plant to haul vehicles up a steep hill and contends that it is not a public-utility corporation, but merely a corporation, and that as such it should not be taxed by the commission but by the local board of review.

The smallest increase accorded to any public-utility corporation up to this time is 100 per cent, the Dresden Electric Company being the fortunate one. Its valuation was boosted from $2,500 to $5,000. The others have varied between 300 per cent and 700 per cent, and some have gone higher. Among the companies whose values have been increased tentatively are the following:

	Former	New
[illegible] Electric Illuminating Company	$[illegible]	$12,000,000
[illegible] Electric Company	36,000	125,000
[illegible] Electric Company	2,500	5,000
[illegible] Lighting Company	8,960	30,000
Electric Light Company of Ottawa	6,010	15,000
[illegible] Light Company, Fayette		700
Greenville Electric & Power Company	[illegible]	75,000
Jamestown Electric Light Company	5,000	12,000
[illegible] Light Company	[illegible]	8,200
Medina Electric Light & Power Company	2,710	18,000
W. Guinser Electric Light Company	1,500	5,000
Lancaster Electric Light Company	12,000	90,000
Springfield Light, Heat & Power Company	207,000	790,000
[illegible] Light & Power Company	26,350	50,000
[illegible] Light Company	28,825	80,000
[illegible] Light & Power Company		10,000
[illegible] Electric Company	8,777	87,000
[illegible] Water & Light Company	[illegible]	100,000
[illegible] Electric Light Company	3,000	10,000
[illegible] Gas Company	6,620	12,000
Defiance Gas & Electric Company	30,800	130,000

The Establishment of Electric Rates.

Before the City Club of Los Angeles, Cal., at its meeting on July 29, Dr. George L. Hoxie, of New York, a member of the board of three consulting experts recently engaged to assist the Board of Public Utilities of that city in establishing electric rates for the ensuing year, made an interesting address on rate fixing, incidentally dealing with the present situation in Los Angeles.

Dr. Hoxie said that rate fixing consists in making such rates as shall not confiscate the property of the corporations and also in giving the people rates which shall not be discriminatory as between consumers and which shall not yield the corporations too much money. When real money is honestly expended to produce a valuable public utility and the best engineering skill has been employed the people have no right to confiscate that property. Nor is the actual value of the property entirely on the physical showing. Necessarily there are some mistakes made in constructing a plant, some machinery purchased that is soon superseded by better machinery and some engineering inaccuracies which time alone can bring to light and remedy. This, Dr. Hoxie said, has been particularly true in southern California, where engineers and capitalists have been the pioneers in certain lines of electrical construction and where the men who put in money took risks no Eastern capitalist would have taken. Progress since then has been very rapid. The daring of these men meant a great deal to electrical engineering and to the companies, but they have been costly. These costs cannot be entirely covered by the physical valuation given a plant nor by the natural depreciation charge allowed.

In speaking of the present conditions at Los Angeles, Dr. Hoxie said that they were unfortunate, and the action of the City Council in fixing light and power schedules, eliminating the recommendations of the Board of Public Utilities, was unwise. Instead of accomplishing beneficial reductions the body succeeded in confusing the rate-fixing regulations. Referring to the work of the board, he said that in the inventory of the properties values were figured on what it would cost to reproduce the properties new and then applying what is known as the "straight-line depreciation" basis. This system allows depreciation on the basis of the number of years it would take for a plant to become entirely worn out. If a plant would last fifteen years and is one year old a depreciation of one-fifteenth for that year is allowed.

There are, he said, three kinds of consumers—for residence lighting, for commercial lighting and for commercial power. It is as unfair to compare the rates for the first class with that of the third as it would be to go to a jeweler's and compare his diamonds with a lump of anthracite coal and expect each to be sold at the same price because they are both carbon. The "connection charge" basis is, he said, the only correct and scientific one. Within ten years all the cities of the country will be adopting it and Los Angeles, instead of being in the forefront in the matter, will be bringing up the tail of the procession.

Dr. Hoxie made reference to the city's hydroelectric system which is to develop from the aqueduct and gave warning that the forces which have upset rate making may lead to the municipal system being a "football for politicians."

Ohio Commission News.

Attorney-General Timothy S. Hogan, of Ohio, has rendered an opinion to the Public Service Commission to the effect that no assessments can be made upon the corporations coming under its jurisdiction for the purpose of paying expenses until June 30, 1912, and no collections can be made until after that time. Members of the Legislature who had the public utilities bill in hand did not look into this matter closely and allowed some of its provisions to conflict with other laws, requiring reports from railroads and other corporations for the year ending June 30 to be made in September. The new law provides for an assessment in August to supply the needs of the commission.

The Legislature appropriated $75,000 as an advance to the commission until the fees should begin to come in, but it is probable that the commission will have to be satisfied with this amount of money for the coming year, unless it can use the $45,000 which has been paid to the State Railroad Commission in the past.

Wisconsin Commission News.

The commission has approved the simplified schedule of rates submitted by the recently organized Ozankee-Washington Telephone Company. The new company is a combination of three independent companies with widely diversified rate schedules. The rates ordered effective are as follows: Party line, $12 per year for residence and $15 per year for business telephones; single line, $18 per year.

In the matter of the Pewaukee-Sussex Telephone Company's petition for authority to increase rates the commission has authorized a portion of the increase asked for. The petition called for an increase in rates for business telephones from $15 net yer year, the present rate for all telephones, to $25 net yer year. A rate for business telephones of $18 net per year was granted by the commission. In reviewing the case the commission called attention to the fact that the rate for business telephones should properly

be higher than for residence telephones. The investigation showed that the company at present is earning more than 12 per cent on its investment, and normally the difference in the two rates should be obtained by decreasing the residence rate. However, a comparison of the rates and operating expenses of the petitioner with similar items in other exchanges of the same size and under the same conditions revealed the fact that the rates of $15 for residence and $18 for business telephones were equal to or below the average for the other exchanges. Furthermore, the operating expenses were shown to be considerably below the average of the other exchanges in the State. Consequently the commission felt justified in increasing the business rate notwithstanding the already high rate of return enjoyed by the petitioner, for the reason, as above stated, that this condition of affairs is not due to excessive rates, but to a very low operating expense.

The Wisconsin Telephone Company was unsuccessful in its appeal to the commission to be relieved from the necessity of removing or placing underground its wires and cables along certain paved streets in the city of La Crosse as ordered by the Common Council. The chief arguments advanced by the plaintiff concerned the impossibility of using underground cables for toll service and the expense incident to the removal of the wires with the possible necessity of acquiring a private right-of-way. In reviewing the case the commission recognized the city's right to require the removal of all poles along its thoroughfares when public policy and expediency demanded such removal. The reasons given by the city were deemed sufficient and satisfactory. Furthermore, an investigation showed that the effects resulting from a compliance with the ordinance would not be as serious as the commission was led to believe.

The new law passed by the last Legislature broadening the powers of the commission by giving it authority over all the water-powers of the State is meeting with considerable opposition on the part of the water-power owners of the State. Meetings are being held to devise ways and means of preventing the enforcement of the law.

Massachusetts Commission News.

The Worcester Suburban Electric Company has petitioned for authority to issue new capital stock to the amount of $125,000 to pay floating indebtedness and to make additions and improvements in its plant.

The Gloucester Electric Company has petitioned the commission for permission to issue $75,000 additional capital stock, to consist of 750 shares of $100 each, for the purpose of placing its wires underground in the principal streets of the city and to pay for the construction of light service in the town of Essex, which includes about 12 miles of public street lighting and 6 miles of streets on the commercial-lighting service. A hearing was held Aug. 1 on this petition.

The company proposes to lay 5990 ft. of underground conduit in all, which will require the laying of about 65,000 ft. of single duct and the building of about sixty-five manholes and 250 service connections.

Work was begun in May of this year, and up to June 1 32,151 ft. of single duct was laid, covering 2731 linear ft. of street, with twenty-four manholes, and costing about $9,600. The estimated cost of the whole work is as follows:

For conduits laid	$18,800
For cables	16,400
For services	2,750
For [illegible]	3,960
For manholes	4,400
For [illegible]	1,500
For automatic regulators	1,500
	$49,340

Treasurer Charles F. Pritchard presented the case at the hearing. It is proposed to rearrange the present coal storage in the station, installing an industrial-railway sy tem with three tracks. The bin will have a capacity 30 tons to 40 tons of coal—two to three days' supply. Ne machinery will be installed at an estimated cost as follow

Two 254-hp boilers, set	$7,500
Stokers for same	2,500
Conveyor, bin, weighing machine, erected	4,000
Piping	3,000
Building addition, 20 ft. x 42 ft. 9 in.	2,580
Raising roof of present boiler-room	1,000
Retaining wall and modification of present coal storage	2,197
Industrial railway with car	750
Addition to coal trestle	650
	$24,177
10 per cent for engineering, incidentals, etc.	2,417
Total	$26,594

The present boiler-room is 5 ft. 6 in. x 42 ft. 9 in. a 24 ft. 5 in. to 23 ft. 5 in. in height. In this are four 125-l horizontal-tube boilers, three on the westerly side of t chimney and one on the easterly side. It is proposed build an addition 25 ft. in length and to raise the ro from 4 ft. to 6 ft. to allow plenty of head room over t new boilers. It is proposed to remove the boiler on t easterly side of the chimney and to install two Babcock Wilcox vertical boilers of 254 hp each. They will twelve tubes high and twelve wide, with wrought-ir headers and designed for 200 lb. working pressure. It proposed to fit these boilers with Murphy stokers wi hoppers which will be filled by means of a small weighi machine operated by hand and moving on overhead rai This machine will be fed from an overhead bunker plac in front of the chimney and underneath the present ve tilator, which is 7 ft. higher than the roof.

The construction in the town of Essex cost for the wo done to June 30, 1911, as follows:

682 poles and paint		$2,888.
Total labor		3,954.
25 miles wire, street lights	$2,125.00	
17½ miles wire, consumers' lights	2,195.52	
		4,320.
Cross-arms, pins and insulators		682.
Street lamp fixtures		378
Lamps		101.
Surveying, plans, etc.		283
Incidental, teaming, etc.		468
Meters		781
Transformers		809.
Total		$14,668

There are installed 113 street lights and about sevent five commercial consumers are connected, with approx mately 1000 lamps.

The present capital stock of the company is $175,000. paid a dividend in the last fiscal year of 7 per cent.

The construction work of the underground conduits in charge of Mr. I. I. Edgerly, of Tuttle & Edgerl Swampscott, Mass., on a 10 per cent allowance above cos The company buys its own materials. The work is su pended until Sept. 1 owing to the large number of summ residents in and about the city. The conduit to be laid the main street will be placed under the sidewalk for large part of the way, being placed about 1 ft. under t paving of the sidewalks.

New York Commission News.

The New York Edison Company has filed with the Publ Service Commission a petition asking for a rehearing i the case of the Long Acre Electric Light & Power Con pany, in which a majority of the commission recently d cided that the Long Acre company should be allowed issue $2,000,000 in stock and $4,000,000 in bonds und certain conditions. The petition will be presented to t commission at its next meeting.

In the petition several reasons are advanced as groun for the request for a rehearing. It is stated that a m jority opinion of the commission finds "that no eviden was offered subsequent to Dec. 1, 1910, before the commi

sion which changed the state of facts from that which existed at the time of the appeal to the Appellate Division." The Edison company asserts that a great deal of testimony which materially changed the state of facts was offered subsequent to Dec. 1, 1910. The Edison company contends that the majority opinion omitted to consider such facts, and that unless they are considered and given full force and effect the Edison company will be seriously injured and that the failure to consider them is sufficient warrant for asking a rehearing.

The petition asserts that the order giving the Long Acre company the right to issue stock and bonds contains no findings of fact or conclusions of law and, therefore, the Edison company "deems it necessary and advisable that specific findings be made by the commission so that they may be reviewed in connection with the evidence by the Appellate Division of the Supreme Court." It is declared that the majority opinion is erroneous because it does not consider the facts placed before the commission and is also contrary to law and the order of the commission contrary to facts and law.

It is alleged by the petitioner that there is no public necessity for a competing company in Manhattan and the Bronx; that the Edison company recently reduced the price of electricity to consumers; that no complaints have been made to the commission that its charges have been unreasonable and unjust; that it is subject to vigorous regulation, has made a large investment in the County of New York which should be protected, and "unless the order of the commission is reconsidered its loss caused by duplication of investment will be large and it will suffer serious loss because of its investment in the Consolidated Telegraph & Electrical Subway Company, which company would be compelled to expend a large sum of money for the accommodation of the Long Acre Electric Light & Power Company without any prospect that the investment would be productive for any length of time whatever."

The New York Public Service Commission, Second District, has received applications from the Mohawk Hydroelectric Company and the Fort Plain Gas & Electric Company for consent to a contract leasing the portion of the Fort Plain company's distribution system situated in the village of Nelliston to the Mohawk Hydroelectric Company. The Fort Plain company is now receiving energy from the Fulton County Gas & Electric Company and proposes to change its source of supply to the Mohawk Hydroelectric Company. Under the new contract with the Mohawk Hydroelectric Company it is stated that the Fort Plain company will be in position to render better service and to increase its opportunities for enlarging its business and prevent future interruptions to its service such as have occurred in the past. The Mohawk Hydroelectric Company has also asked for permission to begin construction and operate a transmission system for the supplying of electricity in the towns of Ephratah and Palatine and the village of Nelliston under franchises granted by these municipalities. The Mohawk Hydroelectric Company has also asked for authority to issue its 6 per cent thirty-year gold bonds to the amount of $56,000 for construction of a substation and a transmission line from its generating station in the village of Ephratah to the villages of Nelliston and Ft. Plain.

CURRENT NEWS AND NOTES.

Electrification of Berlin Interurban Railroad.—Plans are being made for the electrification of the Stadt and Ringbahn in Berlin. This railroad encircles the city and carries a great part of the traffic from the suburbs.

* * *

Electricity for Farmers.—Hon. Adam Beck, of the Ontario Hydroelectric Commission, has announced that the commission will make the distribution of electrical energy one of the chief features of its work. During a recent trip to Europe he found that in practically all countries electricity is extensively used on farms of from 25 acres to 1000 acres. On a government model farm in Bavaria from 25 acres to 30 acres are plowed in one day by a single electric plow.

* * *

Electric Power for Fire Department Service.—In an interview upon his return from a trip to Europe Hon. Adam Beck, of the Ontario Hydroelectric Commission, said that the city of Berlin fire department has adopted electric power. Four stations already have electric equipments, and several gasoline fire "engines" will be replaced by electrics. The electric costs only about half of horse service, and it is but twelve seconds from the time an alarm is sounded until the electric equipment is out of the station. Many German municipalities, he said, have electrically propelled street-watering wagons.

* * *

Edison Feted in London.—Mr. Thomas A. Edison has received a reception in London which recalls the honors showered on him during his visit to Paris in 1889. Upon a visit to the House of Commons the Speaker gave orders that he be escorted to the distinguished visitors' gallery. Upon the close of the session the Speaker and members tendered Mr. Edison an ovation and as a souvenir of the occasion he was presented with a copy of a Parliament bill autographed by Premier Asquith, Lloyd-George and other leaders in the Commons. He expressed the opinion that it is high time that the British hereditary system be abolished and declined to visit the House of Lords.

* * *

High-Power Navy Wireless Station.—The new wireless station now being installed at the Charlestown Navy Yard, Boston, Mass., will be among the most powerful in the world, having a maximum range under favorable conditions of about 3200 miles. The new building to house the station will be erected of stone, and there will be two aerial poles, each 170 ft. high. The old equipment, mostly Stone wireless apparatus, will be supplanted by modern Telefunken sending apparatus, with a Pickard receiver. There will be a 5-kw Telefunken high-frequency, quench-gap machine, the old sending equipment being a 2-kw Stone low-tone spark machine. Chief Electrician J. E. Simpson and Operators W. J. Stedman, F. C. Johnson, J. Lucas and J. J. Harrigan will be in charge.

* * *

Texas Hydroelectric Project.—The Medina Irrigation Company, headed by Dr. F. S. Pearson, of New York, has enlarged its plans for irrigating lands in different parts of south Texas with the incidental generation of hydroelectric power. Besides a large dam that is to be erected across the Medina River a few miles west of San Antonio water rights have been filed for the Guadalupe River at points 9 miles and 12 miles above Kerrville. It is announced that two auxiliary terminals will be constructed at the two latter places for the purpose of storing water for the irrigation of 30,000 acres of land in addition to the 100,000 acres that are to be irrigated in the valley of the Medina River. The cost of the dams and canal system near Kerrville will be approximately $2,000,000. The company has also filed water rights for the Frio and Nueces Rivers in Uvalde County and two or more large dams will be erected across those streams to form water-storage reservoirs. The original estimated cost of the irrigation and hydroelectric works that were to be installed by the Medina Irrigation Company was $6,000,000. The enlarged plans, however, bring this estimate of cost up to $12,000,000.

Public Service Commission Recognizes Dividend Value of Efficient Management.—As noted in the report elsewhere of recent proceedings of the Wisconsin Rate Commission, that commission allowed an increase in telephone rates notwithstanding that the company was earning more than 12 per cent on its investment. The ground given was that the higher rate was not unreasonable and that the large return on investment was due to very low operating expenses.

* * *

Amoskeag Mills Power Plant Again Enlarged.—An additional 5000-kw generator is soon to be installed at the power plant of the Amoskeag Manufacturing Corporation, at Manchester, N. H., a description of which appeared in the issue of June 22, 1911. At the same time several new turbines and a large transformer will also be installed. It is also planned to put in a cable to connect the various divisions of the plant more closely, consisting of a triple-conductor submarine cable, to be laid in the bottom of the canal, where danger of injury will be minimized. The cable, which will be 3 in. or more in diameter and have a total length of about 1 mile, will weigh between 130 tons and 140 tons.

* * *

New York Edison's Association of Employees.—While no regular monthly meetings of the Association of Employees of the New York Edison Company are being held during the summer, the board of trustees is transacting routine business and the membership committee continues its campaign for new members. Ninety new members have been added since the last meeting in May. In view of the large growth of the mortuary funds the board of trustees has withdrawn the funds from savings banks and has made provisions for investing the money to bring larger returns, having purchased eleven $1,000 4 per cent bonds of the New York Gas & Electric Light, Heat & Power Company. The association, while less than six years old, has over $15,500 in its treasury.

* * *

Louisiana Electrical Association.—The Louisiana Electrical Association was organized July 22, and includes in its membership the leading electrical contractors of New Orleans, and the objects of the association as set forth by the constitution are "to foster trade among electrical contractors, to reform abuses and secure freedom from unlawful and unjust exactions, settle differences between its members, promote more enlarged and friendly intercourse between members and to diffuse accurate and reliable information among members as to the standing of merchants, builders and others engaged in the erection of buildings or the furnishing of electrical materials therefor." The officers of the association are as follows: Mr. Roydan Douglas, president; Mr. Thomas J. Burke, vice-president; Mr. W. H. Bower Spangenberg, secretary; Mr. Henry Widmer, treasurer, and Mr. W. H. Earl, sergeant-at-arms.

* * *

Improvements in Denver Station.—A number of improvements have recently been made in the West Side station of the Denver (Col.) Gas & Electric Light Company. Five of the old hand-fired boilers have been equipped with liquid fuel burners and water-gas tar is being utilized as fuel. At present the gas works of the company are supplying something like 35,000 gal. of this tar a month and to store it conveniently two tanks, 31 ft. long by 6.5 ft. in diameter, have been erected in the rear of the station building. From these tanks, each of which has a capacity of 10,000 gal., the tar is pumped to a 5000-gal. tank located on a tower giving a head of 30 ft. at the burners. In order to handle the energy at present received over the lines of the Central Colorado Power Company another set of oil switches has been installed to replace the old switches, which have become inadequate to control the load, and the switch platform below the main switchboard has been extended 6 ft. for this purpose. Improvements have also been mac in the station wiring, especially in the boiler-room, wher the lamp circuits have all been placed in rigid conduit t reduce the fire hazard.

* * *

Electrical Fraud Prosecuted.—The Post Office Depar ment has arrested the inventor and promoter of the Su Electric Generator Company on the charge that it ha defrauded investors out of sums aggregating $250,000 b inducing them to buy stock in an invention having no com mercial merit. The inventor is Mr. George H. Cove, an his so-called invention is a thermoelectric battery, whicl if erected in a back yard or on the roof of a buildin would, it was claimed, generate enough electricity fro the sun's rays in one day to last a household from one t two weeks. An installation set up on the roof of a buil ing in Maiden Lane, New York City, from which incan descent lamps were supplied, was found to be connecte by concealed wires with the Edison service in the buildin Many inquiries regarding the scheme have been receive at this office, and it was apparent that the promoters ope ated largely through a "sucker" mailing list such as is use by other electrical "fakes" still doing business.

* * *

I. E. S. Annual Convention.—According to the a rangements that have thus far been completed there wi be five technical sessions at the Chicago convention of th Illuminating Engineering Society Sept. 25, 26 and 2 These sessions will be held in the Congress Hotel on Mon day morning, Tuesday morning, Tuesday afternoo Wednesday morning and Wednesday afternoon. A rece tion and dance will be given on Monday evening. On Tue day evening there will be a subscription dinner. Accor ing to the preliminary technical program twenty subjec will be covered by committee reports or original paper Among the authors are President A. E. Kennelly ar Messrs. A. J. Humphreys, Louis Bell, E. H. Bostwick, H. McCormick, A. J. Marshall, L. W. Young, F. I Godinez, Bassett Jones, W. H. Gartley, G. S. Barrow J. E. Randall, George H. Keech, A. S. McAllister, Geor H. Stickney, P. S. Millar, L. J. Lewinson, H. E. Ives, C. Smart, E. L. Elliott, George L. Dyer, F. B. Rae, C. Steinmetz and H. E. Clifford.

* * *

Federal Water-Power Policy.—In an address befo the Michigan School of Mines on Aug. 9 Director Geor Otis Smith, of the United States Geological Survey, speaking of the subject of water-power legislation said th the position of the Geological Survey is essentially th set forth in January of this year in a report addressed the Secretaries of the Interior and of Agriculture by joint committee representing the two departments. Th legislation there outlined would provide for lease of publ and reserved lands of the United States valuable for wate power development for a fixed term, not to exceed fif years, with moderate charges for use and occupancy of th land, and revocable only upon breach of conditions or account of the charge of excessive rates to consume These leases should be identical in terms, whatever the d partment under which they are granted, with joint and ur form regulations governing all matters relating to wate power development of land belonging to the United State Provision should also be made for periodic and equitab readjustment of charges, transfer of leases, preferenti rights to renewal and compensation for improvements the termination of the leasehold. The law should speci cally recognize water-power use as dominant and both i sure to the lessee undisturbed occupancy of the land need for such use and reserve for future utilization all the la believed to possess value for water-power developme these lands to be designated by the President, but to open to other entry subject to this reserved right wherev separation of the water-power use and other use is possib

HYDROELECTRIC DEVELOPMENT IN NORTHERN ONTARIO.

Generating Station and Substations of the Nipissing Power Company on the South River Near North Bay.

AN interesting hydroelectric station has been completed for the Nipissing Power Company on the South River near the village of Nipissing, Ontario, by Messrs. Smith, Kerry & Chace, of Toronto, who also act as operating engineers for the project. As hydroelectric stations go, the development is not large, the present installation aggregating less than 1000 kw, but provision has been made for additions which will bring the rating up to 2250 kw, and the market is promising. There is a 20-mile aluminum-transmission line in connection with the development, and not the least interesting feature is the small substations at North Bay and Callander, especially the latter. The territory through which the transmission line

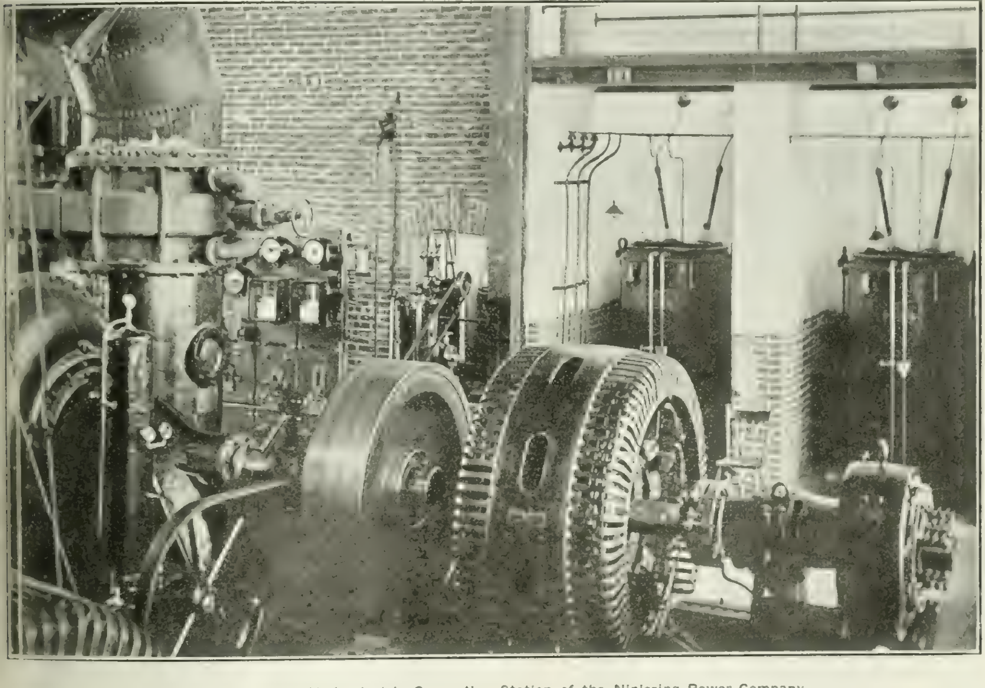


Fig. 1—Interior of Hydroelectric Generating Station of the Nipissing Power Company.

passes is subject to severe winters, but notwithstanding that fact the station and system gave uninterrupted twenty-four hour service all last winter, which was the first since operations began. The line was patrolled regularly by an attendant, who used a sled for that purpose pulled by dogs.

The generating station is located on South River, which rises in a number of small lakes in the Nipissing district in the northern part of Ontario and empties into Lake Nipissing, a large body of water midway between Lake Huron and the Ottawa River. The river is tapped a half mile upstream from the station, where it enters an open canal about 90 ft. long, flowing thence through a 6-ft. wood-stave pipe approximately ½ mile long to the station. A storage pond of 100 acres is provided above the diversion dam in the river. The latter is of reinforced concrete, as are also the portals leading from the open canal to the wood-stave pipe line. The available head at the station is 86 ft.

Plan and interior views of the station are given herewith. The equipment at present provided includes two 925-hp Jenckes turbines, each being equipped with a Lombard governor and 3-ton flywheel and direct-connected to a 450-kw, 2300-volt, 60-cycle, three-phase alternator. On the end of each generator shaft is a 12.5-kw exciter. There is in addition a 35.5-kw induction motor-generator set provided for excitation purposes. The plans call for an additional 450-kw unit and one rated at 900 kw. Facing the generators are compartments in each of which is a 300-kva oil-insulated, water-cooled, delta-connected transformer. These are used to step up the potential from 2200 volts to 22,000 volts, at which pressure the energy is transmitted to North Bay. Adjacent to the transformer compartments and a little to the rear is the electrolytic lightning-arrester equipment, above which in another compartment are the choke coils, disconnecting switches, circuit-breakers, etc., on the outgoing line. The latter is of No. 2 gage aluminum, and after leaving the station crosses the river in a 200-ft. span to an anchor pole on the opposite bank, whence it is carried on regular wooden poles of the type indicated in Fig. 8. A steel cable, grounded at every pole, is carried above the transmission circuit on an extension of the pole as a protection from lightning. A telephone circuit connecting the various parts of the system is also carried on the same pole line below the transmission circuits. The electrical equipment in the station was supplied by the Canadian Westinghouse Company.

Fig. 5 shows a map of the territory through which the transmission line passes. Energy is transmitted to North Bay, to Callander and to Nipissing. The North Bay Light, Heat & Power Company distributes the energy at reduced potential throughout that city and is the chief customer of the transmission company. Prior to the building of the transmission line the North Bay company generated electricity in a steam-driven station and gave only a night serv-

ice. The electrical energy because of this could be used only for lighting circuits. Since the company has contracted with the Nipissing Power Company for energy in bulk a twenty-four-hour service has been inaugurated, rendering the energy available for motor circuits during the day. In addition the Nipissing Power Company reserves the right to supply energy in bulk to other consumers in North Bay provided they require above a certain amount below which the transmission company is obligated not to compete with the local company. The Canadian Pacific Railway Company operates its shops at North Bay with energy purchased from the transmission company.

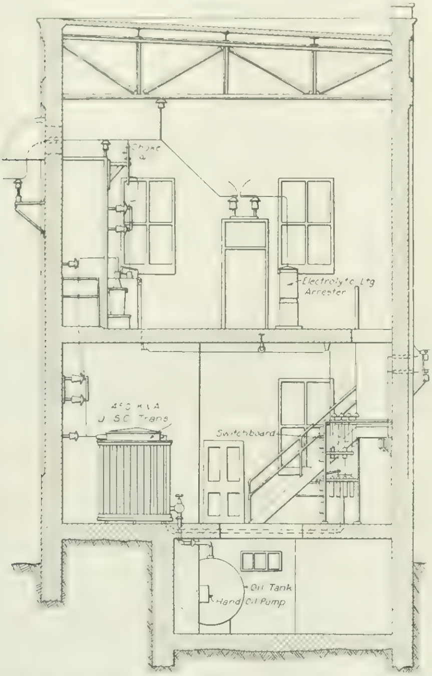


Fig. 2—Sectional Elevation of North Bay Substation.

North Bay has a population of 8000 and is reached by the Canadian Pacific, the Grand Trunk and the Temiskaming Northern Ontario railroads. A cross-sectional elevation of the substation there is shown in Fig. 2. The station has three 450-kva, oil-insulated, self-cooled transformers, two of which are T-connected and step down the potential from 22,000 volts to 2200 volts. The other transformer is held in reserve for emergency use at present and will form one of a set of T-connected units later when the installation is completed.

The North Bay substation has two stories, the upper floor containing the choke coils, disconnecting switches and switches on the incoming high-tension circuit, in addition to the lightning-arrester equipment. Single-phase distribution formerly obtained throughout the city, but this has given place to three-phase distribution. At the head of Trout Lake, 3 miles from the city, is the pumping station from which the city water supply is obtained. There is installed a motor-driven pump comprising a Canadian General Electric Company 150-hp motor connected to a centrifugal pump. A 2200-volt line runs from the North Bay substation to the pump house to supply energy to the motor.


Fig. 4—Generating Station and Standpipe.

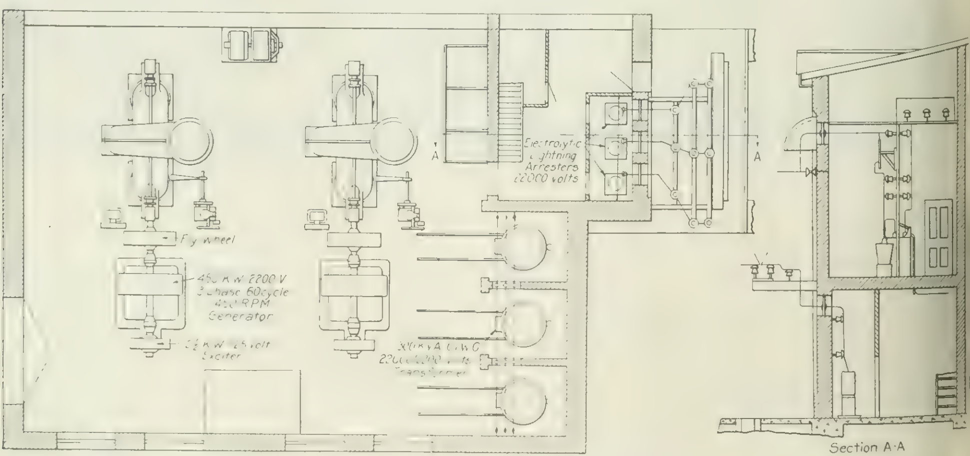


Fig. 3—Plan and Cross-Section of Generating Station.

Th load of the Cánadian Pacific Railway shops will approximate 100 hp when the installation there is complete.

As will be seen from the map, the main line passes through Callander, which is about midway between the generating

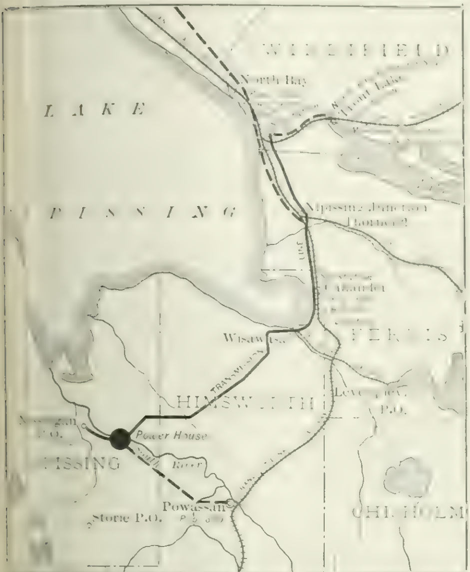


Fig. 5—Map of Transmission System.

station and North Bay The town has a population of only about 600, so that an independent station would be out of the question. Investment in an expensive substation would also be questionable, but the engineers have apparently solved the problem with the inexpensive substation shown in Fig. 6, which has no regular attendant, but receives periodical visits from the transmission-line patrolman. The substation consists of a galvanized-iron pipe framework

Fig. 6—Exterior of Callander Substation, Showing Control System.

covered with corrugated sheet iron. The building is 13 ft. square and cost complete at Toronto less than $250. It is provided with a concrete floor, giving a fireproof building at a low cost. The equipment consists of one 50-kva, single-phase transformer stepping down the potential from 22,000 volts to 2200 volts. The high-tension circuit is controlled by two downward-pull, outdoor-type, disconnecting switches mounted on a pair of poles outside the station and one pair of fused air-brake switches inside the station. No lightning-arrester equipment is provided on the high-tension side other than a pair of choke coils. The connected load in

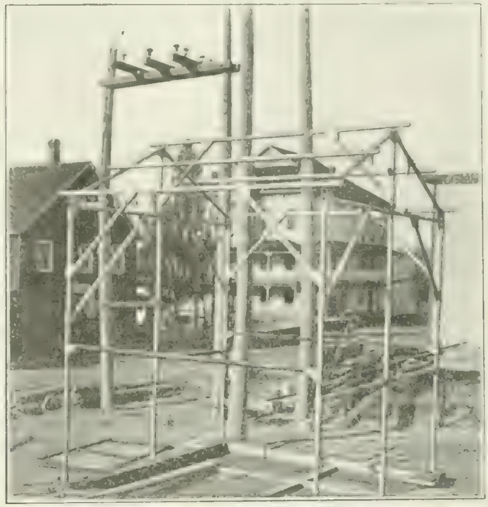


Fig. 7—Framework of Callander Substation.

Callander at present approximates 400 lamps for commercial and residence service and 15 100-watt lamps for street lighting. The station is large enough to house two additional transformers if future motor loads should indicate that three-phase distribution would be desirable.

Three miles from the generating station is the village of Nipissing with a population of not more than 100. The requirements of the village are amply provided for by a 10-hp motor-generator set fed with 2200-volt energy by a single-phase line from the generating station. Six miles west of the generating station on the Grand Trunk Railroad

Fig. 8—Pole Line, Showing High and Low-Tension Circuits.

is the town of Powassan, with a population of approximately 1000, and it is planned to reach that town with a 22,000-volt line tapping the main line and to erect a small substation. The route of the proposed line is indicated on the map shown in Fig. 5.

As outlined in our issue of Jan. 12, the Nipissing Power Company is a subsidiary of the Electric Power Company, Ltd., which controls a number of water-powers in the Trent Valley district. This district embraces nearly all that section of Ontario lying east of Toronto not now supplied from the lines of the Hydroelectric Power Commission of the Province of Ontario.

THE CALCULATION OF CAPACITY COEFFICIENTS FOR PARALLEL SUSPENDED WIRES.

By Frank F. Fowle.

The calculation of induction phenomena between parallel suspended wires is assuming an increased importance from an industrial standpoint and merits more attention than it has hitherto received. All such calculations involve fundamentally the coefficients of electrostatic capacity and mutual inductance between the several conductors which form the groups or systems considered. The coefficients of mutual inductance are relatively simple in the respect that the relations between any two conductors are independent of the others and not affected by the addition or withdrawal of conductors in the several groups. This simplicity of relationship does not extend in every case to the coefficients of electrostatic capacity. Such coefficients are always affected theoretically by the addition or withdrawal of conductors. Under some circumstances the theoretical variations may be negligible, but under others far from so. In general, the complexity of relationships increases with the number of conductors present. The formulas expressing these capacity coefficients take a different analytical form with every change in the number of conductors, becoming very unwieldy in some instances. In view of the present importance of having exact expressions for these coefficients under a considerable variety of conditions, it seems worth while to give the full electrical theory of a group of parallel charged wires and deduce the analytical expressions for some of these coefficients in typical cases.

It seems desirable to commence with the general case of a system of n conductors, with charges $q_1, q_2, q_3 \ldots q_n$ and potentials $V_1, V_2, V_3 \ldots V_n$ respectively. Maxwell shows that the potential of each conductor is a homogeneous linear function of n charges and the whole electric energy of the system is a homogeneous quadratic function of the n charges,[1] expressed in the terms,

$$\begin{aligned} W = {} & \tfrac{1}{2} u_{11}q_1^2 + u_{12}q_1q_2 + u_{13}q_1q_3 + \ldots \\ & + \tfrac{1}{2} u_{22}q_2^2 + u_{23}q_2q_3 + \ldots \\ & + \tfrac{1}{2} u_{33}q_3^2 + \ldots \\ & + \ldots\ldots \\ & + \tfrac{1}{2} u_{nn}q_n^2 \end{aligned} \qquad (1)$$

Under the definition of potential the work done in altering the charge of the system is

$$W = \int V dq \qquad (2)$$

from which

$$V = \frac{dW}{dq} \qquad (3)$$

That is to say, the potential is the partial derivative of the expression for energy with respect to the charge. Applying this to expresssion (1), for each conductor of the system, will produce n linear equations giving the potential of each conductor in terms of the n charges, as follow

$$\left.\begin{aligned} V_1 &= u_{11}q_1 + u_{21}q_2 + u_{31}q_3 + \ldots + u_{n1}q_n \\ V_2 &= u_{12}q_1 + u_{22}q_2 + u_{32}q_3 + \ldots + u_{n2}q_n \\ V_3 &= u_{13}q_1 + u_{23}q_2 + u_{33}q_3 + \ldots + u_{n3}q_n \\ & \ldots\ldots\ldots\ldots\ldots\ldots \\ V_n &= u_{1n}q_1 + u_{2n}q_2 + u_{3n}q_3 + \ldots + u_{nn}q_n \end{aligned}\right\} \qquad ($$

The coefficients of the form u_{xy} are termed coefficients potential, where the first subscript refers to the charge ai the second to the potential. The coefficient of the type u denotes the potential of conductor x when its charge unity and the charges on all other conductors are zer there are n coefficients of this type, one for each conductc The type u_{xy} denotes the potential of the conductor y wh x receives a unit charge and the charges on all other co ductors are zero. It makes, in fact, no difference in wh order the subscripts are stated because the relationships a reciprocal, or

$$u_{xy} = u_{yx} \qquad ($$

This being true, it follows that the number of differe potential coefficients of the type of (5) is $\frac{1}{2} n (n-1)$, one for each pair of conductors. The nature of the coefficients may be made more clear by the following simp equations relating to a single charged conductor,

$$q = CV \qquad ($$

$$V = uq = \left(\frac{1}{C}\right) q \qquad ($$

In this simple case the coefficient of potential and tl coefficient of capacity have a simple reciprocal relatio But the relationship becomes complicated when two more conductors comprise the system. By solving equ tions (4) for $q_1, q_2, q_3 \ldots q_n$, a new set of n equatio will be obtained of the following form:

$$\left.\begin{aligned} q_1 &= C_{11}V_1 + C_{12}V_2 + C_{13}V_3 + \ldots + C_{1n}V_n \\ q_2 &= C_{21}V_1 + C_{22}V_2 + C_{23}V_3 + \ldots + C_{2n}V_n \\ q_3 &= C_{31}V_1 + C_{32}V_2 + C_{33}V_3 + \ldots + C_{3n}V_n \\ & \ldots\ldots\ldots\ldots\ldots\ldots \\ q_n &= C_{n1}V_1 + C_{n2}V_2 + C_{n3}V_3 + \ldots + C_{nn}V_n \end{aligned}\right\} \qquad ($$

A coefficient of the form C_{xy} is a coefficient of capacit and denotes the charge of conductor x when the potenti of y is unity and the potentials of all other conductors a zero. Again there are n coefficients of the type C_{xx} ai $\frac{1}{2} n (n-1)$ of the type C_{xy} for the reason as before that

$$C_{xy} = C_{yx} \qquad (\!$$

In the transformation of equations (4) to equations (8 the method of determinants is applicable, as follows:

$$D = \begin{vmatrix} u_{11}, & u_{21}, & u_{31} & \ldots & u_{n_1} \\ u_{12}, & u_{22}, & u_{32} & \ldots & u_{n_2} \\ u_{13}, & u_{23}, & u_{33} & \ldots & u_{n_3} \\ \ldots & & & & \\ u_{1n}, & u_{2n}, & u_{3n} & \ldots & u_{nn} \end{vmatrix} \qquad (1c$$

$$D_x = \begin{vmatrix} u_{11}, & u_{21} & \ldots & V_1 & \ldots & u_{n_1} \\ u_{12}, & u_{22} & \ldots & V_2 & \ldots & u_{n_2} \\ u_{1x}, & u_{2x} & \ldots & V_x & \ldots & u_{nx} \\ \ldots & & & & & \\ u_{1n}, & u_{2n} & \ldots & V_n & \ldots & u_{nn} \end{vmatrix} \qquad (1\!$$

In (11) the column $V_1, V_2 \ldots V_n$ replaces the colum $u_{x_1}, u_{x_2} \ldots u_{xn}$ in the determinant D, given by (10 Then, in general,

$$q_x = \frac{D_x}{D} \qquad (1\!$$

Maxwell lays down two fundamental theorems in rega to these coefficients, as follows:

1. The coefficients of potential are all positive, but no of the coefficients u_{xy} is greater than u_{xx} or u_{yy}.

2. None of the coefficients of mutual capacity are pos tive, and the sum of all those belonging to a single condu tor is not numerically greater than the coefficient of capa ity of that conductor, which is always positive. That i C_{xy} is always negative and C_{xx} or C_{yy} is always positiv also, in a numerical sense

$$C_{xx} > C_{x_1} + C_{x_2} + C_{x_3} + \ldots + C_{xn} \qquad (1$$

[1] "Electricity and Magnetism," Vol. I, Chap. 3.

[wh]ere, of course, C_{xy} does not appear in the right hand [m]ember.

The determination of all the capacity coefficients in any [st]ated problem requires the full transformation of equations [(…]) to equations (8), using the method of (12). If some [pa]rticular coefficient is needed, alone, it is not necessary to [wo]rk out the full solution, however. Assume, for example, [tha]t the coefficient C_{xy} is desired. This quantity will appear [as] the coefficient of V_y in the expression for q_x, and, there[fore], it can be found by obtaining the proper minor of D_x, [as D]$_x$ is expressed as

$$D_x = \begin{vmatrix} u_{11} & \dots & V_1 & \dots & u_{n1} \\ \dots & \dots & \dots & \dots & \dots \\ u_{1x} & \dots & V_x & \dots & u_{nx} \\ \dots & \dots & \dots & \dots & \dots \\ u_{1n} & \dots & V_n & \dots & u_{nn} \end{vmatrix} \qquad (14)$$

[Then] the coefficient of V_y is found by taking that minor of [D_x] which results from erasing the x^{th} column and the [y^{th}] row, or

$$D_x' = (-1)^{x+y} \begin{vmatrix} u_{11} & \dots & u_{n1} \\ \dots & \dots & \dots \\ \dots & \dots & \dots \\ u_{1n} & \dots & u_{nn} \end{vmatrix} \qquad (15)$$

[and]

$$C_{xy} = \frac{D_x'}{D} \qquad (16)$$

The last expression is perfectly general for any coefficient [of] capacity whatever, that is, when x and y have any in[tegr]al values between 1 and n. The numerical value of the [coeff]icient cannot be obtained, however, until the values of [the] potential coefficients are given. The solution of the [ge]neral case up to this point applies to any system of [ch]arged conductors whatever, but for a system of parallel [wi]res the potential coefficients take a specific analytical [fo]rm and the considerations hereafter relate entirely to the [pa]rticular problem here considered.

The form of the potential function for parallel wires, the [se]parations of which are large compared with their diam[et]ers, has been given by Heaviside[2], and is deduced as fol[lo]ws. Consider a straight cylindrical wire in free space [wi]th a charge q per unit of length; assume also that the [effec]t of the charge is the same as though the charge were [co]ncentrated at the axis, corresponding to a linear distri[bu]tion, which is true for effects at a large distance from the [wi]re compared with its diameter. The force at a point P, [dis]tant y from the wire in a normal direction, caused by an [elem]ent of charge qdx, is given by (17). Fig. 1 illustrates [the] relative positions.

$$dF = \frac{q\,dx}{x^2 + y^2} \qquad (17)$$

But the longitudinal components of all these elementary [fo]rces cancel each other when a summation is taken and [he]nce only the normal components of force need be consid[er]ed. The normal component of (17) is

$$dF' = \frac{qy\,dx}{(x^2 + y^2)^{\frac{3}{2}}} \qquad (18)$$

[The] sum of all these normal elementary forces is [giv]en by

$$F' = \int_{-\infty}^{+\infty} \frac{qy}{(x^2 + y^2)^{\frac{3}{2}}}\,dx = \frac{2q}{y} \qquad (19)$$

The force is the negative partial derivative of the poten[tia]l with respect to the distance, or

$$F = -\frac{dv}{dy} \qquad (20)$$

[W]hence

$$V' = -\int F dy \qquad (21)$$

[2]"Electrical Papers," Vol. 1, p. 42, "On the Electrostatic Capacity of [Su]spended Wires."

Substituting for F in (21) the result of (19) gives

$$V' = -\int \frac{2q}{y}\,dy = 2q \log \frac{a}{y} \qquad (22)$$

where a is an arbitrary constant of integration.

It is a physical impossibility to isolate a single charged conductor from all other conductors; in other words, one must deal necessarily with pairs of conductors and with potential differences between the elements of a pair. In this case if the return conductor is a parallel wire distant y' from the point P and negatively charged with an equal quantity per unit of length, the potential is given by

$$V'' = -2q \log \frac{a'}{y'} \qquad (23)$$

The sum of both potentials is

$$V = V' + V'' = 2q \log \frac{y'}{y} \qquad (24)$$

because the constants of a and a' are seen to be equal when y and y' become indefinitely great, in which case the potential approaches a value of zero.

Returning to the expression for potential as given by (7),

$$V = uq \qquad (25)$$

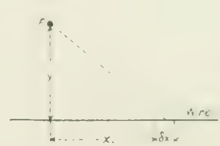
it becomes apparent that

$$u = 2 \log \frac{y'}{y} \qquad (26)$$

This is the form of the potential coefficient for parallel wires under the conditions previously assumed. The solution of any specific problem is henceforth an application of the general solution just completed by the evaluation of the potential coefficient. Heaviside employed this method in deriving expressions for the capacities of a small group of wires, with earth and metallic return, but not exceeding four in number. The same method has also been used by the author[3] in deriving the mutual capacities between parallel metallic circuits. In general, the problem may be classed under the headings of grounded circuits, metallic circuits and combinations of grounded and metallic circuits. The solution of specific cases will next be taken up under those headings in order.

GROUNDED CIRCUITS.

The case of grounded circuits is met most extensively in telegraphy, where the number of such circuits on one pole line may reach 100 or more in extreme cases; the average number is much less and forty is near the limit on trunk lines. Such circuits are encountered also in telephony, where they are extensively employed in rural systems; the average number on one pole line is small, comparatively. The simple case of one wire will be considered first.



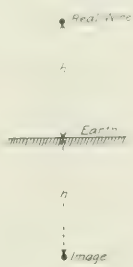


Fig. 1—Geometrical Relations. Fig. 2—Real and Image Wires.

One Wire.—A single wire suspended above the earth at a height h is illustrated in Fig. 2, which also shows the electrical image of the real wire, vertically beneath it at a distance h below the earth's surface.

The potential of the wire with respect to the earth, due

[3]"The Transposition of Electrical Conductors," *Proceedings* of the American Institute of Electrical Engineers, Vol. XXI.

to a charge q per unit of length, will be found by substituting the wire radius r for y in (26) and $2h$ for y', or

$$2q\log\frac{2h}{r} \qquad (27)$$

This follows from the theory of images which shows that the distribution of force and potential in the field above the earth is identical with the distribution which would exist if the earth were removed and a conductor equally but oppositely charged were substituted for it at a point as far below the surface as the real wire is above.

The electrostatic capacity in c.g.s. units is obviously

$$C = \frac{1}{2\log\frac{2h}{r}} \qquad (28)$$

The constant for changing any such expression to microfarads per 1000 ft. or per mile will be given in closing. This deduction assumes that there is no other wire within a very great distance, or many times the value of h. In strict theory, of course, it assumes that the given wire and the indefinite expanse of earth are alone in space.

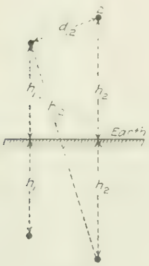


Fig. 3—Two-Wire Ground Return.

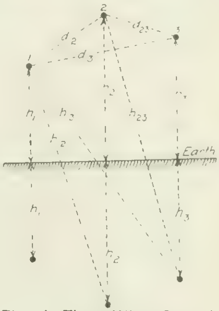


Fig. 4—Three-Wire Ground Return.

Two Wires.—The conditions assumed in this case are shown in Fig. 3. When two or more wires are shown hereafter they will be denoted by subscripts in the analytical expressions.

The fundamental equations of the form of (4) in this case are as follows:

$$\left.\begin{aligned} V_1 &= 2q_1\log\frac{2h_1}{r_1} + 2q_2\log\frac{h_{12}}{d_{12}} \\ V_2 &= 2q_1\log\frac{h_{12}}{d_{12}} + 2q_2\log\frac{2h_2}{r_2} \end{aligned}\right\} \qquad (29)$$

The expressions for capacity are nearly obvious; they have the common denominator,

$$D = \left\{\begin{matrix} 2\log\frac{2h_1}{r_1}, & 2\log\frac{2h_1}{d_{12}} \\ 2\log\frac{h_{12}}{d_{12}}, & 2\log\frac{2h_2}{r_2} \end{matrix}\right. \qquad (30)$$

The minors of D in (30) are obvious and hence

$$C_1 = \frac{2\log\frac{2h_2}{r_2}}{\left(2\log\frac{2h_1}{r_1}\right)\left(2\log\frac{2h_2}{r_2}\right) - \left(2\log\frac{h_{12}}{d_{12}}\right)^2} \qquad (31)$$

$$C_2 = \frac{2\log\frac{2h_1}{r_1}}{\left(2\log\frac{2h_1}{r_1}\right)\left(2\log\frac{2h_2}{r_2}\right) - \left(2\log\frac{h_{12}}{d_{12}}\right)^2} \qquad (32)$$

$$-C_{12} = \frac{2\log\frac{h_{12}}{d_{12}}}{\left(2\log\frac{2h_1}{r_1}\right)\left(2\log\frac{2h_2}{r_2}\right) - \left(2\log\frac{h_{12}}{d_{12}}\right)^2} \qquad (33)$$

When the wires are of the same size and at an equa height above the earth capacities are given by

$$C_1 = C_2 = \frac{2\log\frac{2h}{r}}{\left(2\log\frac{2h}{r}\right)^2 - \left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)^2} \qquad (34)$$

$$C_{12} = \frac{2\log\frac{\sqrt{d^2+4h^2}}{d}}{\left(2\log\frac{2h}{r}\right)^2 - \left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)^2} \qquad (35)$$

These expressions indicate how rapidly the complicatio increases with the number of wires. It soon becomes im possible to use methods of expression such as those jus given.

Three Wires.—In order to simplify the equations in thi case resort may be had to the former symbol for a potentia coefficient, observing in general that

$$u_{xy} = 2\log\frac{h_{xy}}{d_{xy}} \qquad (36)$$

$$u_{xx} = 2\log\frac{2h_x}{r_x} \qquad (37)$$

Fig. 4 shows a general arrangement of a three-wir circuit with ground return.

The fundamental equations are given by (38).

$$\left.\begin{aligned} V_1 &= u_{11}q_1 + u_{21}q_2 + u_{31}q_3 \\ V_2 &= u_{12}q_1 + u_{22}q_2 + u_{32}q_3 \\ V_3 &= u_{13}q_1 + u_{23}q_2 + u_{33}q_3 \end{aligned}\right\} \qquad (38)$$

Then, since $u_{xy} = u_{yx}$,

$$D = \left\{\begin{matrix} u_{11} & u_{12} & u_{13} \\ u_{12} & u_{22} & u_{23} \\ u_{13} & u_{23} & u_{33} \end{matrix}\right\} \qquad (39)$$

$$D = (u_{11}u_{22}u_{33} + 2u_{12}u_{13}u_{23} - u_{12}^2u_{33} - u_{13}^2u_{22} - u_{23}^2u_{11}) \qquad (40)$$

And the capacities are

$$C_1 = \frac{u_{22}u_{33} - u_{23}^2}{D} \qquad (41)$$

$$C_2 = \frac{u_{11}u_{33} - u_{13}^2}{D} \qquad (42)$$

$$C_3 = \frac{u_{11}u_{22} - u_{12}^2}{D} \qquad (43)$$

$$C_{12} = \frac{u_{13}u_{23} - u_{12}u_{33}}{D} \qquad (44)$$

$$C_{13} = \frac{u_{12}u_{23} - u_{13}u_{22}}{D} \qquad (45)$$

$$C_{23} = \frac{u_{12}u_{13} - u_{23}u_{11}}{D} \qquad (46)$$

When the wires are at equal heights above the earth an of equal diameters, or

$$\left.\begin{aligned} h &= h_1 = h_2 = h_3 \\ r &= r_1 = r_2 = r_3 \\ d &= d_{12} = d_{23} = \tfrac{1}{2}d_{13} \end{aligned}\right\} \qquad (47)$$

it follows that

$$\begin{aligned} D = \Bigg[&\left(2\log\frac{2h}{r}\right)^3 + 2\left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)^2\left(2\log\frac{\sqrt{d^2+h^2}}{d}\right) \\ &- 2\left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)^2\left(2\log\frac{2h}{r}\right) \\ &- \left(2\log\frac{\sqrt{d^2+h^2}}{d}\right)^2\left(2\log\frac{2h}{r}\right)\Bigg] \end{aligned} \qquad (48)$$

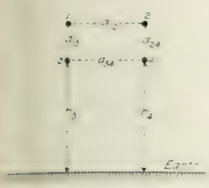
$$C_1 = C_3 = \frac{\left(2\log\frac{2h}{r}\right)^2 - \left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)}{D} \qquad (49)$$

$$C_2 = \frac{\left(2\log\frac{2h}{r}\right)^2 - \left(2\log\frac{\sqrt{d^2+h^2}}{d}\right)^2}{D} \qquad (50)$$

$$C_{[illegible]} = C_{23} = \frac{\left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)\left(2\log\frac{\sqrt{d^2+[illegible]}}{d} - 2\log\frac{2h}{r}\right)}{D} \quad (51)$$

$$C_{[illegible]} = \frac{\left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)^2 - \left(2\log\frac{\sqrt{d^2+4h^2}}{d}\right)\left(2\log\frac{2h}{r}\right)}{D} \quad (52)$$

[illegible]*neral Case.*—When more than three wires are in[illegible]ved the formulas are too cumbersome to give in com-



[illegible]—Four-Wire Ground Return.

Fig. 6—Three-Phase Line.

[illegible] form, but the general solution has already been indi[illegible]. Any particular coefficient of capacity is equal to a [illegible]on whose denominator is the determinant D and [illegible]se numerator is the minor of D for the corresponding c[illegible]fficient of potential. This general rule covers all cases [illegible] the sort considered up to this point.

[illegible]he calculation of some typical cases may be of interest. [illegible]ler to show the effect of adding conductors to the sys[illegible] the capacities of one, two and three conductors will be [illegible]ated, of No. 9 B. & S. gage, each at a height of 20 ft. [illegible] the earth and with a spacing of 1 ft. between ad[illegible]t conductors. The results in each case are shown in [illegible] I.

[illegible]E I.—ELECTROSTATIC CAPACITIES IN THE CASE OF ONE, [illegible] AND THREE NO. 9 B. & S. GAGE WIRES, 20 FT. ABOVE [illegible]HE EARTH, WITH 1 FT. ADJACENT SPACING. MICRO-FARADS PER MILE.

	Number of Conductors		
[illegible]	One.	Two.	Three.
C_1	0.009894	0.01187	0.01236
[illegible]		[illegible]	0.01320
[illegible]			0.01236
[illegible]		[illegible]	0.004045
[illegible]			[illegible]
[illegible]			[illegible]

[illegible]is table shows that the second wire adds 20 per cent to [illegible]pacity of the first, and two wires add (to the middle [illegible]) 33 per cent. At the same time the mutual capacities [illegible] case of three wires are less than in the case of two [illegible]. In general, the addition of conductors increases the [illegible]dual capacities and diminishes the mutual capacities. [illegible]alculation of capacities for a larger number of wires [illegible]traightforward operation, but very laborious.

[illegible]iviside calculated a particular case of four wires [illegible]ged as shown in Fig. 5 and with the spacings as given [illegible] (53).

$$\left.\begin{aligned} h_1 = h_2 &= 31.6 \text{ m} \\ h_3 = h_4 &= 25.6 \text{ m} \\ d_{12} = d_{34} &= 0.5 \text{ m} \\ r_1 = r_2 = r_3 = r_4 &= 2.0 \text{ mm} \end{aligned}\right\} \quad (53)$$

[illegible]n this case the second wire increased the capacity of the fir[illegible] 11 per cent and three wires increased it 24 per cent.

It is obvious that the increase is larger with shorter spacings.

The following example is calculated for the case of a three-phase line of No. 2 B. & S. gage wire spaced equilaterally with 60-in. separation, as shown in Fig. 6.

In this case the assumed conditions are given by (54).

$$\left.\begin{aligned} d_{12} = d_{23} = d_{31} &= 60 \text{ in} \\ [illegible] &= 25 \text{ ft} \\ h_3 &= 29.33 \text{ ft} \\ r_1 = r_2 = r_3 &= 0.129 \text{ in} \end{aligned}\right\} \quad (54)$$

The calculated capacities are given in Table II.

TABLE II.—CAPACITIES FOR FIG. 6 UNDER THE CONDITIONS OF (54). MICROFARADS PER MILE FOR GROUNDED CIRCUITS.

Capacities	Numerical Value
[illegible]	[illegible]
[illegible]	0.01319
[illegible]	0.01340
[illegible]	0.003129
[illegible]	0.003025
[illegible]	0.003129

The upper conductor has slightly less capacity, individual and mutual, than the other two because of its greater elevation. It is evident that the charging currents per phase wire of such a transmission circuit, assuming a star-connected grounded-neutral system, will not be exactly alike, and will be least for the upper conductor. It is obviously necessary to transpose the circuit, as shown in Fig. 7, to obtain a perfect balance.

On account of the line impedance drop it may be necessary to divide the line into several sections of the type shown in Fig. 7. Another interesting case of capacity relations between three wires is illustrated by Fig. 8, which shows the arrangement of three-phase conductors in several transmission lines of a recent type.

The assumed conditions in this case, where the wires lie in the same vertical plane, are given by (55).

$$\left.\begin{aligned} h_1 &= 52 \text{ ft} \\ h_2 &= 40 \text{ ft} \\ h_3 &= 40 \text{ ft} \\ d_{12} = d_{23} &= 6 \text{ ft} \\ d_{13} &= 12 \text{ ft.} \\ r_1 = r_2 = r_3 &= 0.1625 \text{ in.} \end{aligned}\right\} \quad (55)$$

(No. 0 B. & S. gage.)

The calculated capacities in this case are given in Table III. Both in this example and the preceding one the general formulas for the case of three grounded wires, given by (40) to (46) inclusive, have been employed.

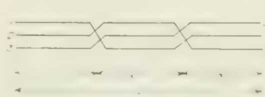


Fig. 7—Three-Phase Line Transposed for Electrostatic Balance.

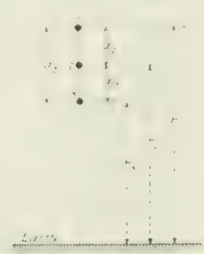


Fig. 8—Three-Phase Transmission Line.

In the last case the middle wire has the largest capacity and the upper one has the least; the latter is about 6.5 per cent less than the former. The mutual capacities are severely unbalanced, as would be expected. A complete balance can be secured only by resorting to the method of transposition shown in Fig. 7.

TABLE III.—CAPACITIES FOR FIG. 8 UNDER THE CONDITIONS OF (55). MICROFARADS PER MILE.

Capacities.	Numerical Values.
[illegible]	0 01256
[illegible]	0.01342
[illegible]	0.01287
[illegible]	0.003668
[illegible]	0.001980
[illegible]	0.003536

In a subsequent issue solutions will be given of the problems involved in various forms of metallic circuits.

A GRAPHICAL METHOD FOR FINDING THE SAG AND TENSION IN WIRE SPANS.

By R. S. Brown.

In the *Electrical World* for Jan. 12, 1907, Dr. H. Pender gave a formula for calculating the relation between temperature, tension and deflection in any span of a pole line. His formula gives quite accurate results and is probably more widely used than any other. It is a cubic equation in tension and deflection and hence must be used by substituting values for these variables and solving for temperature. To overcome this irreversible feature and at the same time do away with the computation involved, a graphical solution of the equation has been devised and is presented herewith.

The charts given here are constructed for the two most common conductor materials, copper and aluminum, using the values for the physical constants of these metals which seem most authentic. The method of constructing the curves is quite simple and a brief explanation of the process will be given so that one may plot curves for any material, using whatever constants he sees fit.

Dr. Pender's formula is:

$$t - t_o = \frac{6\,m^2}{a}\left(\frac{r^2l^2}{T^2} - \frac{r_o^2l^2}{T_o^2}\right) + \frac{1}{aM}(T_o - T) \qquad (1)$$

and

$$D = 1.5\,m\,\frac{rl^2}{T} \qquad (2)$$

Where

m = density of wire in lb. per cu. in.

a = coefficient of linear expansion per degree Fahr.

M = modulus of elasticity in lb. per sq. in.

The values used here are:

	Cu.	Al.
m	0.321	0.0967
a	9.6×10^{-6}	12.8×10^{-6}
M	16×10^6	9×10^6

t = temperature in degrees Fahr.

l = length of span in ft.

r = ratio of resultant force acting on the wire to the weight of wire.

D = deflection or sag at center of span in ft.

The resultant force acting on the wire consists of a horizontal component due to wind pressure and a vertical component due to weight of wire and sleet load. For no wind and no ice $r = 1$. Mr. H. W. Buck gives the following formula for calculating wind pressure:

$$p = 0.00021\,V^2d$$

where p is the pressure in pounds per foot of wire, V is the actual wind velocity in miles per hour and d is the diameter of the sleet-covered wire. The maximum value of r is from 2 to 4 for practical conditions in temperate climates. The subscripts zero refer to assumed values of the variables which fix the curve. They are usually taken at the worst conditions. Thus, t_o is the temperature at which wind, ice and contraction combine most strongly to stress the wire. T_o is the maximum allowable tension and r_o is the value of r under these worst conditions.

From equation (1) it will be seen that fixing the values of t_o, T_o (r_ol) and (rl) determines a curve in t and ... By varying (rl) there is obtained a family of curves ... By varying t_o, T_o or (r_ol) the origin of this family of curves is moved up or down the temperature axis.

COMBINATION OF CURVES.

The tension curves on the chart are the locus of the equation,

$$t = \frac{m^2r^2l^2}{aT^2} - \frac{T}{aM}$$

where (rl) is varied by uniform steps of 100. To ... them let $rl = 1000$ and plot the resulting curve. D... any number of parallel straight lines having the s... $\left(-\frac{1}{aM}\right)$—that is, parallel to the asymptote. By me... of dividers divide the part of these lines included betw... the (t) axis and the curve into ten equal parts and ext... these divisions along the lines as far as is desired to ... right of the curve. The first point on each line ... correspond to $rl = 100$, the second to $rl = 200$ and so ... Through the various points corresponding to the s... value of rl draw the remaining tension curves. For ... lower part of the curves it may be necessary to comp... a few points on the $rl = 100$ curve.

The deflection curves are the locus of the equation,

$$t = \frac{8\,D^2}{ar^2l^2} - \frac{1.5\,mr^2l^2}{aMD}$$

where rl is varied by uniform steps of 100. To plot th... first plot carefully the equation when $rl = 1000$. T... draw in any number of straight lines having the equa...

$$t = \frac{8\,C^2}{3\,a} - \frac{1.5\,mD}{aC^2M}$$

where $C = \frac{D}{rl}$ and has different values assigned to i... random. Divide the part of these lines included betw... the (t) axis and the curve into ten equal parts and d... in the deflection curves in a manner similar to that ... which the tension curves were drawn. When all ... curves are in erase the temperature scale, as it is of ... further use, and construct a temperature scale on a s... of cardboard, the divisions of which have the same spac... as those on the original temperature scale.

USE OF THE CHART.

To use the curves proceed as follows:

Calculate the value of r_o as indicated above.

Select a tension curve marked with the product r_ol ... find the intersection of this curve with the ordinate co... sponding to the value of T_o, the tension desired at t_o.

Lay the movable scale along the (t) axis so that ... temperature t_o on the scale falls opposite this intersect... The value of tension at any temperature may then be ... directly from the curves.

The deflection is read from the deflection curves with... moving the scale from its first position. The true de... tion is the value read from the curve marked with ... divided by r. The deflection is usually wanted when r ... and in this case is read directly from the curve ma... with length of span.

In case the points of support are not on the same l... the deflection D_2 below the higher support is found ... means of an auxiliary formula given by Dr. Pender,

$$D_2 = D\left(1 + \frac{h}{4D}\right)^2$$

where h is the difference in height of the two points of support and D is the deflection for a level span of equal length as found from the chart.

EXAMPLES.

Ex. 1.—400-ft. span of aluminum.

When

$t_0 = 15$ deg. Fahr.

$T_0 = 10{,}000$ lb. per sq. in.

$r_0 = 3$

Find T and D at 70 deg. when $r = 1$ and D at 15 deg. with $r = r_0 = 3$.

Answer:

T at 70 deg. = 3400 lb. per sq. in.

D at 70 deg. = 6.8 ft.

D at 15 deg. $= \dfrac{21}{3} = 7$ ft.

Ex. 2.—1000-ft. span of copper.

When

$t_0 = 0$ deg. Fahr.

$D = 24$ ft.

$r_0 = 1.5$

Find T at 0 deg. when $r = r_0 = 1.5$.

Answer: Place the zero of the temperature scale opposite the point on the 1500 deflection curve cut by the ordinate $r = 1.5 \times 24 = 36$.

T at 0 deg. = 30,000 lb. per sq. in.

REGENERATIVE CONTROL FROM A COMMERCIAL VIEWPOINT.

By J. Gustaf V. Lang.

THE series motor, which is the adopted standard for traction work, lacks the reversible characteristic which is the fundamental basis of regeneration. Moreover, the method used for the control of the standard motor is partly antagonistic to the principle of regeneration, namely, the control by resistances in the armature circuits. In the same way as it is essential to accelerate a vehicle step by step, it is of importance to have the retardation under control by successive degrees. The graduated acceleration has been and generally is to-day accomplished by the use of resistances in the armature circuit. This has been for many years the only satisfactory way, but, although it is simple, it is far from efficient. Developments during the last six years have made practical other means for the control of series motors whereby the efficiency is greatly improved. When Mr. Robert Lundell started about [illegible] years ago to give the problem of regenerative control serious and active consideration he had to face not only a departure from the accepted standard of traction motor, but also from the standard method of control.

Certain economies obtainable by means of regenerative control of railway motors were discussed by the present writer in the *Electrical World* dated March 30, 1911. Below is given a description of schemes that were employed successfully by Mr. Lundell in practically applying regenerative control in railway service.

The motor for regenerative control must be given a shunt characteristic. The counter emf of the equipment must be capable of being raised above the line voltage step by step according to the retardation desired and corresponding to the speed. Either a shunt-connected field winding or some form of independent field excitation can be used for the production of a shunt characteristic. The control of the counter emf is a more difficult problem. A certain field strength would have a corresponding speed at which regeneration would cease. A resistance in the armature circuit would not change this limit, but it would reduce the current and waste a considerable part of the converted energy. It is necessary to obtain a variation of the field strength, but this involves difficulties with regard to commutation. It is desirable to get as low a braking speed as possible, which means a slow-running motor, and this in turn cannot be obtained without increasing the size of the motor, which is prohibitive, or without decreasing the permissible output of the motor.

These considerations led Lundell to adopt the double-series-parallel principle in combination with a speed variation of 80 per cent by means of field regulation. The motors designed on these lines were probably the first multiple-speed motors capable of substantial speed variation by means of field control. The double-series paralleling enabled him to maintain the motor output at full load when all four armature circuits were in parallel, to get a low minimum braking speed when all four armature circuits were arranged in series, and to obtain all the control desired both for acceleration and retardation practically without the use of any added resistance in the armature circuit.

It has seemed necessary to bring out the reason for the adoption of the double-series-parallel system in the early development of the regenerative traction idea for the purpose of explaining the fact that the tests which will be referred to have been made with double-series-parallel equipments. The question of the advisability of a return to the single-series-parallel system will be discussed later, as will the modifications such a change would bring with it in respect to regenerative saving as determined from the experience gained with double-series-parallel systems.

TEST AT NEWCASTLE-ON-TYNE IN 1902.

The first thorough test on a regenerative equipment under practical conditions was carried out at Newcastle-on-Tyne, where two double commutator motors were installed and test runs were made on all the routes of the town. A similar car with a standard equipment was also run. Indicating wattmeters, recording voltmeters and ammeters and speedometers were used. Special tests were run up and down one of the steepest hills and practical results were obtained which checked closely with theoretical calculations.

TABLE I.—COMPARISON OF ENERGY CONSUMPTION OF REGENERATIVE EQUIPMENT AND STANDARD EQUIPMENT, NEWCASTLE-ON-TYNE, 1902.

Route	Length in Miles.	Stops per Mile	Regenerative Equipment. Speed.	Input.	Output.	Net.	Standard Equipment. Speed	Input Kw. Hours
Fairly level [illegible] 1 in 14.....	7.8	4.2	8.5	6.04	1.60	4.44	[illegible]	[illegible]
Fairly level .	3.66	3.5	7.32	3.42	.58	2.84	8.44	[illegible]
*Includes the steepest hill.	2.92	5	7	3.57	1.1	2.47	[illegible]	[illegible]
†Up hill....	1.17	3.4	7.8	2.45	.03	2.42	7.02	2.32
†Down hill....	1.17	2.6	7.0	.21	.67	[illegible]	10.00	.16
Total.	2.34	3.0	7.4	2.66	.7	1.96	8.25	2.48
Total	16.7	4	8	15.7	4.0	11.7	8.7	16.6

Weight of each car, 9.2 tons.

Each trip was a complete return trip.

*The speed difference is mainly due to the hill. Consumption not much affected.

†Both uphill and return is shown. It is evident that the difference in downhill speed is of practically no consequence.

The average results of the four tests recorded in Table I show that, covering a distance of 16.7 miles with four stops per mile at an average speed of the regenerative equipment of 8 miles per hour against 8.7 of the standard equipment, the input to the regenerative car was 15.7 kw-hours and that to the standard car 16.6 kw-hours. The output from the regenerative car measured 4 kw-hours, making the net input to the regenerative car 11.7 kw-hours. The regenerative saving of 4 kw-hours is 24 per cent of the input to the standard car. The weight of the two cars was approximately the same, 9.2 tons. Working out the probable re-

sult according to the method suggested by the writer, the input to the standard equipment, measured at the car, equals about 1 kw-hour per car-mile. Assuming the motor efficiency to be 70 per cent. the mechanical output would be equivalent to 0.7 kw-hour. The tractive resistance figured

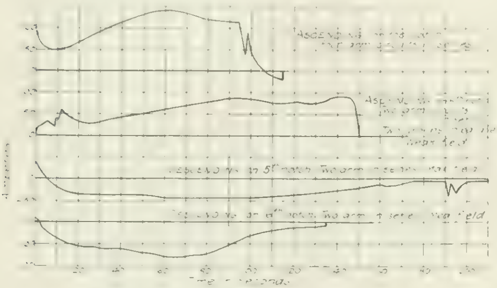


Fig. 1—Hill Test. Average Grade 5 per Cent. Length 2000 Ft.

at 19 lb. per ton would consume 0.35 kw-hour, leaving 0.35 kw-hour representing the kinetic and potential energy, which if transformed at an efficiency of 70 per cent would mean a return of 0.245 kw-hour; in other words, a saving of about 24 per cent.

One test consisted in ascending and descending one of the steepest hills. The total vertical lift amounted to about 100 ft. and the distance measured 2000 ft. The car was loaded up to weigh approximately 12.5 tons. The poten-

	Average Speed	Kw-hours Recording Wattmeter	Kw-hours Watt-hour Meter.
Ascending	[illegible]	1.4	1.425
Descending	12.2	0.845	0.705

tial energy stored up in ascending consequently was 2,800,000 ft.-pounds, or 1.06 kw-hours.

Figuring the tractive resistance at 19 lb. per ton, the hauling energy would be $19 \times 12.5 \times 2000$ ft.-pounds, or 0.180 kw-hour. Assuming the motor efficiency at 80 per cent, which is a very close approximation for the regenera-

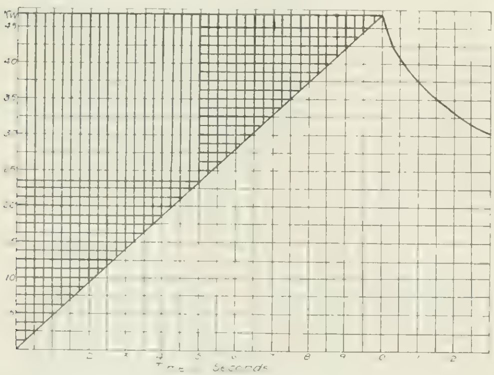


Fig. 2—Resistance Losses During Acceleration by Rheostatic and Single-Series-Parallel Control.

tive equipment in question, the total input to be expected works out at 1.55 kw-hours for the ascent.

The potential energy less the hauling energy leaves 0.88 kw-hour to be converted. If the regenerative efficiency should average 80 per cent the return would be 0.7 kw-hour.

The actual figures obtained are given in the table printed above.

These figures represent average from two tests on [...]ferent notches, as shown in the curves of ammeter r[...]ings, Fig. 1.

It should be remembered that both the double-se[...] paralleling and the absence of armature resistances ougl[...] bring about a decided increase in accelerating efficiency [...] also in the efficiency of intermediate notches, on which [...] traffic often compels relatively long runs. The losses du[...] the accelerating period can best be studied by the use of [...] graphical representations given by Mr. H. M. Hol[...] which are here reproduced as Figs. 2 and 3.

With a single motor, controlled by resistances only, [...] line voltage must be balanced practically entirely by [...] resistance in the armature circuit at the moment of st[...]ing, and as the motor reaches the full speed and the re[...]ance is cut out less and less of the voltage is absorbed [...] the resistance. Consequently the energy represented by [...] area of the shaded triangle represents loss in resistance, [...] as will be seen, this represents about half of the t[...] input.

The series-parallel method cuts the line voltage in h[...] so to speak, and the resistance losses are represented [...] two smaller triangles, each having only a quarter of [...] area of the large one. The loss in resistance is, theref[...] only one-third of the total input. Or, to express the s[...] thing differently, the series-parallel method effects a sav[...] in input of 25 per cent over the plain resistance method.

The double-series-parallel method provides the equiva[...] of still a lower voltage, in other words, cuts the lo[...] triangle of the single-series-parallel method and substit[...] two smaller triangles in place of it, each of one-fourth [...] area of the original one. Thus the double-series-par[...] method effects a saving of a little more than 8 per cent [...] the single-series-parallel method.

The introduction of field control, however, reduces [...] resistance losses to practically nil. Only at the very s[...] is there a resistance in the circuit. There are some a[...]ional losses in the motors, but still one would be justi[...] in looking for from 25 per cent to 30 per cent saving [...]ing the accelerating period out of the theoretically poss[...] 33 1/3 per cent.

Such a saving would mean a difference in gross input

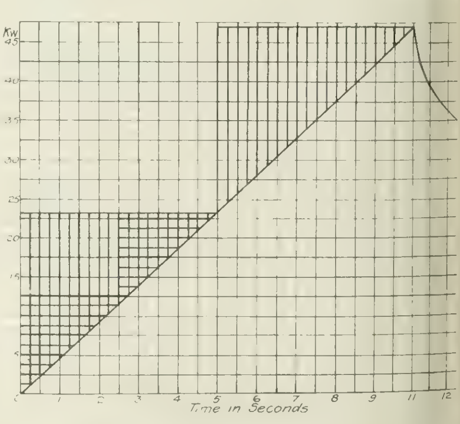
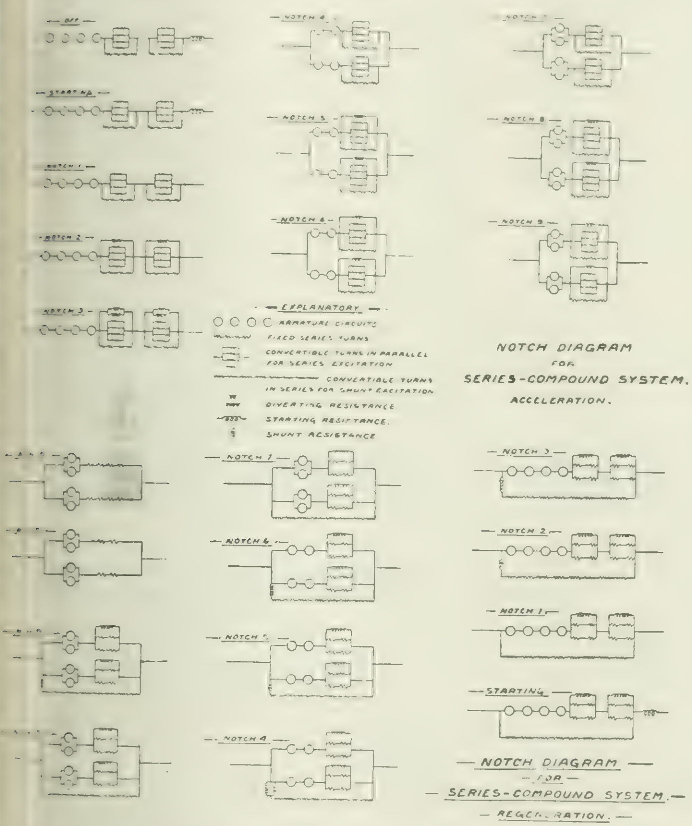


Fig. 3—Resistance Losses During Acceleration by Double-Ser[...] Parallel Control

at least 10 per cent with four stops per mile. The test ab[...] referred to does not show more than about 5 per cent sav[...] in input of the double-series-parallel equipment with[...] armature resistances as compared with the standard sin[...] series-parallel equipment with armature resistances. T[...] discrepancy was explained by the low efficiency of [...] motors at light loads due to the shunt-field losses.

TEST AT NEWCASTLE ON TYNE IN 1903

[illegible]bout a year and a half later an equipment was designed a[illegible] built incorporating the idea of retaining the series c[illegible]acteristic during propulsion and giving the equipment a[illegible]nt characteristic during retardation only. The pur-p[illegible]f this was to avoid the losses in the shunt coils at low [illegible] and thus get the full benefit of the increased efficiency d[illegible] the absence of armature resistances. The speed con-



F[illegible]g. 4—Arrangement of the Armature and Field Coils on the Different Notches.

[illegible]s obtained by field regulation, but the field during [illegible]n was excited entirely by the armature current, [illegible] which was diverted for weakening the field accord-[illegible] the speed changes desired. A special switch was [illegible]d to rearrange certain of the sections of the field [illegible] that they could be used as a shunt-field circuit for [illegible].

[illegible]iagram in Fig. 4 shows the arrangement of the arm[illegible]re and field coils on the different notches. To get more accurate idea of the saving during the ac-celerating period to be looked for with this new equip-ment as compared with the standard single-series-parallel equipment the curves of Figs. 5 and 6 were calculated on the basis of equal maximum acceleration and equal conditions. It w[illegible] be seen that a considerable saving is effected during the [illegible]celeration period. On each of the above diagrams will [illegible] found a curve of the integrated energy area cor-responding to the input, as well as another curve indicating the [illegible]efully employed energy—that is, the amount needed to o[illegible]rcome the tractive resistance together with that stored as kinetic energy corresponding to the speed attained.

By comparison it is found that corresponding to a use-fully employed energy consumption of 0.048 kw-hour the in-put to the regenerative equipment is 0.066 kw-hour and to the standard equipment 0.090 kw-hour. This indicates a saving of 27 per cent, which agrees fairly well with the conclusions reached from the graphical representations which have been referred to in this article.

This new equipment was tested at Newcastle in Decem-ber, 1903, and particular atten-tion was given to the deter-mination of increased efficiency during propulsion. The re-sults are summarized in the table printed below.

A double-bogie car weighing 11.4 tons was used. The fig-ures given are the average from three runs with the regenera-tive equipment and from two runs with the standard. The route was comparatively level, 2.93 miles long. State of road, very thick, greasy mud. The saving in gross input was 8 per cent in the case of four stops per mile and 12 per cent in the case of eight stops per mile.

The regenerative saving in each of the two cases was 15.2 per cent and 17.9 per cent of the energy consumption of the standard equipment. These re-sults compare favorably with those obtained in the previous test on the "fairly level" route, particularly when the bad con-dition of the track is taken into consideration. The input to the standard equipment was consid-erably higher in this test than in the previous when figured per ton-mile, and the only explana-tion is the condition of the track. As a result the regen-erative saving will be smaller in proportion when figured as a percentage on the input to the standard car.

This test is particularly inter-esting as a means for studying the influence of the number of stops per mile on the energy consumption of both the stand-ard and the regenerative equipments. The curves of Fig. 7, plotted from the results of the tests and with the energy consumption at no stop per mile deduced from the other values by subtracting the value of the kinetic energy for four or eight stops per mile, show how important regenera-tion becomes even on very level routes as soon as the

	Four Stops per Mile		Eight Stops per Mile	
	Regenera-tive.	Stand-ard.	Regenera-tive.	Stand-ard.
Speed, miles per hour........	8.05	8.3	[illegible]	7.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	22[illegible]	[illegible]	[illegible]	19.6
Output, kw-hours...........	3.7	[illegible]	[illegible]	[illegible]
Net input	18.6	16.2	[illegible]	[illegible]
Gross input per car-mile.	1.27	[illegible]	[illegible]	1.68
Net input per car-mile...	1.06	[illegible]	[illegible]	1.68

traffic necessitates comparatively high schedule speeds and frequent stops.

Having thus established the feasibility of obtaining regeneration without imparing the decided improvement in accelerating efficiency and efficiency on intermediate run-

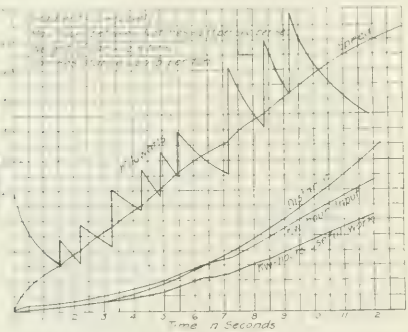


Fig. 5—Calculated Acceleration for Double-Series Parallel with Field Control.

ning notches due to the practical elimination of armature resistances, a number of equipments were designed and built incorporating the ideas tested at this last Newcastle trial. Several of these equipments were installed and

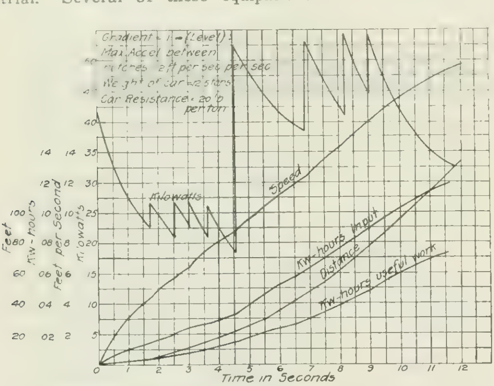


Fig. 6—Calculated Acceleration for Double-Series Parallel with Field Control.

tested both at Norwich, in England, and at Solingen, in Germany.

In subsequent articles details of these tests will be given to show the practical value of regeneration, estimates will

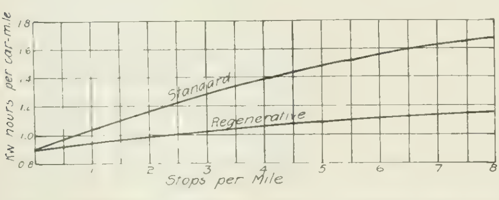


Fig. 7—Comparative Increse of Energy Consumption with Increase of Number of Stops.

be made of the comparative costs of standard single-series-parallel and double-series-parallel equipments, and the cost of maintenance of a standard equipment will be compared with that for single-series-parallel and double-series-parallel equipments.

THE OPERATION OF INDUCTIVELY COUPLED RECEIVING SETS IN WIRELESS TELEGRAPH

An account of a series of investigations on the opera n of inductive tuners in wireless-telegraph receiving se is given by Lieut. J. O. Mauborgue, Third Infantry, Ui d States Army, in the report of technical conference N 14 of the Army Signal Schools of Fort Leavenworth, n. The tests described included use of the inductive t er alone and with variable air condenser in secondary series with the primary and in parallel with the prin From characteristics shown by curves plotted betv wave-lengths and coupling ratios, the author conclud follows: Varying the coupling varies the wave-le Regardless of coupling used, apparatus is always tun two wave-lengths at same time. This double period was illustrated by pulling out the secondary coil to a tion "30," when the equipment is tuned to both a 13 and a 490-m wave. Use can be made of this double quency in avoiding a station operating in the lower r ter while continuing to listen to the desired statio changing primary inductance. In tuning with an indu tuner alone the longest wave-length is obtained wit primary and secondary inductances at a maximum an coupling as close as possible. With a variable conden series with the primary inductance loosening the cou causes a rapid drop in the wave-lengths of the higher and a similar rise in the lower curve, enabling the ope to eliminate an undesired station with a short wave-le In conclusion the author declares that the most sel device would be an inductive tuner having its pri variable by single turns, and with a variable cond capable of being connected in either parallel or series the primary, and a variable condenser of small value a the secondary.

DETERMINATION OF THE EFFICIENCY O SMALL HYDROELECTRIC GENERATING STATION.

The efficiency of small electric generating plants d by waterwheels is a matter of considerable importance. revenue derived by such stations from operation is almost insignificant in comparison with the annual in of plants serving even towns of a few thousand inhabi but in view of the large number of such stations in s and the value of water utilized in individual cases the lems of efficient service are of wide interest and si cance. In the following paragraphs are outlined the ods and results of an efficiency determination made unusual care upon a plant of 75-kw rating located factory village of 2500 inhabitants.

The chief industry of the town was the manufactu shoes, and the plant was originally built by the owne shoe factory for his lighting and power service. Th of an old sawmill was used, together with a canal had served the former. The plant was located half a from the factory and supplied power and lighting s generally throughout the village, of course, in very all quantities. The stream from which the water suppl was drawn was without sufficient storage capacity to car the plant through the year, so the installation was com ted by a supplementary steam plant consisting of two 1 -hp horizontal return tubular boilers and a 60-hp engine. The hydraulic equipment consisted of a 15-in. and an 18-i set of wheels mounted on the same horizontal shaft i one casing, but with two separate gates. The waterwheels ere controlled by a Lombard governor and the generator s a 75-kw, two-phase, 60-cycle Westinghouse machine, ith exciter and Tirrill voltage regulator. The water pply was drawn from the river by a canal about 2500 ft ong

[illegible] an effective head of 25 ft. was obtained on the wheels. [illegible] the draft tube equipment exhausted directly into the [illegible] stream it was impossible to measure the water after [illegible] it the wheels. A weir was accordingly built in the [illegible] The efficiency curve of the generator was known [illegible] previous tests, and the electrical output was measured [illegible] usual way. Belt losses and losses in the governor [illegible] included in the determination of power delivered to [illegible] generator. The weir was built with two end contrac- [illegible] notch with a width [illegible] it of about 1 ft. The canal at the weir site was of [illegible]oidal section and 13 ft. wide, with a rock and gravel [illegible]n. It was necessary to drain the canal while building [illegible] weir, this work being done on a Sunday, while the sta- [illegible] was shut down.

[illegible] the weir construction a framework was made by [illegible] in vertically five 2-in. x 4-in. joists and then fasten- [illegible] horizontal pieces of the same size against them on the [illegible] am side. The framing was well braced on the down- [illegible] side. On the upstream side there were driven vertically ⅞-in. matched boards, nailed to the cross pieces, le[illegible]ing a notch 6 ft. 2 in. wide. The bottom of the notch w[illegible] about 30 in. above the bed of the stream. The matched b[illegible]rds gave a very tight construction, while the bottom a[illegible] sides were made tight by filling in with clay and turf. I[illegible]order to obtain sharp edges on the notch ⅛-in. x 3-in. ir[illegible] plates were attached on the upstream side, overlapping [illegible] notch so that its width was reduced to 6 ft. The usual hook gage was fastened to a bridge about 10 ft. from the crest of the weir. Later it was found necessary to lower the notch of the weir about 6 in.

Excess water was handled by a wasteway located in the forebay. The amount of water flowing over the wasteway was measured by checking the readings of hook gages at the wasteway flashboards and at the weir, there being practically no leakage through the wheels.

The output of the plant was measured by portable electrical instruments placed in the secondaries of instrument transformers, all being calibrated. In series with each of the two phases was placed a series transformer giving a ratio of 15 to 1. Transformers with a much smaller ratio would have been more satisfactory, but were not available. In the secondary of each transformer were placed an ammeter and the current coil of a wattmeter, short-circuiting plugs being provided so that the instruments were protected when not in use. Across each phase was connected the primary of a shunt transformer having a ratio of 20 to 1. The secondaries were connected to the potential coils of the wattmeter, care being taken to avoid putting the potential of one phase on the wattmeter taking current from the other phase. One 110-volt instrument and a double-throw switch enabled the voltage on each phase to be read. All connections were made behind the switchboard and the instruments were grounded so that the maximum potential from any instrument to ground was 110 volts.

The results of the tests are given in the above table.

Water [illegible] (Wheel.)	Water [illegible] (Wasteway.)	[illegible] Wheel. (Horse-Power.)	[illegible] Wheel. (Revolutions per Minute.)	Output of Generator, in [illegible]	Power-Factor. Per Cent.	[illegible] Generator Per Cent.	[illegible] Wheel. Per Cent.	[illegible] Per Cent.
19.5	5.13	55.0	[illegible]	18.46	80.1	77.5	58.1	45.0
[illegible]	4.75	[illegible]	[illegible]	[illegible]	97.5	81.6	70.8	57.8
[illegible]	4.5	52.0	347	23.71	76.5	81.4	75.2	[illegible]
[illegible]	0.37	62.5	347	25.13	89.0	82.5	65.4	53.9
15.43	7.18	[illegible]	347	15.08	97.0	75.0	62.0	46.6
20.26	2.35	56.0	347	15.08	97.0	75.0	[illegible]	[illegible]
18.9	4.20	53.4	347	23.74	72.1	81.6	73.1	59.6
21.07	2.03	59.6	347	21.77	82.0	80.0	61.3	49.0
11.10	12.0	31.75	347	No load gate	0.3 opening.			
11.6	5.88	33.02	347	7.39	100.0	60.0	50.0	[illegible]

Central Station
Management, Policies and Commercial Methods

S[illegible]CKERS TO CREATE SHOWROOM INTEREST.

[illegible]e Public Service Electric Company of New Jersey h[illegible] prepared several 4½-in. x 5-in. stickers reproducing in b[illegible]iliant colors interior views of its Newark apparatus disp[illegible]-rooms, which are attached to customers' bills for the p[illegible]pose of creating an interest in the company's appliance e[illegible]ibit. The views reproduced include the main show-r[illegible]m, electric-lamp section, basement showroom and en-tr[illegible]ce doorway. The company's offices are handsomely fit[illegible]d up in white marble with bronze fixtures and trim-[illegible] and the illustrations by the four-color process make [illegible]king appearance which serves to attract many cus-[illegible]rs to the central-station offices.

C[illegible]NTRAL-STATION KEY TAGS FOR REAL-ESTATE AGENTS.

[illegible] large Western central-station company has furnished ea[illegible] of seventeen local real-estate agents with 100 label tags f[illegible] house-renting keys. One side of the tag is blank for the address, and the reverse bears the legend, "When you are ready for electric light and power, telephone ——— Electric Company, ———." The card presents a reminder to the newly settled householder, informing him whom to call up to have service turned on or his house wired. The real-estate men are much pleased with the tags, and the electric-service company's office was soon deluged with additional requests after the first lot was sent out.

ELECTRIC-VEHICLE HANDBOOK.

The New York Edison Company has just issued for the benefit of electric-automobile charging customers and others interested a 130-page handbook on "The Electric Vehicle, Its Construction, Operation and Maintenance," prepared by Mr. Norman G. Meade. Following a chapter devoted to the general description of both pleasure and commercial cars, including discussions of transmissions, drives, motors, controller positions, etc., other sections contain instructions for the operation and maintenance of cars

and storage batteries, care of batteries, etc. Special chapters are given on the subject of charging batteries from direct-current and alternating-current sources. The final chapter on miscellaneous information includes specifications for various types of trucks, followed by a dictionary of terms used in electric-vehicle practice. The handbook is fully illustrated by more than fifty half-tone and line-cut reproductions, and, while intended primarily for prospective automobile customers of the central-station company, the material has been prepared so as to be of service to garage employees and those handling electric vehicles. The handbook is given out upon application to Mr. Harvey Robinson, manager of the New York Edison Company's automobile bureau.

TUNGSTEN LAMPS ADVOCATED FOR RESIDENCES.

Opposition to the tungsten lamp for residence lighting on the part of central-station operators appears to be disappearing rapidly. In Chicago it no longer exists, if one is to judge by a recent newspaper advertisement of the Commonwealth Edison Company, which notifies its residence customers by this means that they can enjoy in their homes the brilliancy and economy afforded by the tungsten lamp. Attention is directed to a special tungsten outfit, comprising one lamp, either 40 watt or 60-watt in size, with pull-chain socket, shade holder and shade, sold for $2.40 for the combination. This amount may be paid in two monthly instalments. The title to this advertisement is "Double the Light in Your Home at No Greater Cost for Electricity."

DO GAS ARCS "STAY PUT"?

One way of estimating the satisfaction given by a device is to compare the number installed with the number that "stay put." If the gas companies were less reticent about giving out the number of so-called "gas arcs" taken out at the end of the trial period, these data would be of value to electric-light solicitors. However, the gas people are usually silent on this point in their open meetings, although occasionally a pertinent reference to the questionable satisfaction given by the gas arcs creeps even into their public sessions. Thus at the recent annual meeting of the Pennsylvania Gas Association Mr. J. V. Bout, of Williamsport, Pa., gave this advice to his fellow members in a formal paper:

"When replacing electric lamps with gas arcs it is advisable that the electric equipments be removed. This should be suggested, as they are no longer required, gas being perfectly reliable at all times. The place of business will have a much better appearance without them, and, in case the merchant is a man who finds it difficult to remain of the same opinion for any length of time, your suggestion may relieve him of this difficulty."

In other words, the method recommended for making a customer retain the "gas arcs" when once installed is to rip out the electric wiring so that he cannot go back to electricity if he concludes that he has been unfairly talked out of using it. Following this line of reasoning, a glib salesman offering kerosene or gasoline lamps shall ask his prospective customers to tear out both gas pipes and electric wires so that no victim can readily return to the superior illuminant when he finds out the really high cost of poor lighting.

Judging from the growing breadth and shrewdness of the merchants to whom such a proposition would have to be made, it seems hardly credible that any considerable number of them would be led to abandon their ready access to electric lighting and incidentally to the use of fan motors which may be needed all the more when the gas arcs begin to radiate their heat. However, the fact th such a recommendation is made in a formal gas associ tion paper shows to what extremes some gas advocates fe that they must go if they want their lamps to "stay put."

ENERGY CONSUMPTION OF CUSTOMERS' REFRIG ERATING PLANTS.

Some figures on the quantity of energy consumed du ing the year by several customers' motor-driven refri erating installations in Canton, Ohio, were given by M W. C. Anderson, manager for the Canton Electric Con pany, before the Ohio Electric Light Association, July 2

Of the ten such installations now in operation in Cant several have been in use for eight or nine years, and a have been operated with entire satisfaction to their ow ers. Below is given the consumption, in kw-hours, of eac of the six of these plants which are so metered as to gi results available for comparison.

ENERGY CONSUMPTION OF REFRIGERATOR INSTALLATION.

Tons refrigeration	3	3	5	3	5	3
Motor horse power	7½	10	20	7½	26	16
January	146	646	1,950	..	51	51
February	70	733	2,210	.	34	12
March	112	846	2,070	286	102	89
April	322	1,627	2,600	1,528	1,240	2,16
May	247	1,654	2,850	1,622	1,139	1,92
June	403	2,826	3,600	2,050	1,069	1,97
July	343	4,718	6,040	2,062	2,649	1,97
August	540	5,633	5,590	2,060	2,518	2,21
September	591	4,174	4,790	1,712	2,100	2,20
October	576	2,145	4,200	1,476	1,639	2,05
November	453	1,161	2,630	804	944	1,54
December	335	229	3,310	.	936	26

During the discussion Mr. W. S. Culver, of Schenectad N. Y., spoke of the attention given to combination ic making by the technical press, citing articles that ha recently appeared in the *Electrical World*. He also a nounced progress work on a refrigerating system, chemic in nature, which is being brought out for the use c individual families, and which will employ a small mot of ⅛-hp to 3-hp rating, running continuously througho the twenty-four hours.

HEATING-APPLIANCE CAMPAIGN METHODS I OHIO CITIES.

A town of 2000 population in Ohio rents electric irons t customers at the cost of 5 cents per week, which amount i included in the monthly bill, according to Mr. P. I Miles, of the Cleveland Electric Illuminating Con pany, who reported on the introduction of electric hea ing devices in a paper read before the Ohio Electric Lig Association at Cedar Point July 28. About 100 customer in the little town are now using electric irons, eighty o whom rent their irons from the company at this rate.

In a city of 80,000, said Mr. Miles, the company supple mented its extensive advertising campaign on heating ap pliances by sending out a wagon to make a house-to-hous canvass. A young lady demonstrator was also installe in the electric company's office, among her duties being t telephone prospective appliance users on washdays sug gesting that an electric flatiron be sent out to the home fo trial. These days were considered the psychological tim to tell about the comfort and convenience of the electri iron, and several hundred irons were sold as a result o the campaign.

The company in another city of 120,000 has now cease its efforts to advertise electric heating appliances, believ ing that its community is fully saturated. For some tim past this company had a display-room which proved suc

ssful. This room was also supplemented by an intensive vertising campaign with satisfactory results. Now, wever, that these utensils have been thoroughly introced to the public, and they have been informed through educative advertising campaigns of the many advanzes of this class of heating utensils, the company has ned the sale over to the local dealers, closing the dis-room and for the present stopping its advertising ng these lines.

n another city of 50,000 the contractors give an electric as a premium to the owner of each newly wired house, Mr. Miles, thus "killing two birds with one stone and uring both a lighting and a heating load."

LUMINATION OF CENTRAL-STATION OFFICE FRONT.

he Bristol Gas & Electric Company, Bristol, Tenn., has opened a new and elaborate office and salesroom, the t of which is shown in the accompanying illustration.

Illuminated Front of Central-Station Office.

design contains 1500 lamps, 300 red, 300 green and 900 te. The top of the sign represents an immense flame red lights twinkling. The zigzag across the front of building is in white lamps with a chasing effect, while pilasters are green, making a very artistic effect. The front was built at a cost of $900.

COLORADO ELECTRIC SHOW.

he second annual electric show of the Colorado Electric ub will be held in the Denver Auditorium Oct. 14 to Oct. inclusive. The financial management will be on a plan ewhat different from former ones. The stock company ch was formed and which figured in the distribution of earnings of the first electric show has been dissolved. Colorado Electric Club, which has since become a rporate body under the laws of the State, will be in comte charge of the exhibition and the profits will be died in a co-operative manner, the Electric Club and the exhibitors receiving equal shares. It is planned to feature Colorado's resources on a much more extensive scale this year than last, and for this reason all mining-machinery exhibits will be located in the basement of the Auditorium. Numerous underground tunnels and subways depicting the interior workings of a mine will be attempted in order to show mining men visiting the show the advantages of electric drive. Another feature which will be exploited will be the exhibition of electrically operated farm machinery, and the generating and transmission companies throughout the State are planning an elaborate display to demonstrate the possibilities of the electric pump. A miniature farm plot will be constructed in the basement of the Auditorium for this purpose. The street-lighting effects of the last show will be reproduced at the coming show on a more lavish scale, but the interior decoration and illumination of the Auditorium will be much the same as last year, with the exception that the large electrical curtain portraying the Pike's Peak sunset will be displaced by a dancing vaudeville girl. This effect will require the use of some 1200 lamps. The booth arrangement will be the same as last year. Much is promised in the way of entertainment. The freakish whims of high-frequency currents will be repeated with innovations under the supervision of Mr. J. F. Reardon. Mr. Clare N. Stannard, chairman of the entertainment committee, has several unique schemes under consideration, announcement of which has been deferred until a later date. The Sons of Jove will hold a convention during the week of the show and many special features will be arranged for the visiting Jovian delegates on one night which will be set apart for their benefit. The following board of directors will be in charge of the exhibition: Mr. W. P. Carstarphen, Jr., president; Mr. H. L. Wolfenden, vice-president; Mr. W. F. Brown, second vice-president; Mr. C. F. Oehlman, secretary-treasurer, and Messrs. W. G. Matthews, Clare N. Stannard, B. S. Manuel, J. F. Dostal, Irving Hale, F. F. Greenawalt and J. F. Reardon.

SAPULPA'S ELECTRIC-LIGHT WELCOME.

Sapulpa, Okla., is in the center of one of the greatest oil fields in the world, 8000 wells being in operation within a radius of 7 miles of the city hall. The little city is also a junction point and division headquarters of the "Frisco" Railroad, and many through trains are stopped there for

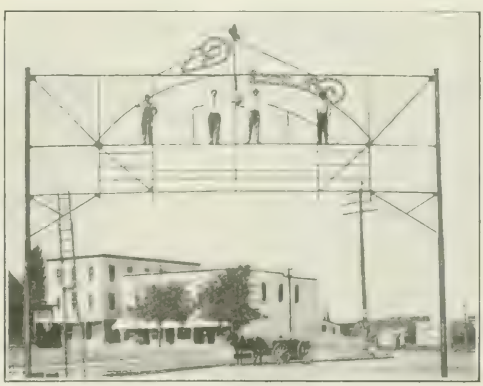


Fig. 1—Sign Under Erection.

waits of from twenty minutes to one hour. To advertise the community to the thousands of passengers who traverse this trunk line to the Southwest, the Sapulpa Electric Company has just erected and presented to the city the hand-

some spectacular sign illustrated herewith, bearing the words, "Sapulpa, the Oil City of the Southwest." The sign is on one of the principal avenues of the town, opposite the station, where trains meet from three directions. The display comprises 1000 5-watt tungsten lamps and is

Fig. 2—Sapulpa's Electric Sign at Night.

erected on two iron poles with angle-iron framework carrying the sign proper.

The operation of the sign is as follows: The fancy scroll border is first flashed on in green, followed by the word "Sapulpa" in 3-ft. letters. Then appear the lines "The Oil City of the Southwest." After all letters on the sign are burning the "flames" on the word "O-i-l" flash on with a twisting, irregular burning effect, giving an excellent representation of the flaming of an oil torch.

The cost of operating the sign is $75 per month, or $2.50 a day, and the sign gives publicity to the town and draws forth favorable comment which could not be obtained in any other manner for several times the cost.

The Sapulpa Electric Company has received the warmest appreciation from citizens and city officials for the progressiveness and "booster" spirit indicated by the installation of this sign. A ten-year contract with the city for the operation of this sign was recently obtained by Mr. A. Larney, new-business manager for the Oklahoma Gas & Electric Company, which, like the Sapulpa company, is under the management of H. M. Byllesby & Company, Chicago.

CONTINUOUSLY CONNECTED ELECTRIC RANGES IN CLEVELAND.

Thirty-two of the continuously connected electric ranges employing the fireless-cooker principle (described in the *Electrical World* of April 27, 1911) are now in use on the lines of the Cleveland Electric Illuminating Company, the thirty-third being retained in the offices of the company for demonstration purposes. Fifteen other generally similar ranges, but having an improved positioning of the oven and heater parts, are now ready for delivery to Cleveland, where they will be put into domestic service in customers' premises.

The feature of these Cleveland ranges of special central-station interest is the twenty-four hour continuously connected 150-watt heating elements inclosed in the thermally insulated oven, which is thus maintained at a temperature of 400 deg. Fahr. and suffices for all cooking operations except frying and broiling. For the latter a 1500-watt radiant-type heating element is also provided inside the oven, and for frying two 400-watt and two 1600-watt disk heaters are arranged on the shelf. These heating units are controlled from push switches, high and low heats being indicated by switchboard-type target lamps. The radiant broiling unit is automatically cut off when th oven door is shut. The 150-watt heating element, inclos in its heavy iron casting, is permanently connected acro the service mains so that it takes 150 watts continuous and cannot be interrupted except by unscrewing the fu plugs.

In the fifteen newly improved ranges for the Clevelar company the convenience of the housewife has been bett served by mounting the oven at the side of instead below the shelf carrying the heater disks, bringing a parts of the range at a comfortable height above the floo In other respects these ranges are generally similar to th original thirty-three.

A very complete series of tests carried out on ranges the above types in actual domestic service have reveal the high load-factor obtained through the combination the continuously connected unit with the short-demar heaters. Curves summing up the total consumption equiva lent to 160 days' use of one range for family cooking sho an average demand equal to about one-third of the max mum recorded peak of demand, indicating an eight-hou load-factor for the range. The total consumption show by these Cleveland ranges for equivalent service, howeve slightly exceeds that of the ordinary high-demand shor hour ranges on the market, which have, of course, ve low load-factors. The high load-factor of the Clevelar stove would entitle it, therefore, to a lower rate from central-station standpoint than the short-demand range but for the thirty-two stoves on its lines the Clevelar Electric Illuminating Company charges the same rate 5 cents per kw-hour, collecting an average bill of $10 month from customers having these stoves in use in the kitchens.

Not content with achieving a 33 per cent load-fact range, Mr. M. E. Turner, contract agent for the Clevelar company, to whom the idea and practical application of th continuously connected heater are due, now has near ready for trial operation in his city a dozen other range having a 100 per cent load-factor of their 500-watt d mand. Unlike the former Cleveland stoves above me tioned, these new unity load-factor ranges have no oth heat elements except the 500-watt heater, which, contin ously connected, provides heat for baking, roasting, fr ing and all other cooking operations. If desired, a 300-wa

Illustration from Booklet Advertising the Continuously Connecte Electric Range.

continuously connected water heater may be provided part of the range at the option of the purchaser. Such range, taking energy twenty-four hours a day, will enab the central station, it is expected, to fix special rates f long-hour service, lowering the cost of electric cooking

a point not desirable with the mixture of continuous and short-hour demand of the earlier stoves.

Besides its present thirty-three continuously connected ranges the Cleveland company has on its lines about seventy of the ordinary intermittent-type ranges.

The domestic advantages of the fireless electric cooker are attractively set forth in a booklet issued by the company. The following quotation is taken from the opening paragraphs: "In the summer months it almost comes to a question of deciding whether the family shall have warm, well-cooked meals, and the housewife or cook suffer with prostration from bending over a hot stove, or whether she shall give the family cold victuals and have them all suffering with indigestion.

"The new electric oven solves this problem completely. Its heat remains inside. You can have bread baking in the oven and a brick of cream on top of the oven without affecting the latter's solidity in the least. * * * There is no waste of heat—no radiation from the stove to make the kitchen hot or unhealthful."

DISTRICT OFFICE OF THE BOSTON EDISON COMPANY.

The Newton-Watertown district office of the Edison Electric Illuminating Company of Boston is one of the attrac-

Fig. 1—Exterior View of the Newton-Watertown District Office.

tive district headquarters of that company. It is located in Nonantum Square, Newton, Mass., in about the center of

Fig. 2—Interior View of the Newton-Watertown District Office.

the district with reference to population. The district, which embraces the city of Newton and the town of Watertown, contains a population of 52,081 and has an area of 22 1/10 square miles.

The number of customers served in the district is approximately 2500. There are 80,000 50-watt equivalents in lamps and about 500 motors with an aggregate of about 3000 hp connected.

The office is attractively decorated with prints of the company's central power plant and several substations and is lighted from drop lights and some attractive shaded table lamps. Customers use the office as a place to pay bills and exchange lamps, which the company does without charge.

Wiring and Illumination

FOREIGN STREET-LIGHTING DATA.

In a series of four articles appearing in recent issues of the London *Electrical Review,* Mr. L. Crouch presented a general review of the subject of street lighting which contained numerous interesting data. Table I contains a summary of illumination values recommended by various authorities for London, Paris and Berlin streets. The ratio of maximum to the minimum illumination falls as low as 5 in certain of the main Berlin streets where flame-arc lamps of the latest type are used. This remarkably uni-

TABLE I.—AVERAGE ILLUMINATION ALLOWANCES IN LONDON, PARIS AND BERLIN.

	Minimum.	Maximum.	Mean.
	Foot-candle.	Foot-candle.	Foot-candle.
Smallest side streets.	0.0085	0.85—1.28	0.13—0.26 or 0.34
Fairly busy streets.	0.128	4.25	0.425—0.85
Main streets........	0.170—0.255	8.5—12.8	1.70

TABLE II.—APPROXIMATE PRESENT USE OF VARIOUS LAMPS IN STREET LIGHTING IN THE UNITED KINGDOM.

Incandescent Lamps.		Arc Lamps.	
Carbon Filament.		*Inclosed.*	
16 cp and under	3,000	5 amp to 7 amp	1,000
25 cp to 50 cp, inclusive	1,700	Miscellaneous	2,400
Miscellaneous	3,600	*Open.*	
Nernst.		5 amp to 7 amp	720
0.5 amp	980	7 amp to 10 amp	6,400
1 amp	150	12 amp to 15 amp	1,150
Miscellaneous	570	Miscellaneous	3,400
Metallic Filament.		*Flame.*	
16 cp	1,300	8 amp to 10 amp	1,500
25 cp to 50 cp, inclusive	10,900	Miscellaneous	2,200
100 cp	2,500	Mixed arc lamps	8,500
200 cp to 1,000 cp	400		
Miscellaneous	37,000		
Carbon and metallic filaments mixed	12,900		

TABLE III.—PERCENTAGE VALUE OF VARIOUS ANNUAL CHARGES.

	Percentage Value of			
Type of Lamp.	Capital Charges	Energy	Renewals	Attendance
Ordinary arc	[illegible]	81.8	3.6	[illegible]
Flame arc.......	10.8	50.[illegible]	23.2	15.4
Metallic filament	7.1	[illegible]	11.7	1.[illegible]
Carbon filament.	[illegible]	82.[illegible]	[illegible]	2.[illegible]

form illumination is attained by the use of high candle-power units mounted at great height. In Table II is given an approximate estimate of the number of lamps of various kinds used for street lighting throughout the United Kingdom. In Table III are shown relative values for interest on investment, cost of energy, renewals and attendance for various types of lamps under London conditions.

ECONOMICAL INTERIOR WIRING CONSTRUCTION.

By W. J. Canada.

The electrical interests of this country, through a gradual growth in exchange of convictions and in resultant harmony between service company, wiring contractor, manufacturer and underwriter, have evolved interior wiring methods and material which would seem to be almost foolproof, and whose initial cost is warranted only by a proved long life and low maintenance expense. Service companies in the past have too frequently looked at the immediate cost and have not seen the permanency and safety thereby secured. They have been the conservative influences resisting innovations in city and underwriters' requirements for extra mechanical protection and better insulation, just as underwriters have been the conservatives where devices of questionable safety were concerned.

To-day conduit protection for wires, cabinets for cut-outs, restricted use of flexible cords and like minimizing of experienced frailities and fire hazards have given electricity the public confidence and have vindicated themselves as the best possible wiring methods with known materials. The underwriters can suggest no greater measure of safety and the service company wishes no less permanent vehicles for safe transformation of its product to the purchasers' use. Some attempts to introduce here methods which have proved satisfactory in the countries of Europe meet with the same obstacle in the way of reduced personal responsibility which is at the root of our national fire waste, our impressive yearly industrial death roll and our other tributes as a nation to a mistaken application of the personal liberty idea.

But with the completion of a conduit system, fuses, switches, wire insulation, all protected cord eliminated, and chances for overheating or harmful arcs apparently gone, the inspector releases the masterpiece of safety to the spirit of carelessness that pervades us. The owner is occasionally thoughtful, but is then at the mercy of his wiring contractor and his various tenants and, most of all, subject to the irresponsibility and petty vanity of tenants themselves or of their employees. A year's changes in this reliable, safe installation will introduce many hazards; five years will necessitate expensive changes to restore the original condition. This being the case with modern installations, it is small wonder that wiring of an earlier day and open wiring as even now installed, with open fuses, cords within reach and unarmored wire insulation, invite defective additions and changes most enticingly and effectually. Thus some of the most rapid depreciation of open wiring systems may be accounted for.

It has become increasingly apparent that only a financial depression of absolutely unprecedented severity and continuance can possibly so change the mental attitude of our citizenship as a whole as to introduce the European standards of painstaking and of law observance, of abhorrence for the continual expense of frail construction and of fear for the greatest destroyer of material wealth—fire. The German seems to appreciate that material wealth is the product of the community and for the ultimate benefit of the people and accepts fully the conviction among thinking men that no individual has a moral right to destroy this beneficial wealth. Our citizenship misconstrues individual liberty into license from any interference by law with carelessness which must and does result in frailty and fire loss, and which to the supposedly less advanced European would seem criminal. Our fire devastations in the last ten years would have bankrupted any other nation, and yet 90 per cent of our population never pause to consider the cause of this effect, in carelessness, first by poor construction laws, then by poor law observation and finally by lack of personal responsibility in maintenance.

Educational methods involving the broadest publicity and utilization of the most popular appeals have been adopted by underwriters and service companies, and some impression is apparent on the public mind. The slow growth in public acceptance of restraint is, however, a most evident fact. No attempt has ever been made to secure restrictive legislation by our federal government for interior wiring and its subsequent maintenance. Few of our States have ever passed any statutes on the subject. Fortunately, our municipalities are awaking to their responsibilities and though much involved still with politics and frequent incompetency, our municipal restrictions are the present stronghold of the defense of community welfare against the aggressions of individual license, in the name of initial cheapness, upon easily maintained and permanently safe building construction.

The matter first to be considered by the municipality has been the character of construction to establish as a standard. The National Electrical Code is the product of early and continued co-operation in the early days of electricity between the various electrical and insurance interests, and has been so well guided as to be to-day the most widely accepted material standard in the world and the code of specifications most widely incorporated into ordinances. Its detractors daily are fewer, their criticisms of less moment. Its faults are eliminated as rapidly as practice demonstrates a need.

The electrical problem most sharply confronting underwriters and municipalities to-day is the maintenance of initially good conditions by prohibition of changes which introduce weaknesses. On a par with this problem is the related one of restoring to a permanently safe condition those older wiring installations in which originally frail material and methods have rapidly succumbed to the deterioration of time and the depredations of unauthorized or irresponsible workmen. Of these problems the latter belongs essentially to the underwriters, by whom it is being conservatively solved by publicity methods, personal presentation to owners, and finally by adjusting insurance taxes so that a greater proportion is contributed by those owners maintaining larger electrical fire hazards.

The former problem is being to some extent attacked in our more progressive cities by adoption of annual reinspections, which not only secure physical rehabilitation but also induce personal interest by owners and tenants in their respective avoidance of future expenditures of this nature. A rigid yearly inspection may readily be changed after a few years to one at longer intervals, as education of the wiring public will be rapid.

The suppression of further wiring without metal protection or runways is a first requisite of reduced maintenance cost and safety. This has been done by ordinance in advanced cities, but is still lacking in most of our communities. Other forms of wiring entail probable injury to wires and interference with them. Their certain deterioration must ultimately bring about lack of safety and the end of their economic life. The uninformed owner of property, rarely the one who paid for the original installation, sees in an enforced renewal an unforeseen duplication, an injury to decorations and a poor relation of electric wiring permanency to that of other portions of his building. The rewiring may be necessitated by serious overloading, by contacts, crosses, broken insulation, the result of mechanical interference, or may be mere deterioration. On the principle, however, that we rarely abandon articles even when uneconomical to use, the wiring is changed usually at the instance of the underwriters, or sometimes of particularly efficient municipal inspectors, and the indefinite grievance of the owner is directed at them.

Until underwriters and municipalities restrict their recognition of any other than metal-protected wiring entirely to dwellings in residence districts, they will be under suspicion of much shortsightedness if not lack of good faith. An approval of open or concealed knot and tube work, only to be condemned or charged for in insurance ratings a few years

after approval (the exact time before necessity for condemnation arises depending only on the character of building construction and occupancy), rightly lays the authority first recommending such construction under strong disapproval of a hastily judging public. An attitude of reluctance in approval of such wiring or, better yet, an active eral campaign for conduit and related construction, together with personal conference with building owners and itten recommendations to that end, will justly place the erwriter in a position of vantage in the few cases re diplomacy and persistence still fail to bring about adoption of the permanent construction. The municility which has reached the point of adopting restrictions hould rapidly arrive at a point where consideration of fuure welfare is effective enough to produce a conduit reurement for new and rewiring.

uite recently in Colorado Springs, Col., a bitter if futile ck was made upon one of the best considered and most ervative electrical ordinances in the country, contain the conduit provision throughout fire limits and for mbling occupancies within city limits, bringing up as ment that underwriters made no extra charge where ler forms of construction were employed. The city trician simply stated that the city should certainly stand permanent safety if underwriters did not and that in pinion the time would shortly come when underwriters ld distinguish in rate between enduring and frail types wiring and avoid the subsequent ill feeling produced by r condemnations of the latter construction after it has ered the vicissitudes to which it is by nature subject.

n spite of the possible ultra-conservatism of underters toward abandonment of early standards, except ere proved initially hazardous, their growing championof conduit ordinances and emphasis on its ultimate rance benefits seem to herald their recognition of its er measure of fire-hazard. The more progressive servcompanies are equally desirous of avoiding any susion of comparative frailty in wiring and strongly back conduit movement.

pon reinspection work the municipality should enter h thoroughness and require the corrected installation to inate all temporary features of every kind. An exstive treatment in the first reinspections will obviate essity for great frequency of following ones. The use flexible cord instead of permanent construction for adonal lamps, the use of pendants and even lack of guards ere stock is handled at or above the lamp level, the use paper lamp shades, the overloading of circuits and feedby additional lamps, motors or heaters, the installation home-made time switches, displays, etc., all are common es of even the best installed wiring systems, and of rse are more numerous, because more easily attached, he less protected forms of wiring. The above faults are ommon as to seem to many concerned in energy supply l even in wiring inspection to be inherent to the interior lications of electrical energy. Too often inspections of ge new additions or changes in the building wiring are le perhaps conscientiously but with absolute disregard r the growing defects of the original system.

his attitude is responsible for the respectable list of and fire loss and the unsatisfactory service which still attributable to modern wiring and which many times rnishes excuse if not reason for unpleasant citations by ers of other illuminants. The attitude is due to an unected interest rather than lack of interest and partially the unfortunate system so generally adopted by our cities ich fosters the concentration of effort by municipal inction departments too largely on income increase as ainst actually greater returns to the municipality in more sily maintained wiring and reduced fire losses.

Recently in a Western city a manufacturer of gasoline ghting systems leased one of two exactly similar buildings, ected adjoining, equipping his building with a hollow-wire gasoline system. The other building possessed a conduit-wiring system. The gasoline arrangements subjected the one building to extra insurance charges. Within the year a small fire occurred through the abrasion of insulation on a flexible cord in contact with stock in the electrically illuminated building. An easily avoidable and noninherent wiring defect thus became responsible for many harmful comparisons.

In a majority of cities the only check on abuse or defective additions to standard wiring is the very irregular reinspection of buildings by underwriters to report on changed conditions of occupancy. Even then it is often inadvisable to apply insurance charges for minor defects, and the owners or occupants will consider the lack of charge to offset the recommendations of underwriters for re-standardization.

The problem is essentially for the municipality and is being gradually so recognized and worked out in our better regulated cities. When by educative processes our municipalities come to require initial conduit construction and enforce its proper maintenance a degree of permanence and safety will be given interior wiring which will add to the convenience, variety and attractiveness of electrical applications that sustained cheapness which has up to this time delayed their more general adoption. We will have our entire urban population customers instead of the present 20 per cent to 60 per cent, and the amount per capita now spent on rewirings and electrical fire losses will be diverted to investment in new applications of electricity and to the replacement of other illuminants. For this result we require a more aggressive co-operation of electrical interests toward permanent construction, the elimination of frail appendages wherever possible and, most of all, the development of the reinspection idea and its general rigid adoption throughout the country. In the early accomplishment of this result electrical engineers and organizations will be doing good pioneer work for the conservation of our created material wealth.

RECENT TELEPHONE PATENTS.

UNIVERSAL CORD CIRCUIT.

When magneto and common-battery lines are terminated upon the same switchboard position the connecting-cord circuit must usually be arranged so as to be operable with either class of lines to which it is to be connected. Such a condition similarly exists where toll lines and common-battery exchange lines are to be interconnected. The adjustment of the cord circuit is sometimes accomplished by manually operated keys, the operator being trusted to switch for any particular condition of the connection. In other cases the switching is made automatic by arranging relays to perform the circuit changes. To accomplish this the relays respond or remain stationary according to the line jack to which the cord pair is plugged.

Since each of these systems has points of superiority not possessed by the other, the two methods can be combined to advantage to meet all conditions, as has been done by Mr. E. D. Hall, of New York City. He arranges a manual key to make certain alternative conditions and supplements this with a relay which performs its function irrespective of the position of the manual key. Mr. Hall has obtained a patent for his circuit, which he has assigned to the Western Electric Company.

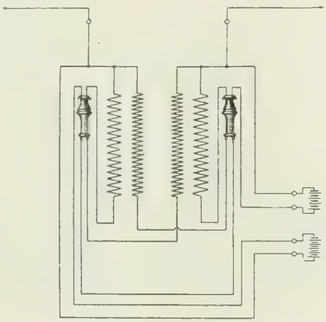
PHANTOM CIRCUIT SYSTEM.

A phantom circuit is obtained by so associating repeating or retardation coils with each of two-wire or physical circuits that a third non-interfering circuit is formed. In order to accomplish this effect a neutral point must be founded for each physical circuit to which the terminal of the phantom is attached. The establishment of this neu-

tral forms part of the novelty of the present system, which has been patented by Mr. H. O. Rugh and is assigned to the Sandwich Electric Company. He makes a bridge across the physical circuit near its end, this bridge consisting of a condenser, two exactly similar retardation coils and a second condenser. The link between the coils is chosen as the neutral point, being brought to this condition by making the condensers adjustable. A further feature is the signaling system. A bell is arranged with its circuit held open by a continuously energized relay. This relay has its circuit carried through both the front and back contacts of a second relay, the winding of which is in turn connected with the phantom. An intermittent current on the phantom causes a vibration of the armature of the connected relay, the armature of which releases the bell-control relay. This closes the bell circuit to signal the phantom station.

REPEATER CIRCUIT.

In the accompanying illustration there is shown a repeater circuit, the invention of Mr. W. Anderson, of Longdale, Okla. From the sketch it will be seen that the re-



Telephone Repeater.

peater is of the telephone-microphone type and that the two elements are so connected to the circuit as to be in series, the idea being to have the incoming and reinforcing currents in unison.

PARTY-LINE SET.

With multi-party circuits, such as rural lines, the battery is frequently quickly run down uselessly because of "listening-in" on the line. To obviate this Mr. R. C. Smith, of Homer, Mich., has patented a set in which the hook switch does not close the local-battery circuit. This must be separately closed by a push switch which locks in the closed position. When the receiver is restored to the hook the push switch is then automatically released.

BELL-LESS SIGNALING SYSTEM.

Mr. G. C. Cummings, of Western Springs, Ill., is the patentee of a signaling system with which no bells are required. The hook switch is so arranged that the receiver is left in circuit when the hook is depressed. A vibratory current of high frequency sent out upon the line will cause the receiver to sing and thus attract attention.

DEVICES FOR IMPROVING TRANSMISSION.

When telephone lines are loaded with distributed inductance to improve the transmitting efficiency the insulation must be kept high or the leakage will not only destroy the effect of the coils in bettering transmission, but the coils become a drag on the circuit. Considerable effort is being made to hold up the insulation of loaded lines under all weather conditions. Mr. L. W. Carroll, of Anamosa, Ia., has approached the subject from a negative direction. Instead of holding up the line insulation he has devised a coil shunt the resistance of which is subject to the weather. The arrangement consists of an insulating carrier with a double thread upon its surface. Each thread carries helix of bare wire, one being attached to each coil termin As the line leakage increases so does that between t helices, thus shunting the load coil.

Mr. J. A. Cuntz, of Hoboken, N. J., has designed a patented a new form of loaded circuit. He includes in l cable a magnetic core about which the conductors of ea pair are wound in opposite directions.

MISCELLANEOUS SYSTEM AND APPARATUS.

A signaling apparatus forms the subject of a pate granted to Mr. A. J. Dunton, of Ketchikan, Alaska. T telephone set is so arranged that the receiver faces a hangs just clear of the transmitter. When the distant st tion calls a relay operates to connect the battery circ through the receiver and transmitter, whereupon they mut ally respond and set up a "howl."

A return to first principles is evidently favored Messrs. J. B. Stemm, of Chicago, and G. E. Slade, of Broc field, Mo., as they have patented jointly a telephone syst using magneto transmission, one instrument serving transmitter and receiver. The coils of this instrument stationary, but the core, which is a small horseshoe magn is secured to the diaphragm, one leg projecting within separate bobbin within which it is able to move with obstruction.

A combined desk set and desk lamp is patented by Mr. J. Kerbel, of New York City. The electric lamps and tra mitter are within a dome shade at the top of the standa the transmitter well up to the apex. A hook switch w receiver is mounted at the usual height from the base the instrument.

Mr. I. F. Manny, of Milwaukee, is the inventor of step-by-step selective system, the patent for which is signed to the Selective Signal Company. An escapem controlled by current impulses permits a rotation of selective apparatus to select the desired station.

Mr. Otto Schmid, of Heilbron, Germany, has combi with a telephone set an apparatus similar to our duplic sale-slip register. The hook switch of the telephone locked until the paper in the register is advanced. Eve one is told to record his call. The next user must adva the paper to unlock the switch. Blank paper indicates p sonal calls. The length indicates how many such calls ha been made.

Letters to the Editor.

Stream Flow and Forestry.

To the Editor of the Electrical World:

Sir:—The writer, in his *Bulletin* on "The Flow Streams and the Factors That Control It, with Special Ref ence to Wisconsin Conditions," which is the subject of e torial comment in your issue of July 15, has not endeavo to prove that deforestation has had no effect on the flow streams. It is a popular superstition that deforestation l a radical effect on stream flow, and the writer has deavored to ascertain if such effects are manifest in flow of Wisconsin streams. He has stated (see page 8 "If deforestation has the effect claimed for it, such eff must be manifest within the period discussed (thirty forty years), otherwise we can but conclude the effects deforestation . . . are insignificant and unworthy consideration."

The editorial comment on the apparent effect of def estation on the flow of the Wisconsin River is incompl and, therefore, misleading. In your discussion of the hi water and low-water periods on this river you have selec about the only period that would illustrate your point regard to the possible effect of deforestation on high wat

al have ignored the question of rainfall, the manifest cause of all stream flow, which is certainly a most important element in the problem. Averages at the best are of little value, for it is only by careful consideration of the details of the problem that the probable cause of observed results can be determined. If there had been added to your published data a statement of the rainfall for each period you would have little reason to attribute the low water of the [illegible] fifteen-year period to deforestation; and if you had [illegible]ared the first and second sixteen-year periods, your suggestion as to the possible effects of forests on floods would have been reversed.

As deforestation is still in progress in Wisconsin, and to as great an extent as at the beginning of the period considered, there seems to be no reason why the entire period should not be considered. In the accompanying table the writer has shown the days of flood (gage over 10 ft.) and [illegible]w water (gage under 2 ft.) for various periods within [illegible] record, in order to show how the selection of the period [illegible] modify conclusions. He has in each case also added [illegible] total rainfall for each period, from which it is seen that [illegible] each of the earlier periods the rainfall was almost 20 per cent greater than in the later periods. This exceedingly low rainfall is a logical reason for low-water conditions that does not require the addition of deforestation as a further explanation.

The direct relation between the progressive means of annual rainfall, mean gage height and extreme low water, as shown by Fig. 68 of the *Bulletin*, and the direct cause of

[illegible]	TOTAL [illegible]		Total In he Rainfall	Exce Per Cent
	Above 10 feet	Below 2 feet		
[illegible] years	28	4	550.38	24
[illegible] years	69	2[illegible]	443.25	
6 years	62	4	582.65	20
[illegible] years	46	3[illegible]	480.58	
7 years	62	72	610.23	[illegible]
[illegible] years	67	232	518.96	
19 years	74	[illegible]	[illegible]	21½
[illegible] years	58	[illegible]	562.15	

extreme floods due largely to rainfall distribution, as shown [illegible] Fig. 50, makes the detailed relations manifest and war[illegible]s the writer's conclusions "that while theoretically for[illegible] will decrease the amount of precipitation reaching the [illegible]'s surface, thus decreasing the water supply of streams, [illegible] under certain circumstances may afford a limited stor[illegible] which may aid in the regulation of stream flow, yet the [illegible]ination of the actual flow of the streams of Wisconsin [illegible]s no indication of such effect," and "that if any effects [illegible] stream flow have resulted from deforestation, they have [illegible] entirely counteracted and obscured by the drainage of [illegible]hes, the clearing of farm lands, the second growth of [illegible]er and brush or other similar occurrences."

The writer agrees with you that the data are incomplete [illegible] unsatisfactory and that much longer and more detailed [illegible]rvations are necessary before the question can be en[illegible]y settled. He is further of the opinion that different [illegible]lusions may be entirely warranted under different con[illegible]ns and in different parts of the country. He believes, [illegible]ever, that a careful consideration of the data he has presented will show that no effects of deforestation are manifest in the flow of the streams discussed.

In conclusion, if the writer desired to argue in favor of [illegible] current theory of the importance of reforestation on [illegible] flow of streams, he would reverse your own expression [illegible]d state that he should hardly wish to advise anyone to [illegible]e the Wisconsin River as an example of the effects of deforestation on stream flow.

DANIEL W. MEAD.

Madison, Wis.

Loading of Telephone Cables and Open-Wire Circuits.

To the Editor of the Electrical World:

SIR: The article on "Notes on the Loading of Telephone Cable and Open-Wire Circuits," by Messrs. Parker and Cavers, in the issue of July 15, page 165, appears to set forth an erroneous theory and explanation of inductance loading.

The authors say: "The theory of loading is so to balance inductance and capacity in a circuit that they neutralize each other, and, as all telephone circuits contain far more capacity than inductance, it will be necessary to introduce more inductance into the circuits." This statement amounts to applying the theory of lumped inductance and capacity in a simple-series circuit to the case of uniformly distributed inductance and capacity, with resistance and leakage also distributed, as in a uniform line of open wire. The two cases are not alike. In the last case the inductance and resistance are serial with respect to the wire, while capacity and leakage are in shunt.

The ordinary line of open wire is never distortionless except in the critical case, long ago pointed out by Heaviside, when

$$\frac{R}{L} = \frac{S}{C} \tag{1}$$

At the same time the distortion in a line composed of conductors having unit magnetic permeability is very slight in its ultimate effect. It has been stated by several observers that a little leakage, such as that caused by moderately wet weather, improves the quality, and I believe personally that it is true. Excessive leakage, of course, impairs the volume, because it increases the attenuation, but unless the weather is exceedingly bad and the plant maintenance is poor, the effect of low insulation on non-loaded open wires is only noticeable in a very slight improvement of quality, if noticeable at all. If the transmission is initially very poor, as over a long high-resistance line, leakage then has more effect, of course.

As regards distortion in general, there is far more of it in the terminal apparatus, especially in transmitters, than there is in open-wire lines. In cables, however, the distortion due to the line is more prominent, because there is more capacity and less inductance than in open wires.

The outgoing impedance of an indefinitely long (theoretically infinite) line is numerically

$$K = \sqrt[4]{\frac{R^2 + \omega^2 L^2}{S^2 + \omega^2 C^2}} \tag{2}$$

and the angle is

$$\theta = \tan^{-1}\left(\frac{\omega C\beta - \alpha S}{S\beta + \omega C\alpha}\right) \tag{3}$$

When the leakage is zero and the inductance is relatively large (increased artificially), then

$$\beta = \frac{R}{2}\sqrt{\frac{C}{L}} \tag{4}$$

$$\alpha = \omega\sqrt{LC} \tag{5}$$

and the outgoing impedance is

$$K = \sqrt{\frac{L}{C}} \tag{6}$$

while the angle becomes

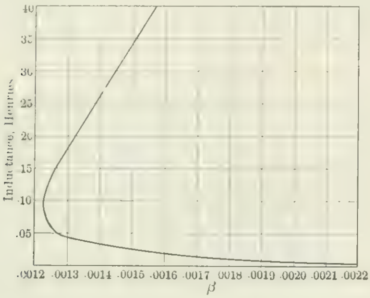
$$\theta = \tan^{-1}\frac{R}{2\omega L} \tag{7}$$

which is all derived from the general theory of distributed resistance, inductance, capacity and leakage. There is no effect such as the neutralization of capacity by inductance, at any frequency. The angle θ diminishes as $\frac{R}{2\omega L}$ becomes smaller, but never becomes zero; and R includes not only the apparent resistance of the line wire, but as well the apparent coil resistance per mile of line.

Fig. 2 (reproduced herewith) does not appear to be derived from the expression for attenuation, in terms of resistance, inductance and capacity. As a matter of fact, aerial lines have been loaded with coils having 0.25 henry each, spaced 2 miles apart, or more than 0.1 henry per mile, and there is no observed loss of efficiency by heavy loading. But the difficulties with heavy loading are threefold: First, the gain becomes relatively less as the loading becomes heavier, because of the added coil resistance along with the added inductance. In the next place, heavy loading results in high-line impedance and greater losses from leakage. Lastly, heavy loading results in greater reflection losses at terminals. And, of course, it costs more.

A spacing of 8 miles has been adopted in American aerial practice because it fits the requirements of the transposition system now employed as standard. At the same time, the gain in transmission is substantially as much as with heavy loading.

The quality of loaded aerial lines is no better than, and probably not quite as good as, the quality on non-loaded



Curve Showing Inductance Required to Give Values of β for No. 8 Circuit (3.95 Ohms for Loop-Mile).

lines. In the case of cables, however, the quality undergoes a marked improvement by loading.

The air-core coil has been tried, and was abandoned for several reasons. One difficulty lies in securing insulation and durability under weather exposure, without the use of metal housing or protection. Another is the fact that nails, screws or pieces of solid metal, anywhere within the field, raise the apparent resistance appreciably. Still another is the inability to obtain as low a resistance as is possible with the iron-core coil, if properly constructed.

The insulation problem requires particular attention, as American experience demonstrates. Porcelain insulators of a larger pattern have been employed in place of the old pony glass, with much improved results. Maintenance requires more attention for the same reason, and for the further reason that loaded circuits must be carefully balanced in order not to produce cross-talk or inductive disturbances and noises.

Chicago, Ill. FRANK F. FOWLE.

Improving Telephonic Transmission by Use of Repeating Coils.

To the Editor of Electrical World:

SIR:—After reading your editorial comment in the issue of July 15 on the valuable paper on "The Commercial Loading of Telephone Circuits in the Bell System," by Mr. Bancroft Gherardi, printed in full in the July *Proceedings* of the A. I. E. E., I am led to communicate an application of the use of ratio-wound telephone repeating coils in connection with telephone circuits having high-capacity cables as a part thereof, hoping that my experience may prove of use to others having similar conditions to overcome.

The problem of securing satisfactory transmission between Seattle, Wash., and Port Townsend, Wash., was a serious question, inasmuch as there is a 5-mile length of single-conductor government-type telegraph cable forming the link of the circuit between Point Edmond and Apple Cove Point in Puget Sound. This type of cable has an electrostatic capacity of 0.40 microfarad per mile and a resistance of 7.45 ohms per mile, the total capacity being 2 microfarads and the total resistance 37.25 ohms. The wire distance (No. 10 copper) from the shore end to Seattle is 20 miles, and the wire distance from the far end to Port Townsend is 40 miles, 2 miles of the latter being through cables similar to the above, looped and crossing Hoods Canal. The later twin cables, being relatively short and of approximately one-half the effective capacity owing to being looped, are not a serious influence in transmission. However, since it is necessary to have repeating coils at the shore ends of the longer single-conductor cable for translating to and from the loop aerial lines, this section of the circuit introduced disturbances and losses making transmission almost non-commercial.

Transmission was very greatly improved in both strength and clearness by introducing specially made repeating coils having the secondary sections in four balanced sections instead of two and connected in multiple. One terminal of the multiple secondary is connected to the cable conductor and the other to the armor of the cable. The primary windings in series are connected to the line wires in the usual way. It will, therefore, be observed that the line voltages are stepped down to approximately one-fourth through the cable and stepped up again on leaving it. It may be said that the same type of coil was previously used, but connected with the one-to-one ratio.

The fact that the difference of potential determines the "charging current" and that this current is a function of the idle power surging due to the capacity of the cable led the writer to adopt this method of suppressing such losses.

Though there is one station between Seattle and Point Edmond and four stations between Apple Cove Point and Port Townsend, ringing by pole-changer or hand generator is satisfactory. The bells have a resistance of 1600 ohms and have 2-microfarad condensers in series. The repeating coil, which is of the toroidal type, has a total secondary resistance of 30 ohms of No. 26 wire, 1200 turns. The total primary resistance is 35 ohms of No. 25 wire, 1200 turns. Thus the secondary resistance with windings multiplied is 1.875 ohms.

A like connection to a single-conductor cable of the same type is made between Point Defiance, near Tacoma, Wash., and Vashon Island, a distance of 5 miles. In this instance a similarly wound repeating coil of the same make is used. The latter coil has a higher talking efficiency though a lower ringing efficiency than the other, but high ringing efficiency in this case is not required. While the coils used are specially made to be connected in the one-to-four ratio, the standard coils of this type made in two-section windings may have the windings on the cable side connected in multiple, thus giving a one-to-two ratio. Even this ratio made a decided improvement in transmission. It is to be observed that the cables to which this scheme is applied have a relatively low resistance and a relatively high electrostatic capacity.

While the application above is made to single conductor grounded, a similar improvement may be expected upon loop circuits. It should, however, not be lost sight of that introducing two coils where they are not inherently required introduces losses of from ½ mile to 1½ miles of standard cable equivalent, and some coils on the market introduce much more; therefore the losses introduced by the coils may in cases overbalance the advantages sought to be gained by their use.

t is sometimes possible so to arrange the cord circuits o switchboards, particularly if the common-battery system is used, that the ratio advantages may be gained witho the use of extra coils at the cable terminals. I have in mind where a long cable connects two common-battery exchanges and where it is necess[illegible] in the switchboard due to certain methods of transmission or in order to avoid the noise due to an unbalanced condition such as might exist if direct metallic connection were made to lines over considerable distances or over territory subject to electrical disturbances.

Portland, Ore. H. M. FRIENDLY.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

[illegible] *[illegible]-King Induc[illegible]* [illegible] author calls attention to the purely transformer [illegible]es of the induction motor which render it the elec[illegible]alent of a stationary transformer of high leak[illegible]ce and variable secondary load resistance. He [illegible] testing the machine by varying the resistance in [illegible]condary circuit, while keeping the rotor stationary. [illegible]put losses, output efficiency, etc., can then be calcu[illegible]s though the machine were a transformer, correc[illegible]eing made for the friction loss of the machine run[illegible]s a motor. This method requires only electrical [illegible]rements and the use of only one machine without [illegible]-Lond. *Electrician*, July 21.

[illegible]duction Generator.—J. H. [illegible]—An an[illegible] of the operating characteristics of the induction [illegible]tor, which is an induction motor driven above syn[illegible]us speed. The analysis is based essentially on the [illegible]fied circle diagram of the induction motor extended [illegible]e negative load range. Excitation of the machine by [illegible] condensance and operation of the machine under [illegible]nditions are explained in simple terms.—Columbia [illegible] of Mines *Quarterly*, July.

Lamps and Lighting.

[illegible]-Voltage, Metallic-Filament Lamps and Their Im[illegible]e for Central Stations.—An article in which it is [illegible]l out that as a result of the introduction of the high-[illegible]cy, metallic-filament lamp the situation of central [illegible]s is now worse than before. The only effective [illegible] is thought to be to get as consumers the mass of [illegible] who do not use at present either gas or electric [illegible]ut burn kerosene oil. To let them have electric light [illegible]heaply, the use of 10-cp, 10-watt, 20 volt metallic-[illegible]t lamps is recommended, fed from 120-volt to 20-volt [illegible]rmers. The Hegner system is advocated, in which [illegible]mary of the transformer is shunted by a condenser [illegible]tralize the exciting current. Experiments were made at the Central Laboratory of Electricity in Paris with an au[illegible]-transformer supplying current to eight 20-cp lamps. W[illegible]out condenser the power-factor was 0.67; with a con[illegible] of 1 microfarad it was 0.835, the current lagging; [illegible] condenser of 1.37 microfarads it was 0.90, the cur[illegible]ading. The condensers used for this purpose are of [illegible]size, requiring 0.1 cubic decimeter space per micro-[illegible]ad. They are tested at 700 volts and are, therefore, perfectly safe at 110 volts or 220 volts. Such installations are provided with prepayment meters. For instance, in towns where the kw-hour costs 14 cents, there would be charged wi[illegible] the prepayment meter 2 cents per 100 watt-hours, of which 1.4 cents is the charge for the energy and 0.6 cent the charge for additional expenses.—*L'Industrie Elec.*, [illegible]

[illegible] Measurements and [illegible]—To modify the formation of shadows in a lighting installation two means may be used: Either subdivide more or less the number of sources of direct light or make use of indirect light. In general, both methods are made use of. The author first defines "diffusion." If the light comes from a single source of direct light, the diffusion [illegible] If the light is infinitely subdivided, that is, perfectly indirect or diffused, the diffusion is $D = 1$. In all other cases the diffusion has a value between zero and unity. A shadow is decreased illumination due to the screening off of the light which comes from one or more sources of light. If a source of light A, producing an illumination a, is screened off, the "shadow effect" ("Beschattung") is a. The "shadow intensity" ("Schattentiefe") depends not only on the shadow effect, but also on the original illumination (which existed when no sources of light were screened off). The reason is that a shadow is a contrast perception; with a total original illumination of 11 lux a single shadow of 10 lux produces almost darkness, while with a total original illumination of 1000 lux a single shadow of 10 lux is hardly perceptible. Shadow intensity α is, therefore, defined at the ratio of the shadow effect a to the total original illumination E; that is, $\alpha = a \div E$, hence is always smaller than, or equal to, unity. "Shadow brightness" ("Aufhellung" des Schattens) is the ratio of the illumination which exists in the shadow to the total original illumination $= (E - a) \div E = 1 - \alpha$. Hence, shadow intensity $= 1 -$ shadow brightness. In an analogous way, "shadowness" ("Schattigkeit") S is defined by the relation $S = 1 - D$, or shadowness $= 1 -$ diffusion. For perfect diffusion, $D = 1$, the shadowness is $S = 0$. For the case of one single source of light, $D = 0$, the shadowness is $S = 1$. The author, therefore, introduced the following system of terms and units:

Total original illumination E
Partial illumination $E - a$
Shadow brightness $(E - a) \div E$
Diffusion D
Shadow effect a
Shadow intensity $\alpha = a \div E$ [illegible]
Shadowness $S = 1 - D$

The author then endeavors to give a general formula for the shadowness in a single point (or rather in an infinitesimal area). The shadowness is determined by the number and intensity of the different shadows 1, 2 .. n. Every source of direct light produces a "partial shadow" when screened off. Indirect light produces no shadow. The author shows that the shadowness S can be given by the formula

$$S = [illegible]$$

where α_1 α_2 α_3 . . are the partial shadow intensities, $\alpha_1 = a_1 \div E$, etc. If all n partial illuminations are equal, then the shadowness $S = (1/n)^{p-1}$. In this case the value of the shadowness becomes a minimum. To use these formulas it is necessary to know the value of p. From physiological considerations the author concludes that p cannot be unity, and he shows how it may be possible to decide experimentally whether $p = 2$ or is larger than 2. For the present p may be taken $= 2$ for all practical purposes, as the simplest possible assumption which does not contradict any of the other assumptions. A discussion of applications of this theory is promised for a later paper.—*Elek. Zeit.*, June 22.

Generation, Transmission and Distribution.

Kootenay River Hydroelectric Plants.—L. A. CAMPBELL.—An illustrated description of the plants of the Kootenay Power & Light Company, at Upper Bonnington Falls and

Lower Bonnington Falls. The plant at the former place has a rating of 16,000 hp and that at the latter 4000 hp in turbines driving 60-cycle, three-phase generators. The company owns a third plant at Grand Forks, on the Kettle River, the rating being 3900 hp. Energy is transmitted at 20,000 volts and 60,000 volts. Descriptions are given of the various uses to which the energy is put throughout the Kootenay District.—Toronto *Elec. News,* August.

Bow River Plant of Calgary Power Company.—An illustrated description of the apparatus and 55-mile, 55,000-volt transmission lines between Horseshoe Falls, on the Bow River, and Calgary, Canada. The ultimate equipment will have a rating of 20,000 hp. The initial installation consists of two 3750-hp turbines driving two 2500-kw, three-phase, 60-cycle, 12,000-volt generators. The transmission lines are of aluminum cable, supported on pin-type insulators mounted on wooden poles. An overhead grounded wire is carried on each pole.—Toronto *Elec. News,* August.

Water-Powers on the Winnipeg River.—E. A. GRAHAM.—The discharge of the Winnipeg River is 35,500 cu. ft. per second as a mean, the maximum being 55,000 and the minimum 16,000. Of the fourteen falls along the river between its junction with the English River and the lake at least four can be utilized profitably for power development, as follows: Point du Bois, 45 ft.; Slave Falls, 25 ft.; Grand Bonnet Falls, 48 ft., and Silver Falls, 45 ft. The total available power at the minimum flow is estimated at 375,000 hp. At Point du Bois 26,000 hp is now being used, while arrangements have been completed for utilizing the power at Grand Bonnet Falls.—Toronto *Elec. News,* August.

Factory Loads for Central Stations.—LUTHER L. PERRY.—An article containing practical hints on methods for securing factory motor loads for central stations. The average factory manager is attached to his private plant and is unwilling to concede the numerous advantages of central-station service, principally because he is unacquainted with them. The saving to be secured by employing central-station service must be proved conclusively to the factory manager before he will abandon his isolated plant. To determine definitely the relative cost of isolated plant and central-station service, generalities must be cast aside and the problem attacked in a logical and thorough manner. After an engineer has investigated a private plant his findings should be presented to the plant management in condensed form, arranged systematically and definitely. The writer suggests that such a report be arranged in the following order: Description of the physical plant, its functions, tests, analysis of the present yearly cost of isolated-plant service, how to apply central-station service, estimated yearly cost of central-station service, comparison of the cost and the effectiveness of the existing and the proposed systems of motive power. An abstract is given of a typical report, in which it is shown that the present annual cost of $28,347 in a certain isolated plant could be reduced to $23,324 with central-station service, the saving of about $5,000 being 200 per cent interest on the net cash outlay for changing from isolated plant to central-station service.—*Elec. Jour.,* July.

Traction.

Electric Traction in England.—G. H. J. HOOGHWINKEL.—An abstract of a paper read at the Congress of the Tramways and Light Railways Association, at Edinburgh. In outlining the reasons why electric traction in England remains stationary, the author shows why railway enterprise does not pay in England as it does on the Continent. In order to make small railway undertakings pay many alterations must be made, including the adoption of the bow collector, light single-deck cars and a more elastic form of track construction.—Lond. *Electrician,* July 21.

Aluminum Coils for Railway Motors.—A note on the use of aluminum in place of copper for coils in railway motors. The weight varies from 50 per cent to 55 per cent of cop r In the cost of manufacture there is also a considerable ing, it being shown that a copper coil weighing 68.2 lb. c $21.40, and an aluminum coil weighing 33 lb. costs $8. the renewal of the coil there is a saving in favo aluminum of $3.60.—Supplement to Lond. *Electri* July 21.

Installations, Systems and Appliances.

Automatic Friction Clutch.—An illustrated descriptio the Broadbent automatic friction clutch, which is par larly applicable to electric motors. The clutch comp

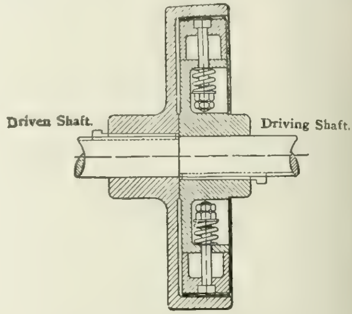


Fig. 1—Section Through Clutch.

a central boss keyed to the motor shaft and carrying tion shoes held in suitable slides. Under the actio centrifugal force these shoes move outward as the s of the motor increases and they gradually engage wit internal rim of the clutch pulley, by which the torq transmitted to whatever machinery is being driven. acceleration of the outer portion of the clutch is gradual, and when driving at full speed there is no The clutch can, however, be designed to slip under load, and in this capacity checks undue strain upon motor and shafting. The clutch acts as a flexible coup in that it prevents shocks or load variations from transmitted to the motor. The renewable portions o clutch are comparatively inexpensive and can be rep in a few moments. They have a long life under the severe working conditions. The form of clutch illust in Fig. 1, in which springs are used, is made so tha engagement of the motor with the outer portion of clutch takes place only at a certain predetermined spe Sup. to Lond. *Electrician,* July 21.

Steam-Turbine Problems.—After referring to the lems involved in the design of steam turbines for dr low-speed or moderate-speed machinery, a descripti given of the latest type of De Laval turbine and red gear. The article is well illustrated.—Lond. *Electr* July 21.

Electric Drills.—An illustrated description of va types of electric drills, their construction and us *L'Industrie Elec.,* June 10.

Wires, Wiring and Conduits.

Cable Jointing.—WALTER E. ROGERS.—An article g directions in detail for making joints in lead-covered c The author gives much attention to the making "plumber's wiped joint" in the lead covering. In Fig shown a special clip for bonding the sheath on a armored cable which is said to have proved very satisfa in practice. The flanged cones A, A are of cast iron, in a horizontal plane, the two halves of the cones for a butt joint similar to the butt of the brasses in a high- engine cross-head. The provision of, or rather the u a butt joint insures that as the outer flanges B, B are up the cones A, A do not pinch the lead cable slee sheath. The upper part of the figure shows opposite

in clip cones connected by means of a wrought-iron side rod, whereas the lower half of the figure shows the flanges held together by bolts, the whole being electrically connected by a copper bond, either flexible or solid. Flanges A A should be notched or toothed to receive the side rods,

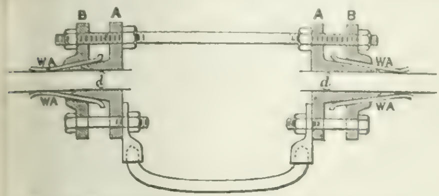


Fig. 2—Special Bonding for Wire-Armored Cable.

while flanges B, B must have drilled holes, and these same flanges should be slipped over the cable before the joint is made. For B B flanges use can be made of ordinary gas flanges, the thread being removed in a lathe and a cone formed where the thread has been obliterated. The whole of the bonding fittings should finally be thickly coated with compound. The author claims that this method of bonding is superior to and more lasting than any form of clip arrangement.—Lond. *Elec. Review,* July 21.

Electrochemistry and Batteries.

Magnetic Separators.—An abstract of a paper by L. B. Wadworth, read before the South African Institute of Electrical Engineers, dealing particularly with magnetic separators suitable for application in the concentration of tin ores. Among the types of separators described is the

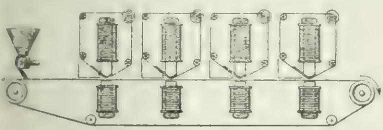


Fig. 3—Improved Separator.

Wetherill-Rowland apparatus, which is provided with cross belts traveling at right angles to the main conveyor belt, upon which the ore is fed from the hopper. The magnetic particles are held to the underside of the cross belts by the magnetic field. One disadvantage in operation of a separator of the cross-belt type is that the particles change their direction of motion when entering a separating zone. The particles travel at a certain speed and direction when on the conveyor belt, and the instant they come under the influence of the upper magnetic pole they are drawn against the under side of the cross belt and travel at increased speed and in a direction at right angles to their former direction. In the separation of tin ore the tin particles have a tendency to move over on the conveyor belt to the side where the throw-off horns are, and in many cases it will be found that tin is carried over. To meet this objection the author proposes the design shown in Fig. 3, where during separation the magnetic particles are drawn up against the under side of the take-off belt of the upper-pole pieces, and without change in direction of motion are drawn up from the throw-off zone until carried out of the influence of the magnetic field. Further separation can be effected on the spray-pole system in the case of some classes of ores.—Lond. *Elec. Eng.,* July 20.

Copper Smelting in Michigan.—Henry D. Conant.—An illustrated article on the copper-smelting industry in the Lake Superior district of Michigan. In the four smelting plants of the district practically the same means of smelting are used to-day as employed by the Welsh refiners fifty years ago, but the operation of refining has been reduced from an empirical proceeding almost to an exact science controlled by laboratory tests. Descriptions are given of the methods employed at the present smelters, which differ radically in certain particulars.—Columbia School of Mines *Quarterly,* July.

Magnetic Separation of Ores.—Lucius L. Wittich.—Electromagnets of various sizes are employed successfully in separating iron from zinc ores in the Missouri-Kansas-Oklahoma district, and in the zinc districts of Wisconsin and Illinois. The present article gives a description of the processes used in mills at Joplin, Mo., and Galena, Ill.—*Mines and Minerals,* August.

Electricity in Copper Smelter.—Leroy A. Palmer.—In the Tooele smelter of the International Smelting & Refining Company, 34 miles west of Salt Lake City, Utah, extensive use is made of electric motors for driving the machinery. The motors are of both the direct-current and alternating-current types. The generating station contains two 250-kw, 550-volt direct-current generators and two 750-kw, 2200-volt, three-phase alternators. The author describes the method of sampling and handling ore by conveyors and the process of roasting and converting.—*Mines and Minerals,* August.

Electrophysics and Magnetism.

Electric Vacuum Valves.—Oliver Lodge.—An account of an experimental investigation of the electric vacuum "valve," which permits the passage of electricity in one direction only, or at least very much more readily in one direction than the opposite. The experiments described were performed with an unsymmetrical tube provided with a supplemental path, in which a tap was inserted. Each end was made successively positive and negative, the tap being first open and then closed. Observations were made of the cathode rays produced and of the local heating within the tube. The author stated that the fact that conveyors of electricity have to change in sign when current passes from a metal to a gas or from a gas to a metal, which exchange can be effected only by a neutralization or combination of the opposite charges at the bounding surface, suffices to account for some of the heat which is there developed.—*Phil. Mag.,* July.

Properties of Selenium.—G. L. Addenbrooke.—An account of a number of researches on the physical properties, more particularly its specific resistance and specific inductive capacity.—Lond. *Electrician,* July 21.

Units, Measurements and Instruments.

High-Tension Electrostatic Wattmeters.—Ernest Wilson.—An abstract of a (British) Physical Society paper giving details of the electrostatic wattmeter outlined on

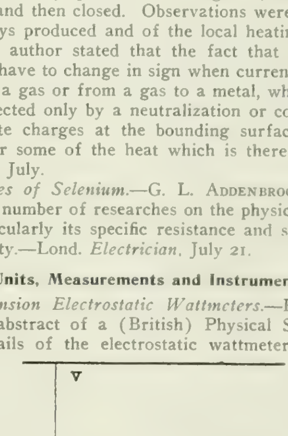


Fig. 4—Tension Wattmeter.

page 1573 of our issue for June 15, 1911. A high-tension wattmeter, the moving system of which is subjected to the full voltage of the supply system, is shown diagrammatically in Fig. 4. The quadrants are connected to a small air-cored generator G, which rotates in a magnetic

field produced by and proportional to the current in the work circuit. This generator is driven at known speed by a small motor, which can be either direct current or alternating current. It was found that when the emf V impressed upon the moving system is of the order of 20,000 volts or more the quadrants require a considerable voltage in order that accuracy and stability may be secured. In addition, the brushes of the generator have to be carefully adjusted so as to eliminate transformer action. The following are a few particulars of one form of generator which has yielded good results: The armature is of the two-pole type and is wound with 100 sections, each having fifty turns and an area for magnetic flux of 130 sq. cm. The commutator has 100 parts. The field coil is built up of copper strip 2 in deep by 1/32 in. thick, and has four sections connected to blocks in such wise that they can be used in parallel or series or parallel-series groupings. The number of turns per section is ten. The speed of rotation is 3600 r.p.m., and is registered by a Hartmann & Braun speed counter, capable of detecting a variation in speed of 0.3 per cent. The curve of voltage between the generator brushes was determined for various positions of a rotating contact-maker fixed to the shaft of the alternator and compared with the curve of current in the field coil. The agreement was as close as could be demonstrated by the method of test. The electrometer in its first form resembled Kelvin's quadrant electrometer. The suspension was made of phosphor-bronze strip, and the vanes, two in number, were each 10¾ in. long by about 4 in. broad at their widest part. In a later form of the instrument the quadrant pairs are the moving system and are suspended by phosphor-bronze strip between two fixed sectors, which are heavily insulated and capable of withstanding several-fold the normal voltage of the instrument. The suspended quadrants are 9½ in. in diameter and are 1¾ in. from the fixed sectors, the instrument being designed for 15,000 volts. The instrument obeys the straight-line law, is accurate on low power-factor and has a sensibility such that on a scale 50 in. distant from the mirror the kilowatts per millimeter deflection are .2 when the generator field coils are four in series.—Ld. *Electrician*, July 7.

Telegraphy, Telephony and Signals.

Train Dispatching on the Northern Electric Railroad.—L. H. Baldwin.—Along the third-rail electric railway operating between Sacramento, Chico and Oroville, Cal., three distinct ways of communication have been provided: a dispatcher's circuit for dispatching trains, a straight magneto telephone circuit for commercial work, and a Morse telegraph circuit for emergency work. The telegraph instruments are looped from one side of the commercial circuit, condensers being used to prevent interference with the telephone voice currents of the calling currents. The interconnections of the various instruments are explained by means of a wiring diagram and a brief description. *Jour. Elec. Power and Gas,* July 22.

Book Review.

Essais des Machines a Courants Alternatifs. By Ferroux. Paris: L. Geisler. 184 pages, 131 il. Price, 2.50 francs.

An excellent textbook on the factory testing of alternating-current machines from the engineering point of view. The work is divided into nine chapters, entitled as follows: Special apparatus for measuring alternating currents; magnetic tests of an alternator; tests of alternators; efficiencies of alternators; tests of transformers; measurement of the efficiency of a transformer; tests of synchronous motors; tests of asynchronous motors; tests of converters and commutator motors. The description is clear and the treatment largely geometric and vector. The book will be useful to engineers constructing alternating-current machines and interested in French practice.

New Apparatus and Appliances

RELATIONS BETWEEN ELECTRICAL SALESMEN AND BUYERS.

At the meeting of the Electric Club of Chicago on July 26 Mr. James H. Delany reported the answers he had received to questions he had put to a number of purchasing agents in relation to the characteristics of electrical salesmen. These purchasing agents represent railroad, steel and general manufacturing companies, and several of them gave their opinions of electrical salesmen freely, on the promise that their names should not be made public. In general the purchasing agents seemed to think, according to Mr. Delany, that electrical salesmen are rather superior to other salesmen calling on the same buyers and exhibit more technical knowledge.

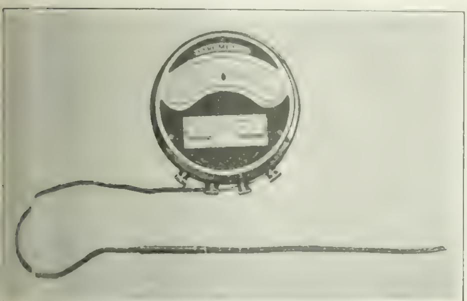
In the discussion Mr. Hugh A. Brown remarked that the bigger the manufacturing organization the more it tends toward standard apparatus and the harder it is to get special types of apparatus. Messrs. W. R. Bonham and Albert Scheible discussed the relations of electrical manufacturers, electrical salesmen and purchasing agents of buyers in placing orders for special apparatus. This subject aroused some attention. Mr. Bonham said that often the salesman has more authority in selling than the purchasing agent who criticises him has in buying. Mr. Scheible remarked that on special work the manufacturer will want the salesman to consult him and not commit him to some new thing without his knowledge. Mr. F. J. Postel said that when special machinery is ordered the salesman can help the purchasing agent or engineer by making suggestions. Often where a change from the standard line is desired a considerable variation is permissible, and salesmen should make intelligent suggestions in relation to dimensions and speeds of, say, an electric motor, which may be nearly the same as those specified and which may answer. The engineer will always welcome a salesman who can tell him something he does not know about electrical machinery by describing intelligently the apparatus offered.

Mr. Delany told of an electrical manufacturer who said that if the "bucolic consulting engineer" could be abolished the customer could get his apparatus 25 per cent less and make 100 per cent more profit. This unnamed man whom Mr. Delany quoted said that many consulting engineers make trivial objections to standard apparatus in order to impress their clients. Mr. S. F. Joor, a consulting engineer, defended the engineer. He said that the trouble with the salesman is that he does not keep his information where he can use it. The engineer will almost always use standard machinery and appliances if he can do so. Mr. Postel, who is also an engineer, pointed out the lack of standardization in the matter of speeds and dimensions of electrical and steam machinery. Engineers obviously are placed at a disadvantage in relation to specifying standard apparatus when there are so many standards, each with vociferous advocates.

RESISTANCE THERMOMETER.

In temperature tests of electrical machinery a mercury thermometer is at a disadvantage owing to [illegible] which limits its indications to surface temperatures. While machines have been rated on an assumption that at the center the temperature is a given number of degrees higher than at the surface, this is at best unsatisfactory, since the difference in temperature between the surface and the center varies with room temperature, the condition of the [illegible], its freedom from dust, etc. If the true temperature at the center of the machine, or of the point where the temperature is highest, could be measured with accuracy there would be no guesswork in fixing the rating, and in some cases it would be found that a machine could be [illegible] with larger output than that indicated by the ap[illegible]te method.

[illegible]er to measure the temperature at the point desired [illegible] coils with exterior leads have been built into the [illegible] of the machine; then by measuring the resistance [illegible] coil the temperature within the machine can be cal[illegible]. While such coils when properly built are capable



Resistance Thermometer.

[illegible] high degree of accuracy the method is open to the [illegible] that the readings are not in terms of temperature, [illegible] resistance. Moreover, the arrangement is usually [illegible] to require the services of the testing department, [illegible] the information is needed at frequent and irregular [illegible] by the operating department.

[illegible] meet the situation above outlined the Leeds & Northrup Company, of Philadelphia, has devised a resistance thermometer which by its shape and its freedom from external electrical effects is especially adapted to the meas[illegible] of temperature of electrical machinery. As [illegible] the accompanying cut, the resistance thermometer [illegible] of two parts, the indicator and a resistance winding called the "bulb." The indicator employed resembles an ordinary switchboard ammeter except that the scale is in temperature units. The particular novelty in the design lies in the "bulb," which for this service is only 1/25 in. in thickness and so flexible that it may be rolled like a ribbon, and is so protected that persistent scratching with a knife-edge is required to injure it. The winding of the "bulb" is non-inductive and, as there is no metal present in such form as to be heated by eddy currents, the arrangement is unaffected by alternating-current fields.

All "bulbs" being electrically adjusted to a standard, they are interchangeable and any number may be used with one indicator through a selective switch. The length of the leads is without effect upon the readings, and hence the reading device—or, as it is called, the indicator—may be at any distance from the "bulbs." In actual work a number of thin "bulbs" are inserted into the stator parts of a machine, each connected by three-wire leads to a selective switch located at the indicator. All are read at intervals and that one which shows the highest temperature is left permanently in circuit.

The temperature indicator resembles in appearance and in mechanical details the conventional small-pattern switchboard voltmeter. Though the scale does not indicate the fact, the instrument has, in reality, a central zero adjustment. That is, when the current is turned off the pointer stands opposite the center of the scale. The instrument requires an external source of electric power, which may be of any voltage between 12 volts and 250 volts, although voltages much over 110 are not recommended.

The connections are those of a differential millivoltmeter or a milliammeter. Hence when the system is balanced there is no deflection, regardless of the magnitude of the current flowing; the accuracy is thus in principle independent of the voltage of the source and practically this holds between wide limits. Thus on the range 10 deg. C. to 90 deg. C. a fluctuation of 2 per cent in the voltage of the source would introduce no error whatever at 50 deg. C.; at 30 deg. and 70 deg. the error would be 0.5 per cent, and 1 per cent at 10 deg. and 90 deg. For all ordinary conditions in central stations this error may be regarded as negligible.

The wiring is similar to that required in an Edison three-wire lighting system, all three wires being well insulated against the ground. The size of the wire is without effect, the only requirement being that all three leads shall be of the same length and material.

GASOLINE-ELECTRIC CAR FOR SAN FRANCISCO RAILROAD

The gasoline-electric motor car, with its reliability, low operating cost and flexibility of control, combined with luxurious accommodation and freedom from cinders, smoke and coal gas, has proved well suited for railroad service. The St. Louis & San Francisco Railroad Company has recently put six of these cars in service.

The cars are 70 ft. long and 10 ft. in width over the sills, with turtle-back construction of roof, pointed front end and observation rear platform. The cars are designed with special reference to light construction with adequate strength. The interior arrangement is designed to meet the Southern traffic conditions, providing separate accommodations and entrances for white and colored passengers. Ventilation is accomplished through large suction ventilators located on the center of the roof, the openings protected by ceiling register plates. The entire car, including platforms and vestibules, is lighted by electricity. The partition between the baggage-room and negro compartment is movable and may be arranged to give the baggage compartment a length of 8 ft. or 10.5 ft. to suit traffic requirements. The car is heated by hot water circulating in four lines of pipe on each side of the car. Only one end of the car is equipped with a pilot, inasmuch as the car is designed primarily for single-end operation. Equipped and ready for operation, the car will weigh in the neighborhood of forty-eight tons.

The generating equipment is located in the cab at the front end of the car and consists of a main gas-engine generating set consisting of an eight-cylinder gasoline engine with direct-connected generator. There are also an auxiliary gas-engine generating set with integral air pump and lighting generator; equipment for motor control; air and hand-brake systems; pneumatic bell ringer, sander, warning and signal whistles and a coal-fired hot-water heater. One motor is mounted upon each axle of the front truck.

The main gas engine is of the four-stroke cycle "V" type. The generator magnet frame is bolted to the frame of the gas engine, which rests upon the floor of the car with cushion support. The speed of the engine is adjusted by a throttle, the normal speed being 550 r.p.m. The cylinders are 8 in. in diameter with 10-in. stroke.

The main generator is of the commutating pole type designed specially for heavy traffic work. The entire machine is inclosed within a three-arm bracket which supports the outer bearing of the generator armature.

The motors are of the box frame, commutating-pole, oil-lubricated type, known as standard GE-205, 600-volt, 100-

Fig. 1—Gasoline-Electric Motor Car.

hp railway motors. Energy to the motors is supplied through cables in conduit from the generator.

The auxiliary gas-engine set consists of a three-cylinder, four-stroke cycle, vertical-type gas engine, the center cylinder being used as an air compressor. The lighting generator is directly connected to the gas engine with armature of the overhung type. The air pump on this engine is capable of delivering 45 cu. ft. of free air per minute and will charge the tanks to a pressure of 90 lb. in about ten minutes. This pump is used to supply air for starting the main engine after it has been idle if pressure in the main reservoirs has gone down. The auxiliary gas engine is started by hand.

The operator's seat is at the right-hand side of the cab

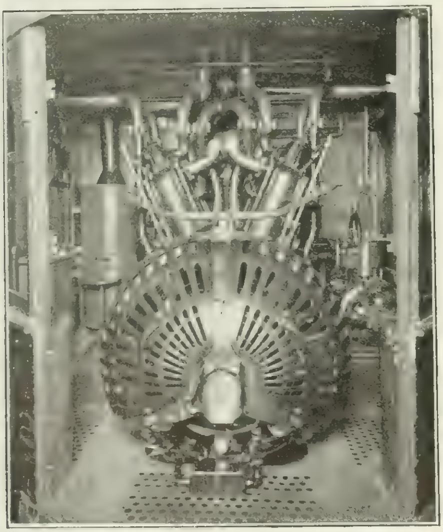


Fig. 2—Main Gasoline-Engine Generating Set.

beside a sliding window. All the control, air-brake and signal apparatus is conveniently located at this point and so arranged that the car and engine may be controlled without the operator leaving his seat.

One of the distinguishing features of these cars is the flexibility of control. Energy is delivered to the motors from the main generator through a controller of a pe similar in appearance to those used in trolley-car pra ce Concentric with the electrical controller handle, but ove it, is an air-starting throttle handle. This handle so arranged that by pressing a lever air for starting the e ine may be admitted to the engine distributing valve thr gh an air valve mounted upon the car plate of the contr at the same time opening the throttle. Provision made, however, so that the throttle may be open only set distance and hence racing of the engine is av The engine having been started, the lever may there released, cutting off the air pressure, and the th opened wider. It is not possible to admit air again t engine without returning to the initial point, thus cl the throttle.

Energy for lighting the car is supplied from the erator driven by the auxiliary gas engine. Each la fitted with an attractive shade. The electric lamps i cab are protected by glass globes inclosed within cages. Condulets for attachment plugs are also pro one on either side of the cab. The head lamp is equ with a 50-cp unit and there is also provided a gage

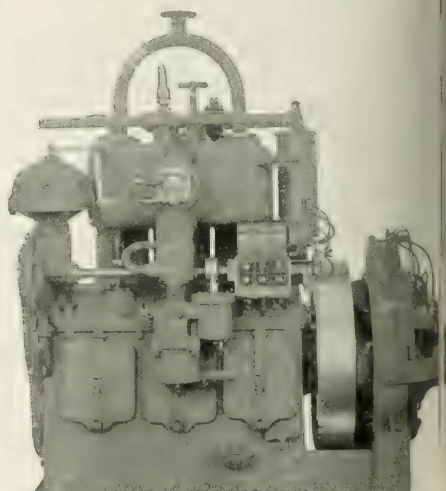


Fig. 3—Auxiliary Gasoline-Engine Generating Set.

which is controlled by a switch convenient to the operator. The gage lamp and head lamp are on a separate circuit from the cab lamps. Switches and fuses for the lighting circuits are mounted in a cabinet which is fastened to the wall.

The car is heated by hot water supplied either from the

gas-engine jackets or from a coal-fired Baker hot-water heater located in the corner of the cab, which is fired from the baggage-room. Provision is made so that hot water from the coal heater may be circulated through the engine jackets and radiators to prevent freezing on cold nights or during layovers.

The gasoline storage tank is located beneath the baggage room. Gasoline is supplied to the tank through a filler on the outside of the car with suitable strainers and filters. There is in addition a vent pipe to the roof.

There are three air reservoirs located under the car and so arranged that the air taken from these reservoirs for starting the engine does not drain the brake reservoirs. There is also a reservoir for the signal and warning whistles.

The trucks are of the swing bolster type, the frames being of boiler-plate steel with pedestal shoes of cast iron. The bolster springs are triple elliptic and the equalizer springs triple coil. The wheels are 36 in. in diameter. Each truck has a wheel base of 7 ft., the total wheel base of the car being 58.5 ft. The car represents the latest design of the General Electric Company.

THE ELECTRICALLY DRIVEN POWER PUMP VERSUS THE DIRECT-ACTING STEAM PUMP.

In selecting equipment for the modern power plant, efficiency is the one consideration that should never be lost sight of. Before deciding upon the type, class or arrangement of equipment the builder should know first of all which will show the greatest operating economy. Data

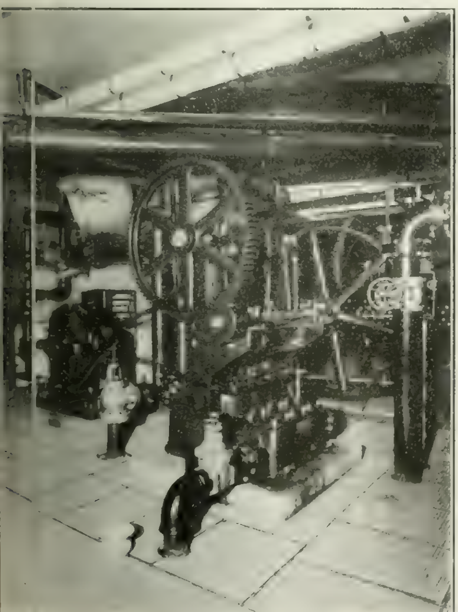


Fig. —Triplex Pumps in the Security Mutual Life Insurance Building, Binghamton, Driven by a 40-hp Motor.

from actual installations showing comparative efficiencies are, therefore, always interesting to the man concerned with the installation or operation of power plants. In every power plant the water-supply system is one of the items that have to be considered. Its importance varies widely, of course, with the type of plant, the service required of the water-supply system, etc. In the average plant, however, it will be found that this item is one worthy of very careful consideration. The efficiency of the motor-driven power-pump equipment is generally recognized as being considerably better than that of the steam pump under ordinary conditions. As giving a direct and definite comparison between the two the installation consisting of both types of pumps in the Security Mutual Life Insurance Building, Binghamton, N. Y., is interesting. In this plant the pumps referred to are for operating the hydraulic elevators. The equipment consists of two Goulds 8-in. x 10-in. triplex pumps, each belt-driven by a 40-hp motor. The pumps operate against a pressure of 170 lb. per square inch. In addition there is a tandem duplex steam elevator pump, which is no longer used regularly, but held in reserve as a result of the large saving claimed to be shown by using the electrically driven pumps. When the comparative tests were made data were taken from a two days' run with the steam pump and then identical data were taken from a two days' run with the electrically driven pumps. In the two days the electrically driven pumps showed a saving over the steam pump of 4581 lb. of coal. The average number of trips per day made by the elevators for the two days when the steam pumps and the electrical pumps were operating was very nearly the same, being 882 with the former and 850 with the latter. Aside from the coal saving the maintenance expense is said to have shown a large balance in favor of the electrically driven pumps. It is also interesting to note that in this plant the steam-pump cylinders are carefully jacketed and the pumps operated under the most favorable conditions.

Another point made in favor of the electrically driven

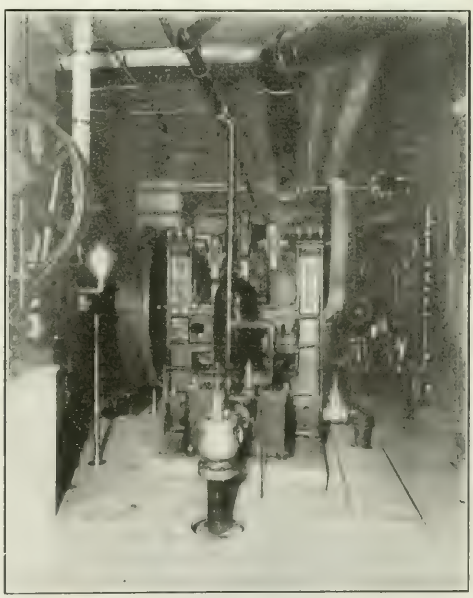


Fig. 2—View Showing Triplex Pump in the Foreground and the Steam-Pump Equipment It Replaces in the Background.

pumps is that the motors are controlled automatically; they start or stop themselves as soon as the water pressure drops or rises to a certain point. In this way a uniform pressure is maintained and practically no attention need be given the pumps, which were supplied by the Goulds Manufacturing Company, Seneca Falls, N. Y.

BATTERY-CHARGING PANELS FOR SMALL GASOLINE-ENGINE SETS.

In country homes and clubs and on farms where central-station energy is not available gasoline-engine-driven generating sets with storage-battery equipment have come into extensive use. On the farm the engine has already been used for general power purposes for some time, and the addition of a generator and battery, with battery-charging panel, provides energy for lighting at night when the engine is not usually run.

Battery-Charging Panel.

Designed especially for this kind of service, the Cutler-Hammer Manufacturing Company, of Milwaukee, has recently put on the market an inexpensive and compact combination battery-charging and generator plant, illustrated herewith. The upper part of this panel carries the terminals, voltmeter, ammeter, voltmeter switch and generator-field rheostat, the handle of which is mounted on the front of the board. The lower section carries a four-pole, double-throw battery switch, a generator switch, a low-current battery cut-out and the necessary fuses. By means of the voltmeter switch the voltage of either half of the battery when charging, the total voltage on discharge, or the generator voltage when the main switch is closed can be read. The low-current cut-out provided prevents the discharging of the battery back into the generator should the generator voltage be decreased for any reason.

NEW DIRECT-CURRENT MOTOR.

The Westinghouse Electric & Manufacturing Company is placing on the market a new direct-current motor for general power service, known as "Type SK." The new motor has a number of novel features and embodies the most advanced design in direct-current machines. One of its strongest features is excellent commutation, which is obtained partly by the use of commutating poles and partly by the careful design of the commutator, brushes and brush holders. Service tests have shown practically sparkless commutation under all conditions of speed or load up to extreme overloads. Another characteristic of importance is the large dust-proof bearings and the efficiency of the oiling system. Large oil rings keep the bearing surfaces well lubricated whenever the motor is in operation, but the oil cannot leak or be thrown out of the oil well.

Fig. 1—Rotor of Direct-Current Motor.

As can be seen from the accompanying illustration, the motor is very simple in construction. The frame, which is of a new design, is a ring of open-hearth steel made by hot-rolling the slab into shape and welding the ends together. Rolled steel is an ideal material for frames because of its high magnetic permeability, un structure and great strength. The feet are pressed steel plate and are riveted under great pressure, mal very rigid construction.

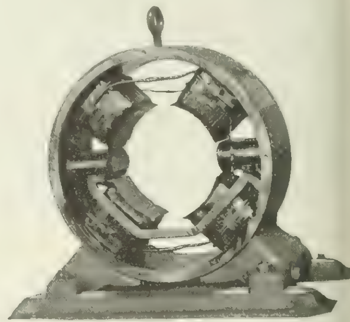


Fig. 2—Stator of Direct-Current Motor.

The armature is so wound that wide spaces are le tween the ends of the coils and air ducts are provi the core, an arrangement that assures ample venti The coils are form-wound, laid in open slots and h fiber wedges and bands. The shaft can be presse without disturbing the armature windings and comm connections.

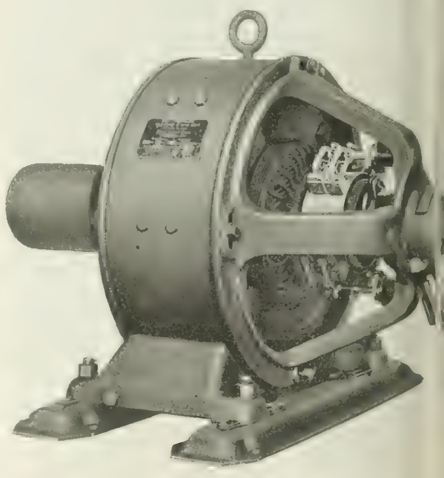


Fig. 3—Direct-Current Motor Complete.

These motors are made for 115 volts, 230 volts and 550 volts in capacities of from 1½ hp to 50 hp. The speeds correspond closely to the full-load speeds of induction motors, thus simplifying the application of motors and making comparatively easy changes from motors of one class to those of another.

[illegible]ndustrial and Commercial News

The Week in Trade.

C[illegible]NDITIONS have not changed materially [illegible] the past week and business continues in its slow recovery from the period of depression. Approach of the fall season [illegible] stability to the advancement of recent weeks, and [illegible] been further strengthened by a wider scale of buying [illegible] season's requirements. Improvement is marked in the [illegible]st as a consequence of excellent crops, and abundance [illegible] has done much to engender optimism. Stock owners [illegible]tly encouraged by good pasturage and by the indica[illegible] a fair corn crop. Building and railroad operations [illegible]uthwest are reported as progressing satisfactorily and [illegible]rade in the territory is advancing. In many of the [illegible] while the tone is better, the volume of trade is as yet [illegible] but the beneficial influence of the crop movement is [illegible]ming widespread and the country is responding at a [illegible]mensurate with the period of the year. From the [illegible]olume of inquiries further expansion is looked for in [illegible] trade, and preparations for increasing output are in [illegible] at many mills. Blowing in of several furnaces has [illegible] the activities in the coke fields. Reports of conces[illegible] prices of finished products are fewer in number and [illegible]ement for lower rates has apparently been blocked by [illegible] interests. The tone of the steel market in general [illegible]aging, and the only uncertain factor in the iron and [illegible]ation at this time seems to be in the pig-iron market. [illegible]r tonnages have been disposed of, but orders are fewer [illegible]r than had been expected and the impression is given [illegible]t of the large producers are stocked for present needs. [illegible]s probably exerting a more important influence upon [illegible] at this time than any of the other elements concerned, ar[illegible]e the presidential campaign is yet too distant to be of [illegible]ortance in the immediate affairs of the country, there [illegible]ubt that a moderate setback can be expected from [illegible]ce later in the year. Business failures for the week [illegible]ug. 3, as reported by *Bradstreet's*, were 208, as compare with 241 for last week, 166 for the same week in 1910, [illegible], 205 in 1908 and 157 in 1907.

The Copper Market.

C[illegible]PPER stocks in the United States decreased 19,695,306 lb. in the month of July, according to the report of the Copper Producers' Association issued on Tuesday of th[illegible]k. The showing for the month was by far the most [illegible]e during the present year. Stocks on hand throughout [illegible]try, as of Aug. 1, were 137,738,858 lb., as compared [illegible]434,164 lb. for June. Production for the month was [illegible]17 lb., the smallest since February, when the total was [illegible]97 lb. July shows a reduction of 12,386,378 lb., as [illegible] with June and a decrease of 6,000,000 lb. in comparison [illegible] July, 1910. Much of the curtailment is attributed to extr[illegible]ely hot weather at the smelters in the past month. The

[illegible] Copper.	Bid.	Asked	Settl'ing Price
[illegible]	[illegible]	12.37½	...
[illegible]	[illegible]	12.37½	12.30
[illegible]	12.20	12.37½	12.30
[illegible]	[illegible]	12.37½	12.30
[illegible]	[illegible]	12.37½	12.30

[illegible]on market, August 8, was as follows:

	[illegible]			[illegible]		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]per, spot	[illegible]	7	6	[illegible]	7	6
[illegible]per, futures	57	2	6	57	2	6

[illegible] fluctuations for the year	Highest			Lowest		
[illegible]	[illegible]			[illegible]		
[illegible]t	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]
[illegible] futures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]ted	61	10	0	57	5	0

decr[illegible]se is larger than had been expected and is the most grati[illegible]ing item in the monthly statement. Domestic deliveries were [illegible]6,982,582 lb., as compared with 61,655,561 lb. in June and 64,54[illegible]63 lb. in the month of May. While this figure was less than [illegible]ad been hoped for, some satisfaction is found in the fact that [illegible]e total deliveries are fully up to the average for the year. Exports were the largest in the present year, reaching 74,88[illegible]58 lb., as against 71,460,510 lb. in the [illegible] Trade has been extremely dull pending the report of the association, as consumers have desired to ascertain the volume of surplus stocks and the probable trend of prices. Inquiries have been very few in number and the prospects for good business are not attractive. The large interests are holding out for 12¾ cents. Very little of importance has taken place in the London market during the week, and prices have not changed materially. Exports for the month, including Aug. 8, were 5660 tons. The daily call on the Metal Exchange, Aug. 8, quoted copper as per the accompanying table.

Industrial and Commercial Notes.

New York Edison Company Opposes Long Acre Grant.—Following approval by the Public Service Commission for the First District of New York of the Long Acre Electric Light & Power Company's application to issue $2,000,000 in stock and $4,000,000 in bonds in accordance with conditions named in these columns Aug. 5, the New York Edison Company has filed a petition requesting a rehearing of the case. It is asserted in the petition that the majority opinion of the commission which authorized the issuing of the securities did not take into consideration certain new evidence that was offered in the case and that failure to recognize this is not only a source of injury to the Edison company, but also a proper ground upon which to request a rehearing. It further alleges in the petition that there is no public necessity for a competing company in Manhattan and the Bronx, and that the New York Edison Company has made large investments which will be much affected by such competition if permitted. It is also stated that the New York Edison Company has recently reduced the price of electricity and that no complaints of injustice in connection with its rates have been made to the commission.

Proposed Michigan Hydroelectric System.—The Consolidated Light & Power Company has been organized in Michigan to erect hydroelectric plants on the Chippewa River for furnishing energy to about thirty towns, among them Midland, Ionia, St. Johns, Ithaca and Mount Pleasant. The capital stock is fixed at $100,000, the land value of the property held by the company. The officers are all Detroit men, and are as follows: President J. L. Hudson; vice-president and general manager, Charles S. Abbott; secretary, Robert Tannehill; treasurer, F. R. Ross. The company now has two dams across the Chippewa River and seven more will be built. It is said the hydroelectric value of the property now owned by the company will run well over $1,000,000 and that the company will probably be the largest in the State when its properties are developed.

Sale of Winnipeg Public Utilities.—It is announced that Sir William MacKenzie, president of the Winnipeg Electric Railway Company, will go to Winnipeg to conduct personally the negotiations for the sale of the company's gas and electric-light plant and street-railway system to the corporation of the city of Winnipeg. It has been stated that a price of $250 per share has been placed on the stock of the company, and while Mayor Evans has intimated that the Council will in all probability accept a proposition for the purchase of the system by the city it will be necessary for the ratepayers to pass upon the by-law to be submitted to them authorizing the raising of the required amount of money for the purchase.

General Electric Order.—The Delaware & Hudson Company, Albany, N. Y., has placed an order with the General Electric Company for one 7500-kw turbine, one 100-kw turbo-exciter and four 2500-kva transformers. This apparatus will give an increased power supply to the electric traction interests of the company in Albany, Troy and Schenectady and will also furnish power for the new shops of the company at Watervliet, N. Y.

To Close Plant of American Fuse Company.—The creditors of the American Fuse Company, which was involved in the financial operations of its president, Frank G. Jones, described in the issue of June 22, have decided that the business is not of a profitable nature and have made arrangements for closing the plant at Muskegon, Mich. About 600 men will be thrown out of employment.

Hall Signal Company Reorganization.—Newman Erb, vice-chairman of the reorganization committee of the Hall Signal Company, has issued a circular to depositing stockholders calling attention to the necessity, in case business is to be carried on under normal conditions pending reorganization, of obtaining sufficient funds at once to supply the company with working capital and to acquire by purchase the current supply bills against it. Contracts and orders on hand cannot be properly filled until this assistance is given. It is reported that the committee has plans under consideration for arranging a readjustment of the affairs of the company and that plans are being made for merging with another company. It is the desire of the committee, in the partial development of its plan under the deposit agreement, to incur obligations for the present not in excess of $100,000, to purchase current material and supply accounts against it. It is stated that over 85 per cent of the capital stock of the company has been deposited with the Empire Trust Company and that money will be borrowed on behalf of the depositing stockholders against the stock deposited. No personal liability will be incurred. An agreement empowering the readjustment committee to proceed with steps for obtaining the $100,000 was sent to the stockholders. J. S. Bache, Newman Erb, W. F. Morgan, W. P. Hall and G. O. Horwitz comprise the committee.

Pittsfield Electric Company Elections.—At the recent meeting of stockholders of the Pittsfield Electric Company, of Pittsfield, Mass., the old board of directors was re-elected as follows: W. L. Adam, Samuel G. Colt, Alexander Kennedy, Charles E. Merrill, Henry R. Pierson, Arthur H. Rice and W. A. Whittlesey. Alexander Kennedy was re-elected president and treasurer of the company, W. L. Adam was elected clerk and W. D. Whittlesey made superintendent of the company. During the year the amount of energy sold was 17 per cent larger than in the previous year, but owing to reduction in rates for lighting on January 1 net earnings showed but slight increase. Mr. Kennedy has been president of the company since its incorporation in 1882.

Central-Station Service for a Massachusetts Steel Company.—The Worcester Pressed Steel Company has contracted with the Connecticut River Transmission Company for energy to drive 600 hp in motors, with a twenty-four-hour load. The Connecticut River company will supply three-phase, 60-cycle, 13,200-volt alternating current and this will be transformed to 500 volts. Contracts for the transformers, switchboards and motor-generator set have been awarded to the General Electric Company and contracts for the motors have been placed with the Westinghouse Electric & Manufacturing Company.

Boston Elevated Plans.—Notice has been given to stockholders of the Boston Elevated Railway Company of a special meeting to be held Aug. 24 for deciding whether the company shall purchase the properties and franchises of the West End Street Railway Company. A circular, signed by President Bancroft and the directors of the company, has also been sent to the stockholders and contains the unanimous recommendation of the signers for purchasing the franchises of the West End company.

New Cable Service to Nova Scotia.—The Western Union Telegraph Company has instituted a new and direct telegraph and cable service from Boston to Canso, N. S., the terminus of three cable lines to Europe. The new arrangement gives greatly improved facilities for the transmission of cablegrams directly to the submarine lines. The Western Union has established its cable department on the ground floor of its office at 109 State Street, Boston.

Texas $12,000,000 Irrigation and Hydroelectric Project.—The Medina Irrigation Company, organized by Dr. F. S. Pearson, has enlarged its plans for irrigation and hydroelectric projects in South Texas from a cost of $6,000,000 to $12,000,000. The present plans provide for dams and storage reservoirs on the Medina, Guadalupe, Frio and Nueces Rivers.

Allis-Chalmers Changes.—Announcement is made that the Scranton plant of the Allis-Chalmers Company will be closed about Jan. 1 and that the hydraulic department will be located in Milwaukee, while the sugar-machinery department will be brought to Chicago.

Aluminum Notes and Prices.—The market for aluminum is quiet but firm, with ingots for remelting held at 20@20½ cents, spot No. 1, the base for large ingots. Rods and wire are 31 cents, and sheets are 33 cents, prices as of Aug. 8.

Financial.

THE WEEK IN WALL STREET.

WEAKNESS developed in the latter part of the pr[illegible] week and prices fell sharply on Friday, with [illegible] sional trading responsible for a greater part [illegible] movement. Prospects of further investigations by the [illegible] state Commerce Commission aided in the uncertainty [illegible] market and reports of additional suits by the gover[illegible] against the coal roads were factors in the transactions [illegible] week. The depressed condition of the market extende[illegible] the earlier part of the present week and at Monday's [illegible] prices showed little improvement. Further breaks took [illegible] on Tuesday and declines of 2 to 3½ points were made in [illegible] issues, while the greatest weakness in the list was shown [illegible] Canadian Pacific group. Several of the subsidiary line[illegible]

NEW YORK.

	Aug. 1.	Aug. 8.	Shares Sold		Aug. 1.	Aug. 8.
All. Ch.	8[illegible]	6¾*	2,200	Int. Met., pf.	49½	45½
All. Ch., pf.	28	22¾	4,300	Mackay Cos.	86	85[illegible]
Amal. Cop.	66⅞	64¼	45,675	Mackay C., pf.	74	74½*
Am. D. T.	20½*	20½*	--	Man. Elev.	139*	137½*
Am. Loco.	40	38	1.960	Met. St. Ry.	15*	15*
Am. Loco., pf.	108	106*	100	N.Y.&N.J.Tel.	139½	139½*
Am. Tel. & C.	79¾	79¾*	516	Steel, Com.	79⅛	74⅞
Am. T. & T.	136⅜	135⅞	7,000	Steel, pfd.	118	116⅞
B. R. T.	81	76⅞	19,750	W. U. T.	79⅝	76½
Gen. Elec.	162¼	155	7,200	West'h, com.	73	66
Int. Met.	17	16⅞	9.800	West'h, pfd.	118¼	118¼*

PHILADELPHIA.

	Aug. 1.	Aug. 8.		Aug. 1.
Am. Rys.	44½*	44½	Phila. R. T.	23¾
El. Co. of A.	11⅞*	11⅞	Phila. Elec.	17⅞
Elec. St. Bt'y.	55	53	Phila. Trac.	86½*
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	52½

CHICAGO.

	Aug. 1.	Aug. 8.		Aug. 1.
Chi. City Ry.	186*	186*	Com. Edison	135⅝
Chi. Elev. Rys.	26½	26½*	Chi. Subways	3⅝
Chi. Elev. Rys.	93	93*	Chi. Tel. Co.	123*
Chi. Rs., Ser. 1	100	95	Nat'l Car	113
Chi. Rs., Ser. 2	32⅞	30¼	Nat'l Car, pfd.	118½*

BOSTON.

	Aug. 1.	Aug. 8.		Aug. 1.
Am. T. & T.	136⅜	135	Mex. Tel.	4*
Cum. Tel.	157⅞	157½*	Mex. Tel., pfd.	6*
Edison E. Ill.	287	286	N. E. Tel.	146
Gen. Elec.	162½	155¼	W. T. & T.	20¼
Mass. E. Ry.	22¼*	20¼	W. T. & T., pfd.	99*
Mass. E. Ry., pf.	93	92½*		

*Last priced quoted.
Shares sold for the week, July 31 to Aug. 5.

fered losses of 3 to 5 points and a decline of over 5 [illegible] occurred in the stock of the parent company. Active [illegible] was in evidence toward the end of the day's trading and [illegible] recoveries were made. The cause of the violent trad[illegible] Tuesday's market was not apparent, for most of the g[illegible] news of the day was of a reassuring nature. Weather an[illegible] reports were favorable and improvement was shown in ra[illegible] earnings and in the metal markets. The market, on the [illegible] is strong in comparison with the condition at the beginn[illegible] the summer season, and the various influences affecting [illegible] rapidly adding further strength. News from abroad [illegible] the close of the Morocco incident and crop news is reass[illegible] Tariff discussions and increase in the number of investig[illegible] into corporate affairs are imparting a large percentage [illegible] certainty to business conditions. With the approach o[illegible] vesting many of the Western banks are now drawing on [illegible] York correspondents for funds and time-money rate[illegible] hardening, while there is a corresponding increase in de[illegible] for commercial paper. Rates Aug. 8 were: Call, 2¼@2[illegible] cent; ninety days, 3¼@3½ per cent. The quotations i[illegible] tables are those for the close Aug. 8.

FINANCIAL NOTES.

Progress of Southern California Edison Company.—[illegible] B. Muller, president of the Southern California Edison [illegible] pany, discussing the industrial growth of Southern Cali[illegible] and the extent to which the use of electricity for powe[illegible] poses now exceeds that for lighting, said recently that [illegible] 1904 power business has been gradually gaining on light[illegible] ness, notwithstanding the enormous increase of the [illegible] which grew 128 per cent during the period from 1904 to [illegible] Power won out in the long race during the month of [illegible] showing an earning of $4,771.95 in excess of lighting [illegible] June the same condition obtained, power showing an exc[illegible] $28,148.53. During the corresponding months of 1910 the [illegible]

[illegible] was reversed, light exceeding power in May by $2,402.40 and in June $10,337.55. In 1904 power earnings were only 22 per cent of gross electric earnings, while in 1910 they had increased to 47 per cent, passing the 50 per cent mark in May of this year. Exclusive of Los Angeles, electric energy is supplied to something over fifty towns from Santa Barbara County to the verge of the desert in San Bernardino and Riverside Counties. The manufacture of cement has been the largest single industry for which electric power has been used until [illegible], but now its application to pumping oil wells and for [illegible] purposes is taking first place, while the agricultural [illegible] of the power consumption is almost as important as the [illegible]turing feature in the territory served by the company.

[illegible]rnings of New York Edison Company.—In the six [illegible] ended June 30, 1911, the gain in business by the New [illegible] Edison Company was in excess of that for the same [illegible] in 1910, and, from present indications, the rate of in[illegible] will be continued until the close of the year. As a conse[illegible] of the reduction in rates on July 1, resulting in a loss [illegible]e $625,000 to the company for the second half of the [illegible]e gross returns will not reflect the actual increase in [illegible]s secured. Estimates, based on the past six months, [illegible]e earnings for the year at the rate of 12.6 per cent on [illegible]k of the company, and distribute the various items as [illegible] Gross earnings, $19,000,000; operating expenses, [illegible]00: taxes, $1,200,000; uncollected, $100,000; operating [illegible] $7,850,000; non-operating income, $1,15,000; gross in[illegible] $9,000,000; deductions from income, $2,700,000; surplus [illegible]e for dividends, $6,300,000. It is expected, in spite of [illegible]bability of this amount available, that the rate of divi[illegible] will not be changed from 6 per cent for 1911. In case [illegible] is unchanged, only half of the surplus will be required, [illegible] close to $3,000,000, if the estimate is correct, for addi[illegible] the previous surplus.

S[illegible]ement of American Telephone & Telegraph Compa[illegible].—The general balance sheet of the American Tele[illegible] & Telegraph Company as of June 30, 1911, as reported [illegible] New York Stock Exchange, gives assets as follows: [illegible]ction, equipment and supplies, $46,556,279; telephone [illegible]ents, $12,131,515; real estate, $2,188,239; stocks and [illegible] $359,867,657; treasury bonds, $5,000,000; loans to tele[illegible]ompanies, $27,522,229; special demand notes, $27,898,262; [illegible]d deposits, $26,994,964; accounts receivable, $7,931,074; [illegible] $516,090,223. Liabilities: Capital stock, $275,432,300; col[illegible] trust bonds, $78,000,000; convertible bonds, $22,734,000; [illegible] notes, $15,000; accrued interest, $1,960,518; taxes, $176,-[illegible] earned revenue, $2,933; notes payable to Western Union [illegible]ph Company, due 1912-1915, $16,500,000: notes payable [illegible]sidiary companies, $17,405,000; other accounts payable, [illegible]03; reserve for depreciation, $38,505,014; surplus, $56,-[illegible] revenue balance, $2,765,263; total, $516,090,223.

S[illegible]erior (Wis.) Water, Light & Power Bonds.—Red[illegible] Co., of New York, are offering first mortgage 4 per [illegible]king-fund gold bonds of the Superior (Wis.) Water, [illegible] & Power Company at 84½ and interest, paying about [illegible]r cent. The authorized issue is $2,000,000, of which [illegible]00 is outstanding. The bonds are due May 1, 1931, and [illegible]able on any interest date at 103 and interest, and are [illegible] by a first mortgage on the entire property of the com[illegible] Net earnings for the past twenty-one years have aver[illegible]e and one-half times the present interest on these bonds, [illegible] the year ended June 30, 1911, amounted to about two [illegible]-half times this sum. The franchises are virtually per[illegible] subject to the right of the city to purchase the property [illegible]s which adequately safeguard the company's interest.

[illegible]nidad (Col.) Central Station Company Sold.—The hold[illegible] of the Colorado Railway, Light & Power Company of Trinidad, Col., were sold at a receiver's sale on Aug. 2 to the Federal Light & Traction Company of New York. It is expected that a company, to be known as the Trinidad Electric Transmission Railway & Gas Company, will be organized by the purchasers, to take its place. The Colorado Railway Company failed about a year ago, and was reorganized with $5,000,000 capital stock and $5,000,000 first-mortgage, 5 per cent bonds, of which $1,998,000 have been issued. The company now serves some sixteen coal mines at Trinidad, which contain the only large deposit of coking coal west of the Mississippi.

[illegible]cific Gas & Electric Company.—Gross earnings of the Pacific Gas & Electric Company, which is to add 71,000 hp to the capacity of its stations, as reported in a recent issue of the [illegible] increased at a rate of nearly $1,000,000 per year in the last five years. Gross revenue in 1906 was $8,047,162 and net revenue was $4,524,043, while the corresponding items for 1910 were $14,229,228 and $5,938,623 respectively. Expenditures for improvements, betterments, etc., in the past seven years aggregate more than $16,450,000, of which $5,000,000 has been secured from surplus earnings. It is stated that the present replacement value of the properties is between $68,500,000 and $70,000,000, which, it is said, is almost double the total outstanding bonded debt of the company.

Earnings of Twin City Company.—Business of the Twin City Rapid Transit Company increased each month in the past six months ended June 30, and the totals for the period show nearly $200,000 in excess of the gross earnings of the previous year. The earnings for the month of June, which showed the largest increase, were 4.67 per cent greater than those in June, 1910. Operating expenses also increased in the six months, but only in the month of April did they overbalance the gain in gross earnings. Such increases in cost of operation as were caused by shortage of power due to low water in the Mississippi have been reduced to the normal. From present indications the earnings for the year will be the largest in the history of the company.

Federal Telephone Company (New York) Files Mortgage.—The final step in the consolidation of the independent telephone companies in western New York was taken during the week, when the Federal Telephone & Telegraph Company gave a mortgage of $25,000,000 upon its properties in ten counties of western New York State to the Trust Company of America.

Continental Motor Manufacturing Company.—The Continental Motor Manufacturing Company, Muskegon, Mich., will erect a large manufacturing plant in Detroit, Mich., including eight large buildings and a power house of 1000-kw capacity. Harry C. Spellman, 505 Ford Building, Detroit, is construction engineer for the company.

DIVIDENDS.

Federal Light & Traction Company, quarterly, preferred, 1½ per cent, payable Sept. 1.

Federal Utilities, Inc., initial, quarterly, preferred, 1½ per cent, payable Sept. 1.

Kings County Electric Light & Power Company, quarterly, 2 per cent, payable Sept. 1.

Pacific Gas & Electric Company, quarterly, $1.50 per share, payable Aug. 15.

Portland Railway, Light & Power Company, preferred, $1 per share, payable Sept. 1.

REPORTS OF EARNINGS.

Period.			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
AMERICAN LIGHT & TRACTION COMPANY.							
[illegible]	Dec.	'11	[illegible]	[illegible]	[illegible]	......	......
[illegible]	"	'10	[illegible]	[illegible]	[illegible]	......	......
BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.							
June,		1911	[illegible]	$41,344	[illegible]	[illegible]	$13,900
"		1910	78,079	41,472	39,607	29,291	10,316
COLUMBUS ELECTRIC COMPANY.							
June,		1911	$39,554	$18,732	$20,822	$10,675	$10,147
"		1910	37,294	17,859	19,435	17,615	1,820
DALLAS ELECTRIC CORPORATION.							
June,		1911	$122,110	$85,962	$36,148	$27,287	$8,861
"		1910	114,514	81,445	33,069	26,605	6,464
EL PASO ELECTRIC COMPANY.							
June,		1911	$52,470	$31,624	$20,846	$8,336	$12,510
"		1910	45,224	27,409	17,815	8,195	9,620
GALVESTON-HOUSTON ELECTRIC COMPANY.							
June,		1911	$134,934	$77,537	$57,397	$25,074	$32,323
"		1910	109,083	67,027	42,056	17,729	24,327
KEYSTONE TELEPHONE COMPANY.							
12m.,	June,	'11	$1,153,788	$572,004	$581,784	$293,383	$288,401
[illegible] "	"	'10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MINNEAPOLIS GENERAL ELECTRIC COMPANY.							
June,		1911	[illegible]	$44,717	[illegible]	[illegible]	$25,337
"		1910	93,050	38,475	54,575	30,725	23,850
NORTHERN TEXAS ELECTRIC COMPANY.							
June,		1911	$136,061	$68,285	$67,786	$25,244	$42,542
"		1910	120,964	64,701	56,263	20,162	36,101
SAVANNAH ELECTRIC COMPANY.							
June,		1911	$59,927	$41,565	$18,362	$18,622	$10
"		1910	53,610	35,596	18,014	18,008	6
SEATTLE ELECTRIC COMPANY.							
June		1911	$433,701	$242,969	$190,732	$114,347	$75,385
"		1910	447,676	261,337	186,339	119,695	76,634
TWIN CITY RAPID TRANSIT COMPANY.							
6m.,	June,	'11	$3,781,952	$1,928,794	$1,853,158	$840,475	$1,012,683
6 "	"	'10	3,582,248	1,748,128	1,834,119	841,141	992,978

General News

Construction News.

BLUE MOUNTAIN CITY, ALA.—The installation of an electric-light system in Blue Mountain City is reported to be under consideration. H. F. Williamson is Mayor. Post office address is Anniston, Ala.

MONTGOMERY, ALA.—The advisability of placing all overhead wires in conduits is to be considered at a conference of the Board of City Commissioners and representatives of the Montgomery Light & Water Power Company, the Montgomery Traction Company, the Citizens' Light, Heat & Power Company and the Western Union and Postal Telegraph companies.

PHOENIX, ARIZ.—A petition has been submitted to the City Council by the citizens of Phoenix requesting that an ordinance be passed requiring the Pacific Gas & Electric Company to place its wires in conduits.

PHOENIX, ARIZ.—The Salt River Electric Company, recently organized, is planning to build an electric railway system in Salt River Valley, involving an expenditure of about $600,000. Work will soon begin on construction of the proposed railway and about 50 miles will be completed within a year. It is proposed to build one line from Phoenix to Peoria, 15 miles in length, another from Phoenix to Scottsdale, a distance of 11 miles, and also a branch to Mesa, 18 miles southeast. A spur will extend to a point 3½ miles east of the city, where it is proposed to establish a large amusement park.

HELENA, ARK.—Contracts have been awarded by the Schofield Engineering Company, of Philadelphia, Pa., which recently purchased the local electric and gas plants, for the construction of a new electric power house to T. P. Reynolds, of Memphis, Tenn. This is a beginning of extensive improvements to be made to both the gas and electric systems in this city.

ANAHEIM, CAL.—The installation of an ornamental street-lighting system on Center and Los Angeles Streets is under consideration. It is proposed to replace the present arc lamps with cluster lamps.

DORRIS, CAL.—Bids will be received by Fred Chapman, town clerk, until Aug. 25 for the construction of water-works system, in accordance with plans and specifications now on file at the office of the town clerk as follows: 1—Construction of system complete with machinery for gasoline power. 2—To construct system complete with equipment for electric power (electricity to be supplied by the Siskiyou Light & Power Company). The above does not include the digging or construction of the well, for which a separate bid must be submitted. Copies of plans and specifications may be obtained upon application to the town clerk, for which a charge of $5 will be made.

EL CENTRO, CAL.—The City Councilmen are discussing the installation of an electric pumping system for the city's water supply. Energy will be taken from the Holton Power Company's system.

HOLTVILLE, CAL.—The Holton Power Company is to increase its capital stock from $500,000 to $1,000,000, the proceeds to be utilized in providing for present and future extensions of the company's electric-lighting and ice plants in the Imperial Valley.

INGLEWOOD, CAL.—The town of Inglewood has entered into a contract with the Southern California Edison Company, of Los Angeles, for street lighting. At present only improved streets will be lighted. Later the service will be extended throughout the entire town. Arc lamps will be installed.

KENNETT, CAL.—The Board of Trustees of Kennett has granted the Sacramento Valley Power Company a franchise to erect transmission lines on the streets and highways of the city for a term of fifty years for the distribution of electricity for lamps and motors.

LONG BEACH, CAL.—Investigations are being made by the city officials with a view of installing electrical machinery in the municipal water plant to generate electricity to light the streets and public buildings. The city now expends about $28,000 yearly for lighting the city. To carry out present plans would necessitate the purchase of the street-lighting system of the Edison company or the erection of new lines.

LOS ANGELES, CAL.—The contract for installing six traction passenger, one electric drum freight, one electric automatic and two hydro-pneumatic sidewalk elevators in the new eleven-story building being erected at Seventh and Springs Street, Los Angeles, by the Van Nuys Building Company, has been awarded to the Otis Elevator Company, for $48,345.

PALMS, CAL.—The installation of an electric street-lighting system in Palms is reported to be under sonsideration.

PALO ALTO, CAL.—An appropriation of $2,300 has been made by the City Council for the extension of the municipal lighting system to South Palo Alto, and work on the construction of the transmission line is to be commenced at once under the supervision of City Electrician Youens.

RIVERSIDE, CAL—The Southern Sierras Power Company has awarded contract for the construction of a steam-power plant be erected near San Bernardino. The proposed plant will have an out 5000 kw.

SACRAMENTO, CAL.—The name of the Citizens' Light & Company has been changed to the Citizens' Electric Company, ar ticles of incorporation are to be filed at once.

SAN BERNARDINO, CAL.—It is announced that F. A. Worthl secured the franchise for which he recently applied in this city, an turned it over to the Southern Sierras Power Company, which con it is understood, he represents, and not the California-Nevada Company, as previously stated.

SAN DIEGO, CAL.—The work of installing its wires in condui been commenced by the San Diego Consolidated Gas & Electric pany, an ordinance having recently been passed requiring the ove wires of all electric companies, with the exception of the San Electric Railroad, to be placed underground.

SAN FRANCISCO, CAL.—The Board of Public Works has a a resolution calling on the Supervisors to sell $400,000 addditional Street railway bonds to provide funds for construction of power and car barns.

SAN JOSE, CAL.—It is understood that the Great Western Company, which operates a 55,000-hp plant at Big Bend, on the F River, is preparing to enter the electric lighting field at San Jo competition with the Union Gas & Electric Company. It is stat Mr. J. H. Hornung commercial representative, that if sufficient ness can be assured to warrant the extension of the company's to that city work will be undertaken at an early date.

WATTS, CAL.—The Pacific Light & Power Company has sub to the Chamber of Commerce the following proposition for lightin city: It agrees to erect poles, string wires and install forty-five tun lamps for the sum of $9,000, the city to pay a flat rate of $68 per for the electricity used for a period of five years and, in additi the above rate, to pay $150 per month for five years for installin plant, making a total of $218 per month for five years.

FRUITA, COL.—The Grand Junction & Grand River Railway pany, Grand Junction, Col., has been granted a franchise by the Council of Fruita for the sale of electricity in that city. The C has also signed a twenty-five-year contract with the company for a s lighting system.

OAK CREEK, COL.—Work has commenced on the installation electric-light plant in Oak Creek under a franchise granted to Sharpe, of Cripple Creek, president of the Oak Creek Town La Mining Company. Orders have been placed for a 2200-volt, altern current generator and 3 miles of wire will be erected at once.

TRINIDAD, COL.—The Colorado Railway, Light & Power Com Trinidad, Col., which was reorganized about a year ago with a ca zation of $5,000,000, was sold to the Federal Light & Traction Com of New York, on Aug. 2, the price being $950,000. The property bid in at a receiver's sale by C. C. Chapelle, of New York City. announced that many important extensions will be made in the future to the plant and business of the company.

GUILFORD, CONN.—The Borough Council is considering the tion of lighting the streets of the borough by electricity. The Housa Power Company has submitted a proposition offering to install incandescent lamps of 25 cp at $13.50 each per year, making total cost per year $1,150, against $540 for maintenance of the pr oil lamps. It is proposed to enter into a three-year contract, the pany to bear the expense of installation of the system.

NEW MILFORD, CONN.—Application for a charter has been by the Still River Power Company, of this city. It is understood the granting of such a charter is being opposed by the New Mi Electric Light Company.

NEW MILFORD, CONN.—Plans for the construction of a below the gorge, at which point electrical energy for its own use for public distribution can be generated, are being considered by Silica Paint Company, of this city.

NORWICH, CONN.—The municipal electric light plant, whic at present installing a new turbine generator and condenser, is pla to extend its transmission line a mile south of Thamesville in ord supply electricity for lighting the Norwich Golf Club and such residences along the route as may care to take advantage of the ser

OCCUM, R. D., VERSAILLES, CONN.—Arrangements are made by the Totakett Company to install an electric-light plant to su electricity to light the mill, tenements and residences in the town generator with sufficient output to supply 1000 lamps will be inst The contract for the work has been awarded to the Norwich Ele Company, of Norwich, Conn.

WASHINGTON, D. C.—Consular Report No. 182 states, under eign Trade Opportunities, Item 7139, that a hotel proprietor in

[illegible] estimates for installing a small [illegible] in his [illegible] Correspondence should be in English.

[illegible]ASHINGTON, D. C.—The contract for furnishing eight 5000-lb. [illegible] lb. electric motor trucks [illegible] and [illegible] Navy Department, Washington, D. C., has been awarded to the [illegible]al Vehicle Company, Long Island City, L. I., N. Y., for $49,000.

[illegible] Notes, that the Durban borough electrical engineer has been [illegible]yed to purchase specimens of suitable and up-to-date electrical ap[illegible] household use, with [illegible] of consumers.

[illegible]ASHINGTON, D. C.—Sealed proposals will be received at the [illegible] the Supervising Architect, Treasury Department, Washington, [illegible] until Sept. 15 for the installation of an electric elevator plant in [illegible] United States post office at Washington, D. C., in accordance with [illegible] and specifications, copies of which may be obtained at the above [illegible]r at the office of D. H. Burnham & Company, of Chicago, archi[illegible] James Knox Taylor is supervising architect.

[illegible]SHINGTON, D. C.—Bids will be received at the office of the [illegible]sing Architect, Treasury Department, Washington, D. C., until [illegible] for mechanical equipment, excepting elevators and mail-handling [illegible]tus, including plumbing, gas fitting, boiler plant, heating and [illegible]ting system, conduit and wiring system, vacuum-cleaning system [illegible]duced-draft system for the United States post office building, [illegible]gton, D. C., in accordance with drawings and specifications, copies [illegible]ch may be secured at the above office or at the office of D. H. [illegible]am & Company, of Chicago, Ill., architects. James Knox Taylor [illegible]rvising architect.

[illegible] AUGUSTINE, FLA.—The St. Johns Light & Power Company has [illegible]aced in the hands of a receiver, B. E. Dyson, of St. Augustine. [illegible] understood that the embarrassment of the company is merely [illegible]ry and that it will be operated under the receivership for a [illegible]ime only. The reason assigned for the default of interest on [illegible] which led to the above action, is the fact that the company's [illegible] earnings have been utilized for extensions and improvements. [illegible]r Dyson states that neither the electric-light nor trolley service [illegible]er impairment under the present arrangement.

[illegible]TH JACKSONVILLE, FLA.—Sealed proposals will be received [illegible] Board of Bond Trustees of the city of South Jacksonville, Fla., [illegible] Aug. 24 for furnishing material and construction of electric-[illegible]lant and water-works system as follows: For furnishing approx[illegible] 5 miles 8-in., 6-in. and 4-in. cast-iron pipe and specials; hydrants [illegible]ves; drilling 12-in. well; furnishing tower and tank; two boilers; [illegible]ter heater; pumps; generator, exciter, swichboard, etc.; simple valve [illegible] laying cast-iron pipe; constructing reservoir, tower foundations; [illegible]ng machinery; furnishing and erecting electric transmission lines, [illegible]nstruction of power house. Plans may be seen at the office of [illegible] W. Lyon, 305 Duval Building, Jacksonville, consulting engineer, [illegible] copies of specification may be obtained upon application. W. W. [illegible] is chairman Board of Bond Trustees.

[illegible]USTA, GA.—Arrangements are being made to begin work on the [illegible]ction of the dam of the Twin City Power Company on the [illegible]ah River, about 30 miles above Augusta. The proposed plant [illegible]st about $1,000,000 and will supply electricity in this section of [illegible] and in South Carolina. The company has filed a petition with [illegible]ty Council of Savannah, Ga., asking for a franchise to supply [illegible]ity in that city. Thomas O'Conner, of New York, N. Y., is in[illegible]d in the project.

[illegible]MBUS, GA.—The Georgia Power Company has applied to the [illegible]ouncil for a franchise to construct and operate an electric plant [illegible].

[illegible]UMBUS, GA.—The contract for the completion of the large dam in [illegible]rse of construction by the Stone & Webster Engineering Corpora[illegible] of Boston, Mass., across the Chattahoochee River, north of Colum[illegible] has been awarded to the B. H. Hathaway Company, of Columbus. The original plans called for the erection of a 26-ft. dam, which was st[illegible]ed last year. The second contract, recently awarded, calls for an ad[illegible]tional 44 ft., making a 76-ft. dam, which, when completed, together wi[illegible] power plant will involve an expenditure of about $1,500,000. The [illegible] when completed will supply electricity in West Point, La Grange, [illegible], Newnan and other towns and cities in that section.

[illegible]MON CITY, IDAHO.—The control of the Andrews Light & [illegible] Company has passed into the hands of Pomeroy (Wash.) capital[illegible] consideration being $76,000. The officers of the company, which [illegible] be known as the Lemhi Power Company, are [illegible] M[illegible]kenzie, president; E. Riggs, vice-president and manager, and Ralph [illegible] secretary.

[illegible]ICAGO, ILL.—Plans are being considered by the Chicago Suburban Ed[illegible]on Company, which recently absorbed the Economy Light & Power Co[illegible]any, of Joliet, Ill.; the North Shore Electric Company, of Chicago, [illegible]e Illinois Valley Gas & Electric Company, of Streator Ill., and [illegible]ankakee Gas & Electric Company, of Kankakee, Ill., to construct [illegible]r three generating plants to supply electric service to sixty-five cities an[illegible] villages more economically than at present. It is proposed to utilize the water rights owned by the Economy Light & Power Company.

[illegible]. SHERIDAN, ILL.—Contracts for constructing a central heating an[illegible] power plant at Ft. Sheridan, Ill., have been awarded as follows: To Nilson Brothers, of Chicago, Ill., for removing boilers and installing new boilers, at $17,000; Heine Chimney Company, for stack, at $3,900, and to the Western Electric Company for other machinery, at [illegible].

MASCOUTAH, ILL.—For some time the citizens of this city have had under consideration the purchase of the plant of the Mascoutah Electric Light Company. An alternative proposition has been the installation of a new plant. To carry out either of the above plans a special election is to be held to vote on a $12,000 bond issue.

MINONK, ILL.—The Minonk Electric Light & Power Company, Minonk, Ill., has been dissolved.

BLOOMINGTON, IND.—Efforts are being made by F. Reibel, general manager of the Southern Indiana Power Company, Indianapolis, to induce the quarrymen of Bloomington to run their plants by electricity. If he is successful, it is the intention of the company, which has its main plant at Williams, to expend $50,000 for the construction of a transmission line from Stinesville to Bloomington. The Consolidated Stone Company has installed a temporary plant, to be used only until the Southern Indiana Company gets its system in operation.

CLINTON, IND.—The capital stock of the Clinton Electric Light & Power Company has been increased from $10,000 to $40,000. The company proposes to make extensive improvements in its plant. David McBeth is president of the company and J. W. Robb, secretary.

ELKHART, IND.—It is stated that the Indiana & Michigan Electric Company proposes to expend in the neighborhood of $500,000 on contemplated improvements.

INDIANAPOLIS, IND.—The Board of Public Works has ordered the wires of all public service corporations in the mile square to be placed in conduits. This also applies to the high-voltage wires of the trolley companies.

INDIANAPOLIS, IND.—The W. H. Schott Company, of Chicago, Ill., has been admitted to do business in Indiana. The company is capitalized at $300,000 and proposes to make a specialty of designing and constructing electric plants, central heating plants, industrial heating plants and overhead and underground electrical construction work. J. W. Fesler, 725 Newton Claypool Building, Indianapolis, Ind., is the State representative.

JASPER, IND.—Bids will be received at the electric light office in Jasper, up to 7:30 p. m., Aug. 21, by the board of trustees, for the construction of an addition to the electric-lighting system, according to plans and specifications prepared by Architect M. F. Durlauf, and which are on file with the town clerk.

KENDALLVILLE, IND.—The City Council has awarded the contract for ornamental lamp standards for the boulevard lighting system, to be installed in the business district, to the Western Gas Construction Company, of Ft. Wayne, Ind. From forty to sixty posts, to cost $42.80 each, will be used.

LAWRENCEBURG, IND.—The construction of an electric railway between Osgood and Versailles is planned, nearly all of the right-of-way privileges having been obtained along the proposed route. Those interested in the proposition are J. L. Phillips, Clinton, Mo., and Julius E. Wayland, Gerard, Kan.

MARION, IND.—A new electric-light plant is to be installed in this city to take the place of the one destroyed by fire some time ago, the contract for the construction of a new building having been awarded by the City Council to J. H. Waldron. Two new electrically driven pumps will be substituted for the steam pumps formerly in service.

NOBLESVILLE, IND.—An order for the sale of the White River Light & Power Company on Aug. 15, at the office of the Wainwright Trust Company, of Noblesville, has been issued by the United States referee, the concern having passed into the hands of a receiver and thence into the Bankrupt Court. An upset price of $30,000 has been placed by the referee, and the requirement made that the successful bidder shall deposit $5,000 in a certified check or cash with his bid, the balance of the purchase money to be paid within fifteen days. About $150,000 has been expended by the White River Company on its hydroelectric development on the White River, and it is estimated that about $75,000 will be required to complete the plant. The company owns seventy-five acres of land in fee, 160 ft. of concrete dam has been built and the turbine chambers are partially completed. The plant is equipped with 406 hp in boilers, a 300-kw turbo-generator set and condensing apparatus, all of modern make and in good condition. Transmission lines are built to Noblesville, a distance of two miles, and a distribution system covers the city.

PRINCETON, IND.—Plans are being prepared by the City Council for the installation of cluster lamps around the public square and in the principal business street.

SHIRLEY, IND.—An electric-light system is being installed on Main Street by the local business men. Electricity for maintaining the lamps will be supplied by the Indianapolis, New Castle & Toledo Traction Company.

CLARION, IOWA.—The electric-light plant at this city, owned by Carr & Mozingo, has been destroyed by fire.

INDEPENDENCE, IA.—The contract for new equipment for the electric plant is reported to have been awarded to the Allis-Chalmers Company, Milwaukee, Wis., the price being $11,000.

KEOKUK, IA.—It is [illegible] Sargeant & Lundy Company have [illegible] Stone & Webster Construction Company, of Boston, the [illegible] Keokuk [illegible] the electric light and [illegible] plants, street railway system and the Keokuk & Warsaw Interurban Line, the consideration, however, not being made public. Lighting and street railway franchises in Keokuk were recently granted to Stone & Webster, and it is understood that several hundred thousand dollars will be expended in the extension and improvement of the public utility plants thus acquired. A. D. Ayers, who has been local manager for the Chicago interests, will be retained in that capacity by the new owners.

NEWTON, IA.—The contract for the construction of the municipal plant at this city has been awarded to Eastmine & Stines, of Newton, for $13,700.

GARDEN CITY, KAN.—The advisability of authorizing a $40,000 bond issue, the proceeds to be utilized for the installation of a municipal electric-light plant, is being considered by the citizens of Garden City.

GREENSBURG, KAN.—Contracts have been awarded by the City Council for equipment for the proposed municipal electric-light plant. The electrical equipment will be furnished by the United Electrical Company, of Wichita, Kan., and the Sheffield Gas Power Company, of Kansas City, Mo., will supply two 50-hp solar oil engines. J. W. Rigby, of Wichita, Kan., has been engaged as electrical engineer.

MANHATTAN, KAN.—The Manhattan Interurban Railway Company is planning to construct an electric railway from Manhattan to Ft. [illegible] with [illegible] between Ft. Riley and Junction City, making a continuous line from Manhattan to [illegible]

NEODESHA, KAN.—At a meeting of the city commissioners the new electric lighting plant, for which the city voted $12,000 in bonds, was accepted, and it is now the property of the city.

COVINGTON, KY.—The Covington Industrial Club has petitioned the Board of Aldermen to install an ornamental street-lighting system on Madison Avenue and Pike Street. Efforts are being made to have cluster lamps erected on the main thoroughfares in the city.

LOUISVILLE, KY.—Arrangements have been completed by the Kentucky Electric Company to take over the contract for lighting the Galt House. It was first proposed to rebuild the electric plant in the hotel, which would have cost $65,000 and $24,000 a year to maintain. The stockholders decided to abandon the private plant and contract with the Kentucky Electric Company for electrical service.

LOUISVILLE, KY.—Permission has been granted to the Federal Sign System by the Board of Public Works to erect boulevard lamps on Jefferson Street, between Second and Third Streets, and between Third and Fourth Streets, electricity for the former to be supplied by the Kentucky Electric Company and for the latter by the Louisville Lighting Company. The lamps, which are to be mounted on standards in clusters of five lamps to the standard, are to be erected without expense to the city and removed should the installation be passed upon unfavorably by the board. On the other hand, should the lighting system prove satisfactory, permission will be sought by the Federal Sign Company to install similar standards along various other business streets of the city, the expense to be borne by the merchants benefited.

RANGELEY, MAINE.—The building, boilers and engine which have been used at the electric-light plant at this city, together with the land on which the plant is located, have been purchased by William Tomlinson from the Kempton Lumber Company. Mr. Tomlinson has also leased the generator, electric-light poles and wires of Mr. Benson, of Lewiston, with the privilege of buying them, and will operate the plant.

RICHMOND, MAINE.—The Board of Selectmen has entered into a contract with the Central Maine Power Company for lighting the streets of the town with electricity. The company will soon begin work on the erection of the transmission line from Gardiner to Richmond. The contract is for a period of ten years and provides for seventy-one 25-cp incandescent lamps.

BALTIMORE, MD.—Orders have been placed by the Baltimore & Ohio Railroad Company with the United States Electric Company for forty complete telephone station equipments for the extension of its telephone train-dispatching service from Clarksburg to Salem.

CONCORD, MASS.—The Municipal Light Board has decided to reduce the rate for electricity for commercial and domestic lighting from 10 cents to 9 cents per kw-hour; no change will be made in the price for cooking and heating purposes, which is 4 cents per kw-hour; for lighting the municipal buildings the rate is 6 cents per kw-hour. Renewals are furnished of all gem lamps free of charge and of carbon lamps up to 8 cp. An appropriation is made by the town of $5,000 for the street-lighting system, which consists of 940 incandescent lamps, operated 3200 hours. A. W. Lee is manager of the municipal electric-light plant.

FALL RIVER, MASS.—The officers of the Bradford Durfee Textile School have been notified that the Legislature has appropriated $53,000 for the school, which is now available. Of this sum $27,000 is to be used for running expenses and $27,000 for erection of an addition to the school, the construction of power house and new equipment, establishing a new designing department and purchase of additional equipment for the engineering, electrical and weaving departments.

FRANKLIN, MASS.—It is the intention of C. D. Parker & Company, who recently took over the plant and holdings of the Union Elec[illegible] Light Company, of Franklin, as well as the property of the Fox[illegible] Electric Company, to construct a transmission line from Frankli[illegible] Foxboro and to discontinue the steam plant which is at present in o[illegible] tion at the latter city.

GRANBY, MASS.—The South Hadley Falls Electric Company is [illegible] ing investigations with a view of extending its transmission lines [illegible] Granby. The company is ready to extend its system if sufficient busi[illegible] is guaranteed.

LEE, MASS.—It is stated that Carl Wurtzbach and Alex. G. [illegible] graff, of Lee, are interested in a plan to increase the equipment of [illegible] Lee electric plant, to secure energy from the Monument Mills Com[illegible] and to furnish service for Lee and Lenox and some of the [illegible] country estates. The present plans call for the building of a 6000 [illegible] transmission line.

MILLBURY, MASS.—The contract for the new substation of [illegible] Worcester Suburban Electric Company, on Grafton Street, has [illegible] awarded to E. D. Ward, of Worcester, and work will be commence[illegible] an early date. It is stated that the new station, which will cost in [illegible] neighborhood of $5,000, is to be supplied with modern equipment. [illegible] generating station of the company, which has recently contracted [illegible] the town of Auburn to furnish electricity for lighting the streets [illegible] located at Uxbridge, and energy will be transmitted from that poin[illegible] Millbury.

SHELBURNE FALLS, MASS.—It is expected that work on the [illegible] crete dam to be built by the Chase and Harriman interests, which i[illegible] replace the wooden structure which now furnishes hydroelectric en[illegible] to the Lamson & Goodnow Manufacturing Company at Shelburne F[illegible] will be commenced in a few days. During the process of construc[illegible] energy for operating the Lamson & Goodnow plant will be transmi[illegible] from the large power station near Brattleboro, Vt.

UXBRIDGE, MASS.—The Worcester Suburban Electric Company [illegible] pects to install in the new addition which is being made to its plant [illegible] Depot Street one 2000-hp steam turbine and two 400-hp Edge M[illegible] boilers.

WORCESTER, MASS.—A. S. Lowell, president of the A. S. Lo[illegible] Company, has purchased the property of the A. S. Lowell Company [illegible] hereafter the concern will be operated by him. The reason [illegible] the change was the refusal of the Massachusetts Gas and Ele[illegible] Light Commission to approve the franchise which the Board of A[illegible] men granted Mr. Lowell to lay a conduit across Foster Street from [illegible] Lowell Building, in which he has a private electric plant, to light [illegible] Lowell store at the corner of Main and Foster Streets. The claim [illegible] made that the party owning the electric plant and the store was not [illegible] same party; the Worcester Electric Light Company claimed that the [illegible] proval of the contract would mean the approval of a second concer[illegible] sell electricity in Worcester, which the commission upheld. Mr. Lo[illegible] proposes to apply to the commission for another franchise.

BARAGA, MICH.—The Oscar Claussen Engineering Company, [illegible] Paul, Minn., has been selected as consulting engineer in connec[illegible] with the installation of water works and electric-light plant at Barag[illegible]

DETROIT, MICH.—The Consolidated Light & Power Company, w[illegible] is capitalized at $100,000, the land value of the property held by [illegible] company, has been organized in Michigan for the purpose of erec[illegible] and operating hydroelectric plants on the Chippewa River. En[illegible] will be generated and distributed to about thirty towns, among t[illegible] Midland, Ionia, St. Johns, Ithaca and Mount Pleasant. The com[illegible] now has two dams across the Chippewa River, and contemplates [illegible] construction of seven more. The officers, all Detroit men, are: P[illegible] dent, J. L. Hudson; vice-president and general manager, Charles [illegible] Abbott; secretary, Robert Tannerhill; treasurer, F. R. Ross.

SAGINAW, MICH.—Judge Angel, of the United States Dis[illegible] Court of Eastern Michigan, on July 27 handed down a decision ma[illegible] the injunction permanent which the Saginaw Power Company sec[illegible] against the city of Saginaw, restraining the Board of Public W[illegible] from removing its poles, wires, conduits, etc., from the steets after [illegible] Bartlett Illuminating Company's franchise was declared forfeited [illegible] August. Owing to the failure of the city and the Bartlett Illumina[illegible] Company to reach an agreement for an adjustment of rates, and the [illegible] nouncement that the Saginaw Power Company had purchased [illegible] physical properties of the Bartlett company and would do busines[illegible] Saginaw under the Eastern Michigan Power Company's franchise, [illegible] City Council adopted a resolution calling for the removal of poles, [illegible] and the injunction in the United States Court followed. There is p[illegible] ing in the Circuit Court of Saginaw County a case of the people ag[illegible] the Bartlett Illuminating Company, the Saginaw Power Company [illegible] the Eastern Michigan Power Company to dissolve the corporation on [illegible] ground that it is a monopoly.

ALBERT LEA, MINN.—It is reported that the Northwestern [illegible] phone Exchange Company will expend about $10,000 in placing [illegible] wires in conduits.

LITTLE FALLS, MINN.—A fire at the plant of the Little [illegible] Water Power Company, due to a short circuit on the switchbo[illegible] caused several thousand dollars damage. The switchboard was ent[illegible] destroyed, and considerable damage done to two 500-kw generators. [illegible] small generator is now furnishing electricity to light the city.

MAYNARD, MINN.—There is a movement [illegible] in the city looking [illegible]ard the installation of a municipal [illegible] plant.

BRANSON, MO.—Surveys are being [illegible] the site for [illegible] White River dam. It is proposed to [illegible] the proposed dam and [illegible] a hydroelectric plant about [illegible] miles from [illegible]. Electricity [gen]erated at the plant will be transmitted to Springfield, a distance of 35 [mile]s. M. L. Holman and John A. Laird are making preliminary sur[vey]s.

ST. LOUIS, MO.—It is [illegible] the [Boar]d of Public Improvements, William T. Findly, secretary, 300 New [City] Hall, until 12 noon, Aug. 15, for furnishing and erecting electric [and g]as-lighting fixtures in the Municipal Court Building.

ST. LOUIS, MO.—Preparations are being made for the construction [of a] power house in West Walnut Manor. The proposed plant will be [locate]d on land contiguous to the Wabash Railroad tracks and will supply [electri]city in West Walnut Manor and also to operate the proposed [stree]t car line which is to connect the new subdivision with the Belle[fontai]ne and the Union Avenue car lines at Walnut Park.

[BU]TTE, MONT.—The Butte, Anaconda & Pacific Railway Company, [it is] said, has decided to discard steam power and equip its railway for [electr]ical operation, which will involve an expenditure of about $1,000,000.

[GL]ASGOW, MONT.—The city of Glasgow is contemplating the in[stalla]tion of an ornamental street-lighting system and would like to re[ceive] prices on lamp-posts, ggiving weights, cuts and equipment. E. S. [Pre]nce is city engineer.

[HE]LENA, MONT.—Steps have been taken by the City Council for the [install]ation of a system of cluster lamps on all streets in the business [par]t of the city.

[BU]RLINGTON, N. J.—A special election for the purpose of voting [on th]e installation of a municipal electric-light system has been called [for] Sept. 6. The alleged high rates and poor service since the plant [passe]d under the control of the Public Service Corporation is stated to [have] precipitated this action.

[MO]NTCLAIR, N. J.—Negotiations are under way between the Town [Counci]l and the Public Service Corporation for lighting the streets of the [town b]y electricity.

[BRO]OKLYN, N. Y.—The contract for installing electric equipment [in Pub]lic School 168, located on Throop Avenue, between Bartlett and [Whipp]le Streets, Brooklyn, N. Y., has been awarded to T. Frederick [Jackso]n, Inc., New York, N. Y., for $9,845.

[BU]FFALO, N. Y.—The Sisters of Mercy, 1475 Abbott Road, Buffalo, [N. Y.], have awarded the contract for construction of power plant for [the Mo]ther House of the order at Abbott Road and Red Jacket Parkway [illegible] & Summers, [illegible] Seneca Street, Buffalo, N. Y., to cost [illegible].

[CA]TSKILL, N. Y.—Because of alleged dissatisfaction as regards [the] the service rendered and the rates charged, it is stated that the [citize]ns of Catskill are considering the installation of a municipal elec[tric-li]ght plant.

[DO]LGEVILLE, N. Y.—The P. B. McCaghey Company, of Little Falls, [N. Y.], has secured the contracts for replacing wooden dams in Dolge[ville] and Newport with concrete structures. The dam in Newport will [be [illegible]] ft. in height and will supply power to operate the electric-light and [power] plant and other industries in that district. The dam in Dolgeville [is own]ed by the American Felt Company and will be 7 ft. high.

[HA]RTWICK, N. Y.—Permission has been granted by the Public [Servic]e Commission to the Hartwick Power Company to erect poles and [strin]g wires in the lighting district of Hartwick.

[MA]LONE, N. Y.—Bids will be received by John P. Badger, president [of Bo]ard of Trustees North New York Institution for Deaf Mutes, [Malo]ne, N. Y., until Aug. 16 for construction, including heating, plumb[ing] and electric work for the administration building, including altera[tions] in existing rear extension, and for two dormitory buildings for boys [and gi]rls at the Northern Institution for Deaf Mutes, Malone, N. Y. [Draw]ings and specifications may be consulted and blank form of proposal [ob]tained at the Northern Institution for Deaf Mutes, Malone, N. Y., and [at] the office of Franklin B. Ware, State Architect, Albany, N. Y. Copies [of] plans and specifications may be obtained upon application to the State [Architect].

[NE]W YORK, N. Y.—The contract for furnishing and installing boilers [and a]ccessories in power house of the Metropolitan Hospital, Blackwell's [Isla]nd, has been awarded to Osborne Rae & Company, 241 West Forty[-fir]st Street, New York, N. Y., for $12,521.

NEW YORK, N. Y.—Bids will be received by the Department of [Pu]blic Charities, foot of East Twenty-sixth Street, New York, N. Y., [un]til Aug. 15 for furnishing all material and labor for certain excava[tio]n, masonry, steel and iron work, painting and plumbing work, power [wo]rk and machinery, refrigerating work, electric work and all the other [wo]rk in connection with the completion of an administration building, a [su]rgical pavilion and dining-hall building, a service tunnel and covered [co]rridor connecting buildings, ambulance and laundry building and also [po]wer work and machinery, etc., for six-ward pavilions, now under con[tra]ct, for the Seaview Hospital, situated on the property of the Depart[me]nt of Public Charities, in the borough of Richmond, N. Y. Blank [for]ms and further information may be obtained at the office of Raymond [F.] Almirall, 185 Madison Avenue, New York, N. Y., architect, where plans and specifications may be seen. Michael J. Drummond is commissioner of public charities.

SAND LAKE, N. Y.—A franchise has been granted by the Public Service Commission, Second District, to the Wynantskill Hydroelectric Company for the construction of an electric generating plant at Wynantskill Creek in the town of Sand Lake. Work on the plant, which is to supply electricity to West Sand Lake, Snyder's Lake, Reichard's Lake, Averill Park, Sand Lake, Crooked Lake, Burden Lake and other towns in the vicinity, will be commenced at once.

WARSAW, N. Y.—The Village Trustees have awarded a contract to the Warsaw Gas & Electric Company for lighting the streets of the village for a period of five years. Under the terms of the contract the company is to furnish thirty-two arc lamps at $75 each per year and forty incandescent lamps at $15 per lamp per year.

SHALLOTTE, N. C.—The Seaside, Shallotte & Wilmington Telephone Company, it is reported, is making arrangements to erect a telephone line, 25 miles in length. Bids for construction of the line will be received until Aug. 25. Walter Leonard, of Supply, N. C., is secretary.

FESSENDEN, N. D.—It is the intention of the Maple Leaf Telephone Company to extend its lines in Fessenden, a franchise to that end having been granted by the County Board.

PAYNE, OHIO.—At an election held recently the proposition to issue bonds for the purchase of the local electric-light plant and the installation of a water-works system was carried. The cost of the electric plant is estimated at $9,700 and the water-works at $17,000.

MULDROW, OKLA.—It is reported that the city is contemplating calling an election to vote on the proposition to issue bonds for the installation of electric-light and water-works systems in Muldrow.

MUSKOGEE, OKLA.—Sealed bids will be received by the City Council of Muskogee, Okla., until Aug. 29 for furnishing and erecting the following pumping machinery: One 1,600,000-gal. low-lift centrifugal pump; one 1,600,000-gal. high-lift centrifugal pump, and one 1,300,000-gal. high-lift centrifugal pump. Bids will be received alternately for direct connection with electric motors and steam turbines. Specifications may be obtained at the office of the city engineer or at the office of Alexander Potter, 114 Liberty Street, New York, N. Y., consulting engineer. All bids to be addressed to E. H. Fleming, city clerk.

ASHLAND, ORE.—It is stated that the franchise of the Ashland Electric Light & Power Company has been revoked, and that the city's municipal plant will soon be in operation.

KLAMATH FALLS, ORE.—The Siskiyou Electric Power & Light Company, of Yreka, Cal., which recently acquired control of the local power plants in this city, contemplates the construction of a transmission line from its Fall Creek plant to Klamath Falls.

MONROE, ORE.—It is reported that the Welch interests are planning to equip the Carver railway from Corvallis to Monroe at once for electrical operation and to push the completion of the line from Monroe to Eugene.

MOSIER, ORE.—Arrangements are being made by the Pacific Light & Power Company to erect a transmission line to Mosier to supply electricity for lamps and motors in this town.

ONTARIO, ORE.—Plans are being made by the Ontario Nyssa Irrigation Company for building an irrigation system to irrigate 10,000 acres of land between Ontario and Nyssa. It is understood that funds have been provided for the construction of the Shoestring ditch and the installation of an 1800-hp electric pumping plant. The officers of the company are: A. W. Trow, president; E. M. Grieg, vice-president; E. H. Test, secretary, and W. H. Doolittle, treasurer.

PORTLAND, ORE.—Preparations are being made for the installation of an electric-light system in Burlington, the industrial suburb on the Spokane, Portland & Seattle, Northern Pacific and United Railways. The power station has been completed and machinery will soon be installed.

CHESTER, PA.—The A. P. Witteman Company, Fourth and Booth Streets, Chester, Pa., is building a new power house, 40 ft. x 50 ft. A 150-kw generator will be installed.

JOHNSTOWN, PA.—Plans are being made for substituting electricity for steam as the motive power for operating the Cambria Incline Plane in the near future. Energy for operating the cars will be furnished by the power plant of the Cambria Steel Company. The steam plant will be abandoned.

LANCASTER, PA.—The property of the Manheim & Mount Joy Electric Light Company has been purchased by the Susquehanna Railway & Light Company. The company supplies electrical service in Manheim and Mount Joy.

MEADVILLE, PA.—The Northwestern Pennsylvania Railway Company has placed contracts with the General Electric Company, of Schenectady, N. Y., for three generators, two for the power plant in Meadville and one for the Harmonsburg substation, to cost $15,500. The greater portion of the increased output of the plant will be utilized on the Cambridge Springs line, which the company has recently taken over. It is proposed to install new motors in the present cars and make other improvements to the service.

MILTON, PA.—It is reported that plans are being prepared by Henry & West, of Philadelphia, Pa., who control the United Light & Power Company, of Milton, Pa., for consolidating all the light and power properties between and including Milton and Sunbury into one company,

to be capitalized [illegible] the proposed new corporation will take over the following electric and gas plants: Edison and Middle Creek Electric Illuminating Company, Sunbury Light & Power Company, Sunbury Gas Company, Northumberland Electric Illuminating Company, the United Light & Power Company, of Milton, and the leasehold of the United Light & Power Company and of the Lewisburg Electric Light Company, of Lewisburg, for a period of ninety-nine years.

NANTY GLO, PA.—Improvements representing an expenditure of over $25,000 are under way at the plant of the Nanty Glo Light, Heat & Power Company, the controlling interest in which was recently acquired by Ebensburg capitalists. The plans for the new work, which are being prepared by C. C. Dovey, of the Swank Building, include the construction of a modern brick power house, of sufficient size to accommodate six 900-hp boilers and three 2220-volt alternators. In addition to supplying electricity for lamps in Nanty Glo, the company will also supply motor service to the nearby mines. The officers of the company are: President, T. P. Burns, Nanty Glo; secretary and treasurer, Walter Jones, Ebensburg. These, in addition to T. Stanton Davis, Ebensburg; E. B. Nairn and Ed. Smith, of Nanty Glo, comprise the board of directors. The offices are in the Cambria Trust Company's Building, Ebensburg.

NEW CASTLE, PA.—It is the intention of the Mahoning & Shenango Valley Railway to enlarge its generating station and install new equipment at Sharon.

SHICKSHINNY, PA.—Negotiations have been completed whereby the municipal electric-light plant will be abandoned and electricity for operating the local system will be obtained from the Luzerne County Gas & Electric Company, of Plymouth, Pa. The service from the municipal electric plant has been unsatisfactory for some time and was available at night only. The price paid for the plant is said to be about $10,000.

WILKES-BARRE, PA.—The Central Poor Directors are reported to have awarded a contract on Aug. 3 for furnishing the new electric engine, generator, switchboard and other appliances to E. F. Roth, of Wilkes-Barre, for $6,956.

EDGEFIELD, S. C.—The proposition to issue bonds to the amount of $15,000, the proceeds to be used for the construction of an electric-light plant, it is reported, will be submitted again to the voters on Aug. 21. J. B. McCrary & Company, Empire Building, Atlanta, Ga., are engineers; W. H. Harling is clerk and treasurer.

ENOREE, S. C.—The Enoree Manufacturing Company, of Enoree, S. C., has awarded a contract to the Irwin Electric Company, of Spartanburg, S. C., for the installation of a 100-kw electric plant. Electricity generated at the plant will be used to operate the ginnery and for lighting streets, cotton mill, stores and residences of the village. The plant will be operated by water-power. General Electric equipment will be installed. Alternating-current system will be used. It is expected to have the plant in operation by Aug. 15.

LAKE CITY, S. C.—The Farmers' Union Ginning & Manufacturing Company is reported to be contemplating the installation of an electric-light plant.

ORANGEBURG, S. C.—The Commissioners of Public Works have placed a contract with the Western Electric Company for an engine and generator to be placed in the water and electric-light plant.

ROCK HILL, S. C.—Arrangements have been concluded for the installation of an improved system of lighting in the business district of Rock Hill, extending from the post office to Railroad Avenue on Main Street. There will be nine ornamental cast-iron posts on each side of the street, spaced 75 feet apart and surmounted with a cluster of five tungsten lamps.

CHATTANOOGA, TENN.—The Georgia Power Company is making preparations to extend its transmission lines from Rome, Ga., to Chattanooga, Tenn. The plant of the company is located at Tallulah Falls, Ga. The company was recently granted a charter by the State of Tennessee. The company is capitalized at $100,000 and the incorporators are: H. P. Boughton, J. E. M. Ellet, L. M. Coleman, W. L. Frierson and Paul Campbell.

KNOXVILLE, TENN.—Surveys are being made by the Georgia Power Company for the erection of its transmission lines from the power plant at Tallulah Falls, Ga., to Knoxville, Tenn., for the purpose of supplying electricity in Knoxville. Work has begun on the erection of the line between Tallulah Falls, Ga., and Franklin, N. C.

NASHVILLE, TENN.—The Nashville Railway & Light Company has recently purchased from Byrd Douglas the site of the latter's old warehouse, fronting on First and Second Avenues, the company's intention being to utilize it for an extension to its present power plant. However, no definite statement as to when the extension will be made has been given out.

PETERSBURG, TENN.—The question of establishing an electric-light plant in Petersburg is reported to be under consideration.

AUSTIN, TEX.—The Austin Electric Railway contemplates the extension of its lines to the site of the proposed dam across the Colorado River, about three miles west of the city.

AUSTIN, TEX.—A special election will be held in this city on Aug. 30 for the purpose of voting on the proposition of William D. Johnson, of Hartford, Conn., head of the Hydraulics Properties Company, of New York, for the construction of a dam across the Colorado River at Austin and the installation of a hydroelectric plant. Mr. Johnson has deposited $25,000 to the credit of the city, as a guaran that the dam and hydroelectric plant will be constructed in accordan with the contract and specifications as agreed upon by him and the c commissioners. The proposed cost is $1,600,000. As stated in our iss of July 15, the City Council has already accepted the proposition made by Mr. Johnson.

BUCKHOLTS, TEX.—It is reported that Dr. W. R. Newton, of Bu holts, Tex., would like to receive estimates of cost of installation of electric-light plant for a sanitarium. The cost of the sanitarium is es mated at $10,000.

SAN ANTONIO, TEX.—The Medina Irrigation Company, headed Dr. F. S. Pearson, of New York, has enlarged its plans for irrigati lands in different parts of south Texas. In addition to the large d which it will erect across the Medina River, mention of which has ready been made in these columns, it has filed water rights on t Guadalupe River at points 9 and 12 miles above Kerrville. T auxiliary terminals will be constructed at the latter places for t purpose of storing water for the irrigation of 30,000 acres of land, addition to the 100,000 acres to be irrigated in the valley of the Medi River. The cost of the dams and canal system near Kerrville will approximately $2,000,000. Water rights on the Frio and Nueces Rive in Uvalde County have also been filed, and two other large dams will erected. The enlarged plans bring the estimated cost of the work up $12,000,000.

TIOGA, TEX.—It is stated that the Commercial Club, of Tio Texas, is formulating plans for the construction of an interurban elect railway to run from McKinney to Gainesville, a distance of about fi miles. The proposition is meeting with favor in the towns along t proposed route, and a company to carry out the project will soon organized.

TYLER, TEX.—The City Council has closed a contract with the Ty Electric Light Company for a large number of additional street lam

WILLS POINT, TEX.—Arrangements are being made to organize stock company in Wills Point for the purpose of taking over the lo electric plant, which was burned several weeks ago, and rebuilding t same. The company will be capitalized at $10,000. The directors a J. H. Human, John E. Owens, E. A. Russell, W. H. Wingo, B. W. Bru R. W. Garrett and W. R. Howell.

FT. MONROE, VA.—Bids will be received at the office of the p quartermaster, Ft. Monroe, Va., until Aug. 16 for a small quantity miscellaneous electrical material and 400 Star screw anchors. Capta Curtis G. Rorebeck is post quartermaster.

RICHMOND, VA.—Application has been made to the Council Co mittee on Electricity by the Virginia Railway & Power Company for p mission to string temporary overhead wires from Ninth to Cary Stre to the new Chesapeake and Ohio First National Bank skyscraper si where it is proposed to use electric hoists instead of the old style ste engines.

SUNNYSIDE, WASH.—The Pacific Power & Light Company has cided to extend its transmission lines to the Garden tracts to sup electricity for lamps and motors in that section.

MENASHA, WIS.—The City Council has awarded contracts for n equipment for the municipal electric plant as follows: To the Die Engine Company for a 225-hp engine and the Wagner Electric Co pany for a 200-kva generator and switchboard. The cost of the wo is estimated at about $8,000.

MILWAUKEE, WIS.—About $1,000,000 is to be expended by t Wisconsin Telephone Company in the erection and equipment of mode exchanges at Milwaukee, Wauwatosa, Beloit, Appleton and Fond du La

NORTH FREEDOM, WIS.—It is stated that O. Nelson and Arth Voeck, who recently took over the plant and holdings of the No Freedom Electric Light Company, contemplate making extensive impro ments in the newly acquired property.

OSCEOLA, WIS.—The plant and holdings of the Osceola Elect Light Company have been purchased by the Minneapolis General Elect Company, of Minneapolis, Minn. Electricity for operating the lo service will be supplied from the latter company's plant at St. Cro Falls. A twenty-four-hour service will be furnished for both lamps a motors.

RANDOM LAKE, WIS.—The citizens have voted for the installati of a municipal electric-light plant.

WYOCENA, WIS.—The Columbia County Power Company is pla ning to establish a twenty-four-hour service and extend the transm sion lines to Pardeeville and Rio to supply electricity for lamps a motors.

COBALT, ONT., CAN.—The plant of the Northern Ontario Light Power Company, at South Porcupine, which was recently destroyed fire, is being replaced rapidly. Larger generators have been ordered a larger boiler equipment is being provided for. The south end ste plant, in which large transformers will be installed, will be kept reserve. Frank L. Cody, president of the company, announces th energy will be obtained from Sandy Falls within six weeks, and that t transmission line is to be run from South Porcupine to the end the lake.

NAPANEE, ONT., CAN.—At an election held recently the by-l authorizing the town to sell the municipal electric plant to the Seymo

wer Company, of Campbellford, Ont., ... Company is to pay the town ... agrees to supply electricity at the ... vate consumers. The town has entered into a thirty-year contract with ... company to light the town.

TORONTO, ONT., CAN.—Bids will be received by registered post only ...ssed to the Chairman of the Board of Control, City Hall, Toronto, ... noon on Tuesday, Aug. 15, 1911, for the supply and erection of ...ic-lighting fixtures for the filtration plant. Plans and specifications ... be seen and forms of tender obtained from the Water Works De...ent at the office of the City Engineer, Toronto.

SASKATOON, SASK., CAN.—The municipal electric plant in Saska... was damaged on July 27 by a boiler explosion.

...CAXA, MEXICO.—It is stated that two additional 10,000-kw units ... been installed by the Mexico Light & Power Company in its hydro...tric plant at this city, and that work on the new storage dam which ...mpany is constructing will soon be finished.

...N LUIS, MEX.—The local street railway system has been purchased ... syndicate headed by ... f. It is stated that the new owners propose to make extensive ...vements and extensions to the system, involving an expenditure of ... than $1,000,000. The construction of an interurban line to the ...bs of Solebad will be among the first of the extensions. The ...n Central Light & Power Company will provide electrical energy ...erating the system.

New Industrial Companies.

... AMERICAN SMOKELESS FURNACE COMPANY, of ... has filed articles of incorporation with a capital stock of ... the purpose of manufacturing and dealing in furnaces, ...s, etc. C. E. Eaton is president and T. L. Corteau, treasurer, both ...

...HE ATLANTIC PERFECTED MOTOR COMPANY, of Atlantic ... has been incorporated with a capital stock of ... by ...own, T. Kilcourse and S. S. Phoebus, of Atlantic City, N. J. The ...any proposes to manufacture motors, engines, etc.

...HE CITY ELECTRIC OMNIBUS COMPANY, of Camden, N. J., ...een incorporated with a capital stock of $500,000 by F. R. Hansell, ... A. MacPeak and I. C. Crow, all of Camden, N. J.

...E GENERAL RAILWAY & MOTOR SAFETY APPLIANCE ...PANY, of New York, N. Y., has been incorporated with a capital ... of $50,000 for the purpose of manufacturing railway appliances ... B. Sorsby, J. D. Wetmore, of New York, N. Y., and H. Kasberg, ...unt Vernon, N. Y.

...E GEYSER ELECTRIC COMPANY, of New York, N. Y., has ... granted a charter with a capital stock of $1,500,000. The company ...ses to manufacture electric apparatus for heating water and other ...s, etc. The chief works of the company will be located in Hart... Conn. The incorporators are: Heath Sunderland, Frederick E. ...son and Mabel N. Bacharach, of Hartford, Conn.; Andrew R. ...ls, of Seattle, Wash., and George S. Landers, of Boston, Mass.

...E WALTER T. GODDARD COMPANY, of Rochester, N. Y., has ... ncorporated by W. T. Goddard, Edna C. Goddard and Janet M. ... all of Rochester, N. Y. The company is capitalized at $5,000 and ...ses to manufacture electrical machinery, etc.

...E INDIANA STEEL & IRON COMPANY, of Linton, Ind., has ... ncorporated with a capital stock of $100,000 by Marcus K. Frank, ... D. Karasik, Angernon Granville, Samuel R. Sobel, of Pittsburgh, ... and William J. Hamilton, of Linton, Ind.

...E McCUE COMPANY, of Buffalo, N. Y., has been incorporated ... Willard Lansing, Ira T. Gleason, B. H. Bean and Henry A. Kam...r, all of Buffalo, N. Y., and Charles T. McCue, of Hartford, Conn. ... company is capitalized at $700,000 and proposes to manufacture ...etric, gasoline and steam vehicles.

...HE NATIONAL INSULATOR COMPANY, of Camden, N. J., has ... incorporated with a capital stock of $500,000 for the purpose of ...acturing glass and other insulators for carrying wires for electric ...t, etc. J. E. Inman of Hartford, Conn.; J. F. Harned and W. C. ...n, of Camden, N. J., are incorporators.

...E PEERLESS ELECTRIC SIGN COMPANY, of Kansas City, ... has been granted a charter with a capital stock of $35,000. The ...orators are: John C. Meredith, W. R. Bump and F. C. Sharon.

...E PORTLAND ELECTROCHEMICAL COMPANY, of Portland, ..., has filed articles of incorporation with a capital stock of $200,000 ...anufacture and sell electrochemical machinery and products. The ...orators are: Scott Wilson, Ethel M. Dyer and S. Wilson, all of ...d, Ore.

...HE PUBLIC SERVICE CONTRACTING COMPANY, of Buffalo, ...Y., has been incorporated with a capital stock of $50,000 by DeL. ...ine, W. M. Huntley and L. E. R. French, all of Buffalo. The com... proposes to do a general contracting business.

...HE SCHIETZEL ELECTRIC SHOT-FIRING MACHINE COM...NY, of Omaha, Neb., has been chartered with a capital stock of ...

THE STANDARD ELECTRIC STOP COMPANY has been incorporated under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: S. D. Townsend, Jr., of Wilmington, Del.; J. P. Kirman, Jr., and F. A. Barnett, of Philadelphia, Pa.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $2,000 to manufacture and sell electric fixtures and specialties. The incorporators are: Earl O. Immel, George N. B. Lowes and Lester L. Falk.

THE UNIVERSAL AUTOMATIC ELECTRIC SIGNALING COMPANY, of La Crosse, Wis., has filed articles of incorporation with a capital stock of $28,000.

THE WESTERN ELECTRIC INSTALLATION COMPANY, of Kansas City, Mo., has been incorporated with a capital stock of $5,000 by William L. Hall, Benjamin F. Shambaugh and John B. Young.

New Incorporations.

SACRAMENTO, CAL.—The Sacramento-Woodlawn Electric Railroad Company has filed articles of incorporation with a capital stock of $1,000,000 to build an electric railway from Sacramento to Woodlawn, a distance of 17 miles. A bond issue of the same amount of the capital has been provided for, of which $750,000 will be used for the construction of the proposed railway and the remainder will be held for extension and maintenance. Work on construction of the road, it is said, will begin within thirty days. T. G. Gregory is president.

WILMINGTON, DEL.—Articles of incorporation have been filed for the British North American Power Company with a capital stock of $1,300,000 by Warren N. Akers, Millard C. Taylor and William J. Maloney, of Wilmington, Del.

MILLEN, GA.—The Millen & Newington Railroad Company has applied for a charter for the purpose of building an electric railway extending from Millen or Newington to some point on the Brinson Railway in Screven County. The company is capitalized at $75,000. The incorporators are: E. S. Lane, H. S. McCall, W. H. Marsh, W. M. Parker, A. S. Anderson and others.

CALAIS, MAINE.—The Eastern Telephone & Telegraph Company has been incorporated with a capital stock of $200,000 to operate telephone and telegraph lines in Washington County. W. S. Alexander, of Eastport, Maine, is president of the company and E. E. Talbot, of Machias, Maine, is treasurer.

HARTLAND, MAINE.—The Hartland Electric Light & Power Company has been incorporated with a capital stock of $5,000 for the purpose of supplying electricity in the towns of Hartland, Palmyra, St. Albans, Harmony, Athens, Canaan and Cornville. The officers of the company are: C. A. Moulton, president; Carl Randlett, treasurer, and R. C. Hamilton, clerk, all of Hartland, Maine.

PORTLAND, MAINE.—The Des Moines River Power Company has filed articles of incorporation with a capital stock of $500,000 for the purpose of developing power sites on the Des Moines River in Iowa; also to construct and operate hydroelectric plants. C. E. Eaton is president and T. J. Croteau treasurer, both of Portland, Ore.

SPRINGFIELD, MASS.—Articles of incorporation have been filed for the Springfield Northwestern Interurban Railroad to build an electric railway from Springfield to Petersburg and Mason City, via Greenview and Athens. The company is capitalized at $15,000. The incorporators are: Homer T. Rice, of Greenview; Richard Y. Kincaid, of Athens; Samuel E. Prather, George L. Harnsberger and W. Frank Workman, all of Springfield.

TUCUMCARI, N. M.—The Tucumcari Light & Power Company has been incorporated with a capital stock of $100,000 by R. G. Lafite, Henry Swan and O. F. Edlar, all of Tucumcari.

COLUMBUS, OHIO.—The Cleveland & Youngstown Railroad Company has been chartered with a capital stock for the purpose of constructing an electric railway between Cleveland and Youngstown, via Cuyahoga, Portage, Trumbull and Mahoning Counties, which, it is expected, will be extended eventually to Leavittsburg. The incorporators are: James P. Wilson, Fred J. Heim, Theodore A. Johnson, John T. Harrington and Thomas A. Jacobs.

COCALICO, PA.—The West Cocalico Electric Light & Power Company of Lancaster County has been granted a charter by the State Department with a capital stock of $5,000.

DELTA, PA.—Articles of incorporation have been filed for the Delta Telephone Company with a capital stock of $10,000. The directors are: Fred N. Ramsay, of Delta, Pa., treasurer; E. W. Keyser, of Bridgeton, Pa., and Jacob E. Weaver, of York, Pa.

GRAMPIAN, PA.—The Grampian Electric Company has been incorporated with a capital stock of $5,000. The directors are: John W. Wrigley, of Clearfield, Pa., treasurer; Jonathan Currier, of Grampian, Pa.; A. W. Lee, J. H. J. Thompson, Heber H. Straw, all of Clearfield, Pa.

HARRISBURGH, PA.—Charters have been granted by the State department to the following companies: The Allegheny Light, Heat & Power Company; the Blacklick Light, Heat & Power Company; the Cresson Light, Heat & Power Company; the Gallitzin Light, Heat & Power Com-

pany; the Summer Hill Light, Heat & Power Company, and the Washington Light, Heat & Power Company. Each company is capitalized at $5,000 and the directors are: James Collins Jones, 1531 North Fifteenth Street, Philadelphia, Pa.; Jacob Mann and Floyd Woodcock, both of Philadelphia, P

HARRISBURG, PA.—Charters have been granted by the Secretary of State for twenty-five electric companies to operate in Allegheny, Washington and Greene Counties as follows: Washington Union Electric Company, East Washington, Smith Township, North Strabane Township, South Strabane Township, North Franklin Township, South Franklin Township, Houston, Morris Township, Chartiers Township, Canton Township, Cecil Township, Amwell Township, Pleasant Valley, Mount Pleasant Township and Burgettstown, all of Washington; Oak Borough Electric Company, North Fayette Township, South Fayette Township, Findley Township and Collier Township, all of Oakdale; Canonsburg Union Electric Company, of Canonsburg, Pa.; Washington Township Electric Company, Franklin Township and East Waynesburg, of Waynesburg. Each company is capitalized at $5,000 and the incorporators are: C. H. Kennedy, of New Brighton, Pa.; E. S. Wheeler and H. P. Carr, of Pittsburgh, Pa.

McCONNELLSBURG, PA.—The McConnellsburg & Breezewood Telephone Company has been chartered with a capital stock of $15,000. The directors are: William C. Hanks, of Clearville, Pa., treasurer; Amos Hixson, of Crystal Springs, Pa.; James F. Pee, Dr. J. Grant Hanks, A. C. Clevenger, of Breezewood, Pa.; George A. Harris, B. C. Lamberson, of McConnellsburg, Pa., and Dr. James M. McKibbin, of Buck Valley, Pa.

MOOSIC, PA.—A charter has been granted by the State Department to the Moosic Electric Company, of Moosic, Pa. The company is capitalized at $5,000.

NEW BRIGHTON, PA.—The College Hill Electric Company has been granted a charter with a capital stock of $30,000. The directors are: Julius Theobald, of New Brighton, Pa., treasurer; A. L. Mitchell, of Freedom, Pa., and H. Clyde Harker, of New Brighton, Pa.

NEWMANSTOWN, PA.—A charter has been granted by the State Department to the Denver Electric Light, Heat & Power Company with a capital stock of $5,000.

SAUCONA, PA.—The Saucona Electric Light, Heat & Power Company has been granted a charter by the State department with a capital stock of $5,000. The directors are: H. M. Ueberroth, of South Bethlehem, Pa., treasurer; A. C. Graham, P. F. Enright, James M. Degnan, Charles H. Green and C. A. Buck, all of South Bethlehem, Pa.

PETERSBURG, TENN.—A charter has been granted to the Petersburg Electric Light & Power Company. The company is capitalized at $2,100, and the incorporators are: A. C. Davis, George McAdams, J. A. Montgomery, J. C. McRady and O. F. Gill.

FT. WORTH, TEX.—The Ft. Worth Southern Traction Company has been incorporated with a capital stock of $1,500,000 by G. H. Clifford, W. C. Forbes and W. A. Hanger, all of Ft. Worth, Tex. The company proposes to construct and operate an electric interurban line between Ft. Worth and Cleburne.

GROTON, VT.—Articles of incorporation have been filed for the Groton Electric Company by T. B. Hall, J. F. Hatch, R. A. Davidson, L. S. Blanchard and E. F. Clark, all of Groton, Vt. The company is capitalized at $35,000 and proposes to acquire and build an electrical plant in Groton and other places in Caledonia County.

DANVILLE, VA.—The Danville Traction & Power Company has been incorporated with a capital stock of (maximum) $500,000. (minimum) $200,000. The company proposes to operate a street-railway system and power plant. The officers are: John F. Risen, president; J. R. Jopling, vice-president, and H. S. Lanie, secretary and treasurer.

WEST POINT, VA.—Articles of incorporation have been filed for the People's Light, Heat & Power Corporation with a capital stock of $25,000. The officers of the company are: J. H. McRae, president; Crosby Thompson, vice-president; A. J. Bagby, secretary, and H. E. Topping, treasurer.

NEWPORT, WASH.—The Metaline Falls Light & Power Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: Lewis P. Larson, Jens Jensen and Harry W. Reading.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Company has been incorporated with a capital stock of $150,000 by Fred Paul Grosscup, Paul B. Grosscup, W. C. Davidson, J. Gluck and H. D. Rummel, all of Charleston, W. Va.

CHARLESTOWN, W. VA.—The Citizens' Electric Company has been incorporated with a capital stock of $50,000 by Thomas C. Dowling, H. C. Getyendanner, Gerard D. Moore, G. E. Hughes and B. L. Langden.

HINTON, W. VA.—The Dominion Power Company has been granted a charter by the Secretary of State with a capital stock of $100,000 The incorporators are: J. J. Mott, of Statesville, N. C.; J. A. Mott, of Hickory, N. C.; Marion Butler, of Elliott, N. C.; S. B. Thomas and R. F. Dunlap, of Hinton, W. Va. The company proposes to furnish power and erect manufacturing plants in Summers and other counties in West Virginia.

MORGANTOWN, W. VA.—The Masontown-Morgantown Street Railway Company has been incorporated with a capital stock of $30,000. The directors are: Byron Trimble, 245 Atwood Street, Pittsburgh, Pa., president; C. W. Scheck, of Mount Lebanon, Pa.; A. E. DuBois, of Pittsburgh, Pa.; Charles C. McBride, of Ingram, Pa., and W. F. Craig, of Swissvale, Pa.

NEW CUMBERLAND, W. VA.—The Hancock Electric Company has been organized with a capital stock of $12,000 by John F. Flood, Harry E. Armstrong, Nelson D. Miller, Samuel McCoy and Samuel G. Stewart of Steubenville, Ohio. The company proposes to construct and operate power house.

MILWAUKEE, WIS.—The Co-operative Electric Company has been chartered with a capital stock of $4,000 by H. H. Schermerhorn, Fred J. Schermerhorn and J. A. Mueller.

Personal.

MR. JAMES D. HOGARTH has been appointed general superintendent of the Chicago Railways Company, with which he has been connected the past three years as general statistician.

MR. D. McFARLAN MOORE has been awarded the John Scott legacy medal and premium by the city of Philadelphia upon the recommendation of the Franklin Institute for his vacuum-tube electric light.

MR. JAMES B. BROKAW has been transferred from the American Falls plant of the Idaho Consolidated Power Company to Black Foot, Idaho, to become local manager, succeeding Mr. C. S. Douglas, recently deceased.

MR. K. A. ALBRECHT, whose return to Europe was noted in this column on April 13, has joined the staff of the Siemens-Schuckert Works, Berlin. It is probable that Mr. Albrecht will later sail for South America.

MR. C. S. DAVIDSON has resigned as manager of the street-lighting department of the Holophane Company, in order to become associated with the Manufacturers' Agency of W. G. A. Reid, Detroit, Mich., in which he has acquired an interest.

MR. R. B. HERTZOG resigned as general superintendent of the Chicago Railways Company upon the completion of his twentieth year of service with the company and its predecessors in order to accept an advantageous offer from a railway supply house.

MR. H. B. TILLEY, manager of Messrs. Bruce Peebles' office in Manchester, has arrived in Canada for an extended business tour in that country on behalf of his firm. Mr. Tilley will visit all places of importance in the Dominion and expects to be away from England for fully a year.

MR. HENRY B. OTIS has retired from the firm of Rush, Otis & Company, contracting electrical engineers, of Chicago, to become a member of the firm of Yard, Otis & Taylor, bond brokers. C. G. Rush & Company will continue the business formerly carried on by Rush, Otis & Company.

MR. ARTHUR R. HILL has resigned as purchasing agent to the New York & Queens Electric Light & Power Company, of Long Island City, N. Y., to accept the position of purchasing agent to the Monterey Railway, Light & Power Company, of Monterey, Mexico, which also includes the Monterey Water Works & Drainage Company, the Monterey Plumbing & Electrical Supply Company and the Monterey Gas Company

MR. BRITTON I. BUDD, whose election as president of the Metropolitan West Side Elevated Railway Company, Chicago, was noted in our issue for Feb. 17, 1910, has been chosen head of the Chicago Elevated Railways, the new concern which has absorbed the four elevated railways and the so-called loop. Mr. E. C. Noe, now general superintendent of the Northwestern Elevated, will act as general superintendent of the combined systems.

MR. SAMUEL INSULL has returned to Chicago after a month's vacation abroad. Mr. Insull went to England to attend the sixtieth wedding anniversary of his parents, and he found them both in good health. Mr. Insull returned to New York on the *Lusitania* and that ship passed the outward-bound *Mauretania*, on which Thomas A. Edison was a passenger. Mr. Insull sent Mr. Edison a wireless message while they were both at sea, congratulating his old chief on his long-deferred vacation journey.

MR. E. M. WHARFF has been transferred from the operating engineering department of the Illinois Traction System and Western Railways & Light Company, at Peoria, Ill., to the position of assistant general superintendent at Galesburg of the Galesburg Railway & Light Company, which is controlled by the Western Railways & Light Company. Mr. Wharff will have direct charge of the light and power, electric railway, gas and steam-heating departments, including power-house, car barns and gas works.

MR. ALONZO PAWLING, president and treasurer of the Pawling & Harnischfeger Company, Milwaukee, and for years a prominent figure in the machinery field, has disposed of his interests in the company and retired from business life. In December, 1884, Mr. Pawling, together with Mr. Henry Harnischfeger, founded the present company, which from a small beginning has grown to large proportions. Mr. Harnischfeger now becomes president and treasurer of the company, Mr. W. H. Hassenplug first vice-president, Mr. F. P. Breck second vice-president and Mr. S. H. Squier secretary

Obituary.

MR. THOMAS SAUNDERS, one of the [illegible] of the original company that [illegible] the Bell Telephone, died at [illegible], N. H., Aug. 7. Mr. Saunders, whose home was in Haverhill, Mass., was making a trip by carriage to Barre, Vt., when he was seized with an attack of heart disease and was forced to stop at a farmhouse in Derry, where he died. Mr. Saunders' home was originally in Salem, Mass., where he came to know Alexander Graham Bell. He is said to have owned at one time half of the stock of the original Bell company. He was for twenty years senior warden of the Trinity Episcopal [illegible] Haverhill, was a member of the Knights Templar and a [illegible]ent Democrat. He leaves four daughters and two sons.

Trade Publications.

[illegible] THREADING MACHINE.—The Toledo Pipe Threading Machine Company, Toledo, Ohio, has issued an attractive booklet with the [illegible] "A Pipe-Threading Miracle," setting forth the story of the [illegible] which are said to have changed all previously existing notions of [illegible] required to thread pipe by hand. The tools are also illustrated [illegible].

[illegible]S-ELECTRIC MOTOR CAR.—The General Electric Company has issued a handsome publication (Bulletin No. 4855) devoted to a [illegible] description of its double-truck type of gas-electric car. The [illegible]ation is elaborately illustrated and contains considerable data [illegible] to the subject. It includes plans and elevations of cars of [illegible] sizes.

[illegible]APHITIZED-FILAMENT INCANDESCENT LAMP.—In Bulletin No. 4853, recently issued by the General Electric Company, is described the company's "Gem" lamp. This lamp is intended to replace the [illegible] lamp as a free renewal lamp. The bulletin compares the [illegible] with the "Gem" lamp and shows the advantages derived by [illegible] of the latter.

[illegible]ERCURY-ARC RECTIFIERS—Folders 4204 and 4205 are two new publications of the Westinghouse Electric & Manufacturing Company, the subject of the former being "Telephone Battery Charging with Westinghouse-Cooper Hewitt Rectifier Outfit"; the latter is entitled "The R[illegible]t Light" and covers the use of the rectified-current arc lamp with moving-picture machines.

[illegible]EAM VALVES AND SPECIALTIES.—The Ohio Brass Company, Mansfield, Ohio, has issued Catalog K, in which are illustrated and described the company's various valves and steam specialties, including [illegible]ocks, water gages and ball-bearing glands. The catalog also [illegible]s instructions how to determine the proper size of regulating [illegible] for a given service.

[illegible]GING AND BENDING PRESSES.—Quick-acting steam hydraulic [illegible] and bending presses, built under the Haniel and Lueg patents, are described in a catalog issued by the Mesta Machine Company, Pittsburgh, Pa. This type of press is said not only to reduce the labor and power cost, but also to produce forgings superior in quality to those made by the use of the steam hammer.

[illegible]EWABLE CARTRIDGE FUSES.—The Columbia Sales Company, Pittsburgh, Pa., has issued a folder on the Columbia renewable cartridge [illegible] the feature of which is the chuck terminal. The fuses are said [illegible] easily renewed and to be adapted to any style of panelboard. They can be inspected without removal from the panelboard, and it is [illegible] be impossible to reload them with fuse wire of the wrong [illegible]

[illegible]ORAGE-BATTERY BAGGAGE TRUCKS.—The Automatic Transportation Company, Buffalo, N. Y., builds an electric truck especially designed and constructed for handling baggage and freight at railway and steamship terminals, etc. The truck is said to accomplish a definite saving of from 25 per cent to 30 per cent over the former mode of hand trucking, and its make-up, uses and advantages are pointed out in a catalog [illegible] the company.

[illegible]ENTRIFUGAL PUMPS.—Henry R. Worthington, New York, has issued two bulletins on centrifugal pumps; one, W-185, describing house and sump pumps, and the other, W-176A, describing pumps for low-head service. The latter type of pump is suitable for contracting work and irrigation plants, and while not as efficient as the standard volute pump but by the same maker, is well suited for the hard usage to which machinery is subjected in this class of work.

[illegible]FTY-TON ELECTRIC LOCOMOTIVES FOR INTERURBAN C[illegible]S.—Bulletin No. 4852, just issued by the General Electric Company, contains a description of that company's standard 50-ton locomotive and its equipment, and a statement of features of construction which have made it particularly suitable for the requirements of the heaviest interurban roads. The bulletin contains, also, an information sheet for the use of those considering the adoption of such a locomotive.

[illegible]OVING COIL GALVANOMETERS.—Catalog No. 20 issued by the Leeds & Northrup Company, Philadelphia, Pa., devoted to moving-coil galvanometers, is divided into two parts, the first containing general information relative to galvanometers, and the second, specifications and price lists of galvanometers and accessories. The instruments are of the D'Arsonval type, although portable galvanometers of the moving-coil type as contrasted with the [illegible] Thomson [illegible] described.

RECORDING VOLTMETERS.—Bulletin No. 131, issued by the Bristol Company, Waterbury, Conn., is devoted to the company's recording voltmeters for direct-current and alternating-current circuits. The instruments are furnished in either switchboard or portable types, or, if desired, with moisture-proof cast-iron cases suitable for installation on poles wherever needed. Charts and schedules of increasing graduations and charts with fractional schedules of uniform graduations are listed for both currents.

TRANSFORMERS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued Bulletin No. 1076 on its transformers, which are built in three types, as follows: Oil-filled, self-cooled; oil-filled, water-cooled, and air blast. The first are ordinarily built in sizes from 50 kva to 2000 kva; the second are built in sizes from 100 kva up, while the last are built in sizes from 75 kva up for voltages under 33,000. The features of merit of the various types are brought out in the description of each type contained in the bulletin.

ADVERTISING HINTS.—"A Little Booklet of Advertising Inspiration" is the title of a pamphlet recently issued by the Holophane Company, of Newark, Ohio, for distribution among central stations and contractors for use in their local newspaper advertising. The book contains ten electric-lighting advertisements, with appropriate cuts, and is prefaced by a number of short, pithy "ad hints." The advertisements, which were prepared by the Rae Company, deal with the lighting of some part of the home, from the front porch to the garage or barn, and are arranged for either single or double-column display.

WESTINGHOUSE PERPETUAL CATALOG.—The Westinghouse Electric & Manufacturing Company has issued revised editions of the following sections of its perpetual catalog No. 3001: No. 121 on Type CC carbon circuit breakers, No. 231 on expulsion-type fuse blocks, No. 233 on outdoor-type fuse blocks, No. 237 on type C watt-hour meters and No. 667 on type KD generator and feeder panels. These revised sections embody new features of interest. The following sections describe an entirely new line of switchboard meters which are very compact in size and yet retain the accuracy, the long scale and other advantageous features of the older types: No. 307 covers types L, SL and TL, switchboard meters; No. 310, type FM and TM switchboard meters; No. 311, types FD and TD frequency meters; No. 312, types FI and TI power-factor meters; No. 314, type TG electrostatic ground detectors and voltmeters; No. 327½, type OA watt-hour meters, and No. 436, new nursery milk warmers, while section No. 740 covers 75-kva and 100-kva distributing transformers.

BUSINESS NOTES.

PITTSBURGH TRANSFORMER ORDERS.—The Sanitary District of Chicago has awarded a contract for sixteen 250-kw, 12,000-volt, 60-cycle Pittsburgh transformers to be used in the new city lighting scheme, power being secured from the Chicago Drainage Canal. This contract was secured by the Republic Electric Company, Chicago, Ill., whose business has recently been consolidated with that of the Delta-Star Electric Company, Western agent of the Pittsburgh Transformer Company.

MR. ARTHUR H. ALLEN, 1011 Franklin Bank Building, Philadelphia, has been appointed district agent for Philadelphia territory for the Allen-Bradley Company, of Milwaukee, Wis. Mr. Allen formerly represented the American Electric Fuse Company, and he is responsible for the introduction and extended use of the Allen-Bradley type of starters and controllers in the territory. Mr. Allen also represents the Triumph Electric Company, of Cincinnati, and reports an increasing demand for Triumph apparatus.

ADDITIONS TO GREGORY ELECTRIC COMPANY'S STAFF.—Mr. E. E. Protherow has joined the staff of the Gregory Electric Company in Chicago and will hereafter devote himself to the sale of motors for that company in Chicago and adjacent territory. Mr. Protherow was for six years with the Chicago office of the Crocker-Wheeler Company and has a large acquaintance in the electrical field. Mr. R. D. May has also joined the selling force of the company. Mr. May has had wide experience and enjoys a large acquaintance among the central station men of the country and was a number of years connected with H. M. Byllesby & Company, looking after their interests at Enid, Okla., and Missoula, Mont.

CHANGES IN FOSTORIA GLASS SPECIALTY COMPANY.—The manufacture of upright air-hole gas chimneys (but not of shades and reflectors for gas burners) has been discontinued by the Fostoria Glass Specialty Company, of Fostoria, Ohio, as the company's plant capacity is taxed to keep up with the growing demand for the higher grades of glassware, particularly of the iridescent variety. The new Fostoria glass factory at Niles, Ohio, is now being operated at full capacity. The following changes have recently, although not concurrently, taken place in the management and personnel of the Fostoria Glass Specialty Company: Mr. E. O. Cross has succeeded Mr. M. H. Lemen, retired, as manager of the company, and Mr. R. E. Briggs has been constituted assistant manager in general charge of sales. Mr. B. C. Coleman, who has just concluded five years of successful experience in the fixture business, will be the company's Western representative, while the Eastern territory will be covered by Mr. Raymond P. Adams, formerly of the engineering department of the National Electric Lamp Association.

Weekly Record of Electrical Patents

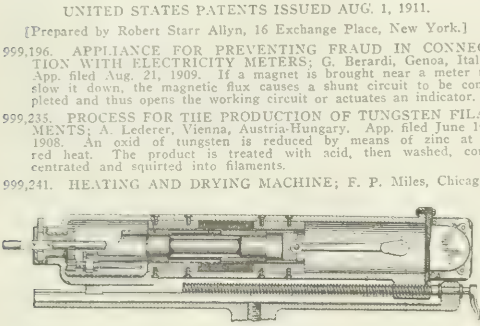
UNITED STATES PATENTS ISSUED AUG. 1, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

999,196. APPLIANCE FOR PREVENTING FRAUD IN CONNECTION WITH ELECTRICITY METERS; G. Berardi, Genoa, Italy. App. filed Aug. 21, 1909. If a magnet is brought near a meter to slow it down, the magnetic flux causes a shunt circuit to be completed and thus opens the working circuit or actuates an indicator.

999,235. PROCESS FOR THE PRODUCTION OF TUNGSTEN FILAMENTS; A. Lederer, Vienna, Austria-Hungary. App. filed June 10, 1908. An oxid of tungsten is reduced by means of zinc at a red heat. The product is treated with acid, then washed, concentrated and squirted into filaments.

999,241. HEATING AND DRYING MACHINE; F. P. Miles, Chicago,



-Drill · Other Impact Mechanism.

Ill. App. filed May 16, 1910. A heating device in a portable casing and a motor and fan for drawing air through the heater.

999,245. FEEDER-REGULATING TRANSFORMER; G. S. Neeley, St Louis, Mo. App. filed Aug. 27, 1909. The primary circuit is broken when the movable lever is on a non-active contact and is reconnected before it reaches the first active contact.

999,298. ELECTRIC SAFETY LAMP; B. Christiansen, Cologne-Sülz, Germany. App. filed April 4, 1911. A storage battery and current conductors are arranged in a casing. The handle prevents removal of the glass protecting bell.

999,309. PROCESS OF UNITING METAL ELEMENTS; C. F. Jacobs, Chicago, Ill. App. filed Aug. 21, 1909. For rail bonds. Loose fusible current-conducting material is fused in the point.

999,312. TROLLEY SWITCH FOR STATION INDICATORS AND THE LIKE; O. E. Kellum, Los Angeles, Cal. App. filed Nov. 23, 1910. The stationary contact is suspended from the trolley wire, so that the moving contact on the trolley pole pushes down on the stationary contact to prevent jumping off.

999,316. RAILWAY SIGNAL AND SAFETY DEVICE; C. H. Kirkendall, Columbus, Ohio. App. filed Aug. 15, 1910. A trip is pivoted to move in a slot in a guard rail and connected to a semaphore.

999,335. MAGNETO-GENERATOR; W. D. and J. R. Pennington, Chicago, Ill. App. filed Jan. 20, 1910. Metallic cores with coils are arranged between the converging faces of C-shaped permanent magnets and are relatively rotatable.

999,340. ARC LAMP; O. A. Ross, Chicago, Ill. App. filed May 29, 1902. An electrode is guided between parallel rods and a ring clutch is pivoted at one end to the rods and moved by an electromagnetic device.

999,367. CALL SYSTEM FOR TELEPHONE CIRCUITS; J. J. Graf, Scranton, Pa. App. filed May 26, 1910. For train dispatcher, etc. The selector apparatus of a substation may be operated from the central office to effect a connection with the main of a normally disconnected outlying circuit.

999,414 HIGH-TENSION STRAIN INSULATOR; L. Steinberger, New York, N. Y. App. filed Feb. 18, 1910. For wireless telegraphy, etc. Two U-shaped tension members pass through opposite ends of an insulating member and are interlocked but with insulation surrounding and between them.

999,421. ELECTRIC IRON; A. Wicks, Ontario, Canada. App. filed March 16, 1911. A smoothing iron heated at the bottom, but thermally insulated at the top.

999,433. DRILL OR OTHER IMPACT MECHANISM; G. H. Condict, Plainfield, N. J. App filed May 31, 1907. Solenoid reciprocation by direct current without reversal.

999,443. DANGER SIGNAL FOR RAILROADS; J. J. Flynn, St. Louis, Mo. App. filed March 2, 1911. Weights supported by the roadbed and alarm devices. To indicate washouts and settling or failure of bridges.

999,444. ELECTRIC SIGNALING SYSTEM FOR RAILWAYS; T. N. Freeble, Rochester, Pa. App. filed June 21, 1909. Improvement on Patent No. 900,273. The rails and a third conductor are used as conductors. To signal to the engineer and automatically slow up the train.

999,494. PROCESS OF TREATING EARTHY MATERIALS; C. Ellis, Montclair, N. J. App. filed Feb. 25, 1911. For cement or phosphate burning. The material is heated by an electric arc in air and then the nitrogen oxid is removed from the air.

999,505. COMPOSITE TELEPHONE AND TELEGRAPH SYSTEM; O. M. Leich, Genoa, Ill. Intercommunicating telephone. The telephones have talking circuits in bridge with the telegraph devices.

999,520. SAFETY DEVICE FOR REVERSIBLE WINDING OR HAULING PLANTS; W. Philip, Germiston, Transvaal. App. filed Aug. 30, 1909. For mine cars, etc. The operator is notified if the reversing mechanism is in a [illegible].

999,521. BINDING BLOCK FOR TERMINAL WIRES; C. D. Platt, Bridgeport, Conn. App. filed May 7, 1910. A plug cut-out or rosette with a lock to prevent disturbance of the connections.

999,534. MULTIPLE-UNIT COIL; E. C. Wilcox, Meriden, Conn. App. filed Jan. 10, 1910. Spark coil for ignition. A single vibr controls all the units of a group of coils and is reversible and in changeable. The units are independently removable from a cas

999,541. ELECTRICALLY HEATED FLATIRON; R. W. Baker, L. King and H. C. Parker, New York, N. Y. App. filed Dec. 1909. The resistor element is made of exposed filaments of a s solution of silicon carbide in carbon called "silundum."

999,543. APPARATUS FOR PRODUCING UNDAMPED ELECT CAL OSCILLATIONS; E. S. Beck, Treichlers, Pa. App. filed J 28, 1910. Blunt and pointed electrodes are slightly submerged liquid. A source of continuous current is connected with the e trodes and an alternating current includes the electrodes and inductance and capacity.

999,565. VIBRATOR FOR INDUCTION COILS; E. B. Jacobson, Pi field, Mass. App. filed Aug. 31, 1910. Adjustment device and me for locking it.

999,568. ELECTROLYTE AND METHOD OF DEPOSITING ZI E. F. Kern, Knoxville, Tenn. App. filed Dec. 18, 1909. Dou chloride of zinc and aluminum, chloride of sodium and grape su is electrolyzed.

999,578. ELECTRIC CONTROLLER; L. A. De Mayo, New York, Y. App. filed March 20, 1909. For motors, etc., automatic cut-

999,581. PRESSING IRONS; F. A. Mills, New York, N. Y. A filed Aug. 18, 1908. Hinged pressers with handles; electric heat For pressing trousers while they are being worn.

999,586. ELECTRIC FURNACE; H. Pauling, Gelsenkirchen, Germa App. filed March 17, 1909. For treating gases as in the manu ture of nitrogen oxids. Has a series of air inlets and gas out alternately with each other.

999,587. ELECTRIC FURNACE FOR TREATING GASES; H. P. ing, Gelsenkirchen, Germany. App. filed March 27, 1911. The face of the furnace walls is subdivided into a number of ar separated by gas passages to prevent loss of heat by radiation.

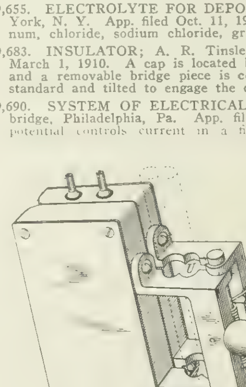
999,618. ELECTRIC COOKER; L. Yancey and J. W. Luppold, D ver, Col. App. filed Feb. 21, 1911. Heating coils are arranged the bottom of a removable oven in an insulating receptacle and passages are provided around and through the oven.

999,624. TROLLEY; R. Black, Canonsburg, Pa. The trolley pole made of tubing with a right-angle elbow between the car top the wheel.

999,655. ELECTROLYTE FOR DEPOSITING ZINC; E. F. Kern, N York, N. Y. App. filed Oct. 11, 1910. Zinc chloride, sodium alu num, chloride, sodium chloride, grape sugar and water.

999,683. INSULATOR; A. R. Tinsley, Anstead, W. Va. App. fi March 1, 1910. A cap is located between spaced, headed standa and a removable bridge piece is constructed to engage slidably standard and tilted to engage the other.

999,690. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Wo bridge, Philadelphia, Pa. App. filed June 19, 1909. A regulat potential controls current in a field coil and the latter cont



999,581.—Pressing Irons.

a battery current for starting and neutralizing without interrupt the main connections for opening any field circuit.

999,710. CONSTANT-TEMPERATURE BATH; T. B. Freas, Chica Ill. App. filed Sept. 1, 1909. One heater is controlled by the te perature of the bath itself and another independent heater is c trolled by the temperature of the surrounding atmosphere.

999,719. ELECTRIC-FURNACE ELECTRODE; C. Hering, Philad phia, Pa. App. filed July 6, 1909. Division from Patent 988,936. Claims an electrode of such length and uniform cr section that substantially no heat will flow into or cut of the nace through the hot end of the electrode.

999,720. ELECTRIC FURNACE; C. Hering, Philadelphia, Pa. A filed Feb. 17, 1911. Division from Patent No. 988,936. Molten c ducting material serves as the resistor and the electrodes are so p portioned as to avoid heat loss by conduction through the electro

Patent Issued July 25, 1911; Delayed in Receipt.

998,719. TELEPHONE SYSTEM; C. A. Simpson, Chicago, Ill. A filed Nov. 30, 1908. Eliminates the cut-off relay and at the sa time maintains the advantage of systems provided with both l and cut-off relays.

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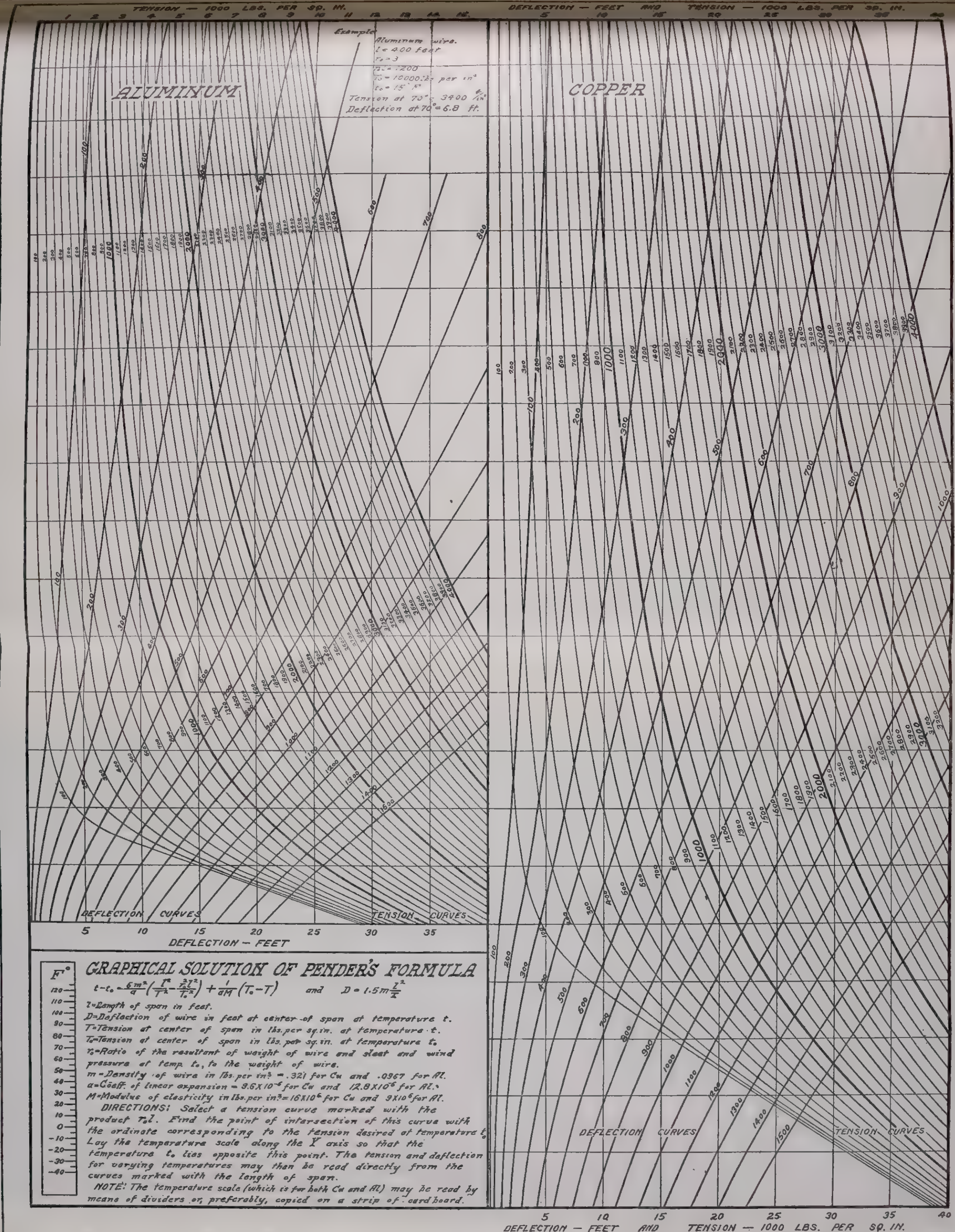

GRAPHICAL SOLUTION OF PENDER'S FORMULA

$$t - t_0 = \frac{6m^2}{a}\left(\frac{l^2}{T^2} - \frac{r_0^2 l^2}{T_0^2}\right) + \frac{1}{aM}(T_0 - T) \qquad \text{and} \qquad D = 1.5m\frac{l^2}{T}$$

l = Length of span in feet.
D = Deflection of wire in feet at center of span at temperature t.
T = Tension at center of span in lbs. per sq. in. at temperature t.
T_0 = Tension at center of span in lbs. per sq. in. at temperature t_0.
r_0 = Ratio of the resultant of weight of wire and sleet and wind pressure at temp. t_0, to the weight of wire.
m = Density of wire in lbs. per in³ = .321 for Cu and .0967 for Al.
a = Coeff. of linear expansion = 9.6×10^{-6} for Cu and 12.8×10^{-6} for Al.
M = Modulus of elasticity in lbs. per in² = 16×10^6 for Cu and 9×10^6 for Al.

DIRECTIONS: Select a tension curve marked with the product $r_0 l$. Find the point of intersection of this curve with the ordinate corresponding to the tension desired at temperature t_0. Lay the temperature scale along the Y axis so that the temperature t_0 lies opposite this point. The tension and deflection for varying temperatures may then be read directly from the curves marked with the length of span.

NOTE: The temperature scale (which is for both Cu and Al) may be read by means of dividers or, preferably, copied on a strip of card board.

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CONTENTS.

TURIN CONVENTION OF INTERNATIONAL ELECTROTECHNICAL COMMISSION.

As previously noted in these columns, a convention of the International Electrotechnical Commission will be held at Turin, Italy, Sept. 7 to 12, in connection with the international electrical congress. The last plenary convention was held in 1908 at London, when Prof. Elihu Thomson was elected president, following Lord Kelvin. A reunion, or unofficial conference, of the commission was, however, held last year at Brussels. The Brussels conference, as was duly reported in these columns, voted to recommend several international projects to the respective national committees and representative institutions. These projects related to international electrical nomenclature, international electrotechnical symbols, international direction of rotation in vector diagrams and international rating of electric machines. In regard to nomenclature, progress was reported at Brussels on a certain international list of terms recommended by the German committee and dealing principally with dynamo-electric machinery. An international committee was also appointed to work on the subject and report at Turin. The project is that, eventually, an official list of equivalent terms will be established commencing with French and English, the two official languages of the commission, and extending later to the languages of all the countries represented; so that, finally, there can be no misunderstanding as to the international meaning of the principal terms in electrical engineering. It was found, for example, that progress could not be made on the international rating of machines, because certain terms had slightly different meanings in different countries.

The project of international electrotechnical symbols made considerable progress at the Brussels conference. A tentative list of eight symbols was adopted and recommended. No progress could, however, be reported upon the symbols for current strength and resistance in Ohm's law, because of the differences of usage in different countries, *I* being used for current in nearly all countries except Great Britain, and *R* being used for resistance in nearly all countries except Germany. Within the last few months, however, an understanding has been reached mutually between these countries to the effect that each will give up its past usage in this matter for the sake of international comity. Consequently, the hope is expressed that at Turin international agreement will be reached, not only on the preliminary eight symbols recommended at Brussels, but also on the symbols *I*, *R* and *C*, for current, resistance and capacity respectively, thus including the international symbolic expression of Ohm's law. The project of international agreement on vector diagrams was brought to the attention of the Brussels conference by the American committee, which reported the vote, to that effect, of the

Jefferson convention of the American Institute of Electrical Engineers. It was agreed to recommend the matter for consideration at the next convention. It is to be hoped, therefore, that some international decision may be reached at Turin on this important electrotechnical question. At present alternating-current electrical literature is divided into two groups, which make advancing phase in its vector diagrams rotate in opposite directions; so that in reading a book it is necessary to find out, from the context, what is the order and meaning of the quantities displayed on the diagrams. Since this is a matter of convention, and not of fundamental mathematical necessity, the direction of phase advance should be standardized internationally.

In regard to the rating of electrical machinery, but little could be accomplished at Brussels, owing to the backward state of the necessary nomenclature or definition of international terms. It is understood, however, that the matter will come up for discussion and perhaps the convention may be in a position to make an advance. The project is that ultimately the rating of a machine, in kilowatts, will be the same in all countries. At the present time a machine receiving its rating in one country would be likely to have its rating changed if transferred to and standardized in another country. Since the rating of a machine should only involve its physical properties under defined conditions, it is very desirable that the specification of those properties and conditions should be the same, by international convention, all over the world. A parallel case might be presented if freight or passenger steamships had different power—or tonnage—rating in the ports of different countries. Such an unnecessary complication of purely conventional attributes would at once call for international settlement. Other matters are likely to come up for discussion at Turin, such as the excellent suggestion of the French committee to call the quadrature volt-amperes of the alternating-current circuit by the name "reactive power." But if this and the list of subjects already outlined receive definite action, the time of the commission will have been well filled. Twenty countries are now represented on the commission and some sixty or seventy delegates are expected at the Turin convention.

A RESISTANCE METHOD FOR OBTAINING THE INSTANTANEOUS PERFORMANCE OF INCANDESCENT LAMPS.

An interesting series of alternating-current Wheatstone-bridge measurements of incandescent filament resistances at different phases of the current wave appears in the article by Messrs. Edwards and Conner on page 441. The bridge with the lamp under test in one of its arms is supplied with alternating currents from electric-light mains, and a rotating-contact device closes the galvanometer circuit once in each current cycle. The measurements show that the tungsten filaments varied from ± 0.9 to ± 1.78 per cent above and below the mean working resistance, depending upon the size of the filament. The thinner the filament or the lower the wattage of the lamp the greater the cyclic change in resistance owing to the increased cyclic elevation of temperature. The tantalum lamp was less affected in resistance than the tungsten lamps, while the carbon lamps were still less affected, and affected in he reverse direction. The method should prove very us ul in bringing to light the electric behavior of metallic a- ments carrying alternating currents. It will be seen at the cyclic change in candle-power amounted to as muc as ± 18 per cent in one instance. The simplicity and n- venience of the method described are very striking.

DISTRIBUTION ABOVE 2200 VOLTS.

For ordinary city distribution for lighting purposes 2 0 volts has long been the standard, but in recent years th re has been a decided tendency to distribute energy for in large quantities at voltages from 5000 to 13,000. Sev causes have been at work to this end. For example, company transmits energy from a hydroelectric plant distant market at voltages anywhere from 30,000 to 100 the substation equipment for reducing this voltage beco quite an elaborate affair on account of the high prim voltage to be handled. Moreover, in many cases it is t feasible to transmit to large consumers within a radiu f 10 miles of the main substation at the ordinary standar 2200 volts, as the capital required would be excessive. the other hand, it would not be feasible to deliver a tr mission-line voltage anywhere from 30,000 volts to 100 volts at the consumer's premises, because the substa n equipment needed would be too costly. For this reason e majority of hydroelectric energy transmission compa s have adopted voltages from 5000 to 13,000 for distribu n over the districts covered from their main substations. the case of large consumers like electric distribu g companies a second reduction of voltages is therefore m le before the 2200-volt distribution is begun. In other ca s, if the consumer is a large manufacturer, for example, e step down to the final voltage is made in one transfor n- tion at the consumer's premises.

The present tendency above noted is in the simplifica n of the apparatus used in transforming from voltages f 6000 to 13,000 to that of the consumer's service. A p r read by Mr. Howard Pett at the last Michigan Electr al Association convention described the system of a l ge hydroelectric company in Michigan in which small s s of pole transformers are used for stepping down f m 6600-volt distribution. There is a strong incentive o the employment of simple pole-type transformers r supplying energy from lines of this voltage, bec e of the consequent increase of the area of econom al distribution and the possibility of taking on consu rs otherwise too far apart to serve. This is especially e where lines pass through farming districts, where m y a profitable motor customer can be obtained if the s p- down transformation is not too costly. The diffic y is not so much with the transformers themselves as with the protective apparatus used therewith, such as fuses and lightning arresters. Developments are u er way looking to the simplification of this protection p b- lem, even for voltages over 30,000. The necessity or lightning protection at each transformer has perhaps en overestimated, but the fuse problem certainly has not. It is by no means easy to get a satisfactory pole-type se

r voltages over 2200. The weather conditions are trying :d fuses must be of a type replaceable safely by ordinary iemen, or by the farmers themselves on rural lines.

E PRIMARY STANDARD OF LIGHT.

A primary standard of luminous intensity or of luminous ix satisfactory both from the scientific and the practical ile has yet to be produced. The standards at present i use, such as the hefner and the international candle, :e fixed with great care and are closely reproducible. But ey stand practically alone among present-day standards i that they are unconnected with the fundamental units of ace, mass and time. Until thus co-ordinated they can be nsidered little more than convenient reference marks to l used in practice, pending the determination of their real lues. The sensation of light is caused by the impinging radiant energy upon the retina, and consequently one r st look to the measurement of radiation for the scientific ecification of the standard of light. However, mere iensity of radiation is not a measure of luminous intsity, for not only is a large part of the radiation from rst light sources invisible, but even the visible part varies eatly in capacity to produce the sensation of brightness. Irthermore, the mode of action of the eye is such that t luminous equivalent of radiation at a given spectral vve-length varies with the absolute illumination—the Purkje phenomenon and its allies. At present, too, a consierable obstacle to establishing a connection between radiaon and light is the absence of general agreement as to nhods, instruments and conditions under which heterocomatic comparisons shall be made. It is because of tlse complications that the "mechanical equivalent of as it has been called—a quantity expressing the reship between visible radiation and light flux, and vying with the source—is not a satisfactory specification f a standard source in terms of energy. A specification ns of radiant energy taking into account all essential nships between light and energy, is necessary.

n a paper presented before the American Institute of Ectrical Engineers in July, 1908, Dr. C. P. Steinmetz posed a primary standard of light based upon radiation a using the mercury-vapor lamp as the source of three scted monochromatic radiations in specified proportions. Mre recently two other suggestions have been made along swhat similar lines. Dr. Herbert E. Ives, in a paper in the *Transactions* of the Illuminating Engineering Sociy on "Energy Standards of Luminous Intensity," suggs as the unit of flux the flux connected with "a definite qntity (per cm²-sec.) of the most efficient possible radiati," to be attained practically by the use of the monoclmatic green mercury radiation, which is of sufficient innsity to measure both as radiation and as light. Dr. R.A. Houstoun, in a paper in the *Proceedings* of the Royal Sciety on "The Absolute Measurement of Light," suggests a ecification of considerably greater length, as follows: "Te unit of light intensity is that source the total intesity of radiation from which at an optical distance of 1 , after passing through an ideal filter, would be x rgs/cm²-sec.; the ideal filter to be one possessing the ligt-absorbing properties of a 3-cm thick aqueous solution of $CuSO_4 5H_2O$ of strength 0.200 gramme-molecule per liter and a 1-cm thick aqueous solution of $K_2Cr_2O_7$ of strength 0.0025 gramme-molecule per liter, but neither to reflect nor to absorb any light in any other way." The "ideal solution" here mentioned involves essentially the idea published by Fery, and carried out in his direct-reading photometer—a solution whose transmission shall be as the luminosity curve of the normal eye. Dr. Houstoun's contribution, in fact, consists in adding the idea of measuring the radiation through such a screen in absolute units. Moreover, it would appear that Dr. Houstoun's suggestion is practically identical with that of Dr. Ives. For if by an "ideal screen" one understands not a particular mixture of chemicals, but a truly ideal screen whose transmission represents exactly the luminosity curve of the eye, then x ergs/cm²-sec. becomes the "quantity (per cm²-sec.) of the most efficient possible radiation" specified by Dr. Ives. In short, the function of an "ideal screen" is merely to reduce any radiation to the intensity which, if the reduced radiation were the most efficient possible, would produce the same luminous intensity as is actually given by the unscreened source. Dr. Houstoun's suggestion can be looked upon as a possible method for obtaining the unit of Dr. Ives from *any* light source; or Dr. Ives' practical suggestion of the use of the green mercury radiation may be considered as a possible method for carrying out Dr. Houstoun's idea without the necessity of interposing an "ideal screen" in the energy measurement.

The important point to notice is, that by either suggestion the brightness of any source of light is connected with a quantity of radiation. This quantity of radiation is, in the suggestion of Dr. Ives, the least quantity which can produce a sensation of brightness equal to that in question. In the suggestion of Dr. Houstoun the quantity of radiation measured becomes this least quantity, provided a truly ideal screen be specified, as suggested above. In fact, the embodiment of a merely experimental chemical mixture (necessarily only an approximation to the ideal screen) into Dr. Houstoun's proposed standard, while the fundamental significance of the quantity x ergs/cm²-sec. as the least mechanical equivalent of light is apparently ignored, constitute the chief objection to Dr. Houstoun's suggestion. Should these suggestions be followed up and prove practicable, photometric quantities and measurements would not only take their place in the c.g.s. system, but would experience a very desirable simplification. For instance, should the new unit of flux, or "lumen," be made the flux given by 1 watt per cm² of the most efficient radiation, then the "lumens" per watt of any illuminant is at once its efficiency on an absolute scale. That is, in place of having two scales of efficiency for a carbon lamp, namely, "four lumens per watt" and 0.43 per cent "reduced luminous efficiency," there would be one figure, N lumens per watt, N also representing the efficiency in terms of the maximum possible efficiency. Before, however, this simplification can be achieved there must be general agreement as to methods and conditions of illumination which are to hold in heterochromatic photometry; for the question of the relative brightness or efficiencies of different colored radiations is directly involved in any theoretically satisfactory proposal to measure light as radiation.

Present Status of Legislation Regarding Niagara Falls.

By the express terms of the act and the terms of its extensions the Burton law expired June 29, so that there is at present no law in effect restricting the importation of electrical energy from Canada into the United States. The restrictions which now govern the diversion of water from the Niagara River for power purposes are those imposed by the provision of the "Water Ways Treaty" between Great Britain and the United States, which was signed Jan. 11, 1909, and proclaimed by the President May 13, 1910. This treaty prohibits diversion for power purposes in excess of an aggregate daily diversion at the rate of 20,000 cu. ft. per second in the United States and at the rate of 36,000 cu. ft. per second in Canada. No measure, however, has been adopted by Congress providing for the administration of the details in respect of such restrictions, such as the granting of permits for the allowable diversion and for the prevention of violation of the restrictions. The President, however, has doubtless general authority to take suitable action preventing such violations.

A bill was introduced in both branches of Congress at the present extra session providing for putting the treaty into effect, arranging the details for carrying out its provisions, prohibiting all diversion within the United States, except in the aggregate amount allowed by the treaty and authorized by the Secretary of War to grant permits for allowable diversion, providing in certain instances for the concurrence of the Treaty Commissioners and the authorities of the State of New York, within the territorial limits of which State only such diversion must be made. Neither the Senate committee on foreign relations nor the House committee on foreign affairs, to whom these bills were referred, took any action on them.

A further bill was introduced in the Senate by Senator Burton extending all of the provisions of the Burton act during the life of the treaty. This bill was passed by the Senate after the foreign relations committee amended it so that the provisions of the Burton law were extended for two years only. The Senate bill was considered by the House committee on foreign affairs and laid over until the regular session. As the bill in the form adopted by the Senate provides for the time extension of provisions which are no longer in effect, it doubtless will require amendment before being acted upon by the House.

The commissioners who negotiated the treaty had before them all of the reports of the War Department and all other attainable data in respect of diversion and of the effect thereof on the Niagara River and Niagara Falls, and it would seem that the proper logical legislation would be an act preventing all diversion in excess of the amount permitted by the treaty and providing for a proper and effective administration of the provisions of the treaty.

Insull Becomes Chairman of Chicago Metropolitan Elevated.

Mr. Samuel Insull, president of the Commonwealth Edison Company, Chicago, was on Aug. 14 elected chairman of the board of directors and of the executive and finance committees of the Chicago Metropolitan West Side Elevated Railway Company. Mr. Britton I. Budd, president of the Metropolitan company, was recently made president of the new Chicago Elevated Railways Company, of which Mr. Insull is chairman of the executive committee. Other newly elected directors of the Metropolitan company chosen at the same meeting were Messrs. John F. Gilchrist, W. H. Fox, J. H. Gulick, Ira M. Cobe, Henry A. Blair and Gilbert E. Porter. Messrs. Frederick A. Delano, former chairman of the board, H. G. Hetzler and B. I. Budd were re-elected as directors.

Indiana Electric Light Convention.

The third annual convention of the Indiana Elect Light Association will be held at the Oliver Hotel, So Bend, Ind., Aug. 23 and 24. The Wednesday morning s sion will be given up to miscellaneous business and annual address by the president, Mr. F. A. Bryan, South Bend. Immediately after noon the members a visitors will be taken on special cars to Berrien Sprin Mich., to inspect the hydraulic plants of the Indiana Michigan Electric Company, where a buffet luncheon wi be served under the dam. The trip will then be resum to St. Joseph, Mich., where the meeting will be called order at the Edgewater Club and the following pap will be read and discussed: *Heating in Connection w Central-Station Work,* by Mr. John Hornung, of W. Scott & Company, Chicago; *Economies of Operation cured by Consolidation of Small Properties,* by Mr. L. Andrus, general superintendent Indiana & Michigan El tric Company, South Bend, Ind.; *Power,* by Mr. R. A. M Gregor, manager Light, Heat & Power Company, Conne ville, Ind. At 6:30 dinner will be served, following wh there will be social entertainment.

On Thursday morning the meeting will again be cal to order at the Oliver Hotel, South Bend, and the follc ing papers read: *Rural Service,* by Mr. C. E. Layt Lebanon, Ind.; *The Steam Turbine for Future Work,* Mr. E. D. Dreyfus, commercial engineer Westingho Machine Company; *Affiliation with the National Assoc tion,* by Mr. John F. Gilchrist, president National Elect Light Association; *Curtis Steam Turbine Installations,* Mr. G. R. Parker, General Electric Company.

During the meeting the by-laws will be amended in der to permit the holding of the annual meetings in Octo instead of August as at present. Mr. J. V. Zartman, Indianapolis, is secretary.

A Serious Shut-Down in Spokane.

A short-circuit and fire in two manholes contain heavy cables shut down a large part of the city lines of Washington Water Power Company, Spokane, Wash., nearly three hours on Friday morning, Aug. 4. The cal affected were feeders from the Monroe Street station the Spokane River to the three-wire system which supp practically all of the light and power service in the bu ness district of the city; as the manholes also contai street railway feeders the street-car system was also cr pled. The ducts carrying the cables run up the hill ab the power house and thence beneath Lincoln Street.

Fire was discovered in two manholes in Lincoln Str about 7:30 a. m. The efforts of the company and fire department to extinguish it with chemicals and wa soon showed that nothing could be done without cutt off the current and interrupting the service.

A large storage battery had recently been tied into three-wire system and when the generators were cut of continued to supply a heavy current, as circuit-break had not been provided between the battery and the li considerable difficulty was experienced in promptly cutt off this source, thus aggravating conditions in the m holes.

The resulting shut-down was one of the most seriou the experience of the Washington Water Power C pany, but the emergency was met in an unusually effic manner. As soon as the current was cut off the wa was pumped from the manholes. It was then found t heavy arcs had totally destroyed the insulation on ev cable and fused the burned ends together. As rapidly possible the cables were cut apart and the fused mass moved, eliminating the short-circuits. Work in the m

hes was extremely difficult, due to the heat and fumes, but by 10:30 a. m. the cables had been cleared and service was restored on the three-wire system in the central business district, using auxiliary tie feeders in other streets. In the meantime current was supplied to the trolley lines down town over one overhead feeder, the circuit-breakers, being bridged temporarily so that the current was distributed directly to the trolley wires. Linemen patrolled the tracks and strung emergency wires wherever the current was found too heavy for the trolley wires.

A temporary overhead cable was thrown across Lincoln Street and connected to the light and power circuits in the southeast portion of the city, which service was carried for a short time after the accident on only one feeder. New temporary cables were also laid in the street in rough wooden troughs. The situation was thoroughly in hand by 11 a. m., and by 3 p. m. a new system of street-railway feeders had been strung overhead.

The most plausible theory of the cause of the accident is that the insulation in one of the 13,000-volt cables broke down, precipitating the short-circuit in the manholes.

Production and Price of Copper in 1910, and the Present Outlook.

By John B. C. Kershaw.

The writer has for some years been studying the production and price curves of the copper industry and has been accustomed to publish during each year a summary of the results of this study of the past year's statistical information and also a forecast of the future course of output and prices during the remainder of the current year. The large amount of copper used in the electrical engineering industry and the marked variations in price which have occurred in the history of copper during recent years should render the subject of special interest and value to the reader of the *Electrical World*. The figures used in the course of the article are those collected by the correspondents of the *Engineering and Mining Journal*, of New York, for the American and Mexican mines, and by Messrs. H. R. Merton & Company, of London, for the remaining copper-mining countries. The annual statistical circular published by the latter firm appeared on March 29, 1911.

PRODUCTION IN 1910.

The aggregate output of raw copper by all countries of the world in 1910 amounted to 852,950 tons, an increase of 13,525 tons over that of 1909. This falling off, as compared with the gain of nearly 85,000 tons in 1909, was due to the attempt to curtail production and to reduce stocks on the part of those in control of some of the larger and more important mining companies. The effect of this curtailment of production upon stock prices will be dealt with below.

TABLE I.—WORLD'S AGGREGATE PRODUCTION OF RAW COPPER.

Year.	Aggregate Production in Long Tons of 2240 Lb.	Increase in Tons.	Percentage Increase.
1901	516,626	37,114	7.7
1902	541,295	24,669	4.7
1903	574,775	33,480	6.1
1904	644,000	69,225	12.0
1905	682,125	38,125	5.9
1906	714,100	31,975	4.6
1907	713,965	(135)*	.
1908	754,180	40,225	5.7
1909	839,425	85,245	11.2
1910	852,950	13,525	1.6

* Decrease.

Tables I and II give the more important figures for the output of copper during the past ten years, and Fig. 1 gives in graphic form the production curves for the six more important mining companies.

The percentage increase in 1910 was, therefore, the smallest of the past ten years with the exception of 1907, when an actual decrease in production of 135 tons was recorded. The aggregate increase in annual output comparing 1900 with 1910, however, is 373,436 tons, equal to nearly 80 per cent, and in 1911 or 1912 one may expect to see the production figures of 1900 doubled and the copper output of all countries of the world approach 1,000,000 tons per annum.

As regards the production figures for the leading countries, Table II gives the totals for the last two years for all countries with an output of 5000 tons or over.

TABLE II.—COPPER PRODUCTION IN 1909 AND 1910 OF THE LEADING PRODUCING COUNTRIES.

Country.	Production in Long Tons. 1909.	1910.	Increase in Long Tons.	Decrease in Long Tons.
Africa	14,945	15,205	60	..
Australasia	34,400	40,315	5,915	..
Canada	24,105	25,715	1,610	
Chili	35,785	35,235	..	550
Germany	22,455	24,710	2,255	..
Japan	47,000	46,000	..	1,000
Mexico	56,325	58,825	2,500	
Norway	9,280	10,425	1,145	
Peru	16,000	18,305	2,305	
Russia	17,750	22,310	4,560	..
Spain and Portugal	52,185	50,255		1,930
United States	490,280	484,890		5,390
Totals	820,510	832,190	20,360	8,870

The above twelve countries in 1910 yielded over 97 per cent of the copper supplies of the world.

On examining the figures of Table II more closely it is found that four of the producing countries have decreased in output, namely, Chili, Japan, Spain and Portugal and the United States, while eight countries have to record increases varying from 60 tons up to nearly 6000 tons, Russia and Australasia heading the list of countries whose production is on the up-grade, with increases of 4560 tons and 5915 tons respectively.

In the light of the attempts made during 1910 to curtail production the detailed figures for the mines and mining countries under the control of the United States of America financiers are of special interest and are given in Table III.

TABLE III.—COPPER PRODUCTION IN 1909 AND 1910 OF AMERICAN-CONTROLLED MINES.

Country.	Production in Long Tons. 1909	1910	Increase	Decrease
United States:				
Calumet and Hecla	40,000	35,000		5,000
Other lake mines	61,450	63,170	1,720	
Montana	140,105	128,770	.	11,330
Arizona	130,375	132,625	2,250	
Other states	118,350	125,725	7,375	
Mexico:				
Boleo	12,230	12,795	565	
Other Mexican	44,095	46,030	1,935	
Chili	35,785	35,235		550
Peru	16,000	18,305	2,305	.....
Japan	47,000	46,000		1,000

The decreased production of the United States is thus seen to be confined to the Calumet and Hecla and Montana mines, whereas the other lake mines and the mines of Arizona and other states record small increases. Of the other countries included in Table III Chili and Japan alone show a decreased production, which is more than balanced by the increased output of the mines in Mexico and Peru.

With these figures before one, it is evident that the curtailment of production which was expected in 1910 as the result of a merger policy on the part of the financiers in-

terested in the United States of America copper mines has not been very rigorously enforced outside the Montana area, and that unless there is a distinct improvement in the demand for copper during 1911 a much stricter check to production in the mining districts of the American continent will be necessary in order to bring about the rise in values so ardently desired by the speculators in copper.

Whether the conflicting financial interests involved in the control of the American copper-mining industry will be able to arrange some common and united action in this matter of curtailment is the question of the moment, and the writer will make some attempt to answer it after discussing the variations in price that have occurred during the past fifteen years.

PRICE AND STOCK VARIATIONS IN 1911.

The price variations of copper during 1910 have been almost entirely in a downward direction, and a fall of $29.37 per ton occurred between Dec. 31, 1909, and Dec. 31, 1910. The settlement prices of standard copper at the close of each month are given by Messrs. H. R. Merton & Company in their valuable monthly circular for March, 1911, as follows:

TABLE IV.—PRICE VARIATIONS OF COPPER DURING 1910.

Dec. 31, 1909	$308.75	June 30, 1910	$272.50
Jan. 30, 1910	304.37	July 30, 1910	277.50
Feb. 28, 1910	298.12	Aug. 31, 1910	279.37
March 31, 1910	289.37	Sept 30, 1910	275.62
April 30, 1910	279.37	Oct. 31, 1910	285.00
May 31, 1910	284.37	Nov. 30, 1910	286.25
[illegible] 31, 1910	279.37		

Since the commencement of the present year the depreciation in the value of standard copper has continued, and on March 31, 1911, the settlement price was $272.50 per ton. The average price of standard copper on the first of each month for the past three years has been $300.12 in 1908, $294.31 in 1909 and $285.79 in 1910, so that the fall in values is rather over-accentuated by the comparison of the value on March 31, 1911, with that of Dec. 31, 1909, when the price was at the highest point touched for twelve months.

Fig. 2 shows the annual average price variations of copper from 1896 to 1910 plotted as a curve, and from the study of this curve, supplemented by the figures given by Messrs. H. R. Merton & Company for the stocks of copper held in England, France and America (or afloat thereto from Chili and Australia), some idea of the course [of] prices during the next twelve months may be gained. [Th]e downward trend of the price curve has now lasted [fo]r three years and one might reasonably have expected it to follow the example of the recovery of the year 1903, [an]d to commence once again to ascend during 1910 if [no] outside influences had been at work to check or ret[ard] this recovery. One of these influences has been the la[rg]e stocks of copper that had gradually accumulated in de[al]ers' and manufacturers' warehouses during the year 1910. H. R. Merton's & Co. figures for the combined visi[ble] supplies of copper in Europe (excluding Holland and G[er]many) and in America, as reported by the American P[ro]ducers' Association, during fifteen months are as bel[ow].

The cause of the failure of copper to rise above [the] present low level of values is thus seen to be this he[avy]

TABLE V.—STOCK VARIATIONS IN EUROPE AND AMERIC[A] DURING 1910.

Dec. 31, 1909	$172,310	Aug. 31, 1910	172
Jan. 30, 1910	154,765	Sept. 30, 1910	160
Feb. 28, 1910	161,306	Oct. 31, 1910	150
March 31, 1910	166,711	Nov. 30, 1910	144
April 30, 1910	173,593	Dec. 31, 1910	138,
May 31, 1910	178,434	Jan. 31, 1911	14
June 30, 1910	179,129	Feb. 28, 1911	152
July 30, 1910	$175,418		

incubus of stocks, which on Feb. 28, 1911, were c[lose on] 9000 tons less than on Feb. 28, 1910, and represent nea[rly] 2.5 months' supplies on the present basis of demand. [The] stocks held in Europe have, it is true, fallen by 27,000 t[ons] (from 109,022 tons to 82,387 tons) during the fourt[een] months covered by the above table, but the Ameri[can] stocks have increased by over 6000 tons (from 63,288 t[ons] to 69,924 tons) in the same period. It is practically cert[ain]

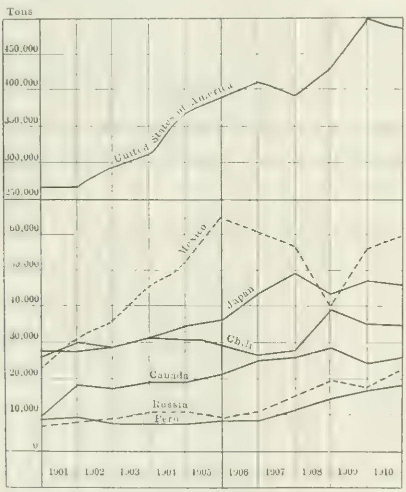


Fig. 1—Production Statistics of Copper 1901—1910.

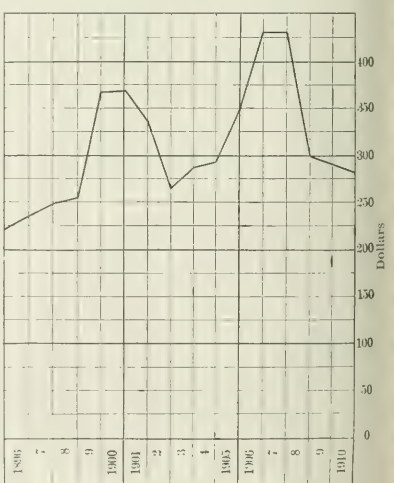


Fig. 2—Price Variations of Copper from 1896 to 1910.

that no marked recovery in price of the metal will oc[cur] until the stocks have been worked down to the more nor[mal] level of Dec. 31, 1908, when Europe and America each h[eld] about 55,000 tons of copper as visible supplies.

Trade in Europe is booming and the demand for cop[per] in the electrical-engineering and shipbuilding industr[ies] must be at its maximum. In America the recovery fr[om] the financial and industrial depression of 1907 and 1908 [is] still delayed, and this to some extent explains the sl[ack] demand for copper and the failure to reduce stocks in t[his] country.

The revival of activity of American manufacturing

dustries is, however, now overdue and is likely to take place either this year or next if no unforeseen events occur to hinder it. This revival, combined with a continuance (in perhaps a more vigorous form) of the present policy of restricted production on the part of the American copper magnates, should lead to a depletion of stocks on both sides of the Atlantic and to the recovery in price which has long been expected. It is improbable that the high prices of the year 1907 will be touched by the metal during 1911, but a recovery to $300 or to perhaps $325 per ton, in the writer's view, is almost certain to occur before the close of the year unless a sudden check to the manufacturing prosperity of Europe should cause a marked slackening in the demand for copper on that side of the Atlantic.

Electrolysis Situation in Chicago.

Possibility of damage to buried metallic structures by corrosion due to the electrolytic action of stray electrical energy, usually ascribed to the ground return of electric railways, is a subject that is discussed at intervals in nearly all American cities. In Chicago the situation is not at all acute; nevertheless, there has been a quiet investigation of the situation for some time by the city authorities and various public-utilty companies interested. The idea now is less to punish the companies for any mistakes or carelessness in the past than to plan a concerted movement by which the subject may be studied jointly and measures for relief adopted.

At a recent meeting held in the office of Mr. L. E. McGann, the commissioner of public works for Chicago, the question of the effect of electrolysis on underground utilities was brought up, and Mr. Bion J. Arnold, chairman of the board of supervising engineers, Chicago Traction, was requested by Mr. McGann to make a statement showing what has been done in this matter by the board of supervising engineers. Mr. Arnold subsequently wrote a letter to Mr. McGann containing some interesting information on this subject.

PRACTICE OF THE BOARD OF SUPERVISING ENGINEERS.

In the rehabilitation of the Chicago surface street railways it was decided at the outset that the tracks should be reconstructed in such a maner as to eliminate, as far as possible, the escape of electricity from the rails. This was done by supplementing the rail connections themselves on all new work with a return copper conductor or conductors laid between the rails and attached to the latter at frequent intervals. In order to meet the probable future growth of the street-railway system and provide against a path for the return current in case of broken joints, it was decided to lay no track unless supplemented by a return conductor, and that for double track a conductor not less than 500,000 circ. mil in section should be used. As the flow of electricity is greater near substations and power houses, this supplemental conductor has been increased in size at many locations so that in not a few instances there have been from two to twelve 1,000,000-circ. mil cables laid to supplement the rail return.

The present Chicago city ordinances relating to electrolysis require that the joints of the rails shall have a conductivity equal to the conductivity of the rail itself. This provision has been carried out by the board of supervising engineers, which has provided welded joints on all new track except at a few points, such as on special work, where it has been impracticable to weld the joints. In these cases copper cables have been provided to connect the main rails. The rails have also been connected together and to the supplemental return cables with copper cross-bonds placed at frequent intervals.

After adopting this standard of track construction it became evident that the necessary information upon which to base conclusions regarding what should be done with other structures, to prevent the destructive effect of electrolysis on underground utilities, might be gathered by co-operative action on the part of the public-utility companies and the board of supervising engineers. The result was that a sub-committee on electrolysis, consisting of representatives of the board and each of the utility companies interested, was appointed.

The committee has endeavored to recommend a practical method for the prevention of electrolytic action between the various underground metallic surfaces in the city of Chicago. The committee has investigated the conductivity of cement, concrete and earth materials, measured the resistance of various cables, conduits and pipes, made extensive electrolytic surveys and done much other work, including the investigation of an extensive drainage system for protecting pipes in power stations. The committee's final recommendations are about to be formulated, and in the meantime certain physical connections have been made between the tracks of the surface railway companies and some of the elevated railway companies with marked effect in the reduction of the flow of electricity and consequent reduction in electrolytic effect.

In concluding his interesting communication Mr. Arnold says that it is his intention, as soon as the committee mentioned makes its formal report, to take up the subject with the city officials with a view of securing their co-operation and carrying out a definite policy for the bettering of conditions.

REPORT OF BUREAU OF PUBLIC EFFICIENCY.

The Chicago Bureau of Public Efficiency has made a report, dated July, 1911, on "Electrolysis of Water Pipes in the City of Chicago." Mr. Herbert R. Sands, who is the director of this bureau, which is a private body of public-spirited citizens, says it is believed that at least two-thirds of the water pumped into the city mains is wasted. A large part of this waste is attributed to leaky water pipes. Possibly some of these leaks may be due to corrosion caused by electrolysis. The Chicago Bureau of Public Efficiency has therefore made a partial study of present electrolytic conditions as affecting the Chicago water mains. The survey was conducted by Mr. A. J. Hammond, chief engineer of the bureau, and Mr. H. J. McDargh, assistant engineer. The report recommends that a complete electrolysis survey of the entire city should be made by the city authorities. Such a survey should include (1) location of all positive and negative territories; (2) examination of all water pipes found to be carrying current, ascertaining whence the current comes, its point of departure and where it goes; (3) analysis of soil in "positive" districts; (4) sufficient tests of railway track rails to determine their efficiency as conductors. It is asserted that the board of supervising engineers has collected numerous data on the subject, but that nevertheless much remains to be done.

The report goes on to consider the relation of electric railways to electrolysis and briefly refers to legal proceedings by various cities and water companies, also dwelling on the importance of the subject in Chicago and the necessity for immediate action. Some "horrible examples" of electrolysis are cited, possibly the most interesting being the following:

"One of the large department stores in Chicago experienced the injurious effect of electrolysis through the failure of one of its 6-in. water mains in the basement. This bureau received an invitation to investigate and found that current from the electric railways was entering the building by the water and gas service pipes and following the piping and structural steel of the building until it found its way to the rails of the Illinois Tunnel Company's track. This investigation disclosed a 6-in. pipe in the building carrying 59 amp of current."

The People's Gas Light & Coke Company, according to this report, has greatly reduced the damage to its system by bonding with copper wires the gas mains in "positive" territories to the track rails. Further, each joint in the gas mains was bonded with two No. 0000 copper wires. These joints are 12 ft. apart. In addition, at a number of places copper cables varying from 500,000 to 1,000,000 circ. mil were tapped into the gas mains and carried to negative busbars at power stations.

The report goes on to show how its survey was made and in an appendix is a long list of readings made at various locations with voltmeters and ammeters. Discussing remedies, the report says that the double trolley system will be impracticable. Various methods heretofore suggested are mentioned and, while the Chicago Bureau of Public Efficiency does not recommend any particular one of these, it believes that means of relief are available.

APPOINTMENT OF EXPERT ON ELECTROLYSIS.

Acting under authority conferred by the City Council of Chicago, which recently appropriated $10,000 for the purpose of making an electrolytic survey of the city, Mayor Harrison on July 25 appointed Mr. Ray Palmer, an electrical engineer, expert for the city to make such a survey and to report the result of his findings. Mr. Palmer, who is an associate of the American Institute of Electrical Engineers, has been employed in similar work in Milwaukee. He will receive $750 a month as compensation and will be required to pay his own assistants.

Ohio Tax Valuations of Public-Service Companies.

The Ohio Tax Commission has fixed a tentative valuation of approximately $18,000,000 on the property of the Union Gas & Electric Company, of Cincinnati. It is possible that some deduction may be made because of the claim that the artificial-gas plant does not pay, but must be maintained in order to retain the franchise granted by the city.

Judge Miller Outcault and Attorney Joseph Heintzman represented the company in a hearing before the commission on Aug. 10. They urged that a valuation of $10,000,000 would be fair. This is an advance of $6,000,000 over the former valuation of $4,000,000, but the members of the commission were not inclined to look upon the matter in that light. The attorneys argued that the company fell about $54,000 short of paying fixed charges last year, and from this argued that the business is not paying. In reply the commissioners said that as the fixed charges include dividends upon stock of underlying companies at a contract rate they would not consider that the company is not earning money as long as it continues to pay these dividends, which they consider unwarranted.

Judge R. M. Ditty, chairman of the commission, told the attorneys that both the commission and the public felt that the holding company alone, and not the State government, is to blame for paying such high returns to others that it is unable to earn money on its own investment. The argument of the company that it should not be valued upon its earning capacity but upon its physical equipment was answered that the property has value only according to its worth as a going concern and that it is unfair to the public to fix its valuation as junk and put it on the t roll at that.

	Former.	New.
Washington C. H. Gas & Electric Company	$43,630	$120,000
Middletown Lighting Company	22,500	115,000
Middletown Gas & Electric Company	28,000	90,000
Chillicothe Gas Light & Water Company	43,000	180,000
Ravenna Gas & Electric Company	22,855	70,000

The attorneys for the company will have the figures the report of the company classified and put in systema shape for reaching the value of various items, and t commission will consider the matter further. These f ures will probably go back ten years.

Tentative valuations have been fixed upon the followi additional Ohio public-service companies given in the tab

New York Commission News.

The Public Service Commission, Second District, h made its final order in the matter of interborough telepho rates of the New York Telephone Company in Great New York. An order was made June 1, 1911, reduci various rates which carried reductions of from 10 cents 5 cents for messages between Manhattan and Brookl and between Manhattan and central-station districts, Ast ria and Newton on Long Island, and reductions from cents to 10 cents for messages between Manhattan a central-station districts Flushing, Richmond Hill a Jamaica, on Long Island. The New York Telephone Co pany asked for modifications of the order and the fi order now provides for a 5-cent rate instead of 10 ce between Manhattan below 110th Street West and 10 Street East to that section of Long Island included betwe the Long Island Sound, East River, New York Bay and line beginning at Sixty-fifth Street and New York B following the route of the Bay Ridge Extension & Ma hattan Beach Division of the Long Island Railroad ea erly from New York Bay to New Lots Avenue; then easterly on New Lots Avenue to Fountain Avenue; then northeastly to the intersection of Blake Avenue and Crys Street extended; thence easterly on Blake Avenue to t boundary line between the Boroughs of Brooklyn a Queens; thence northerly on the boundary line between t Boroughs of Brooklyn and Queens to Forest Park; then north across Forest Park to a point 100 ft. south Myrtle Avenue; thence easterly and parallel to Myr Avenue to a point 100 ft. east of Dry Harbor Ro extended; thence northerly and parallel to Dry Harb Road through St. John's Cemetery to a point 100 ft. sou of North Hempstead Road; thence northeasterly alo North Hempstead Road and 100 ft. therefrom as far Flushing Creek, thence northerly along Flushing Creek Flushing Bay. It also provides for a 10-cent rate instead 15-cent between Manhattan, between 110th Street West a 103d Street East, to central-station districts Flushing, Ric mond Hill and Jamaica upon Long Island. These rat apply from regular subscribers' stations for a connection five minutes or less and each additional five minutes or fra tion thereof may be charged as another call. To give t company a reasonable time to provide for the additions its plant and equipment which increased service followi reduced rates is sure to demand the company is given un Dec. 1, 1911, to put the reduced rates in effect. The co pany has agreed to the terms of the order as now made.

The Rockland Light & Power Company has been autho ized to issue $100,000 5 per cent bonds to be sold for n less than 93 and the proceeds to be used for extensions a improvements to its plant. The company operates in Nya and other villages in Rockland County.

Wisconsin Commission News.

By a recent decision of the Railroad Commission in t city of Neenah's case against the Wisconsin Tractio Light, Heat & Power Company a new rate schedule ordered for all gas sold for whatever purpose used. T

[fo]rmer rate schedule ranged from $1.45 per 1000 cu. ft. [fo]r the first 3000 cu. ft. to $1.25 per 1000 cu. ft. for gas [so]ld above 15,000 cu. ft. per month. No discounts were [a]llowed and a minimum charge of 25 cents per meter was [m]ade. The schedule ordered effective is as follows: For [th]e first 5000 cu. ft. used per month, $1.15 net; for the [ne]xt 15,000 cu. ft., $1 net; for the next 30,000 cu. ft., [..] cents net; for all gas used per month in excess of 50,000 [cu]. ft., 75 cents net. The minimum bill must be graduated [fr]om 25 cents to $4 per month according to the size of the [m]eter. The above schedule of rates will return the company 5 per cent for interest and profit on a valuation of $320,-[0]00. The complaint does not justify an order establishing [th]e proposed rates in all of the territory supplied by the [c]ompany, but the commission recommends that they be [m]ade effective in the cities of Appleton and Menasha as [w]ell as in Neenah.

The commission has held hearings in the matter of the [re]fusal of the Merrill Railway & Lighting Company to [c]omply with certain orders. These relate to the question of [vo]ltage regulation and the accuracy and manner of testing [m]eters. The officials of the company testified that, after [m]onths of fruitless endeavor to obtain a satisfactory volt-[a]ge regulator from the larger manufacturing companies, a [sp]ecial regulator had been obtained which it was thought [w]ould satisfactorily fulfill all conditions. The meter ques-[ti]on, however, has not been settled in a manner satisfac-[to]ry to the commission. The Merrill company uses a meter [w]hose accuracy, as evidenced by tests made by the com-[m]ission, is not up to the requirements laid down by the [co]mmission in its standard of service. To determine if [th]ere were any mitigating circumstances or fundamental [re]asons why this type of meter should not show the same [de]grees of accuracy as the motor meters, a hearing was [h]eld on July 31 at which the manufacturer of the meter [di]scussed its operation, the precautions to be observed in [in]stalling and testing and the reasons why, in his opinion, [th]e meters in Merrill showed such a wide variation in ac-[cu]racy. As a result of the hearings the commission will [fo]rmulate a special set of regulations to govern the testing [and] inspection of the type used in Merrill in order that [the] standards of service for meters, as laid down by the [co]mmission, may be complied with.

The commission has authorized the Superior Water, [Li]ght & Power Company to issue 5000 shares of common [st]ock, of the par value of $100 each, and 5000 shares of [pr]eferred stock, of the par value of $100 each, which stock [is] to be issued and exchanged for a like amount of com-[m]on stock now outstanding. The Campbellsport Electric [Li]ght & Power Company has been authorized to issue [$]5,000 par value of stock and $20,000 par value of 5.5 per [ce]nt bonds. The stock is to be issued and exchanged for [al]l property and effects now held by Mr. A. Hood, which [pr]operty and effects were purchased for the company by [Mr.] Hood and for which no compensation has been given [to] the company. The proceeds to be derived from the sale [of t]he bonds are to be used for the purpose of paying the [ou]tstanding indebtedness incurred by reasons of additions [and] extensions made to the property, as well as providing [wor]king capital. The bonds are to be sold for money only [and] for not less than 75 per cent of par value.

[C]URRENT NEWS AND NOTES.

CONVENTION OF MUNICIPAL ELECTRICIANS.—The place of [ho]lding the next annual convention of the International [A]ssociation of Municipal Electricians has been changed [fr]om St. Paul to Atlantic City, and the date fixed for [Se]pt. 12 to 15. Headquarters will be at Young's Hotel, [w]here there will also be space for exhibits. Mr. Clarence [R.] George, Houston, Tex., is secretary.

CUBAN HYDROELECTRIC CONCESSION.—The Cienfuegos, Palmira & Cruces Electric Railway & Power Company has been authorized to utilize the waters of the Hanabanilla and Negro Rivers and to construct certain railway lines in connection with those already existing in the Province of Santa Clara, Cuba. The company is to be permitted to import free of duty, "within the limits allowed by treaties," the machinery, rails, engines, tools and rolling stock under appropriate restrictions which will be required for the construction and operation of its plant and railway lines. It is stated that all of this material will be purchased in the United States.

* * *

EIGHTY-CENT GAS RATE TEMPORARILY ESTABLISHED IN CHICAGO.—Judge Gibbons, of the Circuit Court of Cook County, to whom the People's Gas Light & Coke Company presented a petition asking the court to set aside the rates for gas fixed by the City Council, has fixed a rate himself. It may take two years to settle the litigation growing out of the company's suit, and until the final determination of the case the judge has fixed a rate of 80 cents a thousand. The present rate is 85 cents and the City Council rates are 75 cents for the first year, 70 cents for the second and third years and 68 cents for the fourth and fifth years. The order made by the court, which went into effect Aug. 7, provides that consumers paying at the new rate of 80 cents shall receive a refund of so much of said payment as is in excess of the rates prescribed by the city ordinance, provided that these rates are finally adjudged just and reasonable.

* * *

BOSTON SUBWAY EXTENSION.—The Boston Transit Commission has instructed its engineers to make survey of the routes for the new Boylston Street subway, the Dorchester tunnel and the East Boston tunnel extension. Work will not be begun until the act of the Massachusetts Legislature authorizing their construction has been accepted by the city and by the Boston Elevated Railway Company. The undertakings involve an expenditure of sums estimated at $10,000,000 in the aggregate. By the construction of these tunnels about 4.5 miles of underground transit facilities are to be added in the city of Boston. The Boston Elevated Railway will lease the tunnels and subway in the same way that it leases present subways, and the leases on all the tunnels and subways will run to July 1, 1936, at a general rate of 4.5 per cent.

* * *

LOS ANGELES LIGHTING COMPANIES CAN CHARGE FOR INCANDESCENT LAMPS.—An ordinance adopted by the City Council, Los Angeles, Cal., in 1910, lowering the lighting rates and which also required the electric-lighting companies to supply incandescent lamps free to consumers, has been declared unconstitutional by the Supreme Court. In its decision the court holds that the City Council has not the authority to regulate prices that may be charged for lamps or to order lamps to be furnished free, any more than it can determine the cost of wiring a house for electrical service. The city, in its case, contended that the cost of furnishing lamps had been considered in the adoption of the rates.

* * *

TUNGSTEN OUTLINING OF PEOPLE'S GAS BUILDING, CHICAGO.—The People's Gas & Coke Company, Chicago, has just completed outlining with 100-watt tungsten lamps the cornice and principal architectural lines of its handsome twenty-story office building on Michigan Boulevard. The office and sidewalk lighting is done with high-pressure gas-mantle units, but for all the ornamental illumination the choice was limited to electricity. The corridors of the building and the gas company's own magnificent offices are lighted by gas, but the majority of the office tenants employ electricity exclusively, although every effort has been made to encourage the use of gas.

Institute of Operating Engineers.—The program of the first annual meeting of the Institute of Operating Engineers, to be held in the Engineering Societies Building, New York, Sept. 1 and 2, includes six technical papers dealing with engine and boiler-room operation. An equal number of papers and addresses relate to the status and instruction of the stationary engineer.

* * *

Chicago's First Electric Sign.—The first electric sign of the thousands which now make Chicago's night sky luminous was installed in 1888, according to Mr. H. L. Markham, of Chicago, who mentioned this early display in a recent address. The sign was used by the Iowa delegation to the national Republican convention to urge the nomination of Senator Allison for President.

* * *

Meeting of Incandescent Lamp Manufacturers.—A meeting of incandescent lamp manufacturers will be held during the week of Sept. 3 at Association Island, near Sacketts Harbor, N. Y. During the meeting papers will be presented on the commercial side of electric lighting by Messrs. A. D. Page, Ward Harrison, C. W. Bender, F. M. Tait, C. L. Eshleman, C. O. Baker and P. S. Dodd.

* * *

Commercial Loss from New Invention.—At the semi-annual meeting of the National Electrical Supply Jobbers' convention this week at Saratoga, N. Y., the subject was discussed of the loss entailed on the electrical trade by the activity of inventors. It was stated that great losses are sustained by depreciation in the value of goods which, though up to date when purchased, are supplanted by other inventions.

* * *

Canadian Members of International Waterways Commission.—Under the terms of a treaty ratified last year the following members of the permanent International Waterways Commission have been appointed by the Canadian government: Chairman, Sir George Gibbons, who was chairman of the Canadian section of the old commission; Hon. A. P. Barnhill, a member of the New Brunswick government; Mr. Aimé Geoffrion, K. C., of Montreal. Mr. Thomas Cote, secretary of the old commission, will hold the same office in the new body.

* * *

Tick-Tick Telephones.—The Chicago Telephone Company is installing that type of prepayment telephones where the coin must be inserted before connection can be had with "Central," the subscriber ascertaining that the line is free by listening for a ticking noise in the receiver. There is some objection to the use of these "nickel-first" telephones rather than the "nickel-last" type now quite general in Chicago, but the company insists that it is going to a large expense to make the change because it is in the interest of first-class telephone service to do so.

* * *

Quebec Province to Sell No More Water-Powers.—The government of the Province of Quebec has adopted a new policy regarding water-powers belonging to the crown. In future no water-power will be sold, in perpetuity, as was the case ten years ago when powers at Shawinigan and Grand Mere Falls were sold for $50,000 each. Instead, leases of ninety-nine years will hereafter be granted. The Minister of Crown Lands at Quebec, Hon. Jules Allard, has decided to offer at auction in September next ten water-powers situated in different portions of the province.

* * *

Aeroplanes and Electric Wires.—Mr. J. A. D. McCurdy, one of the aviators contesting in the aero meet held by the Chicago Aero Club on the Chicago lake front, Aug. 12 to 20, suffered the loss of his biplane Aug. 14 when he came down, striking a group of electric-light wires, severing them and setting fire to his machine. Mr McCurdy's engine gave out 500 ft. in the air and he wa forced to coast to the ground. Misjudging his landing, h struck the wires and carried them down in a shower o sparks which set fire to the planes, completely consumin them and the framework of his machine.

* * *

Citizens Destroy Maywood (Ill.) Dam at Midnight—Declaring that the stagnant water impounded by th condenser-intake dam of the North Shore Electric Com pany in the Desplaines River near Maywood, Ill., fur nished breeding places for mosquitoes and malarial germs as noted in this column Aug. 5, a body of citizens of th village, which is a suburb of Chicago, led by their town president and marshal, proceeded to destroy the dan shortly after midnight, Aug. 9, cutting an opening 16 ft wide through the center of the wall. The action wa planned secretly and followed a five-day notice to th company to remove its dam. Besides the mosquitoes an danger from typhoid the citizens objected to the stencl from thousands of dead and decaying fish which had die in the stagnant pool above the dam.

* * *

Central-Station Baseball Matches.—Rival basebal teams of three electric-lighting companies played a double header at Oriole Park, Baltimore, on July 29 in the pres ence of 2000 people. The "White Sox" of the Consolidated Gas, Electric Light & Power Company, Baltimore, firs played the crack nine of the Edison Electric Illuminating Company of Brooklyn, losing in twelve innings by a score of 2 to 3. The Baltimore nine then beat that of the United Gas Improvement Company of Philadelphia by a score o 3 to 1. Manager Lafferty brought the Edison squad fron Brooklyn and at Philadelphia was joined by Manager Gal lagher and the U. G. I. nine. Luncheon was served en route, and at Baltimore the nines were met by the loca players and a 'bus, which took them directly to th grounds. A full brass band was on hand during both games, and the Baltimore team had as its mascot a diminutive darky of deep ebony hue who cavorted on a more or less white mule. He failed to have any effect on the Brooklyn players, but cast some sort of a spell over Philadelphia.

* * *

New York Edison Stations Carry Record Summer Load in Electrical Storm.—A severe electrical storm reported by the United States Weather Bureau as a black squall, with wind at 55 miles an hour, broke over the southern part of New York and nearby sections of New Jersey about 3 o'clock last Tuesday afternoon, and th entire locality affected was practically in darkness for ove a quarter of an hour. The approach of the storm was re ported by the weather observer of the New York Edison Company and preparations were made for carrying the ex pected increase in load. Before the storm came the nor mal summer load, aggregating some 60,000 kw, was being carried by the stations. At 2 o'clock, when the skies dark ened, this reached 73,000 kw, and as the sky cleared shortly after this time the load dropped again to normal. A 2:45 intense darkness became widespread and units were placed in operation as rapidly as demand required. Th peak on the stations finally reached 105,000 kw in two sudden jumps, which was the highest summer load eve carried, and it was maintained for fifteen minutes. A Waterside No. 1 two 10,000-kw units, six 4000-kw unit and one 5000-kw unit were used, and at Waterside No. 2 one 14,000-kw unit, six 10,000-kw units and one 8000-kw unit were in operation to meet the conditions. So effi cient were the preparations for meeting the storm tha not the least drop occurred in the supply voltage and i was not necessary to fall back upon storage batteries whil placing any of the units on the lines.

RAILWAY TERMINAL POWER PLANT.

oduction and Distribution of Energy in New Northwestern Passenger Station in Chicago.

MANY unusual and special applications of mechanical and electrical energy in the new passenger terminal of the Chicago & Northwestern Railway Company in Chicago make a description of the completed plant, now that the terminal is in service, well worth while. However, a rather elaborate account of the "Electrical Features of the New Northwestern Railroad Terminal in Chicago" appeared in the *Electrical World* of July 8, 1909, in the early stages of the work on the great terminal, which now cost over $25,000,000. That article was quite complete at that time, and it will perhaps not be necessary to repeat a general description of the terminal buildings and tracks. A general street-level plan of the whole terminal is given in Fig. 2.

As shown clearly by this drawing, the terminal has its greatest dimension along Clinton Street, by which it is bounded on the west. Lake Street, Randolph Street and Washington Street are east-and-west streets crossing the terminal underneath the railroad tracks, which are elevated. The terminal may, therefore, be considered as divided into four portions, and the power plant occupies the triangular section occupying the extreme northern portion, as shown in Fig. 2.

The station building proper, referred to here for convenience as the main building, is at the other end of the terminal, facing on Madison Street. From the corner of Milwaukee Avenue and Clinton Street, where the power-house stack is located on the northern corner of the terminal to the front of the building on Madison Street is a distance of 1450 ft. The main building is a four-story structure of the early Italian Renaissance style of architecture, having granite walls and with a lofty Doric portico at the Madison Street entrance, supported on a colonnade of six granite columns, each 7 ft. in diameter at the base and 61 ft. high. The main waiting-room, which is the principal architectural feature of the station, is treated as a great Roman atrium with a barrel vault roof. The lighting features of the main building, the heating and ventilation of the terminal and many miscellaneous utilities will be treated in a succeeding article.

POWER-HOUSE DESIGN.

Considerable ingenuity has been displayed in the design of the power station by the consulting engineers, owing to the limitations in space and the unusual shape of the ground available. In the power house on this triangular lot all of the energy used for heating, lighting, ventilating and operating the various utilities of the terminal is generated. Fig. 3 is an exterior view taken at the corner of Milwaukee Avenue and Clinton Street.

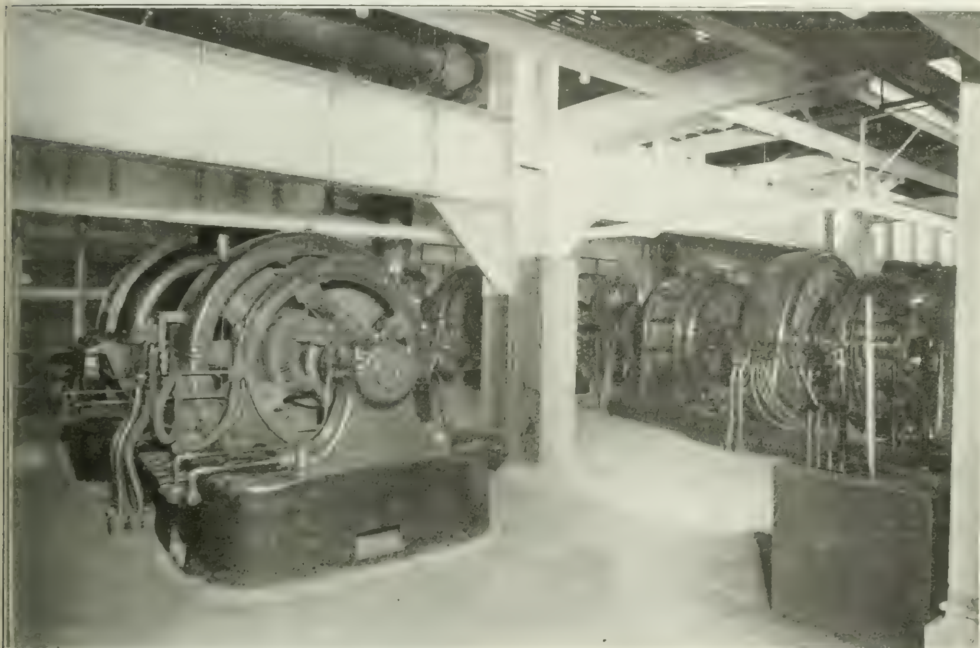


Fig. 1—View Showing (at the left) Exhaust Turbo-Generator, with Motor Generators in the Background.

The boiler-room is placed on the Clinton Street side of the power house, the floor being 21 ft. below the sidewalk level, with the roof 73 ft. above the floor. The main engine-room proper is also on the Clinton Street side of the building, south of the boiler-room. The total width available for the installation of the machinery was 40 ft. from the lot line to the steel girders of the track elevation. The engine-room floor is slightly over 10 ft. below the sidewalk level; the crane rails are 47 ft. 8 in. above the floor, while the ceiling of the engine-room, due to the pitch of the roof, varies between 60 ft. and 67 ft. above the floor, this giving an unusually high engine-room, but one which is at the same time well proportioned.

THE CHIMNEY AND ITS LIGHTNING PROTECTION.

Built of Custodis radial brick, the chimney for the power house rises 225 ft. above the sidewalk and about 245 ft. above the furnace grates. The inside diameter at the base is 11 ft. and at the top 10 ft. 6 in. The stack rests on three caissons carried down to rock. It is surmounted by a very heavy cast-iron cap and is protected by four light-

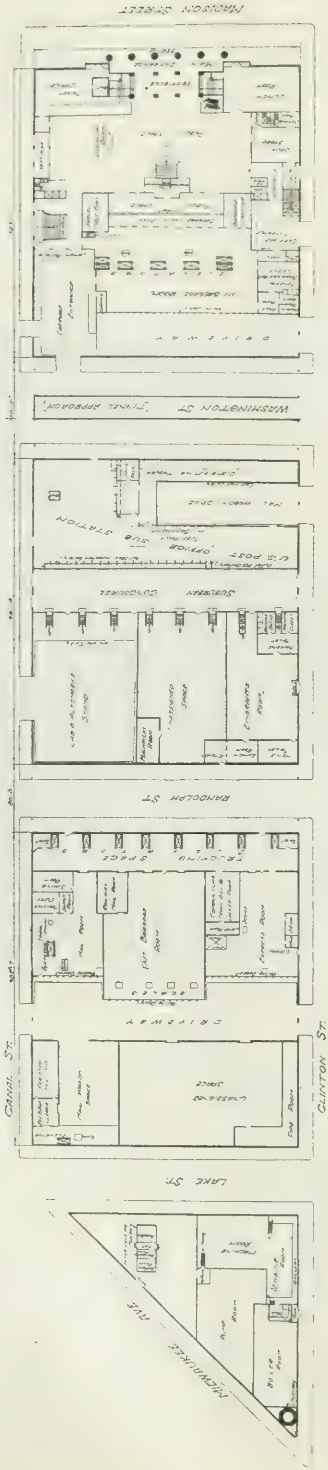


Fig. 2—General Street-Level Plan of the Terminal.

ning-rod points, each having a 24-in. platinum tip, the tips being connected to rods which in turn are fastened a copper ring surrounding the top. Connecting with tl ring at the places where the point rods are also connect

Fig. 3—Exterior View of Power House.

cables are carried down the stack diagonally until co nection is made with the main lightning conductors, one which is placed on each side of the chimney. These ligl ning-conductor cables are 256,000 circ. mils in section ai

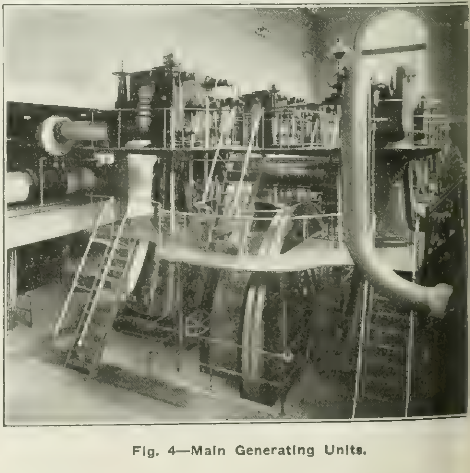


Fig. 4—Main Generating Units.

are tinned to prevent the possibility of corrosion. T entire lightning protection was installed by Mr. Ca Bajohr, of St. Louis.

GENERAL POWER-PLANT EQUIPMENT.

With inside walls of pressed brick and Rookwood gree

le wainscoting the interior of the power house presents handsome appearance, indicating, what is indeed the fact, hat great attention has been paid to detail through the ntire equipment. In the boiler plant there are six Bab-

g. 5—Power House Switchboards. Bench Board for Control and Vertical Board for Distribution.

ock & Wilcox 500-hp water-tube boilers having vertical eaders and being built for 200 lb. working pressure. Each oiler is equipped with superheaters of the Foster type and ith Green mechanical stokers.

The coal and ash-handling apparatus was supplied by e Link-Belt Company. There are continuous pivoted ucket conveyors for handling both coal and ashes. Pan-pe conveyors are used for conveying the coal from the rs to the bucket conveyor, and an inclined pan-type con-r is used for conveying ashes to the ash-storage bins. pecial means are provided for taking care of expansion the boiler breeching, which is supported on saddles and rings resting on the building I-beams, allowing free ovement with varying temperatures. The piping layout so is noticeably simple and direct, a minimum amount piping being used.

In the main engine-room there are three vertical cross-mpound non-condensing Allis-Chalmers engines, each ted at 1150 hp, at 100 r.p.m., with steam pressure at 5 lb. and 70 deg. superheat. Each of these engines is rect-connected to a 750-kw, 250-volt, direct-current com-und-wound General Electric generator, and space has also been left for a fourth generating unit of the same size. The engine platforms of all the vertical engines are interconnecting. Fig. 4 is a general view of the main engine-room. Automatic engine stops are provided for emergency use. One set of switches for operating these emergency stops is shown at the end of the benchboard in Fig. 5.

Alternating current is obtained by means of two motor-

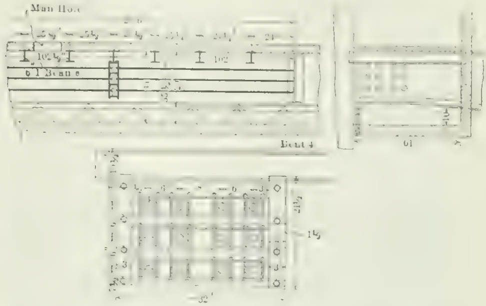


Fig. 7—Sections Showing Details of Cable Supports Between Girders in Cableway.

generator sets, each consisting of a 250-volt direct-current motor turning at 720 r.p.m., driving a 500-kw, 6600-volt, three-phase, 60-cycle generator. Each motor-generator set has its own direct-connected exciter unit. A three-wire balancer set, rated to care for 300 amp of unbalanced load, is also provided.

EXHAUST-STEAM TURBINE.

One of the most interesting features of the power plant is a Curtis low-pressure steam-turbine and generator unit, rated at 500 kw and producing 250-volt direct current, operating at 1500 r.p.m. Space has also been provided for an additional turbo-generator unit of the same size. Fig. 1 shows the turbine unit (at the left) and also the motor-generators in the background.

As it was impracticable to obtain a source of condensing water the main generating units are non-condensing and the exhaust from these Corliss engines, as well as from the various steam auxiliaries, is used in the low-pressure turbine. At the present season of the year, when steam is not needed for heating, the exhaust turbine takes about 40 per cent of the load on the station. It "floats" on the

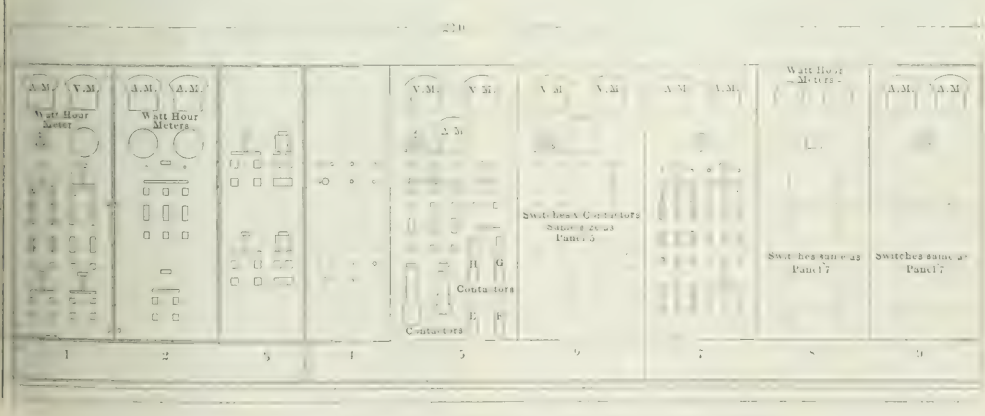


Fig. 6—Diagram Showing Front of Distribution Switchboard in Main Building.

system, there naturally being more exhaust steam as the load grows heavier. The Corliss engine sets are guaranteed to run on 18.6 lb. of steam per indicated horse-power at full load, against 16.5 lb. absolute back pressure. This means 21,400 lb. of steam exhausted to the low-pressure turbine. The latter was installed under a guarantee to deliver a kw-hour on 43.5 lb. of exhaust steam. Using the 21,400 lb. of steam exhausted from the engine unit, the turbine will develop an additional 786 hp, making a total of 1936 hp for the combined outfit on 21,400 lb. of steam, or a hp-hour from 11.8 lb. steam. The turbine will undoubtedly be operated at least eight months in the year, and very likely all the year around. This is believed to be the first power plant with an exhaust-steam turbine installed as part of the original installation.

OTHER POWER-HOUSE FEATURES.

The engine-room is spanned by a Shaw three-motor overhead traveling crane of 25 tons rating. There are also a Worthington condenser and a roof-type cooling tower for the turbo-generator. This cooling tower is equipped with four fans, driven by two 25-hp motors. In the "machine-room," which contains the turbine and the motor-generators, there are also two Ingersoll-Rand two-stage air compressors, each large enough to compress 500 cu. ft. of air per minute to 100 lb. pressure. A 3000-hp Webster feed-water heater and two Epping-Carpenter boiler-feed pumps are included in the equipment.

The present capacity of the generating plant is considered to be 2750 kw—that is, three 750-kw engine-driven generators and one 500-kw exhaust turbine unit. The ultimate plant will have a rating of 4000 kw. Direct current distributed on the 110-220-volt three-wire system is used entirely throughout the terminal, the alternating current from the motor-generator sets being used for supplying energy for lighting, signaling and power purposes on various suburban lines of the Chicago & Northwestern Railway.

CONTROL AND DISTRIBUTION OF ELECTRICITY.

In a switchboard gallery at the south end of the engine-room are the operating switchboard, which is of the bench-board type, and a vertical switchboard for the feeder panels. These switchboards, which were built by the Walker Electric Company, are illustrated in Fig. 5. Inasmuch as the terminal property is divided into four sections by the crossing streets, it seemed best to arrange the electrical distribution in the following manner:

Starting at the power house back of the benchboard on the switchboard gallery is placed the main feeder board, from which all feeders are run. One set of feeders runs to a distributing switchboard in the basement of the main building of the terminal, while another set runs to the switchboard in the machinery room just south of Randolph Street, under the elevated tracks, as shown on the pla

For furnishing energy for motors and lamps in the ma building there have been provided twelve 2,000,000 ci mil cables. These are placed in a runway immediate above the train sheds on the Clinton Street side of t terminal. That portion of the cables leading from t switchboard to the runway is rubber-covered. Where t cables enter the runway they are incased in weathe proof triple braid and are threaded through holes in t roof girders resting on asbestos wooden blocks, porcela bushings being provided in each case. In addition, tv additional supports are provided between girders, as t distance, 26 ft., was considered too long to enable t cables to be supported as rigidly as desired. Fig. 7 show the details of these cable supports between girders. T hold these transmission cables taut there has been pr vided at the north and south end of the cableway a speci device made as follows:

An asbestos board 2 in. in thickness, with 3-in. hol drilled to correspond with the holes in the girder, is plac against the steel work, and after the cable is pulled up t insulation is stripped and a standard 2-in. shaft couplir clamped to the cable, thus firmly securing the cables ar permitting a minimum amount of sag between support After being placed these couplings were thoroughly tape At the south end of the cableway rubber-covered cabl are connected to the transmission cables, these passir through conduits to the distributing switchboard locat in what is known as the switchboard-room in the basemen of the main building.

Four of these cables are connected through double-pol switches to the main lighting buses. Two of them ar connected directly through a double-pole switch wit power buses. Two are connected through a double-pol switch to train-lighting buses and the remaining fou cables are connected as follows:

The two positive and the two negative cables are eac connected separately to a special plate forming part of switch made up with two separate blades, each with it own handle. The arrangement permits of one set bein thrown either to the general lighting buses or the train lighting buses, while the other connection may be mad either to the power buses or general lighting buses. Thi arrangement may be understood more clearly by referenc to Figs. 6 and 8, showing, respectively, the connections o the front and rear of the distributing switchboard in th basement of the main building.

FEEDER REGULATION.

Feeder regulation is effected by special switching ar rangements. During the daytime and until the conceale lamps in the main waiting-room are required one feede cable is disconnected from the distributing board and a

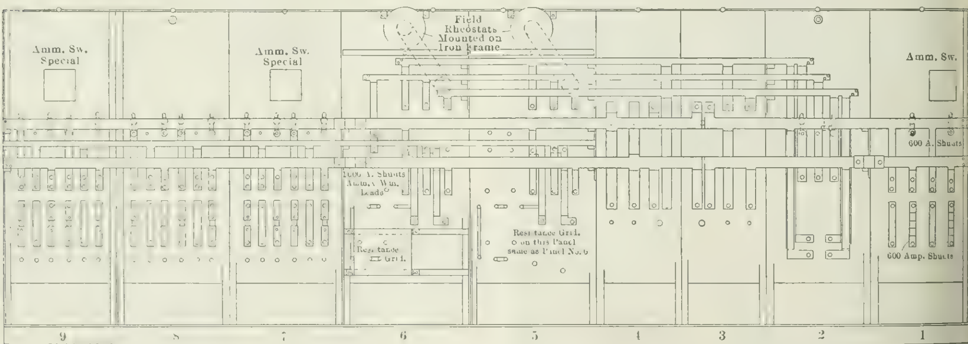
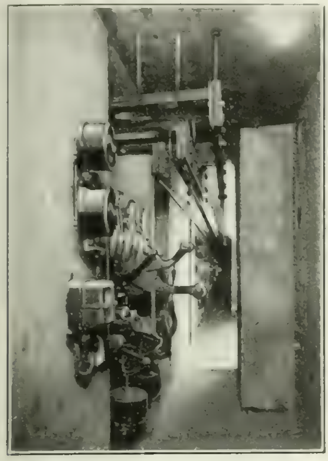


Fig. 8—Diagram of Rear of Distribution Switchboard in Main Building.

t: same time separate feeder switches controlling the ıcealed lamps in the waiting-room are opened. At the ;ne time the switches in the train-lighting feeders are



F 9—Busbar Tunnel Under Engine Room. Showing 4000-Amp. Circuit Breaker.

c "ed, for the train-lighting load does not come on until l:e in the evening. By this means one set of feeders t:es care of practically 110 kw to 135 kw.

practice the result is that when the lighting is on in t main building two sets of feeders are in service for l:ps and two for motors, another set being thrown in v:en the train lighting is required and still another when t concealed lamps in the waiting-room are lighted. The r'ords show that there is a variation of only from 0.3 volt

F 10—View in Pit Beneath Motor Generator and Turbine Sets Showing Circuit Breakers, Busbars and Rheostats.

t0.8 volt between no load and full load. These variations w:ld naturally be dependent upon the load and the cables tlt are in service.

:lectrical energy for lamps and motors in the two blocks o: sections of the terminal between Washington Street and Lake Street is controlled from the board in the machine-room on the south side of Randolph Street under the tracks, to which reference has been made. In this machine-room there is a balancer set rated for 300 amp, unbalanced load. This is interconnected with the balancer in the power house, and by suitably arranged switches one may act as a relay to the other. Lighting and motor service for the power house itself is furnished directly from the main feeder board.

REMOTE CONTROL.

In the power house the remote-control feeders in connection with the alternating-current apparatus are substantially the same as those in general use for 6600-volt work. In connection with the direct-current apparatus the control has been somewhat elaborated, owing to special conditions existing in the plant, such as the controlling of

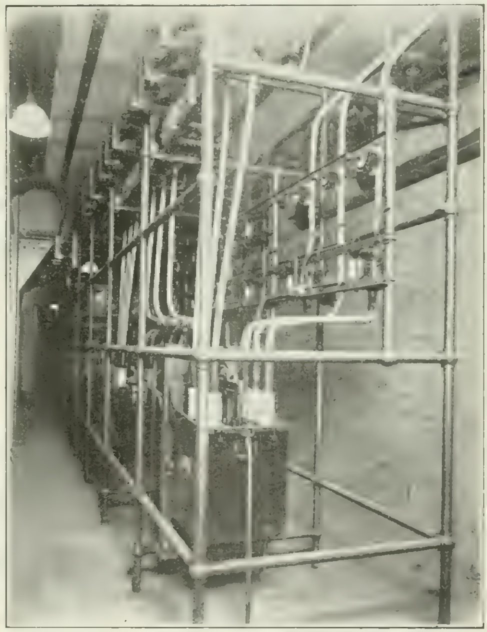


Fig. 11—Oil-Switch Room.

the motor-generator sets from the direct-current end and the operation of circuit-breakers as line switches connecting the various direct-current generators with the system of buses.

The remote-control circuit-breakers for the 750-kw direct-current generators have a nominal rating of 4000 amp. They are installed in recesses in the engine foundations in a tunnel beneath the engine-room floor shown in Fig. 9. By placing these breakers in this manner the switchboard is simplified and the flexibility of the system is increased, for the switching apparatus of each individual unit is placed near it.

Remote-control switches on the benchboard in the switchboard gallery control all of the various circuit-breakers of the direct-current generators and those installed in connection with the motors of the motor-generator sets. In addition, the oil switches for the high-tension end of the motor-generator sets, as well as the oil switches for the outgoing alternating-current feeders, are similarly operated by remote-control switches.

The 4000-amp circuit-breakers for the engine-driven generators and the 3000-amp circuit-breaker for the turbo-

generator are three-pole, 250-volt, two-coil, overload, Reversite, Dalite and Auto-ite, motor-operated, remote-control I-T-E breakers. They are electrically and mechanically interlocking and close without jar, as instantly upon the beginning of the closing movement the control switch is automatically short-circuited by the closing mechanism and the movement thus completed without further action on the part of the operator. The circuit-breakers used in connection with the motors of the motor-generators are of the same general type, but are single-pole, two being installed for each motor. Fig. 10 is a view in the pit beneath the turbine and motor-generators, where these breakers are installed. By closing the control switch on the benchboard one of these single-pole breakers is closed, thus permitting current to pass through the contactors, closing one after the other of the automatic motor starters, the closing of the last contactor automatically closing the short-circuiting motor-operated switch or circuit-breaker.

Resistances have been placed in series with the field of

and at the same time closes a bell circuit, thus indicati to the operator that the "dead" exciter has been thro onto the buses.

Inasmuch as remote control is relied upon entirely, was not feasible to use the ordinary field switch in co nection with the opening of the field circuit of the alt nating-current generators. The special arrangem worked out here consists of placing a connection on t extended shaft of the remote-control switch in the fo of a triangular contact which will enter the blades wh the switch is opened. These blades close the circuit throu the closing coil of a small contactor which connects t discharge resistance across the fields of the alternati current machine.

OIL-SWITCHING EQUIPMENT.

The high-tension oil switches for the alternating-curr service north of the power house are placed in a separ room, as illustrated in Fig. 11. General Electric thr pole, 300-amp, 15,000-volt oil switches are used and th

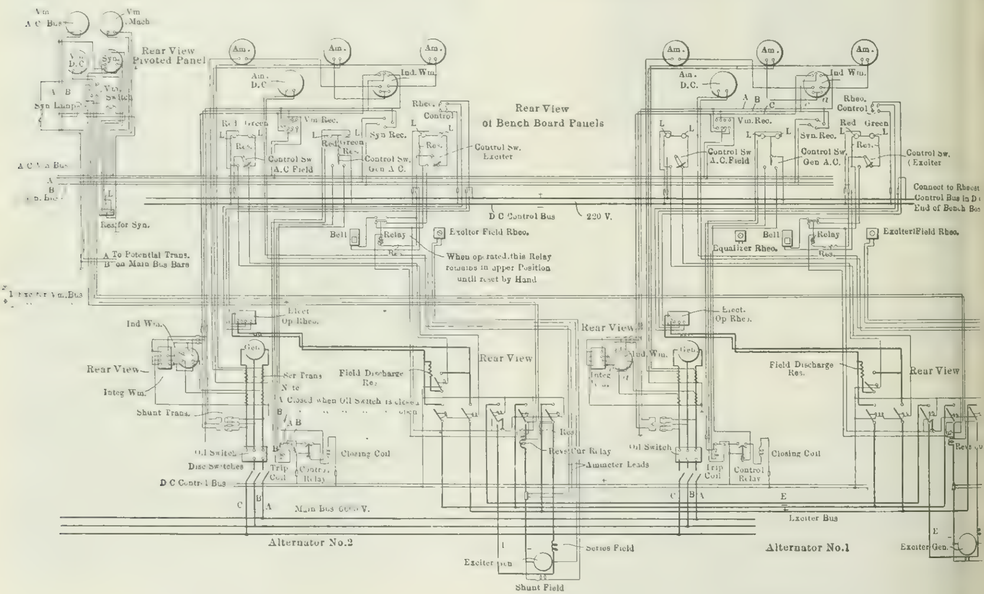


Fig 12—Wiring Diagram of Alternating-Current Instrument and Control Circuits in Power House.

each of the motors of the motor-generator sets, so as to permit of synchronizing, the benchboard being equipped with synchronizing devices.

All of the generators are equipped with electrically operated rheostats controlled from the benchboard. The exciters for the alternating-current generators of the motor-generator sets are connected directly to the buses without any circuit-breakers or fuses, remote-control switches on the benchboard bringing into operation contactors which connect the exciters to the buses.

As each exciter is directly connected to the shaft of its motor-generator set it was necessary to devise some arrangement whereby accidental manipulation of the remote-control switch on one of the "dead" exciters, in case only one machine was running, would not cause a short-circuit when throwing the "dead" exciter onto the buses as a motor. This is accomplished by placing in one of the legs of each of the exciter connections a reverse-current relay which acts upon reversal of current and closes the circuit through an auxiliary relay placed on the benchboard. This auxiliary relay opens the circuit through the closing coil of the contactor connecting the exciter to the exciter buses

have tripping devices adjusted automatically to open t switch on a predetermined overload or "short" on the ou side lines, or from the control switch on the feeder pa of the distributing board when it is desired to open t circuit. A wiring diagram of alternating-current conn tions is given in Fig. 12.

AUTOMATIC CONTROL OF BALANCER.

For the under-track requirements of the block betwe Washington Street and Randolph Street there is provid a remote-control, 500-amp, two-pole switch for connecti the feeder lines to the mains. This switch is operat automatically. To start the balancer set a knife switch closed and when the balancer set comes up to speed contactor connects the neutral of the balancer set to t neutral busbar, this in turn closing the second neutral co tactor connecting the neutral main of the three-wire sy tem to the neutral bus at the switchboard. When th last contact is made connections are effected to energi coils on the 500-amp remote-control switch connecting t two outside legs of the system. It will thus be seen th it is impossible to close the outside legs of the three-wi

stem until the balancer set is brought up to speed and r'dy to take its load, when the contactor in the neutral nin is closed.

PERSONNEL.

The Northwestern Passenger Terminal was planned vile Mr. Marvin Hughitt was president of the Chicago & Nrthwestern Railway Company, and he took an intimate ad personal interest in the details of the electrical and mchanical equipment. The direct supervision of the wrk, however, was in charge of Mr. John M. Whitman, vce-president of the railway company in charge of cons uction. All engineering details were passed upon by tl chief engineer of the company, Mr. E. C. Carter. Fost & Granger were the architects and Pierce, Richards & Neiler were the designing and consulting engineers, to whose ingenuity the numerous special forms of equipment found in this terminal are due. Kohler Brothers wre the electrical contractors. Mr. F. J. Ravlin is the engineer in charge of operation of the terminal power pnt.

A RESISTANCE METHOD FOR OBSERVING THE INSTANTANEOUS PERFORMANCE OF INCANDESCENT LAMPS.

By Evan J. Edwards and George C. Conner.

nsiderable attention has been given recently to the q ... n of cyclic variations of luminous intensity in inc... scent lamps.* Therefore a method which is in some

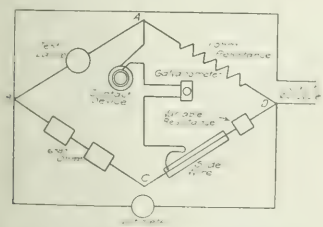


Fig. 1—General Arrangement of Bridge.

particulars new in its application to this particular problem may be of interest at this time.

he luminous intensity, temperature and resistance of filaments are interdependent. They are functions of one another, which in no way involve time. That such is the case can hardly be doubted. There is nothing about the performance of a lamp that would lead one to think otherwise, and there is much evidence to substantiate the above statement. It is a significant and convincing fact in this connection that the angle of lag of luminous intensity behind voltage as obtained photometrically, by the method of his paper, which is a resistance method, and that obtained by computation check within reasonable limits of accuracy.

he relation between luminous intensity and resistance ca be accurately determined under constant conditions wi direct current. Therefore, it is necessary only to mesure the variations in resistance in order to know the vaations in luminous intensity.

*...ers recently published which have a bearing on this subject are: "Measurement of Instantaneous Lamp Resistance," by Frederick Bedell, Electrical World, Feb. 9, 1911; "Effect of Wave Form Upon Incandescent Lamps," by M. G. Lloyd, Elec. Review and Western ..., Jan. 14, 1911; "... of the Forms of Emf Waves Upon the Life and Efficiency of Incandescent Lamps," by Prof. Kinsloe, Bulletin No. 1, Penn. State Coll. Exp. Station, extract in Electrical World, Nov. 17, 1910; "Relative Efficiency of Light Production by Constant-Temperature and Variable-Temperature Incandescent-Lamp Filaments," by E. J. Edwards, Electrical World, Feb. 16, 1911; "Fluctuation of Temperature of Alternating-Current Lamps," by O. M. Corbino, Phys. Zeit.; April 15, 1911; "Effect of Frequency on the Variation of Candle-Power of Incandescent Lamps," abstract of thesis by Messrs. Kiely and Wasserboehr, Electrical World, Feb. 16, 1911.

It is the purpose of this paper to describe a method for measuring the resistance of a lamp at any point in the cycle and to give the results of a few tests.

The apparatus used was essentially a Wheatstone bridge with non-inductive resistances and a synchronous contact

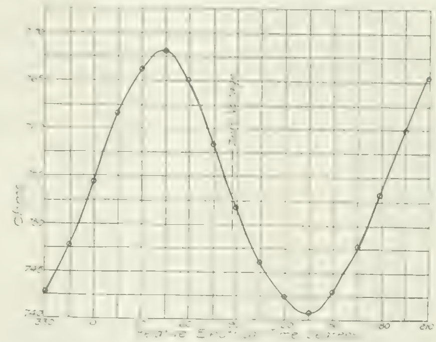


Fig. 2—Resistance Variation of 15-Watt, 110-Volt, 60-Cycle Tungsten Lamp.

device in the galvanometer circuit, as shown in Fig. 1. In the early part of the work one contact per candle-power cycle was used, with a telephone receiver instead of the galvanometer. This arrangement was difficult to operate because of the interference of stray fields. The final ar-

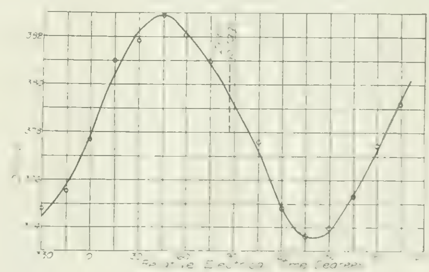


Fig. 3—Resistance Variation of 25-Watt, 110-Volt, 60-Cycle Tungsten Lamp.

rangement was one contact per electrical cycle and a d'Arsonval galvanometer. The one contact per electrical cycle, of course, furnishes the galvanometer with unidirectional impulses of current when the bridge is out of balance, and the impulses are changed in direction when passing through the zero current point of the wave. The latter

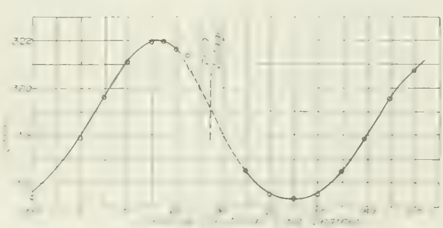


Fig. 4—Resistance Variation of Tungsten Filament Lamp, 40 Watts, 110 Volts, 60 Cycles, Special Spring Hooks.

fact furnishes a means for very accurately determining the zero current and voltage point in the cycle. It was found that by throwing the bridge considerably out of balance it was possible to determine the zero point to within 1 deg. The segments on the contact device were made wedge-

shaped to allow of varying the duration of contact by moving the brush laterally.

Results of tests on several lamps at 60 cycles are given in Table I, and Figs. 2-9. The curve of Fig. 9 is a

TABLE I.—TEST DATA.

Lamp	Normal Watts.	Volt Class.	Normal Resistance.	Per Cent Change in Resistance from Normal.	Calculated Change in Candle-Power.	Measured Change by Kiely & Wasserboehr.
Tungsten filament..	15	110	755	3.56	36.0	....
Tungsten filament..	25	110	378	2.47	23.9	22.5
Tungsten filament..	40	110	324	2.15	20.6	20.5
Tunstgen filament..	60	110	208	1.73	16.6	14.1
Tantalum.......	25	110	510	1.53	25.6	....
Graphitized carbon..	40	110	296	0.47	10.4	....
Treated carbon ...	50	110	234	0.26 (?)	20.0 (?)	....
Untreated carbon....	60	220	773	0.80	19.2	.

sample candle-power curve computed from the resistance curve of Fig. 2, using the relation.

$$\Upsilon = R^{8.8}$$

where Υ is the candle-power and R is the resistance, both expressed as their ratio to normal value. The curve has been shifted from relative to actual electrical time degrees. The exponent 8.8 is an average value for tungsten-filament lamps. The value for the particular lamp used could as well have been determined with precision had it been highly desirable to get most accurate data on that one lamp. The approximate values of the exponent for various types of lamps are given in Table II.

It will be seen from the resistance curves that the method affords an accurate means of getting at the instantaneous

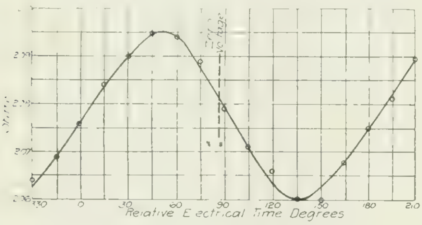


Fig. 5—Resistance Variation of 60-Watt, 110-Volt, 60-Cycle Tungsten Lamp.

performance of a lamp. This is especially true of tungsten-filament lamps because of the relatively large change in resistance corresponding to a given change in candle-power. As will be seen in Table II, the method is not so well adapted to treated-carbon lamps because of the very small

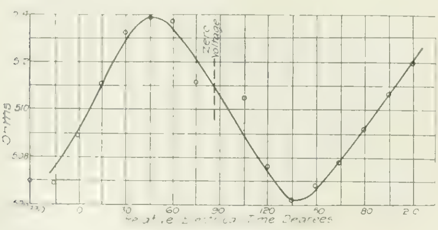


Fig. 6—Resistance Variation of 25-Watt, 110-Volt, 60-Cycle Tantalum Lamp.

change in resistance for a given change in candle-power.

Fortunately the method gives good precision at the points in the cycle where the information is most valuable, that is, at the maximum and minimum values of resistance and luminous intensity. The precision is low around 90 deg. as given on the curves because of the low voltage and consequent low sensibility of the bridge in that region.

It is interesting to note that candle-power variations as

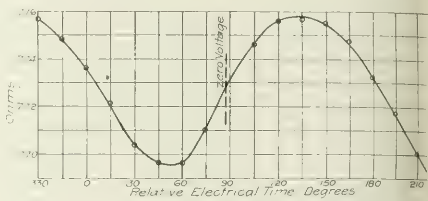


Fig. 7—Resistance Variation of 60-Watt, 220-Volt, 60-Cycle treated Carbon-Filament Lamp.

obtained by this method agree reasonably well with t obtained stroboscopically by Kiely and Wasserboehr,

TABLE II.—EXPONENTS FOR RESISTANCE-CANDLE-POW EQUATIONS.

Filament Material.	Exp
Tungsten............	
Tantalum.......	
Graphitized carbon........	
Treated carbon...........	-
Untreated carbon.........	-

also that the value for the angle of lag of candle-p behind voltages agrees within reasonable accuracy that obtained by Kiely and Wasserboehr and with

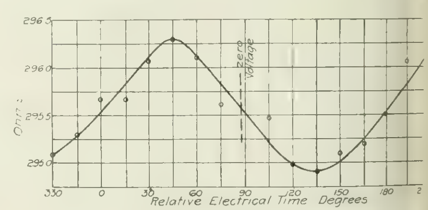


Fig. 8—Resistance Variation of 40-Watt, 108-Volt, 60-Cycle phitized Carbon Lamp.

computed values given in an article, "Relative Efficienc Light Production by Constant-Temperature and Vari Temperature Incandescent-Lamp Filaments." Both cles are referred to in the footnote.

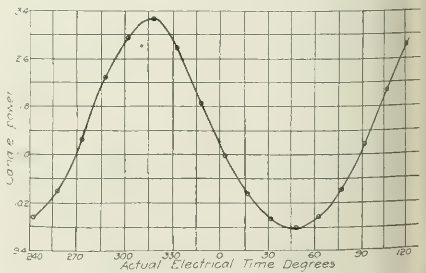


Fig. 9—Candle-Power Variation of Special 15-Watt, 110-Vol 60-Cycle Tungsten Lamp.

The instantaneous-resistance method affords a very n-venient and simple means for investigating the effe of various wave forms and frequencies on the performan of incandescent lamps.

THE CALCULATION OF CAPACITY COEFFICIENTS FOR PARALLEL SUSPENDED WIRES—II.

By Frank F. Fowle.

In the issue dated Aug. 12 was given a solution of the problem relating to the capacity coefficients for grounded circuits. Below is given a treatment of the cases involving metallic circuits.

METALLIC CIRCUITS.

A general solution for the case of any number of metallic circuits is not possible unless the number of wires composing each group or metallic system is given. The general case in its simplest form deals with two-wire metallic circuits, so that the number of wires considered is always even. But every metallic circuit is subject to the special condition that the charges on its respective members are equal and opposite, since the wires are charged from a single emf source. This can be expressed as

$$q_x = -q_{x+1} \qquad (56)$$

where x is an odd integer and the pairs are numbered 1-2, 3-4, 5-6, etc. If the fundamental equations are of the form

$$\left.\begin{array}{l} V_1 = u_{11}q_1 + u_{12}q_2 + u_{13}q_3 + u_{14}q_4 + \ldots + u_{1n}q_n \\ V_2 = u_{12}q_1 + u_{22}q_2 + u_{23}q_3 + u_{24}q_4 + \ldots + u_{2n}q_n \\ V_3 = u_{13}q_1 + u_{23}q_2 + u_{33}q_3 + u_{34}q_4 + \ldots + u_{3n}q_n \\ V_4 = u_{14}q_1 + u_{24}q_2 + u_{34}q_3 + u_{44}q_4 + \ldots + u_{4n}q_n \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \end{array}\right\} \qquad (57)$$

these can obviously be rewritten, using, for example, q_{12} in place of q; the results will be n equations having $\frac{n}{2}$ terms in the second members, as given by (58).

$$\left.\begin{array}{l} V_1 = (u_{11} - u_{12})\, q_{12} + (u_{13} - u_{14})\, q_{34} + \ldots \\ \qquad + (u_{1(n-1)} - u_{1n})\, q_{(n-1)n} \\ V_2 = (u_{12} - u_{22})\, q_{12} + (u_{23} - u_{24})\, q_{34} + \ldots \\ \qquad + (u_{2(n-1)} - u_{2n})\, q_{(n-1)n} \\ V_3 = (u_{13} - u_{23})\, q_{12} + (u_{33} - u_{34})\, q_{34} + \ldots \\ \qquad + (u_{3(n-1)} - u_{3n})\, q_{(n-1)n} \\ V_4 = (u_{14} - u_{24})\, q_{12} + (u_{34} - u_{44})\, q_{34} + \ldots \\ \qquad + (u_{4(n-1)} - u_{4n})\, q_{(n-1)n} \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \end{array}\right\} \qquad (58)$$

However, this case deals with differences of emf and hence V_2 can be subtracted from V_1 and V_4 from V_3, etc. If in general,

$$V_{xy} = V_x - V_y \qquad (59)$$

the equation (58) can be reduced to $\frac{n}{2}$ in number with $\frac{n}{2}$ terms in the second members. The expression for V_{12}, for example, becomes,

$$V_{12} = (u_{11} - 2\,u_{12} + u_{22})\, q_{12}$$
$$+ (u_{13} - u_{14} - u_{23} + u_{24})\, q_{34} + \ldots \qquad (60)$$

and the expression for V_{34} is,

$$V_{34} = (u_{13} - u_{23} - u_{14} + u_{24})\, q_{12}$$
$$+ (u_{33} - 2\,u_{34} + u_{44})\, q_{34} + \ldots \qquad (61)$$

These expressions are too cumbersome to give in full, or to employ in the subsequent treatment. Therefore, a new type of coefficient will be adopted, so that (60), (61) and the remaining equations obtained from (58) by similar operations could be expressed as given by (62).

$$\left.\begin{array}{l} V_{12} = P_{1212}q_{12} + P_{1234}q_{34} + P_{1256}q_{56} + \ldots \\ V_{34} = P_{1234}q_{12} + P_{3434}q_{34} + P_{3456}q_{56} + \ldots \\ V_{56} = P_{1256}q_{12} + P_{3456}q_{34} + P_{5656}q_{56} + \ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \end{array}\right\} \qquad (62)$$

The new coefficients are

$$\left.\begin{array}{l} P_{1212} = u_{11} - 2\,u_{12} + u_{22} \\ P_{1234} = u_{13} - u_{14} - u_{23} + u_{24} \\ P_{3434} = u_{33} - 2\,u_{34} + u_{44} \\ P_{1256} = u_{15} - u_{16} - u_{25} + u_{26} \\ P_{3456} = u_{35} - u_{36} - u_{45} + u_{46} \\ P_{5656} = u_{55} - 2\,u_{56} + u_{66} \end{array}\right\} \qquad (63)$$

In general any coefficient of the new type can be expressed as,

$$P_{(xy)(mn)} = u_{xm} - u_{xn} - u_{ym} + u_{yn} \qquad (64)$$

where the system of numbering the subscripts hitherto employed is rigidly followed. Then the new set of $\frac{n}{2}$ equations can be solved by the method of determinants, just as in the general case of n grounded wires. If,

$$D = \left|\begin{array}{llll} P_{1212}, & P_{1234}, & P_{1256} & \ldots \\ P_{1234}, & P_{3434}, & P_{3456} & \ldots \\ P_{1256}, & P_{3456}, & P_{5656} & \ldots \\ \ldots & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & \ldots \end{array}\right| \qquad (65)$$

any coefficient of capacity is given by the expression

$$C_{(xy)(mn)} = \frac{D'}{D} \qquad (66)$$

where D' is that minor of D which gives the coefficient of $P_{(xy)(mn)}$ in the expansion of D; the rule for finding the desired minor is well known and need not be repeated.

The general case is quite parallel to the case of n grounded wires, although a trifle more involved. The discussion of specific cases is of much interest and value and will next be taken up.

Two Wires.—The general case as presented above gives at once the result

$$V_{12} = (u_{11} - 2\,u_{12} + u_{22})\, q_{12} \qquad (67)$$

and hence

$$C_{12} = \frac{1}{u_{11} - 2\,u_{12} + u_{22}} \qquad (68)$$

$$= \frac{1}{2\log\frac{2\,h_1}{r_1} - 4\log\frac{h_{12}}{d_{12}} + 2\log\frac{2\,h_2}{r_2}} \qquad (69)$$

or finally

$$C_{12} = \frac{1}{2\log\frac{4\,h_1h_2d^2_{12}}{r_1r_2h^2_{12}}} \qquad (70)$$

where the wires are at heights h_1 and h_2, respectively, above the earth, separated by the distance d_{12}, the image of one distant h_{12} from the opposite real wire and the respective radii of the wires r_1 and r_2. This is the most general expression for the metallic capacity of a single pair of wires, of any sizes and spaced in any way. If the wires are of equal size and at equal heights above the earth the expression in (70) becomes

$$C'_{12} = \frac{1}{2\log\frac{4\,h^2\,d^2}{r^2(d^2 + 4\,h^2)}} \qquad (71)$$

If the pair of wires is elevated to a point so far from the earth that $\frac{4\,h^2}{(d^2 + 4\,h^2)}$ is practically unity, expression (70) becomes

$$C''_{12} = \frac{1}{2\log\frac{d^2}{r_1r_2}} \qquad (72)$$

and in the same case (71) becomes

$$C'''_{12} = \frac{1}{4\log\frac{d}{r}} \qquad (73)$$

which is the most familiar expression for the capacity of a metallic pair.

Expressions (70) and (71) differ from (72) and (73), respectively, in the fact that the former include the effect of the electrical image of the pair, beneath the earth's surface, while the latter do not. As will be shown by concrete examples, the effect of the image is negligible in most practical cases because d is small compared with h and again

because the two wires of the pair are equally but oppositely charged.

Consider the case of two No. 8 B. W. G. wires spaced 1 ft. apart and each 20 ft. above the earth. Then,

$$\left.\begin{aligned} h_1 = h_2 &= 20 \text{ ft.} \\ d &= 1 \text{ ft.} \\ r_1 = r_2 &= 0.0825 \text{ in.} \end{aligned}\right\} \tag{74}$$

and by computation

$$\left.\begin{aligned} C'_{12} &= 0.008980 \text{ microfarad per mile} \\ C'''_{12} &= 0.008979 \text{ microfarad per mile} \end{aligned}\right\} \tag{75}$$

In this case $\frac{4h^2}{d^2+4h^2}$ differs from unity by less than one part in 1000, and hence is entirely negligible. The final difference between the capacities is only 0.011 per cent. If the pair is lowered to an elevation of 5 ft. the results are as given by (76).

$$\left.\begin{aligned} C'_{12} &= 0.008989 \\ C'''_{12} &= 0.008979 \end{aligned}\right\} \tag{76}$$

The increase in the second case due to the image is only 0.11 per cent and is again practically negligible. If lowered still more, to an elevation of 3 ft., with the same horizontal separation of 1 ft., the increase due to the image is about 0.28 per cent. These cases show clearly that with metallic circuits as commonly employed in energy or intelligence transmission the images may be neglected. This, however, does not permit a direct cancellation of any of the potential coefficients.

It is also interesting to observe a connection between the grounded capacities given by (34) and (35) and the expression (71). Heaviside shows in general how the theory of transmission over a metallic circuit may be derived from the consideration of mutual interference or induction between two grounded circuits when the impressed emfs are equal but opposite in phase. In this case the proper capacity coefficient for the metallic circuit is

$$C'_{12} = \tfrac{1}{2}(C_1 - C_{12}) \tag{77}$$

and it will be found that this equation is satisfied by the substitution of (34) and (35) for C_1 and C_{12} respectively, which produce the result given in (71).

Four Wires, Two Circuits.—In this case the common denominator of the capacity coefficients is given by

$$D = \begin{Bmatrix} P_{1212}, & P_{1234} \\ P_{1234}, & P_{3434} \end{Bmatrix} \tag{78}$$

$$= P_{1212}P_{3434} - (P_{1234})^2 \tag{79}$$

$$= \left(2 \log \frac{4\,h_1h_2d^2_{12}}{r_1r_2h^2_{12}}\right)\left(2 \log \frac{4\,h_3h_4d^2_{34}}{r_3r_4h^2_{34}}\right) - \left(2 \log \frac{h_{13}h_{24}d_{14}d_{23}}{d_{13}d_{24}h_{14}h_{23}}\right)^2 \tag{80}$$

and

$$C_{12} = \frac{2 \log \frac{4\,h_3h_4d^2_{34}}{r_3r_4h^2_{34}}}{D} \tag{81}$$

$$C_{34} = \frac{2 \log \frac{4\,h_1h_2d^2_{12}}{r_1r_2h^2_{12}}}{D} \tag{82}$$

$$-C_{1234} = \frac{2 \log \frac{h_{13}h_{24}d_{14}d_{23}}{d_{13}d_{24}h_{14}h_{23}}}{D} \tag{83}$$

If the wires are all of the same size and the effect of the images is neglected, the results are simplified to,

$$D = \left(4 \log \frac{d_{12}}{r}\right)\left(4 \log \frac{d_{34}}{r}\right) - \left(2 \log \frac{d_{14}d_{23}}{d_{13}d_{24}}\right)^2 \tag{84}$$

$$C'_{12} = \frac{4 \log \frac{d_{34}}{r}}{D} \tag{85}$$

$$C'_{34} = \frac{4 \log \frac{d_{12}}{r}}{D} \tag{86}$$

$$-C'_{1234} = \frac{2 \log \frac{d_{14}d_{23}}{d_{13}d_{24}}}{D} \tag{87}$$

When the pairs differ in wire size, but the image effe[ct] is neglected, the formulas are obvious from (80) to (83) [and] need not be given. In order to make the mutual capa[city] vanish it is necessary to fulfil the condition,

$$d_{14}d_{23} = d_{13}d_{24}$$

and at the same time the mutual inductance will va[nish] also. This condition when studied analytically shows [how]

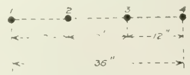


Fig. 9—Four Wires. Two Circuits.

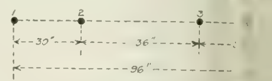


Fig. 10—Four Wires; Two Me[tallic] Circuits.

to distribute four wires (in two pairs) in various way[s to] avoid mutual interference. The results of such a stud[y, in] both analytical and graphical form, have been given by [the] author[4] elsewhere and need not be repeated.

The image effect in this case, as in the last, is ordin[arily] negligible. The numerical values of the capacity coeffic[ients] in the case of four No. 12 N. B. S. G. wires lying in [a] plane, with an adjacent spacing of 12 in., as shown in [Fig.] 9, are given below.

The capacities have been calculated from express[ions] (84) to (87).

$$\left.\begin{aligned} C'_{12} = C'_{34} &= 0.008223 \text{ mfd per mile} \\ -C'_{1234} &= 0.0002174 \text{ mfd per mile} \end{aligned}\right\}$$

The capacity of either pair alone, from (73), woul[d be]

$$C'''_{12} = 0.008218$$

which shows that the second circuit increases the capa[city] of the first by only 0.06 per cent. In general, the incr[ease] of coefficients of capacity for metallic pairs as other [pairs] are added to the system is wholly negligible. It is [also] noticeable that the mutual capacities are relatively [much] smaller in this case than in the general case of grou[nded] circuits.

Another case has been calculated for the condi[tions] shown in Fig. 10, employing No. 4 B. & S. gage conduc[tors].

Using the same formulas in this case as in the last [the] results are,

$$\left.\begin{aligned} C'_{12} = C'_{34} &= 0.007626 \text{ mfd per mile} \\ -C'_{1234} &= 0.0001504 \text{ mfd per mile} \\ C'''_{12} &= 0.007623 \text{ mfd per mile} \end{aligned}\right\}$$

Again it is noticeable that the effect of circuit *3-*[*4* in] raising the capacity of *1-2* is insignificant. If wires o[f the]

Fig. 11—Four Wires; Two Metallic Circuits.

same size as in the last case are rearranged, as show[n in] Fig. 11, the new capacities will be those given by (92

$$\left.\begin{aligned} C'_{12} = C'_{34} &= 0.007648 \text{ mfd per mile} \\ -C'_{1234} &= 0.0004519 \text{ mfd per mile} \end{aligned}\right\}$$

As might be expected, the individual capacities have [be]en increased slightly by the nearer proximity of the two [cir]cuits and the mutual capacity has about three time[s] its previous value.

Four Wires, One Circuit.—Four wires are frequ[ent]ly

[4] "The Transposition of Electrical Conductors"; *Proceedings of the American Institute of Electrical Engineers*, Vol. XXI.

ranged in one circuit, sometimes in energy distribution d again in phantom telephone lines. Referring in this se to Fig. 9, for example, wires *1* and *2* would form one le of the circuit and wires *3* and *4* the opposite side. The res forming one side of the circuit are usually at the me impressed potential in any case.

The fundamental equations are the same as those in any of four wires,

$$\left.\begin{aligned} V_1 &= u_{11}q_1 + u_{12}q_2 + u_{13}q_3 + u_{14}q_4 \\ V_2 &= u_{12}q_1 + u_{22}q_2 + u_{23}q_3 + u_{24}q_4 \\ V_3 &= u_{13}q_1 + u_{23}q_2 + u_{33}q_3 + u_{34}q_4 \\ V_4 &= u_{14}q_1 + u_{24}q_2 + u_{34}q_3 + u_{44}q_4 \end{aligned}\right\} \qquad (93)$$

The nature of the case imposes the following set of con- ...

$$\left.\begin{aligned} V_1 &= V_2 \\ V_3 &= V_4 \\ (q_1 + q_2) &= -(q_3 + q_4) \end{aligned}\right\} \qquad (94)$$

is reduces the number of independent equations in to two, which can be written,

$$\left.\begin{aligned} V_1 &= (u_{11} - u_{14})q_1 + (u_{12} - u_{14})\, q_2 + (u_{13} - u_{14})\, q_3 \\ V_3 &= (u_{13} - u_{34})\, q_1 + (u_{23} - u_{34})\, q_2 + (u_{33} - u_{34})\, q_3 \end{aligned}\right\} \qquad (95)$$

king the difference of the last two equations,

$$\begin{aligned} 0 = (u_{11} - u_{14} - u_{13} + u_{34})\, q_1 &+ (u_{12} - u_{14} - u_{23} + u_{34})\, q_2 \\ &+ (u_{13} - u_{14} - u_{33} + u_{34})\, q_3 \end{aligned} \qquad (96)$$

Substituting the proper expressions for the potential coefficients and neglecting the image effect gives

$$= \left(2 \log \frac{d_{13}d_{14}}{r_1 d_{34}}\right) q_1 + \left(2 \log \frac{d_{14}d_{23}}{d_{12}d_{34}}\right) q_2 + \left(2 \log \frac{r_3 d_{14}}{d_{13}d_{34}}\right) q_3 \qquad (97)$$

order to shorten the expression it may be abbrevi- as,

$$V_{13} = aq_1 + bq_2 + cq_3 \qquad (98)$$

w by subtracting V_2 from V_1 and V_4 from V_3, after nating q_4, it will be found that

$$-q_3 = \left(\frac{2 \log \dfrac{d_{12}d_{14}}{r_1 d_{24}}}{2 \log \dfrac{d_{14}d_{23}}{d_{13}d_{24}}}\right) q_1 + \left(\frac{2 \log \dfrac{r_2 d_{14}}{d_{12}d_{24}}}{2 \log \dfrac{d_{14}d_{23}}{d_{13}d_{24}}}\right) q_2 \qquad (99)$$

bbreviating,

$$-q_3 = \frac{d}{e}\, q_1 + \frac{f}{e}\, q_2 \qquad (100)$$

a

$$-q_3 = \left(\frac{2 \log \dfrac{d_{14}d_{34}}{r_4 d_{13}}}{2 \log \dfrac{d^2_{34}}{r_3 r_4}}\right) q_1 + \left(\frac{2 \log \dfrac{d_{24}d_{34}}{r_4 d_{23}}}{2 \log \dfrac{d^2_{34}}{r_3 r_4}}\right) q_2 \qquad (101)$$

breviating again,

$$-q_3 = \frac{g}{h}\, q_1 + \frac{k}{h}\, q_2 \qquad (102)$$

bstituting (100) in (98) gives

$$\begin{aligned} V_{13} &= \left(a - \frac{cd}{e}\right) q_1 + \left(b - \frac{cf}{e}\right) q_2 \\ &= \left(\frac{ae - cd}{e}\right) q_1 + \left(\frac{be - cf}{e}\right) q_2 \end{aligned} \qquad (103)$$

Subtracting (102) from (100) to find q_2 in terms of q_1,

$$-q_2 = \left(\frac{dh - ge}{fh - ek}\right) q_1 \qquad (104)$$

a substituting (104) in (103)

$$\begin{aligned} V_{13} &= \left[\frac{ae - cd}{e} - \frac{(be - cf)\,(dh - ge)}{e\,(fh - ek)}\right] q_1 \\ &= \left[\frac{(ae - cd)\,(fh - ek) - (be - cf)\,(dh - ge)}{e\,(fh - ek)}\right] q_1 \end{aligned} \qquad (105)$$

But

$$\begin{aligned} q_1 + q_2 &= \left(1 - \frac{dh - ge}{fh - ek}\right) q_1 \\ &= \left[\frac{h\,(f - d) + e\,(g - k)}{fh - ek}\right] q_1 \end{aligned} \qquad (106)$$

Whence,

$$V_{13} = \left[\frac{(ae - cd)\,(fh - ek) - (be - cf)\,(dh - ge)}{eh\,(f - d) + e^2\,(g - k)}\right] (q_1 + q_2) \qquad (107)$$

And finally the general expression for the coefficient of capacity, neglecting the effect of the images and observing that $(g - k) = e$, is

$$C''_{1234} = \frac{eh\,(f - d) + e^2}{(ae - cd)\,(fh - ek) - (be - cf)\,(dh - ge)} \qquad (108)$$

In the special case where the wires are all of one size and the circuits are symmetrically grouped, or

$$\left.\begin{aligned} d_{12} &= d_{34} \\ d_{13} &= d_{24} \\ r_1 = r_2 &= r_3 = r_4 = r \end{aligned}\right\} \qquad (109)$$

the charges are also symmetrically disposed, so that

$$\left.\begin{aligned} q_1 &= -q_4 \\ q_2 &= -q_3 \end{aligned}\right\} \qquad (110)$$

In that case there are several new relations, as follows:

$$\left.\begin{aligned} f &= c \\ g &= d \\ (f - d) &= -h \\ (k - c) &= -(e - h) \\ k &= c - e + h \end{aligned}\right\} \qquad (111)$$

Under these conditions,

$$C''''_{1234} = \frac{e + h}{a\,(e - c) + d\,(b - c)} \qquad (112)$$

which expressed in complete terms is,

$$C'''_{1234} = \frac{\left(2 \log \dfrac{d^2_{12}d_{14}d_{23}}{r^2 d^2_{13}}\right)}{\left(2 \log \dfrac{d_{13}d_{14}}{rd_{12}}\right)\left(2 \log \dfrac{d_{12}d_{23}}{rd_{13}}\right) + \left(2 \log \dfrac{d_{12}d_{14}}{rd_{13}}\right)\left(2 \log \dfrac{d_{13}d_{23}}{rd_{12}}\right)} \qquad (113)$$

Expression (113) gives the total capacity of a four-wire circuit under the conditions expressed in (109). The effect of the images can be included if the complete form of the potential coefficients is retained from the outset, but it merely complicates the solution without giving any practical results in most cases.

The problem can be solved in another way if desired, but the method given is the least complicated and is the most direct one. If the equations in (93) are converted to the form

$$\left.\begin{aligned} q_1 &= C_{11}V_1 + C_{12}V_2 + C_{13}V_3 + C_{14}V_4 \\ q_2 &= C_{12}V_1 + C_{22}V_2 + C_{23}V_3 + C_{24}V_4 \\ q_3 &= C_{13}V_1 + C_{23}V_2 + C_{33}V_3 + C_{34}V_4 \\ q_4 &= C_{14}V_1 + C_{24}V_2 + C_{34}V_3 + C_{44}V_4 \end{aligned}\right\} \qquad (114)$$

where the capacity coefficients have the same form as in the case of four grounded wires it can then be shown that

$$C''_{1234} = \frac{(C_{11} + 2\,C_{12} + C_{22})\,(C_{33} + 2\,C_{34} + C_{44}) - (C_{13} + C_{14} + C_{23} + C_{24})^2}{(C_{11} + 2\,C_{12} + C_{22}) + 2\,(C_{13} + C_{14}) + (C_{23} + C_{24}) + (C_{33} + 2\,C_{34} + C_{44})} \qquad (115)$$

This expression is entirely general and includes the effect of the images. In the case of four equal wires symmetrically disposed, under the conditions given in (109), there are certain new relations between the capacity coefficients.

in (115), as follows:

$$\left.\begin{array}{l} C_{11} = C_{44} \\ C_{22} = C_{33} \\ C_{12} = C_{34} \\ C_{13} = C_{24} \end{array}\right\} \qquad (116)$$

from which it is evident that

$$C'''_{1234} = \tfrac{1}{2}\,(C_{11} + C_{22} + 2\,C_{12} - 2\,C_{13} - C_{14} \quad (\qquad (117)$$

One of the cases of practical interest arises when two adjacent metallic pairs are employed to secure a phantom telephone circuit. In most cases of this kind the wire separations are those indicated in Fig. 12, and the conductors are alike in size and composition. Symmetry of the pairs as to size and grouping is very essential in securing a balanced phantom circuit.

Wires *1* and *2* form one metallic pair and one side of the phantom circuit, while *3* and *4* form the other. Assuming the wires to be No. 12 N. B. S. G., or 0.104 in. in diameter, the phantom capacity is

$$C'''_{1234} = 0.01350 \text{ mfd per mile.} \qquad (118)$$

In order to show that this capacity is not the sum of C_{14} and C_{23}, calculated in each case as though the other pair

Fig. 12—Four Wires; One Metallic Circuit.

were absent, using (73), the latter expression has been applied in the manner just indicated with the results,

$$\left.\begin{array}{l} C'''_{14} = 0.006838 \\ C'''_{23} = 0.008218 \end{array}\right\} \qquad (119)$$

$$\overline{0.015056}$$

The sum of these capacities exceeds the true capacity of the phantom by about 12 per cent of the latter. The capacity of the phantom is greater than the capacity of pair *1-2* or *3-4*, taken alone, by about 64 per cent, while the conductance of the phantom is 200 per cent of the conductance of either pair. That is, a phantom circuit compared with one of its component physical circuits in this case has 200 per cent conductance and 164 per cent capacity, relatively, which shows that the attenuation will be less on the phantom than on either physical circuit.

The equivalent single pair of equal conductance and capacity for this case would have conductors of a diameter of 0.1471 in., separated 2.02 in. between centers. This value of separation is computed from (73), which does not apply when $\frac{d}{r}$ is small. The error in this case is not large, since $\frac{d}{r} = 13.7$ approximately. In general, when single conductors are replaced by multiple conductors in parallel, with some separation between the members, the total capacity is much increased and at the same time the electrostatic stresses are limited to lower values. This suggests a method of avoiding the corona effect with small wires by means of what is the equivalent of open stranding. The corona will appear again, of course, at some higher critical voltage when the stress limits of the dielectric are reached.

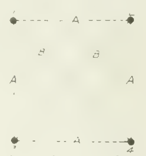


Fig. 13—Four Wires; Pairs 1-2 and 3-4 Arranged for a Phantom Circuit with Neutral Balance.

Returning to the consideration of a phantom like that in Fig. 12, it is evident that while the four charges are symmetrically disposed they are not all equal. That is, the charge on wire *1* is less than the charge on *2*. When the charges on *1* and *2* are unequal it is quite evident that interference will result between the phantom and the physical pairs, for, while the impressed emfs on *1* and *2* are equal, the charging currents will be unequal and a difference of potential will arise, being cumulative with increasing distances from the impressed source. Therefore, it is apparent that the physical pairs must be transposed against each other to prevent interference of a conductive nature caused by unbalance, otherwise the phantom cannot be secu[red]. Transposition of each pair is necessary to secure a balance. The result will not affect the capacities, but equalize the charging currents, or the charging compon[ent] of the total current.

In order that transposition shall be unnecessary [th]e charges on each pair must be equal; that is,

$$\left.\begin{array}{l} q_1 = q_2 \\ q_3 = q_4 \end{array}\right\} \qquad (1$$

This condition imposed on the general case results in [the] expression

$$e\,(k + g) = h\,(f + d) \qquad (1$$

When the four conductors are alike in diameter the c[on]dition imposed by (121) requires in turn that

$$\left.\begin{array}{l} d_{12} = d_{34} \\ d_{13} = d_{24} \\ d_{14} = d_{23} \end{array}\right\} \qquad (1$$

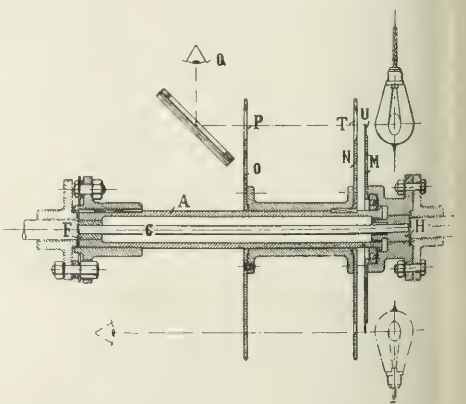
which can only be satisfied by a disposition of the f[our] conductors at the corners of a square, as shown in Fig. The same conclusions will be reached from a considerat[ion] of the inductances, self and mutual, and the inductive d[rop] in each conductor.

The conclusion of the article will follow in a later iss[ue].

TORSION DYNAMOMETER.

A form of torsion dynamometer designed for measur[ing] the mechanical power transmitted to or from high-sp[eed] machines, such as centrifugal pumps, fans, turbo-compr[es]sors, steam turbines, generators, etc., where the tor[que] values are fairly constant was described by Dr. Alf[red] Amsler, of Schaffhausen, Germany, at the Zurich meet[ing] of the British Institution of Mechanical Engineers dur[ing] the present month.

The dynamometer, as shown in section in the illustrati[on], operates on the principle of a torsion spring, the an[gle] through which the opposite ends are turned being prop[or]-



Torsion Dynamometer.

tional to the twisting moment and so to the power tra[ns]mitted. The shaft is made of a special spring steel of v[ery] high yield-point (90,000 lb. per square inch) and it can [be] twisted to a considerable degree without breakage or pern[ma]nent distortion. For example, in the illustration the twist

throd 15¾ in. long is about 20 deg. for a twisting moment of 736 in.-lb. The shaft has a cross-section of 0.4725 in. by 0.125 in. and is therefore subjected to a stress of 78,000 lb per square inch, which is well below the yield-point. The various parts attached to the shaft *G* serve partly for reading its angle of twist and partly to prevent it from being twisted excessively, so that it cannot be overloaded. For reading the angle of twist three disks *M*, *N* and *O* are used. *M* is fixed firmly to the end *H* of the shaft, *N* and *O* are fixed firmly to the end *F* of the shaft. The disk *N* is provided with a radial slit *P*. To the disk *M* a transparent rim *U* made of celluloid is fixed, on which the divisions are cut. Opposite to the slit *P* a small window has been cut out in the disk *N* and is provided with a fine slit *T*. When the eye *Q* looks through the slit *P* the slit *T* will be seen as a streak of light and the divisions will show black on the scale *U*. The slit *T* serves as a pointer for indicating the relative motion of the two disks *N* and *O* as compared to the disk *M*. The line of vision is perfectly defined by the two slits *P* and *T*; parallax is therefore impossible when reading the scale and the observation is independent of the distance between the scale *U* and the eye.

When the apparatus is stationary it will be clear that, if the shaft is twisted, the angle of twist will be shown by the movement of the pointer *T* over the division *U*. This pointer and division are also visible when the instrument is running, in fact clearer and more defined than when the instrument is at rest. The greater the distance from the slit *P* the more the scale will appear to be enlarged; this enlargement is independent of the speed. At velocities below 250 r.p.m. the reading of the machine becomes cumbersome but still possible. The screen is intensely illuminated by a 50-cp incandescent lamp. These instruments are made generally for high speeds of about 4500 r.p.m., but some instruments have already been made for speeds of 7000 r.p.m. and even 8500 r.p.m. The coefficient of elasticity of the shaft can be determined when at rest by fixing a lever of known length at one end and loading this with weights. The largest instrument at present made can measure torques up to 130,200 in.-lb. and the smallest up to 694 in.-lb. The instrument suffers from one defect, the air-resistance of the rotating parts. This, however, is very small, especially when the dynamometer is so inserted that the disk *M* is placed nearest to the machine the power of which is to be measured.

Central Station

Management, Policies and Commercial Methods

ELECTRIC IRONS ON THE RANCH.

Electric flatirons are being extensively used by the wives and daughters of ranchmen located in the agricultural sections of northern Colorado. Energy is supplied throughout the district between Lafayette and Greely by the Northern Colorado Power Company, which has a large and increasing motor and lighting load in the ranch country. Out-of-door ironing is very popular.

SANDUSKY'S NEW CENTRAL-STATION SIGN.

The Sandusky (Ohio) Gas & Electric Company is inaugurating an electric-sign campaign among the business houses of the city by the installation of a novel spectacular display on its own roof advertising central-station service. The sign will show the name of the company together with the figure of a little girl, "Miss Sandusky," who appears to operate first one switch, turning on an electric lamp, and then a second one, starting in motion an electric motor driving belts, pulleys, etc. The purpose of this display, according to Mr. E. A. Bechstein, manager of the company, to whom the idea of the sign is due, is to illustrate how easily electric service can be controlled by a mere child. The display will measure about 30 ft. square and will require 800 tungsten and carbon-filament lamps.

TELAUTOGRAPH IN APPARATUS SHOWROOM.

A pair of telautograph instruments has been installed between the display-room of the Union Electric Light & Power Company, St. Louis, and its main salesroom, enabling the attendant in charge to communicate with headquarters, ask for information, relief, etc., without leaving the station. The telautograph has thus proved practically useful as a means of communication and attracts a great deal of interest from visitors to the central-station's display-room, who marvel at its truthful reproduction of their handwriting.

Several telautograph sets have found valuable uses in St. Louis in the offices of bank presidents and men of affairs. The apparatus is installed in an upper desk drawer, and if during an interview with a business caller the banker desires special information, he can, all unnoticed by his visitor, open the drawer, write his query and receive a confidential answer from his clerk outside.

ELECTRIC SERVICE EXHIBIT AT CANADIAN INDUSTRIAL EXPOSITION.

The exhibit of the Winnipeg City Light & Power Department at the recent Canadian Industrial Exhibition held in Winnipeg, was given the form of a model bungalow or dwelling completely equipped with electrical conveniences in all of its four rooms, boudoir, living-room, dining-room and kitchen.

The living-room, tastefully but not extravagantly furnished, was a model of comfort with its electric grate, reading lamp and the ornamental electric fixtures. An electric piano rendered selections from the great masters with almost perfect touch and skill. An electric cigar-lighter and corn popper occupied places on the table, while from the mantel the breeze of an electric fan kept the room comfortable. The lady's boudoir adjoining contained an electric hair drier, vibrator, curling tongs, water heater, desk lamp, etc. The dining-room and kitchen equipment included examples of every variety of cooking appliance that could add to the convenience of housekeeping.

A daily bulletin published in the interests of the new civic power development and covering various happenings and features of the exhibit was presented to each visitor entering the exhibit. On Tuesday, July 18, Citizens' Day, more than 10,000 people filed past the display.

To illustrate the contrast in living conditions brought about by electrical conveniences an "old-way" house was arranged adjoining the electric-service exhibit. This ramshackle, delapidated hut, which proved one of the sensations of the exhibit, was occupied by a "crazy woman," impersonated by a local comedian, whose antics entertained the crowds.

Adjoining the exhibit hall, in the Manufacturers' Build-

ing, was a working model of the new 35,000-hp plant at Point du Bois, on the Winnipeg River. This was an exact reproduction of the power-development dam and showed the power house as it will look when finished several months hence. The model was complete in every detail from the woods that line the river bank to the first few steel towers of the double transmission line which runs 77 miles across the country to Winnipeg.

At the close of the ten-day exhibition an electrically cooked banquet, laid for eighteen plates, was tendered the Mayor and Council of Winnipeg, as mentioned in the *Electrical World* of Aug. 5. Mr. James G. Rossman, general manager of the department, presided at the dinner, the elaborate electrical preparation of which was supervised by Mrs. Rossman, whose taste was also displayed in the furnishings and arrangement of the "Home, Sweet Home" exhibit.

A GAS-ENGINE WARNING.

Between embossed covers of lurid colors a warning booklet on the subject of gas-engine costs, dangers and annoyances has been published by the Cleveland Electric Illuminating Company for local distribution. The booklet points out that in computing operating costs gas-engine users often overlook the many serious items of expense beside fuel, although in the case of an electric motor practically the only expense is for electrical energy. The costs of oil, water, repairs, labor, depreciation, interest, taxes, insurance, rental value of space occupied, etc., are all enumerated in the case against the gas engine. The repairs on a small gas engine amount annually to from 8 per cent to 15 per cent of the engine's first cost. A capable attendant must be employed to supervise the sensitive mechanism of the engine. Depreciation of the latter's value will range from 10 per cent to 35 per cent, for some engines must be scrapped after three years' service. Gas engines take up valuable space and require good foundations, in contrast to motors, which can be suspended from the ceiling if desired. To withstand overloads gas engines must be purchased of excess ratings and consequently operate with low efficiency at normal partial-load conditions. Although gas-engine salesmen often promise consumptions of only 15 cu. ft. per kw-hour on natural gas, actual tests have shown the consumption to be more nearly from 30 cu. ft. to 40 cu. ft. With artificial gas the consumption will average from 53 cu. ft. to 75 cu. ft. per kw-hour delivered. Gas engines are inherently noisy, and in Cleveland recently a gas-engine owner was sued by his neighbors on account of the annoyance of the exhaust. The arguments conclude with the point that, while an isolated plant precludes enlargement, with central-station service motors can be added at only proportional expense as the business increases.

OFF-PEAK SERVICE FOR BAKER'S ELECTRIC OVENS IN MILWAUKEE.

One of the first electric bread ovens to be installed in a commercial bakery in the United States has just been placed in service in a Milwaukee bakery, using electrical energy from the central-station lines during the off-peak period. This oven has a daily capacity of 1000 loaves and is rated at 10 kw. For this off-peak service the baker pays an average of 4 cents per kw-hour, making the cost of operating the oven about $100 per month. Under his contract the baker is limited to the use of the oven during ten night and early-morning hours after the heavy lighting demand on the station has passed, but the oven consumption is connected under the same meter with the rest of the installation, and except for the terms of the con act there is no clock device to prevent the use of energ at any hour.

This first bakery to install an electric oven in Milwa ee is one of the largest plants in the city, having a ily capacity of 24,000 loaves, so that the successful oper on of the new oven will open the way for a number of er ovens in this bakery alone. Following the installatio of the oven the bakery company plans to advertise in he newspapers, inviting the public to visit and inspect electric oven. The latter has been specially constru with a white-marble-panel switchboard, glass doors nd nickel trimmings, the oven doors permitting a full vie of the baking operation inside. According to Mr. M F Flynn, of the Milwaukee Electric Railway & Light C pany, who solicited this commercial use of electric cook the work of the contract department has not ceased the oven, as efforts are now being made to have the trically baked bread delivered to grocers by ele vehicles.

SIGN AND OUTLINE LIGHTING WITH TUNGS LAMPS.

A warning against the use of small tungsten sign la in series, unless purchased especially for such connec was sounded in the discussion following a paper by W. B. Goudey, of East Liverpool, Ohio, on the subjec sign lighting, read before the Ohio Electric Light A ciation at its Cedar Point convention July 28.

Two years ago the East Liverpool company began a campaign, building its own signs for 5-watt tungsten la To eliminate the cost of transformers, series-conne sockets were installed. "The first five months," said Goudey, "we built signs with a total capacity of over lamps. During that five months we had trouble thick fast. Our signs were almost always in distress, in s of our best efforts. I remember having renewed sixty lamps in less than three months in a sign of lamps. It was almost amusing to travel over the sign cuit and note the different combinations of letters ca by certain circuits having burned out. A halt was ca about this time on series-burning signs and those alre in service were taken down as fast as possible and rec structed with multiple wiring at the expense of the c pany. We have now about 5000 sign lamps on our circ in East Liverpool, all arranged for multiple burning in c nection with sign transformers, and our renewals month average less than 1 per cent. It was learned l that a great part of the above trouble was caused by us lamps selected for multiple instead of series wiring. H ever, it is possible to get fairly satisfactory results f series-connected sign lamps, provided proper care is ta to obtain lamps selected for series operation. This sho be especially mentioned when ordering from manuf turers."

For direct-current work series multiple wiring is better method, said the author. The lamps are wired multiple and then the multiple groups are connected series. If one lamp burns out the remaining seven la operate at a slightly higher efficiency and their life will somewhat shortened. But when a large number of la are used the failure of any lamp will not affect the oth to any great extent. Series multiple wiring should not employed on signs having less than eighty lamps, and best results the signs should have 100 lamps or m Signs operated on direct current and using carbon la can be readily changed to take care of tungsten lamps little cost for rewiring by cutting open the conductor alternate sides of the groups of lamps and converting th to series-multiple connection.

Mr. G. H. Stickney, of Schenectady, N. Y., urged t

central stations open the way for sign business by showing their own faith in this mode of advertising and installing displays. Mr. W. A. Benedict spoke of the advantageous use of 2½-watt sign lamps where freedom from glare and less brilliancy are required. Mr. C. I. Crippen referred to the superiority of the 2½-watt, 2-cp tungsten lamp over the old 2-cp carbon lamp. Mr. J. T. Kermode declared that as a result of his own experience in attempting to maintain series-connected sign circuits he would advise the use of even carbon lamps in direct-current signs where no low-voltage current is available for multiple operation of the lamps. Tests on several series-connected tungsten signs, reported by Mr. O. B. Reemelin, of Dayton, showed pressures varying from 9½ volts to 13½ volts when ordinary multiple lamps were used, although the drop was uniformly about 11 volts in the case of the specially selected series lamps.

THE ENFORCEMENT OF OFF-PEAK POWER CONTRACTS.

A few years ago the number of electric-service companies selling electricity for motors under off-peak contracts which give a low rate in consideration of motors not being operated during winter peak-load periods could be counted on the fingers of one hand. The advantages of such off-peak load have been so apparent, however, that there are now scores of companies making off-peak rates to small motor customers. The principal argument urged against this practice has always been the difficulty of preventing customers from operating motors during the prohibited hours. Some companies allow motors to be operated during the hours prohibited in the contract except at times when the reserve capacity of the station is needed for carrying the lighting load. In other words, as long as the company has reserve station capacity which can be used during peak-load hours to operate these motors, the company allows them to operate; but in case one unit is out of service, thus reducing the capacity of the station, the attention of consumers is called to the off-peak contract and they are requested to shut down during the prohibited hours.

It sometimes happens that, although the consumer who signs the contract may understand the off-peak clause, the men who actually operate the motors do not. A central station in northern Michigan last winter had a rather uncomfortable experience along this line. An installation of several motors was taken on an off-peak contract and last December the owner of the establishment was notified that he must not operate his motors during the peak-load hours. In spite of this the motors were used one evening about the time of the yearly peak with rather disastrous results to the service. The motors were started by employees who were not familiar with the terms of the contract or with the disastrous effect the operation of these motors would have on the ability of the central station to maintain voltage on the system. As a result of this another manager, hearing of his experience, has had issued a notice, to be posted over each motor which is being served under an off-peak contract, which may serve as a useful hint to others. A copy of this notice follows:

"The rate charged for the electricity supplying this motor is less than charged ordinary motor users under unlimited power contract for the reason that it is agreed and understood that the user of this motor will not operate it between 4:30 p. m. and 8 p. m. any day between Oct. 15 and Feb. 15 whenever the company supplying the electricity requests. Operating this motor during the hours specified without permission of the supply company will cause a discontinuance of the low 'limited off-peak contract' rate for electricity under which this motor is now supplied and thereafter the full unlimited power rate will be charged."

HANDLING CUSTOMERS' ORDERS.

In a discussion on the subject of handling customers' orders before the accounting session at the last convention of the National Electric Light Association in New York, Mr. R. S. Hale, of the Edison Electric Illuminating Company of Boston, referred to a form used to explain possible delays in the connection of service. This form is given to a customer at the time an application is signed. It consists of a postal card, with an explanatory statement attached which can be torn off if the postal card is used.

Customers are requested to send the postal card to the company if service is not provided and an immediate investigation will be made. It is explained that in many cases the company is not allowed to furnish electricity until a permit has been received from the city authorities. Application for such a permit is made when the application is taken from a customer, but the municipal inspector does not examine the work until he receives notice from the wiring contractor or from the owner that the installation is ready for inspection. It is also explained that if there is delay in securing the permit from the city the company can do nothing and the customer or wiring contractor should take any steps that are necessary to hasten the matter.

Application may have been made in some locality where the company has no service and has to build new lines, which involves an unusual delay. In the suburban district distances are so great, the company adds, that trips are made only at intervals, usually about a week apart. "Please appreciate," the card says, "that our income does not start until the current is turned on, and it is therefore to our interest to serve you as promptly as we can." The postal card is addressed to the information department of the company, and provides for a statement of the time the application was signed by the customer, and the location at which service was to be supplied, together with a request for the cause of delay.

The timetable on the postal card gives three typical cases, A. B and C. In case A, in which the service meter and lamps are in and there is nothing for the company to do but provide the electricity, the minimum time required is stated to be one-half day, and the average time two days. The customer is requested to inquire after three days, unless the delay is due to some of the possible reasons for delay mentioned in the foregoing. In case B the wiring and service are completed and the meter and lamps are wanted. The minimum time required for this work is one day, and the average time four days. Unless delay is due to other possible reasons the customer is requested to inquire after seven days. In case C the service is not in, so that new lines, poles or digging is required. The minimum time for this work is three days, and the average time ten days. Inquiry should be made after fourteen days, unless the delay is due to some of the other causes mentioned.

The minimum times stated refer only to the ordinary routine; in case of emergency a service is put in by the company in much less time, but for obvious reasons this fact is not advertised to the ordinary customer.

USES FOR MERCURY-ARC RECTIFIERS.

Applications where the mercury-arc rectifier can be used to advantage were pointed out by Mr. J. T. Kermode, of the Cleveland Electric Illuminating Company ,in a paper read before the Ohio Electric Light Association July 27. For charging the batteries of electric vehicles mercury-arc rectifiers are preferable to any other kind of converting apparatus owing to their ease and simplicity of operation. Equivalent motor-generator sets require an increase in the line, service, transformer and meter investment and often cause annoying line fluctuations. In private garages in

Cleveland there are now 453 mercury-arc rectifiers and 180 motor-generator sets. For large public garages, however, motor-generators sets may be more economical.

Where rectified alternating current is used for street lighting line surges are likely to result, especially on underground circuits, so that the lines should be insulated for at least twice their normal potential. Lead-sheathed cable which has withstood a potential of 6000 volts direct current for years has been known to break down when subjected to a strain of 4500 volts rectified current.

The light thrown on a screen from a projection lantern operated by direct current is clearer than that from an alternating-current arc. The mercury-arc rectifier can, therefore, be used to distinct advantage in operating moving-picture machines. Not only is a clearer picture obtained, but the energy consumption is reduced, as the direct-current lamp requires less energy for a given lighting effect than the alternating-current arc. For example, a certain moving-picture show in Cleveland operating an alternating-current arc used an average of 826 kw-hours per week, including all the lighting in the theater. Later this lamp was replaced by a direct-current arc, operated through a mercury-arc rectifier, and the average weekly consumption dropped off 108 kw-hours, which shows a decrease of 13 per cent for the whole installation, or nearly 50 per cent for the arc alone.

In discussing mercury-arc applications Mr. G. H. Stickney, of Schenectady, N. Y., said that for projection-lantern work the alternating-current arc is liable to fluttering, while the direct-current arc is punished by the insertion of resistance. Mr. Stickney referred to comparative investigations of projector operation by Mr. Gage, recently reprinted in the *Electrical World*.

Among new uses found for rectifier sets Mr. R. E. Russell, also of Schenectady, N. Y., mentioned charging service for telegraph batteries, operation of direct-current signals on steam railroads, charging batteries for oil-switch operation, operation of photo-engraving lamps, supply for electrolytic baths, producing bleaching chlorine for laundries, operation of X-ray coils, etc. In answer to a question, Mr. W. S. Culver, of Schenectady, said that the cost of arc-lamp cables might be slightly higher when for use with rectified current than where motor-generator sets are employed.

Wiring and Illumination

TUNGSTEN CLUSTERS ON CHICAGO'S LAKE-FRONT BOULEVARD.

As an example of civic lighting the new tungsten-cluster illumination of Michigan Boulevard, Chicago, between Twelfth and Randolph Streets, will probably long remain unequaled on any other street or avenue in the country. Few other thoroughfares have such advantages of setting as huge blocks of buildings on one side, fronting opposite 1¼ miles of unbroken parkway bordering a matchless waterfront like that of Lake Michigan, and the final touch has been added to this scene, both by night and by day, through the installation of the first 100 or more graceful six-lamp standards bordering the park curb.

These cast-iron pillars, as outlined in the *Electrical World* of Dec. 22, 1910, are 19 ft. 6 in. in height and are surmounted by a Renaissance cap with six richly ornamented arms from each of which are suspended 100-watt tungsten lamps in 12-in. Alba globes at a height of 15 ft. above the street level. The posts are installed at intervals of about 80 ft. along the curb line, the illuminated length of sidewalk being nearly 1¼ miles from Randolph Street to Park Row. The row of pillars on the park side of the street has just been completed and similar posts are now being placed opposite the present ones on the west si[de] of the boulevard. Altogether 135 of these posts will b[e re]quired for the completed illumination. The present t[un]gsten-cluster installation was selected by a committe[e] of judges after a series of practical tests lasting more th[an a] year, during the course of which installations of open [a]nd inclosed carbon-arc lamps, metallic-flame lamps, white [a]nd

Tungsten Cluster Lighting in Chicago.

orange flaming-arc lamps, tungsten clusters and mantle lamps were put up along sections of Michigan Avenue

The new curb-lighting posts were designed by D Burnham & Company, architects, Chicago. The inst tion is being made by the Board of South Park Com sioners, which obtains electrical energy for lighting the Sanitary District of Chicago.

MONOCHROMATIC LIGHT AND VISUAL ACU

By M. LUCKIESH.

Owing to the fact that the human eye is not corr for chromatic aberration, monochromatic light should duce a sharper retinal image than light sources comn used for illuminants, nearly all of which radiate en throughout the visible spectrum.

Dr. Louis Bell in the *Electrical World* of May 11, gives some interesting results of an investigation of relative illuminations of mercury-tube light and tung light required to produce equal definition of the chara on an acuity chart. He attributes the superiority of cury-tube light to its monochromatic character. This approaches in spectral character more nearly to m chromatism than the light from a tungsten incandes lamp, but it is far from monochromatic. Its luminosi due to four lines in each of the following regions of spectrum: Violet, blue, green and yellow. A great pa the total luminosity is due to the two lines yellow green.

One objection to Dr. Bell's results is the fact tha assumed the mercury-tube light to be monochromatic that he used no strictly monochromatic source. A se objection, and a serious one in the minds of many, is in Dr. Bell's experiments is involved the question of brightness of lights of different color. Dr. Bell assu the correctness of the flicker photometer and explains conflict of his results and those of Broca and Laport the ground that their brightness measurements were r with an equality-of-brightness photometer. That is, he plies that the flicker and equality-of-brightness met would disagree. The investigations of Dr. Ives indica close agreement of the two methods at working illum tions, so that Dr. Bell's explanation cannot be consid entirely satisfactory. It would obviously be more satis tory if the question at issue—the superior defining po of monochromatic light—could be settled without intro ing the question of methods of heterochromatic photom y. This can be done, as is shown below.

By the use of absorbing solutions and glasses light of the same hue but of different spectral character ma be produced. For instance, the green mercury line ca be

[illegible]ed, and thus a purely monochromatic illumination is at [illegible]e available. This green line can be matched in hue by screen transmitting tungsten light of correct propor-tio[illegible] from 0.500μ to 0.600μ. These two screens over their re[illegible]tive sources produce a match in hue so slightly dif-[illegible] in degree of saturation that the resultant lights can [illegible]e [illegible]mpared very accurately by the usual methods without inv[illegible]ving any of the difficulties such as would obtain in a co[illegible]arison of the mercury-tube light with the light from a t[illegible]gsten lamp. An example of the accuracy of the lu-

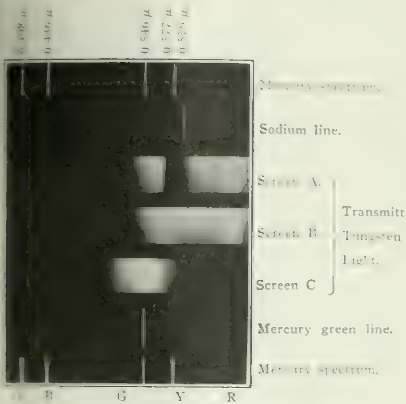


Fig. 1—Transmission Bands of Various Screens.

[illegible] balance obtained in a particular case will be given [illegible]ther absorbing media were prepared which gave [illegible]atches of hue of varying degrees of monochro-[illegible] The transmission of each of the screens is shown [illegible] 1. It must be remembered that luminosity and [illegible]emical action have no direct relation; the photo-[illegible]erely show the extent of the transmission bands. [illegible] *A* consisted of potassium bichromate and neo-[illegible] ammonium nitrate dissolved in water. This [illegible]erved two purposes. It transmitted only the green [illegible] line (0.546μ) and it also matched the sodium yel-[illegible] by transmitted tungsten light. From a continu-[illegible]trum source it transmitted two bands—one maxi-[illegible]ing in the green and the other in the red part of [illegible]ble spectrum. Screen *B* was an aqueous solution [illegible]ssium bichromate of such density that it matched [illegible]nsmitted tungsten light) the hue of the sodium [illegible]ine (0.5893μ). Screen *C* consisted of three glasses [illegible]y transmitted tungsten light matched in hue the [illegible]ercury line. When *A* and *B* transmitted tungsten [illegible]y were of the same yellow hue.

[illegible]s acuity photometers were devised, one being a [illegible] photometer with the grease-spot field replaced by [illegible] opaque slide with similar black characters on both [illegible] The instrument used in the first part of the work [illegible]ery common form shown in Fig. 2. L_1 L_2 are the [illegible]rces, *c* is an opaque black partition, *b b* are mir-[illegible]d *d d* are plane glass cells containing the various [illegible]s or the colored glasses. A double-column page o[illegible] [illegible]nted matter was placed at *a a* and viewed with both eye[illegible] Approximately the same results were obtained with the[illegible]eft eye alone. By viewing both sides of the photom-ete[illegible] field simultaneously the question of pupillary con-trac[illegible]on (considered by Ashe as accounting for some of the[illegible]esults of Bell) is practically eliminated. Dr. Bell, how[illegible]ver, has shown this to be of minor importance by the use[illegible]f an artificial pupil. Both eyes were used in order to [illegible]proach practical conditions. The chart was viewed fro[illegible] a distance of approximately 1 m.

[illegible]e method of procedure was as follows: The screens were placed in position and then with both sides of the photometer field of the same hue the relative intensities of the two sources were obtained. With no difference in hue present, a luminosity balance was easily obtained by either the flicker or equality-of-brightness method, both giving the same results. The illumination was kept as high as possible. After a luminosity balance was obtained the acuity photometer was then placed at the same posi-tion at which the equality-of-brightness photometer was stationed. The illumination on one side was kept con-stant while that of the other side was varied until both sides of the acuity chart appeared equally distinct. Then the ratio of illumination on the two sides was obtained by means of the inverse-square law. This ratio is shown in the last column of the accompanying table. In cases I, II, III a double-column page of type was used as an acuity chart and results given are the mean of many observa-tions made by the writer. In every case the more nearly monochromatic source required less illumination for the same distinctness of detail. The photometers were re-versed to eliminate any instrumental errors, and in case II, where two tungsten lamps were used, it was possible to reverse the absorbing screens, thus eliminating any prejudice. A sodium flame was so devised that it burned quite steadily. This was used as a monochromatic source, it having only a double line in the visible spectrum at 0.5893μ. This monochromatic yellow was matched in hue by screen *A*, which transmitted light, as shown in Fig. 1. Several other experiments, which, however, were not free from hue difference, showed an advantage in favor of the more nearly monochromatic source. Case II is interest-ing inasmuch as neither screen was monochromatic. How-ever, screen *A*, which transmitted two bands, and there-fore two maxima, gave poorer definition. Several ob-servers were asked to make settings in cases I, II, III, and there was no doubt in regard to the side of the acuity chart which was more clearly defined.

TABLE SHOWING RATIO OF ILLUMINATION.

[illegible]	[illegible]	[illegible]	[illegible] Light.	Approximate Illumination (Ft.-Candles).	Advantage of More Nearly Monochromatic Illumination in [illegible] Detail.
I.	A	Mercury tube	Green mer-[illegible]		
	C	Tungsten [illegible]	Green	2.0	[illegible]
II.	A	Tungsten [illegible]	Yellow	[illegible]	1.33
	B	Tungsten lamp	Yellow		
III.	[illegible]	Sodium line	[illegible]		
	A	Tungsten lamp	[illegible]	0.5	1.66
IV.	A	Mercury tube	Green mercury line	0.6	(P.W.C.) 4.90
	C	[illegible]	Green		(M.L.) 5.10
					[illegible]

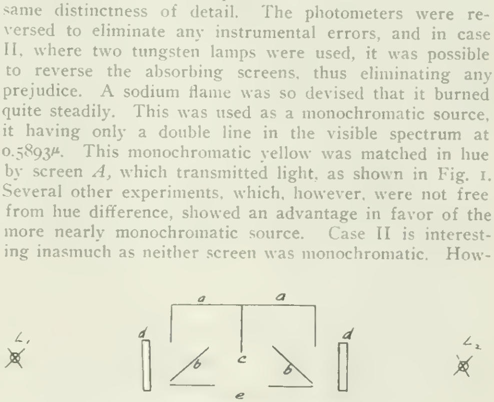


Fig. 2—Bunsen Photometer.

To check these results it was decided to use a better acuity object (which was in use for another investigation when the above experiments were being made) and to ask several experienced observers to make some settings. The chart at *a a*, Fig. 2, was removed and a white matt surface

was substituted. The visual-acuity object devised by Dr. Herbert E. Ives, and described in the *Electrical World* for April 14, 1910, was placed in front of the acuity photometer at *c*. This acuity object consists of two black-line gratings (240 lines per inch) placed face to face. By means of a graduated drum on a micrometer screw the relative angular positions of the gratings can be changed and secondary lines of any spacing or size may be obtained. For all spacing of the lines the total flux of light remains constant. The illumination at *a a* in this case was 3 ft.-candles, and the transmission of the acuity object being 0.2 the resultant brightness of the matt surface was equivalent to that produced by an illumination of 0.6 ft.-candle, which was lower than desired owing to the absorption of the acuity object, but with the apparatus as set up it was inconvenient to obtain a greater illumination. Without any hue difference this rather low illumination was not objectionable. Dr. Herbert E. Ives and Dr. P. W. Cobb kindly volunteered to make some observations, and the writer takes this opportunity to thank them for their helpful assistance.

The procedure was as follows: The side illuminated by green tungsten light was screened off and the object illuminated by the green mercury line. The drum of the acuity object was turned until the lines became so small that they just disappeared or vice versa. A mean of ten settings was obtained by each observer. Each observer then set the drum at the mean value which he obtained, and with green tungsten light (screen *c*) illuminating the object the illumination was varied until the lines just appeared or disappeared. A mean of ten settings of the tungsten lamp was then taken for each observer. Then, with the apparatus as set up, the drum of the acuity test plate turned until the lines were no longer visible, each observer made ten settings for equality of brightness. No difficulty was experienced in this because there was no hue difference in the photometer field. This latter point was further tested by a comparison of the results obtained by the three observers with a very sensitive equality-of-brightness photometer. There was only 1 per cent difference in the readings of the observers obtaining the highest and lowest values of the relative illumination of the two sides of the photometer field. Measurements with a flicker photometer showed the same agreement. This method affords a very accurate acuity test and some surprising results were obtained. These results are given in case IV in the table. Dr. Cobb and the writer required approximately *five* times as much illumination on the side of the photometer field illuminated by the tungsten light through screen *c* as was required on the side illuminated by the green mercury line. Dr. Ives required only one-third more light. The much greater illumination required by Dr. Cobb and the writer as compared with the much less illumination required by Dr. Ives is possibly explained in the following manner as suggested by Dr. Ives. All three observers wore glasses; Dr. Ives wore very strong concave lenses, while the two other observers wore weaker glasses either to correct for astigmatism or far sight. Now a *concave non-achromatic* glass lens in combination with the *convex non-achromatic* lens of the eye of lower dispersion than glass tends to form an achromatic combination. That is, the concave glasses would tend to move the focus for blue rays further back than it would move the focus for red rays, thus decreasing the natural chromatic aberration of the eye. Convex lenses would increase the distance between the points where the red and blue rays focus. The measurement of brightness by acuity is certainly beset with difficulties and uncertainties when three observers whose vision is corrected by the best skill of the optician differ in acuity measurement by several hundred per cent.

It was, of course, possible that pupillary contraction could account for the much greater definition obtained in the above experiment, as the two sides of the field were not viewed simultaneously and as no artificial pupil was used. This point was therefore investigated separately. The mirrors of the photometer were shifted so that the two sources illuminated the same spot on *a a*, Fig. 2. The two sides of the photometer were brought to a luminosity balance by inserting the opaque screen *c*. The screen was now removed and the sources were alternately screened off, so that the writer viewed first the field illuminated by the green mercury line and then by the tungsten [illegible] through screen *c*. The pupil was examined by an observer through a magnifying glass, and no movement whatever of the iris was detected, although the test was repeated several times with the details varied. This [illegible] that pupillary contraction is not the explanation.

Another experiment was carried out which illus[illegible] the obvious fact that brightness values obtained b[illegible] acuity method cannot be added. The acuity object [illegible] tioned above was illuminated from the rear side by a [illegible] sten lamp through an opal glass. The object was v[illegible] through a purple glass and a number of acuity [illegible] ings were taken. A yellow glass was now con[illegible] with the purple glass, making a red combination, ar[illegible] acuity actually increased. The yellow glass absorb[illegible] the blue of the purple, thereby considerably decreasi[illegible] brightness, yet the acuity actually increased. Acuit[illegible] increased when the object was viewed through a [illegible] green glass added to the purple glass. The signal [illegible] glass absorbed all the red of the purple, producing b[illegible] lower brightness than the original purple. This an[illegible] to saying that in some cases a red light added to [illegible] light will give less acuity than either light source [illegible] This fact is an obvious one, yet it shows that for [illegible] purposes for which light is used the acuity method [illegible] give misleading results and would offer an unfair [illegible] parison. A very small part of our "seeing" is done [illegible] servation of fine detail and much by observation of [illegible] ences of light, shade and color.

While it seems to some that the acuity method [illegible] only valid one, it must be remembered that in the ca[illegible] general illumination the results obtained by this m[illegible] would not give a correct measure of luminosity. I[illegible] case of general illumination the eye, as a rule, is conc[illegible] with the vision of comparatively large surfaces whicl[illegible] sent a low degree of brightness-difference between or[illegible] other, and not with minimal-sized detail presentin[illegible] highest practical contrast as reading print. The fac[illegible] monochromatic light produces a more distinct retinal [illegible] does not argue that it is the better light for constar[illegible] in distinguishing fine detail. This advantage may be [illegible] than offset by a possible destruction of the ability t[illegible] criminate colors. A thorough study of physiological [illegible] of monochromatic light may show it to be more dist[illegible] to the other functions of the eye than lights which [illegible] nearly approach in spectral character the natural [illegible] under which the eye has evolved.

ELECTRIC WIRING AND ILLUMINATION (LONDON AUTOMOBILE CLUB.

In the Royal Automobile Club, which was re[illegible] opened in London, particular attention was paid t[illegible] wiring and lighting installations in order that the r[illegible] might be in harmony with the interior architectural e[illegible] A view of the main hall, which is decorated through[illegible] the style of Louis XV, is given in Fig. 1. For the lig[illegible] of this hall use is made of both candelabra and bra[illegible] the place of the candles being, of course, taken by el[illegible] candle lamps. The same idea is followed out in the [illegible] main rooms with excellent results. In the swimming [illegible] for instance, massive Greek bronze pendants of trian[illegible]

sh e with a lamp at each corner are used, the effect being ve striking, while standards, also of Greek pattern, are plced near the edge of the bath. For lighting the bath itself—that is, the water—metallic-filament lamps sunk in he cornice are used, the result of which arrangement ca be seen in Fig. 3. The racquets courts, too, presented an nteresting problem from the lighting point of view. It

Fig 1—The Great Hall from the Platform.

... ourse, necessary, in order that play be possible, that ... l shall cast no shadow. This condition was at last ... l after some trouble by using lamps suspended from ... ing and placed in a reflecting trough inverted so ... the light is thrown downward. The most suitable ... of these troughs was determined by experiment, and it as only after several heights had been tried that the on at last reached was chosen.

As regards the electrical equipment, great care has been tak n to prevent all lamps being thrown out of service at on time. For this reason two separate sets of mains from

The energy is delivered as direct current at 110 volts for lighting and 220 volts for motor service.

The supply mains come into a special chamber where switches and fuses are fitted, and thence pass to the intake chambers. One of these is provided for each of the two supply sources. They consist of a good-sized fireproof room (securely locked) and contain the double-pole

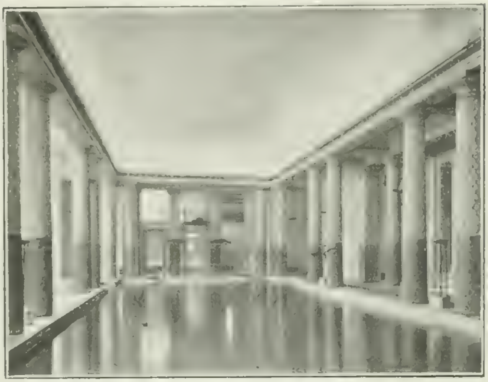


Fig. 3—The Swimming Bath.

switches and fuses controlling the sub-main circuits. These are fixed on marble boards fastened to iron framing to which are also fitted watt-hour meters for determining the energy consumption in various parts of the building. A view of one of these boards is shown in Fig. 4.

The general arrangement of the supply is as follows: The building is divided approximately into two halves, each half having an entirely separate intake chamber. Each room is lighted from both mains so that should one of the supply company's mains break down the whole of the building would still be lighted. Moreover, all the corridors and

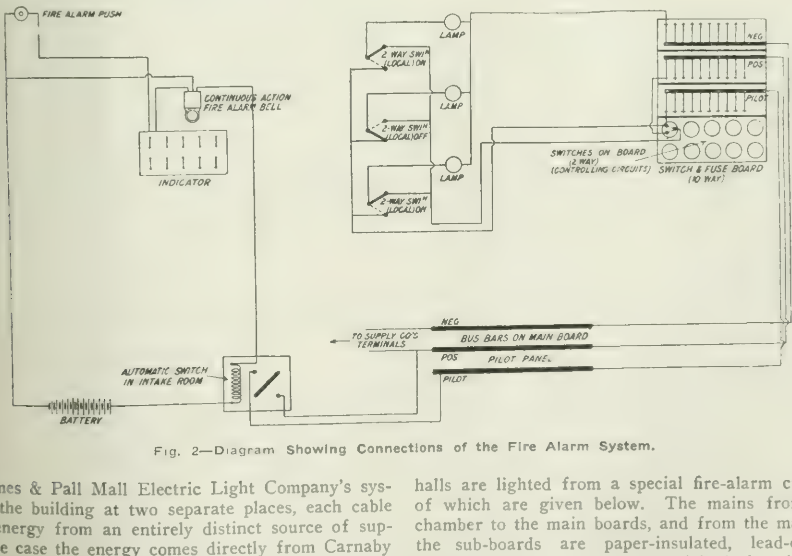


Fig. 2—Diagram Showing Connections of the Fire Alarm System.

the St. James & Pall Mall Electric Light Company's system enter the building at two separate places, each cable receiving energy from an entirely distinct source of supply. In one case the energy comes directly from Carnaby Street generating station and in the other through a substation from the generating station at St. John's Wood.

halls are lighted from a special fire-alarm circuit, details of which are given below. The mains from the intake chamber to the main boards, and from the main boards to the sub-boards are paper-insulated, lead-covered and armored, and are run up special shafts along adjacent staircases. These shafts are easily available should it be

necessary to inspect the cables. At each intake point arrangements are made for a three-wire lighting service and a two-wire motor service.

An ingenious method is employed for controlling the pilot lighting. The leads on one pole are split and pass in parallel through a two-way switch. One side of this switch controls the energy supplied to the various lamps through sub-distribution boards and special local switches in the ordinary way; the other side of the switch controls the energy supplied to the lamps directly through the sub-distribution boards and the other portion of the local switches. The pilot circuits on one side are also controlled by a single-pole switch, which, in its normal position, is held off by a catch. When the fire alarm is sounded by means of push buttons in any part of the building, the coil of the switch is energized and the catch is pulled off. The switch then falls by gravity and connects in circuit the pilot lamps throughout the staircases, corridors, etc., of the building. There are eight pilot circuits, controlled as explained above by a 50-amp triple-pole switch and fuses. The cut-in

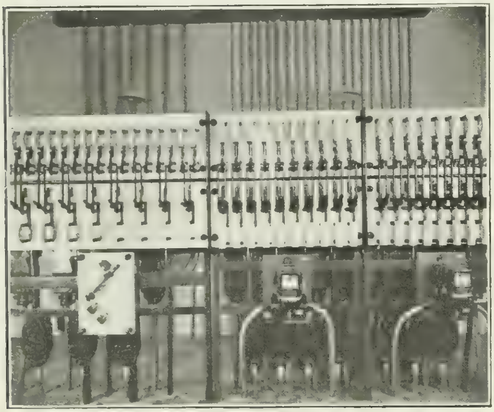


Fig. 4—View of One of the Main Switchboards.

switch arrangement is indicated diagrammatically in Fig. 3.

There are fifty-two general lighting circuits controlled from these boards, some of which receive energy from the Carnaby Street mains and some from the substation. All these circuits have a rating of 100 amp; twelve of them supply energy to the basement, which is metered separately and charged on a special rate. There are also twelve motor circuits receiving energy at 220 volts for working the elevators and fans, and two 110-volt circuits, one for supplying energy to the cinematograph in the lecture theater and the other to apparatus in the photograph-room.

From the sub-boards the wires are run in steel screwed conduit placed under the floors. Where the conduit enters the draw-in boxes it is fitted with brass bushings. The draw-in boxes are easily accessible through traps in the floor and are fitted with flush lids. All the conduit has been laid down to be electrically continuous throughout. The conduit is grounded at each intake room and distribution board by a cable connected to the nearest water pipe. It was tested for continuity by ringing an electric bell through it. All the conduit is of ample size for the wires it carries, and to insure that repairs could easily be made if necessary every wire was pushed into the conduit.

The distribution boards are contained in cast-iron cases lined with uralite and are sunk in the walls. The fuses are carried on marble panels, the two poles being carefully separated. Tubular fuses of 10-amp rating are used on all the lighting boards. Front connections are employed in every case, and great care has been taken to keep the conduits receiving energy from different sources of supply entirely separate. The two runs of conduit are placed quite apart under the floor, while no switch or fitting on one circuit is within 6 ft. of any switch or fitting on the other circuit. The distribution boards of the general lighting and of the pilot lighting are placed so far apart that no man working on one can, even intentionally, touch the other. Moreover, they are divided into two halves, so that while the fuses can be replaced only by the electrician the switches can be turned on or off by the ordinary atten

To make further separation the two sets of circui ceiving energy from the two sources of supply are vided with different colored wires, red and black in used on one circuit and blue and yellow covered on the other.

The switches throughout the building are of the type, with the exception of those on the service and floors; Lundberg plugs are used throughout, and heating circuits are employed a device is employed to vent the heating plug being inserted in the lighting and vice versa.

RECENT TELEPHONE PATENTS.

CONNECTING CALL CIRCUIT.

It is probably well recognized that one of the poin the common battery switchboard which merits imp ment is the device for recalling the operator after a nection is established. The percentage of calls in such a recall is necessary is small, yet most telep users have experienced inconvenience at some tim other due to inability to attract the attention of the ator.

In a patent recently granted Mr. R. H. Manso Elyria, Ohio, the disconnection has been placed absol under control of the subscribers. To this end the inv arranges the cord circuit so that both plugs may be connected by means of cut-off relays. These relay spond to a vibration of the hook switch, provided a determined and sufficient time has elapsed since the e lishing of the connection. A slow-acting relay, held by a dashpot, controls the circuits and no flashing has effect until it has completed its travel. When the ends are cut off, each line involved returns to normal dition as though not connected and ready for other The operator removes the plugs at convenience, everything returns to normal. The Dean Electric pany is assigned this patent.

COOLED TRANSMITTER.

Messrs. C. E. Enger and G. Holmström, of Sw have patented a transmitter cooled by a high-resist heat-absorbing liquid. A vessel is arranged in the of the transmitter casing and the back ends of the statio electrodes protrude through the wall. As the electr are bored out the liquid fills the space within them.

Letters to the Editor.

Depreciation.

To the Editor of the Electrical World:

Sir:—Referring to Mr. H. G. D. Nutting's article in issue of Aug. 5, it would be interesting to know what the author means by the "value in dollars" graphically set forth in his curve reproduced on the next page. I have always thought that the value of a thing was the price it would fetch. If such is the case I cannot see how the c comes to have so many kinks and sharp corners, for obviously the sale value or replacement value is not subject to any sudden variations arising from the depreciatio of the apparatus.

.rhaps the explanation of this anomaly is that Mr. N ting meant to say "utility" instead of "value in dollars," w . the curve would become clear and enlightening. It i wever, hopeless to try to measure utility in dollars. dollar will no more measure utility than a yard- st will measure weight and for the same reason. The r t is that a measure must have the same physical di- ns as the quantity it measures. Thus the unit of h must have the dimensions (L), and the unit of t must have the dimensions (MLT^{-2}), simply because are the dimensions of the quantities they measure. at are the physical dimensions of utility? Does anyone w? Take the case of the Corliss engine cited by Mr. N ting; its utility depends upon its efficiency, its size, its and many other things. Hence the physical dimen- f its utility (were it measurable) would be very com- ed and would probably involve *L*, *M* and *T* in compli- . powers. This complex quantity cannot be measured lars because the physical dimensions of a dollar are of a mere number. Value as defined in modern s on money is also a mere number and therefore, un- il utility, is capable of expression in money, which is, in act, its measure.

he writer takes the liberty of making this criticism b use much of the existing literature on depreciation is m red by lack of appreciation of the nature of value and . especially by forgetting that money is a measure erefore subject to the physical laws that govern all

York. WILLIAM A. DEL MAR.

Editor of the Electrical World:

The article by Mr. H. G. D. Nutting on "Deprecia- in the Aug. 5 issue, brings out an interesting point ation to the rate of advance of depreciation.

has been assumed by many engineers that a compound in rest sinking-fund curve is a proper one to use in fixing p ent values of depreciated physical property. But this is no means the universal view.

Ir. Nutting apparently believes the sinking-fund curve proper method and applies it in the depreciation curve article, between the points *A* and *B*. This curve is ry interesting because it conforms with many conditions o ctual experience. Now let us look at the entire curve fr *D* to *F*. The part *D A B* is convex upward; the part *B* is nearly straight, and *C E F* is convex upward. Look- in at the part *A B C E*, it is concave upward.

D is the initial value—or perhaps some point between *D* nd *A*—and *F* is the final value, then it is interesting to see what type of uniform curve or line represents the actual depreciation most closely.

A sinking-fund curve from *D* or *A* to *F* would not agree with the actual curve Mr. Nutting has drawn, except perhaps at the ends. It would be much too high near the center, over *B* and *C*. A straight line, however, starting just above *D* and passing slightly below *A*, over and parallel to *B C*, under *E* and intersecting the line *F G* just beyond *F*, would compare favorably with the actual curve.

In other words, the actual curve more closely approximates a straight line than a sinking-fund curve. Thus it tends to uphold the straight-line theory rather than the curve theory.

I quite agree with Mr. Nutting that no set method or theory of depreciation fits every sort and kind of condition, but in the case of a going public utility I believe a straight line more nearly represents the advance of depreciation and is a better guide to present value than the sinking-fund curve. If physical property does depreciate, in fact, in a manner which causes present values to coincide with the curve, the connection is a mere coincidence and not one of actual relationship. On the other hand, the straight-line theory is supported by strong economic arguments.

Curve Showing Depreciation of Apparatus.

Perhaps the underlying reason for the use of the sinking-fund method is its economy. Many assume that the straight-line method is not economical because there will be no interest on the fund. This is not the case and the straight-line method may have the advantage of interest on the fund as much as in the other method. On the score of average annual assessments to cover depreciation there is little difference in cost between the two methods, with a slight advantage in favor of the straight-line method.

Chicago, Ill. FRANK F. FOWLE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

nating-Current Commutator Motor.—OSSANNA.— conclusion of his paper on the design of single-phase commutator motors with special reference to heavy trac- ti . The author gives a series of formulas for dimen- si ing the usual single-phase commutator motors with re rence to sparking while starting or running and with re rence to the other characteristic features of the motors u er discussion. The author concludes that the series m or is superior to the repulsion motor. This superiority o he series motor is found to rest in the fact that at full to ue it can run sparklessly at a speed far above syn- ch nism (at three or four times synchronous speed). W h the repulsion motors under discussion this is not p sible and this is the reason of their inferiority, but this w ld disappear at once if means could be found of operating at speeds other than synchronism. For heavy traction a lower frequency, say, 15 cycles per second, is better than a higher one, say, 25.—*Elek. Zeit.*, June 23.

Comparative Ratings of Alternators.—B. G. LAMME.— A long paper illustrated by numerous diagrams in which the author discusses some of the popular misconceptions regarding the relative polyphase and single-phase outputs which can be obtained from a given winding, and then gives a correct summary of the comparative ratings of alternators for polyphase and single-phase currents. Three-phase windings and six-phase windings are first discussed. A comparison is made of single-phase and three-phase ratings on the basis of equal losses in a given coil or group and on the basis of equal total armature copper loss. Two-phase and three-phase ratings are then compared and single-phase ratings from two-phase wind-

ings are discussed. A comparison is made of the permissible alternating-current and direct-current outputs from the same armature winding. Up to this point only the armature copper losses are taken into account. The author then discusses the field-coil heating. Among the various types of alternating-current windings the three-phase true star type of winding is the one which, in general, lends itself to best advantage to the various types of alternating-current machinery. Where windings other than the true star winding are used there is usually some condition which is more important than the output. The author gives some of the principal applications of the different types of windings, especially closed-coil windings, three-phase star windings and delta-type windings.—*Elec. Journal*, August.

Lamps and Lighting.

Radiant Efficiency of Arc Lamps.—H. P. Gage.—An abstract of a paper read before the American Physical Society. The object of the investigation was to determine the radiant efficiency of arc lamps and the mechanical equivalent of light. The definition used for radiant efficiency is: Ratio of energy of the visible part of the spectrum to total energy radiated $= L \div R$. Using the symbols $R =$ total energy radiated, $W =$ energy passing through an 8-cm layer of water, $L =$ energy in visible part of spectrum. The ratio L/R or W/R was obtained by a slight modification of the method of Ångström. After dispersing the spectrum of a light source the infra-red was removed by an opaque screen. The light was then reassembled by a mirror to a white spot. The energy of the white light was compared by means of a radiomicrometer with white light of equal intensity and like color from the same source which had not been robbed of its infra-red. In some cases, owing to the small value of L compared with R, L was compared with the intermediate quantity W. The most important results follow:

Source	Efficiency, L/R per Cent.	Light Equivalent, Candles per Watt.
Positive crater, right-angle carbon arc..........	8 to 12 depending on current	30
Right-angle lamp, alternating current..........	6.5 to 8.5	21
Yellow flame arc..........	15.4	39
Yellow flame, arc stream..........	39.0	
Brilliant white..........	14.6	21
Hefner, recalculated from Angstrom for limit 0.68μ	0.363	21.3
Nernst lamp viewed through $CuSO_4$ solution	100.0	39.5

The greatest efficiency of 39 per cent was found in the case of the arc stream between yellow-flame electrodes, the tips being shaded. The light equivalent was found to be as high as 30 candles per watt with white light and almost 40 candles per watt with light distributed more in the visually intense part of the spectrum.—*Phys. Review*, June.

Lamp Characterstics.—M. Tappley.—The conclusion of his article giving various notes on electric lamps. The author deals with the rating of arc lamps and gives tables of the usual candle-power units in which different kinds of incandescent and arc lamps are being made. He then deals with ageing and with burning hours and gives the following formula for the most economical life of a filament lamp, assuming constant wattage and steady decay of candle-power. Best life in hours for minimum cost per cp-hour $= \frac{1000\,k}{pw}\left(\sqrt{1 + \frac{0.002\,Cr}{ks}} - 1\right)$ where $w =$ wattage of lamps; $2\,p =$ cents per kw-hour; $2\,k =$ cost of lamp (in cents); $C =$ initial candle-power; $c =$ candle-power after t hours; $r = pwt$; $s = C - c$. He finally gives data on the usual voltages and currents for incande ent and arc lamps. He states that it is not generally re zed how considerably the power-factor of a pure lighting oad may depart from unity. The power-factor of filament nps is practically 100 per cent, but few arc lamps ha a power-factor, terminal to terminal, higher than 8 per cent, or rarely 90 per cent, while in many instance the figure falls to 70 per cent; the power-factor of the a it-self is usually from 85 per cent to 90 per cent. In ge ral, 80 per cent may be assumed for the power-factor o th whole arc lamp and 90 per cent for that of the arc i The power-factor of a mercury arc is from 80 per ce t 85 per cent, while that of a nitrogen-vapor tube ma be 90 per cent or more.—Lond. *Elec. Review*, July 28.

Neon Luminescent Lamp.—G. Claude.—A F Academy paper in which the author discusses some fu developments of his neon lamp. With the Moore la is necessary to provide a valve which introduces at re intervals new gas into the tube. This the author en ored to avoid with the neon lamp. He found tha troubles are essentially due to a vaporization of the trodes. Interesting data are given of deposits resu therefrom and the discovery of helium in exhausted t He found that all that is necessary is to prevent vaporization of the electrodes, and this is possible by ing them large enough. He states that it is now po to make neon tubes of a length of from 5 m to 6 m specific power consumption being 0.8 watt per ca power.—*L'Industrie Elec.*, July 10.

Generation, Transmission and Distribution.

Alternating-Current Motors for Elevator Servi A. G. Popcke.—An article on the selection of alterna current motors for elevator service. With the diar of the elevator drum, the speed of the car and the u anced load known, in selecting a motor it is necessa determine the required horse-power and the motor s The author gives two diagrams from which both horse-power and the speed can be easily found and numerical examples of the points of these diagrams. practice it has been found that squirrel-cage moto sizes up to 20 hp are satisfactory for elevator service speed of 720 r.p.m. has been found to be most desir Therefore, eight-pole, 60-cycle motors of the squirrel- type are mostly used for this kind of service. Whe starting current of 2.5 times full load is objectionable when the size of the motor exceeds 20 hp a wound ondary motor is commonly used.—*Elec. Journal*, Au

Abnormal Pressure Rises on High-Tension Altern Circuits.—J. R. Dick.—The author first gives a mec cal analogy of the phenomenon of resonance and discusses methods of preventing resonance. He then t up pressure rises produced on closing a circuit conta capacity and inductance. These phenomena are loosely ascribed to resonance, which is misleading. make use of a mechanical analogy, they are closely to the impact of a load on an elastic body. Finally he cusses pressure rises on switching off heavy curr These are frequently spoken of as being due to reson but, although oscillations are produced when a heavy rent is broken, there can be no resonance, as the orig forced vibration has ceased with the breaking of the rent. A mechanical analogy is that of striking a blov a tuning fork.—Lond. *Electrician*, July 28.

Energy Supply in a Pottery District.—An illustr d article on the energy supply in the pottery district in S f-fordshire. The total area is 11,154 acres, the popula n 245,000. The total horse-power of electric, steam and s plants engaged in the staple industry of the district, e manufacture of pottery and china, and in other minor dustries is 10,000 hp, and of this approximately one-t d is already electric. Electricity is at present supplied f m four generating stations, but it is not intended to n e

...dditions to these in the future, but to build and equip a new power station as nearly as possible in the center of the area. This will be connected with the four existing stations by trunk mains and will contain two 1500-kw tur... ...rators.—Lond. *Elec. Eng'ing*, July 27.

...*ity in Textile Mills*.—An illustrated article giv... ...e notes on the development of electric driving in Brit... textile mills.—Lond. *Electrician*, July 28.

Traction.

...*lysis of Water Pipes*.—E. E. LANPHER AND L. B. ...—A paper presented before the Engineers' Society ...stern Pennsylvania on electrolytic destruction of ...tem underground structures in Pittsburgh. The ... final conclusion is that the only certain method ...ting electrolysis is the installation of the double-...stem and the most successful method of mitigat-...olysis is the installation of the return-pipe feeder ... The latter system was applied in Pittsburgh. An ...s given of the long discussion which followed. ...tion of the "return-pipe feeder system" was ... criticised by several speakers, especially by Mr. ...anz, who referred to the radial-insulated return ...s the one system which has universal recognition ...h is the only one which has correct theoretical ...n. Mr. L. B. Smith reported some interesting ...f a survey made on June 28, 1909. On this date ...xcept mail cars were in operation, a universal ...ring been declared on the previous day. In the ... two city corps covered practically all districts ...re normally "danger zones" and noted electrolytic ...s differing widely from anything observed before ... that is (a) the major part of districts ordi-...sitive were on this date slightly negative. (b) No ...eading greater than 0.15 volt was discovered ex-...re observation was taken while a mail car was in ...ty. (c) Wherever positive readings existed the ... was materially reduced, so that in many cases a ...eter was required in order to measure the emf. ... thus offered furnishes unusual evidence of the ...rce of the electrolytic trouble in Pittsburgh and ...dicate that with no street cars in service the dis-... positive potential on the water mains would en-...appear.—*Proc. Engineers' Society of Western* ... July.

...*Problems*.—C. W. MALLINS.—An illustrated paper read before the Edinburgh Congress of Tramways ...t Railways Association. The author gives data ...rams on the cost of construction of permanent ... overhead equipment and cost of maintenance of ... twelve typical undertakings. He also discusses ...ype of car to be used and rates to be charged. He states that in Great Britain tramways and light railways are carrying the general public at very little more than half ...s charged by railway companies. The railway ...s derive an all-round rate of 2 cents per mile per ...r. The author advocates the transport of mer-... by tramways and light railways. The subject of ... fares is discussed in another paper by Mr. C. W. Shepard before the same congress.—Lond. *Electrician*, ...

Single-Phase Traction.—W. USBECK.—The conclusion of the fully illustrated detailed description of the overhead line construction of the single-phase railroad from Dessau to Bitterfeld, in Germany. The subdivision of the line to sections and the overhead construction at difficult crossings, etc., are described and illustrated.—*Elek. Zeit.*, June 29 and July 6.

Financial Results from Traction Systems.—G. SOBERSKI.—An article discussing the fundamental points which determine the financial results obtained from traction systems, with special reference to tariff and management so as to increase as much as possible the receipts and reduce the expenses.—*Elek. Zeit.*, July 6.

Electric Propulsion of Ships.—A note on the electrical equipment of a British coast liner, the generating equipment of which comprises a gasoline engine of 35 hp, which drives a three-phase alternator, where energy is supplied to an alternating-current motor on the propeller shaft. An induction motor is used without brushes or slip-rings and of the "multiple-wound" type, eight-pole and twelve-pole windings being used. The generator also has two windings (four-pole and six-pole) corresponding with those of the motor, and the various speeds are obtained by combinations of the windings.—Lond. *Electrician*, July 28.

Installations, Systems and Appliances.

Domestic Uses of Electricity.—G. DETTMAR.—The first parts of a very long paper presented at a recent meeting of the German Association of Electrical Engineers. The author urges the co-operation of the electrical engineers with their wives to increase the popularity of the domestic uses of electricity. He first deals with electric lighting and states that in residences tungsten lamps are now used almost exclusively. Carbon lamps are used only where they are employed for short times of lighting or where a long candle-power with a high voltage is required or where they are subjected to serious mechanical vibrations. However, he describes some experiments which show that the modern tungsten lamp is no longer fragile and can withstand vibrations and motions quite well. The easy switching on and off of electric lamps is an advantage which is not sufficiently appreciated. With gas lamps experience shows that generally twice as many lamps are being lighted as are actually needed. The author figures that if one goes into a dark room to get something for a moment the use of a match alone for a few seconds is seven times as expensive as lighting an electric lamp for the same time. Electric lamps can be used in all sizes according to requirements; they develop little heat; their color is good, although the metallic-filament lamp has too high a brightness under some circumstances, so that the use of frosted globes, etc., becomes necessary. The easy replacement of a broken lamp by a new one is a very great advantage. Gas engineers now appreciate the importance of the ease and convenience of electric lamps and several gas plants in Germany are now offering to keep their customers' gas incandescent lamps in good order at a regular rate which is not more than cost. At one plant the yearly rate per incandescent gas lamp is between $1.12 and 75 cents per lamp according to the number of lamps. This is almost half the cost of the gas itself, but is hardly ever taken into consideration in comparisons between gas and electric lighting, although it is a very important factor. Moreover, the electric lamp is clean and hygienic, while considerable data are given on the deterioration of air by gas lamps. The danger of explosion from gas lamps is also pointed out. The advantages of electric lamps are now so well recognized in Germany that at present use is made of 50,000,000 incandescent electric lamps and 2,000,000 arc lamps against 25,000,000 gas lamps. In an ordinary household the cost of lighting and heating in Germany is 4 per cent and a slightly higher expense for a better light is well justified, just as paying higher prices for better clothing and better food. While the production of gas in Germany in the months of November and December, 1910, was only 4.9 per cent higher than in the corresponding months of 1909 the kw-hours produced increased in the same year by 16.5 per cent. The author thinks that the use of gas for lighting is decreasing in Germany and that the increased production of gas is due to the use of gas for other purposes. The paper is to be continued.—*Elek. Zeit.*, June 29 and July 6.

Control of Power-Factor in Three-Phase Installations.—W. GENKIN.—A description of a method in which two

meters are arranged according to the well-known two-wattmeter method. The principle is indicated in Fig. 1. The current coils of the two meters I and II are connected in series. The excitation coils of meter I are con-

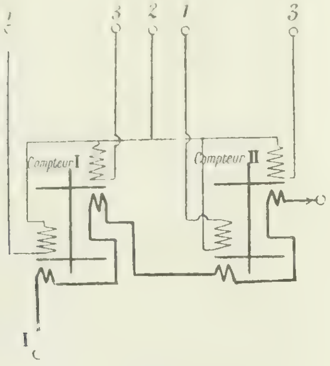


Fig. 1—Wattmeter Connections.

nected in the ordinary normal way, while the connections of one of the excitation coils of meter II are reversed. Under these conditions meter I measures the real power, while meter II measures the wattless volt-amperes. In order to apply the method to the frequent case of a transformer, the primary of which is connected in delta fashion and the secondary in star fashion, the connections shown in Fig. 2 are used. The series transformers I_1 and I_2 deliver current to the series coils of the meter through the terminals *I*. The points 1, 2 and 3 on the low-tension side are connected to the corresponding points of the pre-

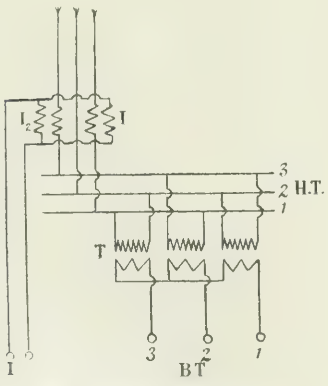


Fig. 2—Transformer Connections.

ceding figure. In contradistinction to the preceding case the meter I records now the wattless volt-amperes and the meter II the real power.—*La Lumière Elec.*, June 3.

Russian Central Stations.—Statistical data on the 156 central stations in Russia. Detailed figures are given for only 111 stations. Of these eighty-one use direct current, five direct current and alternating current and twenty-four alternating current; the emf being between 5000 volts and 8000 volts in four stations; between 2000 volts and 3000 volts in twenty-one stations; between 500 volts and 600 volts in three; between 150 volts and 240 volts in sixty-three, and between 110 volts and 150 volts in twenty stations. Out of thirty-seven stations for which complete data are available, fifteen have a rating below 5(kw, six up to 1000 kw, seven up to 5000 kw, five) to 10,000 kw and four up to 20,000 kw. The total ting of these thirty-seven stations is 117,141 kw. Th include four stations in St. Petersburg, with an agg gate rating of 41,630 kw. The price of the kw-hour for ghting is between 8 cents and 27 cents and for moto purposes between 4 cents and 16 cents. Thirty statio are operated by steam, four by gas and three by stea and gas.—*Elektrischestwo,* No. 6, 1911; *Elek. Zeit.*, July

Electricity on Board Ship.—The first part of an trated article in which are described the various us which electricity is put on board the two White liners, the *Olympic* and *Titanic*. These include, lighting, energy for winches, cranes, fans, wate doors and stoking-helm indicators. The clocks and ing equipment are also electrically worked, while a plete telephone and wireless installation is found on The differences between marine and land practic noted.—Lond. *Electrician,* July 28.

Protective Relays.—K. Edgcumbe.—An illustrated in which the author describes some protective rela alternating-current circuits. The following relays a cussed in succession: (1) Overload relays; (2) n age or minimum relays; (3) reverse-power or dis nating relays; (4) differential or balanced relays. present instalment overload relays are dealt with. paper is to be continued.—Lond. *Elec. Review,* July

Wires, Wiring and Conduits.

Laying of Mains.—W. G. Turner.—The autho phasizes the great importance of careful initial layi mains on the solid system and gives various pr hints and precautions with reference to rubber or bit insulated cables.—Lond. *Elec. Eng'ing,* July 27.

Electrophysics and Magnetism.

Molecular Attraction.—J. E. Mills.—A highly the cal paper on the relation of temperatures and mol attraction. The chief result is that a change of ten ture does not change the nature or the amount c molecular attractive force. The temperature merel termines the orbit that the molecules will follow in ence to the attractive force.—*Phil. Mag.*, July.

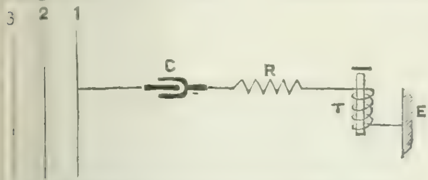
Electronic Theory.—S. B. McLaren.—A highly n matical paper on the emission and absorption of e by electrons. Lorentz's theory of complete radiati extended to all wave-lengths.—*Phil. Mag.*, July.

Units, Measurements and Instruments.

The Bureau of Standards' Current Balances.—I Rosa, N. E. Dorsey and J. M. Miller.—An abstract paper presented before the American Physical Sc The current balances of the Bureau of Standards a the type used by Lord Rayleigh, each consisting pair of fixed coils of equal radii and of square section, and fixed at such a distance apart that the upon the moving coil, also of square cross-section but smaller radius, suspended midway between the fixed and coaxial with them, is a maximum. The final w ings show that the emf of the Weston normal refe cells of the Bureau of Standards is 1.01823 volts, in of the international ohm. That is, the Weston cells an emf of 1.01823 absolute volts if the international is equal to the absolute ohm. The value of the e these coils is 1.01830 international volts (in terms c international ohm and the silver voltameter), showi an apparent difference between the absolute volt and th international volt of 0.00007 volt. However, there is haps a greater difference than this between the ab ute ohm and the international ohm, hence it cannot be said definitely until the absolute ohm is better deter ned whether the international volt or the absolute volt i the larger. The above result and those obtained by othe observers during the last four years seem to indicate th the

e[illegible] of the Weston normal cell at 20 deg. C. in terms of th[illegible] international ohm and the absolute ampere is 1.01822 v[illegible] to within a few parts in 100,000.—*Phys. Review*, Ju[illegible]

[illegible]ing High-Tension Cables.—An illustrated description



F[illegible]g. 3—Diagram of Connections for Testing Cables.

[illegible] simple apparatus called the "phasophone" for the [illegible]m and localization of potential faults of high-[illegible] cables. As shown in Figs. 3 and 4 the essential [illegible]tents are a high-tension mica condenser *C*, a non-[illegible]ve resistor *R* (of over 1 megohm resistance), a sp[illegible]k micrometer *f* and a telephone receiver *T*. The manne[illegible] of connecting these is shown diagrammatically in Fig. 3, [illegible]e actual arrangement being as in Fig. 4 (which is a [illegible]f the essential parts of the apparatus; dotted con-[illegible]s are internal; low-tension terminals are shown by [illegible] rings and high-tension terminals by double rings). [illegible]ndenser, non-inductive resistor and telephone are [illegible]ted in series between one line wire and earth. The [illegible]y current then flowing through this auxiliary cir-[illegible]ts up a note in *T* of a pitch dependent on the fre-[illegible] of the main current. So long as the whole instal-[illegible]s in perfect order the note emitted by *T* is uniform, bu[illegible] should the slightest irregularity arise (such as curre[illegible] leakage, sparking to earth, bad contacts, faulty operatio[illegible] of parallel machines, load oscillations, unbalanced ph[illegible]es, excessive discharge at spark-gaps, and so on), indica[illegible]n thereof is at once given in a definite and recogniz-[illegible]anner in the phasophone. The current taken by the [illegible]one at 5000 volts line pressure corresponds roughly to [illegible] equivalent resistance of 15,000,000 ohms, so that the lea[illegible]ge or sparking at any fault offering less than 15 me[illegible]hms resistance strongly affects the telephone note.

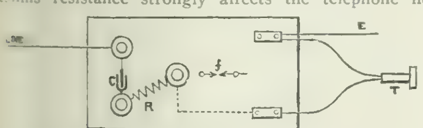


Fig. 4—Plan of Apparatus for Testing Cables.

Ot[illegible]r faults of a similar magnitude are easily detected. Th[illegible] telephone (Fig. 4) may be at any reasonable distance fr[illegible] the rest of the apparatus.—Lond. *Elec. Review*, [illegible]

[illegible]ters.—H. W. Richardson.—After some general rema[illegible]s on various types of electric meters and on the use of [illegible]repayment meters, he discusses high-torque and low-tor[illegible]e meters, the way in which retardation depends on ma[illegible]etic drive and friction, the effect of friction and nec[illegible]ssity for light-load compensation, he points out that hig[illegible] torque is more important than weight of moving eleme[illegible] in minimizing friction effect. Notes are added on bal[illegible] bearings and pivot bearings, on the exaggerated impor[illegible]nce which is often laid on shunt losses, on the care wh[illegible] must be taken in the selection of the location of the me[illegible]r and in its installation, on the importance of regular ins[illegible]ction and testing and on the life of the jewels.—Ge[illegible] *Elec. Review*, August.

Telegraphy, Telephony and Signals.

[illegible]ading a Long Telephone Line with Inductance Coils.—L[illegible] Cahen.—The first part of a mathematical paper in wh[illegible] the author discusses how to load a long telephone line with Pupin inductance coils in order to obtain the maximum possible advantage. In the present instalment he gives the fundamental formulas and discusses in detail the effects of a change of self-induction, all other characteristic properties of the line remaining unchanged. He emphasizes the practical importance which the insulation resistance of the line has for the problem.—*La Lumière Elec.*, June 3.

Miscellaneous.

Apprenticeship.—G. Stier.—An article giving a summary of the regulations in force in Germany for the keeping of apprentices and discussing methods of training the apprentices in the mechanical industries and their further education in schools (Fortbildungschulen).—*Elek. Zeit.*, June 29.

Book Reviews.

A Study of Electrothermal and Electrolytic Industries, By Edgar A. Ashcroft. Vol. I. New York: McGraw-Hill Book Company. 130 pages, 37 illus. Price, $2.

The book is divided into six chapters, dealing respectively with history of the subject, theory of electrochemistry, electrochemical and electrothermal calculations. value of electrochemical and electrothermal processes, general designs for industrial plants and the production of cheap electrical energy. The book is remarkable in its intellectual aspect, for it combines a number of statistical and commercial facts on the one side with speculative and social philosophy on the other, with electrochemical considerations as a sort of binding material. The philosophy is very interestingly written, the statistics are very practical and the electrochemistry is very clearly expressed. The book will be welcome to students of industrial electrochemistry, to electrochemical engineers and to thinking men generally.

Die Unipolare Gleichstrommaschine. A thesis for the Doctorate of Engineering. By Boris von Ugrimoff. Berlin: Julius Springer. 99 pages, 104 illus.

The thesis commences with a history of the development of commutatorless machines for direct current. Special attention is given to the description of the Noegerrath machine. The second chapter deals with a research on high-speed rubbing contacts. A third chapter discusses the mathematical theory of high-speed cooled rubbing contacts. The fourth describes the construction of a particular type of machine designed by the author; while the fifth details the tests made on said machine.

Mesures Électriques Industrielles. By J. A. Montpellier and M. Aliamet. Paris: H. Dunod et E. Pinat. 468 pages, 328 illus. Price, 19.50 francs.

This is the third volume of a series of books by the same authors on industrial measurements and tests. It is divided into eighteen chapters, dealing successively with the following topics: Electromagnetic quantities; general considerations; electrostatic instruments; electromagnetic instruments; electrodynamic instruments; induction instruments; thermic instruments; auxiliary apparatus; resistance measurements; emf measurements; current measurements; quantity measurements; capacity measurements; power measurements; energy measurements; special alternating-current measurements; watt-hour meters.

The book is very logically arranged, clearly written and well illustrated. It is also well up to date. The treatment is arithmetical with elementary algebra. The book is an excellent guide to the principles and modes of operation of electrotechnical measuring instruments, and will be of value to the student of electricity and the measuring engineer.

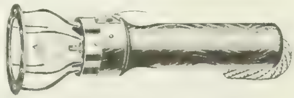
Grundegesetze der Wechselstromtheorie. By Fritz Hoppe. Leipzig: J. A. Barth. 146 pages, 160 illus. Price, 5 marks.

A good elementary treatise on alternating currents from the standpoint of vector diagrams. Rectangular co-ordinates, crank diagrams and polar diagrams are compared and their respective curves developed for a numbe of cases. Attention is paid in considerable detail to the ve forms of alternating-current generators and the met ds of computing the same. The work is thoroughly prac al and well adapted to the needs of the student of elemen n alternating-current engineering.

New Apparatus and Appliances

AUTOMOBILE TROUBLE FINDER.

The McGill Manufacturing Company, of Valparaiso, Ind., is putting on the market an automobile "trouble finder," to which the trade name "Thumswitch" is given. As will be seen, it consists of a small lampholder and

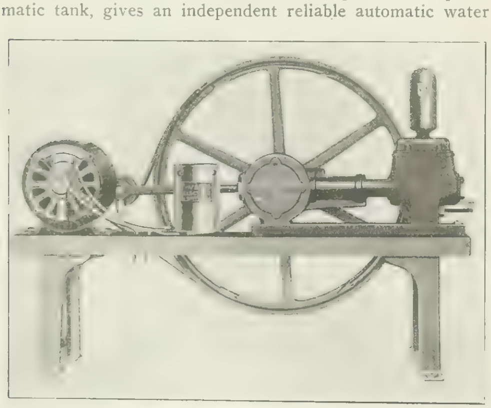


Portable Miniature Lamp.

guard with a switch enabling the light to be controlled at the will of the user. By its use troubles about an automobile may be quickly located and the danger of explosion and injury caused by broken or hot lamps coming in contact with oils is avoided. It is made with a solid brass guard, an attractive handle and is furnished complete with cord and terminal, which may be attached to any battery. Any miniature lamp, carbon or tungsten may be used of from 2 volts to 6 volts.

MOTOR-DRIVEN HOUSE PUMP.

One of the problems that often confronts the property owner in rural and suburban districts is a troublesome and more or less crude water system. The Vaile-Kimes Company, of Dayton, Ohio, manufactures an electric-motor pump which, when installed with a compression or pneumatic tank, gives an independent reliable automatic water



Motor-Driven House Pump.

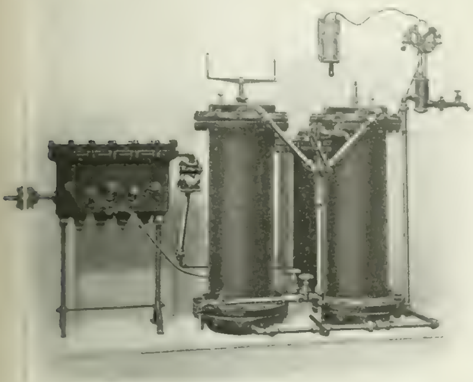
supply for all purposes. It pumps the water direct from the cistern, well, lake or stream into a tank under pressure, whence it is distributed for use.

In cities where water rates are high or where the pressure is low, and where homes are supplied with electricity, this system forms an efficient and inexpensive means of water supply. It is of sufficient capacity to furnish the average suburban home with water under pressure or bathrooms, kitchen, laundry and sprinkling purp s The power is obtained from a 1/8-hp Westinghouse m r of the type extensively used for the operation of s machines. For ordinary service the motor is so well signed and built that the cost of energy consumed does exceed 2 cents an hour. An automatic switch governe the water pressure in the system controls the operatio the motor. This switch starts the motor automati when the pressure falls to a given point, and stops motor when the maximum desired pressure is reac No attention is, therefore, required to keep up the w supply. The pump is belt-driven and is equipped wit automatic belt tightener which keeps the belt always ti A large air chamber makes the discharge smooth and form. The pump may be arranged for mounting on wall by substituting brackets instead of the legs.

ELECTRICAL PURIFICATION OF DRINKING WATER.

Within recent years there has been introduced a sys for the electric purification of water which is sai overcome the inherent drawbacks of other systems. By electric purification no chemicals or other substances introduced into the water, nor does the electric actio the water remove any of the natural salts or gases. electric system of purification has been recognized scientists and laboratory experts for more than f years, but it is stated that, until the introduction of the e tric water-purifying machine it has never been made c mercial. The system as used to-day is illustrated here and briefly described below. The machine is attached to feed pipe connecting with the main from which the w is forced, under the existing pressure, into the elect box (the square casting resting on standard to the le This box is divided by a series of electrodes into sepa compartments, the water filling the first compartment, o flowing into the next and so on until it is forced out the settling chamber. During this operation the proces purification is accomplished by the action of the elec current in conjunction with the aluminum electrodes ing upon the water. The aluminum electrodes throw aluminum hydroxide which permeates the entire bod water, forming a flocculent or sponge-like mass which rounds all the animal and vegetable organisms, toge with all other impurities that are in suspension, and fo a precipitate. It is claimed that concurrently a pa dissociation or separation of the elements takes pl hydrogen and oxygen being liberated in their nas forms. In this state the oxygen has its greatest oxidi g and germicidal properties and, together with the hydrox , energetically attacks all lower forms of animal and v table life. As previously stated, the water is then pa d into the settling chamber (the square compartment tween the two cylinders in the illustration) to give e hydroxide further action on the water and to permit e water to absorb the gases. The water is next passed thr h the two cylinders which are filled with white gra e

quartz, crushed to about the same consistency as granulated sugar. These cylinders with their quartz contents are merely filter beds through which the water is passed in order to remove the impurities which have been previously surrounded by the hydroxide.



Electric Filter.

From the filter beds the water is carried through the outlet at the extreme right in the illustration, or can be piped for an indefinite length throughout a building, with as many faucets as desired. The water is now ready for use and will be found clear as crystal, pure, sparkling and palatable, but still containing the life-giving properties provided by Nature, namely, the essential salts and gases. This fact has been demonstrated by many hundreds of chemical and bacteriological tests and is further vouched for by the diversified and high character of the users of the system.

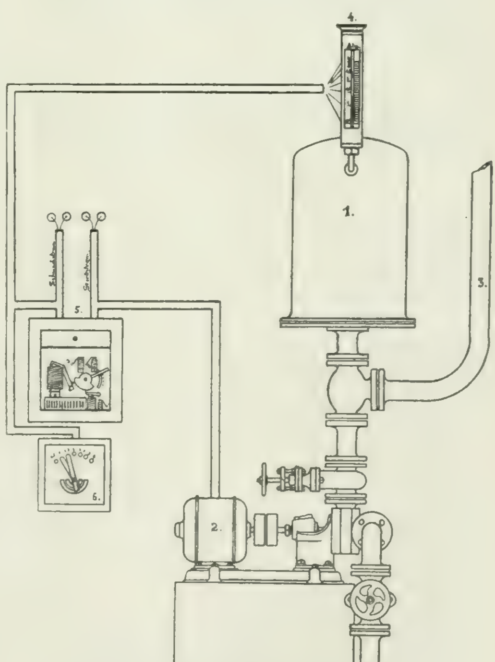
The machines are standardized and are built in various units to supply existing demands. Considering the result obtained the cost of installation is small and the expense of operation is practically only the cost of the small amount of energy required. The construction of the machine is simple and solid. There are no moving parts other than the contact valve, which is strongly constructed, and the polarity changer, where direct current is supplied. Where alternating current is used no polarity changer is needed. In operation the machine requires only a regular flushing of the filter bed by reversing the water current and removing the impurities through a drain pipe provided for that purpose. While flushing the machine the quartz in the filter is agitated by means of the detachable handle shown in the illustration, which fits on vertical shafts with blade attachments extending through the center of the cylinders.

Among those who have installed and are using this machine may be mentioned the following: Carnegie Steel Company, Pittsburgh, Pa.; Western Pennsylvania Institute for Deaf and Dumb, Wilkinsburg, Pa.; Western Pennsylvania Institute for Blind, Pittsburgh, Pa.; Colonial Trust Company, Pittsburgh, Pa.; Boggs & Buhl, Pittsburgh, Pa.; Westinghouse Machine Company, East Pittsburgh, Pa.; Union Trust Company, Pittsburgh, Pa.; George Westinghouse, Pittsburgh, Pa.; Huyler's, Pittsburgh, Pa.; Pittsburgh Trust Company, Pittsburgh, Pa.; Fidelity Title & Trust Company, Pittsburgh, Pa.; George F. MacDonald, confectioner, Pittsburgh, Pa.; Allegheny Theological Seminary, Pittsburgh, Pa.; The Philadelphia Company, Pittsburgh, Pa.; May Drug Company, Pittsburgh, Pa.; Kenyon Theater, Pittsburgh, Pa.; Rosenabum Company, Pittsburgh, Pa.; Superior Steel Company, Carnegie, Pa.; Johnstown Public Schools, Johnstown, Pa.; Lawrence Club, New Castle, Pa.; Carl H. Schultz, Inc., New York, N. Y., and the Hotel Martinique, New York, N. Y.

The above described apparatus is built by the American Electric Water-Purifying Machine Company, the New York sales office of which is in the Fifth Avenue Building.

AUTOMATICALLY CONTROLLED WATER-PUMPING SYSTEM.

An automatically controlled motor-driven pumping system, built by Rennert & Company, of Munich, Germany, is illustrated in the accompanying sketch. The outfit comprises a motor-driven centrifugal pump delivering into a system of mains to which is connected an air bell capable of withstanding pressures up to several atmospheres. When the pump is started the water rises in the bell, compressing the air above it until a pressure of about 60 lb is obtained, when the motor is automaticaly shut off through a relay switch controlled by a mercury-contact manometer. Demands for water are then supplied by the force of the compressed air in the bell, or "hydrophor," until this pressure has fallen to a point where the lower-limit contact of the manometer operates to restart the motor. The motor is automatically accelerated by the starting mechanism shown. Below the starter is the double-lever switch for adjusting the desired pressure limits at which the manometer acts to start and stop the motor. The manufacturer has applied a similar scheme to providing boiler-feed water as needed by boilers. This device is fitted with auxiliary alarm signals which operate when the allowable level limits are exceeded. Another application of the manometer control is its use in an automatic reducing valve, with which gradual pressure



Automatically Controlled Water-Pumping System.

reductions can be attained as low as 0.01 atmosphere. The contact relay, controlled by a thermometer, has also been used for maintaining constant the temperature of heating systems, drying-rooms, etc.

Industrial and Commercial New:

THE WEEK IN TRADE.

POLITICAL conditions are regarded by the majority of business interests as the greatest factor retarding the rapid growth of business at this time. The prolonged agitation over tariff revision has been and continues to be a source of widespread uncertainty, and the great number of investigations originating in the House have restricted application of the future policy of many of the great industries of the country. The general trend of feeling toward these influences has become more sanguine in the past few weeks, but there is every reason to believe that news of a resolution offered this week for adjournment of Congress on Aug. 22 was received with satisfaction in many industrial quarters. In the week just past many evidences of increasing confidence were shown and trade exhibited further signs of expansion. Buyers are appearing more freely in the various markets, and the volume of sales is increasing, although a large degree of conservatism still prevails. Building operations for July are reported as 14 per cent in excess of those for July, 1910, and the recent statement of unfilled orders on the books of the Steel Corporation showed an increase of 233,000 tons over the total reported for the period ended June 30. Mills are now operating on a larger percentage of capacity than has been the case in recent weeks and while a considerable portion of the activity is due to the placing of delayed orders for fall delivery, good business for the remainder of the year seems assured. Sentiment is improved by reports of further decrease in the number of idle cars. The government report on crops issued last week, while depicting unfavorable conditions, was not regarded seriously and better yields are expected than forecasted in the government's review. Weather conditions have been beneficial in the last few weeks and rain has fallen in many districts that were in need of moisture. Opinion in general is inclined to believe that trade has passed the critical stage and that steady advancement is assured. Business failures for the week ended Aug. 10 as reported by *Bradstreet's* were 208, as compared with 208 for last week, 231 for the same week in 1910, 219 in 1909, 249 in 1908 and 146 in 1907.

THE COPPER MARKET.

CONTRARY to expectations, no impetus was given to the buying movement by the favorable report of the Copper Producers' Association, and, aside from a small increase in the number of inquiries, the situation is unimproved. Producers are decidedly disturbed by the lack of response to the report and their only sources of encouragement are the continuation of foreign demand and the belief that stocks in consuming hands are low, as a consequence of prolonged absence from the market for large amounts. Consumers abroad have taken advantage of the low prices of the past few months and have purchased liberally and these foreign sales, as mentioned in previous issues, have been the sustaining element of the copper market. Inasmuch as the recent statement of the Copper Producers' Association showed an increase of over 250,000 lb. in the visible supply of copper abroad, it now looks as if foreign demand is approaching repletion and as if a lighter demand is imminent. Should this be correct, the shortage of copper and higher prices, recently predicted by the president of the Amalgamated Company, are remote and it is more probable, from present indications, that unless the policy of curtailme is maintained the outcome will be lower prices in order to ove the supplies at the mines. On the other hand there is a hood that the hope of the producers for early increase in d tic demand will materialize to a mild degree and this s nearly offset a temporary lull in business from abroad. Ex for the month, including August 15, were 11,656 tons. T daily call on the Metal Exchange, August 15, quoted copp per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.17½	12.37½	.....
August	12.20	12.37½	12.30
September	12.20	12.37½	12.30
October	12.20	12.37½	12.30
November	12.20	12.37½	12.30

The London market, August 15, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	56 10 0	56 7 6
Standard copper futures	57 5 0	57 2 6

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 16 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

INDUSTRIAL AND COMMERCIAL NOTES.

Electrical Equipment for New York's Fifty-five Building.—Bids on elevators, generators, engines and mechanical apparatus for the Woolworth building, no course of erection at Broadway, Park Place and Ba Street, New York City, are invited by the Thompson-St Company, general contractors on the work. Specification this equipment were drawn by Messrs. Mailloux & Knox signers of the electrical installation in the Metropolitan Insurance building and the Municipal Offices building in York. There are to be twenty-nine elevators and the ca the main group are to carry 2,500 lb. at a rate of 700 f minute. Bids are requested on three wire generators as lows: (a) one 200-kw unit, (b) one 300-kw unit and (c) 500--kw units, all at speeds of 100 r.p.m., for coupling dir engines. The commercial efficiency at full load, three-qu load and half load is to be not less, respectively, than th lowing: For the 200-kw unit 91, 91 and 89 per cent; fo 300-kw unit, 92, 92 and 91 per cent, and for the 500-kw 92.5, 92.5 and 91.5 per cent. Alternate estimates may be of first on three wire generators to have speeds of 150 r.p.m the 200-kw and 300-kw units, and 120 r.p.m. for the 50 units, and also on two wire machines with balancer sets. S fications for the engines call for either four-valve Corlis gines with releasing valve gear or four-valve engines with releasing valve gear, and alternate estimates are invite both simple and compound engines of both types.

New Electric Company in Maine.—The Bangor P Company has been incorporated at Portland, Maine, the i poration certificate, however, stating the company to be lo at Bangor, Maine. The authorized capital stock is $1,25 all common stock, and the purpose is stated to be the acqui and operation of the property formerly held by the Bo Water Power Company, and the rights and franchises o same company in the cities and towns of Bangor, Brewer, town, Bradley, Eddington, Hamden, Milford, Orono and V and such rights, property and franchises as may be acc elsewhere in Penobscot County. The property listed in incorporation certificate is the same as that which was re purchased by John R. Graham, president of the Bangor way & Electric Company and of the Lewiston, Augusta & terville Street Railway. The incorporators named in th tificate are Clifford E. McGlauflin, president; E. M. Mi treasurer; and H. M. Verrill, clerk; all of Portland, M the three officers constituting the board of directors.

Sale of Brooklyn Telegraph Company in Abeyan With further reference to advices that F. M. Delano of D has secured an option of four-fifths of the stock of the A can District Telegraph Company of Brooklyn, as mentior these columns July 1, Henry W. Kilbourne, secretary and urer of the company, said this week that no changes hav veloped in the situation and that negotiations will probal deferred until fall. Its charter covers both telegraph and phone service and it is understood that the Western int seeking control of the company will use this provision c charter to establish telephone competition in Brooklyn. Kilbourne said he did not know the nature of the plans consideration by the Detroit interests.

To Manufacture New Battery.—The Efficiency El ric Company, 4524 Lincoln Avenue, Chicago, has been form to manufacture a new type of dry battery invented by Ral G Carpenter and Charles G. Johnson. It is claimed to b the only 2-volt dry-cell made and capable of easy renewal.

Westinghouse Railway Orders.—Among orders recently [illegible] for Westinghouse railway apparatus are the following: From the St. Joseph, Mo., Railway, Light, Heat & Power [illegible]y for a partial equipment of interpole railway motors; [illegible] Denver & Inter-Mountain Railway Company, for quad-[illegible] equipments of interpole railway motors, with control; [illegible]n, Kan., Interurban Railway Company, for a double [illegible]nt of railway motors, with control; from Ford, Bacon [illegible] interests for the Birmingham, Ala., Railway, Light & [illegible]mpany, for a 1000-kw, 60-cycle, self-starting rotary [illegible] with the usual accompaniment of transformers, switch-[illegible] blowers, etc.; Capitol Traction Company of Washing-[illegible], for two complete sub-station equipments, one cov-[illegible] 1500-kw, 25-cycle self-starting rotary converter with [illegible]ssary transformers and switchboards, and the other a [illegible] 25-cycle self-starting rotary converter with switch-[illegible]nd transformers; Chicago Railways Company for [illegible]t for the extension of its La Salle Street sub-station, [illegible] two 3000-kw, 25-cycle self-starting rotary converters, [illegible] necessary transformers, and a 10-panel switchboard; [illegible] Power Company of Rapid City, S. D., for three [illegible] waterwheel generators, three 500-kw, 24,000-volt [illegible]ed transformers, three 200-kw, 24,000-volt self-[illegible]nsformers of 24,000 volts, and a large switch-[illegible] Georgia Railway & Electric Company of At-[illegible] a 1000-kw, 60-cycle self-starting rotary converter [illegible]sformers and switching apparatus; Interurban Rail-[illegible]any of Des Moines, Ia., for a 300-kw, railway rotary [illegible] self-starting, together with the necessary transform-[illegible] switching apparatus; Kokomo, Ind., Public Utility [illegible] for a 1500-kw turbo-generator unit, 500-kw self-[illegible]tary converter and the necessary transformers and [illegible] apparatus; Metropolitan Street Railway of Kansas [illegible] for a 3000-kw, 25-cycle, self-starting rotary con-[illegible] three 11,000-kw air-blast transformers and the nec-[illegible]tching and blower apparatus; Olympic Power Com-[illegible]rt Angeles, Wash., for two 3000-kw waterwheel gen-[illegible]ven 1000-kw 38,200-volt water-cooled transformers, [illegible]sual exciters and a large switchboard.

Ke[illegible]ne Electrical Instrument Company Change in Man[illegible]ent.—A change is announced in the management [illegible]ystone Electrical Instrument Company of Philadel-[illegible]rd P. Brown becoming president of the company, and Fr[illegible]klin Stevens resigning. J. W. W. Cornman, the former secret[illegible]y, will continue in that capacity and Mr. Stevens' ad-[illegible] interest will still be with the company. Richard P. [illegible]s for a number of years been president of the Brown [illegible]t Company of Philadelphia, established in 1860, the [illegible]ern in the United States manufacturing pyrometers, [illegible] has had wide experience in the design and manu-[illegible] scientific instruments. The voltmeters and amme-[illegible]actured by the Keystone Electrical Instrument Com-[illegible] always been designed in a manner to meet particu-[illegible]ral industrial service, and under the suggestions of [illegible]n slight changes in construction have been made [illegible] particularly recommend themselves to engineers. By [illegible]gement the Brown Instrument Company and the Key-[illegible]trical Instrument Company will manufacture pyro-[illegible]rmometers, speed indicators, draft gages, recording [illegible]tmeters and ammeters. In fact, the company is now [illegible]n to manufacture or repair practically any type of in-[illegible] In addition to the works and office at 9th Street [illegible]gomery Avenue, Philadelphia, an office will also be [illegible] for the present at 311 Walnut Street, and the branch [illegible] the Brown Instrument Company at Pittsburgh and [illegible] will now also handle Keystone instruments.

Forgn Trade Opportunities.—Schedule 7181, on file at the B[illegible]eau of Manufactures, Washington, D. C., states that [illegible] African consul in Asia has forwarded the name of a per-[illegible] in his district who wishes to obtain prices f.o.b. Seattle, Wash. with gross and net shipping weights, on the following electri[illegible] machinery: 250-kw, 60-cycle, three-phase, 2000-volt generator; 100-hp, 60-cycle, three-phase, 1000-volt motor; 75-hp, 60-cycle, three-phase, 1000-volt motor; 250-kw air-cooled step-up transformer, 2000 to 10,000 volts; 250-kw, air-cooled step-down transformer, 10,000 to 1000 volts; 10-kw, air-cooled step-down transformer, 1000 to 110 volts; 20-kw, air-cooled step-down transformer, 1000 to 110 volts; 350-hp turbine to operate under a 50-ft. head; a 10-in. centrifugal pump to work under 40-ft. head, and a 6-in., three-stage centrifugal pump for raising water 200 ft. Instruments, switchboard, etc., will be required.

Water Supply for Ohio Hydroelectric Company.—The Auglaize Power Company, of Toledo, Ohio, through its president, James M. Ashley, has secured a twenty-five-year renewal of its contract with the State for water-power from the Grand and Laramie reservoirs, at the rate of $4,000 per year. In addition to this payment the company is to maintain the two reservoirs and keep them in order. They were constructed seventy-five years ago to supply water for the canals in that part of the State. Waste water from the reservoirs will be used during the low-water periods to increase the supply for the hydroelectric plant that is being constructed on the Auglaize River, 3 miles above Defiance. The company will expend $100,000 in establishing facilities for collection, storage and transportation of water during the dry-weather periods.

Changes in Toronto Electric Light Directorate.—At the first meeting of the Toronto Electric Light Company since control was acquired by Mackenzie interests, as mentioned in a recent issue, a number of changes were made in officers and directors. The new directors of the company are: Sir William Mackenzie, Robert J. Fleming, manager Toronto Street Railway Company, D. B. Hanna, Z. A. Lash, general counsel Canadian Northern R. R.; E. R. Wood, H. H. Macrae, R. C. Brown and G. A. Morrow. Sir Henry Pellatt retains the office of president, while W. D. Matthews was succeeded as vice-president by D. B. Hanna, third vice-president of the Canadian Northern R. R. H. H. Macrae gave up the general managership of the company and became second vice-president.

Sale of Sioux Falls Light & Power Company.—H. M. Byllesby & Company, through their principal office at Chicago, confirm the reported purchase of the Sioux Falls Light & Power Company of Sioux Falls, S. D. This company owns and operates a hydroelectric station on the Big Sioux River, reinforced by a modern steam auxiliary plant, and serves the greater part of Sioux Falls with current for lighting, transportation and power. Formal possession will be taken in a few days, with N. C. Draper, formerly of Zanesville, Ohio, as manager. Improvements and extensions will be made to the property. The Bennett Light & Power Company at Sioux Falls has been sold to Frank Thompson of St. Paul.

W. S. Barstow & Company, Inc., Plan Appliance Demonstrations.—The success of the gas appliance campaign conducted earlier in the year by W. S. Barstow & Co., Inc., at their various gas companies has led to plans for a series of similar demonstrations of electric appliances at the electric companies. F. Lewis White, of the Barstow company, who had charge of the gas appliance campaign, will have charge, and will spend at least one week at each of the companies. Demonstrations will be given nearly all classes of appliances, and where prospects warrant it, the exhibit will be continued longer than a week.

New Colorado Power Company.—The Trinidad Transmission Railway & Gas Company has been incorporated with an authorized capital of $4,000,000, the incorporators being Messrs. C. H. Williams, R. H. Widdecamp, John M. Gates, C. W. Collins and A. S. Brooks. The company recently took over the Colorado Railway, Light & Power Company, as noted last week, and will begin operations in Las Animas, Heurfano, Pueblo, Fremont and Denver Counties.

Toledo & Ohio Central Railroad to Install Its First Telephone Train-Dispatching Circuits.—The Western Electric Company has received an order from the Toledo & Ohio Central Railroad for forty-eight telephone selector equipments for use on the eastern division of the road. Two circuits will be equipped, one extending from Bucyrus to Toledo, a distance of 70 miles, and the other from Bucyrus to Thurston, a distance of 78 miles.

Turbo-Generator for Evansville, Ind.—The Westinghouse Machine Company has received an order from the Evansville, Ind., Gas & Electric Company for a 1600-kw turbine of the improved high-speed, double-flow type. The electrical end of the unit comprises a Westinghouse generator normally rated at 2000-kva, delivering 3-phase, 60-cycle currents at 2300 volts.

Aluminum Notes and Prices.—The aluminum market as of August 15 is reported steady, with ingots for remelting held at 20@20½ cents spot No. 1, the base for large ingots. Rods and wire are quoted at 31 cents, and sheets at 33 cents.

Financial.

THE WEEK IN WALL STREET.

DECLINES were made in the majority of active issues in the latter part of the previous week, and in many cases prices nearly reached the lowest figures of the year. The chief cause of the activity was the unfavorable grain report issued by the government, and other matters lending their influence to the downward movement were the continuation of investigations and rumors of heavy liquidation of large holdings. Thursday's transactions reached a million shares. Railroad issues were traded more extensively than other securities on the list and experienced the heaviest declines. Recovery took place in Monday's market and nearly all stocks gained a point over Saturday's prices. Foreign buying was on a larger scale and higher prices were made in international stocks, assisting the trend of the local market. Trading was irregular throughout the day and after a period of dullness in the afternoon advances were made at the close and the highest prices for the day were made at that time. Weakness in the wheat markets reflected news of better conditions from the crop centers. The market on Tuesday was irregular, and Monday's recovery was not advanced, several important issues suffering further decline. United States Steel was the only issue on which a gain was registered and in this case the advance was small. The tone of the market was discouraging to many, not from a standpoint of prices alone, but by reason of the check given to the advance of an outside buying movement. The most encouraging news on Tuesday was the government's weekly report on crop conditions. Both corn and wheat have been improved by the good weather that has prevailed and strong hopes are entertained for yields better than indicated by the August report. The bond market is unsettled as a result of conditions in the stock market. Demand is light, but the prospects for early increase are regarded as good. The money market is hardening slightly with harvesting plans. Rates August 15 were: Call, 2¼@2½ per cent; ninety days, 3¼@3½ per cent. The quotations in the tables are those at the close, August 15.

NEW YORK

	Aug. 8.	Aug. 15.	Shares Sold.		Aug. 8.	Aug. 15.	Shares Sold.
All. Ch.	6¼*	6¼*	100	Int. Met., pf.	45½	43¼	8,725
All. Ch. pf.	22¾	20	900	Mackay Cos.	85⅛	83	700
Amal. Cop.	64¼	62	79,010	Mackay C., pf.	74½*	72*	400
Am. D. T.	20½*	20½*	———	Man. Elev.	137½*	135*	400
Am. Loco.	38	37*	2,850	Met. St. Ry.	15*	15*	———
Am. Loco., pf.	106*	107½	200	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	79¾*	79¾*	———	Steel, com.	74⅞	73¾	1,009,110
Am. T. & T.	135⅞	134⅝	10,370	Steel, pfd.	116⅞	115¾	8,830
B. R. T.	76⅞	75¾	25,100	W. U. T.	76½	74½	5,900
Gen. Elec.	155	154½	7,750	West'h, com.	66	65½	6,200
Int. Met.	16⅞	15½	3,100	West'h, pfd.	118¼*	118¼*	———

PHILADELPHIA.

	Aug. 8.	Aug. 15.		Aug. 8.	Aug. 15.
Am. Rys.	44½	44½*	Phila. R. T.	23½	23
El. Co. of A.	11⅝	11⅞	Phila. Elec.	17¾	17⅝
Elec. St. Bt'y.	53	52⅜	Phila. Trac.	85½	86*
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	51⅜	51

CHICAGO.

	Aug. 8.	Aug. 15.		Aug. 8.	Aug. 15.
Chi. City Ry.	186*	186*	Com. Edison	134	132
Chi. Elev. Rys.	26½*	25*	Chi. Subways	3⅛	2¾*
Chi. Elev. Rys.	93*	93*	Chi. Tel Co.	123*	123*
Chi. Rs., Ser. 1	95	95*	Nat'l Car	111	110½*
Chi. Rs., Ser. 2	30¼	30	Nat'l Car, pfd.	118½*	118½*

BOSTON.

	Aug. 8.	Aug. 15.		Aug. 8.	Aug. 15.
Am. T. & T.	135	134½	Mex. Tel.	4*	4¼*
Cum. Tel.	157½*	156	Mex. Tel., pfd.	6*	6*
Edison E. Ill.	286	286½	N. E. Tel.	148½	147½*
Gen. Elec.	155¼	153½	W. T. & T.	19	18¼
Mass. E. Ry.	20¾	19¾*	W. T. & T., pfd.	99*	96½*
Mass. E. Ry., pf.	92½*	91			

*Last price quoted.
Shares sold for the week, Aug. 7 to Aug. 12.

FINANCIAL NOTES.

Denver City Tramway Bonds Offered.—Russell, Brewster & Company, of Chicago and New York, are offering first and refunding sinking fund mortgage twenty-five-year 5 per cent gold bonds of the Denver City Tramway Company dated November 1, 1908, and due November, 1933, at 95 and interest to yield about 5⅜ per cent. The company was incorporated in 1899 and operates the entire street railway system of Denver, consisting of 223 miles of track, and the bonds are secured by direct mortgage on 197 miles of track within the city limits. The authorized issue is $25,000,000, of which $4,720,000 is outstanding. Of the balance $10,911,800 are reserved to retire all other bonds of the system, and $9,368,200 are for additions and permanent improvements under carefully guarded res tions. The bonds are callable as a whole, but not in part, ex pt for sinking fund, at 105 and interest, on any interest peri fr and including May 1, 1914, to and including November and thereafter at 102½ and interest, upon sixty days The franchises of the company are without time limit 1907 were held by the United States Circuit Court to valid at least until 1935, two years beyond the life of thes Gross earnings of the company for the year ended Dece 1910, were $3,595,158, and operating expenses were $1 leaving net earnings of $1,735,907. After deducting all excepting interest on these bonds, there was left a ba $829,754, which represents more than three and one- interest requirement on the bonds outstanding.

Keystone Telephone Earnings.—In the twelve ended June 30 the revenues of the Keystone Telephor pany were the largest in the history of the company earnings were $1,153,788, as compared with $1,126,030 and net earnings were $581,784, as compared with $56 the previous period. Interest charges showed a decrea $293,383, as against $302,775, and the surplus available dends increased from $265,177 in 1910 to $288,401 in fiscal period. Each of the statements in the past five y been an improvement on the one preceding it and associated with the company regard the prospects as f for continuation of this record. Announcement is m the proceeds of the $300,000 two-year 5 per cent nc to Dick Bros. & Company by the Keystone Telephone will be used for extensions and betterments within two years. These improvements are in addition to t which provision was made in the regular annual appro It is not known at this time whether these notes wi funded at a later date into a more permanent form o but it is believed from the present rate of earnings company should be in a position to take them up from

Western Electric Business.—Although gross sales Western Electric Company for the month of July we cent less than in July, 1910, and it is unlikely that the will earn the $71,000,000 expected from the scale of bu the earlier part of the year, gross sales for the seven m the current year are 4 per cent in excess of those in responding period of 1910. The present rate of busin cates a total of $66,000,000 for the year, approaching cl record of 1906, when gross totaled $69,000,000. Reports various territories show that July sales in the east we equal to those in July, 1910, and that the falling of month was in the central and western territories. Att called to the decrease in the average amount of each or increase in the size of the company and in the numbe tomers. Whereas in 1910 the average of orders was $72, a decrease as compared with previous years, the ave the present year is approximately $70. It is stated th persons are now employed by the company, as against 1906. Foreign business is reported satisfactory and th of all departments is regarded as favorable in view of ness in general trade.

Boston Edison Makes Excellent Financial Show forecast of the annual report of the Edison Electric Illu Company of Boston, to be issued early in the fall, indic the company has made the best showing of any year ir tory. Gross earnings for the fiscal year ended June as already made public, amounted to $5,257,913, an inc $548,457, or 11.65 per cent over the year preceding. pected that the report will show net earnings avail dividends of over $2,300,000, equivalent to 14.7 per cent 156,037 shares outstanding, and an increase of about over a year ago. Increase in the amount of divider during the past year, due partly to the new issue of st partly to the 12 per cent rate, will about absorb this increase.

Cities Service Earnings.—The report of the Cit Service Company, for ten months ended July 31 gives on stocks of subsidiary companies as $718,219. Other was $32,863, and gross earnnings were $751,082. Expenses were $23,299, leaving net earnings of $727,783. Divid on preferred stock were $413,956, leaving a balance of available for dividends for common stock. Dividends on the common stock amounted to $118,650, after payment of which a surplus of $195,177 remained.

San Joaquin Light & Power Corporation.—N. W. Halsey & Company are offering the unsold balance of $1,000,000 first and refunding 5 per cent sinking fund gold bonds of the San Joaquin Light & Power Corporation at 93 and accrued interest, [illegible]d 5.43 per cent. These are dated 1910 and are due in [illegible]. Net earnings in the past year were more than three times all bond interest. A letter of W. G. Kerckhoff, president of the company, says in part that the outstanding bonds of the company, including those now offered, have been issued for [illegible]pletion of a massive dam at the outlet of Crane Valley, [illegible] San Joaquin River, which has increased the capacity of the Crane Valley reservoir to 51,000 acre-feet, thus providing [illegible]ble water to operate the company's hydraulic plants to their [illegible] capacity during the entire season, with a large amount in reserve; for the completion of the new San Joaquin power-house, having a capacity of 21,400 hp; for the erection of a steam turbine plant at Bakersfield, Cal., with a capacity of 10,-[illegible]; for the completion of a high-voltage transmission line [illegible]ting all the properties; double-tracking and otherwise [illegible]ing the Bakersfield Electric Railway; and for making [illegible]etterments which will largely increase the earning power [illegible] corporation.

[illegible]s-Chalmers Earnings.—While the annual report of [illegible]is-Chalmers Company for the fiscal year ended June 30 [illegible]t be made public until October, it is thought that a con-[illegible]e decrease will be shown in both gross and net earnings [illegible]pared with those for the preceding year. Interests asso-[illegible] with the affairs of the company are quoted, however, as [illegible] that there is little doubt that interest requirements will [illegible]ned, and that there will be a small margin over all [illegible]. It is further stated that the policy of the directors in [illegible]g monthly appropriations from net earnings to deprecia-[illegible]ounts has been enforced throughout the year, and that [illegible]robability the total appropriation will equal that of the [illegible]receding. Reports of current earnings show improve-[illegible]nd it is estimated that the plants of the company are [illegible]erating between 50 per cent and 60 per cent of capacity. [illegible]ss, however, is reported as irregular, orders from some [illegible]s of the country being nearly upon a maximum scale, [illegible]n others a falling off is noted.

[illegible]untain States Telephone Company.—The $6,500,000 [illegible]ness of the Rocky Mountain Bell Telephone Company, [illegible]ed in the issue of July 29, which gave an account of [illegible] the company to the newly formed Mountain States Tele-[illegible] Company, will be assumed by the latter. The Mountain [illegible] Company will give 14,217 shares of its stock in exchange [illegible]95 shares of Rocky Mountain Bell Telephone stock, and [illegible]so pay dividends at the rate of 7 per cent, dating from [illegible], in case the transaction is consummated, and the stock is [illegible]ged on or before September 30, 1911. President Lane of [illegible]cky Mountain Company says, in a statement to stock-[illegible], in reference to a meeting scheduled for August 17 to [illegible] the sale of the company, that this transaction is only a [illegible] the plan which directors have been considering for [illegible]g all telephone properties in the Rocky Mountains under [illegible]nagement and ownership.

[illegible]ederal Receiver Appointed for Winona Railway, Light & Power Company.—In connection with the passing of interest due July 1 on $495,500 bonds of the Winona Railway, [illegible] & Power Company, of Winona, Wis., mentioned in these [illegible]s July 29, it is learned that Howard Norris of Milwaukee [illegible]n appointed receiver for the company by the United [illegible] District Court. A cash tender of $12,735 for payment [illegible] defaulted interest to the Old Colony Trust Company of Boston, trustee for the bondholders, was offered by C. C. Smith for the receivers as a plea against appointment. Objection to the tender was made by attorneys for the trust company on the ground that the tender was not offered in good faith.

[illegible]nited Wireless System to Be Maintained.—Selden Bacon, who was recently appointed receiver in bankruptcy of the United Wireless Company by the United States Circuit Court for the District of Maine, states that all the stations of the company will be maintained and kept in active operation. Mr. Bacon starts shortly upon an extended trip through various sections of the country embraced by the stations of the company. It is stated that although many operators of the United Wireless Company at shore stations on Lake Michigan have not received regular salaries since June, all are at their keys to protect shipping and passengers from disaster, but that none will accept commercial business.

Toronto Street Railway Stock Increase Ratified.—At a special meeting held August 14, stockholders of the Toronto Street Railway Company accepted the plan to increase the capital stock from $8,000,000 to $12,000,000. It was announced that the additional capital will be disposed of as follows: Two millions at par are to be issued to stockholders, $1,000,000 is to remain in the treasury, and $1,000,000 is to be divided among stockholders as a stock dividend. This distribution applies to stockholders of record August 25. It was further explained that the additional capital will be used in improving the system.

Receiver for La Crosse Water-Power Company.—Upon petition of a bondholders' committee, a receiver has been appointed for the La Crosse Water Power Company, of La Crosse, Wis. The receiver, Clement C. Smith, of Milwaukee, at once appointed Mr. W. J. Ferris, president of the company, as general manager. The financial difficulty of the company was due to shortage of water in reservoirs during the past two years, which small rainfall has been without precedent, as mentioned in these columns March 30. Plans for increased storage capacity were made, and it is expected that work on these will now proceed.

Plan to Retire Northwestern Elevated Bonds.—Advices from Chicago state that the Northwestern Elevated Railroad Company will retire the $18,000,000 first mortgage bonds which mature September 1. The trustees of the Northwestern Elevated will meet next Monday and formally authorize a new first mortgage of $25,000,000 on all the company's property. This mortgage must be held as part of the collateral security of the Chicago Elevated Railway's issue of $30,000,000 5 per cent three-year notes.

Foreign Interests to Promote Electric Industry.—Announcement is made that a number of European contractors, financiers, and electrical engineers have formed an association known as the Griffiths Electric Contractors, Ltd., to finance design, contract and operate electrical works in various countries of the world. J. Norton Griffiths, E. P. Powles, R. D. McCarter, and J. Kerr Bock are named as members of the London board of management. It is stated that a number of leading French firms are also interested.

Winnipeg Electric Railway Matters.—Negotiations are still in progress between Sir William Mackenzie, president of the Winnipeg Electric Railway Company, and a special committee of the city council for arranging a sale of all the interests of the company in Winnipeg on a basis of $24,000,000.

Omaha Company Increases Stock.—The authorized capital stock of the Omaha Electric Light & Power Company has been increased from $2,500,000 to $4,000,000 by the addition of $1,500,000 common stock. Preferred stock is now $1,000,000 and common stock $3,000,000.

DIVIDENDS.

Brooklyn Rapid Transit Company, quarterly, 1¼ per cent, payable Oct. 1.

Cities Service Company, monthly, preferred, one-half of 1 per cent; common, one-quarter of 1 per cent; both payable Sept. 1.

Northern Texas Electric Company, semi-annual, preferred, $3.00 per share; common, quarterly, $1.50 per share; both payable Sept. 1.

St. Joseph Railway, Light, Heat & Power Company, quarterly, one-half of 1 per cent, payable Sept. 1.

Terre Haute Traction & Light Company, preferred, 3 per cent, payable Aug. 21.

REPORT OF EARNINGS.

LAKE SHORE ELECTRIC RAILWAY COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
June, 1911	$113,950	$58,182	$55,768	$34,604	$21,163
" 1910	103,533	52,244	51,289	34,751	16,537
6m., June, '11	558,585	313,129	245,457	208,003	37,454
" " '10	526,727	298,697	228,030	208,601	19,420

NIAGARA, LOCKPORT & ONTARIO POWER COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
6m., June, '11	$270,859	$87,587	$181,187	$125,000	$56,187
" " '10	247,[illegible]	84,564	155,721	125,000	[illegible]

ONTARIO POWER COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
3m., June, '11	[illegible]	$37,610	$186,779	$167,536	[illegible]
" " '10	170,374	33,192	151,916	137,747	14,168

General News

Construction News.

TUCSON, ARIZ.—It is reported that H. A. Smith, of this city, has perfected plans for the installation of a large electric power and irrigation system near Noria, Sonora, Mex., which, in addition to supplying electrical energy for the operation of four mines and smelters, will furnish electricity for lighting the town of Llano and water for the irrigation of about 15,000 acres of land. A reservoir site near Noria has been selected, and engineers are at work on the project.

ESCONDIDO, CAL.—The City Trustees have granted to the Escondido Utilities Company a sixty-day extension of time, from Aug. 1, in which to install the additional street lamps which will increase the lighting facilities of the city about 40 per cent. The urgent demand for connections from circuits already installed is responsible for this delay.

FALLON, CAL.—An application has been filed by the citizens of Fallon for the right to utilize the surplus electrical energy from the transmission line which the government proposes to construct from the La Hontam dam.

FRESNO, CAL.—The Fresno, Hanford & Summit Lake Railway has applied to the Board of City Trustees for a franchise to construct an electric railway over I and Tuolumne Streets in Fresno.

LOS ANGELES, CAL.—The city of Los Angeles has entered into a contract with the Southern California Edison Company to light the streets at the harbor (San Pedro) with arc lamps at $5 per month, the same as the former contract. Provision is made for the termination of the contract any time after Jan. 1, 1913.

RIVERSIDE, CAL.—The Board of Public Utilities, Riverside, Cal., has ordered the lowering of the lighting rate from 9 cents to 7 cents per kw-hour; for cooking and heating, 3 cents, and power from 6 cents to 4 cents at the municipal plant.

SACRAMENTO, CAL.—An electric-lighting system is to be installed in Capitol Park. It is planned to have twenty lamps on standards in the outer portion of the park, sixty lamps along the walks about the building and twelve lamps on the Capitol dome, the wires being placed in conduits. The estimated cost of the system is $13,000.

SAN JOSE, CAL.—The Peninsula Railway Company has applied to the City Council for permission to construct an electric railway in Alum Rock Park.

TULARE, CAL.—The Tulare Power Company, which was recently organized for the purpose of developing electrical energy for use in Tulare County, and incidentally to furnish service for the new Holly electric railway, will commence at once the construction of the auxiliary plant which it proposes to establish at Tulare, the work to be in charge of former City Electrician W. E. Caffrey, of Reno. A site has been secured near the eastern limits of the city on the Truckee River, at which point it is expected that about 5000 hp can be developed. The directors of the new company are Fred Billings, of Tulare; Mr. Smith, of Strathmore; Messrs. Brisco and McQuerry, of Lindsay, and C. H. Holly, of Porterville.

CANON CITY, COLO.—A special meeting was held recently in this city to consider a proposition of New York capitalists to construct an electric line to the top of the Royal Gorge, the estimated cost of such construction being $230,000. A guarantee of 6 per cent on the investment was asked.

NEW HAVEN, CONN.—The Board of Aldermen has voted to grant Yale University the privilege of installing conduits in certain streets, for the accommodation of the new Yale buildings erected on Pierson-Sage Square. It is estimated that the conduit system will represent an expenditure of $250,000, and the heating plant proper to be located on Pierson-Sage Square another $250,000, making a total expenditure of $500,000 for this central-lighting plant.

NEW MILFORD, CONN.—It is expected that the New Milford Electric Light Company will extend its transmission lines to Bridgewater and Kent at an early date, application for service in these towns having been made.

SAYBROOK, CONN.—The Shore Line Electric Railway Company is seeking an amended charter giving it power to generate and transmit electrical energy in several shore towns. The company will also furnish the energy required for operating the new drawbridge at Old Saybrook.

SOUTH MANCHESTER, CONN.—The South Manchester Light, Power & Tramway Company, which recently took over the North End lighting equipment, is planning to improve that portion of its system by considerable new construction, and by increasing the emf at North End from 1200 volts to 2400 volts. It is also the company's intention to extend its transmission lines to Talcottville and Buckland.

SOUTH NORWALK, CONN.—The Housatonic Power Company has recently acquired possession of the Westport Water Company, which furnishes a lighting service in Westport, Saugatuck and Greens Farms. The deal involves the transfer of the permanent charter to f[urn]ish Westport with water and electricity, the riparian rights held b[y] the company and its up-to-date plant and property. While no definite [state]ment has been made, it is generally believed that the Housatonic [com]pany will dispense with the electrical portion of the Westport [pl]ant, supplying energy from its own power stations.

WINSTED, CONN.—The lighting committee of the Board of Wa[r]den[s] has under consideration the installation of a modern system of [stre]et lighting in Winsted, recommendations for such a system having [bee]n submitted by A. C. Winchester, consulting engineer, of South No[rwalk], and W. W. Young, of New York.

WASHINGTON, D. C.—A bill has been introduced by Senator [...] authorizing the Conrad-Stanford Company to erect a power plan[t and] stamp mill on the banks of the Yellowstone River in the Yellow[stone] National Park, for the purpose of operating the Crevasse mining c[laim]. It is also the intention of the Conrad company to construct a tra[nsmis]sion line from the power plant to the mine.

WASHINGTON, D. C.—Schedule 7181, on file at the Bure[au of] Manufactures, Washington, D. C., states that an American con[sul in] Asia has forwarded the name of a person in his district who wis[hes to] obtain prices f.o.b. Seattle, Wash., with gross and net shipping we[ights] on the following electrical machinery: 250-kw, 60-cycle, three [phase,] 2000-volt generator; 100-hp, 60-cycle, three phase, 1000-volt motor; [...] 60-cycle, three phase, 1000-volt motor; 250 kw, air-cooled step-up [trans]former, 2000 to 10,000 volts; 250-kw, air-cooled step-down transf[ormer,] 10,000 to 1000 volts; 10-kw, air-cooled step-down transformer, 1[000 to] 110 volts; 20-kw, air-cooled step-down transformer, 1000 to 110 [volts;] 350-hp turbine, to operate with a 50-ft. head; a 10-in. centrifugal [pump] to work under a 40-ft. head; and a 6-in., three-stage centrifugal [pump] for raising water 200 ft. Instruments, switchboard, etc., will [be re]quired.

JACKSONVILLE, FLA.—Bids will be received by the Board of [...] Trustees until Sept. 4 for the removal of certain machinery fro[m the] old electric-light plant to the new power station now being constr[ucted] near Tallegrand, and for building the superstructure of the new pl[ant].

ALBANY, GA.—The Albany (Ga.) Transit Company has bee[n in]corporated to construct an electric railway in the city and suburba[n dis]tricts of Albany. The company has an authorized capital stock of [...] 000, and the incorporators are: C. W. Rawson, S. B. Brown, [...] Putney, W. W. Page and J. A. Davis, all of Albany.

DALTON, GA.—Application for a 30-year franchise in this ci[ty has] been made by the Georgia Power Company, of Gainesville, Ga. If granted, it is expected that the work of extending the company's [trans]mission lines to Dalton will be commenced at an early date.

MAYSVILLE, GA.—Advices have been received from J. M. Gill[...] City Clerk, that no definite action has yet been taken for the con[struc]tion of a water-works and electric-light plant.

LEWISTON, IDAHO.—The Nez Perce Water Power Company, [which] furnishes a lighting service in Nez Perce and is also interested in [...] electric developments in northern Idaho, contemplates the extensi[on of] its transmission lines to the Lewiston district. The company rec[ently] passed into the hands of Messrs. Welch & Montague, of Portland.

STITES, IDAHO.—The City Councilmen have decided to con[struct] a dam and electric power plant near Stites, which will furnish a lig[hting] service in that city, as well as energy for operating the pumps a[t the] proposed municipal water works. The installation will cost in the [neigh]borhood of $3,000.

DEKALB, ILL.—An ornamental street-lighting system will pro[bably] be installed in DeKalb at an early date, the City Council having [the] matter under consideration.

FAIRBURY, ILL.—A contract has been awarded by the Fai[rbury] Electric Light Company for a new 300-hp boiler.

MONMOUTH, ILL.—It is the intention of the Western Ston[e...] Company to electrify its plant No. 1 at this city, the contract having [been] awarded to the Monmouth Public Service Company, which installe[d the] electrical equipment in its plant No. 2.

PEORIA, ILL.—A new ornamental street-lighting system is to b[e in]stalled in this city; a committee, consisting of Messrs. Spurck, O'[...] McDowell, Rehfuss and T. O. Grimm, having been appointed by the [...] Street Ornamental Lighting Association to select the proper stand[ards,] advertise for bids and proceed immediately with the installation.

SPRINGFIELD, ILL.—The organization of the Springfield & N[orth]western Interurban Railway Company, which proposes to construc[t an] electric line from Springfield to Petersburg, passing through Anc[...] Cantrall, Athens, Tice and Old Salem, has been perfected. The [com]pany will have a capital stock of $15,000, and the following directors [have] been named: Homer J. Tice, Greenview; R. Y. Kincaid, Athens; [...] Keys, W. F. Workman, Ralph N. Baker, Frank Reisch, Jr., and [...] Prather, Springfield.

[illegible]RD, IND.—The merchants of the Industrial Association [illegible] are perfecting plans for the installation of a new [illegible] of street lighting throughout the business district. [illegible] lamp will be employed, placed on iron and steel standards [illegible].

[illegible]RSVILLE, IND.—It is stated that the installation of the [illegible] and power plant at this city, in which [illegible] is largely interested, will be commenced at once, the con[illegible] the construction of the buildings and the necessary concrete [illegible]ng been placed with Greenwood & Conner. The plant will [illegible] with the existing plants.

[illegible]ORDSVILLE, IND.—The trustees of the municipal electric-[illegible] no energy is used, is made necessary, the [illegible]te, in order to cover the depreciation of transformers, meters [illegible] and the constant [illegible]. Apparently there has been [illegible].

[illegible]VILLE, IND.—For some time the City Council has had [illegible]deration the matter of furnishing the city with a more ade-[illegible] either from an enlarged municipal plant or from [illegible] Interurban power house. Manager Minton, of [illegible]r company, has now agreed to furnish energy at a flat rate [illegible] kw-hour delivered at the plant, [illegible].

[illegible], IND.—It is stated that the Indiana Steel & Iron Company, [illegible] incorporated with a capital stock of $100,000, will [illegible]nd equip a water-works, electric-light and power plant, as well [illegible] the old rolling mill for the manufacture of iron and steel. [illegible] the enterprise, and the company [illegible]reat development in Greene County. W. J. Hamilton is resi-[illegible].

[illegible]L BLUFFS, IA.—The contract for lighting arrangements for [illegible] to be held in this city the first week of September, involving [illegible]g of approximately 3500 16-cp incandescent lamps, has been [illegible] Electric Company.

[illegible], IA.—Plans are being [illegible] by the Des Moines [illegible]er Company for the construction of two dams near Douds [illegible] develop 2000 hp each. Contracts have been secured for [illegible]all of the land between Keosauqua and the proposed Douds [illegible] The citizens of the latter city are said to look with favor upon [illegible]ion. Should the required consents for the construction of [illegible]ot be obtained, however, it is said that a site will be secured [illegible].

[illegible]GE, IA.—It is understood that the citizens of Ft. Dodge have [illegible] of $125,000 of bonds for the construction of a [illegible] power plant and water filtration system.

[illegible]SBURG, KAN.—The contract for building the power house for [illegible] company at this city has been awarded to J. G. [illegible].

[illegible]PTON, KAN.—A special election has been called by the Mayor [illegible]on for the purpose of voting on a $2,500 bond issue, the pro-[illegible] utilized for the installation of an up-to-date lighting system.

[illegible]ON, KY.—The O'Bannon Improvement Club is reported [illegible] this place to promote a new electric-lighting, cold-storage and [illegible]g company. It is proposed to purchase the old power house [illegible]ville & Eastern Railway Company at Marcia, Ky.

[illegible], KY.—At a recent meeting of the City Council [illegible] [illegible]ved for the enlargement of the municipal electric-light plant. [illegible] that several thousand dollars will be spent on the proposed im-[illegible].

[illegible]PORT, LA.—The Council on Aug. 9 passed on second read-[illegible]nance accepting the local electric-light company's offer to give [illegible]ng service for six years at $62.50 per lamp. With the ordi-[illegible] provision that the city shall have the right to purchase the [illegible]g system of the present company at its appraised value [illegible]nd of the six years, providing the city also acquires the water-[illegible].

[illegible], MAINE.—A new electric-lighting system, which w[illegible] all-night service, is being installed in Bingham by the Mai[illegible] Company.

BALTIMORE, MD.—An application has been filed by the Consolidated Gas, Electric Light & Power Company for permission to erect a gen-[illegible] at Heath and Leadenhall Streets, the estimated cost of which [illegible] $[illegible].

CHICOPEE, MASS.—On account of inability to take care of its present contracts to furnish service to local industries, the electric-light [illegible] petitioned the Board of Aldermen [illegible] the proceeds to be used for the enlargement and improve-[illegible]e municipal electric-light plant. The members of the electric-[illegible]mittee are Dennis Murphy, chairman; C. H. Jenness and [illegible].

EASTHAMTON, MASS.—The State Gas and Electric Light Commission has granted the application of the Easthamton Gas & Electric [illegible] Company for permission to issue additional bonds of $[illegible], the proceeds to be used to liquidate the company's indebtedness and to complete construction work at the Mount Tom plant.

FALL RIVER, MASS.—Permission has been granted to the Tiverton Electric Light Company, Tiverton, R. I., to extend its transmission lines in Fall River.

GREENFIELD, MASS.—The County Commissioners have approved the plans of David B. Carse, of New York, for the construction of a dam of reinforced concrete 64 ft. in height on the Deerfield River, about a mile below the Gardner Falls dam of the Greenfield Electric Light & Power Company. The commissioners approval is subject to the condition that the Carse plans and specifications be made to comply with certain recommendations of Engineer J. L. Tighe, of Holyoke, calling for reinforcement of the dam proper.

LAWRENCE, MASS.—The Water Board of this city will receive bids until 3 p. m., Aug. 23, for a turbine-driven centrifugal pump and condenser for handling 3,000,000 gal. in twenty-four hours. J. F. McCarty is president of the board, and Morris Knowles consulting engineer.

LEE, MASS.—The Smith Paper Company is erecting a large brick structure south of the Columbia mill, it being the company's intention, according to newspaper reports, to use it as a power station in connection with the electrification of its mills.

MANSFIELD, MASS.—The property of the Massachusetts Coal & Power Company, of this city, has been sold by order of the receiver, Irvin McD. Garfield, to Joseph A. Haley, representing a syndicate, for $10,400. The plant consists of 1700 acres of land and buildings, and leases in mining rights on about 400 acres of land.

MEDFORD, MASS.—In order to expedite the operation of the locks at the recently constructed dam at Cradock Bridge, Medford, the Park Commission has ordered the installation of electric motors to replace the present hand machines.

NORTH EASTON, MASS.—The Edison Electric Illuminating Company, of Brocton, is planning to extend its transmission lines to North Easton, an application for permission to erect poles and string wires on the principal streets of the town having been filed wtih the Selectmen.

PEABODY, MASS.—At a recent meeting of the finance committee of Peabody, an appropriation of $2,000 was recommended for the extension of the municipal electric-light plant, the original request for $3,000 being denied.

HANCOCK, MICH.—The city of Hancock, which receives its lighting service from the Houghton County Electric Light Company, is considering the advisability of installing a municipally owned plant. It is estimated that an expenditure of about $15.000 would be required to install the generating equipment, irrespective of the poles, wires and other apparatus. The city's contract with the Houghton County Company expires next year.

ISHPEMING, MICH.—It is the intention of the city officials to expend $15,000 in overhauling the municipal electric-light plant. The transmission lines of the company are to be extended from the power plant to the Cleveland-Cliffs Iron Company's plant at the Maas mine, arrangements having been made with the company to furnish the city's patrons with light whenever the municipal plant is out of commission.

LAPEER, MICH.—We are advised by C. D. Hulbert, superintendent of the Lapeer Gas-Electric Company, that the company is in the market for a 200-hp boiler, 150-lb. pressure.

MANISTEE, MICH.—A franchise to furnish electrical energy in this city has been granted to the Manistee County Electric Company, and work will be commenced within three months on the construction of its first dam over the south branch of the Manistee River.

BROWN'S VALLEY, MINN.—The contract for the construction of the electric light plant at this city has been awarded to the Minneapolis Steel & Machinery Company, of Minneapolis, for $10,950. Charles L. Pillsbury, Minneapolis, is engineer.

CANBY, MINN.—E. W. Erick, M. O'Toole and Fred Schult, of South St. Paul, have secured a franchise for the installation of an electric-light, heat and power plant at Canby.

DULUTH, MINN.—Plans are being considered by the West End Commercial Club for the installation of an improved system of lighting on Superior Street, the estimated cost being about $3,500.

DULUTH, MINN.—It is announced that the Zenith Telephone Company had decided to postpone its contemplated improvements, including the erection of a new $20.000 building at the West End.

EVELETH, MINN.—Bids for the purchase of a franchise for constructing and operating an electric line through Eveleth, to be part of an interurban line to run between Hibbing and Gilbert, have been advertised for by the city clerk.

MINNEAPOLIS, MINN.—The following are reported to be the bids for (a) engine and (b) generator for use in connection with the proposed electrical plant at the city crematory, or (c) total cost: Northwest Electrical Company, (a) $9,732, (b) $10,173, (c) $44,506; Electric Machinery Company, (b) $8,279; Minneapolis Steel & Machinery Company, (a) $8,786, (b) $9,475; Allis-Chalmers Company, (c) $20,427; R. B. Whittaker, (c) $17,991; Electric Machinery Company and Frank Cook, $17,550 and $18,350, respectively, on a pole line; the Electric Machinery Company, $1,941 on a switchboard, and the General Electric Company, $21,984 on generators, lamps, switchboard and all electrical equipment.

TOWER, MINN.—By a vote of ninety-two to eight the city of Tower voted on Aug. 7 in favor of an $18,000 bond issue, the proceeds to be

used for the construction of a dam and electric-light plant at Pike River, 6 miles from the city, from which point electrical energy will be supplied [illegible].

WABASHA, MINN.—It is reported that the Minnesota-Wisconsin Power Company, of Menominee, Wis., will construct a 66,000-volt transmission line to Wabasha.

CLARKSDALE, MISS.—H. S. Boles, City Engineer, writes that bids will be received Sept. 5 for the extension and improvement of the water works, sewers and electric-lighting system, the probable cost of such improvements being in the neighborhood of $55,000.

FORSYTH, MO.—A petition is being circulated in Taney County by Attorney C. H. Grooms, of Forsyth, under the direction of Gen. William H. Standish, to secure permission from property owners to divert the waters of the White River from a portion of land 10 miles below Forsyth, the object being to construct a second dam at that point. General Standish is interested in the James River dam proposition, and it is possible that work on the first project will not be carried out until after the White River dam is built.

KANSAS CITY, MO.—We are advised by Louis H. Egan, general manager of the Kansas City Electric Light Company, Kansas City, Mo., that to the best of his knowledge and belief the city has no intention of installing a municipal electric-light plant. Our item in the issue of August 5 should have read Kansas City, Kan., instead of Kansas City, Mo.

ST. LOUIS, MO.—The St. Louis & Jennings Railway Company has applied to the County Court of Slayton for a franchise to construct an electric railway from the western limits of the city to the Jennings Station Road.

CHOUTEAU, MONT.—The local electric-light plant, which was acquired two years ago at a sheriff's sale by Julius Hirchberg, has been sold to H. McCullough, of Corbin, Mont. It is the intention of the new owner to put the plant in first-class condition so as to be able to furnish lighting service by Sept. 1.

BRAINARD, NEB.—The contract for installing a water-works system and erecting the electric-light plant of Brainard has been awarded to the Almo Engine & Supply Company, Omaha, Neb., for $10,713.

CURTIS, NEB.—Plans are being completed for the installation of a municipal electric-light plant at this city. Charles F. Sturtevant, civil engineer, is in charge of the work.

LINCOLN, NEB.—As the result of a fire at this city the lighting plant was put out of service. No damage, it is stated, was done to the pumping machinery.

OMAHA, NEB.—Application for permission to construct an electric railway from Sioux City to Omaha has been made by the Omaha, Sioux City and Northern Railway Company.

OMAHA, NEB.—The portable power plant used as the south-side substation of the street railway company, and which was used for distributing energy to the Manawa line, was destroyed by fire during a recent electrical storm, the damage, almost wholly to machinery, being estimated at $18,000.

WYMORE, NEB.—F. W. Weeks, City Clerk, writes that the contract for constructing 10 miles of street lighting lines (bids opened Aug. 9) has been awarded to the Columbian Electrical Company, of St. Joseph, for $8,303.

ELY, NEV.—Newspaper reports state that a large power plant is shortly to be erected on Cleve Creek by the Telluride Power Company, of Provo, Utah.

JARBIDGE, NEV.—An electric-light and power plant is to be installed at the new camp of Jarbidge, for the operation of the mines and mills. A company capitalized at $100,000 has been organized by Gilmore Kinney, Jr., J. M. Kinney, J. T. Brunn and George F. Elliott, all of Jarbidge.

MANCHESTER, N. H.—In order to furnish the energy lacking because of the low-water conditions, the Amoskeag Manufacturing Company expects to install a 5000-kw generator at its large plant. It is stated that a number of additional motors will also be installed.

MEREDITH, N. H.—The transmission lines of the Meredith Electric Light Company are being extended along Lang Street.

BLOOMFIELD, N. J.—Engineers Runyon & Carey, of Newark, N. J., in a report to the Town Council on Aug. 7 recommended the construction of a municipal street-lighting system which would also provide for a commercial service.

JERSEY CITY, N. J.—It is quite probable that an improved lighting system will be installed on Newark Avenue, from Warren Street to Coles Street, the shopping district, a committee representing the Business Men's Association of Jersey City having requested the Mayor to authorize an appropriation for this purpose.

TRENTON, N. J.—The Board of Public Utility Commissioners has given its approval to the revised plan for the consolidation of the Bernards Electric Company, the Warren County Power Company and the Eastern Pennsylvania Power Company. Under the new plan the Bernards Water Company, Bernardsville, N. J., is to sell to the Bernards Electric Company all of its real and personal property, constituting its electric light and ice plants, for $125,000. The electric company, after purchasing the property, is to issue bonds to the water company in the sum of $125,000. The bonds are to be secured by a mortgage. The next step will be the sale and conveyance of the electric company's property t the Eastern Pennsylvania Power Company, which in turn will le the property to the electric company. The power company is to pu $1,000 of the capital stock of the electric company for cash at p and this stock is to be mortgaged to the Commercial Trust Comp , of Philadelphia. Approval of this plan was given subject to the restion that no extensions or betterments should be made to the property any of the companies without first obtaining the approval of the Boar

ENGLE, N. M.—The Secretary of the Interior, Washington, has awarded the contract to the Lidgerwood Manufacturing Comp New York, for furnishing three cableways for use in the construc the Engle Dam, Rio Grande Irrigation project, New Mexico. cableways each have a span of 1420 ft. and are to be electrically op

KELLY, N. M.—A small electric light and power plant is installed at the Germany mine in this place.

TUCUMCARI, N. M.—R. G. Lafite, who recently took over th electric-light plant and organized a company known as the Tu Light & Power Company, is planning many improvements in the A new powerhouse is to be erected in which new generators and will be installed, the transmission lines of the company extended the residential district and an all-day service provided for the op of electric motors. The voltage of the system will be changed fr volts to 110 volts.

BROOKLYN, N. Y.—Bids will be received by C. B. Snyder, intendent of School Buildings, until Aug. 21 (readvertisement) installation of electrical equipment in the Washington Irving High Borough of Manhattan.

COMSTOCK, N. Y.—Bids will be received by Joseph F. Scott, intendent State Prisons, Capitol Building, Albany, N. Y., until A for construction, including heating, plumbing and electric work fo connecting corridors, laundry and bath houses, mess hall and building, power house, punishment prison and conduits, including plant at Great Meadow Prison, Comstock. Franklin B. Ware, Alt the state architect.

JAMESTOWN, N. Y.—The Odsonia Worsted Mills is installing hp steam turbine engine and two additional tubular boilers.

LOCKPORT, N. Y.—A mortgage for $25,000,000, given by the Telephone Company to the Trust Company of America, of New has been recorded in the Western New York counties in wh properties of the telephone company which secures it are located is said to be the final step in the recent acquirement by the company of a large number of independent companies west of Sy including Niagara Falls, North Tonawanda, Lockport, Middlepor port, Sanborn, Medina and other places.

NAPLES, N. Y.—We are advised by Edward L. Bailey, of the Electric Lighting Plant, that he has made application to the Service Commission of New York to exercise and enjoy a fr granted by the Village Board of Naples, Ontario County, N. Y., t poles and string wires for the purpose of supplying electric serv fifty years. The system will be 60-cycle.

WATERTOWN, N. Y.—Plans are being perfected by the Department Store to install its own electric system. The plant located in the new Anthony Street addition which the comp erecting, and will cost in the neighborhood of $3,500.

GREENSBORO, N. C.—On account of the shortage of water dams, the Southern Power Company has made temporary arrang with the White Oak cotton mill, which operates a 10,000-hp pl supply electrical energy to several North Carolina cities.

MOTT, N. D.—The North Dakota Independent Telephone Com constructing a telephone line from this city to Bismark.

BEACH CITY, OHIO.—It is the intention of the citizens of City to construct a 26-mile electric railway from Beach City to burg by way of Winesburg, Mount Hope and Berlin.

CINCINNATI, OHIO.—The Ohio Valley Electric Railway Co of Cincinnati, contemplates the erection of an addition to its house at Kenova, W. Va.

COLUMBUS, OHIO.—Bids will be received until Aug. 22 by Holton, Director Public Service, for furnishing and installing a lighting system on Dublin Avenue, also at the same time a separ for 866 ornamental standards.

KENTON, OHIO.—Bids were opened Aug. 3 for pumping mac etc., and a contract for a 65-hp engine was awarded to the Browne pany, of Dayton, and a 40-kva generator to the Ft. Wayne Company. The contract for pumps has not yet been let. Brossman, Union Trust Building, Indianapolis, Ind., is the con engineer.

NORTH LIMA, OHIO.—A fire of unknown origin totally de the freight and passenger depot, as well as the substation, of the Y town & Southern Railway Company, of Youngstown, Ohio. The electrical machinery alone, exclusive of the buildings, is stated in the neighborhood of $25,000. It is understood that the power will not be rebuilt at North Lima, but that, if a new structure is e it will be located at Columbiana.

SHARON, OHIO.—The City Council has under consideration the establishment of a municipal electric-light plant. Estimates are being secured on the cost of erecting such a plant and on the cost of

... and it is believed that active steps will be taken at an early date ... toward the installation of an up-to-date system.

WORCESTER, OHIO.—A $10,000 plant is to be installed at the Experiment Station, bids for which, it is announced, will not be advertised.

OKLAHOMA CITY, OKLA.—The reorganization of the Oklahoma-... Interurban Railway Company has been effected, and ... charter ... in the name of the Oklahoma-Shawnee Railway Company. ... concern is to be capitalized at $3,000,000, and proposes to con... electric line 100 miles in length, the work to be commenced ... next few months. L. E. Patterson is president of the com... line is to be affiliated with the Oklahoma City Traction ... of which Mr. Patterson is also president. While the line is to ... ally operated, the company in its articles of incorporation re... right to operate by steam if necessary. It also reserves the ... operate a telegraph and telephone system and electric plants in ...

... OKLA.—Bids were opened Aug. ... for the ... water works and an electric plant, and the contract has ... to the Oklahoma Engineering Company, of Oklahoma City, ... Other bidders were: N. S. Sherman Machine & Iron ... Kennedy & Fleming, ... and Fletcher & Holtz, ...

...N, ORE.—The equipment of the Municipal Electric Light & ... plant is to be increased from 260 hp to 560 hp, this action having ... red necessary in order to meet the increasing demand for ...

...AND, ORE.—Arrangements are being made by the Mt. Hood ... Power Company for the construction of a substation at the ... liams Avenue, the cost of which will be in the neighborhood ...

...AND, ORE.—Plans have been matured by the Portland (Ore.) ... ght & Power Company for improvements that will represent ... ture of $135,000. The work will include the installation of ... power-house equipment.

...RG, ORE.—The Oregon Gas & Electric Company is installing ... plant at Roseburg, the cost of which, it is stated, will exceed ...

...—The only bid received and opened on Aug. 11 at the ... Panama Canal Commission at Washington, D. C., for one ... turbo-generator unit was submitted by the General Electric ... of Schenectady, N. Y., at $26,623, if delivered in ninety days, ...

...BURG, PA.—Preliminary steps toward the organization of ... electric-lighting company in this city are said to have been ... it is understood that a charter will be applied for at an ... The new company, the promoters of which are all citizens ..., is to be known as the People's Light Company of Gettys... it is planned to interest as many local people as possible in ... The names of those directly responsible for the proposed ... have not as yet been made known, but it is understood that ... ives of the company have already been securing prices on ... and equipment.

...BURG, PA.—On account of the proposed merger of the elec... plants of Sunbury, Northumberland, Milton and Lewisburg, ... lders of the newly organized Citizens' Company of Lewisburg ... ed to increase the capital stock of the company from $15,000 ... with the intention of constructing at once an up-to-date elec... plant. It is estimated that about $30,000 will be expended by ... in the construction of this plant.

...ELPHIA, PA.—Bids will be received until Aug. 25 by ... Hasskarl, Acting Director Department of Wharves, Docks and ... electric freight elevators for the Vine Street pier.

...ON, PA.—A private lighting and heating plant, with an ... for 200 arc lamps and an equal number of incandescent lamps, ... operate elevators and cash systems, and that will supply heat ... story building of the Globe Warehouse, of Scranton, is to ... by that company. All of the heat and electricity used in ... building is to be produced in the company's plant.

...ELD, S. C.—We are advised by F. M. Boyd, owner of the ... ting plant at Johnston, S. C., that, owing to some slight ... in the election, the town of Edgefield will be compelled ... other election on the question of issuing bonds for the estab... an electric-light plant.

...ON, S. C.—According to advices received from F. M. Boyd, ... the electric-light plant at this city, a bond issue for a water-... em is to be voted on very shortly, and should the election carry ... water works will be operated in connection with the electric-...

SIOUX FALLS, S. D.—The Bennett Light & Power Company, which derives its energy from the waters of the Big Sioux River and is one of the two great hydroelectric plants in Sioux Falls, has been acquired by Fr... Thompson, of St. Paul, the purchase price being $80,000.

GREENVILLE, TENN.—W. T. Mitchell, City Recorder, writes that the proposed water-works and electric-light plant will cost about $65,000. Bids ... yet called for. W. S. Shields, of Greenville, is the engineer.

JOHNSON CITY, TENN.—The power plant of the Johnson City Traction Company is being enlarged. A new boiler room is being built and new boilers are to be installed. There is also some talk of connecting Johnson City with Jonesboro by an electric line, the improvements which are being made at the power plant enabling the traction company to furnish energy for its operation.

KNOXVILLE, TENN.—Application for permission to install a lighting system in this city has been filed by the Eastern Tennessee Power Company, of Parksville, and it is understood that the Ocoee Power Company will also ask for the same privilege.

BRENHAM, TEX.—A twenty-four-hour service is soon to be established by the electric lighting company of this city. New machinery is being installed and the system will be changed from 133 cycles, 1100 volts, to 60 cycles, 2200 volts.

DEL RIO, TEX.—The Del Rio Electric Light & Ice Plant has been sold to W. R. Payne, the consideration being $37,550.

FT. WORTH, TEX.—The Ft. Worth Southern Traction Company has received a franchise from the County Commissioners' Court to build an electric railway from Ft. Worth to Cleburne by way of Everman, Burleston and Joshua.

KENNEDY, TEX.—A franchise to install an electric-lighting system in Kennedy has been granted by the City Commissioners to J. D. Autry and D. D. McAda.

FARMINGTON, UTAH.—Representatives of Farmington, Kaysville and Bountiful are considering a proposition to purchase the electric light plant of the Davis County Power Company, which went into the hands of a receiver about a month ago, it being believed that the property can now be obtained for half of its original value of $150,000. The Davis County Company has been furnishing energy for lighting the streets in Kaysville and Farmington, and it is planned, if the deal is consummated, to make the plant a municipal station for the three above-mentioned towns.

OGDEN, UTAH.—The Davis & Weber Counties Canal Company will let a contract about Aug. 31 for the construction of its proposed hydroelectric plant at Riverdale; it is reported that the contract for the excavation and concrete was let on Aug. 12.

PARK CITY, UTAH.—Pending the hearing of a suit to decide its right to occupy a piece of land owned by N. J. Hansen, P. A. Sorenson and W. Richards, in Parley's Canyon, Judge M. L. Ritchie has granted to the Knight Power Company the right to construct a high-tension transmission line from its plant on the Provo River in Wasatch County to its plant at the mouth of East Mill Creek, the proposed construction of which has been previously mentioned. The company has been required to give a $500 bond to guarantee the defendants against damage.

NORTH TROY, VT.—The Frontier Electric Company, which was recently organized with a capital stock of $30,000, is to construct a generating plant for the distribution of energy at a point about two miles south of North Troy. Water rights have been secured, and a concrete dam is to be erected west of the Duboise bridge, which, it is estimated, will develop 800 hp for ten hours a day and 200 hp for the remainder of the day. The Frontier Company has purchased the plant and lighting system of the North Troy Electric Light & Power Company, and upon completion of the new plant the two systems will be interconnected.

GRANDVIEW, WASH.—A fifty-year franchise to supply electrical energy in this city has been granted to the Pacific Power & Light Company, of Portland, Ore., and it is expected that a lighting system will be installed inside of sixty days.

HILLYARD, WASH.—On account of dissatisfaction over the rates charged by the Washington Water Power Company, the citizens of Hillyard are considering the installation of a municipal plant, a committee composed of Messrs. J. F. McGinnis, A. M. Murray, Jesse Jones, H. R. Jones, J. E. Barr and others having been appointed to look into the matter.

MOUNT VERNON, WASH.—An application has been filed by the Nooksack Valley Traction Company for permission to build an electric railway through Mount Vernon.

SOUTH BEND, WASH.—Among the improvements planned by the Twin City Power & Electric Company are the construction of an electric line from South Bend to Raymond and the erection of a new substation midway between the two cities.

SPOKANE, WASH.—The International Power & Manufacturing Company has filed articles of incorporation and proposes to construct a dam across the Spokane River at the site of the new paper mill at Millwood, from which electrical energy will be furnished to manufacturing concerns in the immediate vicinity for the operation of lamps and motors. The capital stock of the company is placed at $250,000, and the incorporators are: W. S. Yearsley and Martin H. Gerry, Jr.

STEVENSON, WASH.—E. P. Ash and S. Samson have made arrangements to file claims on Wind River, about 18 miles northwest of Stevenson. Their intention is to organize a company to be known as the Cleom Tumwater Light & Power Company, capitalized at $250,000, the greater number of shares to be held by themselves. Mr. Stevenson is the owner of the Skamania Light & Power Company, of Skamania, and is at present furnishing energy for lamps and motors in that city and Carson. It is expected that 6000 hp can be developed at the falls on Wind River without a dam, and that with a dam the power can be doubled or trebled.

VANCOUVER, WASH.—The Portland Railway, Light & Power Com-

[illegible] of establishing a new steam-power plant at Vancouver., and instead will erect a substation, electrical energy being supplied from its Portland plant through two new cables which will be laid under the river. Two new transformers, additional switches and other necessary apparatus will be installed in the new station.

WHITE BLUFFS, WASH.—The Pacific Power & Light Company is planning to expend between $6,000,000 and $10,000,000 in the development of hydroelectric power on the Columbia River at Priest Rapids, [illegible] a dam 85 ft. in height at the Rapids and the construction of transmission lines which will supply electrical energy to a large section of eastern Washington.

MORGANTOWN, W. VA.—The National Power Company, of Pittsburgh, has been granted a charter under the laws of West Virginia. The company proposes to build a scenic electric railway from Point Marion up Cheat River for several miles. The incorporators are: F. B. Parriott, W. B. Beecher, E. J. Cole, W. H. Young and S. B. Kelly, all of Pittsburgh, Pa.

JANESVILLE, WIS.—The city is planning to install a street-lighting system similar to that employed at Des Moines, Ia., an investigation of this system having been placed in the hands of the Janesville Commercial Club.

MENASHA, WIS.—The total amount of the contracts awarded for the municipal electric plant at this city was $18,000, and not $8,000 as stated in a previous issue.

MENDOTA, WIS.—The contract for the construction of the new power house for the State hospital at Mendota has been awarded to T. C. McCarthy, of Madison, for $38,850.

NEW LISBON, WIS.—W. A. Sargent, City Clerk, will receive bids until Aug. 23 (readvertisement) for constructing an electric-light plant and water works. Aug. H. Meyer, Appleton, Wis., is the engineer.

STOUGHTON, WIS.—The City Council has approved final plans for the installation of a municipal lighting system, and a power house is to be erected at a cost of $6,000 at the city mill dam.

LARAMIE, WYO.—Advices have been received from the Laramie Electric Company, A. E. Anderson, superintendent, that contracts have been let for extensive improvements in its plant, including the installation of a water-tube boiler, non-releasing Corliss engine-driven, three-phase alternator and an entirely new switchboard. A tank and all appurtenances for a steam-heating system for the business district is also to be installed.

KAMLOOPS, B. C., CAN.—It is stated that the municipality of Kamloops will expend $200,000 in the development of a hydroelectric plant at Barrier River.

REVELSTOKE, B. C., CAN.—The contract for constructing the second flume at the power plant has been awarded to the Pacific Coast Pipe Company, of Vancouver, for $7,425.

PORTAGE LA PRAIRIE, MANITOBA, CAN.—The city's offer of $110,000 for the plant of the General Electric & Gas Company, mention of which was recently made in these columns, has been accepted by the company.

THAMESFORD, ONT., CAN.—At a recent meeting of the citizens of this city and the surrounding district, including Kintore, final action was taken on the proposition to utilize hydroelectric service in and about Thamesford, the voting having been unanimous in favor of the adoption of such a system.

MONTREAL, QUEBEC, CAN.—At a recent meeting of the directors of the Porcupine Gold Mines Company, held at its offices, 47 West Thirty-fourth Street, New York, the plans and specifications for a new mill and power plant submitted by C. H. Porrier, the manager, were approved, and orders for machinery will be placed at once. The new plant will have a rated output of 100 tons per day.

OAXACA, MEXICO.—It is reported that Jose Vasconcelos, of Mexico City, representing a syndicate of Americans, has applied to the City Council of Oaxaca for a franchise to install an electric-light and power plant in the latter city. It is the purpose of the syndicate to construct transmission lines to many of the towns and mining camps of the state and provide them and the various industries with electrical energy.

New Industrial Companies.

AMERICAN NIEUPORT AEROPLANE COMPANY, New York, N. Y., has filed articles of incorporation, and expects to manufacture and deal in aerial machines. It is capitalized at $50,000, and the incorporators are: A. A. Ryan, I. V. McGlone, K. R. Howard, W. J. Reed, all of 32 Liberty Street, New York.

THE AMERICAN LIGHTING COMPANY, Camden, N. J., has been incorporated to manufacture incandescent lamps, gas burners, etc. It is capitalized at $25,000, and the incorporators are: E. R. Hansell, G. H. B. Martin and J. A. MacPeak, all of Camden.

THE AUTO-ELECTRIC COMPANY, Mobile Ala., has applied for a charter to do general electrical work. It has an authorized capital of $10,000, and those responsible for its formation are E. B. Walzl, W. B. Royster, A. C. Carroll, A. C. McClellan and F. Geddings.

NEWTON A. K. BUGBEE & COMPANY, Trenton, N. J., has filed articles of incorporation for the purpose of conducting a general contracting, engineering and construction business. The authorized capital of the concern is placed at $100,000, and the incorporators are: A. K. Bugbee, H. W. Bradley and B. H. Bugbee, all of Trenton.

CALIFORNIA INCANDESCENT LAMP COMPANY, Los Angeles, Cal., has been incorporated with a capital stock of $100,000 by H. P. Oates, J. E. Bowen, B. B. Lady, O. O. Clark and W. S. Davis

THE ELECTRIC EQUIPMENT COMPANY, Springfield, [illegible], capitalized at $10,000, has been incorporated by H. F. Ford, J. T. [illegible] and W. A. Coon.

THE ELECTRICAL CONSTRUCTION & SUPPLY COMP[illegible] New Bedford, Mass., has been incorporated with a capital stock [illegible] 000. The incorporators are: Ernest L. Howe and Sylvanus P. [illegible]

THE G. & E. FONDEN ROCK DRILL COMPANY, Philadel[illegible] has been incorporated with a capital stock of $500,000 to ma[illegible] electric rock drills. The incorporators are: B. F. Harpel, To[illegible] C. A. Smith, Chester, Pa., and T. Thompsen, Philadelphia, Pa.

THE IGNITION MANUFACTURING COMPANY, Newar[illegible] has been incorporated with a capital stock of $100,000 by P. [illegible] A. Markowsky and W. L. Roder, all of Newark. The new con[illegible] poses to manufacture automobiles, motor vehicles, supplies, etc.

THE INTERNATIONAL SANITARY TELEPHONE CO[illegible] New York, N. Y., has filed articles of incorporation. It is c[illegible] at $50,000, and the incorporators are: A. L. Carter, 60 Wall Str[illegible] York; I. A. Edelstein, 61 E. 112th Street, New York, and C. [illegible] shank, 498 Westminster Road, Brooklyn, N. Y.

THE IRIS AEROPLANE COMPANY, New York, N. Y., has [illegible] corporated with a capital stock of $25,000 to manufacture an[illegible] aeroplanes. The incorporators are G. H. Godley, C. D. Jarvis, N[illegible] City; S. S. Godley, Cincinnati, Ohio.

New Incorporations.

MOLINE, ALA.—Articles of incorporation have been filed [illegible] Moline (Ala.) West Shore Traction Company. The new conce[illegible] is capitalized at $10,000, proposes to construct an electric railw[illegible] Moline to Alabama Port, near the west shore of Mobile Bay. Th[illegible] of the company are: H. Austell, president; J. N. McAleer, v[illegible] dent; E. E. Posey, secretary and treasurer.

SACRAMENTO, CAL.—The North Sacramento Light & Wa[illegible] pany has filed articles of incorporation, and the following direc[illegible] been elected: Marshall Diggs, R. C. Waring and M. N. Willia[illegible] Sacramento; D. W. Johnston, of Los Altos; G. A. Richards, o[illegible] ville; C. E. Hollister and J. T. Elliott, of Courtland. The com[illegible] an authorized capital stock of $50,000.

SAN BERNARDINO, CAL.—The Sierras Construction Com[illegible] the Southern Sierras Power Company have filed incorporatio[illegible] the capitalization in each instance being $5,000,000, and the inco[illegible] of each company are: Delos A. Chappell, Lawrence C. Phipps, [illegible] F. Potter, G. S. Wood, T. S. Hayden and W. E. Porter. Thes[illegible] enterprises that are behind the various moves for franchises [illegible] been asked for by F. A. Worthley, of Riverside.

GARNER, N. C.—The Garner Telephone & Telegraph [illegible] capitalized at $10,000, has been incorporated by J. T. Wrenn, M[illegible]llers; H. Bryan, Garner; C. U. Harris, Raleigh.

MIDDLETOWN, OHIO.—At a special meeting of the City Co[illegible]cil an ordinance was passed providing for the installation of cluster l[illegible] Third Street, between Canal Street and Curtis Avenue, a dis[illegible] about 700 ft. on each side of the street.

DENVER, PA.—Articles of incorporation have been filed [illegible] Denver Electric Light & Power Company. It has an authorize[illegible] stock of $5,000, and the incorporators are J. W. Moore, Mon[illegible] Sheridan; Robert Immell, Oscar Witter, James Cherington, D[illegible] Horn, J. F. Mattis, A. Fisher, N. P. Coldren, Newmantown; D. [illegible] tin, Bellevue, and A. W. Marberger, Denver.

CAMDEN, S. C.—A charter has been granted to the Camden [illegible] Light Company, of Camden, by the Secretary of State. The [illegible] which has a capital stock of $70,000, proposes to do a general [illegible] service business, and the incorporators are: J. T. Harrington, [illegible] town, Ohio; E. C. Brainard, Chicago; R. E. Cornelius, Youngst[illegible] W. M. Shannon and H. G. Garrison, both of Camden.

SIOUX FALLS, S. D.—It is announced that H. M. Byllesby [illegible]pany, engineers and managers of public utilities, 206 La Salle St[illegible] Chicago, Ill., have purchased the plant of the Sioux Falls Light [illegible] Power Company, of Sioux Falls, S. D. This company owns and [illegible] hydroelectric generating plant on the Big Sioux River, reinfor[illegible] by modern steam auxiliary station, and serves the greater part [illegible] Falls with energy for lighting, transportation and industrial [illegible] poses. Formal possession will be taken in a few days, with N. C. [illegible] formerly of Zanesville, Ohio, as manager. Improvements and e[illegible] will be made to the property.

WEST POINT, VA.—A charter has been granted to the Peopl[illegible] Light, Heat & Power Company, West Point, Va. The maximum capital [illegible] placed at $25,000, minimum capital, $5,000. The following officers h[illegible] been

el[illegible]ed: J. R. McRae, president; Crosby Thompson, vice-president; A. J. B[illegible]by, secretary; H. R. Topping, treasurer, all of West Point.

[illegible]POKANE, WASH.—The Bellingham, Mount Baker & Spokane Inter-[illegible] Railway Company, capitalized at [illegible], has [illegible] articles of [illegible]ration.

Personal.

[illegible] F. BEAMS has resigned as manager of the Northern Ontario [illegible] Power Company, Cobalt, to accept the position of chief electrical [illegible] State of Mysore, India. Mr. Beams sail[illegible] New [illegible] his new post on Aug. 16.

R. S. B. TUELL, formerly manager of the Key West (Fla.) Elec-[illegible] has been appointed superintendent of the Pawtucket [illegible] Company to succeed Mr. Donald C. Barnes, who will [illegible] charge of electrical and traction properties for Stone & Webster [illegible] State of Washington.

[illegible] L. ARNOLD, of the Arnold Company, Chicago, accompanied [illegible] Arnold, has sailed for Europe for an eight weeks' stay, following [illegible] proceed on a leisurely trip around the world, [illegible] February, 1912. Although Mr. Arnold is [illegible] principally for recreation, he plans to investigate a number of [illegible]f engineering interest in the countries he will visit.

[illegible] C. DRAPER, formerly superintendent of the Zanesville (Ohio) [illegible]f the Columbus, Newark & Zanesville Electric Railway, which [illegible]lectric lighting for Zanesville, has been appointed manager of [illegible] Falls Light & Power Company, of Sioux Falls, S. D., which [illegible]ntly acquired by H. M. Byllesby & Company, Chicago. Mr. [illegible]as for a time master mechanic for the Central Railway Com-[illegible] Peoria, Ill., and later became superintendent of the Peoria and [illegible]rminal Railway. Before going to Zanesville, Mr. Draper was [illegible]lent and general manager of the Eastern Wisconsin Railway [illegible]pany, of Fond du Lac, Wis.

Obituary.

[illegible]ILLIAM DUNLAP SARGENT, director of the New York [illegible] Jersey Telephone Company, of which he acted as general man-[illegible] was first formed, died at his summer home in Somerset, [illegible] Aug. 10, following a long illness. Mr. Sargent served as tele-[illegible]rator at General Burnside's headquarters during the Civil War. [illegible] member of the Telegraphers' Mutual Benefit Association and [illegible]merican Institute of Electrical Engineers. He was sixty-seven

Trade Publications.

[illegible]AULIC PUMPS.—The Watson-Stillman Company, 50 Church [illegible] York, has issued Catalog No. 81, a new 120-page, 6 x 9 [illegible]escriptive of many standard and several new types of hydraulic [illegible] Useful information for hydraulic engineers and users of hy-[illegible]achinery is also included.

[illegible]MATIC CUT-OFF VALVE.—The Lagonda Mfg. Co., Springfield, O., has issued a circular relating to the Lagonda automatic cut-off valve, which is stated to be the only valve which has been admitted, up to date, to the Museum of Safety Devices in the Engineering Societies Building, 39 West 39th Street, New York. The valve is so made as to close automatically if a break occurs on either side of the valve. The circular described some tests made at Washington in January, 1909, in which a 4-in. valve was used, showing the reliability of the mechanism.

BUSINESS NOTES.

CHICAGO OFFICE OF JAEGER MINIATURE LAMP MFG. COMPANY.—A branch office of the Jaeger Miniature Lamp Mfg. Company of New York (Bible House) has just been opened at the Rand-McNally Building, 157-173 West Adams Street, Chicago, Ill. A full line of Jaeger miniature lamps, automobile lamps, novelty outfits and Christmas-tree outfits will be carried in stock at the Chicago wareroom, which is located in close proximity to the office.

GENERAL MOTORS COMPANY.—Mr. William Vaughan, chemist, of Arthur D. Little, Inc., chemists and engineers, Boston, has been detailed from that organization as an assistant in the new centralized testing department which has just been organized under its direction for the General Motors Company, Detroit, Mich. Mr. Vaughan brings to this work experience with Arthur D. Little, Inc., as well as with the Salem Iron Company and Union Iron & Steel Company, where he filled the position of chief chemist.

PULSOMETER COMPANY.—Mr. F. B. DeGress, for over ten years New York district manager of the Crocker-Wheeler Company, has resigned from that company to assume the position of general sales manager of the Pulsometer Company, 17 Battery Place, New York City. Besides looking after the sales end of the business, Mr. De Gress is also carrying on a series of experiments, with a view to improving certain features of the pulsometer in order to make it suitable for general pumping work in power plants, industrial establishments, etc.

CHICAGO OFFICE OF FEDERAL MINIATURE LAMP COMPANY.—A branch office of the Federal Miniature Lamp Company, 812 Hippodrome Building, Cleveland, Ohio, has been established at 301 Fort Dearborn Building, Chicago, Ill. The new office is in charge of Mr. Frederick S. Armstrong, brother of Mr. Walter R. Armstrong, general manager of the company, who has had about fifteen years' experience in the lamp business. The Chicago warerooms are located in the Cambridge Building, corner of Randolph and Fifth Avenue. More than 100,000 miniature lamps, embracing scores of different styles and types, are here carried in stock.

ESTERLINE DETROIT BRANCH OFFICE.—The Esterline Company, Lafayette, Ind., manufacturers of the Esterline graphic meters and the "Matchless" electric-light and ignition system, announces the appointment of Mr. Le Moyne L. Parkinson as district sales manager for the State of Michigan, with his office at Detroit. Mr. Parkinson leaves the Standard Underground Cable Company, Pittsburgh, Pa., with which he has been associated for the past five years in charge of the sales of underground cable for electrical purposes. He was graduated from Geneva College in 1895, and the same year entered the employ of the Beaver Valley Water Company, in whose employ he continued for eleven years as assistant general manager. He is also a graduate of Rand's Commercial College, and of a special course in electrical engineering at the Cosmopolitan University, New York City.

Weekly Record of Electrical Patents

[illegible]NITED STATES PATENTS ISSUED AUG. 8, 1911.

[illegible]red by Robert Starr Allyn, 16 Exchange Place, New York.]

[illegible] TELEPHONE SYSTEM; P. B. Allen, Elyria, O. App. filed [illegible] 29, 1909. A complete set of signals controlled for guiding [illegible]erators in making connections on a trunk circuit.

[illegible] TELEPHONE SYSTEM; P. B. Allen, Elyria, O. App. filed [illegible], 1909. Trunking system. Apparatus for giving a distinctive [illegible] to both the calling subscriber and the central station whenever [illegible]lled line is already in use.

[illegible] ELECTRIC-CIRCUIT-OPERATING DEVICE; E. S. Beck, [illegible]lers, Pa. App. filed Nov. 30, 1909. Two electrodes (one [illegible]able) in an electrolyte and a manually controlled switch for [illegible]g the removable electrode.

[illegible] MECHANICAL MOVEMENT; T. S. C. Both, New York, [illegible] App. filed July 2, 1910. Electric lamp socket switch with [illegible] key and sliding cam and contacts.

[illegible] MECHANICAL MOVEMENT; T. S. C. Both, New York, [illegible] App. filed July 2, 1910. Division from application 570,138. [illegible]ctric lamp circuit rotary snap switch socket with laterally movable [illegible]

999,7[illegible]. METHOD OF FORMING COILS FOR ELECTRIC AP-[illegible]RATUS; L. W. Chubb, Wilkinsburg, Pa. App. filed June 25, [illegible]07. An aluminum strap is bent into coil form (edgewise) and [illegible]mersed in a bath of sodium silicate and cement is pressed through. [illegible] convolutions are then pressed together.

999,7[illegible]. ELECTRIC RAILWAYS; R. J. Dearborn, Edgewood Park, [illegible] App. filed July 6, 1908. Lazy tongs support for a plurality of [illegible]leys for two overhead conductors.

999,761. ARC LAMP; G. M. Dyott, Pittsburgh, Pa., and C. Carson, Wilkinsburg, Pa. App. filed April 28, 1906. Flaming arc lamp metallic oxid electrode. Means to remove the deposit from the metallic electrode.

999,762. STORAGE BATTERY AND PROCESS OF TREATING THE SAME; T. A. Edison, Llewellyn Park, N. J. App. filed March 20, 1908. Negative electrode of finely divided iron and mercury is immersed in trochloride of bismuth dissolved in acetone and then heated in caustic alkali.

999,772. COIL WINDING MACHINE; C. LeG. Fortescue Wilkinsburg, Pa. App. filed July 3, 1905. A folder for applying an insulating strip to a strap conductor for making transformer coils.

999,780. ELECTRIC FUSE AND FUSE HOLDER; F. W. Harris, Wilkinsburg, Pa. App. filed May 9, 1908. A U-shaped fuse member projects downwardly into a magnetizable member which quenches the arc formed upon rupture of the fuse.

999,781. MEANS FOR CONTROLLING ELECTRIC CIRCUITS; G. W. Hart, Hartford, Conn. App. filed Feb. 21, 1910. A single-winding magnet which can be energized whether the switch is open or closed but will be open-circuited by the subsequent action of the switch in either instance.

999,782. SWITCH; G. W. Hart, Hartford, Conn. App. filed July 7, 1910. Mechanically locked and released by the opening of a controlling circuit.

999,792. CONTROL SYSTEM; R. P. Jackson, Wilkinsburg, Pa. App. filed Jan. 5, 1907. Means for preventing simultaneous closure of two or more switches. (See No. 834,525.)

999,800. ELECTRICAL MEASURING INSTRUMENT; S. M. Kintner, Pittsburgh, Pa. App. filed Oct. 3, 1905. Electrostatic type. The

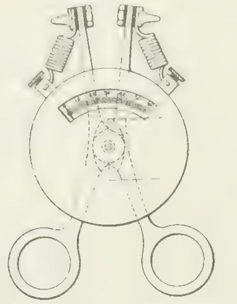
[illegible] condensers are immersed in [illegible]

[illegible] SWITCH; H. [illegible], New Britain, Conn. App. filed [illegible] 18, [illegible] button type, spring detent for the [illegible]

[illegible] ELECTRIC GENERATOR, MOTOR, ETC.; B. Lundstrom, [illegible] the rotating element but yieldingly connected to [illegible]

[illegible] POLYPHASE TRANSFORMER; W. M. McCrainey, Pitts[illegible] Laminated magnetizable and [illegible] the core members [illegible]

[illegible] ELECTROMAGNETIC GRAPPLING TOOL; C. G. Miller, [illegible] May 1[illegible], 1910. For picking up articles in a plating tank.



[illegible]77. Volt and Ammeter.

[illegible] ELECTRIC SWITCH; G. E. Palmer, Winchester, Mass. App. [illegible] Electromagnetically controlled.

[illegible] PORTABLE TELEPHONE; N. Pedersen, Geneva, Ill. App. filed June 4, 190[illegible]. Structural details of the standard.

999,871. ELECTRICAL APPARATUS; K. C. Randall, Edgewood Park, Pa. App. filed July 23, 1909. Dry air is supplied under pressure to a casing containing the parts.

[illegible] PROTECTIVE DEVICE FOR ELECTRICAL CIRCUITS; G. B. Rosenblatt, Butte, Mont. App. filed April 4, 1906. The terminals are separated when the circuit is opened.

999,883. ELECTRIC SWITCH; F. Schneider and J. C. Dunfer, Cleveland, O. App. filed Dec. 8, 1910. For hand tools, such as drills.

999,893. WINDING COIL FOR DYNAMO ELECTRIC MACHINE; C. E. Skinner, Wilkinsburg, Pa. App. filed Oct. 7, 1908. A fireproof coil of conducting material separated by aluminum foil treated to produce an insulating coating.

999,[illegible]27. TELEPHONE SYSTEM; H. G. Mosler, Chicago, Ill. App. filed July 16, 1906. The cut-off relay is actuated by current flowing over a portion of the talking circuit when a link conductor is connected with the spring jack.

99[illegible]28. ARMATURE WINDING FOR ELECTRIC MOTORS; J. F. Webster, Pittsburgh, Pa. App. filed June 19, 1905. The lengths of the end portions of the armature coils are unequal and adjacent groups of the longer end portions are displaced with respect to each other.

9[illegible]35. CONSTRUCTION OF ELECTRIC MOTORS AND DYNAMOS; C. E. Willey, Louisville, Ky. App. filed Nov. 16, 1910. The pole piece and frame have registering longitudinally arranged key-ways and a key for holding them together.

9[illegible]945. HAND ELECTRIFYING DEVICE; H. Aub, Munich, Germany. App. filed July 19, 1910. A head band with two adjustable electrodes.

999,947. MOTOR CONTROLLER; T. E. Barnum, Milwaukee, Wis. App. filed Nov. 8, 1909. Set to start a motor and then automatically stop it after it has made any desired number of revolutions. For controlling the steering apparatus of ships, etc.

[illegible]77. VOLTMETER AND AMMETER; H. Fish, Stamford, Conn. App. filed Sept. 6, 1910. Has handles and terminals for making temporary connections with the poles or binding screws of a battery or magneto.

[illegible] APPARATUS FOR PRODUCING HIGH-FREQUENCY CURRENTS; R. Goldschmidt, Darmstadt, Germany. App. filed Aug. 26, 1908. For wireless telegraphy, etc.

999,994. ENGINE STOP; A. S. Hawks, Bethlehem, Pa. App. filed July 8, 1910. A switch operated by centrifugal force.

1,000,031. CONNECTOR; E. Mattman, Milwaukee, Wis. App. filed Sept. 13, 1909. A terminal with a stepped bored hole, the walls being cut to make them yielding.

1,000,034. TROLLEY HARP; J. S. Norton, Wilkes-Barre, Pa. App. filed Dec. 4, 1909. The wheel shaft is held in the frame by a spring pressed locking [illegible].

1,000,043. PIPE CONNECTION FOR OUTLET BOXES; J. N. Seisna, Syracuse, N. Y. App. filed Nov. 4, 1908. A part of the threads is cut away to admit a larger pipe and a setscrew fronted to hold the pipe end.

1,000,052. ELECTRIC SWITCH; C. H. Thordarson, Chicago, Ill. App. filed June 27, 1910. For storage battery power equipment, etc. Solenoid plungers operate the switch arm.

1,000,061. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Norwood, O. App. filed Nov. 1, 1907. For rolling mill drive. The motor shaft has a limited endwise movement upon the breaking of the coupling in case of an overload.

1,000,066. DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, O. App. filed Nov. 27, 1905. The cross connectors are so supported and insulated from each other as to avoid short circuits.

1,000,074. ELECTROMAGNETIC SWITCH; H. B. Collier, Prairie Grove, Ark. App. filed Sept. 14, 1908. For burglar alarms, etc.

1,000,077. TRANSMISSION SYSTEM; G. C. Cummings, Western Springs, and A. Wray, Chicago, Ill. App. filed March 3, 1909. [illegible] party line telephones, etc. Allows one party to select an[illegible] party on his own line. (57 claims.)

1,000,078. SYSTEM FOR TRANSMITTING INTELLIGENCE; G. C. Cummings and J. A. Kick, Western Springs, Ill. App. filed June 16, 1909. Keys for selecting and modifying the current a[illegible] transmitting station. An electromagnetically operated typewrit[illegible] the receiving station.

1,000,116. TROLLEY; G. E. Palmer, Chicago, Ill. App. filed Ja[illegible] 1911. The wheel is carried by a spring-pressed plunger.

1,000,123. SWITCHBOARD-CIRCUIT AND EXCHANGE APPA[illegible]TUS FOR TELEPHONE; H. J. Roberts, Evanston, Ill. App. [illegible] Sept. 5, 1905. For selective party lines and individual lines [illegible] two systems of signals.

1,000,141. ELECTRICAL FITTING; H. C. Barber, North H[illegible] Conn. App. filed May 8, 1911. A rosette with strain reli[illegible] grooves and openings for the wires.

1,000,146. TEMPERATURE COMPENSATING DEVICE; W[illegible] Bristol, Waterbury, Conn. App. filed July 28, 1910. Improve[illegible] on 783,503 and 860,792. A perforated container with member[illegible] side having differential coefficients of expansion. For minute [illegible] rents.

1,000,154. SAFETY APPARATUS FOR AMUSEMENT OR OT[illegible] AUDITORIUMS; J. H. Cresser, Philadelphia, Pa. App. filed M[illegible] 19, 1909. Automatically lights an auditorium and unlocks the [illegible] upon occurrence of abnormal conditions, as when a moving-p[illegible] machine becomes deranged.

1,000,158. ELECTRIC SWITCH; W. E. Dow, Baintree, Mass. [illegible] filed Aug. 6, 1909. A removable plug controls operation o[illegible] switch arm. For automobile ignition systems, etc.

1,000,161. METHOD OF AND MEANS FOR CONTROLLING E[illegible]TRIC MOTORS; A. C. Eastwood, Cleveland, O. App. filed [illegible] 8, 1910. For a series-wound motor for operating electric [illegible] without a mechanical brake. Changes from series to parallel.

1,000,183. ELECTRIC CEILING FAN; E. Marelli, Milan, Italy. [illegible] filed March 23, 1908. The blades are attached to a combined [illegible] and armature mounted on a stationary hollow shaft. For [illegible]nating current.

1,000,189. TROLLEY; A. Nash, Chicago, Ill. App. filed Aug. 15, [illegible] Spring supported fork to prevent sparking and jumping.

1,000,217. MANUFACTURE OF STEEL; W. R. Walker and J[illegible] Gray, New York, N. Y. App. filed Sept. 19, 1908. An open-h[illegible] charge is oxidized by flame and gases to remove carbon, silicon [illegible] phosphorus. The slag is removed near the end of the heat [illegible] fresh basic slag introduced. The gases and flame are then exc[illegible] and the charge is electrically heated to deoxide and desulph[illegible] the metal.

1,000,248. APPARATUS FOR SHORTENING ELECTRIC WA[illegible] C. Ferrari and M. Pizzuti, Naples, Italy. App. filed April 14, [illegible] A combination of a self induction, a capacity and discharge g[illegible] protect electric installation from excessive accidental voltages.

1,000,294. ELECTROMAGNETIC VIBRATOR FOR LOCAL M[illegible]CATION TO THE PERSON; A. Rosenberg, London, Eng. [illegible] filed March 19, 1910. Mushroom-shaped casing having e[illegible] adapted to be inserted in the ear cavity. Solenoid vibrator.

1,000,300. TESTING INSTRUMENT; H. W. Secor, Trenton, [illegible] App. filed Jan. 11, 1910. A base and casting with two [illegible] lamps and connections for comparing lamps.

1,000,314. TELEGRAPHIC INSTRUMENT; J. A. Zundel, New [illegible] N. Y. App. filed Dec. 7, 1910. Adjustable sounder lever.

1,000,320. MERCURY CONTACT BREAKER; L. Baumeister, [illegible]laneen, Germany. App. filed Nov. 12, 1910. The heat of the [illegible] when the contact is broken effects a rapid separation betwee[illegible] contact point and the mercury.

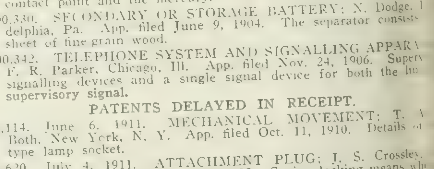
1,000,330. SECONDARY OR STORAGE BATTERY; N. Dodge, [illegible]delphia, Pa. App. filed June 9, 1904. The separator consists [illegible] sheet of fine grain wood.

1,000,342. TELEPHONE SYSTEM AND SIGNALLING APPAR[illegible] F. R. Parker, Chicago, Ill. App. filed Nov. 24, 1906. Superv[illegible] signalling devices and a single signal device for both the lin[illegible] supervisory signal.

PATENTS DELAYED IN RECEIPT.

994,114. June 6, 1911. MECHANICAL MOVEMENT; T. [illegible] Both, New York, N. Y. App. filed Oct. 11, 1910. Details o[illegible] type lamp socket.

996,620. July 4, 1911. ATTACHMENT PLUG; J. S. Crossley, [illegible]vay, N. Y. App. filed Nov. 30, 1908. Spring locking means wh[illegible] the two parts may be easily connected together or disconnecte[illegible]



999,754. Electric Railway.

996,844. July 4, 1911. FASTENING DEVICE FOR ELECTRI[illegible] SIGN RECEPTACLES; E. H. Freeman, Trenton, N. J. [illegible] filed April 1, 1910. The receptacle can be fastened in place w[illegible] from one side of the sign board.

997,563. July 11, 1911. ROTARY SNAP SWITCH; S. Korf, Chi[illegible] Ill. App. filed June 6, 1910. For use in key-type socket with [illegible] pull.

997,588. July 11, 1911. LAMP SOCKET; E. E. Taylor and [illegible] Elkins, Amesbury, Mass. App. filed Aug. 11, 1910. Provided th[illegible] bayonet joint held in position by springs.

999,234. Aug. 1, 1911. ELECTRIC LAMP SOCKET; F. A. L[illegible]combe, Newport, Ky. App. filed July 23, 1909. Provided th[illegible] anti-vibration support to minimize breakage of metallic filament.

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CONTENTS.

A NOTABLE ISOLATED PLANT.

The description, completed in the current issue, of the great power and lighting plant for the new Northwestern Passenger Station in Chicago gives an impressive idea of what is really one of the most complete isolated plants in the country. It would call for close consideration merely on account of its size, for its total capacity of hard upon 3000 kw is exceptionally large for a plant devoted to general purposes. There are few larger ones for private service save in the case of some plants especially devoted to motor service. Perhaps the most striking thing, from an engineering standpoint, about the whole plant is the deliberate installation of compound, non-condensing engines in connection with a low-pressure steam turbine. The economy of such a combination is, of course, well known, but the turbine has in practically every case been an afterthought, while here, in view of the impracticability of getting a suitable source of condensing water, the turbine immediately became an essential factor in station economy. The engines themselves give for their type rather exceptional results, being guaranteed for 18.6 lb. of steam per ihp at full load, while operating at 16.5 lb. absolute back pressure. The low-pressure turbine was guaranteed to deliver a kw-hour on 43.5 lb. of this exhaust steam, and when the whole system is at full load the net result comes down to 11.8 lb. of steam per hp-hour—a beautiful example of shrewd design for maximum economy. The turbine alone is provided with a cooling tower.

There are many interesting features in the arrangements for the control and distribution of the output of this great station, of which it is only necessary here to remark that the remote control of the system is worked out in an extraordinarily complete way and is the sole reliance of the plant. The equipment operated by the installation is a very intricate one, as is to be expected from the service of a building of this character, including the complete lighting of the terminal, the lighting of standing trains, a considerable amount of special and street lighting, pumping, mechanical ventilation, elevators, vacuum cleaning, refrigeration and other miscellaneous output. Nearly 1000 hp in motors for these various utilities is regularly in use. The lighting of the station is, of course, the chief work of the plant during the hours of heavy load. It is almost entirely by tungsten lamps, mostly of sizes from 100 watts to 250 watts. These are systematically installed in diffusing globes or reflectors, and both the direct and indirect-lighting systems are employed, the latter usually in conjunction with the former. The main waiting-room, for instance, contains the equivalent of 70,000 cp in concealed lamps with reflectors pointing to the ceiling, in addition to the light given by suspended figures and standards bearing groups of tungsten lamps in diffusing balls. Such a com-

bination of direct and indirect lighting is often very effective and beautiful, while not particularly economical. A somewhat unusual feature of the lighting system is the fact that it is in the main equipped with remote-control switches worked by push buttons from the two information bureaus, so that the lighting can be entirely controlled from these points. The street lighting about the huge building is carried out by clusters of large tungsten lamps inclosed in diffusing balls. These are on special ornamental posts to the number of more than fifty. Altogether this terminal plant is a wonderfully complete example of the finished and thorough working out of a set of problems difficult from the intricacy of the requirements, and the details of the work will repay study on the part of engineers.

THE LAW OF CORONA AND THE DIELECTRIC STRENGTH OF AIR.

The subject of corona formation occupied a fair share of attention at the recent convention of the American Institute of Electrical Engineers. A very good paper on the subject was contributed by Mr. F. W. Peek, Jr. This paper, although perhaps unnecessarily detailed in certain directions, is valuable to engineers, having been written in simple metric units and with the symbols and formulas clearly defined. A large number of experimental measurements are adduced to show that the power dissipated in corona from a three-phase transmission line is directly proportional to the frequency and to the square of the root-mean-square line voltage in excess of a certain critical value. This may be stated in another way by saying that a three-phase line offers negligible dielectric corona leakance until a certain critical star voltage is exceeded. Once this critical voltage is passed the leakage is constant to the voltage excess and proportional to the frequency. Thus, taking a three-phase line of solid wires, each ½ cm in diameter, at usual separating distances, the line, in fine weather, has no corona leakage until the star voltage exceeds in round numbers 50 kv. At, say, 60 kv, the line has a leaking excess star voltage of 10,000 volts and a linear corona leakage corresponding to about 0.4 micromho per kilometer of triple line per cycle per second. At 60 cycles per second this would become 24 micromhos per triple line kilometer, and this would absorb from the excess emf of 10,000 volts a linear triple line power of 2400 watts, or 2.4 kw., per kilometer of triple line.

The paper declares that the loss during storms, and particularly during snowstorms, is markedly greater than during fair weather, although the reason for this circumstance is not very clear. Smoke and sleet are both declared to increase the corona power loss, but humidity is stated not to have any effect. A few years ago Mr. Ralph W. Mershon collected a large number of observations on corona loss with experimental lines near Niagara Falls, and arrived at the conclusion that the humidity of the air had a very decided effect. This humidity effect noticed in the Niagara Falls tests has not been corroborated as yet by any published results, either in the laboratory or in the field. It is possible that in the vicinity of a large waterfall the corona conditions may not be the same as prevail elsewhere, but the discrepancy should certainly be cleared up. The claim that the linear power loss increases ... with the frequency is a very interesting and nov... consideration, because it would appear from laboratory measurements that the critical voltage of coronation ... only slightly affected by the frequency. That being th... case, the reason for the increase of power loss with frequ...cy is by no means self-evident. Another remarkable observation mentioned in the paper is that a strong wind does ... appreciably affect the corona power loss. It might ...sonably have been supposed that since the loss is due ... the charges carried away from the wires convectively, b... individual air particles, any wind action which tended ... crease the convection of air particles across the surf... the wires would help the dissipation of power. Ass... that the results in the paper are duly corroborate... fact brought out that the corona linear leakage is, li... conductance of a condenser, a relatively fixed qu... proportional to the frequency, active to all excess v... above the critical value, makes the matter easily ... understood by engineers.

LUMINOUS EFFICIENCY.

A recent article in these columns by Dr. H. E. Ives ... a deal of interesting information regarding the muc... cussed subject of possible efficiencies of illuminants. ... Ives points out that the only proper and exact meas... luminous efficiency is lumens per watt. The meth... reckoning which has been much used in the past—t... determining the ratio of the visible to the total energ... obviously improper from the standpoint of illumi... merely because the illuminative value of visible energ... pends on the luminosity curve of the eye, the red and ... radiations being relatively very ineffective. The spe... interesting feature of Dr. Ives' investigation is the ... mous efficiency theoretically attainable when the lum...ous radiation is concentrated in the most intense visible ...art of the spectrum. The point assigned as the peak o... luminosity curve by Dr. Ives differs slightly from ... obtained by some other investigators, being placed by h... 545 $\mu\mu$. Obviously the exact point of highest luminosit... pends somewhat on the intensity of the illumination ... cerned, but it is quite certain that the location for ord... intensities lies somewhere in the yellow-green, whic... counts for the very high practical efficiencies reache... the flaming arcs and by the quartz-mercury tube, bo... which have spectra extremely powerful in this regio...

As Dr. Ives points out, the most efficient monochro... radiation is almost exactly in the position of the green ... cury line which furnishes a very large percentage o... light of the mercury arc. For light of this wave-lengt... Ives figures an efficiency of about 65 spherical candle... watt. The highest possible efficiency of white light ... continuous spectrum he reckons at 26 spherical candle... watt, so that the monochromatic source has a prodig...us theoretical advantage, and practically a considerable ...li- tional gain, from the fact that the temperature require... or Dr. Ives' most efficient white light is about 6000 deg ... quite unattainable with any usable solid material. ...n- fortunately, as a practical matter, there is also diffic...ty

with the gaseous sources which give discontinuous spectra, since their energy is scattered over a wide region of the spectrum, so that nothing approximating a really monochromatic source of radiation is actually known. Dr. Ives' suggestion of a standard of luminous intensity, to be reached practically by the use of the yellow-green light of the mercury arc, is a very interesting one, and we trust that he will carry it into practice. Of course, such a standard would involve heterochromatic photometry from the start, but from the present state of experience with the flicker photometer the difficulty is not at all an insuperable one, particularly since such a source could be made to give the high luminous intensity desirable in flicker photometry. At all events, the scheme is well worth trying.

Of course, a monochromatic source is not well adapted for the purposes of general illumination, however useful it may be for specific classes of work, but from Dr. Ives' work as well as from that of others, it is now pretty evident that any sensational increase in practical efficiency of radiation must be reached by utilizing sources which give discontinuous spectra. How far the efficiency can actually be pushed in such a device remains to be seen, since all known gases and vapors radiate energy, generally in [illegible] ible amounts, in the infra-red and other undesir[illegible] tions of the spectrum. The helium tube, for ex[illegible] investigated as a possible standard of light, was [illegible] have a lower efficiency than that of the metallic-[illegible] incandescent lamp owing to the unfortunate distri[illegible] f its energy spectrum. Gaseous illuminants, how[illegible] not follow Wien's law, and it may be possible to [illegible] hods and degrees of excitation producing improve[illegible] distribution of radiation, and possibly also radia[illegible] distributed as to give at considerable efficiency a better approximation to white light than is usual with discontinuous spectrum. The last chapter on high-efficiency [illegible] illuminants is far from being written, and this [illegible] uld be raked over as carefully as was the field of the rare metals in the beautiful and painstaking researches that led up to the metallic-filament lamp.

THE NATURE OF LIGHT ACTION ON SELENIUM.

It is a well-known fact that the electrical conductivity of selenium is subject to variation under the action of incident light, but the nature and cause of this variation [illegible] stions of much complexity. The experimental fact [illegible] l to have been discovered accidentally. Selenium is a metalloidal substance which, in regard to electric conductivity, occupies a sort of middle ground between con[illegible] and insulators. That is, its resistivity is high, but [illegible] rly so high as that of typical insulators, such as [illegible] porcelain. It was proposed at one time to use a [illegible] f selenium as a very high-resistance leak in submarine-cable testing. In adjusting this leak the resistivity of the selenium was found to vary greatly, and on investigating the nature of this variation it was found that the resistivity was greatly and promptly affected by light, the resistivity being greatest in the dark and least in strong light. With the aid of this principle, grids or cells of selenium have been successfully used in radiotelephony for reproducing speech through a long beam of light. When the photo-electric properties of selenium came to be studied in detail various anomalies were discovered. Thus, the effects varied with the temperature of the selenium, with the magnitude of the impressed voltage, with the previous history of the illumination, and with the intensity of the illumination. Stranger still, samples of selenium were occasionally produced which showed the reverse effect, or increased resistivity under incident light, so that light-negative selenium and light-positive selenium had to be recognized in discussing the effect of light on conductivity.

The *Physical Review* for July contains a paper, by Mr. F. C. Brown, on "The Nature of Light Action in Selenium," in which a hypothesis is advanced for the whole series of phenomena. It is proposed to assume that the substance selenium has three allotropic forms—*A*, *B* and *C*. All these forms are chemically alike, but physically they differ. Allotropic varieties exist, as we know, in many substances, such as oxygen, water, sulphur, etc., so that there is nothing extravagant in such a proposal. In general, allotropes are assumed to be formed of different molecular groupings of like atoms, as, for instance, when molecules of eight, four and two atoms respectively are formed in the element sulphur. These molecules are all alike of sulphur, but most of their physical properties and some of their chemical affinities are different in these different states. It is further suggested that varieties *A* and *C* of selenium have very high resistivity or are almost insulating substances, while variety *B*, on the contrary, has low resistivity or behaves almost like a metallic conductor. When light falls on a mass of selenium it tends to change *A* into *B* and *B* into *C*, the process going on until a certain equilibrium-ratio exists between the respective numbers of such molecules, depending upon the intensity of the incident light as well as on the temperature of the mass. When the light is shut off the *C* molecules tend to return to *B*, and the *B* molecules to *A*, until the original equilibrium-ratio is reached.

Starting from the above assumptions and adding a few more as occasion seems to require, a fairly good case is made for the hypothesis in meeting the experimentally observed facts. That is, among the curves which could be accounted for hypothetically on the above premises some are in accordance with curves derived experimentally. The least that can be said for the hypothesis under discussion is that it offers a promising clew to the elucidation of a very complex state of affairs. We know in general physical chemistry many cases of molecular changes that are either effected or assisted by incident radiant energy. Among these cases are some in which molecular changes of the allotropic type occur in the atoms of one and the same elementary substance under the action of light. The number and variety of these allotropic forms are found to be greater than has been heretofore supposed, and new additions to the list of duly certified allotropes are frequently made. In fact, when energy is added to or removed from a molecular aggregation of a single kind of atoms it is not difficult to understand that changes in aggregation may ensue. If such changes occur, it is very likely that changes will follow in physical properties, such as in electric conductivity.

American Institute of Electrical Engineers Affairs.

At a meeting of the board of directors of the American Institute of Electrical Engineers held Aug. 22 a resolution offered by President Dunn was adopted favoring a larger measure of publicity than in the past for Institute affairs and directing that a résumé of the action of the board be sent after each meeting to the technical press, discretion being reserved to the secretary and president as to what matter shall be included in the résumé. As a result of this wise action we are enabled to present below an account of the many interesting matters upon which the board of directors acted at its recent meeting. This account will also give an idea—for the first time to many—of the broad scope and the importance of the work of the governing body of the Institute.

At the meeting 363 delinquent members were ordered dropped from membership in the Institute, fifty-nine applicants were elected as associates, seventy-nine applicants were enrolled as students, and the following associates were transferred to the grade of member: Messrs. Orin B. Coldwell, Portland, Ore.; Lucius B. Andrus, South Bend, Ind.; Milton W. Franklin, Schenectady, N. Y.; M. de Chatelain, St. Petersburg, Russia; Charles d'Ornellas, Buenos Aires, Argentina.

Petitions were considered from members in Vancouver, B. C., and Lynn, Mass., for authority to form sections, and upon the recommendation of the sections committee the necessary authority was granted.

The report of the committee recommending a change in the method of nominating officers of the Institute was submitted, and in order to secure further consideration it was ordered to be brought up at the October or November meeting.

President Dunn announced the appointment of the Institute committees for the present administrative year. The following is a list of the chairmen of these committees: Executive, Mr. Gano Dunn; finance, Mr. A. W. Berresford; library, Prof. Samuel Sheldon; meetings and papers, Mr. H. W. Buck; editing, Prof. W. I. Slichter; board of examiners, Mr. W. G. Carlton; sections, Mr. Paul M. Lincoln; code, Prof. George F. Sever; law, Mr. C. A. Terry; railway, Mr. Frank J. Sprague; education, Prof. A. S. Langsdorf; high-tension transmission, Mr. David B. Rushmore; industrial power, Mr. W. H. Powell; telegraphy and telephony, Mr. Bancroft Gherardi; electric lighting, Mr. P. Junkersfeld; electrochemical, Prof. Albert F. Ganz; power station, Mr. S. D. Sprong; indexing transactions, Mr. George I. Rhodes; public policy, Mr. Henry G. Stott; intermediate grade of membership, Mr. Percy H. Thomas; historical museum, Mr. T. C. Martin; committee on relations of consulting engineers, Mr. Francis Blossom; United States national committee of International Electrotechnical Commission, Mr. C. O. Mailloux; code of ethics, Prof. George F. Sever.

The following representatives of the Institute were also appointed by President Dunn: On joint committee on engineering education, Profs. Charles F. Scott and Samuel Sheldon; on American Year Book, Mr. Edward Caldwell; on Resuscitation Commission, Dr. A. E. Kennelly; on electrical committee of the National Fire Protective Association, Prof. George F. Sever.

The board elected the following three members of the board of directors to serve upon the Edison medal committee for two years: Messrs Lewis B. Stillwell, H. H. Barnes, Jr., and S. D. Sprong. The board also confirmed the appointment by the president of Mr. Frank J. Sprague and Mr. Schuyler Skaats Wheeler as members of the Edison medal committee for terms of five years.

A resolution was adopted discontinuing the committee on conservation of natural resources and authorizing the president to appoint a committee of seven on public policy. The duties of the committee shall be to report to the board on such questions of public policy as the board shall re[fe]r to it and to call the attention of the board to such matt[er]s of public policy as the discretion of the committee pr[om]pts. The president appointed on this committee Mr. He[nr]y G. Stott, chairman; Messrs. H. W. Buck, John J. Carty, [J]o[hn] H. Finney, Charles W. Stone, Calvert Townley and [Nor]m[an] G. White.

A resolution was adopted declaring it to be the se[nse of] the board of directors that it would be desirable t[o hold] an International Electrical Congress during the P[anama] Exposition in San Francisco in 1915, such congress [to be] initiated and conducted by the American Institute of [Elec]trical Engineers under the authority of the Interna[tional] Electrotechnical Commission; and that a committee o[n con]gress organization be authorized, the members to [be ap]pointed by the president after receipt of such infor[mation] from the International Electrotechnical Commissi[on as] would indicate a disposition on its part to authori[ze the] American Institute of Electrical Engineers to und[ertake] the holding of the congress.

Upon the invitation of the officers of the America[n ...]ing Congress, to be held in Chicago Sept. 26-29, 191[1, the] board authorized the appointment of two delegates t[o rep]resent the Institute at this congress. The preside[nt ap]pointed Messrs. Peter Junkersfeld and William B. Ja[...] of Chicago.

A resolution was adopted viewing favorably the [...] of an Institute trip to Panama in January or Februa[ry ...] the president was authorized to appoint a commit[tee in] co-operation with the meetings and papers commit[tee to] make final recommendations thereon at the October [meet]ing of the board. The president appointed Messrs [S. D.] Sprong, chairman; Messrs. A. W. Berresford, F. L. [...]inson, P. Junkersfeld, H. A. Lardner, W. S. Rugg, [...] Rushmore, Edward Schildhauer and A. M. Schoen.

The question of a suitable acknowledgment of th[e gift] of a bronze bust of von Helmholtz by Mr. Edwa[rd D.] Adams was referred to the president with power.

The committee appointed at the meeting of the [...] held at the Chicago convention to canvass the can[didates] for secretary and report to the board presented a reso[lution] which was adopted, recommending the appointment [of Mr.] F. L. Hutchinson as acting secretary in place of Mr. [R.] W. Pope, resigned. Mr. Hutchinson will discharge all [duties] devolving upon that official under the constitution [of the] Institute, and is authorized to draw and countersi[gn] checks and drafts in payment of approved bills and [vouch]ers, his services as acting secretary to continue [until] the end of Mr. Pope's unexpired term, Aug. 1, 19[12, or] until the earlier appointment of a secretary by the [board.] The resolution also provided that as the president is [about] to go abroad to represent the Institute at the meet[ing in] Turin of the International Eletrotechnical Commissi[on and] the International Electrical Congress, he be authori[zed to] add a fourth member to the committee on the select[ion of] a secretary and to delegate the chairmanship to one [of the] present members. President Dunn appointed as the [fourth] member of the committee, Mr. John J. Carty, and [dele]gated Mr. H. W. Buck to act as chairman.

A resolution was adopted directing that the port[ion of] last year's proposed amendments to the constitutio[n pro]viding for the appointment of the secretary by the [board,] instead of his election by the membership, be agai[n sub]mitted to the membership for action at the proper tim[e this] year. The board also defined the type of secretary [de]sired as one possessing tact, executive ability and c[...] force, preferably a man of liberal engineering trainin[g and] of well recognized standing in the profession of eng[ineer]ing.

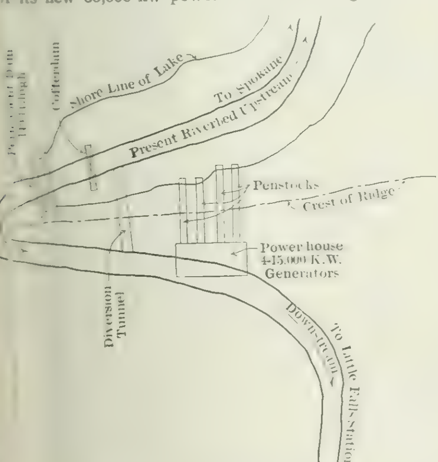
President Dunn announced that during his abse[nce in] Europe matters requiring the attention of the pre[sident] should be referred to Vice-president H. W. Buck. [Pr]esi[dent] Dunn sailed from New York on Aug. 26.

onvention of the Pennsylvania Electric Association.

he fourth annual convention of the Pennsylvania Elec- ic Association, the banner geographic section of the . L. A., will take place at Exposition Park, Conneaut a., Pa., Sept. 5 to 8, inclusive. The place is a summer s on the Bessemer & Lake Erie Railroad readily ached by way of Erie or Pittsburgh. The general ses- io. will begin on Sept. 6, when there will be morning afternoon meetings, and on the other days but one ses- in will be held, so as to enable the attendants to inter- experiences and enjoy the various entertainments ed. On the evening of Sept. 5 a reception will be en red to President and Mrs. A. R. Granger, of Chester, A number of interesting papers have been prepared much attention has been given to the various commit- rts, the overhead-line committee being one of the mittees of its kind in the country. It was this e which was instrumental in holding up action on rt of the overhead-line committee of the N. E. L. s last convention in New York City. This com- as done much original work and investigation and rt is considered to be very important. Other re- heduled for presentation will deal with rates, ating, lamps, etc. Among the papers which will and discussed are the following: *Central Station Isolated Plants,* by Mr. T. E. Spencer, Plymouth; *Appliances,* by Mr. E. B. Greene, Altoona; by Mr. A. M. Dudley, Pittsburgh. An interesting also promised on *Service Connections.* It is ex- hat the attendance this year will eclipse that of the nmit meeting last year, which established a record meetings. The secretary of the association is n Dusen Rickert, Pottsville, Pa.

New Spokane 60,000-Kw Power House.

F llent progress is being made by the Washington Wa r Power Company, Spokane, Wash., in the construc- tion f its new 60,000-kw power station at Long Lake on



Site of the New Spokane Plant.

the okane River, 4 miles from the present plant at Litt Falls. The cofferdam is completed and the work of prep ing the river bed for the dam foundations is also finis d. Concrete work on the dam will commence short- ly. xcavations for the power house and work on the diver on tunnel are also well under way.

The new plant will be equipped with four 22,500-hp turbines, each direct-connected to 15,000-kw, 400-volt, three-phase, 60-cycle generators. The turbines, which will operate under a head of 140 ft., are being built by the I. P. Morris Company, Philadelphia, and the generators by the General Electric Company. Either four 15,000-kw, three-phase or twelve 5000-kw, single-phase transformers will be installed to step up the generator voltage to the transmission level, 60,000 volts.

A short transmission line will be built connecting with the Little Falls station, and eventually a tower line will be constructed north of the river between the new station and the Post Falls station, a distance of about 50 miles.

At the site of the plant the river makes a horseshoe bend in a deep canyon. The hill between the two sides of the bend rises about 250 ft. above the river bed. The power house will be located on the down-stream side of the bend, the four penstocks being carried over the hill. The dam, 140 ft. high, will be built between the canyon walk near the toe of the horseshoe. A cofferdam has been placed some distance above the main dam site, and a tunnel, approximately 18 ft. x 22 ft. cross-section, is being driven through the hill between the channels to carry the river water during the construction work. The lake formed by the dam will extend upstream about 25 miles.

Hydroelectric Development at Healey Falls, Ontario.

The Eastern Power Company, Ltd., one of the subsidiary companies of the Electric Power Company, Ltd., of Toronto, Ontario, has commenced construction work on the development of Healey Falls, on the Trent River, about 5 miles north of Campbellford. At this point there is a head of 76 ft. and the initial installation will consist of two 3000-kw, 6600-volt, three-phase generators driven by 5600-hp turbines, each of which will be fed from a separate steel penstock. The power house is designed to contain two additional main units of the same size, but the third and fourth units will not be installed until the load warrants it. Three-phase transformers will also be installed in the generating station to step up the potential to 44,000 volts for transmission.

The load on the Electric Power Company's system is rapidly increasing at present and the prospects are that by the time the initial installation at Healey Falls is completed, which should be about a year from now, the total capacity of the first two units will have been contracted for. One of the most recent contracts closed is with the Canada Cement Company for the supply of 1000 hp for its Belleville mill located at Point Anna about 4 miles east of Belleville. It is expected that the substation will be completed and the mill electrically operated by the end of this month. When this installation is complete the Canada Cement Company will be taking 4000 hp in all from the Electric Power Company's system in the vicinity of Belleville, the Lehigh mill, requiring 3000 hp, having been connected to the system since the early part of this year. Messrs. Smith, Kerry & Chace, of Toronto, are the engineers of the project.

The Toledo Rate Situation.

In its answer to the petition of the city of Toledo, Ohio, for a court order to enforce the electric-light ordinance recently passed, the Toledo Railways & Light Company attacks the validity of the ordinance and Section 3982 of the Ohio Statutes, which empowers cities to regulate the rate of charge which shall be made for service. Both are alleged to be unconstitutional on the ground that they deprive the company of property without due process of

law and are confiscatory, and that besides they impair the obligation of contracts.

The answer sets forth that the company is furnishing service under individual contracts with consumers, and that its assent on March 30, 1911, to the lighting rate ordinance of July 7, 1907, made a contract between the company and the city which is still valid. This ordinance, it is claimed, fixed the rate for a term of five years after its passage at 9 cents per kw-hour with a 10 per cent discount for the payment of bills by the tenth of the following month. The new ordinance is held to be illegal because this one has not been repealed.

Of its 4000 consumers under contract at the rate established by the former ordinance 2000 use an average of less than 20 kw-hours per month and 1000 use less than 10 kw-hours per month. The average used by all is 23 kw-hours per month. The actual cost of furnishing service for lighting to citizens, the company says, is $25 a year and the cost of furnishing to minimum users is $17 per year. Should the company be compelled to furnish service at the rate established by the new ordinance, 8 cents with a discount of 1 cent, the company claims that it would lose $25,000 per year, and then if it should be compelled to carry out its contracts with consumers having a lower rate than 8 cents it would lose $50,000 a year. It is probable that this case will be carried to the higher courts if the position of the lighting company is not sustained by the lower tribunals.

Massachusetts Legislation Affecting Central Stations.

The annual meeting and dinner of the Massachusetts Electric Lighting Association was held at the Point Shirley Club, Winthrop, Mass., Aug. 16. It was the largest gathering of the association in ten years, fifty-five members being present, representing practically all the important companies in the State. The meeting was called to order by Mr. Charles L. Edgar, president, and the report of the executive committee was read by the secretary, Everett W. Burdett, Esq. In this report were outlined the important measures passed by the recent Legislature of Massachusetts that had special reference to electric-lighting interests and also the bills which were introduced but which were defeated or modified before enactment.

The report stated that although the Legislature of 1911 was the most radical of any in the history of the State and seemed to be willing to do damage, yet nothing inimical to electric-lighting interests was finally enacted. Several highly objectionable measures were adopted in one branch, but defeated in the other. Furthermore, the recent Legislature enacted several measures that are very helpful to electric-lighting interests, of which the law relative to the transmission of electricity and that relative to the confirmation of defective locations were most important.

The first of these acts is a careful revision of the laws relative to the erection and maintenance of poles and wires and the construction of conduits and cables in public streets. It clears up many points hitherto obscure and enables the companies hereafter to obtain and hold valid and effective locations instead of maintaining doubtful and often unlawful obstructions in public ways.

The other act points out a method by which all locations actually in use which have ever been granted by aldermen or selectmen, no matter how defective, may be made valid. The provisions of this law are briefly these:

A location actually granted by public authority and in use may be confirmed and ratified by the present owners filing before Jan. 1, 1913, with the city or town clerk a map showing the exact location and nature of the structures, together with a memorandum of the dates of the grants of locations therefor. These are to be kept with the records of original location for poles and wires.

It is suggested in this connection that when asking for locations, etc., each company act in co-operation with other wire-using interests in the same locality, particularly the telephone company. By this means a uniform practice can be established in each city and town. It is further suggested that each company have blank petitions and orders printed for its own use of the same size as those used by the other companies in the same localities and that the local authorities be requested to use these forms in all cases. In a circular issued by the association a form is suggested for petitions and for orders.

A proposition urged by Governor Foss, to do away with the several existing public-service commissions and substitute a single commission with the authority a of all, failed of being adopted. While the publ companies did not intermeddle with the matter, seems to show that the plan has little favor with l and the people at large.

The effort to authorize cities and towns to mai derground municipal conduits and to compel priv panies to use them was also ineffective.

By agreement of all parties in interest the Bost ground wire act was amended and the transm high-tension currents through that city except ground ducts forbidden. Likewise by agreemen derground wire act for the city of Beverly was

The effort to forbid the use of demand indic the employment of differential rates of charge r the reference of the subject to the Gas and Elect Commissioners for investigation and report to Legislature.

No radical measures on the subject of taxat enacted, though some were proposed and advoc important act relative to payments to employees sonal injuries during employment, and the prev such injuries, was approved July 28 and goes i next year. It does not deprive employers of which they now have to defend injury cases, b deprive them of three important defenses which have, viz.: (1) That the employee was himself (2) that the injury was caused by the neglige fellow-employee; (3) that the employee assumed of the employment. If the employer does not wish to rely upon his legal rights, as above stated, he may insure his liability to pay the compensation to employees pr the act either in any stock or liability insurance or in the Massachusetts Employers' Liability As created by the act. This latter association is to have fifteen directors, appointed in the first instance by the Governor and afterward elected by the subscribers to the as namely, employers. The act provides an elaborate of payments to an injured employee of much character as the schedules in accident insurance But if an employee is injured as a result of his o ous and wilful misconduct" he is not entitled to c tion, while if he is injured by reason of the se wilful misconduct of his employer the compensation is doubled. An employee cannot waive his rights to compensation under the act, but is held to have waived his rights under the common law unless he gives notice of his intention to rely upon them instead of upon the provisions of the act.

The act creates what is called the Industrial Accident Board, of three members appointed by the Gover salaries of $6,000 each, with $500 additional for the chairman. If the new insurance association, or a liability company, as the case may be, and an injured employee cannot reach an agreement as to compensation for an accident, the board is to provide for an arbitration committee of three, of which one of its own members is chairman. The decisions of such committees have the force of decrees of the Superior Court. All employers are required to keep records of all injuries to employees, whether fatal, other-

…ard to report the same in writing to the Industrial …ccent Board within forty-eight hours.

… ollowing analysis of legislation of 1911 affecting … interests, in addition to that already given, ac… …d the executive committee's report and was in its …atures as follows:

… izing the town of Danvers to distribute electricity … Redding and Middleton. This act does not invade, … ts, the principles of the general municipal owner… …ite and affects no company except the Middleton … ight Company.

… ng the burial of certain wires in the city of Bev… … is act is similar to those relating to other cities … tisfactory to the Beverly Gas & Electric Company.

… ing the Gas and Electric Light Commissioners to … e names and addresses of officers and directors … annual report of lighting companies.

… ng that no electric light, heat or power company … out the Legislature's consent, transfer its fran… …se its works, or contract with any party to carry … rks except when so authorized by the Gas and … ight Commissioners pursuant to a previous law.

… ng that, beginning January, 1912, and for five … reafter, the commissioner of wires shall prescribe … main streets" outside sections of Boston al… …vided for and 2 miles of "side streets" within … ires shall be placed underground or removed. … reets" are defined to be streets on which trunk … ires or cables are located, and "side streets" those … n into such main streets. The act, after long … ns, was finally enacted with the assent of all … terested.

… ng that no wires for the transmission of elec… … more than 5000 volts alternating or 10,000 direct … r June 30, 1913, be maintained in Boston except … und.

… ng the existing law relating to political adver… … which forbade any lighting company or a … ning a majority of its stock contributing to the … or the promotion of any candidate's nomination … for public office, or the interests of any political … the vote on any measure submitted to the voters. … ove act such corporations or their trustees may … aid advertisements, with the word "advertise… …ached, when under a referendum the question of … any of the property or business of the company … d. The name of the corporation must appear as … re.

… ng that money lost in cash-recording meters by … be the loss of the lighting company.

… ng that the towns of Wakefield and Reading, each … has a municipal electric-lighting plant, may sup… …city, each in the other town, and that Wakefield, … also a gas plant, may supply gas in Reading.

… ng the existing law relative to stationary engi… … firemen in several particulars.

… aw was amended by the association making the … ip fee $20 for each company and the basis for … ssessment 1 per cent of the "balance of electric … ring account" of each company, as shown by the … the Gas and Electric Light Commission, the … assessment for any company to be $3,500. Hith… … ssessments have been based on the capital stock … of the member companies, and the maximum was …

Th following officers were re-elected for another year: Presi…nt, Mr. C. L. Edgar, Boston Edison and amalga… mate… companies; vice-president, Mr. C. F. Prichard, …ynn Beverly and Gloucester companies; vice-president, Mr. …lbert F. Dow, Fall River Electric Light Company. Othe… members of the executive committee: Messrs. Fred… …erick S. Pratt, Lowell Electric Light Corporation and … Company of Brockton; Robert W. … Electric Light Company, of Springfield; Arthur E. Childs, Ayer, Clinton, Leominster, Milford, North Adams, Northampton and Spencer companies; Alfred B. Tenney, Fitchburg, Haverhill, Malden, Salem and suburban companies; George T. Dewey, Worcester Electric Light Company; Joseph W. Stevens, Greenfield Electric Light Company.

Public-Service Commission Law of Nevada.

Under the authority of the new regulative law the Public Service Commission of Nevada has prescribed a uniform system of accounts for electric utilities and rules and instructions for gas and electric service.

The public-service commission law makes the Railroad Commission of the State ex officio a public service commission for the regulation and control of commercial, private or municipal heat, light, power, water and sewerage plants. The act was approved on March 23, 1911.

Nothing in the act is to be construed as vesting judicial powers in the commission or as denying to any one the right to test in a court of competent jurisdiction the legality or reasonableness of any final order made. Reasonably adequate service is required and reasonable and just charges must be made. The commission may in its discretion value the property of the companies and in any investigations for this purpose may avail itself of information contained in assessment rolls of counties and public records of various branches of the State government. Uniform accounts shall be kept and the commission has the right to examine all records. Failure to report for a period of thirty days to the commission in accordance with the law makes any officer, agent or person subject to a fine of not less than $100 or more than $500. Each day's refusal shall constitute a separate offense. Schedules shall be filed with the commission. While rebates or discriminations are made unlawful, existing contracts shall not be suspended or invalidated. An expert engineer may be employed at a salary of $3,600 per annum and necessary traveling expenses. The commission may employ such other experts and assistants as it may deem necessary and fix their compensation. Disobedience to a subpœna commanding attendance before the commission shall be deemed a contempt of the court and punished accordingly. The commission shall have power to substitute just and reasonable rates for any that are found to be unreasonable or unjustly discriminatory.

In adopting rules and instructions for gas and electric service in the State the commission gave consideration to the rapidly changing conditions to which the electrical industry is subjected. The accuracy of an electric meter shall be determined from readings taken at normal operating load and at 10 per cent of the rated capacity of the meter. The normal load, expressed in percentage of the total connected load or installation, shall be classified as follows: Class A, residence and apartment lighting and elevator service, 40 per cent; Class B, factories and general store lighting and power, 50 per cent; Class C, churches, offices, theaters, clubs and restaurants, 60 per cent; Class D, saloons, pumps, air compressors and ice machines, 70 per cent; Class E, sign and window lighting, blowers and moving-picture machines, 100 per cent. Two per cent is the permissible limit of error. In addition to the installation test and the yearly test of each meter, it is provided that each company shall make a test upon request of a consumer, provided the request is not made more frequently than once in six months. The commission will make tests upon application and payment of a fee of $1.50, to be met by the consumer if the meter is correct or slow within the allowable limit or by the company if the meter is fast beyond the limit fixed. Each company is required to maintain a record of all interruptions of service. Each company supplying energy on constant-potential systems

shall maintain a standard average voltage as measured at any consumer's cut-off, which shall remain constant from day to day and vary during any one day by an amount not more than 6 per cent of the minimum value. It is probable that a closer regulation may be required in the future. The commission recognizes that it may be some time before all the companies may find it possible to meet these requirements and in such cases conference is to be held with the commission. Companies are to inform consumers upon request as to the specific conditions under which efficient and economical illuminating service may be secured from the system. Where local conditions would make a literal enforcement of the rules an unwarranted burden to a utility or consumer, application should be made to the commission for a modification. The rules are to go into effect on Sept. 3.

The uniform classification of accounts for electric utilities prescribed by the Nevada commission says it is desired that the companies conform their accounts to the system at their earliest possible convenience. In order that the system may meet in a most satisfactory manner the needs of the electric interests, consistent with the requirements of the law, it is urged that all companies which are unable to conform to the accounts communicate with the commission, stating their reasons and explaining how full a compliance can be made. A note under the operating expense account says that in case any utility finds it impossible or impracticable to keep its accounts with the detail prescribed, it should petition the commission for authority to consolidate any two or more accounts, accompanying the petition with a statement of the reasons for its position. Operating expenses are divisible into two classes, operating and maintenance. Operation is stated to mean the "use" of the property and includes labor, materials and supplies and expenses, but excludes all maintenance items. Maintenance is stated to mean "upkeep," and should cover all expenditures for ordinary repairs, renewals or replacements of property resulting through wear and tear, or through those casualties which are incidental to the nature of the operation and which are necessary in order to keep up the productive capacity of the plant to its original or equivalent state of efficiency.

New York Commission News.

The Public Service Commission, Second District, has received a petition from the Long Island Lighting Company for permission to construct necessary poles and appliances for the furnishing of electricity in the town of Smithtown, Suffolk County, and authority to issue $90,000 in 5 per cent twenty-five-year first-mortgage bonds under an existing mortgage; an application from the Keeseville Electric Company for permission to construct a transmission line and exercise franchises for the supplying of electricity in the towns of Jay, Essex County, and Ausable, Clinton County, and application from the Bolton Light & Power Company asking authority to issue $12,500 common capital stock.

A complaint has been received from Attorney Thomas M. Losie, of the town of Elmira, against the maintenance charge exacted by the New York Telephone Company to its patrons in that town. The complainant states that the telephone company charges a flat rate to its subscribers within the city limits of Elmira, but patrons residing beyond the city limits are required to pay a maintenance rate over and above the regular rate for each fourth mile or fraction thereof distant from the city line. Inasmuch as the service rendered the patrons in and outside the city limits is the same, complainant alleges that discrimination exists. He also alleges that the city limits are not reasonable and equitable starting points for an extra maintenance rate for the reason that the city line has [illegible]thing whatsoever to do with telephone service or the [illegible]st of same, and for the further reason that the past exp[illegible]ience of the company has not proved that it is necessary f[illegible] it to make such extra charge. Complainant also conten[illegible] that the New York Telephone Company is writing fou[illegible]party and two-party residence service contracts at differen[illegible]ates, and that both services are identical for the reason t[illegible]t the company will not be able for a long period of t[illegible] operate four-party lines. The commission is as[illegible] enter an order directing the telephone company to [illegible]tinue its maintenance charge in so far as the same [illegible] to the district known as the West Water Street distr[illegible] Elmira Heights in the town of Horsehead. Th[illegible]plaint has been served upon the company and an [illegible] will be filed within twenty days.

Ohio Commission News.

The Gratiot & Brownsville Telephone Company h[illegible] a complaint with the Ohio Public Service Com[illegible] against the Brownsville Farmers' Telephone Compar[illegible] of Muskingum County, in which it says that ther[illegible] public need for another system in that community a[illegible] it would result in a duplication of service. The B[illegible]ville Farmers' Telephone Company has filed an ans[illegible] this complaint to the effect that the proposed new [illegible] will be of very material benefit to the people and [illegible] that the service of the other company is not up [illegible] standard. It also states that its business was begun [illegible] the enactment of the new public utilities law and [illegible] construction work has been under way for some time [illegible] is the first case brought before the commission unde[illegible] it must either issue or refuse a certificate of public [illegible]sity to a company desiring to build a system where [illegible] already in use.

Massachusetts Commission News.

The Dedham & Hyde Park Gas & Electric Ligh[illegible]pany has petitioned the Massachusetts Gas & Electri[illegible] Commissioners for permission to issue additional [illegible] stock to the amount of $14,200, to consist of 284 sh[illegible] the par value of $50 each, to be issued at $60 per [illegible] The purpose of the increase is to pay for extensio[illegible] additions to its mains, services, etc., and to prov[illegible] further extensions and enlargements. The present [illegible] stock is now fixed and limited at $141,750.

The Ware (Mass.) Electric Company has petitio[illegible] commission for permission to issue $40,000 new [illegible] stock, in 400 shares of the par value of $100 eac[illegible] purpose of the desired increase is to pay floating in[illegible]ness for new constructions, extensions and perman[illegible]provements already made and for further develop[illegible] the property. The present capital stock of the com[illegible] is $40,000.

The commission on Aug. 22, 1911, approved the [illegible]mouth Light & Power Company's petition for the a[illegible] of an issue of new capital stock of the par value of $[illegible] on account of additions to plant. At the same [illegible] annulled the order issued Feb. 6, 1903, which appr[illegible] issue of $25,000 of capital stock and $50,000 of firs[illegible]mortgage bonds. The proceeds of the new issue will be [illegible] for additions to the company's plant. On Feb. 6, 19[illegible], the board approved an issue of 250 shares of the par v[illegible] of $25,000 and of bonds to the amount of $50,000. T[illegible] proceeds of 110 shares of this stock were to be applied [illegible] the cost of installing new steam and electrical equipm[illegible], the proceeds of 140 shares were for the purpose of ca[illegible]ling an equal amount of coupon notes outstanding, a[illegible] the

were for refunding an equal amount of bonds. At that time the company had a capital stock of $50,000, bonds of $0,000 and coupon and other notes of $54,500. No part of the stock or the bonds approved in 1903 has ever been issued, but extensive additions have been made to the company's plant. The expenditure for this purpose for the year ending June 30, 1911, has been about $80,000. The ... and all but $7,000 of the coupon notes have matured ... paid. The board specifies that 1700 shares of ... stock shall be applied to the payment of an equal ... of the company's obligations represented by prorssory notes outstanding June 30, 1911.

Wisconsin Commission News.

On Aug. 15 the Railway Commission served notice on the Milwaukee Electric Railway & Light Company, the ... Light & Fuel Company, of Menominee, and ...ern Wisconsin Railway and Light Company, of ... Lac, that after the expiration of ten days from ... of serving the notice the commission will proceed ...igate the refusal of the above companies to com... the orders of the commission relative to rates and ... The commission states that it has made repeated ...tions of the service furnished by these corpora... found that such service is not in accordance with ... has issued orders that the faults be corrected ...aw regarded. To these orders the corporations ... no heed. This condition of affairs has existed ...igh in the mind of the commission and it will ... to make an example of the delinquent corpora... The results of the investigations made within the ... days will determine whether or not proceedings ...egun to enforce the penalty as provided in the ...r non-compliance with the commission's orders. ...mmission has authorized the La Crosse Indepen...phone Company to issue 400 shares of preferred ... the par value of $50 each. This stock is to be ...r and for money only. Because of its rapidly ...g business the company has found it necessary ... a new and larger exchange and to increase its ...t and extend its toll service. The proceeds to be ... from the sale of the stock are to be used toward ...or the cost of laying underground conduit and ...he new building and for extending and improving ...nd rural systems.

CURRENT NEWS AND NOTES.

...ICAL NOMENCLATURE OF LIGHTING.—The Inter... Photometric Commission has appointed a com... consider a proposal by Prof. A. Blondell relating ...menclature of lighting. The committee includes Brocun, of Germany; Laporte, of France, and Patterson, ...nd.

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JOVIAN HEADQUARTERS TO ST. LOUIS.—The headquarters of the Sons of Jove, together with all records and para...a of the order, have been removed by Secretary ...ickland from the former offices in the Monadnock Bloc Chicago, to new quarters at 1412 Syndicate Trust Building, St. Louis, Mo. Mr. Ell C. Bennett, manager of the *Electric St. Louis Magazine*, will devote part of his time to the order in that city. An enlarged issue of the *Jovian Bulletin*, the official organ of the Sons of Jove, is planned and a campaign to stimulate interest will be begun.

* * *

ELECTRICAL REPRESENTATION ON INTERNATIONAL PHOTOMETRIC COMMISSION.—At a meeting of the International Photometric Commission recently held in Zurich it was voted to admit to membership men identified with the electrical science and industry. The commission, which was founded at the time of the International Gas Engineering Congress held in Paris in 1900, has heretofore directed its work more particularly to the needs of the gas industry. The proposition for electrical representation came from Herr Dettmar, secretary of the German National Electrical Association.

* * *

INTERNATIONAL TELEPHONE LINES IN EUROPE.—A bill concerning the establishment of telephone communication between Milan, Zurich, Basel, Frankfort and Berlin has been passed by the Italian Parliament. The proposals for the new lines have to be ratified by the authorities in Germany, Italy and Switzerland, but this is said to be a mere matter of form, and construction work may soon commence. The shortest course between the different places will be followed, railway lines and highroads not to be considered in routing. The lines from Milan to Basel and from Milan to Basel and Frankfort will probably pass through the Simplon and go via Lausanne, whence the shortest route will be taken to Basel.

* * *

AN AEROPLANE-PROPELLER TEST PLANT.—A 75-hp adjustable-speed motor is used by the Worcester Polytechnic Institute for testing aeroplane propellers in its new experimental plant. The propeller is mounted at one end of a centrally pivoted 160-ft. beam and, driven by the motor, propels the beam against the adjustable resistance interposed by paddles which can be let down into the water of the lake in which the plant is mounted. To simulate flight conditions further, a second motor will be installed to drive the beam at a tip velocity of 60 miles per hour. The thrust exerted by the aeroplane propeller and the power taken to drive it under various conditions are measured by recording instruments on the rotating beam.

* * *

ELECTRIC IRON MELTING IN SWEDEN.—A report on experiments in the reduction of iron ore in electric furnaces at Trollhättan has been made by the Association of Swedish Iron Manufacturers, which, with government support, carried on the work. The results showed a reduction of 2.7 tons of pig iron per yearly electrical horse-power, but it is thought this can be increased to 3 tons. The consumption of carbon electrodes was 22.6 lb. gross, or 11.6 lb. net, per ton of iron, and 816 lb. of coal were consumed per ton. On the basis of selling price of product the experiments were self-supporting. In view of the successful results the government has proposed to raise the price of electrical energy to $13.40 per kw-year; the ironmasters, however, claim that the business will be unprofitable at any rate exceeding $10.72 per kw-year.

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CHICAGO SANITARY DISTRICT EMPLOYEES' SALARIES HELD UP.—As a result of the political deadlock between the Harrison and anti-Harrison members of the board of trustees of the Sanitary District of Chicago the July payroll of the district's employees, totaling $53,645, still remains unpaid. President Smyth, the recently elected Harrison successor of Mr. Robert R. McCormick, a month ago ordered discharged thirty-seven appointees of the former administration, among them several electrical employees. The anti-Harrison members blocked this action and insisted that these men continue to work. Meanwhile the president has held up the payroll of the entire body of employees, declaring illegal any payment to the men he discharged. Discipline of the district's staff is said to have suffered, and the employees are badly in need of their salaries, some having fallen into the hands of loan sharks to tide over their necessities.

ing to add to the fund for the entertainment of visitors to the Jovian National Convention in Denver, in October.

The International Photometric Commission has recommended that the calorific value of gas shall express also its illuminating power. This is the result of an investigation by a committee, of which Dr. Burite, of Germany, was the chairman, which reported that the calorific power expresses accurately the energy of gas, and that "the determination of illuminating power, in the actual conditions in which gas is used, ought henceforth to be regarded as useless."

* * *

Pacific Gas & Electric Company, of San Francisco, supplies electrical service to 158 cities and towns in twenty-six counties in California having an aggregate population of 1,080,790, or, without San Francisco, Oakland and Berkeley, a population of 367,790. The area covered is half that of New England. The company employs 3500 men and has eleven hydroelectric and three steam-driven plants and eighteen gas works. Gas is supplied to a population of

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panies of Los Angeles, Cal., have organized for the purpose of holding an electrical exposition at Fiesta Park for two weeks, Nov. 25 to Dec. 9. An executive committee, headed by Messrs. H. B. Woodhill, C. S. Walton and J. E. McDonald, has been appointed to formulate plans. Eastern companies will be invited to exhibit. The site selected includes about 90,000 sq. ft. and the display is estimated to cost $100,000. Mr. Woodhill is chairman of the com-

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Colorado Electric Club.—On Friday, Aug. 24, the Colorado Electric Club opened its 1911-12 season, by a dinner at El Jebel Temple to Hon. R. W. Speer, Mayor of Denver, upon occasion of his return from a European trip in company with the Bureau of University Investigation of the Boston Chamber of Commerce. Mayor Speer has been appointed chairman of the sub-committee of the Bureau on Municipal Affairs, on which subject he gave a talk. Hon. Willis V. Elliott introduced the speaker. The occasion formed a part of an advance publicity campaign for the Colorado Electrical Show, on Oct. 14-21, at the

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Lake Michigan's Fruit Crop.—Official recognition is now to be accorded the claims put forth by Michigan fruit growers that the opening of the Chicago Drainage Canal by withdrawing water at the lower end of Lake Michigan causes cold currents to flow down from the Straits of Mackinac, affecting the climate of Michigan, Illinois and Wisconsin fruit belts and damaging crops. In accordance with a provision in the Rivers and Harbors bill of the last Congress Col. C. M.

staff of assistants on board the steamship *Hancock* plan a complete investigation of the temperatures, currents and depths of Lake Michigan, which will be compared with the results of earlier investigations. A few minutes' exercise with pencil and paper reveals the interesting fact that the southerly current in the lake due to the quantity of water being taken by the Drainage Canal reaches the velocity of about 0.000085 mile per hour, at which rate the time taken by a given gallon of water to flow from Mackinac to the Chicago entry would be about 4,118,000 hours, or 4(years —probably time enough for it to become well acclimated to the few degrees' difference in temperature betw the ends of the lake.

* * *

The Horn Lightning Arrester.—A Nevada newspaper furnishes the following not unintellig account of the horn lightning arrester: "While waiting for supplies to finish up his job of connecting the subst the power company with the machinery at the Wonder shaft Mr. Halpenny has kept busy mak provements about the plant. The most conspicu probably the most important job is the installatic lightning arrester. It is a curious thing in app and anyone with half a mechanical eye could tell is a lightning arrester, because it couldn't possibly thing else. It is mounted on staging at the rear power station and consists of a curious system of and six long, slightly curved pieces of small iro The idea is, as nearly as the lay mind can grasp when a bolt of lightning attaches itself to the wire follow it till it finds a good jumping off place. great horns of iron pipe, pointing toward the sky, a conductors as far as they go, and when the lightnin along it follows the line of least resistance. Three horns, near their bottoms, are near but do not touc connected with the three main lines. The curr lightning bolt jumps across this space, follows the d gas-pipe horn upward toward its tip, and, having n place to go, just goes out into the sky, whence it c

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Electric Motors for Logging.—Donkey engines by electricity are now used in logging operations Spokane (Wash.) district and it is planned to exte use to forests in other parts of the Pacific Slope an mountain country. The first electric "donkey engi be used in the Northwestern forests, at Potlatch, are built on lines originated by Mr. E. P. Barry, el engineer, of the Potlatch Lumber Company, who perimental purposes converted a steam donkey mac gearing the motor to the position formerly occupied boiler. A motor-driver compressor supplies air for nal whistle. The apparatus, specially built for service, is of 150 hp, three phase, 550 volts, 60 cyc r.p.m., equipped with a current-limiting device, and an average of 35,000 ft. of logs a day. Ten eng handle from 300,000 ft. to 500,000 ft. a day will be i to replace steam engines. In the latter case the tr sion lines will always be in the rear of the logger a sequently built over logged-off land. A portable tion consisting of a three-phase transformer of capacity will be placed at a convenient point for s down the voltage from 11,000 to 550, a steel-armore running to the motor on the logger, this cable b sections to allow the logger being warped out up to tance of 1800 ft. from the substation. Mr. Barry interested in the electrification of logging roads. he says, the first cost of an electric road is high i parison with a steam road, varying from two and a three times in initial outlay, owing to the expense o insulators, trolley lines, transformers, rail bondi the labor involved in installing the apparatus, the nance costs are much less. Delays through break have decreased one-third since adopting electric dri road previously operated by steam. The average electric locomotives is from $11,000 to $16,000, de on size and capacity, about the same as for steam l tives. A great advantage of electric drive is, he sa fact that through it the large quantities of fu burned as refuse by every lumber mill can be utilized. Many thousands of horse-power are thus wasted year.

[N]ORTHWESTERN TERMINAL IN CHICAGO.

[L]ig[ht]ing, Heating, Ventilation, Motor Applications and Various Miscellaneous Utilities.

I[N] [a p]receding article the power plant and electrical dis[tribution of the new passenger terminal of the Chi[ca]go & Northwestern Railway Company in Chicago wer[e] described at some length. It is the present intention [to descri]be the interesting and extensive application made [of the el]ectrical and mechanical energy obtained from the [power p]lant. It may be well to preface the account by [stating] that the terminal covers three full city blocks [bounded] by West Lake, North Canal, West Madison and [North C]linton Streets, exclusive of a triangular block on [the nort]h side of West Lake Street and also bounded by Milwaukee Avenue and North Clinton Street. This triangular block contains the power plant. Fig. 2 is an ex[terior v]iew showing the imposing façade of the main [buildin]g on Madison Street. This Madison Street front [is] 3[illegible] ft. wide, while the terminal extends north 1450 ft. to th[e] tip of the triangular lot, marked by the power-house chimney. The terminal tracks are elevated and the cross [streets,] West Washington Street, West Randolph Street [and We]st Lake Street, go beneath the tracks. The ex[te]rio[r] walls of the main building are of granite and are cont[in]uous with the inclosing walls of the train shed, which are [o]f gray brick. This gives to the entire terminal the exte[rn]al appearance of one mammoth building. After be[i]ng [u]nder construction for two years and a half the ter[m]in[al] was put into service on June 3, 1911. It is very han[ds]omely and completely equipped. The expenditure for the [p]ower plant and appurtenances installed in this build[ing] [illegible] alone $1,500,000.

GENERAL LIGHTING FEATURES.

Tungsten lamps are used throughout for the lighting of the main building. With but few exceptions the lamps are of the 150-watt or 250-watt size. The public space on the ground-floor level and the main waiting-room on the track-elevation floor are two of the most brilliantly lighted rooms in any railway terminal or public institution anywhere. As shown in Fig. 3, the fixtures in the public space on the ground floor are extremely simple. They consist of white opal globes 18 in. in diameter, each one in the ceiling of each bay containing four 100-watt lamps. These lamps are arranged on two circuits so that 50 per cent of the lighting can be utilized if desired. In addition to this, various sections of the room can be turned on or off as needed.

ILLUMINATION OF MAIN WAITING-ROOM.

Indirect lighting is used to a great extent in the main waiting-room, shown in Fig. 5. Along the ledges running along the north and south sides of the room at an elevation of 46 ft. above the floor are placed concealed lamps. The ledges are 10 ft. wide and each one is divided into seven spaces by the arches supporting the barrel roof, in the manner shown in Figs. 1 and 5. In each of these sections there are thirty 250-watt lamps, each with an Alba glass shade set at the proper angle to obtain the greatest amount of reflected light from the ceiling. Lamps and globes, shown in Fig. 1, are mounted on a special frame, being adjusted so as to vary the angle at which the light strikes the ceiling, which at its highest point is 82 ft. above the floor. On both ledges there is a total of 420 lamps, or the equivalent of 70,000 cp. It should be explained that the ceiling is made of guastavino to give a soft, even dis[tribution ov]er the entire surface and is very [illegible] pleasing.

Fig. 1—View in Main Waiting-Room, Showing Manner of Lighting Vaulted Ceiling

Supplementing the indirect lighting of the main waiting-room there are splendid fixtures, as shown in Figs. 1 and 5, hanging from the soffits between the columns of both the north and south sides under the ledges heretofore mentioned. In addition to this the room is supplied with eight

Fig. 2—Exterior View of Northwestern Railway Terminal in Chicago.

handsome standards. Four of these, as seen in Fig. 5, are at the west end of the room and there are four others at the east end. A nearby view of one of these standards is shown in Fig. 4. Each of the standards and lighting fixtures supports lamps giving about 1880 cp, the lamps being 100-watt and 150-watt in size.

INDIRECT LIGHTING AND SPECIAL FIXTURES.

Generally speaking, the lighting throughout the terminal station is direct. However, special treatment has been given to the women's waiting-room and the women's tea-room (Fig. 6) and to the dining-room (Fig. 7). In each of these cases indirect or reflected lighting is used, the pictures indicating clearly the kind of fixtures employed. In the barber shop on the track-level floor indirect lighting has been provided with the addition of direct lighting for the mirrors, as well as lamps in brackets along the wall. The arrangement here is such as to keep the direct rays of light out of the line of vision of any one in the barber chairs. Fig. 8 shows the simple type of fixtures adopted for the train concourse. Where direct lighting is used Alba globes or Alba deep-bowl shades are employed with but few exceptions, such as in the corridors in the office portion of the main building, where the diffusing Alba shade is installed.

Special fixtures, in wall recesses, covered with a glass front and near the floor, have been designed and installed for throwing light directly on stair landings. Since the

Fig. 3—View Showing Lighting of Public Space on Ground-Floor Level.

station has been opened it has been found that this lighting is quite sufficient without the use of brackets to illuminate all of the minor staircases throughout the building. Special fixtures were also designed for lighting the basement, the baggage storage-room under the train concourse and the incoming baggage-room on the ground-level floor. These are made up with a specially designed shock absorber, plain conduit stem with spun-zinc canopy and cast-zinc weatherproof socket, each 250-watt lamp being equipped with an Alba shade with but few exceptions. A single unit was placed in each bay as near as the steel construction would permit, and this arrangement has been so carefully worked out as to give an even distribution of light over the entire floor space.

Many of the main-building fixtures are notably handsome, as may be judged by the newel-post lamp support shown in Fig. 9. Here the uprights are of bronze and characteristic terminal ornamentation in relief, while the bowl is of alabaster. The latter contains three 60-watt lamps.

REMOTE CONTROL.

One feature of the lighting to be noted particularly is that in all large spaces the circuits are operated by remote-control switches brought into action by momentary-contact push-button switches located in the two information bureaus, one being in the public space on the ground-

Fig. 4—One of the Bronze Lamp Standards in Main Waiting-Room.

floor level and the other in the main waiting-room on the floor above. From these points are controlled the lights in the main public space, the street lamps about the building, the lamps in the main waiting-room and in the concourse and the end of the train sheds between the concourse and track bumpers. Fig. 10 shows a typical cut-out cabinet, this one being in the train concourse. It may be mentioned here that the lighting of the main waiting-room is controlled in sections, so that a number of combinations for partial lighting may be obtained.

The lighting of the under-track portions of the terminal is the same as that of the basement of the station building, 250-watt units with Alba shades being used except in such places as carriage driveways and automobile spaces, where 100-watt lamps are employed. In the subways or street crossings under the elevated tracks 100-watt lamps with shades and specially made guards are used. These guards, hinged at the top and fastened at

the ottom with a small Yale lock, serve the double pur-pos of preventing lamps from being stolen and avoiding bre:age by teamsters' whips.

SPECIAL AND STREET LIGHTING.

Special lighting provision has been made in the post-

Fig. 5—Main Waiting-Room, Looking West.

... station, on the street level of the terminal, north ... tington Street. The main wagon drive is illumi-... y about thirty-five Cooper Hewitt mercury-vapor ... In the post office proper the general illumination ... l out in the same manner as in other under-track ... of the terminal, but in addition there have been ... over the sorting cases small 12-volt tungsten ... erated nine in series.

... l attention has been given to street lighting about ... inal. The architects designed special posts or ... s, those on the Madison Street front of the build-... g especially large and ornamental, while those for ... valk lighting on Canal Street, Clinton Street and M... ee Avenue are more simple in design, but quite ... The four large standards in front of the main ... on Madison Street each support seven globes ... ng thirteen lamps. Three 150-watt lamps are plac in the 30-in. globe at the top. There are also four smaller globes near the top, each containing a 100-

Fig. 6—View in Women's Tearoom.

watt lamp, and lower down on the standard two globes each containing three 60-watt lamps, making a total of 1210 watts for each standard. The other street posts are equipped with three 60-watt lamps in a 20-in. globe at the top, while from each of three brackets depends a 12-in. globe containing a 60-watt lamp, making a total of 360 watts for each post. In all there are fifty-three lamp-posts in addition to the four large standards in front.

Considering the whole terminal, there are perhaps 5000 tungsten lamps connected, mostly of large size. In addition, about 350 tungsten lamps are used for the street

Fig. 7—Day View in Dining-Room.

lighting, while provision is also made for lighting the terminal yards and approaches north of the train sheds, where tungsten clusters on poles or brackets will be used.

LIGHTING OF STANDING TRAINS.

Carefully designed equipment has been provided for the lighting of trains standing in the train shed. At the end of each track there are one or more train reels suspended overhead and containing a length of insulated cable connected to the 110-volt train-lighting circuits from the power house at one end and at the other provided with a suitable plug to be inserted in a receptacle to make connection with the car wiring. By the insertion of this plug connection is made so that the lamps and electric fans of the trains are operated while the train is at rest in the station.

Inasmuch as the train lighting is carried out on the 110-220-volt three-wire system, an ingenious application has been made to detect any unbalancing. Ammeter stands are provided with small Weston instruments connected in

Fig. 8—View of Train Concourse.

such a way as to show by the deflection of the pointer whether any particular train being supplied with energy causes an unbalance of the system. If this is so, the connections may be changed quickly so that the train-lighting load may be practically balanced. The capacity of the

train lighting system is for the simultaneous supply of electrical energy to six trains, each taking 25 kw.

With 2400 amp supplied to the main building for lamps and motors, the lighting load is so well balanced that the maximum unbalance amounts only to about 60 amp. However, two duplicate balancing sets are placed in the switch-

Fig. 9—Newel-Post Lighting Fixture.

board room in the basement of the main building, as shown in Fig. 11. These balancers also take care of the balancing of the train-lighting load, to which reference has just been made.

SEARCHLIGHT AND CLOCK DIAL ILLUMINATION.

Above the train shed over the east entrance to the Washington Street subway there has been installed one of the most unusual features of the building in the shape of a permanent searchlight with a perpendicular beam intended to advertise the location of the Northwestern Station all over the downtown section of the city. A General Electric 24-in. searchlantern is placed in the clock machinery room at this point. It is set so that the beam of light is projected horizontally. A mirror is provided so that the light is deflected upward in a vertical position.

Each of the towers of the main building contains a clock dial 10 ft. in diameter. There are also other clocks of the same size on the train-shed walls. Each of these clock dials is electrically illuminated by twenty-four carbon-filament lamps of 16 cp each. These lamps are placed behind the dials and arranged on a ring support in such a manner that any one of them can be reached for renewal by moving the supporting ring which turns on rollers placed about its outside rim. It may be added that the hands of these large clocks are driven by small electric motors.

HEATING AND VENTILATION.

The entire heating system throughout the terminal is a vacuum system, this permitting of utilizing all of the exhaust steam from the engines and other steam-driven machinery. The surplus is used in the exhaust-steam turbine in the power house, as noted in the preceding article. Two 14-in. pipes are installed for transmitting exhaust steam from the power house to the main building. These pipes, together with a 5-in. high-pressure steam pipe for the elevator pumps, are carried in a runway above the train shed on the Clinton Street side of the terminal. The terminal property being divided by the intersecting streets into practically four sections, it was necessary to treat each section as a separate building so far as the return end of the heating system was concerned. Each block, therefore, has its own duplicate set of vacuum pumps, although these deliver into a common return running back to the power house except that an independent return is run from the main building.

The exhaust from engines and other steam-driven machinery in the power house is utilized for heating purposes and is supplemented at the main building by exhaust from the elevator pumping machinery and the pumps used in connection with the heating system. During the summer months the exhaust from the elevator pumps is utilized for the heating of water for the kitchen and toilet-roo[ms] thus allowing the service mains from the power hou[se to be] cut out. In operation it has been found that it is [possible] to utilize the excess supply of exhaust from the [elevator] pumping machinery during the summer time by [opening] the valves in one of the 14-in. mains connecting w[ith the] power house, the steam passing back through this an[d] used in the exhaust steam turbine, this pipe actin[g as a] regenerator.

Mechanical ventilation is provided in very comp[lete de]tail, electrically operated fans supplying outside ai[r which] is heated, if necessary, and also washed. The mai[n venti]lating plant for the main building is located in th[e base]ment underneath the Madison Street front. The f[ans are] all of the Sirocco design and are driven by Sprague [motors]. The air-washing machines are of special design [and the] success of the ventilating plant was well attested du[ring the] extremely warm weather of the early summer of th[is year]. At that time the temperature of the main waiting-ro[om and] the public space on the track-level floor was from [10] to 15 deg. lower than the temperature of the [outside] air.

The air is exhausted from all ventilated portions [of the] building by fans located on the fourth story, ther[e being] three installations similar to the delivery fans in th[e base]ment. Fig. 12 shows an installation of exhaust fa[ns and,] on the left, electric motors operating dumb-waiters. [All] these fans are motor-driven and are operated by [remote] control from panelboards at each individual fan i[nstalla]tion in the basement. A small Weston ammeter co[nnected] with each exhaust fan motor on the fourth floor i[ndicates] that that fan is operating. The motors are of the v[ariable] speed type, and it is expected that they will be ope[rated at] their normal speed during the winter months an[d at a]

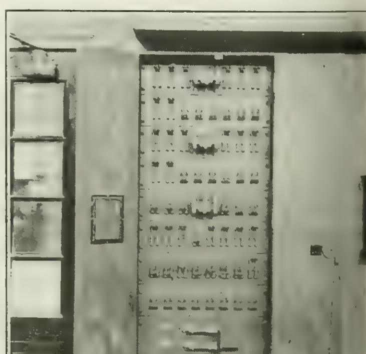


Fig. 10—Cutout Cabinet in Train Concourse.

higher speed during the summer, the latter being accomplished by field weakening. The same method of control is applied to the motor-driven centrifugal pumps circulating the water for washing the air. All registe[r] faces for heating and ventilating openings in public spaces are of solid bronze

MOTOR APPLICATIONS.

...ctric motors with a total rating of 932 ... hp. are in ... in the terminal. They range in size from 1 ... hp. to ... and are used for driving pumps, fans, hoists, elevators ... various other mechanisms. The elevators in the main ... building are hydraulic, but there are ten electric ele... in the under-track portion of the terminal. These ... located north of Randolph Street, and eight of them ... outgoing baggage and express and two for mail ... The lift is about 19 ft. and the elevator mechan... which is of the Otis drum type, is equipped with a ...

...r mail conveyors are placed between tracks in the ... shed and so arranged as to permit of readily unload... ...il from the cars, dropping it into these conveyors at ...nt where the car to be unloaded may stand. The ...ks are delivered to the post-office substation, coming ...nto distributing tables. This post office is located ... street level between Washington Street and the ...n concourse.

VACUUM CLEANING.

... complete installations for vacuum cleaning have ...le, each of eight-sweeper capacity under continuous ... One system is installed in the machinery room ...nain-building basement to care for that building. ...e other is installed in the machinery room in the ...ack portion of the terminal, just south of Randolph ... This latter plant cares for all the under-track space ... Randolph and Washington Streets, with separate ...ons leading to the post office. The apparatus in ...ants was furnished and installed by the Vacuum ...ng Company.

REFRIGERATION.

... serving-room—that is, the one for the lunch coun... ...he ground floor, the one for the dining-room on the ...vel floor and the one for the women's tearoom on ...d floor of the main building—is equipped with a ...rator box which is cooled by brine circulation from ...gerating plant located in the sub-basement of the ...ilding.

...e refrigerating apparatus was installed by the Carbon-dal Machine Company and is a 50-ton absorption plant. It ...so cools drinking water for the entire terminal, in... clu...ng the power house, the system of piping being divided.

F... 11—Switchboard-Room in Basement of Main Building, Showing Balancers.

on...pump caring for the main building and the other for the...nder-track portion of the terminal, including the power ho...e. City water is used for drinking purposes, but it is tho...ughly filtered. A plan formerly worked out by the co...ulting engineers for the terminal station has been used he... for the cooling of milk. Refrigerated water is circu...lated between the outer and inner shell of the milk coolers, rendering the use of ice unnecessary and making it very much more convenient than to keep the milk in refrigerator boxes.

As the refrigerating system uses ammonia, the room in which the apparatus is installed is designed with the idea

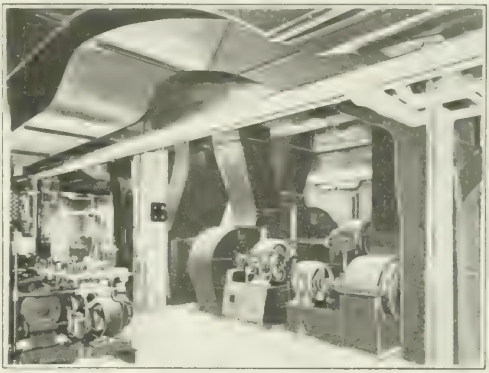


Fig. 12—Motor-Driven Exhaust Fans and (at the Left) Electric Mechanism for Dumb-Waiters.

of being entirely closed off, and a separate ventilating plant, electrically driven, has been installed, which will entirely clear the room every three minutes. Doors have been arranged at opposite corners of the room so as to afford ready egress to anyone working in the plant should a breakdown occur. All precautions have been taken for the protection of the men operating this system, although no accidents with a plant of this kind have ever occurred within the experience of the engineers who designed the plant.

The drinking fountains in those portions of the terminal open to the public are equipped with double faucets, one of the usual type and the other of the sanitary bubbling design. The latter type is used exclusively in the post office and in the emigrants' quarters, as well as in the power house.

COMMUNICATION AND ALARM SYSTEMS.

An intercommunicating telephone system has been installed throughout the terminal. It was supplied by the Couch & Seeley Company, and connects all of the operating departments of the terminal from the main building through to the power house.

A complete McFell fire-alarm and watchman's clock system has been provided with fire-alarm boxes located at convenient stations. Storage batteries for the operation of this system are installed in the basement of the main building. In connection with this local fire-alarm system a city fire-alarm box has been installed adjacent to the switchboard of the local system, and thus an alarm may be turned in to the city after it is registered in the switchboard-room of the local system, thus linking the city fire-alarm system and the local protection.

Telautograph stations are placed in various localities around the terminal and orders written at any station are reproduced at other stations in writing. The telautograph system is used in connection with the issuing of train orders and is operated in connection with the telephone system. The dining-room in the main building has been equipped with a telautograph service of its own, so arranged that orders written in the dining-room are reproduced in the kitchen.

DUMB-WAITERS.

As the kitchen is located in the basement of the main building, where is also the serving-room for the lunch

counter of the ground floor, it was necessary to devise some quick means of transportation between the kitchen and the serving-room for the dining-room on the track-level floor and the serving-room for the women's tearoom on the third floor. For this purpose three electrically controlled dumb-waiters have been installed, and in addition to the customary control-button system a buzzer system has been added, which greatly facilitates the operation of these small hoisting conveniences. The motors operating these dumb-waiters are placed on the fourth floor and are shown to the left in Fig. 12.

PNEUMATIC TUBES.

All incoming baggage is delivered on the ground-floor level in the baggage-room under the main concourse of the main building, while the outgoing baggage is delivered to the baggage-room in the under-track portion of the terminal between Randolph and Lake Streets. It was necessary to establish some quick means of communication between the two baggage-rooms. This was accomplished by installing a pneumatic-tube system with terminals in the two baggage-rooms mentioned. Special carriages are used in these tubes, being elliptical in cross-section. The blowers are installed in duplicate and are driven by Sprague motors, the power plant for this system being placed in the basement of the main building. The pneumatic-tube system was installed by the Lamson Consolidated Store Service Company.

CONDUCTORS' AND TOWERMEN'S GATE SIGNALS.

A carefully worked-out electric-lamp signal system has been devised for the exchange of signals between the towermen, the conductors of outgoing trains and the gatemen. The lamp signals are contained in neat cases placed at convenient points in the train shed. About five minutes before the starting of a train the towerman signals by the lighting of a lamp that the track is clear. This signal is given to the conductor who is standing beside his train and near the signal station. One minute before the time for the train to leave the conductor signals the gateman to that effect by pressing a button, which lights a lamp at the gate permitting the ingress of passengers. The gateman then closes the gate, and when he has done so signals the conductor in the same manner, but in this case the signal is also produced in the signaling tower, so that both the towerman and the conductor know the instant the gate is closed.

Fifteen wires are needed for each track for this signaling system, which is interlocked or relayed in such a manner that one signal cannot be given the towerman or conductor until preceded by the one that should properly come before it.

IMPROVED TELEPHONE-BOOTH DOOR SWITCHES.

Ordinarily telephone booths are provided with doors which are normally open, and when the customer goes in and closes the door after him a lamp is lighted by that act. The telephone-booth doors at the Northwestern Terminal Station, however, are arranged on a different principle. It was desired to have the booth doors normally closed, and the automatic switches installed, which are made by Edwards & Company, are so designed that opening the door lights the lamp. Shutting the door after entry, however, does not extinguish the lamp, which still burns, but opening the door the second time by the person inside passing out extinguishes the light.

ELECTRIC-CLOCK SYSTEM.

All wall clocks in the terminal—there are about forty of them—are electrically regulated from a master clock in the office of Mr. A. J. Farrelly, electrical engineer of the Chicago & Northwestern Railway Company, who has his quarters on the fourth floor of the main building. Mr. Farrelly's office is in direct connection with the United States Observatory at Washington, and thus the master clock is in close telegraphic connection with the nation's source of correct time.

MISCELLANEOUS.

Compressed air is used for many purposes around the terminal, including the cleaning of cars and the blow g out of electrical and other machinery. The air is p d also up to the ledges containing the concealed lamps r lighting the ceiling of the main waiting-room, and shades of these upwardly pointing 250-watt lamps blown out by compressed air. Compressed air is also plied to the barber shop for use in tonsorial operations

The hose pumps of the main building are electric driven and there are two small motor-driven circula pumps in the undertrack hot-water system in blocks 2 3—that is, the portion of the terminal between Washing and Lake Streets. A garbage crematory also forms a tion of the remarkably complete mechanical equipment this terminal station. Another feature is the provisio steam-heating pipes for melting the snow in the yard winter so that the tracks can be cleaned with dispatch ing any heavy snowfall.

Train signaling for the operation of the terminal is electric and interlocking. There is a tower at Lake St and Milwaukee Avenue, near the power house, from wh it obtains its electrical energy. In this tower there sixty-seven levers for signals, twenty-nine for switc forty-six for double-slip switch ends, twenty-three movable-point frogs and six to govern traffic, makin total of 171 working levers.

Pierce, Richardson & Neiler, Chicago, were the mech cal and electrical engineers for the remarkably w equipped Northwestern passenger terminal.

THE ELECTRIC VS. THE GASOLINE VEHICLE

By Hayden Eames.

CONTRARY to popular opinion, the cost of mai nance of an electric vehicle is, in general, less t that of a gasoline vehicle of the same load capac and furthermore, and equally contrary to popular opin the disparity between the load efficiencies of the two ty is very trifling, with the advantage at present in favor the electric, but possibly ultimately in favor of the gasol truck.

It does not follow from this, however, that installati of electric vehicles under all circumstances are cheaper operate than installations of gasoline vehicles for the sa purposes. If the service of the gasoline vehicle is not stricted by external conditions, it can do more work a given time—that is, transport the same number of t more miles than the corresponding electric vehicle. A rule, however, in the majority of large cities the number stops required, the congestion of traffic and the conditi governing the daily routine deprive the gasoline vehicle this advantage, and in consequence under the circu stances named, and within the radius of its safe appli tion, the electric vehicle has the full advantage of superiority in the matter of maintenance.

On the other hand, it also not infrequently happens— fact, is happening now in a number of cases in the city Cleveland, for instance—that the driver of a power wag in the service of a small merchant not only takes mecha cal care and makes minor repairs upon the vehicle whi he drives, but incidentally has the delivery periods so reg lated that he has numerous other duties in and about t store. At the present state of electric-wagon education would be hardly possible to employ for this purpose a m who had had the training necessary to qualify him to ca for an electric vehicle, so that, with rare exceptions, t gasoline vehicle may be expected to show up to the bet advantage in this service, and, in fact, actually does so.

The confusion that has existed in the people's minds the subject of the load efficiency of electric trucks has be

partly due to the subconscious error that "a pound of lead is heavier than a pound of feathers," and partly to differences of rating, and, more especially on the part of engineers, however, to a failure to recognize that a gasoline automobile for a given weight, duly filled with gasoline, is the embodiment of more ton-miles than the electric automobile with the same capacity with its necessarily limited but entirely adequate radius of action.

I have before me some authentic load efficiencies collected in this country and in France in 1905 in which the ratings of the various vehicles considered have been reduced to a common standard. Three French gasoline trucks of 2½ tons, 3 tons and 4 tons respectively had load efficiencies of 39 per cent, 31 per cent and 44 per cent, as compared with 57 per cent, 45 per cent and 42 per cent on the part of electric vehicles of 5-ton, 3-ton and 2500-lb. capacity respectively.

Academically, in spite of the great difference in the radius of action, the gasoline truck can undoubtedly be designed with a higher load efficiency than an electric truck of the same capacity, but the disparity will be small at best, and in proportion as that disparity is increased in favor of the gasoline truck, its cost of maintenance will also increase. Consequently in practice it may be assumed that, except in the very lightest ratings, the attempt to increase the load efficiency of a gasoline truck over that of the corresponding electric truck would be economically inexpedient.

In comparing various trucks, not only of different motive powers, but also of the same motive powers, one of the greatest difficulties is the reduction of the arbitrary ratings to a common standard. No one element of dimension is sufficient for the purpose. In the almost wholly empirical design and production of draft-animal vehicles the factor of safety are simply enormous except in the heaviest units. This is, of course, the result of fierce and protracted competition and habitual misuse and abuse of the vehicles. Under normal circumstances the possibility of misuse and abuse diminishes as the capacity of the vehicle increases. The early power wagons, and the great majority of all electric power wagons, inherited their structural factors and ratings from draft-animal-wagon practice. This seems to be always true with electric vehicles with the exception of one single make. The practice is a wise one. The customers to whom the vehicles are sold cannot shed the draft-animal standards immediately, and to some extent indefinitely and perhaps perpetually the power wagon is going to be subject to very much the same misuse, if not abuse, as that suffered by the draft-animal wagon heretofore. The designer and manufacturer of the electric truck and wagon, with the possible exception noted, have therefore been wise in taking advantage of past experience in street traffic and wagon use to discount this possibility, which is a very real one and which would otherwise have reacted upon them sooner or later. To the fact that most designers of electric power wagons have taken the fullest advantage of the purely empirical lessons to be learned from draft-animal-wagon experience the electric truck owes most of its extremely long life and slow depreciation.

Some wise gasoline-wagon manufacturers approximate the same practice. The majority of designers of gasoline vehicles, however, have learned from their superior education to view with contempt the empirical development of the draft-animal wagon, entirely overlooking the fact that instead of the definite requirements of railway practice there have been the most highly indefinite conditions of road service, human errors of administration and load requirements upon which to base computations. They overlook the fact that the result of empirical development of the draft-animal wagon must more or less accurately represent the aggregate compromises of design which years of experience have shown to meet best the uncomputable and indefinite requirements of the service. In consequence of this the great majority of gasoline vehicles are designed in accordance with railway practice on the basis of a factor of safety figured on rated load. As a result the published ratings of the majority of gasoline vehicles are higher in proportion to actual capacity than those of any make of electric vehicles but one, and, in consequence, their actual factors of safety on rated load are lower and their depreciation and repairs necessarily correspondingly greater. A purchaser of any power wagon whatever, therefore, should disregard the published ratings and try to make his comparisons of trucks of various makes and motive powers as nearly absolute as possible.

Perhaps the best basis of comparison for a hasty judgment is the size of the axle spindle—that is to say, its diameter at the shoulder. This is by no means absolute, not only because of minor differences of design in the spindle and axle, but because of a few cases in which the designer takes the fullest advantage of stronger than ordinary axle material. The resulting differences, however, are not great and after a little practice the observer can arrive at a very fair comparison by a consideration of the axle size in combination with the general dimensions, the springs and other parts of the structure, and of the structure as a whole. In the greater part of the structure difference in the quality of the material has heretofore made very little difference in the dimensions and weight of the parts for a given actual use. So much for an analysis of the facts.

The difficulty of obtaining a competent battery overseer or caretaker at any wage justified for the care and operation of a single light vehicle necessarily opens a very large use for the gasoline vehicle even in a field which would otherwise be legitimately of proper application for the electric. This objection should not apply in the case of central stations. If any central station in any important town has not already some one on its staff manually familiar with the care and operation of electric vehicles, it ought to have, and it ought not to employ such a man without inquiry of some thoroughly well-established storage-battery company or other organization that has been obliged to keep track of this kind of "talent." The storage-battery vehicle has suffered about enough from the ministrations of recent graduates of high schools and of academic electricians. Even the thoroughly well-grounded and able central-station electrician, thoroughly familiar and expert in the oversight of stationary storage batteries, is not infrequently almost as bad for the storage-battery vehicle as "my nephew who has just left college and knows all about electricity." The care of an electric storage-battery vehicle or a station full of them is a "trade," not a science, and a man may know ever so much about how to do it and still not do it right. It has been our experience that in the early days of the storage-battery vehicle it suffered quite as much from excess care and unnecessary "treatment" as it did from neglect. The best possible injunction is the frequent one of those who know, namely, "intelligently leave it alone," and this is quite a trade in itself.

The same reason, therefore, that makes the operation of a single electric-power wagon on a small scale possibly costly can be made to operate very strongly in favor of the use of such a wagon on the part of the central stations, and, in view of the fact that the central station's principal interest in the matter is the sale of electric energy under favorable circumstances, it would certainly be a serious example of penny wisdom for a central station in any large-sized city to buy a gasoline-power wagon for its own use within the legitimate radius of action of an electric vehicle, even though its rating indicated the gasoline vehicle to have the advantage as to initial cost. On the other hand, every central station in a large city has some service which at some time in the year, and in many cases throughout the year, can be more effectively performed by a gasoline-power wagon than by any other method, and to fail to take advantage of the gasoline vehicle for this purpose and de-

...to operate any other wagons except electrics is not only on the face of it an extremely narrow and, of course, uneconomical position to take, but one that will inevitably tend to retard the introduction of the power wagon generally and, therefore, the electric vehicle. The very superiority of the electric vehicle in its own field is a guarantee that the general introduction of the power wagon will necessarily lead to the establishment of the electric vehicle where it can do the best work.

To those of us who have been interested in, actively connected with and continually investigating the power wagon and power-wagon applications and economies for a matter of fifteen years the draft animal in city service is a joke. Our standards have changed. We no longer take it as a matter of course when a horse falls down in crowded traffic without apparent cause; when upon being overtaken (as he usually is) he speeds up and thereby momentarily increases the traffic congestion in the street; when he shies at the imminent risk of street accident; when he stops and starts, generally at inopportune moments; when he gives out at the critical moment when he is perhaps most needed, as he very frequently does; when he runs away and smashes up people and things, including himself; when he meanders down the crowded street in a sinusoid, or when he pushes his head point blank into a street car and shoves the pole through the windows, with the driver strenuously trying to restrain him, as he is just doing now as I look out the window. A few moments ago this highly archaic form of motor sat down on the street-car track in the public square, and while a power wagon could possibly have been pushed off the track by hand, nothing short of a derrick would have done the trick in this case, and the blockaded street cars of a crowded city stretched down the track as far as the eye could reach.

But hundreds of thousands of years of use of this perfectly miserable form of unreliable automatic motor have so accustomed the public to its tremendous shortcomings that until very recently they were almost prepared to reject any motor which did not suffer from the same troubles. For ten years past the horse has been the most uneconomical known means of merchandise transportation in cities. That the public should recognize this and act on it is the first step toward what the central stations wish to attain. Part of the work can be most economically done with electric automobiles and a part of the work most economically done by gasoline automobiles.

The principal difficulty to-day is to wean the public from its horse traditions. If it is going to take two or three years for the public to recognize the superior economy of the electric wagon, and the public is all ready to accept the gasoline wagon, the latter is the more effective means for doing this weaning, and, in fact, will ultimately form a stepping stone to the use of the electric vehicle in the fields in which the latter happens to be of superior economy. If the influence of the central station can be exerted to anticipate materially "equilibrium" in this choice, so much the better. Every time an electric central-station management procures the use of a gasoline-power wagon in its proper field it is hastening the day when the use of electric wagons in their proper field will bring to that central station the already well-recognized profits at the very period of the day that is most convenient to it. The central-station management can make no greater mistake than to try to keep gasoline vehicles out of its territory or in any way to retard their introduction.

Even if a gasoline truck is about to be purchased for a field which can be more advantageously occupied by the electric one, or in the doubtful field of the two spheres, it is better to help the sale through than to permit continued dependence on the horse. The essence of the whole proposition is so to educate the public as to make it as disgusted with and contemptuous of draft-animal transportation as are those who are really familiar with the comparative economies of the various methods. There is no better way to do this than to help it succeed with whatever initial substitute for the horse it can be most quickly brought to adopt. If it is an electric vehicle in an electric field, then so much the better, both for "equilibrium" and for the central station, and if not, then a gasoline truck and, wherever possible, each in its own field.

Anything but the heavy-footed, hopeless, meandering, uneconomic, uncertain draft animal. The horse for pleasure perhaps, but not for business.

REGENERATIVE CONTROL FROM A COMMERCIAL VIEWPOINT.

By J. Gustaf V. Lang.

As mentioned in the previous article, the ideas in[corporated] in the equipment tested in the last Newc[astle] test were later worked up into more practical s[hape] and a number of equipments built. Several of these [were] installed at Norwich, England, where they were ru[n in] regular service and a series of tests was carried out.

First preliminary tests were made with watt-hour m[eters] which were prevented by small ratchets from operatin[g in any] other than one direction. One of these instruments [was] connected so as to register the input, the other the ou[tput]. Both the standard equipment and the regenerative e[quip]ment used for the tests were mounted on similar si[ngle] trucks. The car with the standard equipment weig[hed] complete, 18,102 lb., and the car with the regener[ative] equipment 19,817 lb. Part of this difference in weight [was] due to a special brake equipment which was designe[d to] bring the mechanical brakes into play when the contro[llers]

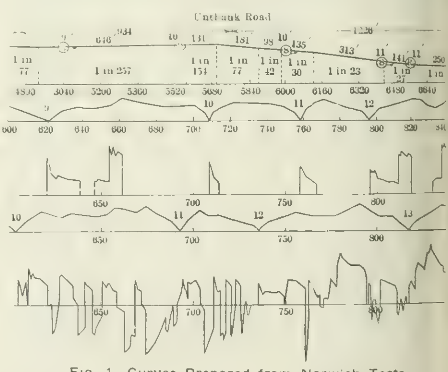


Fig. 1—Curves Prepared from Norwich Tests.

were brought to their off position or in cases of emerge[ncy].

Mr. A. Beazley carried out the final test, for which [he] used the most modern forms of recording voltmeter [and] ammeter, particularly constructed for tests on trac[tion] equipments. The following is a somewhat condensed [ab]stract from Mr. Beazley's report:

Both instruments were fitted with chronograph mar[kers] operated electromagnetically from a clockwork. On [one] of the papers a record of each revolution of the car wh[eel] was made by a distance marker, a contact maker pla[ced] on the hub of the wheel operating the marker electrom[ag]netically. The circumference of the wheel having b[een] measured, the distance could be calculated very closel[y].

The ammeter was set with its zero in the middle of [the] paper so that both input and output might be recor[ded]. The cars were taken over nearly all the routes in the [city] and were operated under service conditions so that [any] faults likely to develop out of exigencies of ordinary se[rv]ice might be located. The particular route the rec[ord]

[illegible] which was selected to be worked out in detail was that from the Royal Hotel to Unthank Road and back, which may be considered a fair average of the city routes as regards grades, curves, etc. A section of the records as worked out from the data obtained from these runs will be found plotted in the accompanying diagram, Fig. 1. It is to be observed that the wattage and speed curves are plotted on time, and thus to locate the corresponding part [illegible] road in the profile it is necessary to refer to the [illegible] Those of the standard car are marked S and those [illegible] regenerative car R on the profile, Fig. 1.

[illegible] figures obtained by integration of these curves in [illegible] complete form are entered as runs 1 and 2 in Table I. [illegible] 3 and 4 are preliminary watt-hour meter tests. It [illegible] noticed that while runs 2 and 4 with the regenerative equipment check very closely, and run 1 "out" checks [illegible] well with run 3 "out," there is a very considerable [illegible]ancy between run 1 "back" and run 3 "back." Fur[illegible]e, another preliminary test with a standard car [illegible]s route showed a total input for the round trip of [illegible] hours, or 1.16 kw-hours per car-mile. This is a [illegible] between the other figures, 1.04 and 1.28. It is rea[illegible] to suppose, and this opinion is verified from several other tests elsewhere, that this discrepancy is caused by the great difference in the handling of a car on a down gra[illegible] by different drivers.

In view of the above divergence of results it becomes necessary to decide on some reasonable basis which would [illegible] to both equipments. Mr. Banister, engineer and manager of the Norwich Tramways, had made a series of measurements of the energy consumption for one week of all the standard cars running on various routes by mounting watt-hour meters on the feeder poles.

Among the routes so measured was the greater part of the one under consideration, that from Haymarket to Unthank Road terminus and back. It has therefore been accepted as a fair basis to adopt the average input per car-mile thus obtained as the correct figure for the standard equipment, this decision being supported by the fact that the input, 1.15 kw-hours per car-mile, so found is almost exactly the average of the three figures given in the table. The figures for the regenerative equipment are taken from that part of the route (Haymarket to Unthank Road terminus) to which the chosen figures of the standard equipment apply. The results then appear to show an energy saving in favor of the regenerative equipment of about 25 per cent, as given in Table II.

The regenerative equipment during the test maintained an average speed of 7.05 miles per hour with 8.5 stops per mile. The average speed of the cars on which Mr. Banister's observations were made was not noted, but during the test recorded by graphic instruments the standard car made an average speed of 6.28 miles per hour with 8.5 stops per mile. While it is evident that the regenerative equipment is able to operate a schedule at least 10 per cent faster than the standard equipment, it is hardly possible to make any allowance for this in the energy consumption. But the preceding fact should be noted and may be considered as a margin indicating that the regenerative equipment can develop an average saving of 25 per cent in energy consumption over the standard equipment under the conditions existing at Norwich, which conditions, however, can scarcely be looked upon as favorable to regeneration.

For the sake of completeness it may be appropriate to mention that, though Mr. Banister's measurements were taken on cars in traffic whose average load was calculated to be eight passengers, the comparison with the regenerative equipment is quite fair since the extra weight of eight passengers was offset in the case of the regenerative car by the weight of the testing apparatus and the members of the testing corps.

The higher accelerating efficiency of the double series-parallel system with field control is apparent from the fact that the gross input to the regenerative equipment was 1.099 kw-hours per car-mile, as against 1.15 kw-hours for the standard, which indicates a saving of 5 per cent. In reality this saving is larger because the weight of the regenerative car was 9½ per cent greater than that of the standard car as already mentioned, consequently the input is proportionately larger. At the same time the regenera-

TABLE I.—RESULTS OF RUNS FROM ROYAL HOTEL TO UNTHANK ROAD.

[illegible]	Type of Car	Direction of Run	Stops per Mile	Running Time Seconds	Average Speed, Miles per Hour	Input, Kw-hours	Output, Kw-hours	Net Input, Kw-hours	Net Input, Kw-hours per Car-Mile.	Average Speed, Miles per Hour
[illegible]	Standard	Out	[illegible]	1053	[illegible]	2.395		2.395	[illegible]	[illegible]
		Back	10.00	1069	6.06	1.41		1.41		
[illegible]	Regen.	Out	[illegible]	957	[illegible]	2.44	0.287	2.153	[illegible]	[illegible]
		Back	10.00	[illegible]	6.52	1.71	0.594	1.116		
[illegible]	Standard	Out	7.2	[illegible]	[illegible]	2.60		2.60	1.28	[illegible]
		Back	6.09	1071	6.06	2.015		2.015		
[illegible]	Regen.	Out	7.2	976	[illegible]	2.50	0.30	2.20	[illegible]	[illegible]
		Back	[illegible]	[illegible]	[illegible]	1.73	0.60	1.13		

[illegible] graphic recording meters. **Tests with watt-hour meters.

TABLE II.—RESULTS OF RUNS FROM HAYMARKET TO UNTHANK ROAD.

Type of Car	Direction of Run	Running Time, Seconds.	Average Speed, Miles per Hour.	Input, Kw-hours	Output, Kw hours.	Net Input, Kw-hours.	Round Trip. Kw-hours per Car-Mile.	Round Trip. Average Speed
Standard	Out	855	[illegible]	1.77		1.77	.945	[illegible]
	Back	868	6.15	1.053		1.053		
Regenerative	Out	748	7.24	1.868	.232	1.636	[illegible]	[illegible]
	Back	[illegible]	6.87	1.41[illegible]	[illegible]	.947		
[illegible]andard average of all cars for one week							1.15	

tion is greater in the same proportion. Taking the average figure from the tests given in the first table, the gross input to the regenerative equipment is just the same as that to the standard. Reduced to the same weight, however, this indicates a higher propelling efficiency, mainly due to higher accelerating efficiency, and corresponding to a saving in input of 9.5 per cent.

If the total saving is reduced to equal weight of cars, and the average values of the first table are used as a basis, then 0.916 kw-hour for the regenerative equipment would compare with 1.16 x 1.095 kw-hours for the standard equipment, indicating the total saving to be 28 per cent.

TEST AT SOLINGEN, GERMANY.

A duplicate of the equipments used at Norwich was tested in Germany at Solingen, well known as the home of the German cutlery factories. Both the regenerative and standard equipments were mounted on similar single-truck cars. The route over which the test runs were made covered a distance of 1.2 miles, rising during almost the whole distance until a final elevation of 160 ft. above the starting point was reached, after which there was a fall of 12 ft. in the last tenth of a mile. The profile of the road is given in Fig. 2.

The first test runs were of a preliminary character and the elaboration of the final test of timing each run between stops was not bestowed on them. The results from the preliminary tests, however, are of much value for comparison. All the tests were carried out with watt-hour meters which were free to rotate in either direction. The energy returned to the line was consequently subtracted directly by the meters.

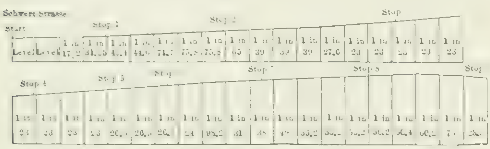


Fig. 2—Profile of Tramway Route, Schwert Strasse, Krahnhohe, Solingen, Germany.

The regenerative car was driven by the chief inspector, who had no previous practice in handling this kind of an equipment. The preliminary tests consisted of four return trips and the total time of each trip, including stops, was noted. As the line was single-tracked, the variation in time is mostly due to delay at the turnouts. The following day a similar test was carried out with a standard equipment, the car being driven by an ordinary motorman. After the first run the driver was instructed to drive as economically as he could. It is to be regretted that the actual running time was not noted because it would have been of interest to determine how much this endeavor at economy on the part of the driver impaired the running speed.

The consumptions registered during the preliminary test were as follows:

Regenerative Equipment			Standard Equipment		
Trip.	Kw. hours.	Time (Seconds) Excluding Stops.	Trip.	Kw. hours.	Time (Seconds) Excluding Stops
1	2.21	1001	1	3.33	1015
2	2.22	[illegible]	2	3.36	971
3	2.20	[illegible]	3	3.41	971

During the final test, which was carried out over the same route, the actual running time between each stop was observed and the watt-hour meter readings at the beginning and end of each such period were noted.

The chief inspector also handled the regenerative equipment during the final test. The standard equipme was similar to but not the same as that used in the preli iary test and it was driven by a different motorman. the final test all the runs with both equipments were ma the same day. The results were as follows:

Regenerative Equipment			Standard Equipment		
Trip.	Kw-hours	Minutes	Trip	Kw-hours	Min
1	2.20	21	1	3.22	
2	2.30	19	2	2.87	
3	2.11	19	3	2.80	
4	2.08	20			

The figures of the three runs in each case corr exceptionally well. The average net input was 2. hours for the regenerative equipment against 3.37 kw for the standard, the respective running times bei and 986 seconds.

This indicates an average saving of 34.4 per cent final test. Taking the average of the preliminary an tests in conjunction, the net energy consumption f regenerative equipment is 2.19 kw-hours, against 3. hours for the standard equipment. The saving is per cent in spite of the fact that two out of the si with the standard equipment were made with special tion to economy in energy consumption.

Comparing the six runs with the standard car the mous variation in input is striking. It is evidently differences in the handling. This marked influence personal element of the driver on the energy consu of a standard equipment has been noticed in all the ent tests at Newcastle, Norwich and other place the other hand, the variations of the net input to generative equipments are very insignificant, and it as if the results obtained are practically the same w the regenerative equipment is handled by a man wi siderable previous experience or by one to whom it entirely new. This is a rather important argument ir avor of regeneration, since all the special efforts, time and oney now spent on instructing and inducing motormen to the standard equipments economically can be dispense with. This in itself means a considerable saving.

A very interesting test was carried out for the pose of substantiating the claims to increased accelerati efficiency. On a level stretch of road ten runs were ade with each equipment, during which the controll was moved to the top notch as uniformly as possible. Ten seconds after starting the current was broken and t distance covered from the starting point was noted. average distance was found to be 148 ft. with a ma variation of 3 ft. The input to the standard equ nt had been 1 kw-hour and that to the regenerative uipment had been 0.79 kw-hour. A similar series o runs was made with the regenerative car, differing fr the previous tests in that at the end of the ten secor the kinetic energy was regenerated as far as possible. net input was then found to be 0.55 kw-hour.

An analysis of these results shows that the accel ating efficiency of the regenerative equipment is highe than that of the standard and corresponds to a saving per cent. Since there was some difference in the ight of the two cars, the regenerative car being so what heavier and thus causing an increase in input to regenerative equipment, the saving due to improved elerating efficiency of this equipment, as compared wi that of the standard, in reality agrees fairly well with result theoretical deductions had led to be expected, s set forth in a previous article.

The car with the standard equipment weighed a roximately six tons. As the 148 ft. were covered in t sec-

..., the maximum speed would have been 20.6 ft. per sec. ... had the acceleration been uniform. We know that ... is not the case, and by comparison with the calculated acceleration curves published in the preceding article we ... get some idea of the deviation. If a maximum speed ... ft. per second is assumed, the kinetic energy would be about 136,000 ft.-lb., which corresponds to 0.051 kw-hr. or 0.51 kw-hour for the ten runs. The track resistance taken at 20 lb. per ton, would amount to 12 × 148 ft.-lb. per trip, or 178,000 ft.-lb. for ten trips. This equals about 0.07 kw-hour. The total useful work thus amounts to 0.58 kw-hour, and the standard equipment shows an efficiency during the accelerating period of 58 per cent, whereas the regenerative equipment, due to double series-...ling and the practical elimination of main-circuit ...nces, shows an efficiency of 73 per cent, which in ... is higher if corrected to equal weight of cars.

...rtunately the distance covered during regeneration ...t measured. On the assumption that this was about ...me as that covered during acceleration there is ...07, or 0.44, kw-hour of mechanical energy to be ...ted into electrical energy. The measurements seem ...cate that the conversion took place at an efficiency ...t 55 per cent. In this connection it may be perti... question the reliability of measurements obtained ... test with regeneration, because of the decided ...tum of the moving parts of the watt-hour meters ...ime of the reversal of current.

...ar conditions no doubt existed to a greater or less ...luring the other tests carried out at Solingen, as the ...att-hour meters were used in all of the tests, and ...ch stop on down grade the car was first accelerated ...ing power before the regeneration was brought in. ... course, impossible to estimate to what extent slug...s of the meters to respond to a reversal of the cur...uld influence the results, but it is certain that it ... tend to give regeneration less credit than it de...

...st be admitted that all the tests described support ...ch other and also the contention that a substantial ... in current can be effected. From the experience ...t would seem reasonably conservative to claim that ...erage 25 per cent saving is feasible.

... all these tests, however, were carried out with ... series-parallel equipments, the question arises to wh... extent this saving would be reduced if regenerative equipments with but single series paralleling were used. The change from the first to the latter system would have an influence first on regeneration of kinetic energy and secondly on the accelerating efficiency.

... argument's sake that the maximum speed was 26 ... second and the speed variation by field control was

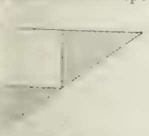


Fig. 3—Double-Series Parallel.

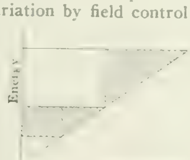


Fig. 4—Single-Series Parallel.

... cent, then the lowest speed with single control ... 6½ ft. per second, whereas with double control ... be 3¼ ft. per second. The total kinetic energy is proportional to the square of 26. The part capable of partial recovery by regeneration by means of a single-series parallel equipment would be proportional to $26^2 - 6.5^2$ and that by means of a double-series-parallel equipment to $26^2 - 3.25^2$. Consequently the loss in kinetic-energy saving would be in the ratio of $6.5^2 - 3.25^2$ to $26^2 - 3.25^2$, or 4¾ per cent. Assuming that the regenerated energy is drawn half from kinetic energy and half from potential energy, the change from double to single series parallel would only reduce the regenerated energy to the extent of 2 per cent to 2½ per cent.

Looking, on the other hand, at the influence on the accelerating efficiency, the difference would come in mainly in the necessity of using a larger starting resistance. With the help of the diagram representation used by Mr. Hobart, referred to in a previous article and reproduced in Figs. 3 and 4, we can get some idea of the magnitude of the influence. The shaded area represents the saving in each case and measures for the double 31/96 of the total as against 28/96 for single series-parallel control. The latter is thus about 10 per cent smaller, which means that the saving with the latter system would be 10 per cent less than with the double as regards input during acceleration.

Applying these corrections to the results found by experiments with a double-series-parallel equipment showing a saving of say 30 per cent total, 6 per cent being due to increased accelerating efficiency and 24 per cent to regeneration (half of which is converted kinetic energy), a single equipment would be found to modify the figures as follows: Six per cent due to saving during acceleration would be cut down by 10 per cent, or be reduced to 5.4 per cent; and the 12 per cent due to regenerated kinetic energy would be reduced by 5 per cent, or cut down to 11.4 per cent. Thus the total would be changed from 30 per cent to 28.8 per cent, a reduction which is not worth mentioning. The only advantage of the double-series-parallel system is therefore the lower braking speed, which advantage is of little consequence as compared with the relative complications of the double-series-parallel equipment.

In the next article the additional cost of a double-series-parallel and single-series-parallel regenerative equipment over and above the cost of a standard equipment will be discussed and comparison will be made between the cost of maintenance of a standard equipment and regenerative equipments of double and single series-parallel types.

THE CALCULATION OF CAPACITY COEFFICIENTS FOR PARALLEL SUSPENDED WIRES—III.

By Frank F. Fowle.

In the previous article was given a treatment of problems relating to capacity coefficients involving metallic circuits. The treatment is continued in the present article and covers also mixed grounds and metallic circuits.

Six Wires, Three Circuits.—This case is an extension of the four-wire, two-circuit case, from two to three metallic circuits of two wires each, and can be solved with no difficulty by the general method for any number of metallic pairs. Without going through the deduction in detail, which has already been well illustrated by the case of three grounded wires, the results may be given at once and the reader may check the formulas if desired. The use of abbreviations is necessary on account of the length of the complete expressions. If

$$\left.\begin{aligned} a &= 2\log\frac{d^2_{12}}{r_1r_2} \\ b &= 2\log\frac{d_{14}d_{23}}{d_{13}d_{24}} \\ c &= 2\log\frac{d_{16}d_{25}}{d_{15}d_{26}} \\ d &= 2\log\frac{d^2_{34}}{r_1r_2} \\ e &= 2\log\frac{d_{36}d_{45}}{d_{35}d_{46}} \\ f &= 2\log\frac{d^2_{56}}{r_5r_6} \end{aligned}\right\} \qquad (123)$$

The [illegible] are

[illegible]

where

[illegible] (125)

These formulas cover the general case of wires of any size and grouping, but neglect the effect of the images. In order to show the effect of three such circuits or pairs in

Fig. 14—Six Wires, Three Metallic Circuits

[illegible] the capacities will be calculated for the [illegible] in Fig. 14, where all conductors are No. 10 N. B. S. G. Such a case permits some simplification of the general formulas, but it is too tedious to give in detail. The calculated results appear in Table IV.

TABLE IV.—METALLIC CAPACITIES FOR FIG. 14.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

By referring to the calculated capacities before given for [illegible] pairs of the same size and similar spacing it will be seen that the capacity of pairs 1-2 and 5-6 has been increased [illegible] by the addition of the third circuit, while the capacity of 3-4 has been increased six parts in [illegible] per cent. The mutual capacity between pairs 1-2 and 3-4 or between 3-4 and 5-6 has been increased [illegible] by the addition of the third circuit; it would be decreased if the third circuit were reversed in position—[illegible] of the third pair were interchanged. [illegible] per cent.

The capacity of pair *1-2* to pair *5-6* with pair *3-4* absent is $C_{1256} = 0.00004873$ microfarad per mile; the presence of pair *3-4* therefore increases the capacity about 12 per cent, but the reversal of pair *3-4* would diminish the capacity. These differences grow out of the assumption that conductors [illegible] are positively charged, while [illegible] are negatively charged.

Three Wires, Three Circuits.—This case has already been considered for grounded circuits, but three-wire circuits without a ground return or a grounded neutral point are very common. The fundamental equations are,

$$[illegible] \qquad (126)$$

which are subject to the condition,

$$q_1 + q_2 + q_3 = 0 \qquad (127)$$

If all the coefficients of the type u_{xx} were equal to each other and similarly all those of the type u_{xy} were equal to each other, it could be shown at once that

$$V_1 + V_2 + V_3 = 0 \qquad (128)$$

as a consequence of (127). While these two condition[illegible] be satisfied simultaneously in special cases, it is not t[illegible] the most general case. If the sum of the charges is [illegible] then the sum of the potentials is slightly different [illegible] zero, and vice versa. A system of transposition c[illegible] devised, however, to equalize these small difference [illegible] satisfy both (127) and (128) exactly.

In the case of grounded neutrals it is preferable, [illegible] general rule, to follow the method used in the three[illegible] grounded circuit, but not always necessary. For exa[illegible] consider the case shown in Fig. 15.

Assume that conductor *2* is the grounded neutral, a[illegible]

$$[illegible]$$

and also assume that

$$r_1 = r_2 = r_3 = r, \quad d_{12} = d_{23}, \quad d_{13} = d$$

It follows at once from a consideration of (126) a[illegible] similar expressions for the charges that

$$[illegible]$$

Whence,

$$[illegible] = \left(\frac{1}{2 \log \frac{d}{r}} \right) [illegible]$$

Therefore, the neutral is without effect on the [illegible] capacity of the outside pair and is devoid of char[illegible] potential. Such an arrangement of the conductors [illegible] in a balanced circuit electrostatically and a minimum [illegible] ing current.

But there are many cases of three-wire circuits w[illegible] grounds charged from insulated or so-called m[illegible] sources; the sources may impress single-phase or [illegible] phase emfs on the circuit. The fundamental equatio[illegible] given by (126) and the fundamental limitation by [illegible] Hence it can be written at once that

$$V_{12} = (u_{11} - u_{21}) q_1 + (u_{12} - u_{22}) q_2 [illegible]$$
$$V_{23} = (u_{21} - u_{31}) q_1 + (u_{22} - u_{32}) q_2 [illegible]$$
$$V_{31} = (u_{31} - u_{11}) q_1 + (u_{32} - u_{12}) q_2 [illegible]$$

In this case the problem is with potential differenc[illegible]

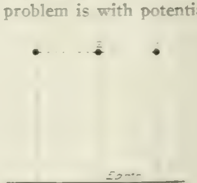


Fig. 15—Three-Wire Circuit with Grounded Neutra[illegible]

tween the conductors, and it should be observed th[illegible] sum of all the potential differences is zero, or

$$V_{12} + V_{23} + V_{31} = 0$$

Expressions (133) and (134) show that two indep[illegible] equations may be obtained, as follows:

$$V_{12} = (u_{11} - u_{21} - u_{12} + u_{22}) q_1 + (u_{12} - u_{22} - u_{13} + u_{23}) q_2$$
$$V_{23} = (u_{21} - u_{31} - u_{23} + u_{33}) q_1 + (u_{22} - 2 u_{23} + u_{33}) q_2$$

or

$$V_{12} = \left(2 \log \frac{d_{12}d_{13}}{r_1 d_{23}}\right) q_1 + \left(2 \log \frac{r_2 d_{13}}{d_{12} d_{23}}\right) q_2$$
$$V_{23} = \left(2 \log \frac{d_{13}d_{23}}{r_3 d_{12}}\right) q_1 + \left(2 \log \frac{d^2_{23}}{r_2 r_3}\right) q_2$$

And if (136) is abbreviated for convenience,

$$V_{12} = a q_1 + b q_2$$
$$V_{23} = c q_1 + d q_2$$

[illegible] follows that

$$q_1 = \left(\frac{d}{ad - bc}\right) V_{13} - \left(\frac{[illegible]}{ad - bc}\right) [illegible]$$
$$q_3 = -\left(\frac{c}{ad - bc}\right) V_{13} + \left(\frac{a}{ad - bc}\right) [illegible] \qquad (138)$$

[illegible] the coefficients of V_{13} and V_{23} are capacity coeffi[illegible]. The solution is here complete if it is desired to have [illegible] charges per conductor. But in case the charge per pair [illegible] phase, as in a delta system, is desired one more trans[illegible] is necessary.

$$\tfrac{1}{2}(q_1 - q_3) = \left[\frac{\tfrac{1}{2}(c - d)}{ad - bc}\right] V_{13} - \left[\frac{\tfrac{1}{2}(a + b)}{ad - bc}\right] V_{[illegible]} \qquad (139)$$

$$\tfrac{1}{2}(c + d) [illegible] \log \frac{[illegible]}{r_{[illegible]} d}$$
$$\tfrac{1}{2}(a - [illegible]) [illegible] \frac{r_{[illegible]} d^2_{[illegible]}}{r_1 d^2_{23}} \qquad (140)$$

[illegible]e are two similar solutions for the other two com[illegible] of pairs, which can readily be worked out. It is [illegible] to do so, however, for purposes of calculation, [illegible] of the conductor numbers on the diagram is [illegible].

[illegible] the three conductors are disposed in one plane the [illegible] is unbalanced electrostatically, as already shown in a [illegible]us case. If, however, the conductors are situated at [illegible] corners of an equilateral triangle, the system here becomes perfectly balanced.

[illegible] case

$$r_1 = r_2 = r_3 = r$$
$$d_{12} = d_{13} = [illegible] = d \qquad (141)$$

[illegible]

$$a = -b = c = \tfrac{1}{2} d - 2 \log \frac{d}{r} \qquad (142)$$

and [illegible] reduces to

$$\tfrac{1}{2}(q_1 - q_3) = \left(\frac{1}{4 \log \frac{d}{r}}\right) V [illegible] \qquad (143)$$

and the coefficient of capacity is identical with that for a single pair of equal conductors. Thus it is a simple matter to find the charging currents per phase of a delta three-[illegible] system when the line is arranged as shown in Fig. 16.

[illegible] formulas in general apply, of course, to the simple [illegible] continuous emfs, and also to the instantaneous charges and emfs in a single-phase system, or to the effective values. They apply equally to the instantaneous values

[illegible] Three-Wire Insulated System Grouped for Electrostatic Balance.

[illegible] polyphase system. Under these circumstances all [illegible]s are of a scalar character.

[illegible] in a vector sense they are just as true for the effective charges and emfs of a polyphase system, so that (138) and (139) are perfectly general for continuous emfs or for sinusoidal alternating emfs, single-phase or polyphase, when regarded as vector equations. The charging currents with sinusoidal emfs follow directly from

$$i = \frac{dq}{dt}$$

which simply amounts to the complex imaginary operator $\pm j$ where the sign depends upon the assumption in regard to positive and negative directions of rotation.

MIXED GROUNDED AND METALLIC CIRCUITS

There is nothing really new in cases of this sort, because the principles already developed apply here also. It seems unnecessary to work out a general case, because the general process can be illustrated very well by a simple case.

Three Wires.—The simplest case comprises three wires arranged as one grounded circuit and one metallic circuit. Let wires *1* and *2* comprise the pair and *3* the grounded circuit. Starting with the fundamental equations given in (126), the limiting condition is given by

$$q_1 + q_2 = 0 \qquad (145)$$

whence

$$[illegible] \qquad (146)$$

and

$$[illegible]$$
$$V_3 = (u_{13} - u_{23}) q_1 + u_{33} q_3 \qquad (147)$$

Solving for the charges,

$$[illegible] \qquad (148)$$

where

$$[illegible] \qquad (149)$$

$$[illegible] \qquad (150)$$

$$[illegible] \qquad (151)$$

It is obvious that if conductor *3* is so placed that $d_{13} = d_{23}$ the mutual capacity will vanish and the capacity of each circuit will have the same value as it would if the other circuit were not present.

Two Wires; Grounded Phantom.—Two wires are frequently employed in telephony to secure one metallic circuit and one grounded phantom circuit by familiar methods. In this case the fundamental equations are,

$$[illegible] \qquad (152)$$

and the limiting condition is

$$[illegible] \qquad (153)$$

whence

$$[illegible] \qquad (154)$$

[illegible]

$$[illegible] \qquad (155)$$

But,

$$[illegible] \qquad (156)$$

so that,

$$[illegible] \qquad (157)$$

and finally

$$C_{1+2} = \frac{\left(2 \log \frac{4 h_1 h_2 d_{12}^2}{r_1 r_2 h_{12}^2}\right)}{\left(2 \log \frac{2 h_1}{r_1}\right)\left(2 \log \frac{2 h_2}{r_2}\right) - \left(2 \log \frac{h_{12}}{d_{12}}\right)^2} \qquad (158)$$

Except in a special case, to be mentioned, there will theoretically be conductive interference between the physical circuit and the phantom, caused by unequal charging currents in the two conductors from the emf impressed on the phantom. This can be neutralized by transposition, of course.

However, a natural balance will exist when,

$$\left.\begin{array}{l} r_1 = r_2 = r \\ h_1 = h_2 = h \end{array}\right\} \qquad (159)$$

In that case

$$q_2 = q_1 \qquad (160)$$

and

$$C'_{1+2} = \frac{2}{\left(2 \log \frac{2 h \sqrt{d^2 + 4 h^2}}{r d}\right)} \qquad (161)$$

The capacity in this case is considerably more than the capacity of either conductor, alone, to earth; at the same time it is less than twice the capacity of either conductor alone. So that the attenuation over the phantom will be less than the attenuation over a grounded circuit composed of one of the single conductors.

The calculation of capacity coefficients for more complicated cases of this general character might be extended almost indefinitely, but the principles involved have been fully covered. The great variety of possible cases makes it inadvisable to attempt a more extensive treatment.

CALCULATION OF CONSTANT

The capacity coefficients deduced throughout this treatment are in terms of c.g.s. electrostatic units per centimeter length of conductor; natural or Napierian logarithms are also implied in every case. In order to change the results to electromagnetic units and finally to practical units, it is necessary to calculate the value of the proper factor or constant.

The value of the constant for obtaining the result in microfarads per mile, using common logarithms, is

$$K = \frac{10^{15} n}{v^2 n} \qquad (162)$$

where,

10^{16} = factor to change from c.g.s. electromagnetic units of capacity to microfarads.

n = 160,930, or the number of centimeters in one statute mile of 5280 ft.

$v = 3 \times 10^{10}$, or the velocity of light, being the factor to change from electromagnetic to electrostatic units of capacity.

m = 2.3026, or the factor to change common logarithms to Napierian logarithms.

The value of the constant is,

$$K = 0.07766 \qquad (163)$$

For microfarads per 1000 ft. the value of the constant is

$$K' = 0.014708 \qquad (164)$$

These constants apply to every coefficient of capacity deduced by the methods heretofore employed. In every case where numerical values have been presented the unit is microfarads per mile.

LIMITATIONS OF METHOD.

The general method here used depends fundamentally upon the exactness of the potential coefficients. Given, in any case whatever, an exact expression, or form of expression, for the potential coefficient, the methods heretofore used are rigid.

As stated very much earlier, the form of the potential coefficient actually employed is not precise when the separation between the conductors is small compared with ir diameters—that is, when $\frac{d}{r}$ is not large. In most c s of suspended bare wires, however, the value of $\frac{d}{r}$ is ra r large; in such cases there is no appreciable error what in assuming that the surface distribution of the charg each conductor can be represented by an equal charge linear distribution along the axis of the conductor.

For values of $\frac{d}{r}$ which are small and the corresp ing formula for capacity in simple cases the reader sh ld consult an article in the *Electrical World* of Sept. 22, 1 0, by Messrs. H. Pender and H. S. Osborne, on "The Elec static Capacity Between Equal Parallel Wires," and other article by Dr. A. E. Kennelly, Oct. 27, 1910, "Graphic Representations of the Linear Electros Capacity Between Equal Parallel Wires." These art deal with the exact formula when $\frac{d}{r}$ is small, in the of a pair of equal wires charged from an insulated so and also show the error under such conditions of appl the formula deduced in the present instance.

It is proper to point out, also, that the present treat does not apply to insulated wires if the specific induc capacity of the insulation differs from unity. Ordin it is greater than unity and causes an increase in the c cient of capacity. For example, if conductor *1* is insul to a radius r_3 and conductor *2* to a radius r_4, whe is the specific inductive capacity of the insulation, then

$$C_{12} = \frac{1}{2\left(\frac{1}{k} \log \frac{r_3 r_4}{r_1 r_2} + \log \frac{d_{12}^2}{r_3 r_4}\right)} \qquad ($$

and for a single insulated conductor, insulated to a radi

$$C_1 = \frac{1}{2\left(\frac{1}{k} \log \frac{r_2}{r_1} + \log \frac{2 h}{r_2}\right)} \qquad ($$

It will be observed that when the insulation thick becomes zero, or when k equals unity, these express reduce to the simple and familiar form for bare wires. general, the effect of insulation complicates the prob besides increasing the capacities.

COST COMPARISON OF SMALL GAS-ENGINE AND STEAM PLANTS.

In a recent discussion of internal-combustion eng for power stations Mr. R. M. Carr, chief electrical neer for the Leek (England) gas-engine-driven genera

	500 Kw. or Under.	500 Kw. to 1000 Kw.	1000 to 2 K
Steam:			
Engines, generators, boilers, auxiliaries, switchboard, battery, piping, crane, etc. Cost installed per kilowatt............	$180.00	$130 00	$10
Land, buildings, shaft, foundations.......	95.50	59 00	47
Total cost per kilowatt..............	$275.50	$189.50	$14
Gas:			
Engines, generators, producer plant, switchboard, battery, piping, crane, etc.	$140 00	$122 00	$11
Land, buildings and foundations.........	60.00	45 00	42
	$200 00	$167 00	$152

station, enumerates the comparative costs of opera ng steam and gas-engine plants. The higher investmen in a gas-engine plant has been urged against this form of motive power, and, although the author admits this ob tion when bearing upon large units, especially turbine he

deares that for small plants up to a certain rating the ga driven station costs less than steam.

r plants under 500 kw in rating he estimates costs ven in the table on the preceding page, the equivalent of is figures being stated in United States money.

ese figures as given are the averages from actual co of a number of stations up to 500-kw rating. The g gine figures above 500 kw were taken from manu- ers' estimates, says the author. His own plant at st as follows:

[illegible]	$52 [illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	$31,68[illegible]	
[illegible] installed		$13[illegible]
[illegible]	$2[illegible]	
[illegible]		$6[illegible]
[illegible] watt		$10[illegible]

e it is usually acknowledged that the fuel costs of a en plant are considerably below those of a similar lant, other items must be taken into account in g comparison. Particularly is this the case in repai and maintenance of engines, which, in the author's opi on, will be somewhat greater after a few years of g for gas engines than for steam. Of course, the efficiency of a gas plant is admittedly much better than that of steam, but, as the author continues, the advertised figures of some makers of gas engines, while the may possibly be true with the conditions under which the ests were taken, are seldom, if ever, realized under ord ary working conditions, and it is impossible to get anything like such results with the fluctuating load of the avege central station.

the other hand, the repairs to a well-designed produc plant should not be nearly so great as those of boilers. For purposes of comparison, however, there have bee taken the figures of three municipal plants, each entire gas-driven, the averages of several others, also gas-driven, and these are compared with the average of all the municipal undertakings of a capacity under 1000 kw. Where the figures given were per kw-hour generated, 20 per cent has been deducted to allow for losses in transmission, energy used in station, battery losses, etc., so that the figures shall fairly represent the costs per kw-hour sold.

COMPARISON BETWEEN GAS AND STEAM STATIONS UNDER 1000-KW RATING.

	Average of Municipal Gas-Engine Plants.	Averages of Other Gas Stations.	Averages of Steam Stations.
Rating, kilowatts	314	632	600
Kw-hours sold per annum..	299,210	874,720	502,980
COST IN CENTS PER KW-HOUR SOLD.			
Fuel	0.56	0.52	1.06
Oil, waste water and stores	0.12	0.08	0.12
Wages of workmen	0.52	0.32	0.60
Repairs and maintenance	0.38	0.44	0.56
Total works costs	1.58	1.36	2.34
Rent, rates and taxes	0.20	Not available	0.24
Management and establishment charges, insurance, etc.	0.82	Not available	0.68
Total costs	2.60		3.26

The average price for fuel in the municipal stations quoted is $2.54 per ton delivered, either coke or bituminous coal being used. It will be noted that the repairs and maintenance item for the gas stations is not so high as that of steam. It may be attributed in part to the gas stations not having been in operation so long as the steam plants, but, notwithstanding the heavy wear and consequent repairs to be expected in gas engines, it is questionable whether this will ever exceed the total repair bill on steam engines and boilers.

Central Station
Management, Policies and Commercial Methods

GAS HOLDER USED IN COOLING-TOWER AT HOT SPRINGS, ARK.

The power house which produces electrical energy for lighting and railway purposes at Hot Springs, Ark., has re used the run-off water from the famous hot as the only available supply for condenser purposes. The temperature of this water averages 80 deg. Fahr. in summer. To augment the supply, as noted in the *Electrical World* of May 26, 1910, a pumping station was installed 2 mes further up the stream bed into which the hot springs discharge, and a large addition thus made to the natural

Natural gas has now been piped into Hot Springs, and the ocal company, which furnished all the utilities for the own, will distribute this gas to its former artificial-gas onsumers, besides burning it under the boilers of its powr station. The advent of natural gas into Hot Springs has accordingly released from further duty the 90-ft. holdr tank used in connection with the artificial-gas plant. and his receiver is now being adapted for use as a cooling tow in connection with a new condenser just installed. The water-seal pit is used as the receiving tank, while Koeing sprays are arranged to throw streams of water ove the sides and top of the tank. After being cooled by evaporation, this water returns to the seal pit. No other changes have been made in the gas holder, which may be required for use should the natural-gas supply fail. Meanwhile the holder serves as a very effective cooling tower. Mr. R. Schwartz is general superintendent of the Hot Springs Water Company, and Mr. A. E. Main is superintendent of its electrical department.

HOUSE-WIRING RESULTS AT SHREVEPORT.

The Shreveport (La.) Gas & Electric Company has inaugurated a new-business campaign, a feature of which is the wiring of old houses on an instalment plan, according to which the customers are required to pay $2 down and $2 per month. This cost refers to both concealed and open work, and the proposition is tendered to all houses remaining unwired that are reached by the company's pole lines. The electric company meets the cost of construction and then collects from the customer at the rates above mentioned, the amounts being added to the monthly electric service bills. The contract between the company and the consumer stipulates that the consumer shall immediately begin the use of electric service following the completion of the installation. Shreveport is a city of

31,000 population, and has 2000 electrical consumers. As the result of the house-wiring campaign, seventy-five new consumers were obtained in thirty days. The instalment feature of the scheme has proved especially attractive in getting new business, and the results obtained have been gratifying to Mr. J. E. Cowles, superintendent of the lighting department of the Shreveport Gas & Electric Company

ELECTRIC SIGNS IN MILWAUKEE.

In the organization of the new sales department for the Milwaukee Electric Railway & Light Company, headed by Mr. C. N. Duffy, who is comptroller of the company, special attention was paid to the matter of display and sign

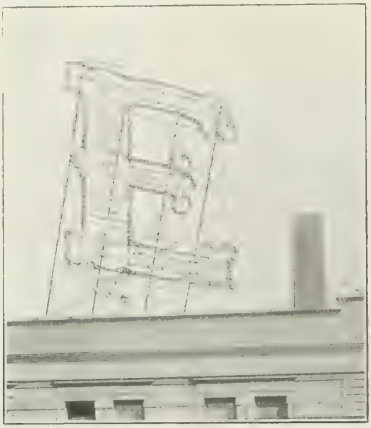


Fig. 1—Milwaukee Electric Company's Monogram Sign on Power House.

lighting, two specialists in these lines being provided for. The results of this new-business campaign are already in evidence on the streets of the city, where in spite of the restrictive sign ordinance a number of handsome displays

Fig. 2—Curb and Sign Lighting of Milwaukee Public Service Building.

have been erected. Milwaukee's city fathers limit all electric signs to positions flat on the walls of buildings, and this restriction has hampered the location of many installations.

At the beginning of its sign campaign the electr company itself led off with the erection of a handsom 40-ft. monogram sign containing 540 lamps on the top i its Oneida Street power plant, as shown in Fig. 1. Tl sign is 32 ft. high and 30 ft. wide, and stands 40 ft. ab e the roof. The symbol is that used generally by the company and is familiar to Milwaukee people. The sign is p vided with alternating-current service, and by means of a asher first the large "E" is made to appear, followed turn by the words "The Electric Co.," "Light," "Hea and "Power."

Fig. 3—A Milwaukee Manufacturer's Appeal to Citizen in Home Products.

Fig. 2 shows the attractive display erected by the station company on its handsome Public Service B ding. The ball at the top of the sign is kept in motio by a flasher and the effect of the sign is not lost even in contrast with the brilliant electric curb lighting maintained the Milwaukee company in front of its offices.

Fig. 3 shows a sign erected by a local manufact er appeal to the citizens of the community which h own product is reputed to have made famous. Another striking spectacular sign in Milwaukee is a small-sized repro ction of the famous chariot-race sign displayed in New York Detroit and Dayton. The Milwaukee sign was ere the enterprise of a local merchant who operates the entirely in his own interests. This chariot-race disp , the electric company's big "E" and a number of other si find an unusual and effective setting against the darl background of the buildings abutting on the Milwaukee river, which bisects the city. At the Wisconsin Avenue the main arteries of travel are concentrated, so that large number of persons are continually passing in view f the electric displays.

ELECTRIC AUTOMOBILES AT DENVEI

Electric pleasure vehicles have attained great po larity in the city of Denver, Col., there being over 800 in gular service at the present time. It is estimated that one amily in every sixty is the owner of an electric runabout, aeton or coupé, and the Denver Gas & Electric Light C ipany is now deriving a total yearly revenue from the le of energy for charging of about $43,600. The ener con

sumption is now at the rate of 2,180,000 kw-hours per annu and the greater part of this business is handled off the company's peak. Each vehicle is producing a revenue for he central-station organization of about $54.50 a year, or little over $1 a week.

re are at present fifteen garages making a specialty

Fig. 1—Parade of Electric Trucks.

ectric-vehicle service, and the rates vary from $20 per per car upward, the lowest price being charged for s maintained in the garages but not delivered to or ed from owners by the garage staff. Garage charges the supply of energy to the batteries, washing, oilminor adjustments and general cleaning and super- The popularity of the electric machines is evidenced by their almost continuous appearance on the and in the residential sections of the city it is diffiwalk more than two or three blocks without passing ric pleasure vehicle. Long rows of these equipline the important side streets of the shopping dis- d there is little question that they illustrate the most type of car for town service. Runs into the counhilly districts outside the city are becoming frend the trip from Denver to Colorado Springs, a of 75 miles, including the passage of the divide the Platte and Arkansas Valleys, is not seldom a single charge.

Denver Gas & Electric Light Company owns nine vehicles, ranging in size from a light runabout to truck for delivering coke about the city. These

Fig. 2—Small Truck Advertising Electric Fans.

machines are charged and maintained at a garage operated by e company near its West Side power station. The garage is strictly private and handles no commercial business although its staff is constantly at the service of the commercial garages in matters requiring consultation, emergencies and difficulties occurring in operation. The garage also maintains forty-eight motor cycles used by the company's inspectors and trouble men in meeting emergency calls and twelve gasoline cars used in long-distance service. The garage is open twenty-four hours a day and seven days a week. It contains facilities for the simultaneous charging of eighteen electric vehicles, a stockroom, machine shop and battery maintenance department. At present the work of charging is handled by a 25-kw, 150-volt generator direct-driven by a 40-hp, 2300-volt, three-phase induction motor. A new motor-generator set of 100-kw rating will shortly be added. All the wiring is in conduit and the charging service is controlled by a switchboard of five panels, two panels being equipped for motor-generator control and three for the control of charging circuits. The arrangements permit the charging of any vehicle with or without an ammeter in series with the battery, and the usual plug receptacles for voltmeter measurements are installed. Each of the eighteen charging circuits is provided with a rheostat which is installed behind and above the switchboard on an angle-iron framework. All circuits are fused at the board and at the wall outlet. The outlets are arranged to permit the sudden withdrawal of the charging plug without short-circuiting. The machine shop contains an engine lathe, a drill press and a grinder group driven by a 3-hp induction motor. Ten thousand battery plates are carried in stock by the company. Battery boxes are manufactured for the company's service in the garage, and the woodwork is paraffined with the aid of an electric flatiron to protect it from liquid damage.

Many electric vehicles were exhibited during an industrial parade held in Denver on July 18, and every type of machine owned by the company was in line. The electric division of the parade was headed by a 2-ton construction truck used in line service, this being fitted up to represent various features of an electric home. Electric washing machines were demonstrated with genuine soapsuds by two young ladies, electric flatirons were operated as the procession passed along the streets and an electric piano was in service on the truck. Energy for the operation of this equipment was obtained from the storage battery propelling the truck, additional cells being connected in series to furnish the necessary voltage. Another electric vehicle used in meter service was equipped with electric fans. Other trucks were provided with flags, signs and other decorations calling attention to the average saving of 25 per cent to 50 per cent in transportation effected by the electric vehicle.

Most of the prominent makers of pleasure vehicles of the electric type are represented in Denver, and at present a vigorous campaign is being made to acquaint the public with the economies of the electric truck. The streets of Denver are well paved and characterized by moderate grades, and the climate is favorable to continuous electric-vehicle service throughout the entire year. Gasoline trucks have been adopted to some extent in Denver, but the Denver Gas & Electric Light Company is planning to compete against these through the work of its electric-vehicle department in educating the public to the better understanding of the possibilities of the electric truck. There is little doubt that the success attained in the use of electric pleasure cars will count heavily in favor of this type of truck in Denver.

Among the prominent garages that of the Fritchle Automobile & Battery Company has a representative equipment of motor-driven machinery for washing, cleaning and charging service, including a 50-kw motor-generator set for night work in charging batteries and smaller generators for day service. This company manufactures electric pleasure vehicles, producing every part of its cars except tires and lamps, and it operates a large plant on the garage premises in which all the machining, carpentry, upholstery and assembling work required in the manufacture of vehicles are handled. All the machine tools on the premises

are motor-driven. Each vehicle is supplied with a 4-hp laminated-field, direct-current motor and a battery of the Fritchle type, the motor being capable of being operated for short periods at 400 per cent overload. The latest coupés built by this organization are equipped with automatic switches by which the interior lamp is lighted by the opening of the door, and it is also provided that the motors shall return electricity to the batteries in descending grades. The garage has a capacity of 250 cars, and 135 vehicles of this make are now in service in Denver. The company has lately taken up the question of commercial electric-truck development and will shortly enter this field.

Other prominent garages in service are the three electric-vehicle stations of the Carstarphen interests, and those of the Krebbs-Gotschall, Capitol Hill, Davis, and Denver Omnibus & Cab interests. The last-named establishment has three electric sight-seeing trucks seating twenty passengers each, and a baggage truck which recently delivered fifty-five sample trunks weighing over 200 lb. each and thirty suitcases on a single trip. The sight-seeing cars make about forty-five miles daily, individually, upon one battery charge each and their cost of operation is one-fifth that of the former gasoline vehicles used in this service. The Denver Gas & Electric Light Company's coke truck recently delivered 26 tons of fuel in one day, only one man being required for the service. There are about 125 private garages in Denver, the rate for a 30-amp rectifier on off-peak service being 4 cents per kw-hour, less 10 per cent discount for prompt payment, the minimum charge being $5 net per month. If charging is done at the time of the peak on the lighting company's system, the rate per kw-hour is the same, but the monthly minimum becomes $7.50. Commercial garages are given a rate based on the horse-power connected—$24 per year per horse-power plus 3 cents per kw-hour as metered, with a 10 per cent discount. In addition, a so-called consumer's charge of 75 cents per month is imposed.

CENTRAL-STATION COMMERCIAL ENGINEERING.

In a paper read at a joint meeting of the Milwaukee Engineering Society and the Milwaukee Section of the American Institute of Electrical Engineers Mr. Egbert Douglas gave many interesting hints relating to central-station commercial engineering. Below is given an abstract of his suggestions bearing on motor and heating applications.

MOTOR APPLICATIONS.

The expiration of practically all broad patent claims on motor designs has brought the cost of electric motors down to the point where their use for factory driving is well within the required limits of first cost to compete successfully with the now obsolete mechanical drive. These conditions might seem to simplify greatly the task of the user in making selection and purchase of proper factory equipment. As a matter of fact, however, the situation is inclined to become more complicated. Some of the reasons for such complication are as follows:

To the inexperienced user of motors there is a strong inclination to employ too many motors and subdivide the load too far. As a general proposition the use of individual motors is easily overdone, with the result that: (a) the first cost of equipment is readily increased beyond the point of profitable investment; (b) the saving in energy is often widely overestimated by the use of individual motors; (c) the use of individual-motor drive in some industries tends to increase rather than decrease the amount of energy—this is particularly true in cotton mills. In this class of industry, however, the increased energy is of little moment, as the increase in production readily overcomes the increase in energy at a handsome return.

As an indication of how easy it is to overdo the individual-motor drive it was once suggested that the proper way to equip a cotton mill would be to put a motor on every spindle. Imagine a cotton mill with 50,000 in... equipped with 50,000 motors!

There are industries, however, where individual ... applications are very desirable without regard to eith... saving in energy or increase in production. The ui... ity of speed necessary for successful operation will justify their use. Other conditions are encountered whe... individual motors are desirable solely on account of co... of cleanliness; for instance, in a laundry or printin... where the elimination of overhead shafting and ... the means of removing much undesirable dirt.

Certain applications where the nature of the ... would indicate the group method as being prefer... account of rapidly fluctuating load conditions are ... anced by the nature of the finished product. For e... a ribbon loom takes little power and gives rather an ... load, and as far as load is concerned grouping is de... The nature of the product, however, is such that b... undesirable, as the frictional electricity from then... to distort the silk threads and makes the fabric c... On account of high cost of material few second ... can be tolerated, with the result that individual mot... here very desirable.

The amount of power is often overestimated, anc... absence of accurate information on average com... load conditions often plants are provided with to... motors, and, again, they may be equipped with to... motors. With the desire to be safe, however, the mo... more usually too large than too small. This result p... is due to giving insufficient attention to the time-fa... machines or groups of machines or to the nature ... plant and character of material used. For exar... 36-in. lathe in a manufacturing plant used for r... shafting of low-carbon steel and taking two cuts at ... of 150 ft. per minute will require 25 hp. The sam... in another plant used for finishing or repair work ... require only from 3 hp to 5 hp.

In large factories where competition is keen th... are worked much harder than in repair shops anc... plants, and hence the motor requirements are ra... different from those for the same tool in different ... tries.

Again, the cycle of operation of machines where t... is intermittent should be given careful considera... selecting the motor, to secure proper sizes and re... heating.

Consider an application requiring 50 hp for 5 ... and 10 hp for 10 minutes, the operation being re... every 15 minutes. The average load of the motor ...

$$50 \times 5 = 250 \text{ hp-min.}$$
$$10 \times 10 = 100 \text{ hp-min.}$$

Total, 350 hp-min.

the time average being 23.3 hp.

This average load will not produce the same heatir... the cycle will, for the reason that the copper losses ... motor vary as the square of the current. The roo... square or equivalent heating will be produced by t... lowing:

$$50^2 \times 5 = 12,500$$
$$10^2 \times 10 = 1,000$$

Total, 13,500

Dividing this over 15 minutes the average square is ... to be 900, the square root of which is 30. Thus a ... mean-square load of 30 hp if applied continuousl... produce the same heating as the cycle.

In machine-tool applications where the cutting is intermittent, such as planers, shapers, slotters, etc., the maximum load almost invariably comes when the reverse movement is made from the cutting stroke.

[illegible]e central-station commercial engineer finds it difficu[illegible] with inexperienced motor users to prevent them in suc[illegible] cases from purchasing motors rated equal to the [illegible] load.

[illegible] there are applications where the load is on a

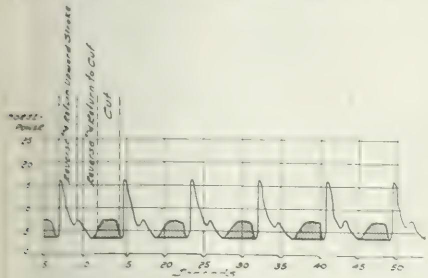


Fig. 1—Cycle of Slotter Operation.

[illegible] for, say, from an hour to an hour and a half once a [illegible]ch as in a small gray-iron foundry cupola. In [illegible] case where the load is carried by a cold motor a [illegible]ent or 25 per cent overload on the motor would be [illegible]tive, as the motor would hardly reach its permis[illegible]perature when the work would be finished.

[illegible] following two examples show some of the principles [illegible] the basis of analysis of the comparative cost of [illegible]g group and individual drives.

[illegible]*ne Shop.*—It is proposed to equip with electric [illegible] machine shop now being driven by a 150-hp steam [illegible]nd 800 ft. of main-line shafting kept in excellent [illegible]. Indicator cards showed:

[illegible]wer of engine	[illegible]
[illegible]orse-power friction of shafting.	[illegible]

[illegible]omparative investment and operating costs are [illegible]n the following table:

	Group Drive	Individual Drive
[illegible]	1	217
[illegible] horse-power	[illegible]	450
[illegible]	$4,000.00	$25 000.00
[illegible] maintenance	[illegible]	$1 280 00
[illegible]	$600.00	[illegible] 750.00
[illegible]nsumption, kw-hours	240,000	132,200
[illegible] cents per kw-hour	[illegible]	[illegible]
[illegible]	$11,920 [illegible]	[illegible]

[illegible] energy costs less than 3.6 cents per kw-hour, the tota[illegible] cost of operating the group-drive installation would be l[illegible]s than that of operating the individual drive.

[illegible]*Factory.*—It is proposed to equip the 149 sewing

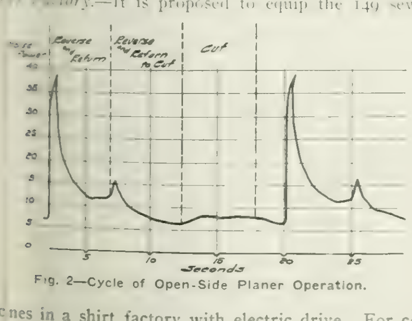


Fig. 2—Cycle of Open-Side Planer Operation.

mac[illegible]nes in a shirt factory with electric drive. For compari[illegible]n the actual results in another factory manufacturing [illegible]e same quality and line of goods, but equipped with 174 [illegible]ewing machines, are known.

The comparative investment and operating costs of the three equipments are shown in the following table:

	[illegible]	[illegible]	[illegible]
Number of machines	[illegible]	[illegible]	[illegible]
Number of motors	[illegible]	[illegible]	[illegible]
Aggregate rating of motors, horse-power	[illegible]	[illegible]	24.8
Friction load, kilowatts	[illegible]	[illegible]	...
[illegible]	[illegible]	[illegible]	$4,500.00
Yearly cost of maintenance	$30 00	$50 00	$125.00
"Fixed charges"	$150.00	$210.00	$675.00
Annual consumption, kw-hours	42,600	24,240	22,700
Cost of energy at 4 cents per kw-hour	$1,704.00	$969.60	$908.00
Total annual cost	$1,884 00	[illegible]	$1,708.00

From the foregoing table it appears that the five-motor group is more economical than either the two-motor group or the individual drive if the cost of electric energy is 4 cents per kw-hour. The group drive with two motors is more economical in total annual cost than the individual drive if the cost of energy is less than 3.3 cents per kw-hour and more economical than the five-motor group if the cost of energy is less than 0.6 cent per kw-hour.

HEATING APPLICATIONS.

The general subject of the application of electric heat is divided into two classes, namely, domestic applications and industrial applications. Both these classes of applications

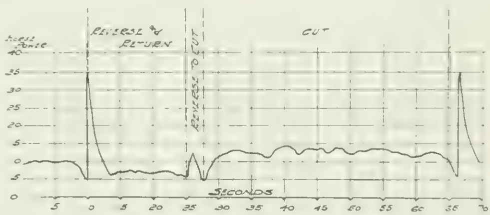


Fig. 3—Cycle of 120-in. Planer Operation.

of electric heat are now receiving well-merited attention from central-station commercial engineers, since the former has an important bearing on the financial results of distributing electric energy in a residence district and the latter sometimes influences the use of central-station service in place of privately produced energy.

Domestic Applications.—The price at which electric service can be profitably sold is dependent largely on the density of the business and the load-factor such business produces. In a city with the residence-lighting business only moderately developed it is probable that the business is being done with only a very small return on the investment devoted to such business. This result is attributable to the relatively low density of business—that is, to the small amount of energy per mile of line and to the low load-factor developed by this class of business. Any use of electricity that will tend to increase the density and load-factor of the residence-lighting business is looked upon with favor by central stations.

The first domestic electric-heating device that found a large use was the smoothing "iron." Following closely upon the development of this device came other heating devices, such as chafing dishes, coffee percolators, water heaters, heating pads and toasters. The principal argument for the use of these devices is that of their convenience. At the rates at which electric service can be sold under the present condition of residence-business development these services cannot be said to compete with other means of producing heat and their use is another example of the willingness of people to pay for convenience.

The electric stove or cooker is now assuming a prominent field in the mind of central-station operators. Much

has been done in the development of the design of such stoves, but their actual use is not large as yet. In the ordinary electric stove the heat is produced only when needed. Under such conditions of use the maximum demand imposed on the distribution system is high and the load-factor low. Moreover, the time of the maximum demand coincides with that of the commercial-lighting peak. The ordinary stove accordingly does not meet the requirements of central stations in improving the residence load-factor.

When this condition was fully appreciated attention was directed to a type of stove that would use electric energy at a low rate through a large number of hours each day, store the heat thus produced in a heat-absorbing medium, such as cast iron or zinc, and give off heat at such rate as was necessary to perform the cooking process. This method has thus far been applied only to the oven of the stove in which roasting or baking is done.

Along this line there has been developed in England the so-called "Therol" system of heat storage and in connection therewith a few devices for making use of the heat so stored. In these devices the heating elements are embedded in a block of cast iron or zinc, which forms the heat-storage medium. In the case of the water heater the iron or zinc is cast around a coil of the pipe into which passes the water to be heated. The insulating medium consists of magnesia and outside the magnesia is a water jacket, etc.

The future development of electric-cooking apparatus seems to be rather largely dependent upon the discovery of a heat insulator or device that will retain its insulating qualities at the high temperature necessary for the storage of an appreciable amount of heat in a moderate-sized mass of material. So much effort is now being directed along this line that success in the near future is not at all improbable. Most central stations are awaiting the further development of the electric range with heat-storage system before undertaking the commercial application of the device.

Industrial Heating Applications.—Aside from the interest in industrial heating appliances arising out of the extensions of the field of electric service by their use central stations are interested in such appliances, as in many cases they assist in handling the isolated steam-plant problem. One of the difficulties often confronting those putting into practice the gospel of central-station electric service is the requirement of a small amount of live steam for heating in some part of the industrial process. In many such cases electric heat can be applied with good economy and increased output or saving in time and with better factory working conditions.

The field for the introduction of electrical heat for industrial purposes is a wide one and covers an enormous variety of applications in which steam and direct-combustion methods are now used. The adoption of electric heat presents many of the advantages over the older methods that the electric drive does over the mechanical system of transmitting energy. Safety, cleanliness and flexibility are as apparent as in the motor applications. Increased production, improved product and decreased manufacturing costs are also included in the results obtained by its use.

New industries have been created by the aid of electric heat through processes possible only by this method. Some of the industries which present opportunities for its use are embossing and matrix drying and heating glue in paper-box industries and furniture factories. In the leather trade it finds a ready application for heating the large variety of tools required in finishing and ornamentation. In laundry work it has been found preferable for ironing even in the natural-gas belt. In the celluloid industry, the clothing industry and textile trades its use has been found desirable. Bakers and confectioners are inviting prospective customers for its adoption.

As an example of the advantages it has over live steam may be cited matrix drying in the newspaper industry. In this work temperatures as high as 450 deg. Fahr. m[illegible] safely used and, since time is a very important fact[illegible] getting out extra editions, this high temperature is [illegible] desirable as it minimizes the time required to dry a m[illegible] To secure this high temperature requires such high [illegible] pressure that the use of electric heat has proved its su[illegible]ority. The steam pressures required for various tem[illegible]tures are as follows:

Steam Pressure, Pounds per Square Inch.	Temperature, Degrees Fahrenheit.
352	125
361	140
388	195
400	235
450	435

It is readily seen from the above that prohibitive [illegible] pressures are reached long before the desirable tem[illegible]tures are approached.

The matrix-drying apparatus can be kept warm in [illegible] cases by using energy at times when energy is not [illegible] used for other purposes, which arrangement under m[illegible] rates secures the energy for the heating at relativel[illegible] rates on account of the improved load-factor.

Wiring and Illuminatio[illegible]

INDIRECT LIGHTING OF AN ARCHED CHU[illegible] INTERIOR.

Several unique features of indirect and projected i[illegible]nation, means of reaching fixtures for cleaning, etc [illegible] incorporated in the lighting arrangements of the han[illegible] new church building of the North Chicago Hebrew [illegible]gregation, of Chicago, Ill.

The main auditorium, which is lighted entirely by [illegible]cealed tungsten units, measures 70 ft. x 88 ft. in a[illegible] and, as shown in the illustration, has its ceiling divide[illegible] a central barrel arch, 48 ft. wide and 50 ft. from flo[illegible] crown, and two flat-ceilinged panels each 20 ft. x [illegible] and 30 ft. above the floor. The central span is light[illegible] fifty-two 100-watt lamps, twenty-six on a side, inclos[illegible] helmet reflectors and concealed behind the two girder[illegible] dering the arch. As shown in the sketch, these h[illegible] reflectors have their axes inclined about 15 deg. t[illegible] horizontal, and each row of lamps projects its light on [illegible] opposite side of the arch. A good deal of experime[illegible] was done to get the proper angle for the reflecto[illegible] that a uniform illumination of the arch might be obt[illegible] as shown in the illustration.

The helmets rest in wooden cradles, the lamps [illegible] supplied through several feet of flexible cord from ju[illegible] boxes opposite each reflector. For renewing lam[illegible] cleaning the reflectors, the cover can be reached [illegible] overhead platforms running the length of the stru[illegible] girders. The reflector lamps are switched in grou[illegible] four alternate units, so that any desired degree of illu[illegible]tion can be obtained. All of the interior lighting is [illegible]trolled from a panel box at the rear of the altar.

The side panels of the ceiling are indirectly light[illegible] six chain-suspended, eye-comfort reflector bowls, thr[illegible] each side, each bowl containing four 100-watt tu[illegible] lamps. The outsides of the bowls are tinted an ivory [illegible] with gold trimmings, harmonizing well with the pre[illegible]nating colors of the temple interior, ivory for the c[illegible] and a darker cream for the sidewalls. The benches [illegible] Circassian walnut.

the indirect lighting bowls are suspended 5 ft. from the ceiling and at a height of about 25 ft. above the benches, some means for reaching the lamps and reflectors without the use of ladders had to be provided. Accordingly, ... type arc-lamp hangers were resorted to, and the

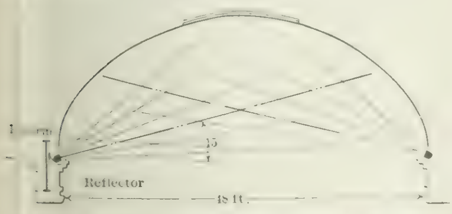
F —Interior View of the North Chicago Hebrew Temple.

fixtures, canopies and all, were suspended from ...ses, arranged so that the whole unit can be lowered ...loor. When hoisted to the ceiling the contact rings ... with the ceiling receptacles, completing the circuits ...

...tle difficulty was encountered at the beginning in ... the fixture canopies to fit snugly against the ceiling, ... hide the receptacles, since the arc-lamp hanger ...s that the lower member be first pulled an inch ...he permanent position and then dropped into place. ...fficulty was solved by making the canopy of tele...g construction so that its upper rim is always pressed against the ceiling by a spring.

...e photograph several small direct-lighting brackets ... noted on the side walls. These 8-cp lamps were ...l as emergency units in compliance with the Chicago ...linance which requires that for every 400 sq. ft. ... area in a public hall there shall be a lamp on a sep... ...rcuit from the main lighting and controlled from a ...assageway.

...e indirect lighting of the North Chicago temple a ...f 7600 watts of tungsten lamps is used, illuminating ... of 6160 sq. ft. Although no photometric tests have ...n made, the intensity everywhere in the auditorium ...icient to permit the smallest print to be read easily, ... the old people of the congregation. Special lamps ...lly planned for the use of the choir over the altar



F 2—Cross-Section of Main Arch, Showing Arrangement of Reflectors.

ha... not been installed, as the general indirect illumination wa... found sufficient for all purposes.

...e lighting and electrical features which characterize the North Chicago Hebrew temple were laid out by Mr. M... Hartman.

INTERIOR CONDUIT SYSTEMS FOR FEDERAL BUILDINGS.

By Nelson S. Thompson

The standard arrangement of the electric-lighting installations in federal buildings under the control of the supervising architect, Treasury Department, consists of an underground service connection to an entrance switch just inside of the building. In small buildings where only two distributing cabinets are used the entrance switch and the subfeeder switches are concentrated in the same cabinet, and in the larger buildings requiring three and not more than four distribution cabinets there is installed a subfeeder tablet from which subfeeders or mains are run to the various distribution cabinets located throughout the building. Where more than four distribution cabinets are necessary the subfeeder cabinet and main switch cabinet are eliminated and a switchboard is installed. In the large buildings, in which an electrical generating plant may be installed at some future time, a standard type of switchboard is installed in the engine room with a service connection to the local companies' mains.

The main service switch is usually located as near as possible to the point at which the feeder circuit enters the building and the subfeeder tablet or the switchboard is so located as to obtain the best runs and the shortest average length, capacities considered, of subfeeders. The point sought for is one at which the sum of the products obtained by multiplying the length of each subfeeder by the number of its ampere capacity is a minimum. In selecting the location for main service switch and subfeeder tablet or switchboard due consideration is given the character of room in which it is to be located, and they are not located in coal-storage rooms, storage rooms, or in letter carriers' lounging or toilet rooms.

The distribution cabinets for the post-office section are in the post-office workroom, so that all lamps in the workroom, letter carriers' lounging and toilet rooms, and the executive offices of the post office, can be controlled from them. All other cabinets in the building are located in public spaces, such as corridors or lobbies, or in the basement outside of post-office space and storerooms. The locations sought for distribution cabinets are those which will admit of being readily reached with the feeder and which will make all branches of approximately equal length. The maximum length of a branch circuit is generally limited to 100 ft. The architectural features of the building are considered in locating distribution cabinets.

The public lobby on the first floor and the exterior lamps at the main entrance are controlled from a cabinet located in the lobby, or, in special cases, in the basement. In cases where not more than three circuits are required to supply a floor above or below a given cabinet they are controlled from the cabinet mentioned. As a general rule not more than sixteen circuits are taken from a cabinet and usually one or more spare switches are provided on each distributing cabinet.

In locating distribution cabinets in thin walls, care is taken to see that a steel beam is not located directly over the cabinet, and should this be the case the structural engineers are requested to substitute two channels for the beam and set the backs of the channels 1½ in. apart. A cabinet is never located in a partition wall less than 4 in. thick, exclusive of the plaster. The cabinets containing the distribution panels are of steel and both the cabinets and the tablets are of special design. The tablets are of marble and contain 25-amp switches and 10-amp inclosed fuses controlling the various circuits.

All wiring is run in rigid metal conduits and all main service connections to the building are made underground either from a steel pole located on federal property or from the service poles of the company adjacent to the

federal building site. The conduits to the service poles are run up a distance of 10 ft. and are provided with a weatherproof hood. The former practice of installing handhole boxes at the base of service poles has proved to be unsatisfactory, and has, except in special cases, been abandoned. The junction box on the main feeder conduit inside of the basement is not made less than 8 in. x 8 in. x 4 in. as a rule, and when the service switch is close to the point of entrance of the service conduit the junction box is sometimes omitted.

The feeder and other conduits in the basement larger than 1 in. are run exposed on the basement ceiling and are installed parallel to the lines of the building. As a general rule all other conduits in the building, except in the roof space and in unfinished attics, are concealed. Conduits in floors are run in the most direct manner and are not as a rule made larger than 1½ in. in diameter, as a larger size is difficult to conceal in the floor construction. Care is taken that conduits do not cross each other in the floor construction.

In the majority of cases the conduits run up from the cabinets and run in the floor construction above with drops to the single-pole snap switches at the entrance doors. This

CONDUIT SIZES FOR CONDUCTORS.

Wire and Cable Size.	Two Wires, Same Size. Inches.	Three Wires, Same Size. Inches.	Four Wires, Same Size. Inches.	Three Wires, Double Size, Neutral. Inches.	Duplex Wires. Inches.
14	[illegible]	[illegible]	[illegible]	[illegible]	½
12	[illegible]	[illegible]	[illegible]	[illegible]	½
10.........	[illegible]	1	1	[illegible]	[illegible]
[illegible]		1	1	1	
[illegible]	1	1¼	1¼	1¼	
[illegible]	[illegible]	[illegible]	1¼	1¼	
4	[illegible]	[illegible]	[illegible]	1½	
[illegible]	1¼	[illegible]	1½	1½	
2	[illegible]	1½	2	2	
1	[illegible]	2	2	2	
[illegible]	2	2	2	2½	
[illegible]	2	[illegible]	[illegible]	2½	
[illegible]	2	[illegible]	2½	2½	
[illegible]	2½	[illegible]	[illegible]		
200000 ...	[illegible]	[illegible]	2½		
250000....	2½	[illegible]	[illegible]		
300000....	2½	[illegible]	[illegible]		

NOTES:—The above table is based on double-braided rubber-insulated wire and unlined metal conduit.

The conduit sizes are given for runs up to 100 ft. with not more than four right-angle bends between outlets. For longer runs larger conduits are used.

LEAD-INCASED CABLE IN UNLINED METALLIC CONDUIT.

Wire and Cable Size.	Two Wires, Same Size. Inches.	Three Wires, Same Size. Inches.	Four Wires, Same Size. Inches.	Three Wires, Double Size, Neutral. Inches.
[illegible]	1¼	[illegible]	1½	[illegible]
[illegible]	1½	[illegible]	2	2
[illegible]	2	2	2	2
4	[illegible]	2	2½	2½
[illegible]	2	2	2½	2½
[illegible]	[illegible]	[illegible]	2½	2½
1	2	[illegible]	[illegible]	3
[illegible]	[illegible]	2½	[illegible]	[illegible]
[illegible]	[illegible]	3	[illegible]	3
000..............	[illegible]		[illegible]	
0000..............	[illegible]		3	
25000............		3	[illegible]	
300000...........	3		[illegible]	....

is, however, a matter which is governed by the construction, ceiling heights, etc., and an effort is made to reduce the length of the runs to a minimum. In vertical risers containing wires of the following sizes and lengths provision is made for supporting the wire by making a right-angle bend in the conduit or in a junction box: No. 0 wire, a support every 100 ft.; No. 00 to No. 0000, a support every 80 ft.; No. 0000 to 300,000, a support every 60 ft.

The preceding tables, many of which are due to Mr. N. R. Stansel, formerly an inspector of mechanical and electrical engineering in the supervising architect's office, are used to ascertain the size of conduits to accommodate the various sizes and number of wires.

OUTLETS.

The standard type of outlet boxes suitable for rigid conduits are used and no conduit larger than ¾ in. is connected to any outlet box and not more than four connections are made to any outlet box. The locations of outlets are made to conform to the architectural treatment and to the construction of the building. This requires generally the symmetrical spacing of outlets and the placing of the same so as to not interfere with construction details. Ceiling outlets are used for general illumination, and bracket outlets are used only where space restrictions demand them, that is, in small toilet rooms, stair landings, low ceil..., etc. Bracket outlets are also sometimes used for ornament in court rooms. As a general rule ceiling outlets in the same space supply from 150 to 300 sq. ft. of floor ... Single outlets will often supply a smaller area than the minimum value given above.

In general the ratings of ceiling outlets do not exceed 300 watts, bracket outlets, 50 watts, and receptacles, 50 w... Some bracket outlets at windows in post-office screen..., in court rooms, in lobbies, on exterior of building, etc., ... supply 100 (or more) watts. Court-room and lobby ...ing outlets, where the total number of outlets is restr... by the architectural treatment, have a greater rating ... 300 watts. Such outlets sometimes require more than ... circuit.

Rooms less than 20 ft. square have one ceiling o... Rooms over 20 ft. in either dimension, and narrow ro... have two or more ceiling outlets placed on the longe... mensions, the number of rows of outlets being gove... by the width of the room. In the post-office work ... a space about 3 ft. wide adjacent to the screen is co... ered to be sufficiently lighted by the brackets on the sc... and this area is deducted from the total area of the ... in calculating the illumination.

In locating outlets in large office rooms the possibili... such rooms being subdivided at some future time rec... consideration. The location of ceiling outlets in ... rooms and in main lobbies depends very largely upon the designs of the ceilings and other architectural features of these spaces. As far as is practicable ceiling outlets are located in the centers of squares.

It is considered that approximate uniform illumin... is obtained when the distance between the outlets is ... to twice the height of the lamps above the plane of ... mination, using reflectors which direct the greatest ... tion of the light downward within an angle of 60 deg. ... the vertical and with the maximum apparent candle-p... at about 45 deg. from the vertical.

Outlets near beams are located a sufficient distance ... the beam to admit of the placing of a standard 4-in. o... box, and if the beam projects below the ceiling the o... is located a minimum of 10 in. from the outer edge of the flange. If a beam is directly over a necessary or very ...sirable location for an outlet, an effort is made to ... structural engineers substitute two channels with a 1... space between the same for the single beam. Outlets are not placed within 6 in. of heating mains or other ... piping. A ceiling outlet is not located in front of an ...ward projecting revolving door unless the edge of the roof over the door is at least 3 ft. from the center line of the lobby.

Ceiling outlets are not placed on skylight frames unless necessary; if such is the case, special construction of the frames to accommodate the piping, gas and electric, ...lets, boxes, canopies, etc., is obtained from the architec...

Combination ceiling outlets are not used where the ...ing heights are less than 8 ft. 6 in.

..e standard height of bracket outlets is 7 ft. above the fl... but in court rooms the bracket outlets are frequently plaed higher than 7 ft. above the floor. Bracket outlets are ..cated so that the fixture canopy will rest on a smooth ...u surface not less than 5½ in. wide. Bracket outlets ...vided over each window in the post-office screen, ... two windows are quite close together, in which case ...itlet will serve both windows. Bracket outlets are ...ed on the lock-box section also, on the basis of one ... for each four feet to six feet of length of the box ...

...supply the local illumination of furniture in post-office ...om bracket outlet boxes with covers are set out exposed on the basement ceiling. One box is pro... ...or each 300 sq. ft. of floor area, and each box is ... 500 watts in calculation of wire sizes. Receptacle ... for local illumination are placed in both floors and ... the principal offices and in walls of all office rooms. ... floor outlets are located on the center line of the ...nger dimension, and one floor outlet is provided ...h 250 sq. ft. of floor area when more than one such ...s needed. Desks are generally placed so as to re... maximum amount of daylight, and this guides the ...t of the locations for wall outlets. One such out... each two windows of the average office is provided ...onditions indicate the need of a greater number. ...rder and registry rooms have one or more wall ... An outlet is provided in each elevator and lift ...l located at the center of travel of car.

...g receptacle is provided at each end of the judge's ...d a plug receptacle is also provided for the clerk's ...Bracket outlets, which are placed against the wall, ...vided over the writing desks in the public lobby. ...m portable lobby desks are so connected that the ...ip of a floor to place the conduit will not be neces... ...nction box being set on the basement ceiling near ...able location of the riser to the desk bracket, and ...zontal run of conduit from the box to the desk exposed on basement ceiling.

...eiling outlets in the first-floor lobby are supplied ...ist two circuits. The outlet for the elevator circuit ...cted on a basement circuit which supplies outlets ...iler room. The special junction boxes on the base... ...ling are connected two on a circuit, or in case there ...ld number three per circuit. The branch circuits ...ected so that the loads on the two sides of the ...re circuit will be approximately balanced. The ...n public toilets and in attics are connected on the ... circuits. In the workroom not more than two ...utlets are connected on one circuit. Independent ...re provided for the post-office screen outlets.

...ts in the lobby, outside entrance outlets, and base... ...tlets not in spaces connected with the post-office ... space are connected to a tablet in the lobby or the ...t. The outlets for the lobby desks are connected to ...e workroom or lobby tablets.

...rt rooms an independent circuit is provided for ...ts at the judge's and clerk's desks, and if condi... ...quire two circuits are run to each ceiling outlet. Outside fixtures at each entrance are in general connected on separate circuit, but where the fixtures are small those at ...e two entrances are connected on one circuit. Lead-cov...ed rubber or paper-insulated wire is run from the junction boxes just inside the wall in the basement to the outdoor lamps at the main entrances. At each vault in the building a plug receptacle is provided on the exterior near the ..ck side of the door, and in cases where the vault ex-cee. 80 sq. ft. in floor area a ceiling outlet box is provid... in the vault with a receptacle just inside the door so ...at the inner and outer receptacle may be connected wit.. a flexible cord when desired.

...tlets are provided in the roof space or attic, as judg-me.., dictates, and ample illumination is provided for the overhead sheaves of elevators. The outlets in the basement and machinery spaces are located as judgment dictates. Each branch circuit is controlled by a double-pole knife switch located on the distribution tablet.

Except in the post-office workroom and basement and unfinished attic or roof spaces all ceiling outlets and all bracket outlets located over 9 ft. above the floor are controlled by snap switches. Snap switches are of the single-pole, flush type, and are set 5 ft. above the floor, and those in public spaces have a lock attachment. Snap switches in rooms are located near the entrance-door casing on the lock side. Large rooms which have two entrance doors from the corridor and more than one ceiling outlet have a snap switch at each entrance door. Switches controlling large spaces and long corridors are frequently placed in gang boxes, but not more than three switches are placed in one gang box. Switches are not located in partition walls less than 4 in. thick, and are so placed that the face plate will rest on a smooth plane surface.

A uniform-size 10-amp fuse is used for all branch circuits; the smallest wire in lighting fixtures used is No. 16. The sizes of fuses for feeders and subfeeders are selected to correspond to the carrying capacity of the wires, which the fuses protect. In case of a small switch controlling a large cable the size of the fuse is adapted to give protection to the switch.

Letters to the Editor.

The Relation of Temperature to Stream Flow.

To the Editor of the Electrical World:

SIR:—In following your recent editorial comments on the relation of deforestation to stream flow, as brought forth by Professor Mead's *Bulletin,* I observe that no particular emphasis has been placed on the relation of temperature to floods. But this factor is undoubtedly one of the elements of the problem, although not perhaps of major importance.

Under average conditions the flood stage occurs during the spring of the year, but the exact time of occurrence, the intensity and the duration are uncertain. At this point the temperature plays its important part. An early thaw, lasting perhaps a week, will inevitably swell the streams, without regard to the immediate rainfall. If rains occur at the same time the effect is naturally accelerated and usually the flood touches a higher mark. On the opposite hand, a long, cold spring and a late thaw will defer the flood perhaps many weeks.

Of course, these remarks apply to a climate like that of our middle and northern belt, which includes Wisconsin. The spring temperatures, and also the winter temperatures, undoubtedly account to some extent for stream flow variations which are difficult to explain on the basis alone of rainfall. Perhaps we can go even farther with this and study the proportion of rainfall which is precipitated as snow. In the case of a thaw, it is reasonable to believe that melting snow would give up water at a faster rate than the earth's frozen crust, and hence the crust beneath the snow would be less affected by the temperature, and the water released would not reach the subsoil, but pass off largely on the surface, to the brooks and streams.

Following this still farther, it is evident that deforestation will cause the snow to melt much sooner than it otherwise would, as anyone knows who has been through the forests in the late spring, when the snow in the open has long since disappeared. The proportion of snowfall varies from year to year, as well as the total rainfall—another factor in this fascinating question.

When we come to consider all the probable or possible elements which determine stream flow it seems likely that

our recorded data have hitherto been hardly comprehensive enough to enable us to settle the question. Certainly it demands the most careful study and research.

Chicago, Ill. FRANK F. FOWLE.

Depreciation

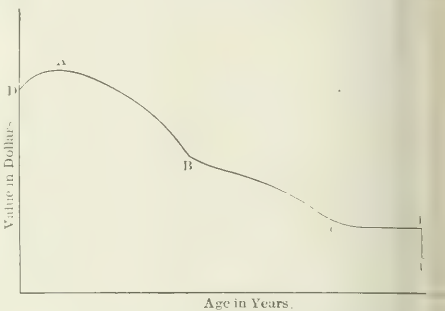
To the Editor of Electrical World:

SIR:—Your issue of Aug. 5 contains a very timely and interesting article on "Depreciation," by Mr. H. G. Nutting.

It is a pleasure to note that Mr. Nutting has adopted one of the suggestions of my recent paper on the subject of "Depreciation," presented at the convention of the American Institute of Electrical Engineers, and has published exact data on age and depreciation of physical property. He has very properly been careful to set forth the reasons for the abandonment of the property referred to at the ages indicated. It is worthy of comment that not in a single instance cited is any clew given as to the life of boilers or engines where depreciation is due merely to age—his example of "lack of capacity" being depreciation due to inadequacy or obsolescence. Another conclusion to be drawn from a study of Mr. Nutting's table supporting the observations by other engineers is that local conditions and individual treatment materially affect the life of apparatus.

In connection with depreciation on boilers it is worth noting that out of a collection of several hundred specific records owned by the writer there is not a single instance of water-tube boilers having been abandoned or retired because of age; and out of 152 fire-tube boilers, varying in life from nine to thirty-four years, it is found the average life was 20.7 years. The great variation in life is due to methods of firing, quality of water used and system of maintenance. It is said that the life of the Scotch type of boilers formerly used in the United States Navy averaged about seven years, this briefness of life being due to the use of more or less salt or brackish water and irregular conditions of operation.

Mr. Nutting gives an interesting curve showi[illegible] hi[illegible] ideas of the rate of depreciation of apparatus, but [illegible] wil[illegible] probably find few engineers who are ready to acc[illegible]t h[illegible] curve as the correct one. Very much apparatus d[illegible]s not increase in value shortly after installation, so that th[illegible] point *A* would not apply; similarly, much apparatus is s[illegible]pped as soon as its regular use is discontinued and th[illegible]efor[illegible] has no section of curve *B C*. It can thus be safe[illegible] co[illegible]



Curve Showing Depreciation of Apparatus.

cluded that no general curve will apply to each par[illegible] type of apparatus.

Mr. Nutting is mistaken in his statement that "th[illegible] tice of the Wisconsin Railroad Commission in ma[illegible] valuation does not use the straight-line method, but [illegible] 'a 4 per cent compound-interest depreciation curve'.' Wisconsin commission frequently uses the "straig[illegible] method"—for example, in estimating the rate of de[illegible] tion of the electrical plant of the Madison Gas & E[illegible] Company. He is correct in calling attention to th[illegible] that the said commission modifies the amount of de[illegible] tion for given age according to the condition of the [illegible] ratus.

New York. HENRY F[illegible]

Digest of Current Electrical Literatur[illegible]

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WOR[illegible]

Generators, Motors and Transformers.

Effect of Short-Circuit Armature Currents Under the Brushes in Interpole Motors.—E. ROSENBERG.—In interpole direct-current motors hunting troubles may occur if the motor is working with a weak field, for instance, in motors for a wide range of speed which is obtained by shunt regulation. The author agrees with the explanation of R. Pohl that the hunting phenomenon is due to the short-circuits under the brushes. He first discusses the magnetic effect of the brush currents in machines without interpoles. It has a demagnetizing effect when the machine runs as a generator and strengthens the primary field when the machine runs as a motor, while the cross-magnetizing armature reaction is the same whether the machine runs as a generator or a motor. The magnetic influence of the short-circuit currents under the brushes can be very considerable, and is, to a large degree, dependent upon the speed, the reactance of the short-circuited coils, width of the brush and actual contact surface of the brush. In consequence of the last-named item, the mechanical condition of the commutator is of great importance, and hence it is possible that high mica, a high bar or a rough commutator surface influences the magnetic conditions of a machine to a considerable degree. The author then discusses interpole machines. A commutating pole of ideal proportions could produce an ideal commutation, n[illegible] a reversal of the current in the no-load neutral. If th[illegible] mutating pole is too weak the reversal of the curre[illegible] be delayed, and therefore the action of the brush c[illegible] will be the same in quality, if not in quantity, as t[illegible] a machine without commutating poles. However, [illegible] commutating pole is too strong the current revers[illegible] take place before the no-load neutral is reached. [illegible] case of a generator the main field will be strengt[illegible] in the case of a motor the main field will be weaker [illegible] the brush currents due to a strong commutating pole. [illegible] first assertion explains the well-known fact that it is [illegible] ble with proper brush position to obtain a level compo[illegible] overcompound characteristic in a shunt machine with [illegible] mutating poles even when the brushes are fixed i[illegible] no-load neutral. Very often the compounding act[illegible] falsely attributed to the direct action of the commu[illegible] pole. This would offer an explanation, first of all [illegible] for a brush position with a backward lead, for o[illegible] this case does the commutating pole, having the p[illegible] of the main pole following it in the direction of ro[illegible] and being series-excited, support the main pole. C[illegible]sidering, however, that commutating poles are very oft[illegible] such a small cross-section that the total flux going th[illegible] them is only a few per cent of the main flux, and [illegible]

...ound characteristic can be obtained even with brushes in the no-load neutral, it is clear that the direct action of the commutating pole is not a sufficient explanation, whereas the action of the brush current ampere-turns working on the ... magnetic mass of the main field coil explains the ...menon fully. With regard to motors, the brush ...s due to a commutating field which is too strong ...aken the main field. If the commutating pole was always too strong and the brushes were in the no-load ... then such a motor would behave like a compound-wound motor with reversed series winding. Now, it is easily possible that a commutating pole with a given number of turns is too strong with small currents and ...weak with large currents; also, that it is too strong ... speeds and too weak for high speeds. The change ... relative value of the commutating field is particu... ...arked if the commutating pole has considerable ... and has a small section. For lower currents ... critical current therefore the main motor field is ...ed, for higher currents strengthened. Such an ...e is very apt to set up hunting. In every motor, ... slight oscillations of current occur all the time ... of the small oscillations in the impressed emf, due ... variations in the load torque, even if the motor is ... with a practically constant load. In an interpole ... if the current is for a moment smaller than it ... be, the commutating field will be too strong and ...sh currents will weaken the main field, thus causing ...r to speed up. With the reduced field the motor ...e considerably more current, and the current may ...high that the commutating pole will then be too ... which, in consequence of the brush currents, will ...en the main field and will make the speed come ... a very considerable amount when the action starts ...gain. There are several remedies for the hunting ...rpole motors. One well-known way is to increase ... gap in the main field. Another means is to set ...ushes forward in the direction of rotation. This ...however, is only applicable in non-reversible motors; ...ward brush position for one direction would turn ...ackward position for the other direction and aggra... ...e evil. For reversing the motors the brushes have ...ept in the no-load neutral, and then it is important ... the ratio between interpole ampere-turns and ...e ampere-turns as low as ever compatible with ...mmutation. For this purpose the air-gap between ...e and armature should be made small, the pole tip should be shaped so as to give very small leakage and the body of the interpole should have sufficient section to prevent saturation, and then it will be quite possible to commutate with a slight excess of interpole ampere-turns.—Lnd. *Electrician*, Aug. 4.

...resis Torque.—H. Zipp.—The author refers to a ...liscussion on the explanation of the sudden jump ...r when an induction machine passes through syn...n from lower to higher speeds. This phenomenon ...n used for separating the iron losses in an induction ... but the question has been raised whether the hys... torque is independent of the slip or not. The author describes experiments with an eddy-current brake, with brass disks first of magnetic and then of non-magnetic material. They prove the existence of a hysteresis torque independent of the speed. At synchronism this torque may have any value between a positive and negative maximum according to the instantaneous position of the rotor in the field at synchronism.—*Elek. Zeit.*, July 6.

Ventilation of Machinery.—A note on a British patent of Siemens Brothers Dynamo Works, Ltd., and C. A. B. D. Koegen (8392, July 27), an arrangement for ventilation of a generator of the turbo type, consisting of the combination of three fans on the rotor for forcing air through the stator air ducts, drawing air through the rotor air ducts and also through the air-gap. A partition within the generator separates the air discharged from the stator ducts from that discharged from the rotor ducts and the air-gap.—Lond. *Elec. Eng'ing*, Aug. 3.

Stray Fields of Transformers.—F. Niethammer and E. Siegel.—The authors discuss the leakage fields of regulating transformers in which more or less secondary coils can be disconnected, such as are in use on single-phase locomotives. The stray fields are discussed for different designs of these transformers.—*Elek. u. Masch.* (Vienna), May 21.

Circular Diagram.—C. F. Guilbert.—The conclusion of his theoretical paper on the circular diagram of single-phase induction motors, giving a numerical example.—*La Lumière Elec.*, July 1.

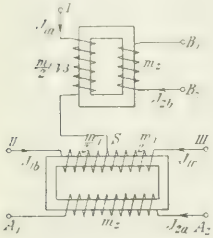
Lamps and Lighting.

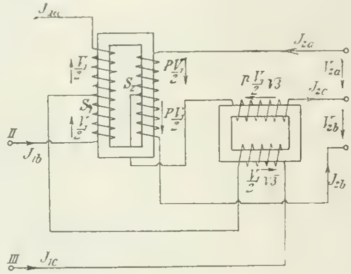
Photometric Flame Standards.—W. J. A. Butterfield, J. S. Haldane and A. P. Trotter.—A paper presented to the International Photometric Commission at Zurich, giving a record of a research on the corrections for the effects of atmospheric conditions on photometric flame standards. The principal results may be summarized as follows: The curve connecting air pressure and correction factor is for the Harcourt lamp nearly a straight line for the range from 700 mm to 850 mm and shows that within these limits the light increases or decreases by 1 per cent, with an increase or decrease respectively in pressure of 12.5 mm; that is, that a variation of 10 mm in pressure is attended by a variation in the same sense of 0.8 per cent in the light afforded by the lamp. The curve of the Hefner lamp is likewise nearly a straight line for the range between 700 mm and 850 mm and shows that within these limits the light increases or decreases by 1 per cent with an increase or decrease respectively in pressure of 25 mm; that is, that a variation of 10 mm in pressure is attended by a variation in the same sense of 0.4 per cent in the light afforded by the lamp. Sets of observations on the Harcourt lamp showed that a change solely in the temperature of the air from 8 deg. C. to over 20 deg. C. had no definite effect on the light afforded, but the light of both the Harcourt and Hefner lamps decreases by 1 per cent for an increase of 0.16 per cent in the aqueous vapor in the air, so that an increase of 1 per cent in the aqueous vapor in the air is attended by a decrease of 6.25 per cent in the light of the lamps. It was also found that 1 per cent decrease in the light of the Harcourt lamp was caused when approximately 0.035 per cent of carbon dioxide was present in the air, and in the light of the Hefner lamp with 0.045 per cent present.—Lond. *Elec. Eng'ing*, Aug. 3.

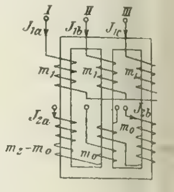
Generation, Transmission and Distribution.

Transformation from Two-Phase to Three-Phase.—G. Rasch.—A paper describing and comparing nine different methods for transforming three-phase currents to two-phase currents. The diagrams are given in Figs. 1 to 9. Fig. 1 shows the so-called Scott system. Fig. 2 shows the system of Meyer, which is very similar to that of Scott. Two single-phase transformers are used, the primary windings being arranged in the same way as in the Scott system. One free end of the secondary winding of transformer II is connected to the center of the secondary winding of transformer I. While in Figs. 1 and 2 two single-phase transformers are used, one three-phase transformer is employed in the method of Arnold, shown in Fig. 3. Standard star connection is used on the primary side. The secondary winding of each phase consists of two coils of $m_2 - m_0$ and m_0 turns respectively. But while the two coils of $m_2 - m_0$ turns are placed each on a separate core, the two coils of m_0 turns are placed together on the third core. In this case $m_0 = 0.52 \ m_1 V_2 \div V_1$ and $m_2 = 1.93 \ m_1 V_2 \div V_1$. In the next four arrangements auto-transformers are used. Fig. 4 shows the direct application of

the Scott system to auto-transformers. In Fig. 5 the two-phase circuits are connected to the terminals *IV*, *V* and *VI*. The circuits *II S* and *III S* are divided at the points *IV* and *V* respectively, in the ratio of $1 - b \div b$, while the winding *I S* is divided at point *VI* in the ratio of $1 - a \div a$







Figs. 1, 2 and 3—Diagrams Showing the Scott, Meyer and Arnold Systems of Transformation Respectively.

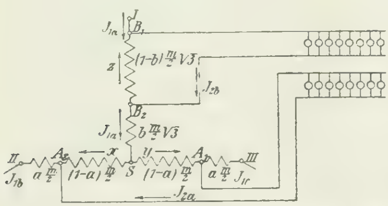
where $b = 1.414\ V_2 \div V_1$ and $a = 0.517\ V_2 \div V_1$. Another arrangement is shown in Fig. 6, in which $a = 1 - 0.816$

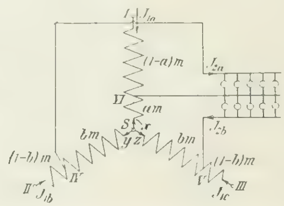
POWER IN KVA FOR $V_2 \div V_1$.

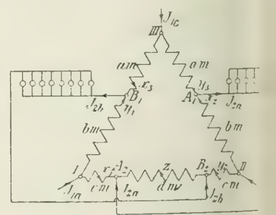
	0.1	0.3	0.5	0.7	0.8	0.85	0.9
Figure 1........	96.5	96.3	96.3	96.3	96.3	96.3	96.3
" 2	87.5	87.5	87.5	87.5	87.5	87.5	87.5
" 3	97	97	97	97	97	97	97
" 4	108	141	200	325	451	503	
" 5........	115	147	203	314	.	.	.
" 6	84	118	120	185	262	333	.
" 7	93	117	170	268	354	404	.
" 8	101	113	127	140	146	149	151
" 9	235	263	295	295	295	295	295

$V_2 \div V_1$, $b = 0.816\ V_2 \div V_1$, $c = 1 - 1.115\ V_2 \div V_1$, $d = 2.23\ V_2 \div V_1 - 1$. A method of transforming three-phase into two-phase currents by two single-phase auto-transformers is shown in Fig. 7. In this case $a = 1 - 1.115\ V_2 \div V_1$, $b = 0.816\ V_2 \div V_1$, $c = 0.299\ V_2 \div V_1$. The last two arrangements use transformers which could be called neither normal transformers with two windings nor auto-transformers. In Fig. 4 the application of the Scott connection to auto-transformers was shown, but this method is applicable only as long as the ratio of the transforma-tion of the voltages $V_2 \div V_1$ is not more than 0.866. But if the auto-transformer *I S* is replaced by a two-coil trans-former, as shown in Fig. 8, the transformation ratio may be raised to unity. Moreover, in this case a three-wir system may be used on the secondary side, while in four wires are required. Finally Fig. 9 shows a n of the Allgemeine Elektricitäts Gesellschaft. The pri equations are given for all the different systems, to with vector diagrams. In all cases the influence of a balanced secondary load on the primary system is the The primary currents differ less from each other i cents than do the secondary currents. The utilizati the material is very different in the different method aside from the first three cases it depends very mu the ratio of transformation. Designs which yield 1c at normal operation can be used for an apparent given in the accompanying table.

For high ratios of transformation that arrangem Fig. 4 appears therefore to be most valuable, while f ratios of transformation Fig. 9 is the best; the latte is preferable for values of $V_2 \div V_1$ between 0.866 and —*Elek. Zeit.*, July 13 and 20.







Figs. 4, 5 and 6—Application of Above Systems to Auto-Transformers.

Vibrating Wires and the Measurement of Distan C. A. SMITH.—The propagation of transverse waves

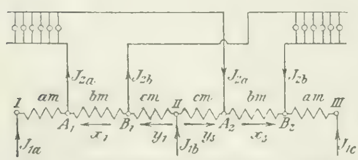


Fig. 7—Three-Phase to Two-Phase Transformation.

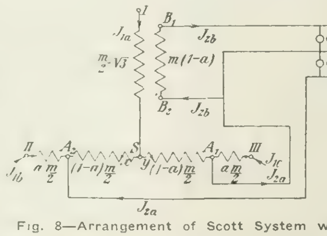


Fig. 8—Arrangement of Scott System with Two-Coil Transformer.

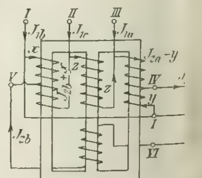


Fig. 9—Scott System Ar ged for Low Transformat

a stretched wire is given by the formula $v = \sqrt{T/m}$, where v is the speed, T the tension applied and m the mass of unit length of the wire. On this the author bases a method for measuring distances which is accurat and

It should have an application to the measurement of distances between poles or wire supports when the latter are inaccessible, especially where they pass over gorges and over water or swamps. If a wire [fixed] on both ends is struck or plucked near one end [a transve]rse wave results which travels at a uniform speed [to the di]stant end. On reaching the far end it is reflected [and continues] to traverse the wire to and fro several [times, al]ways maintaining the same velocity, but gradu[ally decreasin]g in amplitude. If the exact time in seconds is [known in] which the pulse reaches the distant end, also [the tensio]n applied to the wire, and its weight per unit [length, it] is easy to calculate the length of the wire accord[ing to th]e above formula. The method is carried out as [follows:] An accurate dynamometer is attached to one [end of th]e wire, which need not be cut, and with it the [wire is dr]awn up to several tensions, which are noted. At [each tensi]on the wire is struck at a convenient distance [with the d]raw-tongs attached and the exact time observed [for the ten]th return wave to reach the experimenter's hand [on th]e wire. This time interval is divided by ten to [get the ti]me taken for the wave to travel in one direction. [A fift]h-second watch is best suited for this purpose. [The m]ean of several readings should be taken at each [tension an]d noted. If these readings are then plotted as [abscissas] T and t, on squared paper, a curve of the shape [shown in F]ig. 10 will be obtained if carefully drawn. Then [taking th]ree points a, b and c well spaced along the curve the correct distance in feet between the poles [can be ca]lculated from the following empirical formula [by applyin]g it to the three pairs of values thus found and [taking] the mean of the results. D . t . [illegible]

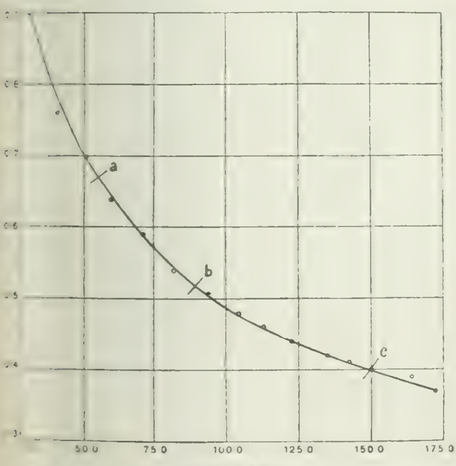


Fig. 10—Wave Curve for No. 14 Iron Wire.

[illegible] where t is the time of outward wave; [illegible] a constant; w is the weight of 1 ft. of the wire [illegible] to four significant figures. Still more accurate [results can] be had if logarithms of the tension and time are [used in]stead of the natural numbers. In this case there [i]s obt[ai]ned a straight-line curve. The factor of greatest impor[ta]nce, and the one which requires close attention, is [t]he re[ad]ing of time. As a converse measurement to dis[t]ance [b]y the same method, if the exact distance be known [i]n fee[t] the tension of a given wire can be closely calcu[l]ated, [r]endering a dynamometer unnecessary, by the fol[lowing] expression: T in pounds $= w \times (D/t)^{[illegible]} \div 30.5$. The a[u]thor found that the tension thus determined agrees within [illegible] per cent always, with an average of 2 per cent above or below the actual values given by the dynamometer.—Lond. *Elec. Review*, July 28.

Hydroelectric Plant.—A detailed description of the Gosau plant in Tyrol, which utilizes the falls of the Traun River. The falls are developed in five different steps. The first station contains two turbines each of 1500 hp, the second one one turbine of 800 hp, the third three turbines of 1500 hp each, the fourth one turbine of 1500 hp and the fifth four turbines of 2000 hp each and two turbines of 6000 hp each. One of the latter is used as reserve. The total rating will, therefore, be 23,800 hp. The four turbines of 2000 hp of the fifth station have been in operation since December, 1910, and the plant is working satisfactorily. Each turbine is coupled to a 1900-kva, 5250-volt, three-phase alternator. The transmission voltages are 25,000 and 43,500. The plant is working in parallel with the Traun plant at a distance of 36 miles (60 km). The farthest distance of the consumers from the Gosau plant is 67 miles (112 km).—*Elek. u. Masch.* (Vienna), July 2, 9 and 16.

Speed Regulation in Three-Phase Systems.—H. von Sääf.—An illustrated paper read before the Electrical Society of Vienna on the different methods of speed regulation in three-phase systems and their application in mines and metallurgical works. The cascade connections of the induction motor and the three-phase commutator motor or rotary converter can be used for regulating large motors which revolve in one direction only. The Déri motor and the combination of two Déri motors to a double-commutator motor, which forms a uniform load on all three phases of a three-phase system, are used for reversing operations, especially in cases in which the brake effect is to be utilized and for smaller operations with a wide limit of speed regulation. For the latter purpose the three-phase series motor may also be used and it is also well applicable for reversing operations, especially those of small loads.—*Elek. u. Masch.* (Vienna), June 4 and 18.

Electricity in Mines.—An illustrated description of the electric equipment of the Sneyd Colony in Burslem, England. The installation is of interest because from very small beginnings it was gradually enlarged to an output of 1000 kw on account of satisfactory working.—Lond. *Electrician*, Aug. 4.

Steam Turbines.—H. Zoelly.—A paper illustrated by diagrams presented at a recent meeting of the (British) Institution of Mechanical Engineers at Zurich. The author gives a historical account of the progress in theory and practice made in the design of the type of steam turbine that bears his name. He also shows how certain details must be modified in accordance with the work the turbine is likely to be called upon to do.—Lond. *Electrician*, Aug. 4.

Diesel Oil Engine.—F. Schubeler.—A paper read at the recent meeting of the (British) Institution of Mechanical Engineers in Zurich. The author gives a short survey of the practical development of the Diesel engine up to the present time and its application to various forms of driving. —Lond. *Electrician*, Aug. 4.

Traction.

Single-Phase Locomotive.—An illustrated description of the single-phase locomotive built by the Allgemeine Elektricitäts Gesellschaft for the Compagnie du Midi, of France. The two motors and the main transformer are arranged in the center of the locomotive. Two Winter-Eichberg motors are employed, each having an hourly rating of 800 hp. They have fourteen poles and are excited through the rotors. All brushes are conveniently accessible owing to the open form of construction adopted for the motors. The stators are wound with a single-phase lap winding. At high speeds the portion of this winding which lies in the reversing zone is connected to a part of the exciter transformer circuit by means of special contacts, in order to insure good commutation at these speeds. The stators are rigidly bolted to

strong cross girders. The rotors run in amply dimensioned bearings having pad lubrication. The bearings are not directly connected to the stators, but are bolted to the longitudinal girders on the lower frame. In order to allow convenient access to the commutators, no bearing shields are used. The frames are stiffened at the bearing by steel castings which are riveted to the locomotive framework. Within speed limits of 30 km to 55 km (18.6 miles to 34 miles) per hour energy can be returned to the line when traveling on down grades.—Lond. *Electrician*, Aug. 4.

Electric Traction in Switzerland.—E. HUBER STOCKAR.—A paper read at the recent meeting of the British Institution of Mechanical Engineers in Zurich. The author deals with the reasons why electric traction has not made as much progress in Switzerland as was expected because this was one of the earliest countries to adopt electric locomotion. He also gives full details of the various railways at present being electrically worked in Switzerland and finally of two schemes that have been prepared for the electrical operation of the St. Gotthard Railway. A list is given of the sixteen electrically operated railways in Switzerland, of which seven use direct current, six single-phase current and three three-phase current. The scheme for the St. Gotthard Railway proposes single-phase alternating current with a frequency of 15 cycles and a voltage of 15,000 for the supply to sections immediately adjacent, and of perhaps 45,000 volts for transmission to transformer substations delivering energy to the sections remote from the generating station. Two or three generating stations will be required.—Lond. *Electrician*, Aug. 4.

Installations, Systems and Appliances.

Electric Industry of Austria.—E. HONIGMANN.—The development of electrical industries in Germany as well as in Austria has taken place essentially in the ten years from 1900 to 1910. In 1900 there were in Germany 652 central stations with a total rating of 230,000 kw. In 1910 there were 2260 stations with a rating of 2,140,000 kw. The total number of plants now existing in Germany is estimated as 50,000 with an aggregate rating of 6,500,000 kw and a yearly production of 7,000,000,000 kw-hours. In Austria there were at the end of 1899 only 166 stations and in 1910 there were 675 with an aggregate rating of 295,000 kw. In the city of Vienna there were in 1900 three stations owned by companies with 1,102,000 connected lamps and producing 27,500,000 kw-hours. Now there is only one station owned by a company with 432,000 connected lamps and producing 8,400,000 kw-hours, and besides this the municipal central station, which supplies energy for lamps and motors (not including traction), produces 44,421,000 kw-hours, the connected lamps numbering 2,077,000. The receipts of the three privately owned companies in 1900 were $1,115,000, while the receipts of the municipal station in 1909 were $4,760,000. The receipts of the one station owned by a company were $780,000. In 1900 there were in Austria twenty-three electrical stock companies with a total capital of $29,000,000. At present there are fifty-one electrical stock companies with a total capital of $33,000,000, but this does not include the Vienna municipal central station and street railways, in which alone $48,000,000 is invested. In 1900 there were twenty-one electric tramways with a total track length of 68 miles (115 km). Now there are fifty electric tramways with a total length of 506 miles (843 km). Detailed tables are given of the imports and exports of electrical machinery into and from Austria.—*Elek. u. Masch.* (Vienna), June 25, July 2 and 16.

Domestic Uses of Electricity.—G. DETTMAN.—Continuations of his very long illustrated paper. The author endeavors to show that the prevailing idea that electric cooking is too expensive is all wrong. He emphasizes the cleanliness, simplicity and other advantages of electric cooking in great detail and then gives figures from his own experience, comparing the costs of cooking with gas and electricity. With a rate of 2.5 cents per kw-ho[ur] for energy for cooking and 10 cents for light, electric c[o]oking is found to be cheaper than cooking with gas if th[e] cubic meter costs 3 cents (1000 cu. ft., 84 cents). If t[he] kw-hour for cooking costs 4 cents electric cooking is so[me]what more expensive than gas cooking for the same cost [of] gas. Results of electric cooking experiments are give[n]. The application of electricity for heating rooms (especi[ally] by electric heating rugs), for electric flatirons and [cu]rling irons is also dealt with. The paper is to be concl[uded].—*Elek. Zeit.*, July 13 and 20.

Electricity on Shipboard.—The conclusion of th[e] ill[us]trated article on the electric equipment of the stea[mships] *Olympic* and *Titanic*. In the present instalment t[he] u[se] of electric power for operation of the winches and of the accessory power gear and in connection w[ith the] ventilating and heating system is described. The sys[tem of] electric clocks, telephones and the wireless telegraph [equip]ment is also outlined.—Lond. *Electrician*, Aug. 4.

Ozonizers for Ventilating Houses.—J. B. C. KERSH[AW].—The article discusses the use of ozonizers for ven[tilating] and similar purposes as a useful day load for centr[al sta]tions. A review is given of ozonizers made by d[ifferent] companies.—Lond. *Elec. Review*, Aug. 4.

Wires, Wiring and Conduits.

Fuses.—E. JASSE.—A continuation of his former [paper] on the theory of fuses. If the heat given off by the [fuse is] assumed to be constant and not to vary with the te[mpera]ture, the theory shows that the time constant and th[e final] temperature would become infinitely great for a [certain] critical current. The author now shows that if the [more correct] assumption is made, that the heat given off by the f[use in]creases with the temperature, the theory gives finite [values] for time-constant and final temperature for any c[urrent]. Finally, the effect of self induction on the time of fu[sing in] short-circuit tests is investigated and it is found th[at the] time of fusing is increased approximately by 1.5 tim[es the] electric time-constant.—*Elek. u Masch.* (Vienna), M[...]

Electrophysics and Magnetism.

Electric Resistance of Pure Metals at Very Low [Tem]peratures.—H. KAMERLINGH ONNES.—An account [of ex]periments in which the author measured the temp[...] of pure metals, especially gold and mercury, at the te[mpera]ture of liquid helium. The former conclusion that [the re]sistance of pure gold vanishes at liquid helium te[mpera]tures is greatly strengthened. Extensive experimen[ts were] made with pure mercury. The value of the merc[ury re]sistance used was 172.7 ohms in the liquid condi[tion at] 0 deg. C. At 4.3 deg. C. on the Krypton thermome[ter it] had decreased to 0.084 ohm and at 3 deg. C. on the K[rypton] thermometer it had fallen below 0.000003 ohm.—[Lond.] *Electrician*, Aug. 4.

Equalizing Currents.—C. RICHTER.—A long and [...] mathematical paper in which the author gives some [...] fundamental formulas for equalizing currents (Aus[gleich]ströme); that is, currents which equalize some e[...] difference in the conditions.—*Elek. u Masch* (V[ienna]), June 18 and 25.

Ions in Gases.—J. S. TOWNSEND.—A paper cri[ticising] the conclusion reached in a recent paper of R. A. M[illikan] and H. Fletcher that no ions with double charges a[re pro]duced in a gas of primary or secondary Röntge[n rays]. The present author thinks that the experimental e[vidence] is in general entirely in favor of supposing that such [...] charges exist.—*Phil. Mag.*, July.

Electrostatic Lines of Force.—D. N. MALLIK.—A [math]ematical paper describing a new and simple geom[etrical] method of drawing the lines of force due to give[n elec]tatic charges.—*Phil. Mag.*, July.

Units, Measurements and Instruments.

Measuring and Control Instruments.—D. BERCOVI[TZ].—A

paper read before the Vienna Electrical Society on various new measuring and control instruments made by the Paul Mey Company. An instrument for inspecting lightning-rod installations is first discussed. It is used for measuring the resistance between the lightning rod and the earth. A

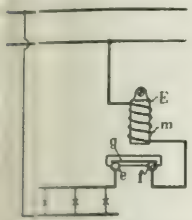


Fig 11—Simplest Kind of ... Device for Light... ...ation.

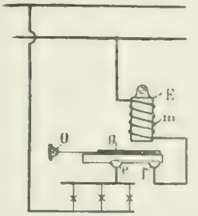


Fig. 12—Limiting Device for Currents of from 3 Amp to 12 Amp.

modification of this instrument for more universal use for ...ing resistances, voltages, currents and for making ...n tests is also described. Quite a number of instruments are then described for use in lighting installations in which a flat rate is used and the consumer is to be restricted in the amount of power. The simplest limiting ... shown in Fig. 11. The coil m of an electromagnet ... series with an iron rod g and the lighting installa... ...e iron rod g is contained in an air-tight tube and ... two mercury cups e and f. When the current rises ...e maximum value which the consumer is allowed ...he iron rod g is attracted by the electromagnet and ...nt connection between the two mercury cups is ... Then the iron rod falls back and the current is ... again and so on. The lamps will flicker until the ...s decreased below the maximum limit agreed upon. ...orm the controlling device is built up to 3 amp. ...ents from 3 amp to 12 amp use is made of the ...ion shown in Fig. 12, in which the iron g is ... on the outside of the closed tube. Within the tube there is some mercury connecting the two cups e and f. When the current rises above the predetermined value the ...l g is attracted by E and the tube containing the ... together with the iron rod rotates round the pivot ... column of mercury which connects e and f is then ... To prevent oxidation of the mercury the tube is ...h an inert gas. The power consumption of these ... is about 0.1 per cent of the power agreed upon, ...ch less than that of meters. The application of ...miting devices in connection with meters is also ... Fig. 13 shows an arrangement by which a con... ... charged a flat rate as long as his consumption is

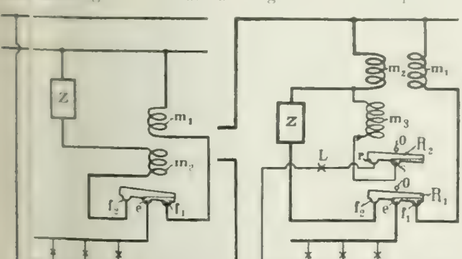


Fig 13 and 14—Instruments for Flat-Rate Change Below a Certain Consumption.

below a certain value. If he consumes more, the energy consumption is metered. The winding m is designed according to the maximum power which he can take at the flat rate. The current passes simply through m, through the mercury between the two cups e and f in the tube, and then through the lamps. If he demands more current the tube f_2, e, f is attracted upward and the mercury flows over and makes connection between f_2 and e. The meter Z is now in circuit. The coil m_2 keeps the tube attracted upward as long as the consumption is higher than the predetermined value. If then the demand goes below this limit the tube drops back into its initial position and the meter Z is disconnected. The exact design of the windings is somewhat difficult with this arrangement and the arrangement of Fig. 14 is preferable. In this case there are two tubes and they revolve around their centers so that no force is required to keep them either to the right or to the left. The winding m is again dimensioned according to the limiting value of power agreed upon. If more power is consumed m attracts the armature, the tube P turns over and connects the meter Z and the second winding m_2 in the circuit. Together with the winding m_2 there is a second winding m_3 on the same electromagnet core, but the direction of the mmf of m_3 is opposite to that of m_2. By means of the tube R_2, also connected with the armature, the voltage coil m_3 is connected to the circuit automatically when the meter Z is switched in. It is so dimensioned that its magnetic pull compensates that of the main current coil m_2 at the power consumption agreed upon and accomplishes the turning back of the armature when the demand goes below the predetermined value. The small lamp L is lighted when the meter is in circuit so that the consumer can always ascertain this fact. Some other modifications are also described, as well as some recording devices of the same company.—*Elek. u. Masch.* (Vienna), July 9.

Induction Meters at Varying Load.—Karl Schmiedel.—An account of an investigation carried out in the German Reichsanstalt. Orlich and Schulze have formerly shown that the readings of motor meters and pendulum meters do not vary with varying load if, other than friction, there are no influences which would cause a deviation of the readings from the actual power consumption. This supposition is not fulfilled for induction meters on account of the damping effect of the alternating magnetic fluxes in the current and voltage circuits. The induction meter is therefore made the subject of the present investigation. The author shows that on account of the damping effect mentioned the readings of induction meters are too high at varying load. Under normal conditions, however, the error due to a certain change of load will be less than the difference of the errors for half-load and full-load when operation is without sudden changes of load. Only in exceptional cases may the error become large in practice, especially if the meter armature has a very high momentum of inertia, if the damping effect mentioned is very large compared with the torque, if the torque is very small and if there are short and strong variations of current or voltage (lasting less than one second).—*Elek. u. Masch.* (Vienna), July 2.

Miscellaneous.

Manufacturing Plant.—A very full and profusely illustrated description of the equipment and the different lines of manufacture of the Oerlikon Engineering Works in Zurich.—Lond. *Eng'ing*, Aug. 4.

Book Reviews.

Theoretische und Experimentelle Untersuchungen an der Synchronen Einphasen-Maschine. By Dr. Max Wengner. Munich and Berlin: R. Oldenbourg. 88 pages, 44 illus. Price, 2.40 marks.

A carefully planned, executed and reported research on a single-phase alternator with a view to determine the reaction of the armature on its own and on the excitation field. The research has led to the development of certain formulas which will be of especial interest to the designing engineer.

Qualitative Chemical Analysis, from the Standpoint of Solubility, Ionization and Mass Action. By J. I. D. Hinds. Easton, Pa.: Chemical Publishing Company. 265 pages. Price, $2.

A joint textbook and analysts' reference book. It is divided into five sections: I. Principles and Methods of Qualitative Analysis. II. Basic Analysis. III. Acidic Analysis. IV. Complete Analysis of an Unknown. V. Reagents and Tables. Great care has been taken in the preparation of the book and a large amount of material is collected into it. Special attention is devoted to the theory of electrolytic dissociation and the laws of mass action. To a certain extent, unconsciously, perhaps, the author has expounded very fully certain recent aspects of the electrical ionization theory. The work will be useful to analysts and to students of chemistry.

Encyclopédie Électrotechnique. F. Loppé, editor. Vol. V. (Induction and Alternating Currents.) By Eug. Vigneron. Paris: L. Geisler. 147 pages, 89 illus.

A treatise, from the mathematical standpoint, on the laws of electromagnetic induction and of alternating currents. The theory is particularly discussed on the analytical side, but the vector representation of alternating-current phenomena is also discussed. The book is valuable as entering more deeply into the fundamental theory of alternating currents than the ordinary engineering textbook. On the other hand, however, it is thereby the less to be regarded as an engineering handbook. The volume has an important place in an encyclopedia of electrotechnics.

Messungen an Maschinen und Motoren für Gleichstrom. By Fritz Hoppe. Leipzig: J. A. Barth. 171 pages, 214 illus. Price, 5.80 marks.

Commencing with the elementary principles of direct-current armature windings, the book deals with the various measurements and tests that are commonly applied to direct-current machines of the shunt, series a[nd] compound-wound type. The method employed is d[esc]riptive and geometrical with numerous arithmetical [ex]amples. The treatment is simple and clear. Numerous cu[rv]es and diagrams accompany the text. The book will be o[f i]nterest to elementary students of dynamo testing who [de]sire to acquaint themselves with modern German practic[e].

Messungen der Stromstärke, Spannung, Leist[ung] Arbeit bei Gleich und Wechselstrom. Eic[h]... Graduieren von Messinstrumenten. By Frit[z] H... Leipzig: J. A. Barth. 134 pages, 128 illus... 4.40 marks.

The book is divided into three sections, dealin[g]... tively with direct-current measurements, alterna[ting-cur]rent measurements and instrument testing. The... elementary in character, but very clearly writ[ten]... numerous arithmetical illustrations. A number ... ments employed in electrical engineering are des[cribed]... principle. In the last section various methods of ... and calibrating ammeters, voltmeters and wattm[eters] ... described. The book will be appreciated by el[ementary] students of electrical engineering interested in ... methods and apparatus.

Beanspruchung und Durchhang von Freile[itungen]... By Robert Weil. Berlin: Julius Springer. 1... 42 illus., 3 plates. Price, 4 marks.

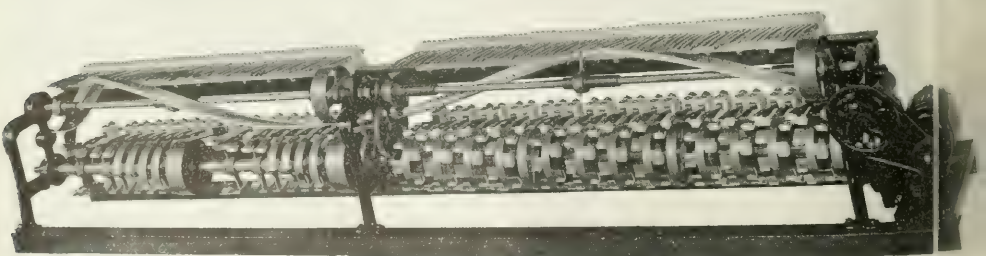
An engineering treatise on the tension in overh[ead]... of copper, bronze, aluminum, iron and steel for ... spans, sags and temperatures, with tables and cu[rves]... the guidance of the constructing engineer. The ... thoroughly practical and well illustrated. The s... not carried further than 1000 ft. at most in the ta[bles]... curves, so that specially long spans would have to ... puted from the formulas. The constructing and ... engineers of long overhead lines for lighting a[nd trans]mission will find the book of much value.

New Apparatus and Appliances

DOUBLE-DECKED SIGN FLASHER.

The flasher illustrated herewith has been built to operate a sign containing 1800 5-watt tungsten lamps. It contains 106 script switches, which are shown on the top layer, twelve high-speed switches, shown in the lower section at the end near the motor, and six 30-amp double-pole switches, shown in the lower section at the opposite end, together with double-pole controlling switches. The flasher mechanism runs in ball bearings throughout and is driven by a 1/30-hp General Electric motor.

The three sections revolve at different speeds, the result being accomplished by means of intermedia[te] brass gearing. Although arranged in double deck to [m]inimize the length, the height is only 12 in., which is said [to] be no greater than the height of ordinary single-deck [fl]asher mechanism. The length is 65 in.



Double-Decked Sign Flasher.

Each contact is equipped with a non-arcing de[vic]e and the brush is mounted in a porcelain holder. T[he] non-arcing device consists of a porcelain insulating bloc[k] which rotates with the contacting cylinders and lifts eac[h] brush from the cylinder until the position is such as to [gi]ve full

...act area, when the brush is dropped suddenly into total ...act, thereby avoiding the fusing which takes place wh... the contact area is too small. It is claimed that this so-called "Noark pickup block" permits the brushes to ...e so as to insure long life and the minimum degree ...

... the high-speed section two switches are used for each contact; this arrangement is employed in order to per... the contacts to be used alternately and thus minimize ...perature at the contacts, which might otherwise be... ...gh on account of the unusually high speed of opera...

...e above-described flasher was built by Betts & Betts, ...West Fifty-third Street, New York.

DIRECT-READING OHMMETER.

... instrument shown in the accompanying illustration ... the rapid and direct measurement of resistances ... fall within the range of the slide wire or the ...tone bridge to a commercial degree of accuracy, ... designed to fulfil the requirements of manu...s, electricians, testing engineers and those who ... an instrument giving results without calculation. ...nipulation consists of closing the battery and galva... keys and rotating the index until the galvanometer ...s a balance. The unknown resistance is then read ...e scale without the necessity of referring to a table ...

...ler to give maximum accuracy multipliers are pro... that a balance can be obtained in the mid part of ...es for all resistances ordinarily measured in actual ... A contained battery adapts it for portable pur...s well as for bench use in manufacturing estab...s and repair shops. The portable feature makes ...rument applicable for use in car barns for checking ...es in the car circuits, etc. Provision is also made ...necting an external battery to the instrument in ...here this is desirable.

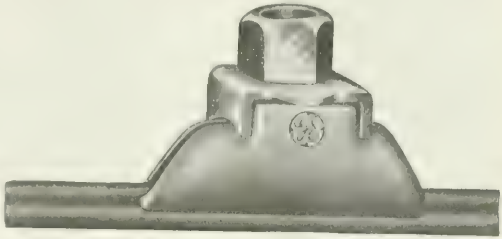
...ale is engine-divided on brass and is, therefore, not ... to the defacement of paper scales. The convenience ...pulation is very striking, since it is only necessary ...e the index to balance. This feature adapts it for ... not skilled in the use of the Wheatstone

Direct-Reading Ohmmeter.

...e. The galvanometer in the ohmmeter is a sensitive D'Arsonval type as used in the high-grade portable testing sets manufactured by Queen & Company, Inc., Philadelphia, Pa., by which firm this new ohmmeter is also manu...red.

TROLLEY EAR.

The General Electric Company has recently placed on the market a new mechanical clamping ear, known as "Form M," especially designed for use on overhead construction in and around mining and industrial properties.



Mechanical Clamping Ear for Trolley Wires.

The ear consists entirely of forgings and punchings of steel, thus eliminating entirely such imperfections and variations as are common to iron castings. This feature also permits of using small light sections of great mechanical strength, resulting in an ear giving a maximum clearance from passing trolley wheels and a minimum height from the center of the wire to the top of the clamping nut. The jaws are duplicate drop forgings, each lip fitting into the recesses of the trolley wire with absolute accuracy, insuring a grip which will have the greatest possible holding power. The jaws are hinged by a steel pin located close to the wire and are of a length sufficient to utilize the maximum clamping effect produced by the clamping nut. The machine steel stud jacket engages shoulders on the clamps and fits into the hexagonal interior of the clamping nut; thus by rotating the nut the stud jacket is drawn on to the suspension stud while the nut exerts an outward pressure on the upper outer edge of the jaws, which by reason of the hinge press against the trolley wire.

The punched washer is formed around the top of the jaws to prevent its turning while the clamping nut is being tightened. It is also provided with two small lugs which may be bent up against the side of the clamping nut effectually preventing any possibility of the ear becoming loosened in service.

The new ear is made up suitable for round, grooved and figure 8 wire and has either japanned or standard sherardized finish. When used in connection with a suspension of the mining and ceiling type it renders possible an increase in head room of 1 in. to 2½ in.

14,000-KVA TRANSFORMERS.

The largest transformers thus far constructed have recently been shipped by the General Electric Company to the Shawinigan Power Company, at Shawinigan Falls, Canada. This shipment included four three-phase water-cooled units designed for operation at a frequency of 60 cycles, two of them having a normal load capacity of 14,000 kva and the remaining two of 12,500 kva. The 14,000-kva transformers will step the potential up from 6600 volts to approximately 100,000 volts for long-distance transmission. All four transformers have the same over-all dimensions, occupying approximately 23 ft. x 8½ ft. floor space and being 18 ft. from the floor to the top of the high-tension terminals. The walls of the tank are made of steel plate ⅜ in. thick. On account of the great weights necessarily dealt with the supporting framework of the coils and core is built up of heavy "I" beams, the general apearance of the frames closely resembling the construction used in large locomotive framework.

These transformers were designed to withstand a test

of 270,000 volts from the high-tension winding to all other parts. Oil-filled entrance leads are employed and these also were subjected to this high-tension test. Although the striking distance of this test voltage in clear air is nearly

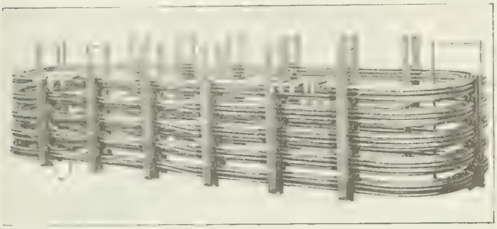


Fig. 1—Cooling Coils for 14,000-kva Transformer.

2½ ft., it is noteworthy that, when applied to these transformers after dark and with all lights turned out, no corona was visible.

There appears to be no practical limit in the design of

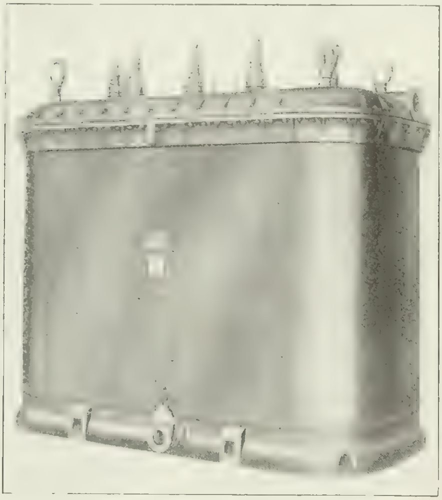


Fig. 2—14,000-kva Transformer.

transmission transformers from the standpoint of either capacity or voltage, as both of these conditions are limited by other features—the transmission lines being the limit for potential and the transportation facilities for the size of the units.

MEASURING NATURAL GAS WITH ELECTRICITY.

The People's Natural Gas Company, which supplies fuel gas for domestic and commercial consumption in Pittsburgh, has a pumping station near the town of Brave, in Greene County, Pa., 50 miles southwest of the city. In the suction line of this station there has been installed one of the Thomas electrically operated gas meters, which were described on page 573 of the *Electrical World* of March 2. As therein outlined, this meter, which is made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., utilizes the principle of heating the gas traversing it through a fixed small temperature range, usually about 2 deg. Fahr.

The difference in the temperature is controlled and held constant by electric resistance-thermometer screens placed before and behind the heating element, and the electrical energy required to heat the gas is therefore proportional to the mass of gas flowing, regardless of its tem-

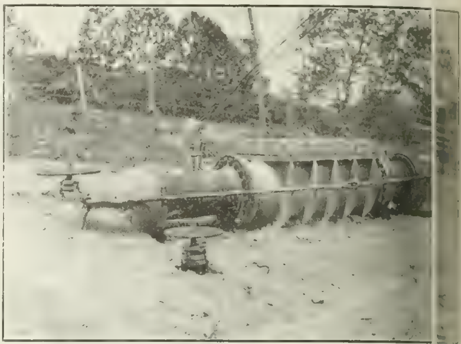


Fig. 1—Measuring Element in Pipe Line.

perature, pressure or volume. The energy input in heater disk may be registered on a watt-hour meter or curve-drawing wattmeter, which can be calibrated directly in cubic feet of gas at standard conditions of temperature and pressure. About 1 kw-hour is required for each 75,000 cu. ft. of gas passing through the meter.

The Thomas meter at the Brave pumping station is installed in a field, about 200 ft. from the pumps. The pipe inclosing the heating element and two thermometer screens is arranged between two elbows, as shown in Fig. 1, and the recording panel, shown in Fig. 2, is located near the switchboard of the station-lighting plant, from which energy to operate the meter is obtained. The meter is inserted in a 10-in. pipe, and has a maximum capacity of 750,000 cu. ft. of free gas per hour, but will register accurately quantities as low as 12,500 cu. ft. per hour. The accompanying curve in Fig. 3 is a portion of a record made by the curve-drawing meter element in the office of the pumping station, and shows fluctuations in the rate of flow of the gas caused by changes in the setting of valves or pumps. As already explained, this record is actually the curve showing the watts input into the heater, but since for any constant quality of gas a definite number of watt-hours is required to heat a given quantity through

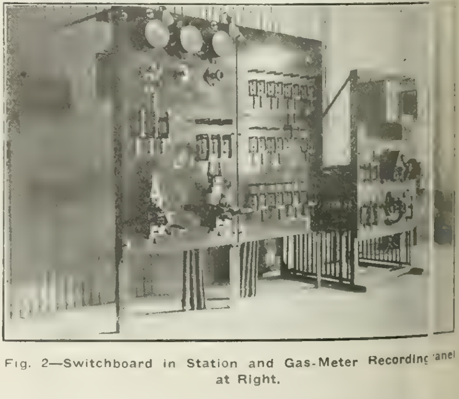


Fig. 2—Switchboard in Station and Gas-Meter Recording Panel at Right.

2 deg. Fahr., the curve virtually reproduces the rate of gas flow.

In connection with the electrical meter it is especially interesting to note that the record is made in terms of the

equivalent number of cubic feet at standard conditions of temperature and pressure. In the case of the Brave meter these are set at 15.025 lb. absolute pressure and 60 deg. Fah. although the actual pressure on the gas line varies from 50 to 200-lb. gage, and the temperature of the exposed

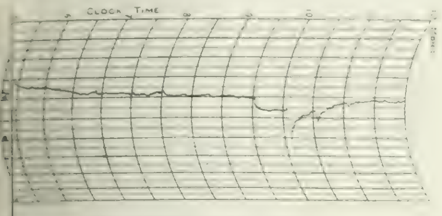


Fig. 3—Meter Record Chart.

line and meter varies as widely as the outdoor temperature. Natural gas is used as fuel in the lighting plant of the People's company, and the electrical energy required by the meter, expressed in total cubic feet of gas measured, represents a consumption of about one-twentieth of 1 per cent of the gas measured.

Recent tests made on the Thomas meter at the station have shown the close accuracy of this device, even though no calibration has been made after setting the instrument in place. At Beulah, W. Va., 1½ miles distant from the Brave, the People's company had already installed an accurately calibrated Pitot-tube station which can be placed in series with the 10-in. line to the Thomas meter. A twelve-hour comparison test between the curve-drawing and integrating meters of the electric device and the Pitot tube ... the rate of gas flow was kept nearly constant and the temperature remained about the same, the pressure ... from 123 lb. to 72 lb. per square inch. Other tests ... on the Brave installation, including twenty-four- ... forty-five-day tests under widely varying conditions of flow, pressure and temperature, have demonstrated ... agreement between the electrically operated meter and the Pitot tube that a natural quandary arises as to which is correct. During a forty-five-day endurance test, from April 17 to June 3, the Pitot tube registered ...82 and the Thomas meter 336,732,018, showing a ... of but one-fifth of 1 per cent after the most careful and frequent observations on the Pitot tubes at ... intervals.

AUTOMATICALLY CONTROLLED ELECTRIC COOKSTOVE.

The convenience and simplicity of electric cooking on a domestic scale may be expected to be greatly enhanced by the automatic control appliances with which the Copeman electric stove is equipped. This cooker ... the fireless principle of operation, the heating elements being inclosed in thermally insulated compartments, through thermostatic cutouts being automatically cut ... as the ovens have reached the predetermined temperatures for the cooking operations required.

The stove, as shown in the illustration, comprises two separate, well-insulated cooker ovens, one measuring 10 in. x 14 in., used for boiling, and the other 10 in. x 2... x 14 in., for baking and roasting. Each oven is fitted with a dial-type thermometer, the pointer of which upon making contact with an adjustable hand momentarily closes an auxiliary circuit, tripping out the heater switch. The temperature at which the heating element is thus disconnected can be set at any desired point by means of the thumb-controlled contact pointer. For the boiler the disconnect point is ordinarily set at 212 deg. Fahr. and for the roasting oven at 375 deg. After the temperature required to operate the cut-out has been reached, cooking proceeds with the heat already stored in the oven, which is so insulated as to lose only about 10 deg. in temperature per hour.

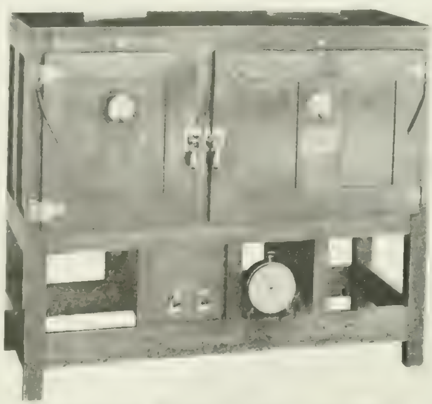
Where the housewife plans to be absent part of the day she may set the alarm-clock shown at the hour she wishes the oven to begin heating. When the alarm operates, a lever on the winding key throws a switch closing the circuit to the heating elements that have been turned on. Later, when the predetermined temperatures are reached in the ovens, the thermostatic circuit-breaker trips interrupt the heater circuits, cooking continues with the stored heat until the food is done and the housewife returns to find her dinner warm and waiting.

The switch handles for closing the heater circuits are shown at the left of the clock. Above the doors are two push buttons, connected across the respective thermostats, so that the circuit-breakers can be released by hand if it is desired to shut off the heaters before the thermostats operate.

Each cooking compartment contains a 660-watt disk heater, that in the boiler measuring 8 in. in diameter and the roasting element 10 in. in diameter. The terminals of the heater disk are brought out as contact tongues, which are inserted into push receptacles in the floor of the compartments. Similar receptacles are provided on the top of the cabinet, so that while cooking is going on in the oven with stored heat the disk elements may be removed to the top and used to heat a chafing dish, pan or other utensil, all of which are arranged to lock onto the disks. Where a chafing dish or percolator is to be brought to the table the heater element, still locked to the utensil, is disconnected from its receptacle and the whole brought onto the table, the heat stored in the hot disk element serving to keep the contents of the dish warmer than by its own thermal storage alone.

The cooker is built of specially treated wood, which is filled and stained to render it proof against action of heat, moisture, steam, acid and grease. The ovens are lined with bright copper, behind which is a ⅛-in. sheet of asbestos, 2½ in. of mineral wool and a second layer of asbestos against the wood.

A point claimed for the Copeman cooker, besides its convenience, is the low kw-hours consumption required in its operation. At the Electric Shop, Chicago, Aug. 16, a



Automatically Controlled Electric Cookstove

dinner comprising four chickens, with dressing, steak, vegetables, biscuit, tea and pie was cooked for fifteen persons at an expenditure of 2600 watt-hours.

The stove described is built by the Copeman Electric Stove Company, of Flint, Mich.

Industrial and Commercial News

The Week in Trade.

FURTHER expansion in the volume of new business and growth of public confidence have developed in the past week, and business in nearly all lines is progressing on an encouraging scale. The cessation of tariff agitation and of further investigations as a result of the adjournment of Congress last Tuesday will have a beneficial effect upon general trade, and it is expected that the situation will be greatly bettered in the interval before the next session.

Retail trade is showing the effects of gradual advancement, and in wholesale lines the forward movement is more pronounced. Buyers are appearing in larger numbers than earlier in the season, and sentiment is improved in spite of the tendency toward conservatism. Gains are shown in the operations at the iron and steel centers, and there has been decided increase in the shipments of pig iron. Much of this activity is due to the large number of foundry orders of moderate sizes for early delivery, and sales of large tonnages are few, but the outlook is bright, and preparations are being made for blowing in many furnaces. Demand for steel products for both domestic and foreign interests is a most encouraging feature of the situation. Orders for railroad equipment are coming in more rapidly and negotiations are reported in progress for over 15,000 cars of various types. Some expansion has taken place in the New England woolen market, induced by the outcome of tariff revision; but the cotton market in that district has been checked somewhat by price conditions. Commercial centers show marked increase in weekly bank clearings, and crops are promising. Business failures for the week ended Aug. 17, as reported by *Bradstreet's*, were 215, as compared with 208 for the previous week, 222 for the corresponding week in 1910, 183 in 1909, 230 in 1908, and 153 in 1907.

The Copper Market.

THERE was little business in the copper market in the past week, and price changes were unimportant. While the larger producers asked 12⅝ cents for electrolytic delivered thirty days, a few small sales were reported at lower rates, but neither consuming or producing interests showed a strong disposition to enter into new contracts for large amounts under prevailing conditions.

Some price concessions were made abroad, but response was decidedly mild, the lack of interest being attributed to labor disturbances in Great Britain, and the probability that European consumers are well supplied for the next few months as a result of their recent purchasing at the low level of the market. The continuation of dullness following the favorable report of the Copper Producers' Association is thought to be a result of the conservative attitude still maintained toward

Standard Copper	Bid.	Asked.	Settling Price
Spot	12.10	12.30	.....
August	12.10	12.30	12.20
September	12.10	12.30	12.20
October	12.10	12.30	12.20
November	12.10	12.30	12.20

[illegible]

	New £ s d	Closing £ s d
Standard copper, spot	56 5 0	56 5 0
Standard copper, futures	57 0 0	57 0 0

Extreme fluctuations [illegible]

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 [illegible] 6	54 0 0
Best selected	61 10 0	57 5 0

revival of general trade; and it is confidently expected that good business in the copper trade will immediately follow decided advance in other lines. Whether consumers are making a mistake in keeping out of the market at present prices is a matter that will develop later, but from present indications there is strong probability that the decreases of stocks here and abroad, shown in the recent report, will result in higher prices when the trade of the country becomes more brisk and copper demand increases. Opinions on the August report of the association are inclined to expect a satisfactory showing on the ground that there has been no opportunity for production to increase at a rate greatly in excess of that in J[illegible], when curtailment was enforced by excessive heat at the smelters, and this feeling is strengthened by the fact that exports for the month will be heavy, although not as large as in J[illegible]. The total exports for the month, including Aug. 22, [illegible] 20,637 tons. The daily call on the Metal Exchange, [illegible] quoted copper as per the accompanying table.

Industrial and Commercial Notes.

New York Edison Company vs. Long Acre Co[illegible]—The Public Service Commission for the First Distric[illegible] York has denied the petition of the New York Edis[illegible] pany for a rehearing in the Long Acre case. As set fort[illegible] columns July 12, this petition followed approval b[illegible] mission of the Long Acre Electric Light & Power [illegible] application to issue $2,000,000 in stock and $4,000,000 [illegible] and requested that this authorization be withdrawn, [illegible] rehearing for the consideration of certain new e[illegible] which the petition alleged due regard was not give[illegible] commission in previous hearings. It is understood [illegible] New York Edison Company will take the matter to t[illegible] and ask for a writ of certiorari, basing its appeal for[illegible] of the decision of the commission on the ground [illegible] authorization of competition in a public service the[illegible] requirements of which are now being adequately suppli[illegible] the New York Edison Company is a doubtful publi[illegible] When the Long Acre company first applied for perm[illegible] take steps to provide working capital this was refuse[illegible] commission and the company appealed to the courts, [illegible] an order for a rehearing. As the case stands at th[illegible] the positions of the competing companies are reve[illegible] with respect to the attitude of the commission.

Bangor Utility Merger.—The Bangor Power Company, which has just been incorporated, as mentioned in the [illegible] issue, to acquire the rights, franchises and properti[illegible] the Bodwell Water Power Company, will be absorbed by th[illegible] Bangor Railway & Electric Company. The new company h[illegible] an authorized capital stock of $1,250,000, and $750,000 in bo[illegible] and John R. Graham, president of the Bangor Railway & Electric Company, has been chosen as general manager. Stockholders of the Bangor Railway & Electric Company will m[illegible] Aug. 26 to take up the matter of guaranteeing the $750,000 [illegible] of the new company and to consider the issuing of [illegible] stock for the purchase of the Bangor Power Company stoc[illegible] A reorganization of the Bangor Railway & Electric Comp[illegible] is to be made in connection with the Bangor Power Com[illegible] the Penobscot Realty Company and the Veazie Lumber [illegible] This calls for increase of the capital stock of th[illegible] Railway & Electric Company to $3,500,000, made up [illegible] 000 7 per cent cumulative preferred and $2,000,000 [illegible] One share of new preferred stock and one of new [illegible] will be given to present stockholders for each $100 [illegible] of the old stock.

Stockholder Liability.—The Supreme Court, [illegible] Wash., has reversed a decision of the lower court [illegible] a case brought by T. E. Grady, receiver for the Yakima Im[illegible] Company, against A. B. Graham for payments on un[illegible] stock subscription. The court holds that when bonds [illegible] issued by a corporation and it is stipulated that the stockho[illegible] cannot be held either for the principal or the interest, s[illegible] cannot be instituted against a stockholder to force payme[illegible] on an unpaid subscription. In this instance the Yakima [illegible] Improvement Company installed a lighting plant capitalized [illegible] $1,000,000, and issued bonds to pay for the plant, obtaining [illegible] Mr. Graham funds for partial payment and giving him [illegible] as security. He was given $213,200 worth of stock, 5 p[illegible] cent. which was paid, $202,540 remaining due. When Recei[illegible] Grady was appointed he brought suit against Mr. Graham, [illegible] jury in the lower court rendering a verdict for plaintiff [illegible] $10,000 which verdict the upper court reversed.

Telephone News Service in New Jersey.—The New Jersey ... Herald Company is completing its organization ... telephone news service to Newark, N. J., and other ... towns in the State. Daily news, embracing the full ... newspaper matter, will be transmitted from a central ... subscribers' instruments as soon as received ... service. Proceedings of public gatherings will be con... subscribers through instruments placed in the ... churches, theaters, or other places where meetings are ...s. The plan is patterned after the Telefon-Hirmonde ...st, which has been in successful operation since 1889. ...ican rights to the Hungarian invention are held by ... States Telephone Herald Company, and the New ...ephone Herald Company holds subsidiary rights in ...f New Jersey. The Public Utilities Commission of ...y has issued an order, operative September 7, direct... York Telephone Company to furnish leased ... ...lephone Herald Company. Negotiations for leased ... been in progress for nearly a year, the New York ... Company having withheld its sanction to the lease ...s for the purpose through fear of invalidating its ...

New Hydroelectric Developments in Oregon.—Two new ...ic power companies, La Tourelle Falls Power Com... the Coast Range Power Company, have recently been ... utilize the water-power of lower La Tourelle ... the Nehalem River, Oregon. The plant of the ...mpany will be located at the foot of La Tourelle ... will utilize both the upper and lower falls, which will ... a head of about 500 ft. The first installation will ...wo 200-kw, 6600-volt, three-phase, 60-cycle generators, ...ergy will be sold to the town of La Tourelle and ...he Coast Range Power Company will utilize the ... Nehalem River, below the mouth of the Salmon...r, where it is planned to install two 750-kw turbo-...sets. Energy will be developed at 6600 volts and ...which will be stepped up to 44,000 volts and trans... Tillamook, Ore., and to the Tualatin Valley. La ...alls Power Company will have a capital stock of ...l the Coast Range Power Company $75,000. The ... the two companies are Jerome L. Blaisdell, president, ...d Case, secretary and treasurer, both of Portland, ...

Pacific Power & Light Company to Increase Capacity.— ... that plans are being made by the Pacific Power & ...pany for extensive hydroelectric developments in the ... River at Priest Rapids, southwest from Spokane. ...he ultimate capacity of the system will be 1,000,000 hp. ...f the project is estimated at $6,000,000 to $10,000,000 ...work of construction will take over six years for com... Advices state that a dam will be constructed at the ...e rapids, to have a height of 75 feet, which is the ...he river in nine miles. The plans include further ... the Hanford irrigation project owned by the com... also the building of a distribution system for supply... to the eastern portion of the State of Washington.

Vermont $12,000,000 Hydroelectric Project.—Interests as... with one of the Connecticut River power companies ...ing a hydroelectric project on the Deerfield River in ...he initial development of which, it is reported, will ...te 25,000 hp. It is planned to dam the river at ...ces near Shellburne Falls, Vt., and to construct a ...t Somerset, Vt., where water will be impounded to ...f 100 ft. and over an area approximating six square ... underwriting agreement for the issuance of $3,000,-... cent, forty-year gold bonds and $750,000 6-per cent ... preferred stock was effected in Boston early this ...e ultimate expenditures, it is stated, will aggregate ...

Pittsfield (Mass.) Electrical Manufacturer May Move.— ...obson-Brandow Company, of Pittsfield, Mass., ...rer of spark coils, is contemplating moving to Springfield, unless $50,000 additional capital can be raised in Pittsfield. It is reported that Springfield capitalists have offered to invest in the concern. The plant employs about 100 people and the number is to be doubled if the increase in capital is effected. Bay City, Mich., has made an offer for the removal of the business there.

La Crosse Water Power Reorganization.—The outcome of reorganization of the La Crosse (Wis.) Water Power Company and the Winona (Minn.) Railway & Light Company, both of which are in the hands of receivers, as stated in recent issues of the *Electrical World*, is regarded as a consolidation between the two companies. The common stock of the Winona company is owned by the La Crosse Water Power Company. The committee representing the La Crosse bonds consists of F. O. Wetmore, vice-president of the First National Bank of Chicago; Harrison B. Riley, president of the Chicago Title & Trust Company, and Frank Vogel, president of the First National Bank of Milwaukee, the latter being chairman.

Conviction of Wireless Officials Affirmed.—The mandate of the United States Court of Appeals affirming the conviction of the three officials of the United Wireless Telegraph Company for fraudulent use of the mails in connection with sales of stock of the company was filed on Monday in the Federal Circuit Court in New York and made the order of the lower court. Christopher C. Wilson, president of the company, was sentenced to serve a term of three years at the federal penitentiary at Atlanta, and Francis X. Butler counsel and director, and W. W. Tompkins, of the New York sales agency, received sentences of two years' and one year's imprisonment respectively at the same institution. They left New York on Tuesday for Atlanta.

Holtzer-Cabot Electrical Company.—A parcel of land at Newton Highlands, Mass., has been purchased by the Holtzer-Cabot Electrical Company, of Brookline, Mass., and the purchasers plan to erect a large factory on the site. It is probable that the Boston end of the business will be transferred to the new factory, but it is not the company's intention to do away with the Brookline factory for some time to come, if at all. The land is at the junction of the Boston & Albany and New York, New Haven & Hartford railroad tracks, and the shipping facilities are excellent.

Milwaukee Manufacturers' Exposition.—The Merchants and Manufacturers' Association of Milwaukee will celebrate its fiftieth anniversary, September ? to 12, with an exposition of Milwaukee-made products to be held in the local Auditorium. Local electrical manufacturers will display their products, and one of the features promised for the exhibition will be a "Welcome" sign made up of frost-covered brine pipes chilled by a motor-driven refrigerating machine.

Consolidation of Pennsylvania Companies.—The merging of a number of public utility companies which recently obtained charters in Pennsylvania was certified to in papers filed this week at Harrisburg by the Philadelphia Suburban Gas & Electric Company and the Luzerne Gas & Electric Company, which are two of the principal subsidiaries of the American Gas Company. Changes in management or operating methods are involved in the consolidations.

New Electric Enterprise in Mexico.—Señor José Vasconcelos, an attorney practising in Mexico City, who is acting for a group of American financiers and business men, has applied for a concession to establish an electric light and power plant in Oacaxa. The plan includes not only the lighting of the city, but also the supplying of energy to other cities and mining centers, eventually covering the greater portion of the state.

Reorganization of Hudson River Power Company.—Notice has been given to Hudson River Power Company bondholders that the reorganization plan recently submitted by the protective committee, of which J. R. Hooper, of Boston, is chairman, has become operative by virtue of approval of more than 51 per cent of bondholders concerned.

Winnipeg Rates for Energy to Be Reduced.—Announcement is made by the municipal electrical department of Winnipeg that a reduction of rates for energy supplied from the municipal plant will become effective within a month. It is stated that the new rates will be over 20 per cent less than those of the electric railway company.

Directors of Northwestern Elevated Company.—The following directors have been elected by the stockholders of the Northwestern Elevated Railroad Company of Chicago: Samuel Insull, chairman; Henry A. Blair, Ira M. Cobe, Britton I Budd, William A. Fox, John H. Guick, W. V. Griffin, Mason B Starring and Samuel McRoberts.

Aluminum Notes and Prices.—The aluminum market as of August 22 is reported steady, with ingots for remelting held at 20@20½ cents spot No. 1, the base for large ingots Rods and wire are quoted at 31 cents, with sheets at 33 cents.

Financial.

The Week in Wall Street.

DECREASED apprehension over the outcome of the English labor troubles assisted in rallying the market toward the close of the last week, and it became stronger, with general recovery throughout the list. Sentiment in the street was influenced by the uncertain crop prospects in the West, and by rumors of plans for amending the Sherman law to give more direct benefit to business conditions. Discussion on the part of railroad companies of possibility of reducing dividend rates was made during the week, and denial by the management of the Union Pacific of existence of unfavorable conditions on the system were items of interest in connection with the sharp breaks in railroad stocks in the week's transactions. At the opening of the market on Monday reaction took place from the moderate improvement at the end of the preceding week, and prices fell, with Union Pacific leading the decline with a loss of 4 points. Outside buying of stocks was on a very narrow scale. The principal feature of the day's news was announcement of a retrenchment plan on the part of the Harriman lines, with a view to adjusting the

NEW YORK

	Aug. 15	Aug. 22	Shares Sold		Aug. 15	Aug. 22	Shares Sold
Al. Ch.	6[illegible]	[illegible]	100	Int. Met., pf.	43	42	6,700
All. Ch., pf.	[illegible]	[illegible]	400	Mackay Cos.	83	83	[illegible]
Amal. Cop.	62	[illegible]	140,150	Mackay C., pf.	72*	72*	[illegible]
Am. D. T.	20	20[illegible]	———	Man. Elev.	135*	135*	600
Am. Loco.	37[illegible]	36	2,100	Met. St. Ry.	15*	15*	
Am. Loco., pf.	107	107	[illegible]	N.Y.&N.J. Tel.	139	139	
Am. Tel. & C.	79¾*	79		Steel, com.	73[illegible]	72[illegible]	943,550
Am. T. & T.	134[illegible]	133[illegible]	8,315	Steel, pfd.	115¾	115¾	13,400
B. R. T.	75¾	75[illegible]	17,200	W. U. T.	74[illegible]	75	10,165
Gen. Elec.	154	153	3,520	West'h, com.	65½	66	5,700
Int. Met.	15	15	[illegible]	West'h, pfd.	118[illegible]	[illegible]	[illegible]

PHILADELPHIA.

	Aug. 15.	Aug. 22		Aug. 15	Aug. 22
Am. Rys.	44½*	45	Phila. R. T.	23	23
El. Co. of A.	11⅞	11⅞	Phila. Elec.	17[illegible]	17[illegible]
Elec. St. Bt'y	52[illegible]	52[illegible]	Phila. Trac.	86	86
Elec. St. Bt'y, pf.	30[illegible]	30[illegible]	Union Trac.	51	50¾

CHICAGO.

	Aug. 15	Aug. 22		Aug. 15.	Aug. 22
Chi. City Ry.	186*	186[illegible]	Com. Edison	132	133
Chi. Elev. Rys.	25*	25	Chi. Subways	2¾	2⅞
Chi. Elev. Rys., pf.	93*	90	Chi. Tel. Co.	123*	123*
Chi. Rs., Ser. 1	95*	95	Nat'l Car	110[illegible]	101
Chi. Rs., Ser. 2	30	29¾[illegible]	Nat'l Car, pfd.	118	118[illegible]

BOSTON

	Aug. 15	Aug. 22.		Aug. 15.	Aug. 22.
Am. T. & T.	134[illegible]	133[illegible]	Mex. Tel.	4[illegible]	4[illegible]*
Cum. Tel.	156	156*	Mex. Tel., pfd.	6*	6*
Edison E. Il.	286[illegible]	286[illegible]	N. E. Tel.	14[illegible]*	140[illegible]
Gen. Elec.	153½	153[illegible]	W. T. & T.	18¼	18[illegible]*
Mass. E. Ry.	19[illegible]	18[illegible]*	W. T. & T., pfd.	96*	98
Mass. E. Ry., pf.	6[illegible]	58[illegible]			

*Last price quoted.
Shares sold for the week, Aug. 14 to Aug. 19.

cost of operation to gross receipts. Prices recovered on Tuesday, following a sharp decline at the opening, and the general trend of the day's transactions was upward. Trading was largely professional and listless throughout. No particular attention was given to the adjournment of Congress. The government's weekly report on weather conditions in crop districts was favorable in the main, and its publication was followed by declines in the cotton and wheat markets. The most important news received on the street during the day was of temporary suspension of work on some of the Harriman roads. From the action of the market on Tuesday, opinions were inclined to belief that liquidation has run its course, and that the favorable aspect now shown by business conditions throughout the country indicates substantial recovery in the stock market, with public participation before fall. Rates in the money market Aug. 22 were as follows: Call, 2@2¼ per cent; ninety days, 3@3¼ per cent. The quotations in the tables are those at the close Aug. 22.

Financial Notes.

Court Decision on Non-Negotiable Bonds.—The Superior Court, Sacramento, Cal., has handed down a decision against the Sacramento Electric, Gas & Railway Company, holding it responsible for the payment of sixty-five $1,000 gold bonds, which were stolen in 1905 from the California Safe Deposit & Trust Company, San Francisco, by the bank's general manager, J. D. Brown, subsequently tried and convicted for the theft. The suit was instituted by Isaac Kohn, a sto[ck] bro[ker] of San Francisco, who handled the bonds, on whic[h] he ob[tained] loans aggregating $60,000. The Sacramento Electric Gas & Railway Company contended that the bonds [w]ere not negotiable instruments, and had so warned the holder but the court in its decision makes a statement to the followi[ng] effect: "It would create an unfortunate financial conditi[on] if all corporation bonds in the State were held non-nego[tia]ble by reason of a reference therein to a securing mortgag[e] or deed of trust containing some provision which alone mi[gh]t affect such bonds. The effect of such decision would [be] to depreciate greatly the value of all corporation bon[ds] in the State, because it would greatly lessen the facility w[ith] which banks, stockholders and business men deal therein because without a thorough examination of such security [in] every such transaction they would always take the bonds [at their] own risk and subject to any equities in favor of the [corpora]tion issuing the same or the real owner from whom th[ey] might have been wrongfully taken. The plaintiffs were [in]nocent purchasers of the bonds for value; * * * the [fact] that Brown stole the bonds cannot, under the facts sho[wn] here, defeat the plaintiff's right to recover."

Initial Dividend of Chicago Elevated Railways.—[...] of the initial quarterly dividend of 1½ per cent on th[e] [cumula]tive preferred stock of the Chicago Elevated Railway[s] [will be] made about Dec. 1. The consolidation was effect[ed] July 1, but the fiscal affairs of the new company are [not ...] until Sept. 1. The two months intervening have been [requi]red to adjust the accounts of the several companies, secu[re] [for]mal possession of their properties, and for completi[on] of a preliminary organization for operation of the roads. [Of] $16,000,000 of the Chicago Elevated Railways prefer[red] [...] is outstanding, there is only some 6 per cent of the [tot]al held by former stockholders in the old companies. The b[al]ance of the stock is in the hands of the syndicate that furn[ish]ed the funds used for payment of the old stocks. Annua[l re]quirements for preferred dividends will amount to $960,00[0]. Stockholders of the Northwestern Elevated Railroad at spe[cial] meeting Aug. 21 ratified the proposal authorizing an issu[e of] [...]000,000 first mortgage bonds. The trustees of the [Chicago] Elevated Railways voted nearly all of the capital sto[ck] of the company. The bonds are to be turned over to the tru[st]ees and will be held as security against money advanced fo[r] [ret]iring some $19,000,000 4 per cent mortgage bonds on Sept. 1 and also to liquidate floating indebtedness. It is said that no[ne] of the bonds will be offered to investors.

Canadian General Electric Company.—The repo[rt] of the Canadian General Electric Company for the ye[ar] ended December 31, 1911, shows operating profits of $9[...] as compared with $625,990 in the year preceding. Deduc[tio]ns for interest were $76,820, as against $51,660, and the deduc[tio]ns for depreciation were $188,088, as compared with $91,[...]. The balance available for dividends was $646,300, as against $[...],237, and after payment of $140,000 on the preferred s[toc]k and $354,625 on the common, there was a surplus of $151,[...] comparing with $14,237 in the previous year. The amo[unt] available for dividends on the common stock was equal t[o] [...] per cent earned on $5,392,737 common, as compared with [...] per cent earned last year on $4,700,000 common stock.

Pacific Light & Power Corporation.—A speci[al] stockholders' meeting of the Pacific Light & Power Corpo[rati]on has been called for Oct. 9 for the purpose of increasing th[e] bonded indebtedness from $3,000,000 gold bonds to $38,000,0[00], an increase of $35,000,000. The corporation has assumed [th]e outstanding bonded indebtedness of the Pacific Light [&] Power Company and certain subsidiary companies to an am[ou]nt approximating $9,015,000, together with the $3,000,000 iss[ue] [...] which is of five-year duration, bearing 6 per cent. [Th]e new issue is to be evidenced by 35,000 bonds of par value $1,000 each, of the same term and bearing the same intere[st as] [the] previous collateral trust bonds.

Opposition to Stock Issue in Ohio.—W. R. [...] [...] president of the Cuyahoga River Power Company, [ha]s filed a protest with the Ohio Public Service Commission ag[ai]nst the issue of $3,000,000 stock by the Northern Ohio Tr[ac]tion & Light Company. It is alleged in the petition that [th]e proposed stock issue would be contrary to the provisio[ns] of the public utilities act which became effective June 30, gi[vi]ng full power over stock issues to the state commission, and [th]at part of the issue has been sold to a co-director at less than par

[illegible] alleged that part of the proceeds have been diverted, and [illegible] issued by a New York banking house contain mis[illegible]statements.

Washington, Baltimore & Annapolis Earnings.—[illegible] the [illegible] Baltimore & Annapolis Electric Railroad Company [illegible] its good earning record is evidenced by report [illegible] for the month of July, which has been just issued [illegible] month both gross and net income of the property [illegible] over the figures for the corresponding month of 1910. [illegible] gross operating revenue of the company for July was [illegible] compared with $57,202, making a gain of [illegible] [illegible] present year. Operating expenses for the period were [illegible] against $28,303 for July of 1910, or an increase of [illegible] [illegible]t month. The net operating revenue of the com[illegible] [illegible], as compared with $28,808 for 1910, the in[illegible] [illegible] for July of this year. For the four months [illegible] [illegible]mpany's new fiscal year, which began on April 1, the [illegible]ation plan becoming effective at that time, the gross [illegible] revenue of the road was [illegible], as against $230,[illegible] [illegible], the increase for this year being $6,465. The net [illegible] revenue was $127,013, as against $118,231 for 1910, [illegible] [illegible]n of $9,382 for the four months of the current year. [illegible] gross income of the Washington, Baltimore & Annapolis [illegible] period mentioned, including miscellaneous income, was [illegible] against $118,497 for the corresponding period of [illegible] [illegible]ious year, while the net income was $38,660, as com[illegible] with a deficit of $4,676 for last year. The percentage of [illegible] expenses to gross operating revenue for the four [illegible] [illegible] per cent, as against [illegible] per cent for 1910.

[illegible]ntain States Telephone & Telegraph Company.—[illegible] Porter & Company, of Denver, Col., own and offer [illegible] of the Mountain States Telephone & Telegraph Com[illegible] [illegible] paying 7 per cent per annum on the par value of [illegible] share. This company, the outcome of a merger be[illegible] [illegible] the Colorado Telephone Company, the Tri-State Tele[illegible] & Telegraph Company, and the Rocky Mountain Bell [illegible] Company, as outlined in recent issues, owns and [illegible] the telephone properties of six states, and crosses the [illegible] of two others, operating in Colorado, Utah, Idaho, [illegible]a, Wyoming and New Mexico, with toll lines extending [illegible] surrounding territory. The reorganization has been [illegible] by acquisition of the stock of each constituent company, [illegible] transfer to the new company of all physical and other [illegible]s, franchises, good-will, etc., of the three former com[illegible]. The Mountain States company has an authorized capital [illegible],000, par value of each share being $100, fully paid [illegible] assessable; issued and outstanding $18,937,400. There is [illegible] class of stock and no bonded or floated debt. The [illegible]se of the merger has been to bring all telephone [illegible] the Rocky Mountain region under one management [illegible]ship. The Mountain States company has a surplus, [illegible] profits and depreciation reserve of $4,208,261. Price [illegible] stock will be furnished upon application to Boettcher, [illegible] Company.

[illegible]t Worth Power & Light Bonds.—Perry, Coffin & [illegible] offering $1,500,000 first mortgage 5 per cent gold bonds [illegible] Fort Worth Power & Light Company, which does the [illegible]ectric light and power business of Fort Worth, Texas. [illegible]ue is secured by a direct first mortgage upon all the [illegible]s, rights and franchises of the Fort Worth company, [illegible]ned and hereafter acquired. The authorized first mort[illegible] [illegible]nd issue is $10,000,000, of which $1,500,000 bonds are [illegible]sued for the present time. The remaining $8,500,000 [illegible] may be issued from time to time to the par value of [illegible] of the cost of permanent extensions and im[illegible] [illegible] to the property, provided that net earnings for the [illegible] twelve months have been equal to at least twice the [illegible] on all bonds outstanding, including those it is pro[illegible] [illegible] issue. A deposit of $900,000 of the proceeds of the [illegible] issue will be made with the trustee, to be expended on [illegible]struction of a modern power station. The company has [illegible] obtained a contract with the city of Fort Worth for [illegible]ing energy to the new city pumping stations and has a [illegible]ntract for street lighting. Net earnings exceed twice [illegible]t requirement on the present bond issue.

Union Railway, Gas & Electric Bonds.—E. W. Clark & [illegible], of Philadelphia, are offering $3,000,000 5 per cent [illegible]ral trust convertible gold bonds of the Union Railway, [illegible] Electric Company at 93 and accrued interest. The com[illegible] [illegible] and controls one hundred and thirty four miles of [illegible] comprising the street railway system of Springfield, Ill., and a number of street railways and interurban lines in neighboring towns, and also the gas, electric-lighting and electric power properties in the territory served. The bonds are dated July 1, 1909, and mature July 1, 1939; are convertible at any semi-annual interest period into 6 per cent cumulative preferred stock on thirty days' notice, and are redeemable at par and interest on any interest date.

Dividend Dates of Southern California Edison Company.—John B. Miller, president of the Southern California Edison Company, has announced that on account of opening a transfer office in New York City it has become necessary to designate permanent dates for payment of dividends, and that the directors have accordingly authorized the following dates, contingent upon the earnings of the company: Dividends to holders of preferred stock as shown on the books at the close of business on the last days of March, June, September and December, checks to be forwarded therefor on the 15th of April, July, October and January; dividends to holders of common stock of record on the last days of January, April, July and October, checks to be forwarded therefor on the 15th of February, May, August and November.

Hamilton Gas & Electric Company.—Bondholders of the Hamilton Gas & Electric Company, of Hamilton, Ohio, have selected W. E. Hutton, of Cincinnati; Stanley Matthews and Joseph Kelly as a committee to make an investigation into the operation of the company with a view to suggesting methods of safeguarding the interests of the bondholders. The company has been unable to pay the interest on outstanding bonds, as, it is claimed, the company has been operating its plant at a loss for some time. This is said to be due to competition with the gas and electric plant operated by the city of Hamilton. The company now has a suit pending against the city to prevent its operating at the present rates, which are claimed to be so low that the city is sustaining a loss.

Marconi Wireless Company Dividends.—At a recent meeting in London the Marconi Wireless Telegraph Company, Ltd., declared dividends as follows: 7 per cent per annum on the cumulative participating preference shares issued on or prior to December 31 last, and an interim dividend at the rate of 7 per cent per annum on the cumulative participating preference shares issued on or prior to June 30 last, and also an interim dividend for the half year ended June 30 at the rate of 10 per cent per annum on the ordinary shares issued July 20, 1911; all dividends payable September 1.

Philadelphia Electric Company.—The income of the Philadelphia Electric Company has been increased during the year by the increased sale of energy for municipal lighting and further additions to the revenue will be made by the contract to supply energy to the Philadelphia Rapid Transit Company. It is expected that the company will end its fiscal year on December 31 with a very large surplus.

DIVIDENDS.

Mackay Companies, quarterly, preferred, 1 per cent; common, 1¼ per cent, payable Oct. 2.

New York & Queens Electric Light & Power Company, quarterly, 1 per cent, payable Sept. 1.

Standard Gas & Electric Company (Chicago), quarterly, preferred, 2 per cent, payable Sept. 15.

REPORTS OF EARNINGS.

CHICAGO & MILWAUKEE ELECTRIC RAILWAY COMPANY

Period		Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus
[illegible]	[illegible]	[illegible]	[illegible]	$120,219	$59,305	$60,914
	[illegible]	[illegible]	[illegible]	59,515	55,825	3,690

COLORADO SPRINGS LIGHT, HEAT & POWER COMPANY

[illegible]	[illegible]	[illegible]	$120,612	$90,287	$46,805	$43,48[illegible]
	[illegible]	[illegible]	[illegible]	87,8[illegible]	44,[illegible]	43,6[illegible]

EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON.

[illegible]	[illegible]	[illegible]	$172,044	$197,828	....	
	[illegible]	332,5[illegible]	155,318	177,276	....	

KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY

[illegible]	1911	$366,90[illegible]	$185,333	$181,56[illegible]	$122,773	$58,79[illegible]
"	[illegible]	34[illegible]	170,765	170,8[illegible]	106,45[illegible]	64,3[illegible]
[illegible] July,	'11	2,708,964	1,350,881	1,358,083	797,59[illegible]	60,48[illegible]
"	[illegible]	[illegible]448,65[illegible]	1,167,877	1,280,774	717,1[illegible]	563,6[illegible]

General News

Construction News.

ANNISTON, ALA.—The Anniston Realty Company is planning to build a seventeen-acre park and extend electric lighting system, etc. H. F. Williamson is interested in the company.

CEDAR BLUFF, ALA.—The installation of an electric-light plant in Cedar Bluff is reported to be under consideration. W. T. Lassiter is interested in the project.

COLUMBIANA, ALA.—The franchise granted to G. T. Carlisle and associates several months ago has been acquired by the Mount Dixie Sanatorium, Land & Investment Company, which, it is said, will construct an electric-light plant.

STEVENSON, ALA.—The City Council is reported to have engaged J. B. McCrary & Company, Empire Building, Atlanta, Ga., to prepare plans for a municipal electric and water plant.

MIAMI, ARIZ.—The Summit Copper Company is planning to install an electric-light and power plant.

PHOENIX, ARIZ.—The City Council has awarded a contract to the New State Electric Company for the installation of an ornamental lighting system in the business district of the city, to cost about $20,000. Iron lamp standards and incandescent lamps will be used.

PHOENIX, ARIZ.—Contracts have been awarded by the Salt River Valley Water Users' Association for equipment for its power house at Arizona Falls, as follows: To the S. Morgan Smith Company, of York, Pa., for 725-hp hydraulic turbines, at $11,500; for 530-kva alternators to the General Electric Company, of Schenectady, N. Y., at $15,462, and to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for switchboard, for $3,222.

CLARKSVILLE, ARK.—The proposition to issue bonds to the amount of $75,000, the proceeds to be used for the installation of an electric-light plant, water-works and sewer system, will be submitted to a vote of the people. Plans for electric-light plant have been prepared by R. L. Goodman.

ALAMEDA, CAL.—An election will soon be held in this city to vote on a $15,000 bond issue, the proceeds to be used for improvements to the electric-light plant

ALPAUGH, CAL.—Plans are being prepared by the Second Extension Water Company for the installation of an electric pumping plant.

ANAHEIM, CAL.—Plans are being considered for the installation of an ornamental street-lighting system in the business district of the city. It is proposed to erect ornamental lamp standards, each standard carrying five lamps.

COLUSA, CAL.—The County Supervisors of Colusa County have granted the Northern California Power Company a franchise to erect transmission lines to supply electricity for lamps and motors throughout the county.

LODI, CAL.—The Central California Traction Company, it is reported, is contemplating the construction of a railway from a point near Lodi up Dry Creek. Extensions are also planned to Jackson and Sutter Creek.

LONG BEACH, CAL.—Preparations are being made by the Pacific Telephone & Telegraph Company for the erection of a new exchange building on Fifth Street and to install a conduit system to cost approximately $140,000.

LONG BEACH, CAL.—The Southern California Edison Company has completed the installation of the initial 15,000-hp unit at its power plant, which will be put in operation immediately. The cost of the plant to date is approximately $2,000,000.

LOS ANGELES, CAL.—Preparations are being made by the Pacific Telephone & Telegraph Company for improvements and additions to its exchange building, located on East Jefferson Street, for which a permit has been granted.

LOS ANGELES, CAL.—The Southern California Edison Company is erecting a new transformer house in the Lawnsdale district.

LOS ANGELES, CAL.—In the city budget for 1911-12 adopted by the City Council the sum of $92,855 is appropriated for the installation of a modern fire and police telegraph system.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation announces that it will build new car lines on West Jefferson Street and Vermont Avenue if suitable franchise is given.

LOS ANGELES, CAL.—Parkinson & Bergstrom, architects, Security Building, have awarded a contract to the Meyberg Company, Sixth and Spring Streets, for furnishing and installing electric fixtures in the twelve-story Chester Building, at Fifth and Spring Streets, for $5,650.

LOS ANGELES, CAL.—The City Council on Aug. 8 decided to appropriate $5,500 for August and $5,000 for September, to cover the expenses of securing rights-of-way and making surveys for transmission lines and locations for power houses in connection with the development and transmission of the city's electrical supply, and William Mulholland, chief engineer of the aqueduct, will file on additional power sites on the Owens River and on Cottonwood Creek that will increase the rating of the aqueduct by 30,000 hp.

MARYSVILLE, CAL.—Plans are being considered by the Great Western Power Company for extension of its transmission lines to Marysville to supply electricity for lamps and motors. The erection of a new power plant on the outskirts of the city is contemplated.

NAPA, CAL.—Application will be made by the Napa & Clear Lake Railway Company for a charter to construct an electric railway from Napa to Lakeport, 90 miles in length. The company is to be capitalized at $500,000. The directors are C. W. Conlisk, W. M. Rank and Morton.

OAKLAND, CAL.—The Blue Lakes Power & Lighting Company is erecting a transmission line across the hills from Lake County with a view of extending it to Oakland and ultimately to San Jose and up the peninsula, via Palo Alto to San Francisco.

PALMS, CAL.—At an election held recently the proposition to install a street-lighting system in Palms was carried.

REDONDO BEACH, CAL.—The Pacific Light & Power Company has awarded the contract for the installation of a new piping system in its power plant to H. R. Boynton, to cost $11,619.

RIVERSIDE, CAL.—The Southern Sierras Power Company, it is reported to have awarded contracts for the erection of distributing lines throughout this county, one of which will tap the Moreno and country and another the West Riverside and Corona districts, planning to build a transmission line from San Bernardino to Bishop, a distance of 250 miles. The cost of the line is estimated at $2,000,000. A. Worthley, of Riverside, Cal., is local representative.

ROSEVILLE, CAL.—The installation of a municipal electric lighting system in Roseville is reported to be under consideration.

SACRAMENTO, CAL.—The Sacramento Valley West Side Electric Railway Company has awarded the contract for construction of its proposed electric railway from Woodland to Red Bluff to the Dozier Construction Company, of Sacramento, Cal.

SACRAMENTO, CAL.—Bids for the installation of the new underground conduit system for the lighting arrangements on the capitol grounds and the building were opened on Aug. 12 by Capitol Superintendent Radcliff, and all bids are reported to be higher than the estimate, which is about $13,000. New bids may be called for.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company has purchased a site for its large power plant, which is to be located on Poplar Street and the intersection of the Santa Fe tracks. The plant will be installed immediately and operated until the transmission line from Bishop to San Bernardino is completed, after which the plant will be used as an auxiliary.

SAN BERNARDINO, CAL.—The California-Nevada Power Company has awarded a contract to Milliken Brothers, of New York, N. Y., for 2000 steel towers, and to the Aluminum Company of America for tons of wire for its proposed transmission line from Bishop to San Bernardino, a distance of 240 miles. The Southern Sierras Power Company, a subsidiary company, has acquired a site in this city for an auxiliary and distributing plant. A conduit system will be installed in the business section. The cost of the work is estimated at about

SAN FRANCISCO, CAL.—The site for the new power house of the Geary Street Railway at Jefferson and Jones Streets has been purchased for $55,000. Plans are now being prepared for the building.

SAN JOSE, CAL.—The Great Western Power Company has applied to the Board of Supervisors of Santa Clara County for a franchise covering the entire county.

VACAVILLE, CAL.—The Board of Supervisors has granted the Pacific Portland Cement Company a franchise to maintain an electric transmission line on the county road in Vacaville.

WINTERS, CAL.—In order to be able to take care of its increasing business in this city, the Pacific Gas & Electric Company has arranged to reconstruct its entire system, and work has already been commenced.

JULESBURG, COL.—An electric pumping plant installed at Neb., a siding on the Union Pacific Railroad, by L. W. Ferson and H. C. McNew, having proved successful, it is proposed to erect in the vicinity of Julesburg, the electrical energy from which used for the operation of the various pumping equipments in County.

LONGMONT, COL.—George H. Stonex, City Clerk, writes that H. Whiting, 216 Central Building, Denver, is preparing plans for municipal electric-light plant, which is to cost $60,000. R. E. son is city engineer.

PUEBLO, COL.—The Trinidad Transmission Railway & Gas Company has been incorporated with a capital stock of $4,000,000 to

[illegible] light, gas and street-railway [illegible] State [illegible] heating and water service [illegible] companies for domestic and commercial purposes [illegible] over the properties of the Southern [illegible] & Power Company and [illegible] Las Animas [illegible] Fremont and Denver Counties. Those responsible for its formation [illegible] H. Williams, R. H. W[illegible] A. S. Brooks.

[illegible] CONN.—[illegible] [illegible]lk is under consideration, a site on the Blackberry River having been surveyed for the purpose. It is understood that Mrs. George [illegible]

[illegible] NORWALK, CONN.—Beginning with November the [illegible] Light Plant will make the following reduced rates to consumers [illegible] energy [illegible] public lighting the price [illegible] from $13.20 to $10.80 per year, public offices and buildings to be [illegible] at actual cost. [illegible] from 9 cents per kw-hour for the first 100 kw-hours to 5 cents [illegible] over 500 kw-hours, the present rates [illegible] over 300 kw-hours. The minimum rate [illegible] [illegible]nts will be $1.11 and for residences 55 cents. For industrial [illegible] rates will be 5 cents per kw-hour for the first 100 kw-hours, [illegible] next 400 kw-hours and 3 cents for all over 500 kw-hours, [illegible] rate of $1.11.

[illegible]TON, D. C.—Consular Report No. 186 states under [illegible] Opportunities, Item No. 7160, that a firm in England [illegible] American consular officer that it wishes quotations from manu[illegible] electrolyte wire bars in the United States.

[illegible]NGTON, D. C.—Consular Report No. 187 states under Trade Opportunities, Item No. 7166, that an American consular [illegible] England has forwarded the name of a business man in his [illegible] wishes to communicate with manufacturers of motors and [illegible] accessories in the United States with a view of obtaining the [illegible] that line.

[illegible]NGTON, D. C.—Consular Report No. 193 states, under the British Columbia Activities, that it is understood that the Great [illegible] Railway Company will install at Ardley, British Columbia, [illegible] Burnaby line of the British Columbia Electric Railway crosses [illegible] interlocking plant at a cost of over $7,000, which will pro[illegible] from line to the other.

[illegible]N, FLA.—The installation of an electric-light plant, [illegible] system is reported to be under consideration. [illegible]ntz is interested in the project.

[illegible] a group of capitalists for the organization of an electric-power [illegible] this city. The purpose of the proposed enterprise is to estab[illegible] generating plant on the Wekiwa River, from which point electrical [illegible] be distributed to the nearby towns.

[illegible]N, GA.—Surveys are being made for the erection of the trans[illegible] of the Eastern Tennessee Power Company east of Dalton, [illegible] line running just outside of the city limits. If granted a fran[illegible] company will supply electricity in Dalton. The company is de[illegible] the water power of the Ocoee River.

[illegible] GA.—C. T. Clifford, of Columbus, Ga., has secured the [illegible] for rebuilding the power house of the Virginia-Carolina Chemi[illegible]any, of Richmond, Va.

[illegible] IDAHO.—The city of Boise is planning to install a cluster [illegible] system, which will double the area covered by the present sys[illegible] involve the erection of 540 additional poles, each surmounted [illegible] cluster of three lamps. It is stated that the maintenance of the [illegible] installation will cost the city $3,000 more per year than it is paying [illegible] present system.

[illegible]S, IDAHO.—Application has been made to the City Council [illegible] Frank, manager of Kooskia Milling & Power Company of [illegible] for a franchise to supply electricity in Stites for lamps and [illegible] The company proposes to erect a transmission line from its Kooskia to Stites and agrees to furnish electrical service at the [illegible] as charged in Orofino. If granted a franchise Mr. Frank [illegible] have the system ready for operation within thirty days.

[illegible], ILL.—The Fox & Illinois Union Railway Company is plan[illegible] begin work on the construction of its proposed electric railway [illegible] Yorkville and Morris, 20 miles in length, about Sept. 1. H. H. [illegible] of Aurora, Ill., is president of the company.

[illegible], ILL.—The Aurora, Elgin & Chicago Railroad Company [illegible] contemplating the installation of a coal-handling and coal-storage plant at its Batavia power house.

[illegible], ILL.—At a special meeting of the stockholders of the [illegible] Elevated Railroad Company held recently a $25,000,000 bond issue was authorized, the proceeds to be used to retire $19,000,000 in bonds due September, and to pay floating indebtedness.

CHICAGO, ILL.—The Chicago Railways Company has awarded the contract for equipment for the extension of its La Salle Street substation, including two 3000-kw, 25-cycle, self-starting rotary converters, with necessary transformers and a three-panel switchboard, to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.

CHICAGO, ILL.—Bids will be received by [illegible] city electrician, 608 City Hall, Chicago, Ill., until Aug. 28 for furnishing the city of Chicago with lamps on certain parts of streets in different sections of the city for one year from Sept. 1, 1911, as per specifications on file in the office of the city electrician. Alternate propositions will be received covering a period of two, three and five years from Sept. 1, 1911; also alternate proposals covering a period of one, two, three and five years from Jan. 1, 1912.

MASCOUTAH, ILL.—The citizens have voted in favor of a $12,000 bond issue, the proceeds to be used for the construction of a municipal electric-light plant, as mentioned in a previous issue.

PAXTON, ILL.—The question of establishing a municipal electric-light plant in Paxton is under consideration, and bonds to the amount of $15,000 have been authorized.

TAYLORVILLE, ILL.—A contract has been awarded by the Taylorville Gas & Electric Company to John W. Morrison, of Lincoln, for the construction of a new electric-light plant on the site of the old plant. Not only will a new structure be erected, but the plant will be entirely equipped with new machinery, which will displace that which has been in use for some time.

ALBION, IND.—At an election held recently the citizens voted to purchase the local electric-light plant and water-works system, to be owned and operated by the municipality.

ELKHART, IND.—The City Council is considering an ordinance which provides for installing electric wires in conduits in the business district of Elkhart.

EVANSVILLE, IND.—[illegible] Evansville Railways Company, which operates traction lines from Evansville to Grandview, Ind., and Mount Vernon, Ind., for leasing the abandoned tracks of the Illinois Central Railroad from Evansville to Henderson, Ky. The Evansville company will operate electric cars on the line and expects to have the system in operation in about three months. Eventually the Evansville Railway Company will extend the railway from Henderson to [illegible], Ky.

GARY, IND.—It is stated that the $10,000,000 plant which the American Car & Foundry Company is to erect in Gary will be electrically equipped throughout.

INDIANAPOLIS, IND.—The Commissioners of Marion County are not favorably impressed with municipal operation of utility plants, and will close the power, light and heating plant which has been supplying the jail and court house with water, heat and light. It is the belief of the commissioners that the county can buy its water, heat and light at a rate that would be lower than the cost of maintaining its own power plant. Bids are now being asked of the existing companies to furnish such service.

NEWCASTLE, IND.—A five-year contract to supply electrical energy to the Indiana Village of Epileptics, for the operation of lamps and motors, has been awarded to the New Castle Light, Heat & Power Company.

CLARION, IA.—The local electric-light system, which was recently destroyed by fire, has been purchased by Messrs. Morengo and Mack. It is understood that the new owners will rebuild the plant.

COUNCIL BLUFFS, IA.—Bids will be received by the Board of Water Works Trustees of Council Bluffs, Ia., until Sept. 7, for furnishing complete two 100-hp, three-phase, 60-cycle, 2000-2300-volt induction motors, in accordance with plans and specifications on file at the office of the superintendent of water works, Des Moines, Ia., copies of which may be obtained on application to S. L. Entyre, superintendent of water works. Bids will also be received at the same date and place for the construction of concrete reservoirs and also for 5000 barrels of Portland cement.

DES MOINES, IA.—The city is reported to be considering the question of taking over the electrolier lighting system.

DES MOINES, IA.—Plans are being considered by the Des Moines City Railway Company for the erection of an addition to its power plant in Des Moines.

MARSHALLTOWN, IA.—The recently organized Merchants, Mechanics & Farmers Telephone Company will award a contract in September for the construction of a plant that will cost in the neighborhood of $100,000.

NEW SHARON, IA.—Owing to the Town Council and the owners of the local electric-light and water plants being unable to come to an agreement, the plants have been closed and the town is without street-lighting service and fire protection. Announcement has been made that the town authorities will take charge of the lighting and pumping plants and operate them until the courts settle the controversy.

HILL CITY, KAN.—The J. S. Worley Company, Reliance Building, Kansas City, Mo., is reported to be preparing plans for the installation of an electric-light plant and water-works system in Hill City, to cost approximately $50,000.

KANSAS CITY, KAN.—Plans and specifications for the installation of a municipal electric light plant in this city, drawn by the McLaughlin Engineering Company, have been approved by the Commissioners, and that the City Clerk has been instructed to advertise for bids for its construction.

SYLVAN GROVE, KAN.—It is reported that plans and specifications are being prepared by Von Unwerth & Cooke, Finance Building, Kansas City, Mo., for the installation of an electric-light plant and water-works system [illegible] bonds [illegible] the amount of $35,000 [illegible]

[illegible] estimated at $10,000 [illegible] the water-works [illegible]. It is understood that bids for construction [illegible] system [illegible] year later.

O'BANNON, KY.—The residents of the eastern part of Jefferson County are considering the organization of a light, heat and power company to operate in this section of the county. It proposes to locate at Marcia, where the old plant of the Louisville & Eastern Electric Railroad is located, which has been abandoned by the Louisville Railway Company, which took over the former company. It is understood that the railway company is anxious to sell the property. It is proposed to organize a company with a capital stock of $60,000.

NEW IBERIA, LA.—The Southwestern Traction & Power Company, of New Orleans, La., will place contracts during the next ten weeks for the construction of a new power house in New Iberia. The equipment will include two 250-hp water-tube boilers, turbines, generators, etc. Oil will be used for fuel for boiler:

BANGOR, MAINE.—The Bangor Power Company, recently incorporated for the purpose of acquiring the property and franchises of the Bodwell Water Power Company, is to be absorbed by the Bangor Railway & Electric Company. A dam is soon to be built at Gilman's Falls, on the Stillwater branch of the Penobscott River, for which surverys are now being made. John R. Graham, president of the Bangor Railway & Electric Company, has been elected general manager of the Bodwell Power Company.

BANGOR, MAINE.—The Bangor Power Company was recently incorporated with an authorized capital stock of $1,250,000 and $750,000 in bonds, to take over the rights, property and franchise of the Bodwell Water Power Company, which was purchased at a foreclosure sale on May 19 by the reorganization committee. A meeting of the Bangor Railway & Electric Company will be held Aug. 26 to consider the guaranteeing of the $750,000 bonds of the Bangor Power Company, and also the issuing of new stock for the purchase of the stock of the Bangor Power Company. It is proposed to reorganize the Bangor Railway & Electric Company in connection with the Bangor Power Company, the Veazie Lumber Company and the Penobscot Realty Company. The plan calls for an increase in the capital stock of the Bangor Railway & Electric Company to $3,000,000.

WILTON, MAINE.—Charles O. Sturtevant, general manager of the Franklin Electric Light & Power Company of Farmington, Maine, has purchased the plant and holdings of the Wilton Electric Light, Power & Gas Company. The Town Council has contracted with the Franklin Company to supply electricity for lighting the town. Thirty street lamps will be erected in the villages of East Wilton and Wilton. Work will soon begin on the erection of the transmission line from Farmington to Wilton.

BOSTON, MASS.—Plans are being considered by Mayor Fitzgerald for the installation of an electric-light plant in the new city hall annex to supply electricity for lighting the city hall and annex and possibly the nearby buildings. It is also proposed to light Gallup's Island quarantine station with electricity.

DEDHAM, MASS.—The Dedham & Hyde Park Gas & Electric Light Company has petitioned the Massachusetts Gas and Electric Light Commissioners for permission to issue additional capital stock to the amount of $14,200, the proceeds to be used to pay for extensions and additions to its mains and services, and to provide funds for further extensions.

NORTH ADAMS, MASS.—The stockholders of the Hoosac Cotton Mills have authorized the erection of a new spinning mill, power house and other buildings at their Eclipse plant and the removal of machinery of their Beaver plant to the new mill. An increase of capital stock from $750,000 to $1,000,000 has also been authorized.

WARE, MASS.—The Ware Electric Company has applied to the Massachusetts Gas and Electric Light Commissioners for permission to issue $40,000 additional capital stock, the proceeds to be used to pay floating indebtedness for new construction and improvements already made and for developments to the property.

WEYMOUTH, MASS.—The Massachusetts Gas and Electric Light Commissioners have approved the petition of the Weymouth Light & Power Company to issue new capital stock to the amount of $210,000, the proceeds to be ustd to pay for additions made to its plant.

STANTON, MICH.—At a special election held recently the proposition to issue $10,000 in bonds, the proceeds to be used for the construction of an electric-light plant and water-works system, was carried.

ALBERT LEA, MINN.—Improvements are contemplated by the Northwestern Telephone Exchange Company to its new system, which will involve an expnediture of about $10,000.

DEER RIVER, MINN.—The Everton Light & Power Company has commenced work on the construction of a new electric-light plant in Deer River.

RUSH CITY, MINN.—The Village Council of Rush City, Minn., will receive sealed bids for an electric fire pump and motor up to Sept. 5. Detailed information may be obtained from the Village Recorder, J. F. Sommers.

ST. PAUL, MINN.—It is reported that the Board of Public Works has decided to install a new street-lighting system. About 1000 new lamps will be erected.

WINONA, MINN.—Judge Charles A. Willard, of the U. S. District Court, has appointed Howard [illegible] of Milwaukee [illegible] receiver of the Winona Railway & Light Company. C. C. Smith, for the [illegible] offered a cash payment of $12,375 as default interest to the Old [illegible] Trust Company, of Boston, as a plea that the receiver be not ap[pointed], but the attorney, acting for the Trust Company, objected to [ac]ceptance on the ground that it was not offered in good faith.

KIRKWOOD, MO.—At an election held Aug. 19 the propos[ition to] issue $10,000 in bonds, the proceeds to be used for improveme[nts and] extensions to the electric-light plant and water-works system, was [carried].

MONETT, MO.—Bids will be received for the constructio[n of an] electric-light plant, including pole line, etc., until Aug. 29. The [cost of] the plant is estimated at approximately $35,000.

PRINCETON, MO.—Bonds to the amount of $7,000 have bee[n voted], the proceeds to be used for extensions to water-works and elec[tric] systems.

ROLLA, MO.—The proposition to issue bonds to the amount of [illegible] the proceeds to be used for improvements to the municipal elec[tric] plant, will be submitted to a vote of the people.

BIG HORN, MONT.—The Big Horn Telephone Company, [recently] organized with a capital stock of $20,000, is planning to erect [a tele]phone line to Custer, Mont.

BILLINGS, MONT.—The City Council has passed an ordina[nce pro]viding for the installation of an ornamental street-lighting sy[stem in] Billings.

LIBBY, MONT.—Plans are being considered by J. A. Coram, [of Bos]ton, Mass., for the installation of a power plant at Kootenai Fall[s].

BURWELL, NEB.—Preliminary arrangements for the installa[tion of] an electric power plant at this city having been concluded by [illegible] Reasoner and Beardsley, of Lincoln, work on its construction [will be] commenced at once. Local subscriptions to the amount of $10,0[00 have] been secured, and it is understood that the remainder of the [amount] required to cover the cost of the plant will be furnished by [outside] parties. The present plan is to construct a dam on the Lou[p River] north of Burwell, at which point 1000 hp can be developed. A [number] of towns in the valley are considering the utilization of the ene[rgy gen]erated, and plans are being formulated for the construction of [a trans]mission line from Burwell to Taylor and Almeria.

FREMONT, NEB.—The installation of a new lighting system [in the] Court House at this city has been authorized by the County Boa[rd].

GRAFTON, NEB.—It is reported that L. R. Jensen, of Auro[ra], has secured the contract for the installation of an electric-light [plant in] Grafton, to cost approximately $15,000.

OMAHA, NEB.—Arrangements are being made by the O[maha &] Council Bluffs Street Railway Company for rebuilding its subst[ation on] the Manawa line, which was recently destroyed by fire.

STERLING, NEB.—The citizens are reported to be conside[ring the] installation of an electric-light plant and water-works system in [illegible]

WEEPING WATER, NEB.—Plans and specifications have be[en sub]mitted to the City Council by H. H. Henningsen, of Omaha, N[eb., for] the construction of an electric-light plant in Weeping Water. Th[e plans] call for an addition to the pump-house and the installation of tw[o addi]tional engines. Bids for construction of the plant will be receiv[ed until] Aug. 28. The Alamo Engine & Supply Company, of Omaha, N[eb., has] charge of the engineering work.

GOODSPRINGS, NEV.—Plans are being considered for the [erection] of a new power plant at the Yellow Pine mine. J. F. Kent is [illegible]

ALBANY, N. Y.—Contracts have been placed by the Delaware [& Hud]son Company with the General Electric Company for one 7500[-kw tur]bine, one 100-kw turbo-exciter and four 2500-kva transformers. [The] equipment will supply additional power for the company's elect[ric rail]way service in Albany, Troy and Schenectady, and will also [supply] electricity for its new shops at Watervliet, N. Y.

BOLTON LANDING, N. Y.—The Bolton Light & Power C[ompany] has petitioned the Public Service Commission, Second Distr[ict, for] authority to issue $12,500 in capital stock.

BUFFALO, N. Y.—Sealed proposals will be received at the [illegible] Department of Public Works, Room 5, Municipal Building, Bu[ffalo, N.] Y., until Aug. 29 for furnishing 106 five-lamp, 60-watt Unio[n] Standard luxolabras of pressed steel or their equal, complete wi[th glass]ware, sockets, lamps, etc. Dimensions, materials and glasswar[e] equal to to be the same as used in Genesee Street. Francis G. [illegible] commissioner.

EPHRATAH, N. Y.—The Mohawk Hydroelectric Company has [applied] to the Public Service Commission, Second District, for permi[ssion to] issue 6 per cent thirty-year gold bonds to the amount of $56,000, [the pro]ceeds to be used for the construction of a substation and the ere[ction of] transmission lines from its generating station in Ephratah to the [villages] of Fort Plain and Nelliston.

KEESEVILLE, N. Y.—The Keeseville Electric Company has [applied] to the Public Service Commission, Second District, for permis[sion to] erect transmission lines and exercise franchises for supplying el[ectricity] in the towns of Jay, Essex County, and Ausable, Clinton Count[y].

NAPLES, N. Y.—Permission to install and operate an elect[ric] plant in this city, application for which was noted in our last is[sue, has] been granted to Edward L. Bailey, of the Dundee Electric [Light] Plant, and plans are being made by him to enter into competit[ion with] the Natural Gas Company.

[illegible]

[illegible] N. Y.—The Olean Electric Light & Power Company has filed with the Secretary of State asking for permission to extend [illegible] s of Portville and Allegany.

[illegible] Public Service Commission, Second District, for permission [illegible]

[illegible] k Board of Supervisors to proceed with the work of equip- [illegible] n placed in charge of the proposed installation, which [illegible] ll cost about $2,000. Although no definite contract [illegible]

[illegible] plant, plans and specifications for which are on file at the city auditor.

[illegible] Light, Heat & Power Company [illegible] submitted a proposition to the City Council offering to fur- [illegible] street lighting at cost and to give the city 2 per cent [illegible] gs, in return for which the company asks for franchises [illegible] m in all parts of the city. The franchise of the com- [illegible] ghting expires Sept. 1.

[illegible] EEN, OHIO.—The Lake Erie, Bowling Green & [illegible] mpound steam engine or turbine unit in its power plant in [illegible] n. An automatic stoker will probably be installed.

[illegible] ND, OHIO.—Proposals will be received at the office of the [illegible] Education, East Sixth Street, Cleveland, Ohio, until [illegible] at the office of the Board of Education, East Sixth Street. [illegible] r material and labor must be stated separately, and bidders [illegible] ic wiring, electric-lighting fixtures, clock system, ele- [illegible] kers, special furniture, composition floors, chemistry de- [illegible] ipment, forge-shop equipment, woodworking shop equipment, [illegible] ipment. Charles Orr is director of schools.

[illegible] OHIO.—A fire at the Boys' Home, which is conducted by [illegible] use, carpenter shop and storeroom. The loss will amount, [illegible] l, to approximately $15,000.

[illegible] IMA, OHIO.—The depot and substation of the Youngstown [illegible] Railway Company at North Lima was destroyed by fire re- [illegible]

[illegible] SANDUSKY, OHIO.—Newspaper reports state that the Upper [illegible] ard of Education expects to construct an up-to-date power [illegible] northwestern portion of the grounds of the Union school [illegible] which the present heating system will also be installed.

[illegible] OKLA.—Preparations are being made for extensions to the [illegible] ctric-light plant and water-works system, for which bonds [illegible] nt of $20,000 have been voted.

[illegible] ITY, OKLA.—The Oklahoma-Shawnee Railway Com- [illegible] r a charter to build an electric railway to connect Okla- [illegible] nee and Tecumseh, with a branch line to Chandler, a [illegible] miles. This company is a reorganization of the Oklahoma- [illegible] Railway Company. The capital stock is placed at [illegible] L. E. Patterson, of Oklahoma City, Okla., is president.

[illegible] H FALLS, ORE.—The Department of the Interior has noti- [illegible] math Water Users' Association that the reclamation service [illegible] elop the Keno, Ore., power site at this time, nor will same [illegible]

[illegible] D, ORE.—Plans are being made by the Mount Hood Rail- [illegible] & Power Company for the construction of a substation at [illegible] Williams Avenue, Portland, to cost about $60,000.

PORTLAND, ORE.—Application has been made by the Portland & [illegible] Railroad & Navigation Company for a charter to build an [illegible] way to connect Minnville and Bay City, via Willamina, [illegible] le, Tillamook, Sheridan and Pacific City. The company also [illegible] supply electricity for lamps and motors in Sheridan, Willa- [illegible] Tillamook. Power for operating the plant will be secured [illegible] ttle Nestucca River. The company also proposes to operate [illegible] n the Yamkill, Nestucca, Siletz and Tillamook Rivers, and on [illegible] Bay and the Pacific Ocean. The capital stock of the company [illegible] $1,000,000. The incorporators are: W. F. Prier, C. F. Hen- [illegible]

[illegible] for the installation of a municipal electric-light plant

HARRISBURG, PA.—The capital stock of the Harrisburg Electric Service Company has been increased from $5,000 to $2,000,000.

PHILADELPHIA, PA.—A permit has been granted to the H. E. Gran Company for the erection of a $10,000 power house on the south side of Chester Avenue, west of Fifty-ninth Street, which will supply electrical energy to the Presbyterian Orphanage.

SHICKSHINNY, PA.—By a unanimous vote the Shickshinny Councilmen passed an ordinance disposing of the municipal electric light plant to the Luzerne County Gas & Electric Company for the sum of $10,500, the transfer to be made September 1, at which time the Luzerne company expects to be able to furnish electrical energy in Shickshinny. Should there be any delay in so doing, the new owners will take over the new plant and run it until energy can be transmitted from its power house at Plymouth.

HONEA PATH, S. C.—Bids will be received by the Board of Public Works until Sept. 5 for the construction of an electric-light plant. The plant will cost approximately $11,000 and have an output of approximately 75 kw. John F. Monroe is chairman of board.

LEXINGTON, S. C.—The Lexington Electric Light & Power Company is reported to be contemplating the installation of an auxiliary steam plant in its power house.

BRUCE, S. D.—The installation of an electric-light system in Bruce is reported to be under consideration.

PLANKINGTON, S. D.—It is reported that W. A. Kuntz, to whom the City Council recently granted a franchise to install and operate an electric-light plant in Plankington, has closed a contract with the State Board of Charities and Correction whereby his plant will furnish energy for lighting at the State Industrial School, situated on the outskirts of Plankington.

SIOUX FALLS, S. D.—The plant and holdings of the Sioux Falls Light & Power Company are reported to have been purchased by H. M. Byllesby & Company, of Chicago, Ill. The new owners, it is understood, will make improvements and extensions to the system.

BUCKHOLTS, TEX.—It is reported that W. R. Newton is contemplating the installation of an electric-light plant in the sanitarium.

CRYSTAL CITY, TEX.—The installation of an electric-light plant and ice plant is under consideration. The Commercial Club is promoting the project.

CUERO, TEX.—The Cuero Light & Power Company is extending its transmission to Dr. Burns' new sanitarium and is also erecting a special line to the Cuero packing plant to supply water to operate the cold-storage plant.

WACO, TEXAS.—It is stated that should the Waco Electric Light Company fail to submit a more liberal contract for lighting the city streets, a municipal electric-light plant will be installed at an early date, a $250,000 bond issue for the purpose having been voted by the citizens of Waco some months ago.

JENSEN, UTAH.—John T. Pope is reported to be interested in the construction of an irrigation system in Umtah County. It is proposed to build a dam across the Green River, 400 ft. high, about 7 miles from Jensen. The installation of a power plant is also contemplated in connection with the irrigation system.

RUTLAND, VT.—Preparations are being made by the Rutland Railway, Light & Power Company for the construction of a dam 96 ft. high and 100 ft. long in the lower gorge on Mill River in Clarendon. The company already has a transmission line running within a short distance of the proposed new dam.

SHELBURNE FALLS, VT.—Initial steps have been taken by the promoters of the hydroelectric development of the Deerfield River near Shelburne Falls by the completion of an underwriting agreement for the issuance of $3,000,000 in bonds and $750,000 in capital stock. It is understood that the project will ultimately involve an expenditure of about $12,000,000. The present plans provide for a development of 25,000 hp. It is proposed to build four dams on the river near Shelburne Falls, Vt., and to erect a reservoir at Somerset, Vt., where water will be impounded, covering an area of approximately six square miles. Interests connected with the Connecticut River Power Company, of Burlington, Vt., are said to be interested in the project.

LAWRENCEVILLE, VA.—Bonds to the amount of $50,000 have been voted, the proceeds to be used for the construction of an electric-light plant, water-works and sewer systems, plans for which have been prepared by J. B. McCrary & Company, Empire Building, Atlanta, Ga.

DAYTON, WASH.—A notice of appropriation of water to the amount of 1000 cu. ft. a second, at a point on the Tucanon River about 28 miles southeast of Dayton, has been filed by E. S. Isaacs, of Walla Walla, the purpose of the appropriation being the installation of a plant for the generation of electrical energy.

DAYTON, WASH.—R. H. Kribs, of Pomeroy, has filed with the auditor of Columbia County a notice of appropriation of 100 cu. ft. per second of water in the Tucanon River, about 30 miles east of Dayton. The notice sets forth that the purpose of the appropriation is to generate electrical energy for industrial and commercial purpose.

MESKILL, WASH.—Preparations are being made for the installation of an electric lighting plant at the new rock-crushing plant of the State in Meshkill. P. E. Robbins is State superintendent of quarries.

MOUNT VERNON, WASH.—[illegible] Mount Vernon [illegible] Light & Power Company have been [illegible] by the Stone & Webster Management Association, of Boston, Mass. The consideration is said to be $[illegible]. Improvements will be made to the system, including the erection of a new substation to supply energy to the Bellingham-Mount Vernon Interurban Railway. Robert Bowels will be local manager.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied to the County Commissioners for a franchise to erect transmission lines to supply electricity in White Bluffs and Benton City.

OLYMPIA, WASH.—It is announced that L. B. Faulkner, manager of the Olympic Light & Power Company, is securing the rights-of-way for the transmission line which his company is constructing in Thurston County. A large power plant is being erected at Lake Lawrence, a few miles out of Olympia, and work on a reservoir which will cost $30,000 has been commenced. When completed it is estimated that the plant will represent an expenditure of approximately half a million dollars.

PORT ORCHARD, WASH.—The contract for the installation of the power plant at the Veterans' Home has been awarded by the State Board of Control to J. C. Corbin & Company, of Seattle, Wash., for $13,987.

SEDRO-WOOLEY, WASH.—It is proposed to install a complete power and generating plant in connection with new Northern Hospital. Contract for erection of buildings has been awarded at $115,000.

SOUTH BEND, WASH.—The power house of the Twin City Electric Company will be located midway between South Bend and Raymond.

WARWOOD, W. VA.—Plans are being considered to organize a company to establish an electric plant to supply electricity for lamps and motors in Warwood. Steps will be taken at once to secure a charter for the company, and a franchise to operate in Warwood.

CHETEK, WIS.—The local electric-light plant, owned by W. J. Gavin, is reported to have been destroyed by fire.

FOND DU LAC, WIS.—Plans are being considered by the Eastern Wisconsin Railway & Light Company for the erection of an addition to its plant, located at North Main and Rees Streets, to cost about $12,000. New stoking apparatus will be installed.

MARIETTA, WIS.—The Harmony Telephone Company, which is capitalized at $10,000, has been organized to construct a telephone line from Harmony Corners to Marietta. H. L. Reeves, Oconto, is manager.

MILWAUKEE, WIS.—Work has commenced on the foundation of the new substation of the Milwaukee Electric Railway & Light Company, located at Twentieth Street and North Avenue, Milwaukee, Wis.

STOUGHTON, WIS.—The City Council will soon advertise for bids for construction of new power house for the municipal electric-light system, to cost about $6,000.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of Board of Control for furnishing and installing underground cable for the electrical distribution system. Specifications and form of tender may be obtained at the office of the general manager of the Light and Power Department, 449 Main Street, Winnipeg, Man. M. Peterson is secretary of Board of Control.

MIDDLETON, N. S., CAN.—The ratepayers have voted to appropriate from $15,000 to $20,000 for the installation of an electric-light system in Middleton. James A. Gates is town clerk.

ST. MARY'S, ONT., CAN.—It is stated that through a recently consummated deal the town of Seaforth has become the owner of the 13,000-volt electrical equipment of the Water, Light & Heat Commission of St. Mary's, the purchase price being $1,000. The sale was effected by the Hydroelctric Commission, and the equipment will be transferred to Seaforth by the Canadian General Electric Company.

ST. MARY'S, ONT., CAN.—Arrangements have been concluded by the North Midland Electric Railroad for the construction of an electric line from London to St. Mary's and Stratford, with branch lines to Granton and other points in the district. The company will also build switch lines to all of the factories of the town, energy for the operation of the system to be obtained from the St. Mary's substation.

MONTREAL, QUE., CAN.—The civic experts who were appointed to take charge of preparing plans for the construction of the municipal underground conduit system have recommended to the Board of Control that an appropriation be made to open an office in the city and engage a competent staff to carry on the work. The cost of proposed system is estimated at about $5,000,000. The city will charge rental to electric companies for space occupied in the conduit.

ST. JEROME, QUE., CAN.—Tenders will be received until Aug. 28 for the erection of a complete hydroelectric power and distributing system, to cost approximately $60,000. For specifications apply to De Gaspe Beaubien, 112 St. James Street, Montreal, Que., Can.

New Industrial Companies.

THE BULLOCK-KENNEDY COMPANY, of Troy, N. Y., has been chartered with a capital stock of $10,000 by Phillip N. Bullock, of Troy, N. Y.; John W. Kennedy, of Watervliet, N. Y., and Albert J. Crawmer, of Troy, N. Y. The company proposes to do a general electrical engineering business and electrical work of all kinds.

THE DAKOTA ENGINEERING & SUPPLY COMPANY, New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 to manufacture engineering tools and supplies. The incorporators are: Simon Mohrbach, 87 Hamilton Place; Daniel O'Con[illegible], 323 East Eighty-third Street; James A. Lynch, 333 West Seve[illegible] eighth Street, all of New York, N. Y.

THE ELECTRIC SUPPLY COMPANY, of Little Falls, N. [illegible], has been incorporated by S. H. Newberry, William H. Coffey, Ed[illegible]rd W. Gearhead and Robert D. Dodge. The company is capitalized [illegible] $2,500 and proposes to manufacture electrical supplies.

C. G. EVERSON & COMPANY, of Chicago, Ill., have b[illegible] porated by R. B. Everson, H. V. Willman and C. G. Everson. [illegible] pany is capitalized at $40,000 and proposes to manufacture [illegible] goods.

THE FEMES MANUFACTURING COMPANY, of New Yor[illegible] N. has been incorporated with a capital stock of $10,000 by John [illegible] Otto Foell and G. W. Williams. The company proposes to ma[illegible] and deal in electrical supplies.

THE LUX MANUFACTURING COMPANY, of New York, N[illegible] filed articles of incorporation with a capital stock of $25,000 [illegible] purpose of dealing in electrical supplies. The incorporators a[illegible] T. Booth, Guy V. Williams and Lewis V. Hulse.

THE NATIONAL INSULATOR COMPANY, of Camden, N[illegible] been incorporated by Jesse E. Innuian, 331 Caper Street, Hartfor[illegible] John F. Harned, 424 Market Street, Camden, N. J., and W[illegible] Aitkin, 334 Penn Street, Camden, N. J. The company is capi[illegible] $500,000 and proposes to manufacture glass and other insul[illegible] electric current, etc.

Personal.

PROF. A. M. WILSON has resigned as professor of electrical [illegible]ering at the Kentucky State University to accept a similar cha[illegible] at the University of Cincinnati.

MR. GEORGE W. PERRY has been elected general manag[illegible] the Weymouth (Mass.) Light & Power Company to succeed Mr. [illegible] A. Carter, who has resigned that office.

MR. ARTHUR WRIGHT, the well-known English central-s[illegible] engineer and originator of the Wright demand system of cent[illegible] station charging, sailed for New York this week.

MR. S. Z. FERRANTI, of London, well known throughout [illegible] world for his pioneer work in alternating-current engineering, will [illegible] at New York on Aug. 26 and will remain in this country until [illegible] the middle of September.

MR. S. H. GLUCROFT has resigned as illuminating engin[illegible] of the Wilmington & Philadelphia Traction Company, to become [illegible] engineer and sales manager of the General Illuminating Comp[illegible] with headquarters in New York.

MR. W. H. WHITESIDE, formerly president of the Allis[illegible] Chalmers Company, has been elected president and a director of the Steve[illegible] Duryea Company, of Chicopee Falls, Mass., one of the leading automo[illegible] manufacturing concerns of the country.

MR. MAX LOEWENTHAL has recently joined the [illegible] of the Philadelphia Electric Company, in the capacity of manag[illegible] of the showroom and sales department. Mr. Loewenthal has had a [illegible] experience in the electric-heating and appliance field, which ampl[illegible] him for his new duties.

MR. PETER W. SOTHMAN, chief engineer of the H[illegible] Power Commission of Ontario, has returned from his trip [illegible] whither he went with members of the commission on April 25 [illegible] certain phases of electrical development abroad in connection [illegible] commission's work in Canada.

MR. C. A. COFFIN, president of the General Electric Comp[illegible] sailed with his family on Saturday for an automobile trip on the Co[illegible] of Europe. Mr. Coffin had passage booked on the S. S. *Olympic* [illegible] will be gone over a month. Accompanying the party was Mr. Hin[illegible] sons, general counsel of the company.

MR. F. E. DRAKE, until recently in charge of the We[illegible] Electric Manufacturing interests in France, Italy and Austri[illegible] ceived a contract for the track and permanent-way work on [illegible] tem of electric railways for Palermo, Italy. The first sectio[illegible] finished by Dec. 1, and the second section by the latter pa[illegible] of next year.

MR. GANO DUNN, who for some years has been first vice[illegible] president, chief engineer and a director of the Crocker-Wheeler Compan[illegible] has resigned from that company in order to accept an important e[illegible]neering and executive position. Mr. Dunn will sail shortly for Eur[illegible] to attend, as president of the American Institute of Electrical Eng[illegible], the meeting during the Turin Exposition of the International E[illegible]rotechnical Commission, to be held on Sept. 7, 8 and 9, and also the [illegible] meeting of the International Electrical Congress.

MR. CHARLES H. MERZ, consulting electrical engineer [illegible] London, sailed for New York the present week. In addition to his conn[illegible] on with many important British electrical works as designing or consu[illegible] engineer, including the Tyneside district electrical supply plant, Mr. Merz has

[illegible] adviser for the State of Victoria, Australia, and [illegible] Railway Company with reference to the electrification of its [illegible] suburban lines.

[illegible] of the Toronto Electric Light Company, Ltd., of Toronto, Ontario, has been appointed [illegible] of the company by [illegible] Mackenzie [illegible] recently [illegible] public utilities in the Province of Ontario. Mr. Pack was born on [illegible] educated for the Royal Navy at the Portsmouth Grammar School. In 1889, however, [illegible] parents to Canada, then showing [illegible]. Shortly after becoming settled Mr. Pack entered the employ of the Great Northern Telegraph Company, where he remained for about one year. At about that time the Toronto Electric Light Company became a factor in the development of the city of Toronto and Mr. Pack joined himself to that company, remaining with [illegible] as [illegible] manager is a most popular [illegible] Pack having worked his way through the various grades to secretary prior to his present promotion. As a member of [illegible] Association he has done much to further the [illegible] of electricity in Canada, imbibing all that American practice offer through membership in the National Electric Light [illegible] in the formation of the Toronto N. E. L. A. [illegible] section, and, naturally, he was also instrumental in getting the association to affiliate with the N. E. L. A.

[illegible] Pack.

Obituary.

[illegible] G. JENNINGS, superintendent of telegraph of the Chicago, [Rock] Island & Pacific Railroad Company, died at his home in [illegible] Aug. 19. He was born in Bellaire, Ohio, in 1862, and for [illegible] had filled the position he held at the time of his death.

Trade Publications.

[illegible] MOTORS.—The General Electric Company has just [illegible] No. [illegible] devoted to single-phase repulsion motors.

[ROTARY] CONVERTERS.—Bulletin No. 4868, recently issued by the [General Ele]ctric Company, illustrates and describes rotary converters for [illegible] lighting, in capacities ranging from 25 to 2500 kw. The bulletin [illustra]tes also a portable substation in which a converter is installed.

[INSTRUME]NTS FOR SWITCHBOARD SERVICE.—The General [Electric Company] has recently issued Bulletin No. 4866 on Thomson horizontal [in]struments for switchboard service, which supersedes all [bul]letins issued by this company devoted to this type of instru[ment].

[LOCOMOTIVES.]—The [illegible] W. [illegible] Company, West New [illegible] Y., has issued Catalog No. 11-5, containing a description of [its] locomotives, together with illustrations of plants showing the [locomotives i]n operation under varying conditions. The locomotives are [illegible]

INDUCTION MOTORS.—[illegible] land, has issued illustrated leaflet No. 10 devoted to induction motors of the single-phase, two-phase and three-phase types, in which special attention has been paid to ability to carry overloads. The primary coils are wound with asbestin-insulated wire, the insulating materials being selected with a view to withstanding the high temperatures arising from heavy and frequent overloads.

ELECTRICAL SUPPLIES.—The H. W. Johns-Manville Company, New York, has issued Catalog No. 15, containing over 400 pages, illus[trating and describing the electrical products of the company, together] with a line of electrical supplies. Usually sufficient descriptive matter is [illegible] required. The book provides a ready reference to "J-M" products, as it is well arranged and completely indexed, making it easy to locate the [illegible]

ENGINE-TYPE ALTERNATIONS.—The Allis-Chalmers Company, Mil[waukee], W[is]., has issued [illegible] No. 1050, superseding Bulletin No. 1038, and describing the company's engine and the flywheel types of alternating current generators. It will, of course, be understood that the Allis-Chalmers alternators are built for all classes of service. The bulletin contains numerous illustrations, showing the application of the alternators in central-station practice, and also showing detail parts of the winding, armature coils, pole pieces, etc.

BUSINESS NOTES.

THE HYGRADE INCANDESCENT LAMP COMPANY, Danvers, Mass., announces that in order to show its confidence in the efficiency of its product the offer is made to give credit for any tungsten lamps broken in transit.

MR. C. P. LINDSLEY, president of the Lindsley Brothers Company, manufacturers of Western cedar poles and cross-arms, Spokane, Wash., is making an extended inspection trip to the company's pole yards, which are located in northern Idaho, northeastern Washington and British Columbia. The British Columbia headquarters are at Nakusp on Arrow Lake.

THE VOHR OZONE ELECTRIC COMPANY, with offices at 506 South Fifth Avenue, Chicago, has been organized to manufacture and distribute the Vohr Electric Ozonizer, under the licenses and patents of the Standard Electric-Utilities Company, which formerly made the Vohr device. The officers of the Vohr Ozone Electric Company are: President, F. A. Hill; vice-president, A. B. Adair; secretary, Oscar Lindner, and treasurer, W. H. Wright.

THE ALBERGER CONDENSER AND ALBERGER PUMP COMPANIES have opened a branch office at 97½ Peachtree Street, Atlanta, Ga., which will be under the care of Mr. R. S. McMichael. The Pacific branch office of these companies, located at 503 Market Street, San Francisco, is now in charge of C. F. Braun & Company, Inc., of which new corporation Carl F. Braun is president, George C. Singletary vice-president, and Emory S. Singletary secretary. The corporation succeeds that formerly known as Braun, Williams & Russell.

THE STERLING ELECTRICAL MANUFACTURING COMPANY of Warren, Ohio, will on or about Sept. 1 transfer its offices to the company's new office building on West Summit Street. The sales force of the Sterling company, including the various district managers, the traveling representatives and the home office employees, have been spending a profitable week in the company's camp at Riverside Farm, on the Mahoning River, Warren. Daily conferences on the technical and commercial aspects of the incandescent lamp, interchanges of sales experiences, addresses by lamp manufacturing experts and illuminating engineers, present as invited guests, mingled with plenty of outdoor exercise, fresh air, fresh food and fishing, have put the men in the best possible shape for the work of the coming season.

[W]eekly Record of Electrical Patents

[UN]ITED STATES PATENTS ISSUED AUG. 15, 1911.

[illegible]

[illegible] MOTOR-STARTING SWITCH; F. G. Dustin, Minneapolis, [Minn.] App. filed Feb. 6, 1911. Arrangement of contacts, carrier [illegible]

[illegible] INSULATOR BRACKET; C. G. Ette, St. Louis, Mo. App. [illegible]

1,000,3[illegible] MAGNETIC SEPARATOR; E. J. Feeley, Fairfield, Conn. [illegible]

[illegible] APPARATUS FOR PRODUCING ELECTRIC OSCILLA[TIONS] [illegible]

[illegible] [PRODUC]TION OF CONTINUOUS [illegible] [ELE]MENTS OF PRIMARY SPARK CIRCUITS; R. C. Galletti, Lyons, [illegible] duced quickly or continuously following each other.

1,000,401. SIGNALING SYSTEM FOR RAILWAYS; H. W. Griffin, New York, N. Y. App. filed Sept. 21, 1908. A circuit including an interlocking relay operates to "clear" a single track switch indicator for one direction of traffic and set it to "danger" for the opposite direction.

1,000,402. SIGNALING SYSTEM FOR RAILWAYS; H. W. Griffin, New York, N. Y. App. filed Sept. 21, 1908. The position of one signal is dependent upon the position of the opposing signal.

1,000,421. PRIMARY ELECTRIC BATTERY; G. A. Lutz, Plainfield, [illegible] The depolarizer comprises a plate of cupric oxid and the positive electrode zinc. Means for holding the plates spaced apart.

1,000,440. ELECTROMAGNET COIL; F. W. Reeves, Pittsburgh, Pa. App. filed Dec. 28, 1909. The inner coils have a greater carrying capacity than the outer.

1,000,456. APPARATUS FOR BRAZING OR SIMILAR WORK; C. R. Sturdevant, Worcester, Mass. App. filed July 9, 1910. Apparatus for supporting and manipulating the bond terminal clamp.

ELECTRIC LAMP; Sept. 14, 1909. A s[illegible] gripping the enlarged terminal ends of the "glover."

against a smaller and cooler body of confined air to operate auto-

000,488. PARTY-LINE TELEPHONE SYSTEM; W. M. Bruce, Jr., Springfield, Ohio. App. filed Aug. 16, 1907. To enable the operator to signal one only of the parties at one time and to prevent "break-

000,493. INSULATOR FOR ELECTRIC RAILWAY CARS; J. Christensen, Evans City, Pa. App. filed Sept. 27, 1910. For suspending rheostats, etc. The supporting bolts and heads are incased in insulation.

000,499. TELEPHONE TRANSMITTER; W. W. Dean, Elyria, Ohio. App. filed April 24, 1908. The diaphragm has a flanged periphery which supports it as its outer edge. The expansion due to heat tends

000,535. INSULATOR; L. McCarthy, Boston, Mass. App. filed Feb. 26, 1909. Ball and socket members embedded in insulation and having grooves for the insulation, to prevent turning.

000,536. ELECTRIC-SWITCH-OPERATING ROD; C. R. Meston, and H. I. Finch, St. Louis, Mo. App. filed July 6, 1910. A jointed rod with couplings.

1,000,572. SIGNALING APPARATUS; G. F. Atwood, East Orange, N. J. App. filed Feb. 20, 1906. A telephone set for use in fire-control systems for artillery, etc.

1,000,601. INK-WRITING TELEGRAPH REGISTER; B. Hurd, Nutley, N. J. App. filed Dec. 16, 1907. The tape-feeding mechanism is wound up when one or more of a plurality of inking elements are actuated.

1,000,608. ELECTROLYTIC APPARATUS; J. W. Kenevel, Philadelphia, Pa. App. filed Sept. 22, 1910. The electrodes are supported by the hoods which cover a porcelain-lined chamber. For destroying animalcules and coagulating solids held in water.

1,000,614. WIRING SYSTEM FOR AUTOMATIC TELEPHONE EXCHANGES; F. R. McBerty, New Rochelle, N. Y. App. filed Aug. 16, 1909. One of the pairs of conductors in one of two parallel sets is connected in circuit in reverse order to that of the other pairs in the set to prevent cross-talk.

1,000,661. THERMOSTAT; I. F. and F. C. Beers, Rochester, N. Y. App. filed Feb. 23, 1910. A coil spring is interposed between the ends of sections inside a tube, the sections and tube having different coefficients of expansion.

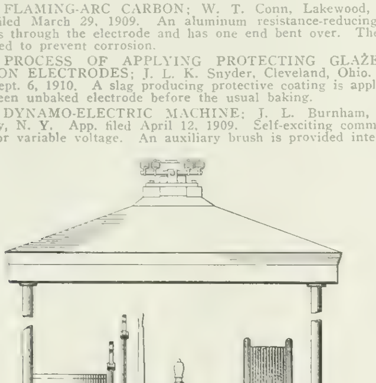
1,000,679. SUPPORTING AND PROTECTING DEVICE FOR THIRD RAILS; G. S. Inman, Chicago, Ill. App. filed Oct. 2, 1908. Laterally arranged grooved sections of reinforced concrete for grasping the edges of the bottom flange of an inverted rail.

1,000,687. COMBINED DOOR-KNOB AND PUSH-BUTTON; P. J. O'Donnell. Newark, N. J. App. filed Jan. 24, 1910. A series of push-buttons are arranged around the periphery but do not project.

1,000,717. FLAMING-ARC CARBON; W. T. Conn, Lakewood, Ohio. App. filed March 29, 1909. An aluminum resistance-reducing wire extends through the electrode and has one end bent over. The wire is coated to prevent corrosion.

1,000,761. PROCESS OF APPLYING PROTECTING GLAZE TO CARBON ELECTRODES; J. L. K. Snyder, Cleveland, Ohio. App. filed Sept. 6, 1910. A slag producing protective coating is applied to the green unbaked electrode before the usual baking.

1,000,776. DYNAMO-ELECTRIC MACHINE; J. L. Burnham, Schenectady, N. Y. App. filed April 12, 1909. Self-exciting commutator type for variable voltage. An auxiliary brush is provided intermedi-



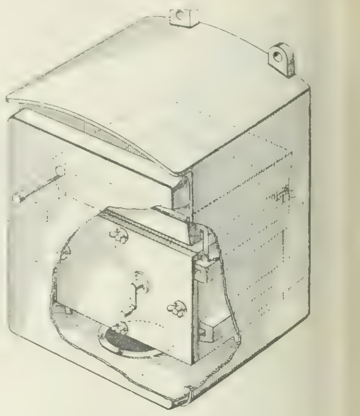
1,000,456.—Apparatus for Brazing . . . .

ate the main brushes, a constant induced armature voltage is maintained between the auxiliary brush and one main brush, and the induced armature voltage between the auxiliary brush and the other main brush is varied.

1,000,779. TROLLEY-CONTROL SYSTEM; F. E. Case, Schenectady, N. Y. App. filed Aug. 24, 1910. Pneumatic means for automatically retracting the trolley is electromagnetically actuated upon overload

1,000,795. TELEPHONE-TRANSMITTER; F. Gottschalk, New York, N. Y. App. filed Aug. 11, 1910. The transmitter is air, [illegible] and dust-proof.

1,000,805. ELECTRIC FURNACE; A. Helfenstein, Vienna, Hungary. App. filed July 21, 1910. The top of the furnace [illegible] receptacle for the charge are supported by girders, and two [illegible] gas-eliminating chambers are formed when the full charge is [illegible]



1,000,572.—Signaling Apparatus.

1,000,825. CONDUIT CREEPER; H. C. Lehman, Winder, Pa filed Nov. 6, 1909. Laterally disposed pivoted gripping ja[illegible] operated by a shiftable cam. For cylindrical and polygonal [illegible]

1,000,838. ELECTRICAL FURNACE; H. Nathusius, [illegible] Germany. App. filed June 24, 1909. Modification of Pate[nts] 958,757 and 983,303. Alternating currents of different [illegible] are simultaneously passed through the material and a neutr[al] of alternating-current circuit is maintained in the bath.

1,000,846. MEANS FOR COOLING DYNAMO-ELECTRIC MA-CHINES; H. Roos, Berlin, Germany. App. filed Dec. 8, 190[illegible] space blocks in the radial ventilating spaces form channels se[parate] from each other. See Patents Nos. 957,102 and 957,103.

1,000,847. BURGLAR ALARM; G. A. Sabine, Robinson, Md filed Aug. 5, 1910. For outlying buildings. A normally open [illegible] and device for closing it at regular intervals.

1,000,848. STARTING AND SPEED-REGULATING RHEOST[AT] J. Seabolt, Schenectady, N. Y. App. filed Jan. 24, 1910. T[illegible] of contacts and an arm movable in one direction for starting [illegible] the opposite direction for varying the running speed and a [illegible] for controlling the latter.

1,000,854. TROLLEY WHEEL; L. J. Tetlow, Holyoke, Mass [illegible] filed May 4. 1909. Composed mostly of iron with conducti[ng por]tions of brass or copper and lubricating means.

1,000,864. MOTOR-CONTROL APPARATUS; D. Wald, O. C. [illegible] and M. Taigman, New York, N. Y. App. filed April 15, 1[illegible] brake is applied when the power is shut off. For sewing [illegible] drive, etc.

1,000,871. IMMERSION HEATER; G. C. Young, Oceano, Ca[l.] App. filed Aug. 9, 1910. Two electrodes in a perforated casin[g.] The fluid to be heated is used as a resistance medium. For heatin[g] small quantities as in cups, etc.

1,000,902. CALLING DEVICE FOR ELECTRICAL EXCHANG[E] SYS-TEMS; A. H. Dyson, Chicago, Ill. App. filed Feb. 16, 19[illegible] electro-mechanical number-recording machine, the numbers [illegible] recorded by means of electromagnetic switching devices at [illegible] change. A movable member with finger-holds.

1,000,925. CONDENSER; K. Kuhlmann, Berlin, Germany. A[pp. filed] April 29, 1910. A dielectric with its end divided into d[illegible] portions so as to reduce the capacity of the edge and preven[t] [break]ing down.

1,000,934. PROTECTIVE DEVICE FOR DISTRIBUTION SYS[TEMS]; R. M. Ostermann, Bogota, Colombia. App. filed Nov. 2, 1908 [illegible] ping relays are interconnected so that the movement of o[ne] [to] tripping position holds the other inoperative. For paralle[l trans]mission lines.

1,000,939. ELECTRIC RELAY; L. J. Le Pontois, New Rochelle App. filed July 24, 1908. For telephone or telegraph use. A disk is subject to the magnetic flux of an exciting coil.

1,000,941. MEASURING INSTRUMENT; W. H. Pratt, Lynn App. filed Feb. 7, 1910. A series solenoid and a movable co[il com]prising a potential coil and two windings inductively rela[ted] connected in series with the coil and solenoid.

1,000,942. ELECTRIC MEASURING INSTRUMENT; W. H[. Pratt,] Lynn, Mass. App. filed Feb. 24, 1910. A tapered coil is [illegible] to swing between a conical core and pole pieces having conica[l] [illegible]

1,000,964. LAMP FOR MOTION-PICTURE MACHINES; J. [illegible] sier, Philadelphia, Pa. App. filed July 20, 1910. The carb[ons] are adjustable longitudinally and angularly and provided with special clamps.

1,000,967. ELECTRIC SEAM WELDING; M. J. Farquhar, Wil[illegible] Ohio. App. filed May 14, 1909. A welding current is sent [thr]ough and progressively along the ridge of a joint (as a box joi[nt]) and light blows are applied in proximity to and progressively [illegible] current.

Patent Delayed in Receipt; Aug. 8, 1911.

1,000,101. ELECTRICAL ATTACHMENT PLUG; G. C. Mar[illegible] Elizabeth, N. J. App. filed Sept. 28, 1906. The blocks of insula[ting ma]terial are molded with recesses for the metallic parts large [en]ough to permit some play.

Electrical World

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CONTENTS.

FOUR YEARS OF THE TUNGSTEN LAMP.

It is now about four years since the tungsten lamp began to appear in the United States. The fears of some central-station managers that the lamp would cause a serious decrease in revenue, and the hopes of others that it would be a great boon to the business, because of the new basis upon which electricity could compete with other illuminants, have been recited many times in papers dealing with the tungsten-lamp situation. Nevertheless it is interesting to note after four years of use of the tungsten lamp in this country that electric-lighting companies are "still doing business," and, as far as we know, none has been forced into receivership by virtue of the tungsten lamp. On the other hand, it is well known that the tungsten lamp has found its way into places where heretofore gas and gasoline lighting held almost indisputed sway. There has undoubtedly been a small reduction in the gross revenue received from many hundreds of electric-lighting customers because of the change to tungsten lamps, but this has been more than compensated for by increase in the number of customers. On the whole, the electric service business has shown fully its normal rate of increase during the past four years in spite of the tungsten lamp and the 1907 panic. One result of the introduction of tungsten lamps has been a general increase in the amount of illumination considered satisfactory by users of electric light, the tendency having been to use about twice the illumination formerly common. Another tendency has been to light a room as a whole, giving sufficient general illumination in all parts of the room for any of the purposes for which it is used, as contrasted with the localized lighting which was formerly common. This is one of the natural results of economical units of high candle-power. Since with the tungsten lamp it is possible to light satisfactorily a whole room with a lamp taking the same energy as an old carbon lamp sufficient to provide localized lighting only in one part of the room, light users have not felt it necessary to adhere to the old localized system, and have gladly accepted the more cheerful conditions of general lighting. This applies both to the office and to the home. In the office where desk lamps were uniformly the rule general lighting is now the accepted modern practice. In the home the table lamp is now largely an ornament and the room is lighted sufficiently well to admit of reading in all parts.

The tungsten lamp came in about the time the present movement for better illuminating engineering began. As the introduction of tungsten lamps in many cases involved the installation of new fixtures, this gave opportunity for better illuminating design, so that in addition to the increased efficiency of the tungsten lamp the user had the further advantage of better utilization of the light pro-

duced. In some cases this better utilization has taken the form of increased efficiency or a higher percentage of lumens effective per lumens generated. In other cases the efficiency of utilization has been decreased or has remained stationary as compared with former practice, but the use of diffusing globes and reflectors or indirect-lighting systems has been made commercially feasible by the economy of the tungsten lamp and the comfort of users has been thereby much increased and artificial light has been brought nearer to daylight in its qualities as regards diffusion. The sales of carbon-filament lamps have not as yet shown any radical falling off from previous years. Nevertheless, it is a matter of common observation that tungsten lamps have displaced carbon filaments in a large number of places where lamps are used for many hours per year. In other words, although the percentage of tungsten lamps in use is not large yet as compared with carbon lamps, the kw-hours supplied to tungsten lamps yearly are a much larger proportion of the total. There are many places where lamps are used but little, and many consumers have refrained from purchasing a fragile lamp to put in such places and incur the risk of breakage for a very small possible saving in energy used. The recent introduction of wire-filament tungsten lamps, which are not fragile when new, will tend to reduce the number of carbon lamps in use. It is true that such lamps as are now made frequently become fragile with use, but they retain a decided shipping advantage. The tungsten lamp is completely displacing multiple inclosed carbon-arc lamps for interior illumination. It is steadier and more efficient, requires no trimming, and the light is more easily controlled by means of globes and reflectors. Electric-lighting companies have been glad to get rid of the arc-lamp maintenance cost which they formerly assumed, and the customer has received more light for the same money. For the street lighting of small towns the tungsten lamp has shown its great superiority over the standard inclosed-carbon arc lamps, not only in efficiency but in steadiness and in the possibility of supplying it in any size units.

CENTRAL-STATION INSURANCE.

The figures presented at the recent Ohio Electric Light Association convention by Secretary Gaskill on the actual ratio of cost of insurance to losses paid only confirm the facts brought out in previous similar investigations (most notably one in Illinois several years ago) that the premiums paid by central-station companies for fire insurance on power-plant buildings are excessive and have little relation to the actual losses sustained with the business as it is at present under existing conditions of central-station operation. It is undoubtedly true that the stations reporting to Mr. Gaskill made a somewhat exceptional showing, namely, $82,000 premiums to $60 loss. More complete returns would doubtless be more favorable to the insurance companies, but, after allowing for all contingencies, Mr. Gaskill's investigations, as well as others which have been made by central-station state associations and by the National Electric Light Association, indicate that the insurance companies have paid little attention to making their central-station insurance rate equitable, and that the central-station companies are really carrying the burden of other less desirable risks. These matters have been brought to the attention of the insurance interests so many times that it is not strange that central-station managers are beginning to consider mutual insurance, or insurance "by exchange," as about the only feasible way out of the difficulty. A number of central stations operating auxiliary ice plants have been able to realize the practical benefits of mutual insurance through an insurance exchange which has been in existence among ice plants for a number of years in the Central West with a saving of 40 per cent of the board rates. Various other industries have also undertaken mutual insurance very successfully.

The successful insurance exchanges of this kind have usually taken only the better class of risks and have insisted that plant conditions shall be brought up to a high standard before accepting any risk. The stock companies, on the other hand, have been on the whole less careful as to the risks taken, their general plan of operation having been to charge high premiums on all business and not to trouble themselves much with the kind of risks taken or the difference in risks. In other words, the plan appears to have been to get as much business as possible at a sufficiently high price to cover losses rather than to discriminate between good and bad risks, the result being that the provident have had to pay the bills of the improvident. Perhaps one reason why mutual insurance companies organized for one particular class of business have succeeded so well is that the working force of such an underwriting organization is able to concentrate its attention on one class of business and to weed out bad practice more effectually than an organization covering all kinds of business. In these days of syndicate operation of a large number of properties it is feasible for companies controlled by one syndicate to carry each other's insurance on a mutual or exchange plan. This, however, is limited to very large organizations. A movement is now on foot in the Mississippi Valley to organize an employers' liability insurance among public-utility companies, and it seems likely that this will be followed by a fire-insurance exchange of the same general character. When organized with a sufficient number of companies and kept in competent and safe hands, insurance of this kind has been very satisfactory.

DEMAND AND DIVERSITY FACTORS.

It is rather remarkable that a subject of such fundamental importance to central stations as demand and diversity factors has received so little attention at meetings of electric-light organizations. The present increasing interest in this subject dates back only to 1909, when Mr. L. A. Ferguson in his presidential address before the American Institute of Electrical Engineers called attention forcibly to its importance, stating in effect that it is the foundation of our systems of centralized supply of electrical energy and the reason for existence of such method of supply. Diversity factor, according to the recently adopted standardization rule of the A. I. E. E., is the ratio of the sum of the maximum power demands of the subdivisions of any

sumer or part of a system to the maximum demand of the whole system or part of the system under consideration, measured at the point of supply. Demand factor is defined as the ratio of the maximum power demand of any system or part of a system to the total connected load of the system or part of the system under consideration. It is thus seen that diversity factor deals with the maximum demand of a consumer, whereas demand factor deals with his connected load. Both these factors are due to the fact that the maximum demands of all consumers do not come simultaneously. If they did profitable supply of electrical energy from central stations at present prices would be out of the question.

It is the diversity factor plus economies of large power plants as compared to smaller power plants which make central-station supply feasible. Central-station system investments are necessarily high, and if were it not for the diversity factor central stations could not compete for many classes of business which they now take away from isolated plants. As central stations reach out more and more for classes of business heretofore untouched a study of demand and diversity factors becomes more important because these factors have so much bearing on the rates which can safely be made. For example it is of fundamental importance for a central station to know in taking on a certain class of business with 100-kw connected load whether the full 100 kw will be turned on at the time of peak load on the power station or what percentage will be on at that time, and hence what power investment is necessary to serve that business per kilowatt connected. This, however, is only the first step. A more complete study for a given class of consumers includes gathering information on how the maximum demand of certain classes of consumers coincides with that of others on the same feeders or transformers, and hence its effect on the amount of feeder and transformer equipment necessary.

The paper by Mr. C. J. Russell, of Philadelphia, which won the Doherty medal awarded by the National Electric Light Association at its last convention, part of which is printed in this issue, takes up the question of diversity factor and helps explain the importance of this subject to those who have not given the matter much previous thought. A study of demand and diversity factors for different classes of business is difficult because of the fact that all kinds of business are carried on the same feeders by most companies, and there is no method of telling at what time the demands of various customers come, except by placing a recording instrument of some kind on the consumer's service. The most extensive study of this matter has probably been made in Chicago, and the papers presented by Mr. H. B. Gear, of Chicago, before the Western Society of Engineers, and before the Association of Edison Illuminating Companies in 1910, constitute the most important information we have on the actual values to be assigned to the diversity factors of different classes of consumers. The Wisconsin Railroad and Public Service Commission has also done some excellent work investigating this subject and in compiling information from all available sources. The net results of these investigations have appeared in rate decisions which have been rendered by the commission from time to time and reported in these columns.

CAPITALIZING NEW-BUSINESS EXPENSE.

The recent discussions on the "going value" of a public-service property bring forward the question of the capitalization of expense incurred in getting new business. Going value has been recognized in decisions of the Wisconsin commission and by appraisals for rate-making purposes by a number of prominent engineers, and is taken to include expenses incurred other than for plant and equipment in getting a business started and putting it on a paying basis, losses incurred during the first years of operation being included in going value. In other words, going value is usually taken to cover legitimate items of expense in getting the business started which cannot be figured in as part of the tangible physical property of the company. An extension of the principle of going value is toward the inclusion of a certain amount of the expense incurred continuously in securing new business, this to be charged to capital account and not to operation. Electric energy supply companies, for example, have approximately doubled their actual equipment and output every five-year period, taking the country as a whole. A certain portion of this increase, of course, comes to the companies naturally, without effort on their part, but in many cases a considerable portion is the result of work to secure new business. It has been suggested that a fair way to handle this matter would be to charge to "operation" that portion of commercial department expense which is incurred in holding business already obtained and in securing new consumers to compensate for those who drop out. Commercial-department expense over and above this would then be charged to capital account, as an addition to going value, because it is expense incurred in securing business with which to make earnings on additional plant investment. While the separation of these two classes of commercial expense would appear to be a difficult matter, this could be overcome by keeping a record classifying currently the two sorts of expense. The charging to capital account of new business expense of the kind outlined is a matter which deserves attention, as appraisements for rate-making purposes are being made with increasing frequency, and it is to the interest of public-utility companies that their actual investment, tangible and intangible, should be a matter of systematic record.

SHADOWLESS ILLUMINATION.

In an article which was recently published by the London *Electrician*, Mr. H. T. Harrison calls attention to the imperfection of our terminology, and of our notions, concerning illumination. He points out that if a room is lighted in such a manner that there is a complete absence of shadows, as, for instance, in a case of indirect lighting carried to such an extreme that the light is perfectly scattered and uniformly diffused, then there will be great difficulty in perceiving the outlines of bodies. It is

largely by shadows that we are able to detect objects and estimate distances; so that when shadows are destroyed we may have ample illumination for reading purposes, but miserable illumination to see by beyond our books. He thinks that there should be a discrimination against shadowless illuminations, as compared with illuminations that, like coming events, cast their shadows before them. To a great extent Mr. Harrison's contention is justified, although there are limits to the proposition. To many a room without shadows is, like a story without a moral, a thing flat, stale and unprofitable. The eyes are constantly striving to assign distances to objects by binocular muscular adjustments, to replace the absent information carried by shadow, and they tend to become unduly fatigued. Besides, the esthetic effect of perfectly shadowless illumination is very depressing. The sun is a magnificent dispenser of shadows, and scatters them over the landscape with lavish hand. We are so accustomed to the coexistence and blending of light and shade that an artificial world of shadowless illumination leaves us, like fish out of water, stranded on the rocky shore of discontent.

Nevertheless, we think it is possible to go to the other extreme and have contrasts of light and shade too powerful for peace of sight. When a naked arc lamp lights up a room with poorly reflecting walls and ceiling, the shadows look like the darkness of the Egyptian plague—a darkness that could be felt. A due medium in light and shade is the most pleasing to mind and eye. It should neither be shadowless nor all light or all shadow. There should be intermediate blends of shadow tones, where light forgets itself in shade and shadows dance with lights. Mr. Harrison seeks a numerical criterion and gradation of illumination, in regard to its shadefulness. This should not be difficult.

If we select any point in a room, or lighted space, we can always insert an opaque card at this point, and measure, or assume as measured, the illumination on this card as we turn it round in different directions. The ratio of the minimum to the maximum illumination throughout the process might be called the chiaroscuro ratio of the illumination at that point; or, if objection is taken to the Italian phrase, it might be called the light-shade ratio. If we wish to confine our measurements to the horizontal plane through the point, then the card should be considered as a vertical photometer screen, and rotated about a vertical axis so as to face all points of the compass successively. The ratio of the minimum to the maximum illumination in the rotation would then be the horizontal chiaroscuro ratio of illumination. In a shadowless room with uniformly scattered lighting this ratio might approach unity, since the card would be nearly equally well illuminated at all points of the compass. In the opposite extreme of a room all light or shadow the ratio might approach zero. In a pleasingly lighted room it might be, say, 0.2 to 0.3. If the measurement were made in a selected vertical plane, instead of in the horizontal plane through the point, the ratio would be the chiaroscuro ratio of illumination in that vertical plane. Finally, if the greatest range of illumination at the point were sought, regardless of the plane in which the card turned, the ratio might be taken of the minimum to the maximum illumination at the point, with the card set by tri[al] to the proper angles. This ratio might be called the [sp]herical chiaroscuro ratio of illumination at the point. As a rule illuminating engineers are content to specify a certain amount of illumination at given areas in a room and to leave the shadows to good taste; but the chiarosc[ur]o ratio might occasionally be of service, if only in order [to] define ideas.

THE PHYSIOLOGICAL EFFECTS OF THE MERCURY ARC.

The article by Dr. Charles H. Williams in the current issue is of importance as summarizing the results [of a thor]ough ophthalmological examination of a consideral[ble] group of persons who have regularly and for long period[s] worked by the light of the mercury arc. There has been more or less dispute as to whether this particular light produces any observable effect on the vision of those habitually [using it]. It is probable that where belief has existed as t[o the in]jurious nature of the light, this has been due to prejudice against its peculiar quality rather than to any actual observation of ill effect. In a case where about f[our years] ago the mercury-vapor tube was adopted by a large [drafting] office the men employed were at first inclined [to criti]cise the light, but after a short experience all favored it strongly, some even going so far as to claim [a] curative effect on weak eyes. The results of Dr. [Williams'] investigation confirm this experience of a large n[umber of] men extending over four years, though he observ[ed a cer]tain amount of temporary color fatigue, which, however, is inevitable in the regular use of any strongly colored illuminant. As regards other effects on vision, which his results are completely negative, the clinical records for this group of twenty-eight persons show certainly quite as good conditions as would be expected in any oth[er] group of similar size working much by artificial light. There is always opportunity for eye strain owing to glare from misplaced lamps in the use of artificial light, and prob[ab]ly the mercury arc is not exempt from this difficulty. [Ce]rtainly if it were at all more likely to produce eye str[ai]n than other lamps, some evidence of the fact should h[av]e been observable in the careful examination of this nu[m]ber o[f] cases, whereas no evidence of it appears.

The color fatigue observed was of a particula[r]ly interesting character from a theoretical standpoint, though practically of small account from its evidently te[m]porary character. The strongest lines in the spectrum of [th]e mercury arc, to which at least nine-tenths of the vis[ibl]e light is due, lie close to the point at which the red a[nd] green sensations, as given in the curves of Koenig an[d] others, overlap with nearly equal ordinates, and hence b[oth] these sensations are subject to fatigue in somewhat nea[rly] equa[l] degree. It therefore appeared, in general, in Dr. [Wi]lliams' color sense tests, that there was comparatively l[ittl]e confusion of red and green. On the other hand, th[e] fatigue of the green sensation showed rather plainly at th[e] contac[t] of the blue and green owing to the greater fatig[ue] of the latter sensation. Even this did not appear in the [gr]oup of draftsmen investigated who used the light onl[y] a portion of the time, and it seemed to disappear in [th]e other cases after a few hours' rest. This is quite in acordanc[e]

[illegible] results of Burch, who was able to produce all [illegible] of temporary color fatigue by suitable exposure to [illegible] light, which, while temporarily complete, disap[illegible] after the eye had opportunity for rest. It would be [illegible] ing to follow out the matter of color fatigue in [illegible] er artificial illuminants. The yellow flame arc [illegible] expected to give results not very different from [illegible] re recorded, while in the case of ordinary flame [illegible] s and incandescent lamps some red-green fatigue [illegible] will be evident owing to the predominance of these [illegible] As regards other ophthalmological matters, Dr. [illegible] results are about what might be expected. At [illegible] it is gratifying to have these thoroughly negative [illegible] orded, and we are inclined to the opinion that [illegible] negative results will be found in general for [illegible] under artificial light, assuming that it is intelli[illegible] talled. It is improper use, rather than much use, [illegible] al light which is chargeable with eye strain, and [illegible] strain exists it can generally be remedied by in[illegible] arrangement of the illuminants.

[illegible] LINE OSCILLATIONS.

[illegible] general property of electric lines to oscillate when electrically disturbed, which property has both ad[illegible] and disadvantages. The advantage is developed [illegible] tion with wireless telegraphy, where a line is [illegible] ertically and very powerfully disturbed by high[illegible] harges and discharges. The electromagnetic [illegible] s excited in the wire under the influence of the [illegible] tance overleap their boundaries and spread out [illegible] agnetic waves, radiating over the surface of the [illegible] e disadvantage is often developed incidentally [illegible] entally by a short-circuit or other powerful dis[illegible] n a transmission system, which may set up oscil[illegible] great and destructive amplitude in the potential and c[illegible]rent on the system. At first the men accustomed to opera[illegible] energy-transmission systems were inclined to dis[illegible]redit the latent possibilities for injury in the oscilla[illegible] heir lines. Their prevous experience had been deriv[illegible] with lower-tension systems of relatively small power delivery. Their more recent experience with sys[illegible]ems [illegible] increased area, voltage and power did not at first rouse heir fears so long as no accident occurred, although the [illegible]signing engineers had some misgivings. Time, carry[illegible]g unfortunate opportunity on his shoulders, brought to the central-station operators a realization of the latent [illegible]ges in electric oscillations through break-downs [illegible] and apparatus.

[illegible] al research on the electric oscillations set up in a lo[illegible]-distance energy-transmission system by switching has been presented by Mr. G. Faccioli in a paper read before the American Institute of Electrical Engineers at the r[illegible]ent Chicago convention. The lines on which the resea[illegible]h was conducted were those of the Great Western Powe[illegible] Company, 154 miles (244 km) in length, running from Big Bend to Oakland, Cal., via Sacramento. They are o[illegible]rated at about 100 kv between conductors and can readi[illegible] carry 10,000 kw per wire. They are operated at a frequ[illegible]cy of 60 cycles per second, and have, of course, transformers at the generating and receiving ends. In the simplest case any such line must have four sets of oil switches, two sets at each end—one for the high-tension and the other for the low-tension sides of the transformers.

When voltage is thrown on or off such a line the conditions are very varied, depending on the load, the phase of the cycle at which the operation happens to commence, the time-interval between the actions of the three blades of the operated switch and the location in the system of the particular switch operated. The oscillograph records have, therefore, to wrestle with a good deal of variety and complexity of detail on these accounts. Nevertheless, the paper tends to show that the largest overvoltage oscillation on the line at no-load set up by switching operations of various kinds, both opening and closing, was only 60 per cent of that normally impressed. Consequently, if a system is operated at 100 kv, the maximum voltage that can momentarily be set up by light-load switching as measured through transformers would only be 160 kv and ordinarily less. The above result is in conformity with the existing theory of the subject, which indicates that when an unloaded line is switched on or off the maximum overvoltage to be expected is less than 100 per cent unless the line is resonant to the impressed frequency, when on switching there may, under particularly favorable conditions, be generated a considerably higher voltage at the distant end, not merely momentarily, but also permanently. Even in such resonant cases, however, a small amount of load should be sufficient to destroy the overvoltage.

The paper contributes much valuable engineering information and is unusually definite in its details. Incidentally many conditions are brought to light which are unusual to short-distance transmisssion. For instance, it is mentioned that when the unloaded generator is excited to less than half terminal voltage the mere act of connecting it to the unloaded transmission lines doubles that terminal voltage, owing to the magnetizing effect of the leading current that charges the line—a current which at rated voltage is about 50 amp per wire, representing a reactive power of some 3 megawatts per wire at an extremely low power-factor. This idle current is nearly as strong as the current delivered when the generator is under rated load, so that with a single generator supplying the line throwing the entire load off and on makes but little difference to the current strength, but a large difference in the power-factor. An appendix to the paper by Mr. W. W. Lewis describes the technique that is required in operating an oscillograph under such conditions. In the ordinary instrument the film covers only a small fraction of a second, namely, one-tenth to one-thirtieth second, according to the driving speed. This duration of exposure may be all that is desired in a laboratory experiment when the operator closes a switch, which not only initiates the phenomenon, but also releases the oscillograph shutter. When the switch is released by a distant operator, 250 km away, there is naturally some little difficulty in releasing the shutter at the right instant to catch the record of his performance. Specially long films were used, and a chain of four assistants was made, a telephone line being used as one of the links.

Fall Convention of New England N. E. L. A. Section.

The third fall convention of the New England Section of the National Electric Light Association will be held at The Mount Washington, Bretton Woods, N. H., Wednesday, Sept. 27, to Friday, Sept. 29, inclusive. The tentative program calls for a reception and dance on the evening of the 27th; a business session in the forenoon of Thursday, the 28th, the afternoon being devoted to the entertainment of the ladies, and a banquet in the evening; another business session on the morning of Friday, the 29th. The convention will close probably in the latter part of the afternoon of that day, leaving the week-end for those who desire to take further trips through the mountains. A large attendance is anticipated.

Convention of the Association of Edison Illuminating Companies.

The thirty-second annual convention of the Association of Edison Illuminating Companies will take place at Spring Lake Beach, N. J., Sept. 19, 20 and 21. Provision has been made for an opening reception and dance on the evening of Sept. 18 and for a fishing excursion on Barnegat Bay on Sept. 22 in addition to the entertainment features provided during the three days of the convention proper. The list of papers is not yet available, but reports will be presented on the following topics: Incandescent lamps, meters, National Electrical Code, electric heating, steam turbines, electric vehicles, high-potential disturbances and electric storage bateries. Morning sessions will prevail with the exception of Tuesday, when an afternoon session will be held as well, the other afternoons being devoted to golf, automobile trips, etc. On Thursday evening a session will be held in conjunction with the formal closing of the convention. During the forenoons while the convention is in session the ladies will engage in a croquet tournament, tennis tournament, putting contest and other special entertainments provided for them.

Railway Electrical Engineers' Convention.

Arrangements for the annual convention of the Association of Railway Electrical Engineers, to be held in Chicago at the Hotel La Salle Nov. 6 to 10, are being made by the committees of the Association of Railway Electric Supply Manufacturers. The latter association is composed of some sixty companies manufacturing electrical supplies for use on railways. Membership in this association is prerequisite to the reservation of exhibit space at the convention. The grand ballroom on the nineteenth floor of the La Salle has been reserved for manufacturers' exhibits, twenty-nine booths ranging in size from 70 sq. ft. to 182 sq. ft. being provided. Further information in regard to exhibits may be obtained from Mr. W. E. Ballatine, 436 South Dearborn Street, Chicago.

Chicago Elevated Railways Merged by Central-Station Finance.

Following the plan of elevated-railway reorganization in Chicago under the leadership of Mr. Samuel Insull and his associates in the Commonwealth Edison Company, the old board of directors of the South Side Elevated Railroad Company has resigned and a new board has been elected. This consists of Messrs. Samuel Insull, Henry A. Blair, B. I. Budd, Ira M. Cobe, William A. Fox and J. H. Gulick. Mr. Insull, who is president of the Commonwealth Edison Company, was elected chairman of the board. Mr. Budd was elected president of the South Side road, succeeding Mr. Charles V. Weston, resigned. Mr. Budd is also president of the Metropolitan West Side elevated roa and has been or will be elected president of the Northweern and Chicago & Oak Park lines, these four roads beg combined in the Chicago Elevated Railways, of wch Mr Insull is chairman of the executive committee. r. Blair is the promoter of record of the elevated merger nd Mr Cobe is a financier who has been associated wit Messrs Insull and Blair in the deal. Mr. Fox is treaser and Mr. Gulick is auditor of the Commonwealth com ny.

By this merger, to which the Commonwealt Edison Company was a party, that company will eventually ncrease its already large railway load greatly. It is saic that the railway business of the elevated and surface ra ays of Chicago is worth $6,000,000 a year to the centr station company, and it is highly probable that all of this usiness will go, sooner or later, to the Commonwealth mpany, for it is likely that the surface and elevated roac will be combined before long. After that it is not impos the Commonwealth Edison Company and the Chi ways may be merged in one great corporation the electric-service and electric-railway needs of At present, however, the Commonwealth Edison and the men associated with it are the dominat figures in the elevated-railway situation in Chicago.

Telephone Pioneers of America.

The Telephone Pioneers of America, a recent organized body, will hold its first meeting at Boston 2, 3 and 4, at which President Theodore N. Vail, Pr Alexander Graham Bell and other prominent figures in te telephone field will be present. The committee in charge consists of Messrs. Henry W. Pope, Charles R. T and Thomas B. Doolittle, of 15 Dey Street, New Yo from whom further information may be obtained.

The association has issued in neat pamph form memorial notices, accompanied by a portrait, of the late William Dunlap Sergent, for many years vice-president and general manager of the New York & New Jersey Telephone Company; William N. Estabrook, recen vice-president and general manager of the New York Pennsylvania Telephone & Telegraph Company, and Frederick Allen, night chief operator in the New Haven exchange of the Southern New England Telephone & Telegra Company.

Deerfield River (Mass.) Hydroelectric Development.

The New England Power Company has entered large undertaking of developing the hydroelectr resources of the Deerfield River in Massachusetts mont. The work involves the construction of fc in the Deerfield River at or near Shelburne Fall Mass., with falls of 45 ft., 70 ft., 65 ft. and 65 ft. respect storage reservoir will be built at Searsburg, Vt. capacity of 2,500,000,000 cu. ft. It is estimated energy developed will be about 70,000,000 kw-h year. Each of the four stations to be erected at will have three generating units of about 2000 kw kw capacity. There will be horizontal waterwheel rbines.

A transmission line will connect the Vernon (Vt. plant, now operated by the Connecticut River Power Company, with the new plant. A large part of the energy generated on the Deerfield River will be bought and distri ed by the Connecticut River Transmission Company, of Boston. A contract has already been made to furnish the Boston & Maine Railroad Company with a large block of th energy for its use in operating trains in the Hoosac Tunn which was lately electrified. All the new plants, toget with

...rnon (Vt.) plant and the new plant built by the State of Massachusetts at its Wachusett reservoir dam in Clinton, Mass., will be run in multiple.

The engineering and construction is being done by the Power Construction Company, of Boston, with local headquarters at Shelburne Falls, Mass. The property was ... and the power company organized by Messrs. ... & Harriman, 50 Congress Street, Boston, who ... the Connecticut River undertaking about two ..., which has proved very successful.

Operation of Consolidated Properties in Ontario, Canada.

An account was published in these columns Jan. 12 of the consolidation of a number of electrical properties in the ... of Ontario, Canada, by Messrs. Smith, Kerry & ... engineers, of Toronto. The holding company is ... the Electric Power Company, Ltd., and the com... controlled operate in that portion of the Province ... lying east of Toronto, west of Kingston and ... Lake Ontario. This district embraces practically ... section of Ontario not now supplied by lines of the Hydroelectric Commission, which has thus far confined its operations chiefly to the western section of the ...

... Electric Power Company controls a number of ... powers along the route of the Trent Valley Canal, ... leigh Falls to Trenton. The district served cov... area of approximately 5000 sq. miles, and has a ... of about 250,000. In this district are such cities ... as Peterborough, Kingston, Belleville, Oshawa, ... Cobourg, Port Hope, Bowmanville, Trenton, ...ord, Napanee, Deseronto, Madoc and Picton. ...trical energy is being delivered at present from ... to a number of substations at a pressure of ...ts. Of the substations erected subsequent to the ...on of the properties those at Brighton, Colborne, ... and Port Hope are now in operation. The ... Deseronto, Newcastle and Bowmanville substa... expected to be placed in operation during Septem... generating and transforming station of the ... Electric Power Company, on the Trent River, just ... Trention, it is expected, will be placed in opera...ng September. This will provide an additional ... and enable the various substations to carry addi...l. The present generating stations at Campbellford have a rating of over 5000 hp and have been running for some time with a daily load-factor of from 80 per cent ...

... resting feature of the work of the Electric Power ... is the unification of the systems so as to have a ... frequency, phase and voltage for the various ...n and villages of eastern Ontario, and in addi... substitution of a twenty-four-hour service for the ...awn" service.

...station at Cobourg, which is typical of all the ... designed to contain three 750-kva, oil-insulated, ...ed, three-phase transformers for stepping down ...ial from 44,000 volts to 2400 volts. Two of these ...rs have already been installed and have been in operation now for some weeks. The entire load of the Cobourg Utilities Company has been transferred to the new substation, and coincident with this transfer has been the change from 125-cycle, 1100-volt, single-phase service to 60-cycle, 2400-volt, three-phase service. There were between 90 and 100 service transformers on the old distribution lines, and about a dozen of these could not be used in connection with the new system as they were wound for ... volts only. The remainder were reconnected for 2200 volts and practically all of them operated satisfactorily at the higher voltage and lower frequency. The thirty-five-light, constant-current transformer for the arc-lamp circuits is now being rewound for 60 cycles by the Canadian General Electric Company, the street-lighting system at present being supplied with energy from a 60-cycle transformer loaned by the manufacturing company while the old transformer is being rewound.

The change over of both the street-lighting and commercial circuits was made with practically no interruption of service. The Cobourg Utilities Company, in addition to furnishing electric light and gas, also furnishes the water supply to Cobourg, and as soon as a new motor-driven pump has been installed, which will be in the course of a few weeks, the old steam plant will be entirely shut down.

Prize for Electric Lamps for Miners.

A statement has been issued by the United States Bureau of Mines and also by the British ambassador in Washington regarding the conditions of entry for a competition to be conducted by the British government for obtaining a safe and efficient type of electric lamp for miners. The prize offered is £1,000, to be awarded on the recommendation of Mr. Charles Rhodes, a former president of the Institute of Mining Engineers, and Mr. Charles H. Merz, a member of the departmental committee on the use of electricity in mines. The competition will be open to persons of any nationality. Lamps must be addressed care of C. Rhodes, Esq., at the Home Office testing station, Rotherham, England, and must reach the testing station not later than Dec. 31, 1911. A spare globe should accompany each lamp.

The requirements which should be fulfilled by any lamps submitted for competition are as follows:

The lamp should be of sound mechanical construction, so as to withstand rough usage; should be of simple construction and easy to maintain in good order and repair; so constructed as to render impossible the ignition of inflammable gas either within or without the lamp, and should be effectively locked so that it cannot be opened without detection. The lamp battery should be so constructed that any liquid which it may contain cannot be spilled when the lamp is in use and means should be provided for dealing with any gas which may be generated by the battery. The materials used and the construction should be such that metals and other parts will not be liable to deterioration by corrosion as a result of the action of the electrolyte, etc., used in the battery. The lamp should be capable of giving an amount of light not less than 2 cp continuously for a period of not less than ten hours. The light should be well distributed outside the lamp. A movable reflector to concentrate or to shield the light may be provided.

In addition to the above requirements, regard will be paid to (*a*) the first cost of the lamp; (*b*) the cost of maintenance; (*c*) convenience in handling, and (*d*) the weight of the lamp when charged and ready for use.

Electrical Code of the City of New York.

The Bureau of Electrical Inspection, Park Row Building, New York, is distributing the 1911 edition of the electrical code of the city of New York, which represents the work of the engineers of the Department of Water Supply, Gas and Electricity and those of the New York Board of Fire Underwriters, extending over a period of years, in producing a set of electrical inspection requirements which, while based on the National Electrical Code, are adapted for use in New York City. Such departures from the standards of the National Electrical Code as have been made necessary by local laws or conditions are indicated

in the edition by bracketing the portion omitted and inserting immediately after it in italics the substitute requirement of the city, if any exists. The rules relating to wiring in marine work, which is under federal and not municipal jurisdiction, are omitted from the New York edition. The National Electrical Code has been adopted almost in its entirety by the commissioner of water supply, gas and electricity. The rules on constant-potential pole lines over 5000 volts are displaced by the general city rules on pole lines, and the rules for constant-current systems for concealed knob and tube work and for transformers in buildings on low-potential systems are eliminated entirely, none of these constructions or systems being permitted in the city. A complete set of regulations governing garages is added, and there are slight modifications to some of the rules. The edition embraces all the revisions made by the Underwriters at their recent biennial meeting in New York City. Criticism of the new rules is invited, and for this purpose copies may be obtained from the Bureau of Electrical Inspection.

Indiana Electric Light Association Meeting.

With a final registration of about 120 members and associates the three-year-old Indiana Electric Light Association held the largest and most successful meeting of its existence at South Bend, Ind., Aug. 23 and 24. President F. A. Bryan, of South Bend, opened the first session at the Oliver Hotel on Wednesday morning, welcoming the delegates to the city in his official address. He referred further to the close interrelation and co-operation that should connect the interests of central-station men, manufacturers, contractors and jobbers, and among the tendencies of the day noted the increasing value placed upon the commercial side of central-station work, as evidenced by the discussions at recent conventions. The public must be educated, declared President Bryan, to a proper realization of the burdens of corporation affairs, the increasing expenses of plant operation and the cheapness and convenience of the electric service supplied by the corporations. One of the good uses of a public-utility commission, he added, is to convince the public of the real facts of the utility business. Corporation regulation is soon to be expected in Indiana, and such a commission, when appointed, urged the speaker, should be selected from among the very ablest men. A good utility law should have the result of stopping the abuses of competition and financiering. The interests of the public and the companies are identical, but if the latter are subjected to ruinous competition or unfair reduction of rates, service is sure to suffer. While electricity has already done much, said President Bryan in closing, in the future it may be expected to go still further toward saving labor and rendering cities smokeless.

The report by Secretary-Treasurer J. V. Zartman, of Indianapolis, showed a total membership of sixty-five central stations in the association, in addition to twenty-five associate members among manufacturers and sales representatives.

Mr. John C. Hornung, of the W. H. Schott Company, Chicago, then opened the program with his paper on "Heating in Connection with Central-Station Work." After pointing out the magnitude of the heat quantities which are lost in the exhaust of the purely electrical generating plant the author submitted practical data showing the heating service which may be expected in connection with typical engine-driven plants. Mr. Hornung's paper was discussed by President Bryan and Messrs. R. A. MacGregor, of Connersville, and W. J. Kyle, Chicago.

MOTOR SERVICE.

Mr. MacGregor then presented his paper on "Power," in which he protested against the tendency to make very low rates to gain motor-service business, when su[ch] business may be unprofitable. The speaker charge[d] some motor salesmen with urging rate reductions in [ord]er to secure the sale of their motors. In such cases, he said, a few motors are sold to the utter demoralization [of] rates within the town. In some instances, even dental [m]otors and 16-in. fans have been accorded a "power" ra[te,] said the speaker. While electric drive has a great man[y] well-known advantages and conveniences, he continu[ed], the practical central-station salesman realizes very w[ell th]at where an isolated plant has already been installed no[...] argument than the potent one of a saving in cost wi[ll] the replacement of the private plant. But the rates [...] under any conditions should be such as to insure p[...] both the customer and the company. Mr. MacGreg[or] pointed out that sometimes, through the purchas[e of a] number of smaller individual motors at a higher c[ost than] a single large group-drive motor, the customer ma[y pay] a higher rate and yet save money where his load i[s inter]mittent and diversified. In Indiana, he said, some [manu]facturers have gained the idea that a 2-cent rate is [...] "power" price, and demand this rate without inves[tig]ating their own costs. Others cite the low rates given by [munici]pal plants in nearby towns to political favorites[...] manufacturer who is a prospective central-station c[...] should be shown the high cost of isolated-plant [...] concluded Mr. MacGregor, and in this connection t[he] fireman can usually provide some valuable informa[tion].

The paper was discussed by President Bryan, [...] W. J. Kyle, Chicago, and W. D. Ray, of Hammond. [Presi]dent Bryan said that many rates have been establis[hed too] low and are in need of revision. Mr. Kyle show[ed...] it has been possible to employ a higher rate and y[et save] the customer money by installing a number of in[...] motors in place of a single large motor which w[...] required to run continuously. Mr. Ray objected [...] author's references to the central station's relati[on...] manufacturers in soliciting motor business, and d[...] that the manufacturers can give special and most v[...] assistance. In his own experience, said Mr. Ray, [...] never found rates to be driven down by motor sales[men].

RURAL ELECTRICAL SERVICE.

An afternoon session was held on Wednesday [...] ballroom of the Edgewater Club at St. Joseph, [...] where the party was taken by special electric int[erurban] cars. Mr. C. E. Layton, of Lebanon, read his pa[per on] rural electrical service. The value of mechanical [...] on the farm, he said, is now being appreciated, an[d...] transmission lines have been built out into farmi[ng dis]tricts, at the cost of the customers, who find electric [...] cheaper than gas engines. In one case Mr. Layton[...] pany ran a line of this kind, the farmers furnishi[ng...] wire and the company the poles and transformers. [...] many of these customers use only the minimum a[...] of energy, the service has not paid. Motors for p[...] cost one-tenth as much as the price of windmills a[...] provide good central-station business. The convey[...] of ensilage elevator is found much more economic[al...] the very large motor-driven blowers required for th[...] duty.

In conclusion Mr. Layton pointed out that, freed [...] tribution costs where the farmer pays for the line [exten]sions, rural service may be profitable business. F[...] future this offers a large field for development, bec[ause...] per cent of the country's population lives in countr[y com]munities and if the central stations could acquire ev[...] tenth of the business their output would be increa[sed...] per cent. In a discussion of the subject of distr[ibuting] voltages which followed the presentation of Mr. L[ayton's] paper, Mr. H. C. Sterling, of Three Rivers, Mic[h., told] of his use of small transformers stepping down t[he...] directly from his transmission pressure of 11,000 v[olts to] the customer's service. Others taking part in the [discus-]

...re Messrs. F. A. Bryan, South Bend, T. C. Palmer, ... N. M. Argabrite, Muncie; J. W. Robb, Clinton, ...ning, Elwood, and W. D. Ray, Hammond. While ...ce, said Mr. Ray, seems hardly profitable now, ... possible of development, as in the case of the ...erurban railway. In general, he added, exten... ...en prudently planned have always proved profit-

...s of Operation Secured by Consolidation of ...perties" was the title of a paper by Mr. L. B. ... general superintendent of the Indiana & Michigan ...ompany, read in the author's absence by Secre-...man. Mr. Andrus submitted an exhaustive study ...ses that contribute to improved administrative or ...er" effectiveness and increased technical effi-... the result of grouping isolated properties into a ...he numerous factors in this result were enumer-... careful detail.

BUSINESS SESSION.

...usiness session of Thursday morning Mr. C. C. ... Indianapolis, called attention to the impending ...-law agitation in Indiana and suggested that for ...f the central-station interests, as well as those ...lic, through the construction of a fairly drawn ...vernor of the State be petitioned to appoint a ... to study utility regulation measures. Mr. J. ...f Clinton, also urged repeal of the State law ...ires competitive bids when awarding street-...tracts in Indiana towns of less than 10,000. As ... pointed out, such communities cannot support ... one lighting company, and the requirement of ...e bids brings bidders into the field having no ...ention of supplying service but expecting only ...ght out. On motion of Mr. MacGregor these ...re referred to the advisory committee.

... F. Gilchrist, of Chicago, president of the Na-...tric Light Association, then addressed the In-...on the subject of the aims of the national body ...nefits Indiana members might receive through ...n with the larger body. Mr. Gilchrist referred ...rest stimulated among corporation employees ...e members of the N. E. L. A., and showed how, ...lt of the Indiana association becoming a state ...' character and self-government would be ...while it would receive the benefit of the valuable ...rinted matter of the larger body.

STEAM TURBINES.

... D. Dreyfus, commercial engineer for the West-... Machine Company, Pittsburgh, Pa., read a paper ...Steam Turbine for Future Work," in the course ...e discussed diversified services, mechanical con-... inherent characteristics, accessibility, exterior ...iencies and ratings. In general, he said, there ...,000,000 hp of steam turbines in use, and ma-... available ranging in rating from a fraction of ...ver up to 30,000 kw. The turbine has met many ...irements in its applications, and is not encum-...e steam engine is restricted. For example, said ...r, great vessels like the *Mauretania* and *Lusitania* ...mpossible without turbine drive. Mr. Dreyfus ... reaction and impulse types of turbines and ...hat, while both actions occur in all commercial ...ne or the other predominates and gives its name ...the type. Complete-expansion and low-pressure tur-...ines ...ere described, and the new "bleeder" type of tur-...ine f... steam-heating service was illustrated by lantern ...

The author deplored the confusion resulting from the ... systems of turbine ratings, one using a maximum con-...nuous basis, while the other considers a conservative ...normal rating with allowance for 25 per cent overload. ... Dreyfus also spoke of the liberal guarantees sometimes made on turbine efficiencies, sometimes efficiencies higher than the theoretical possible limits being solemnly included in the specifications. The paper was concluded with some further pointed suggestions to persons interested in turbine equipment. To give close regulation such machines should have quick-operating governors, the simplest possible construction being desirable. After pointing out the dangers of unbalancing where disk construction is used, the point was made that with the multitude of small blades in the Parsons type the loss of a number may be suffered without seriously affecting the operation of the unit. In reaction turbines, the speaker added, the low relative pressures and velocities across the blades act to decrease wear. The design of turbines, he continued, should be such that all parts are readily accessible for inspection while a good arrangement of the piping and auxiliary equipment is secured. The reading of the paper was followed by an exhibition of lantern slides.

At the afternoon session Mr. G. R. Parker, of the General Electric Company, Schenectady, N. Y., followed with

President-Elect F. A. Bryan.

an illustrated talk on Curtis steam-turbine installations. Beginning with Hero's classical experiment Mr. Parker traced turbine development down through modern large units. Bucket wear, he said, is due chiefly to local conditions. Erosion sometimes occurs, caused by water coming over in the steam, but is rare where superheated steam is used. A number of illustrations were then thrown on the screen to show that such wear is negligible even after years of service. Originally low-pressure turbines were expected to be used with non-condensing engines, but most of the turbine units are now in service with engines formerly run condensing. The interesting exhaust-steam turbine application in the power house of the New York subway was cited by Mr. Parker, who said that, without increase in boilers, buildings or real estate, the rating of this station has been more than doubled with an accompanying reduction of 25 per cent in the specific coal consumption. While the engine efficiency has been lowered as the result of overrating them, the efficiency of the turbines is so high as to maintain the combined figure practically constant at all loads. In the new mixed-pressure turbines recently brought out automatic valves are provided by which the unit takes live steam when sufficient low-pressure steam is not available. Separate sets of high-pressure and low-pressure nozzles are provided, so that the turbine works at very high efficiencies under either condition of operation. A brief discussion of the turbine papers was entered into by Messrs. F. A. Bryan, T. C. Palmer, G. R. Parker and E. D. Dreyfus.

ELECTION OF OFFICERS.

For the ensuing year the Indiana Electric Light Association unanimously elected officers as follows, President Bryan being retained at the head of the organization for another year:

President—Mr. F. A. Bryan, South Bend.
Vice-president—Mr. Felix L. Cadou, Vincennes.
Secretary-treasurer—Mr. J. V. Zartman, Indianapolis.

Executive Committee—Messrs. R. A. MacGregor, chairman, Connersville; E. Darrow, Indianapolis; W. D. Ray, Hammond; Thomas Donohue, Lafayette.

Advisory Committee—Messrs. C. C. Perry, Indianapolis; T. C. McReynolds, Kokomo; J. W. Robb, Clinton.

Finance Committee—Messrs. C. Blank, Martinsville; J. W. Moncrieff, Bloomington; Thomas A. Grist, Knox.

Mr. F. A. Bryan, who was re-elected president of the association, is general manager of the Indiana & Michigan Electric Company, operating steam and water-power plants at South Bend, Elkhart and Mishawaka, Ind., and Berrien Springs and Buchanan, Mich., and lighting the cities of Elkhart, South Bend, Mishawaka, Buchanan, Berrien Springs, St. Joseph and Benton Harbor. Mr. Bryan has been located at South Bend for the past eleven years, during which period a series of combinations of the old South Bend Electric Company with the Elkhart Electric Company, the C. A. Chapin Light & Power Company, of Buchanan, and the Berrien Springs Power & Electric Company has resulted in the formation of the present system with its chain of water-power and steam plants connected by high-tension transmission lines. Mr. Bryan was graduated from the Pennsylvania State College with the civil-engineering class of 1890 and served for a time with the old Edison General Electric Company, in 1893 going with the H. Ward Leonard Company. For six years before coming to South Bend he was engaged in civil-engineering work for the Michigan Central Railroad.

ENTERTAINMENT.

Following the session of Wednesday morning the members of the convention were taken by special cars of the Southern Michigan electric railway to the Berrien Springs water-power plant of the Indiana & Michigan Electric Company, where a picnic luncheon was served. After inspecting the plant the journey was resumed to St. Joseph, Mich., where the afternoon and evening were spent at the Edgewater Club. The special cars returned the party to South Bend late in the evening.

Texas and Electrical Corporations.

Attorney General J. P. Lightfoot of Texas has submitted to the Legislature a lengthy report on his investigation of the alleged electrical trusts said to be operating in Texas. Referring to electric light and traction properties, the report states that "the Texas companies which are operated by Stone & Webster, of Boston, Mass., are as follows: The Dallas Electric Light & Power Company, Dallas Consolidated Electric Street Railway Company, Rapid Transit Railway Company and the Metropolitan Street Railway Company, which are all owned by the Dallas corporation. In El Paso the El Paso Electric Railway Company and the Juarez Traction Company are owned by the El Paso Electric Company. The Galveston-Houston Electric Company owns the controlling interest in the Galveston Electric Company, the Houston Electric Company, the Galveston-Houston Electric Railway Company, and also owns stock in the Suburban Realty Company and the Hotel Galvez at Galveston. The Northern Texas Electric Company owns a controlling interest in the Northern Texas Traction Company, the Dallas & Oak Cliff Electric Railway Company and the Ft. Worth Southern Traction Company.

"It will thus be seen that the several street-railway systems of Dallas, Ft. Worth, Galveston, Houston and El Paso are all owned by a holding corporation, which in turn is owned, controlled or managed by the Stone & Webster Management Association, which is a corporation organized by the partnership of Stone & Webster. All the above corporations are under the management and control of one corporation, through which the ectrical supplies and appliances are purchased, principa from the General Electric Company.

"The four electric-railway companies of D las are owned by one corporation, the two lines of El also by another, the street-railway systems of Galve n and Houston by a third corporation; the Northern Te Traction Company and the Ft. Worth Southern Tract Company are owned by a fourth corporation. Eac of the four corporations is owned and managed by the t e & Webster Management Association, another co Some of the stock and bonds of all these Texas c are owned by electric securities companies, which n urn are partly owned or controlled by the General Company.

"The Southwestern Telegraph & Telephone many is owned by the American Telephone & Telegra om-pany, known as the Bell system. The Wester Telegraph Company is also controlled by the Telephone & Telegraph Company. The Postal T Company of Texas was until recently owned, the American Telephone & Telegraph Company.

"It will, therefore, be seen that the lines for te and telephonic communication in Texas are large ned and controlled by the Bell system, while the elect railways find control and domination finally l Stone & Webster and the General Electric through subsidiaries.

"We also find that the General Electric Comp the American Telephone & Telegraph Company and t est-ern Union are strongly tied together through co di-rectors and common stockholders. Each and all ese concerns, that is to say, the American Telephone graph Company, the Western Union and the Gene tric Company and all underlying corporations, a nated by a group of bankers in New York an chief among whom may be mentioned the firm o pont Morgan & Company, Kidder, Peabody & mpany, Lee, Higginson & Company and several other b and trust companies."

General Lightfoot discusses water-power conc tration and deprecates what he declares to be the evident tention of great corporations to get all this in their own h s and under their domination. Much of the report en s into details affecting the ownership of stock of the arious electrical corporations doing business in Texas, e con-clusion being that nearly all of them are dominat by the Bell Telephone Company, the General Electric mpany and a few others, or, at least, controlled by men o con-trol these companies. The conclusions of the torney General's report are as follows:

"The resolution under the authority of whic acted made it necessary to examine into the rel the corporations not only from a legal standpoint, also in the light of the effect of such concentration the industrial and economic welfare of the State an ation. Many of the facts which have been set forth are luable only for the light which they may throw on t great economic questions involved. It would be dif lt for street railways and electric-light plants in widely arated cities to enter into competition. Moreover, a gr many of these concerns have no permit to do business i Texas, and if the facts set forth show any violation of e law by them it would be rather a violation of the laws other states or of the federal government. The Sta courts have no jurisdiction to punish offenses which alo affect interstate or international commerce.

"There are also serious legal difficulties involv touch-ing the power of the State to control the action f cor-porations which manufacture and deal in patente evices, as it is claimed that the patent rights carry with t m cer-tain exclusive privileges and monopolies grante by the federal government. These contentions find som upport

in te federal decisions, but the question has never been defirely and satisfactorily adjudicated by the Supreme Cou of the United States.

"While all the facts tend to show a movement toward concentration which will, if persisted in, wield a potent influence over the industrial welfare of the nation, the ... very much handicapped by reason of the limita- ... its powers and the law to deal with a subject ... s international in its scope and effect.

... peration in Texas by the Stone & Webster syn- ... resents several interesting questions for determi- ... ir movements have always been predicated ... e most eminent legal advice to be had. So far as ... een able to determine the fact, it appears that the ... rters of the various cities in which they operate ... street-railway systems confer upon the several ... rnments a wide control over the matter of fran- ... e fares to be charged, the character of the equip- ... e service to be rendered the public, the hours of ... the employees and other pertinent and salient mat- ... h might bring such cases within the reasoning of ... n by the Supreme Court of this State in the case ... against Shippers' Compress Company, 95 Texas, ... which the court held that under the facts in that ... e was no unreasonable restriction of competition ... several of the compress companies which were ... the same corporation. The Railroad Commis- ... ng fixed the amount to be paid by the railroad ... s for the service of compressing cotton, and by ... g the delivery of cotton to the various com- ... ompetition between the companies operated by ... t was barely possible under the rules fixed by such

... the relations existing between the Western ... l the Bell Telephone system, while I do not be- ... it is necessary to pass upon all legal questions ... or the purposes of this report to the Legislature, ... free to say that the practical combination be- ... se two great companies trenches upon our anti- ... There can be no competition either in rates ... between two such great concerns where they ... cally under the same management and control. ... er shall receive further investigation and con- ... at the hands of this department. The depart- ... deems it wise to continue the investigations into ... ns, if any, between all these concerns, especi- ... Postal Telegraph-Cable Company of Texas and ... can Telephone & Telegraph Company, the West- ... and the Mackay interests. For a time the ... stal was owned and controlled by the Bell sys- ... as hereinbefore stated, it claims that it has ... f that interest. On the question of that branch ... siness of the General Electric Company which ... the manufacture and sale of electrical devices, ... necessary to conduct a further investigation be- ... n be definitely stated whether or not any of the ... rangements heretofore in existence have been ... in effect in this State."

Illinois Legislative Notes.

... mbers of a special commission of the Illinois Legislature visited Boston last week and on Aug. 24 held conference with the Massachusetts Gas & Electric Light Commissioners and the Railroad Commissioners. The Illinois commission is securing material pertaining to the subject of supervision of public utilities and will report to the Legislature of that State in 1913, with recommendations whether Illinois should change its present system of regulation. That State now has a commission on railroads and warehouses which has limited supervision of railroads, warehouses and express companies, but has no control over street railway companies. There has been considerable agitation for increased powers of regulation and the present investigators were delegated to secure data on what other states are doing in that line.

The commission has visited Wisconsin and New York. The former State has a single commission which has supervision over all public-utility corporations. New York has two commissions, each having control over all public-utility corporations, the jurisdiction of one being limited to New York City and of the other to the remainder of the State. Massachusetts has a system of small commissions, each of which has powers of regulation of a single branch of public service.

The visiting delegation was impressed with the difference in cost to the State of the New York and Massachusetts systems. The commission that covers New York City expended about $1,300,000 last year, and this amount was borne by the people, while the three Massachusetts commissions, controlling railroads and street railways, gas and electric light companies and telephone companies, expended less than $200,000, all of which was borne by the supervised companies.

The Illinois commission of investigation consists of: Senator John Dailey, of Peoria, chairman; Senators E. J. Glacken and John F. Denvir, of Chicago; Representatives William P. Holaday, of Danville; Thomas Gorman, of Peoria; Chester W. Church, of Chicago, and William M. Scanlan, of Peru.

New Jersey Commission News.

The Public Utilities Commission has made an investigation to determine the reasonableness of rates charged for electricity and gas by the Consolidated Gas Company of Long Branch. In the appraisal of the property of the company no allowances were made for intangible values, good-will, deficits in early years or uncertain or indefinite matters, but an allowance of 12 per cent was made for engineering, superintendence and other expenses during the period of construction. It is pointed out, however, that it cost at least 20 per cent more to build the plant than the valuation arrived at in the tables, due in part to the fact that the property has been constructed piecemeal and also somewhat to the fact that new and improved methods have been adopted from time to time which involved the purchase of new apparatus. The appraisal value was $1,649,260, but the conclusion of the commission was that it is reasonably certain that the amount of money expended for legitimate capital purposes has been very close to $2,000,000. In the course of the inquiry the general manager of the company stated that, in his opinion, the physical value of the company was between $1,750,000 and $2,000,000.

One of the conclusions of the report is that not enough of the old property was written off to compensate for what it was found necessary to discard from time to time. It is brought out that the Long Branch company, since it supplies a summer resort, operates under very disadvantageous conditions and that it is practically impossible to change materially the shape of the load curves in order to make the operations more economical. The peak load in the daily load curve, for example, has a value approximately six times as great as that of the average load in the daytime. Moreover, a large part of the plant is not used except during a short period in the summer. Among the recommendations of the commission are that some steps should be taken to write off some of the older portions of the plant, thereby bringing the book value to correspond more nearly with the physical value of the property.

An order was issued making a change in electric rates which it was estimated would result, on the basis of 1910

business, in a loss of revenue of $8,975. The old rates were 20 cents for the first 50 kw-hours per month, 16 cents for the next 50 kw-hours and 12 cents in excess of 100 kw-hours, the motor rate being 10 cents per kw-hour for twenty-four-hour service. The new rates are 15 cents for the first 200 kw-hours monthly, 12 cents for the next 200 kw-hours and 10 cents for all over 400 kw-hours, the motor rate remaining at 10 cents per kw-hour.

The commission has ruled that it has no jurisdiction over public utilities operated by municipalities except that it shall require every municipality operating any form of public-utility service to keep its accounts in the manner described for the accounting of similar privately owned utilities and that statements of such accounts shall be filed with the commission; also that for statistical purposes municipalities have been requested to furnish information concerning rates and certain other statistics required of private public-utilities companies.

Wisconsin Commission News.

The Wisconsin commission has dismissed the case of the city of Green Bay versus the Green Bay Traction Company. The city appealed to the commission for an order requiring the defendant company to lay a line of street railway through a certain portion of the city in accordance with the rather indefinite terms of a franchise and agreement entered into between the city and the Fox River Electric Railway & Power Company, the previous owner of the traction system. The nature and indefiniteness of the original franchise provisions were such that, in the opinion of the commission, the present company could in no manner be held liable for any presumed obligation incurred by the Fox River Electric Railway & Power Company.

The commission has handed down one decision in response to two petitions, one by citizens of Platteville alleging discrimination by the Platteville, Rewey & Ellenboro Telephone Company and the other by the company requesting an increase in rates. At the hearing held on the first petition the testimony showed that the company had been making a practice of discriminating between stockholders and non-stockholders in the matter of rates and installation charges. The company attempted to justify its action on the plea that the exchange was a private enterprise conducted for the mutual benefit of its stockholders. In the application for an increase in rates made by the company before the above hearing was held the commission was petitioned to authorize an increase in charges from $1 per month, the present rate to non-stockholders, to a graduated schedule ranging from $1 per month for party-residence service to $2 per month for single-line business service. In the decision covering both petitions the commission denounced the practice of charging stockholders and renters different rates as illegal and ordered the practice stopped. Attention was also called to the point brought out in several previous decisions that the fact that a stockholder or any other person owns his own instrument in no way furnishes a reason for a difference in rates. The reason advanced by the company for an increase in rates was that it was considered necessary to install a complete metallic return because of interference by electric power circuits. On account of the poor condition of the company's accounts, it was impossible to determine accurately what the operating expenses amounted to. As far as could be learned the company can earn about 5⅕ per cent on its present valuation of $35,000 by charging the present rate of $1 per month to all subscribers, including stockholders. With the proposed rate the return would exceed the value which the commission considers ample in cases of this kind. The order, however, authorizes the company to install a graduat rate schedule ranging from $12 per year for party-residence service to $21 per year for single-line business service upon evidence that a complete metallic circuit has been installed. The commission intimated in the order that if the company considered the provisions of the order unfair or harsh its only recourse is to keep its accounts in the manner prescribed by law, which would then enable the commission to deal with the case more intelligently.

The city of Waukesha has filed a complaint with the commission alleging that the rates charged by the Waukesha Gas & Electric Company are unreasonable and discriminatory. A hearing will probably be held during the month of September.

Massachusetts Commission News.

A petition has been filed with the Massachusetts (Electric Light Commissioners signed by a number zens of Brockton who ask for the "substantial red in the price of lighting furnished by the Edison Illuminating Company of Brockton. The present s of the company is 16⅔ cents per kw-hour for t thirty hours' monthly burning and 10 cents for excess, with a monthly minimum charge of $1 and count of 10 per cent for prompt payment. Lamp re are free for carbon and gem lamps, and tungster are sold to customers at cost.

Consumers of electric lighting in Abington and land, Mass., have petitioned the Massachusetts G Electric Light Commissioners for a reduction in th charged by the Abington & Rockland Electric L Power Company. The company now charges a m rate of 20 cents per kw-hour with a minimum ch $1 per month. For store lighting it charges 16 ce kw-hour for the first fifty hours' use per month nected load and 7 cents for all energy in excess. It carbon-filament lamps on the basis of one 16-cp la each $6 of energy used, free. A discount is made per cent on all lighting bills if paid in fifteen days.

New York Commission News.

A petition has been presented to the New York City Public Service Commission on the part of a number of societies representing stationary engineers protesting against the low rates accorded by the New York Edison Company to large consumers. Appended to the petition are 212 signatures, and it is stated that its text represents also the views of a joint committee of the International Convention of Steam Engineers, the National Association of Stationary Engineers, the Marine Engineers' Beneficial Society, the New York Engineers' Protective Society, the Blue Room Engineering Society and the National Isolated Power Plant Association. An attorney, Mr. Gustavus A. Kirby, has been retained to represent the interests of the societies before the commission. The charge is that the New York Edison Company is selling electrical energy at less than cost to large users, which deficiency is made up by higher charges to small consumers than are just, and that the average amount it charges for electrical energy is greatly in excess of that which would represent the cost of production and a reasonable return upon the amount invested in plant equipment and distributing systems. It is contended that the energy which a large consumer obtains for 3 cents per kw-hour comes to him in every instance through the same feeders and mains as those which carry energy to the small consumer, for which 10 cents per kw-hour is paid, while the only differential in price between

... rge and small consumer is that due to constancy of ... of consumption and the cost of metering, billing and ...n.

... Public Service Commission, Second District, has ... the Delaware & Otsego Light & Power Company ... cause before the commission at Albany on Aug. 29 why an order should not be entered requiring it to make reasonable improvements in its electric generating ... distributing system in the village of Otsego. The com... received complaint from the president and mem... the board of trustees of the village as to the char... of electric service furnished there, and an inspector ... commission found upon examination that the serv... irregular in character and generally inadequate and ...

... application for voluntary reductions in electric light... motor rates has been made by the Fulton County ... Electric Company applying to the cities of Johns... Gloversville, to take effect Sept. 1. The rates for ... are reduced from 5 cents to 8 cents and 10 cents ... our to 4 cents to 9 cents per kw-hour, depending ... amount used by the consumer. The minimum ... this company for electric lighting remains at 50 ... per month. Rates for motor service under the new ... will be from 1½ cents to 9 cents per kw-hour in... 2½ cents to 10 cents per kw-hour under the ... rate schedules of this company.

... Lockport Gas & Electric Company has been author... purchase $32,500 par value of the capital stock of ... Lockport Light, Heat & Power Company. This ... of stock constitutes the balance of an original ... $150,000 heretofore authorized by the commis... was in the hands of Messrs. Bertrom, Griscom & ... bankers, of New York City, from whom the ap... desired to purchase the same that it might hold all ... the capital stock of the Lockport Light, Heat & Power Company in accordance with the Public Service ...sions law.

... commission recently had a complaint as to rates ... by the New York Telephone Company in Albany ... ...red with those charged in other second-class cities. ... shown in the complaint that whereas an annual rate of $... is charged in Albany for a single-party line, the rate in Buffalo is $84, in Troy, Utica and Syracuse, $60, and in Rochester, $48. It was also shown that the charge ... two-party line in Albany is $66 per year, in Buffalo, ... $48 in Troy, Utica and Syracuse, and but $42 in ...er. The New York Telephone Company, in a ... replying to the commission, admitted differences between rates in Albany and those in the other cities mentioned, but added that these apparent discrepancies are due to the fact that the rates at the other localities are much ... rather than that the rates in Albany are too high.

CURRENT NEWS AND NOTES.

Salt Lake City Electric Show.—An electric show will be held in Salt Lake City, Utah, Oct. 2 to 7, under the direction of the Electric Show Association of Utah. Mr. B. ... Mindenhall, commercial agent of the Utah Light & Railway Company, is president of the association. A feature will be made of special street illumination during the show and prizes will be given for the most original and best exterior lighting displays.

* * *

Grounding the Secondary.—The Denver Gas & Electric Light Company, following two years' of favorable experience with grounded lighting secondaries, is now considering the extension of grounding to three-phase motor secondaries at 220 volts. Fewer personal injuries and transformer troubles have accompanied the grounds now installed, and the management believes that motor secondary grounding will be correspondingly beneficial.

* * *

Feather River Water Storage.—Preliminary work has been commenced by the Great Western Power Company on a project for water storage at the headwaters of the North Fork of the Feather River. It is proposed to build a dam at a point 2 miles below the Big Meadows in Plumas County and thereby overflow about 2500 acres of land at an average depth of 25 ft. By tests made with a diamond drill at this point it is found that the company will have to make an excavation about 50 ft. below the surface to reach a solid foundation for the dam. The dam itself will be 150 ft. above the surface and many hundred feet long.

* * *

Long-Distance Telephone Lines Radiating from Chicago.—With competition, and the prospect of increasing competition, the telephone-service companies of Chicago have become liberal advertisers in the daily newspapers. Some interesting statements are contained in these advertisements. Thus the Chicago Telephone Company asserts that 596 telephone circuits (Bell) radiate from Chicago. Most of these are to comparatively near-by points, there being fifty to Milwaukee, for instance, but there are also direct circuits to New York, Boston, Washington, Denver, New Orleans and other distant cities.

* * *

Public-Utility Tax in California.—A recent report from the State of Wisconsin mentions that it derives 71 per cent of its public income from corporation taxes, and that no Eastern state approaches this percentage of revenues from such source. The State of California presents, however, figures for the present year which show that it will obtain about 85 per cent of its total revenues from corporation taxes. The total of assessed taxes of electric corporations is $2,689,013, distributed as follows: Gas and electric, $1,224,767; electric railway, $1,039,491; telephone, $399,594; telegraph, $25,160. The total corporation tax of the State comes to $10,455,577.92 for the fiscal year 1911.

* * *

Association Island Meeting of Lamp Manufacturers.—Among the papers to be read at a meeting of lamp manufacturers at Association Island, N. Y., on Sept. 6 and 7, will be one by Mr. A. D. Page on the commercial possibilities of tungsten street lighting and one by Mr. E. L. Elliott on the attitude of central stations toward tungsten street lighting. The policy to be pursued in furthering tungsten street lighting will be discussed in a paper by Mr. C. W. Bender. Mr. Bender will also present a paper discussing the relative merits of carbon and tungsten lamps for street-car service. The following papers also will be presented: *Competitive Illuminants for Street Illumination*, by Mr. Ward Harrison; *What the Post Manufacturers Are Doing to Develop This Business*, by Mr. C. L. Eschleman; *What the Reflector Manufacturers Are Doing to Develop This Business*, by Mr. C. O. Baker; *Some Co-operative Suggestions*, by Mr. Philip S. Dodd; *Lamp Testing*, by Mr. P. S. Millar; *Specifications from a Railroad Standpoint*, by Mr. J. L. Minich; *Free Lamp Renewals*, by Mr. Henry Schroeder; *Development of Electrical Service in Rural Districts*, by Mr. Caryl D. Haskins; *Co-operation Between the Lighting, Lamp and Contracting Interests*, by Mr. M. L. Barnes; *The Possibilities of the Development of the Incandescent Lamp*, by Dr. C. P. Steinmetz; *Co-operation in Increasing the Business*, by Mr. Frank S. Price, and *The Central Station and the Lamp Manufacturers*, by Mr. John F. Gilchrist. The following topics will be treated by the speakers indicated: *Association Island*, by Mr. F. S. Terry; *Remarks*, by Mr. C. N. Stone, and *Jovianism and the Electrical Business*, by Mr. W. E. Robertson. On Wednesday evening Fra Elbertus Hubbard will speak on business co-operation.

Sons of Jove at Eastern Point, New London, Conn.—A rejuvenation of the Sons of Jove will be held at the Griswold, New London, Conn., on the afternoon and evening of Sept. 9. Delegations will be present from New York, Boston, Philadelphia, Hartford and other Eastern electrical centers. Information in detail will be supplied by Statesman C. McKew Parr, 342 Capitol Avenue, Hartford, Conn.

* * *

Largest Gold Dredger Electrically Operated.—Gold dredger No. 13 of the Yuba Consolidated Gold Field Mining Company, said to be the largest gold boat in the world, has been placed in operation at Hammonton, Cal. The boat is 135 ft. long and the machinery has a total capacity of 720 hp, including a 300-hp motor used to bring the buckets to the surface. The equipment is entirely electrically operated, energy being carried over the water in insulated cables.

* * *

Meter Technique.—A correspondent sends the following verses, which, unfortunately, technical journalistic technique will not allow to be printed in true poetic measure: "Now, considering what makes the rotor rote, this electrical dope is sure sport. Take one little ampere impressed with a volt, and the two make a rotating torque. But who cares for all the precise technique of what makes watts and why? You are sure of the fact when you recalibrate that a few less watts slip by."

* * *

Electric Hoists in Building Operations.—A large number of office or store buildings are now under construction in Chicago, and in nearly every case electric hoists are in use to lift the steel or other structural material into place. Only a few years ago steam hoists were used almost exclusively for this purpose, but the advantages of the electric motor for this work are obvious, doing away with smoke, dirt and noise in busy streets and at the same time reducing the cost of operation.

* * *

Electricity in Japan.—At the end of June there were 367 different electrical companies operating in Japan, representing a total capitalization of $225,423,000. Plants under construction represent $167,767,000 and projects on which work has not yet commenced call for $53,470,000. Of the latter 127 are electric light and power plants and nineteen electric railways. Of capital advanced by Japanese banks during the past to industrial enterprises, amounting to $15,350,000, more than half ($8,900,000) was to electrical companies.

* * *

Independent Long-Distance Telephone Connections for Chicago.—The Illinois Tunnel Company, which operates the competing automatic telephone system in Chicago, recently rehabilitated, announces that it has made long-distance connections with the Independent telephone lines in DuPage and Kane Counties, Illinois. This will give the subscribers of the Independent company in Chicago connection with Aurora, Elgin, Batavia, Naperville, Geneva and other cities and villages in northeastern Illinois. It is said that this is the beginning of a movement which will connect ultimately the Chicago automatic-telephone users with all the Independent lines of the Central West.

* * *

Pioneer Chicago Turbine Erected as a Monument.—The first 5000-kw Curtis steam turbine installed in the Fisk Street station of the Commonwealth Edison Company, Chicago, and later replaced by one of the ten 12,000-kw units now in use there, has been re-erected in the center of a park plot in the grounds of the General Electric Company at Schenectady, N. Y., to serve as a memorial to the rapid development of the steam-turbine unit applied to central-station service. This pioneer turbine was installed in the Fisk Street station in February, 1903. In its present permanent position in the midst of flower beds at Schenectady, the shell of the barely old unit is fitted with a large bronze plate detailing its interesting history.

* * *

An Economical Indiana Motor.—"An automatic ... which may be used for running machinery without ... of fuel" is reported to be the invention of an Indiana man, Mr. A. C. Rutzen, who is said to have succeeded in keeping fourteen electric lamps alight with his ... "The motor," according to the newspaper man, "somewhat resembles an ordinary compound motor," the resemblance probably having been noted in the construction, which comprises thirty-six steel springs, each 14 in. in length, ... spring being wound while the others are supplying ... to the motor. A 30-hp motor of this type, says the ...tor, can be inclosed in a box 24 in. on a side, and the ... is guaranteed to run until a spring breaks, which m... happen for years!

* * *

The Institute of Operating Engineers.—The f...ing are the papers prepared for the first annual m... of the Institute of Operating Engineers, in the Eng...ing Societies Building, New York, Sept. 1 and 2: *Te...ture Changes and Heat Transmission,* by Mr. Vern... Rupp; *A Boiler-Room Analysis of Coal,* by Mr. J. P. ...ing; *Cooling Towers Versus Steam Pumps,* by Mr. ... W. Geare; *Engine Lubrication,* by Mr. R. D. Toml...; *Reduction of Lubricating Costs in Smelter Power ...,* by Mr. George L. Fales; *Removing Emulsified Oil ... Condensed Steam,* by Mr. Darrow Stage. Addresse... be delivered by Hon. William S. Bennet and Messrs. ... Low, D. B. Heilman, A. C. Dougall, William D. ... James A. Pratt and Prof. Frederick H. Sykes.

* * *

Electrified Children.—Prof. Svante Arrhenius, ... celebrated Swedish authority on physical chemistry ... Dr. Wilhelm Ostwald, the distinguished German au...ity in electrochemistry, and Dr. Oliver Lodge, of ...land, has devoted himself in recent years to the elabo... of philosophical systems and cosmic theories. One of ...fessor Arrhenius' recent theories is that life was s... through the universe by germs driven by the force of ... from one star to another. Another idea has recently ... applied to school children in Stockholm. The wall... ceilings of a schoolroom were lined with a coil of ... through which high-frequency current was passed. ... children in the room were then in the position of an ... core in the center of a magnetizing coil. Fifty ch... were kept in this room, while fifty others of the ... average age, size and mental development were kept ... adjoining room without electrical treatment. It is ... that at the end of six months the children under elec... treatment showed an average growth of 2 in., while ... without electricity grew only 1¼ in. The electrified ...dren showed an increase in weight and other forms ...velopment in proportion to their height. The elect... children also showed an average proficiency in their s... of 92 per cent, and fifteen of them showed 100 per ... The unelectrified children, on the other hand, were ... 75 per cent proficient on the average and not one of ... reached 100 per cent. It is added that the electrified ...dren appeared to be much brighter, quicker and more active. They were prompter in attendance and much less subject to fatigue. The teachers also showed superior working capacity in the electrified room. While there was an odor of ozone in the room, it was held that the presence of ozone would not account for the results observed.

…OMBINATION HEATING AND GENERATING PLANT AT SPRINGFIELD, ILL.

…niqu Features of Flexibility of Equipment in Station of Light, Heat and Power Company.

…BILITY to an unusual degree marks the design …d operation of the interesting plant of the Spring… Light, Heat & Power Company, at Springfield, … station furnishes electrical energy for local light- …tor-circuit purposes and for the street railway, … tion, during the winter season supplies both low- …team and hot-water systems for district heating. …mple non-condensing and compound-condensing … installed, and through motor-generator sets in … the alternators and direct-current generators …gines drive are interlinked so that either class

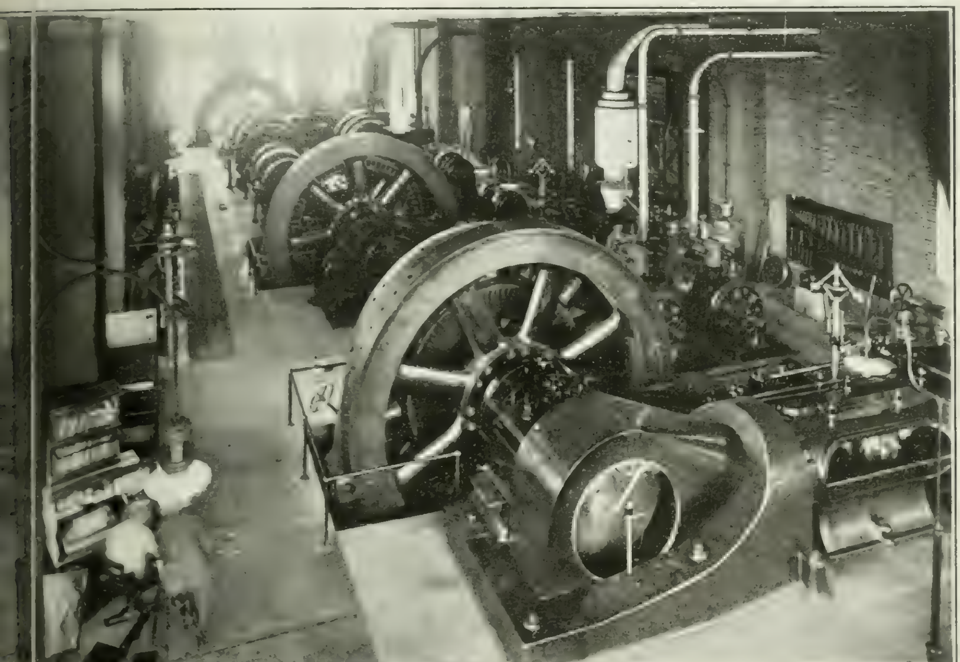


Fig. 1—Interior of Engine-Room. Showing Single and Compound Engine Units.

… service can be carried on either set of engines, accord…g to the demand for power and the conditions of most … operation in connection with the heating require… … of the converting sets, a three-unit outfit …prising a synchronous motor and two direct-current …nerators, can also be applied to such varied duties as …nerating either 250-volt Edison service or 500-volt rail…ay direct current. generating 2300-volt alternating cur…nt, or motoring with overexcited fields to raise the sta…n power-factor.

Normally the large compound-condensing engine in…lled as its condenser supplied with circulating water …om a cooling tower, but under certain conditions it has …en found more economical to connect the hot-water heat…g system to the condenser line, thereby raising the tem…rature of the water and at the same time providing a …nsiderable degree of vacuum to receive the exhaust from …e engine. Manipulation of the controllers of several motor-operated valves returns the engine condenser to cooling-tower operation and connects the hot-water system to special heaters supplied with exhaust steam from the simple non-condensing units. At certain times of the year this transfer is ordinarily made several times during the day as fits the conditions of most economical operation with cooling-tower or hot-water circulation.

A second 1500-kw compound condensing unit similarly arranged for operation either with a cooling tower and condenser, or in connection with the hot-water system, is now being installed and will be operated in the same way as the earlier unit hereinafter described and illustrated. In connection with this extension to the plant property a water-softening plant is also being installed, which is unique in the respect that it will be arranged for treating separately the raw make-up water, the cooling-tower water and the condensation from the various units, the purified effluent being then mixed in the reservoir tank which serves as a common source of supply for all units.

BOILER ROOM.

From a spur track alongside the boiler-room coal is dumped from drop-bottom cars into track hoppers which deliver the fuel to hooded chutes opening opposite the line of boilers. As shown in the illustration (Fig. 2) these chutes extend within 12 in. of the floor, below which the coal lies at its natural angle of repose in position to be easily shoveled into the Green chain-grate stokers with which the ten boilers are equipped. Six of these steam-generating units are of the 400-hp Stirling type, two are of the 300-hp Babcock & Wilcox type, and the remaining two are 500-hp McNaul boilers, the ratio of heating surface to grate area being 44:1. All of the foregoing units are equipped with Williams feed-water regulators.

The flue gases on their way to the stacks are conveyed through two Greene fuel economizers, with a total heating

surface of 21,000 sq. ft. Ordinarily the boilers are operated under induced draft created by two overhung fans, 18 ft. 6 in. in diameter, with 5-ft. faces, and driven by 14-in. x 14-in. adjustable cut-off engines. These engines

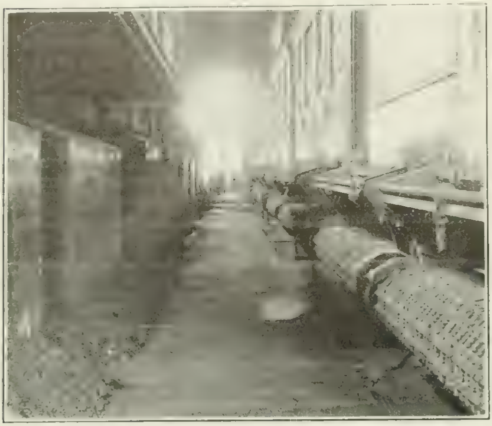


Fig. 2—Interior of Boiler-Room.

are controlled by automatic regulators which vary the intensity of the draft with the demand for steam. In addition to the forced draft there is also provided one reinforced-concrete stack, 200 ft. high and 11 ft. in diameter, which may be used when it is desirable to shut down both fans.

Ashes from the boilers are dumped into small cars running on an industrial-gage track. The cars can be elevated by means of a hydraulic lift to a runway above a spur track from the street railway so that the ashes can be dumped into work cars to be hauled away.

City water treated in the purifier plant is used for boiler-feed purposes. After being brought through the water-regulating valves on the 3000-hp Cochrane open-feed water heaters this water is passed into the water-back header on the basement ceiling beneath the boiler foundations, from which it is returned to the feed-water heater. Water from the hot wells is also passed through these water backs before reaching the heater. Any possible interruption to the supply of water is eliminated by connecting the water-back header to a 50,000-gal. reserve tank so that in case the supply of water from the city mains and the hot wells should be interrupted the tank will furnish sufficient water to insure the protection of the water-backs against overheating. From the feed-water heaters the water passes through the economizer tubes and is thence delivered into the boilers by one 12½-in. x 9¼-in. x 10-in. admiralty-type and two 14-in. x 10-in. x 15-in. vertical duplex pumps. The temperature of the water entering and leaving the economizer is recorded by Bristol thermometers, while the water evaporated is also registered by a Venturi meter.

The water-softening plant which has recently been put into operation at the Springfield station is of the Kennicott type and is declared by the manufacturers to meet a condition quite unique in power-station practice. The purification plant, in fact, consists of three separate water-softening systems, the first of which is capable of treating 20,000 gal. of raw city water per hour, removing from it carbonates and sulphates of calcium and magnesium which are present in the quantity of about 18 grains per gallon. Although the make-up water in the cooling tower is supplied from the softener and contains but 4 grains to 5 grains per gallon, due to concentration resulting from the evaporation which takes place in the tower, the amount of solids in the cooling-tower circulating water i[f] not treated will rise to approximately 8 grains per [g]allon in twenty-four hours' operation. To eliminate thi[s] concentration and keep the hardness of the circulating w[at]er down to a point where fouling of condensing tubes will [no]t occur the second section of the softener is designed t[o] re-treat 6600 gal. of water per hour. The amount of c[ir]culating water which it is thus necessary to re-treat is [a]ppr[oxi]mately equivalent to that which is evaporated in [the tower]. The third section of the softener treats 8000 ga[l. of con]densation water each hour, removing from it oil [and other] impurities. After being separately treated the wa[ter from] the above several sources are mixed together in a[...] tank or emergency supply well, which has a ca[pacity of] 50,000 gal.

ENGINE-ROOM.

Until the completion of the new extension th[e] [...] 68-in. x 48-in. cross-compound Fulton-Corliss eng[ine driv]ing a 1500-kw, 2300-volt, 60-cycle, three-phase [...] (Fig. 3) remains the only unit in the plant arr[anged for] condensing operation, as above outlined. The o[ther non-]condensing engine-driven units are as follows: ([...] x 48-in. Fulton-Corliss engine driving an 800-k[w] [...] volt alternator; one 32-in. x 48-in. engine drivin[g] [...] kw, 600-volt direct-current generator, and one [...] 28-in. Fulton engine driving a 400-kw, 600-vo[lt direct-] current generator.

The 600-volt direct-current and 2300-volt alt[ernating-] current buses are enabled to exchange power thr[ough] [...] 400-kw and one 550-kw motor-generator sets. [...] these sets is of the three-unit type, comprising [...] synchronous motor driving two 250-volt dire[ct-current] generators. Connected in series the generators [are] able to furnish 600-volt energy from the compo[und con]densing engine-driven alternator when the railwa[y demand] is light. Connected in parallel they may also b[e used to] supply the 220-volt direct-current motor service, [...] two additional 2300-volt motor-generators sets, o[...] kw and one of 230 kw rating, are especially [pr]ovided. There are three 30-kw exciters, two of which are [dri]ven by General Electric marine-type engines, the thi[rd] being operated by a 2300-volt induction motor energi[zed] from the alternating-current buses.

The condensing equipment of the large compou[nd] engine

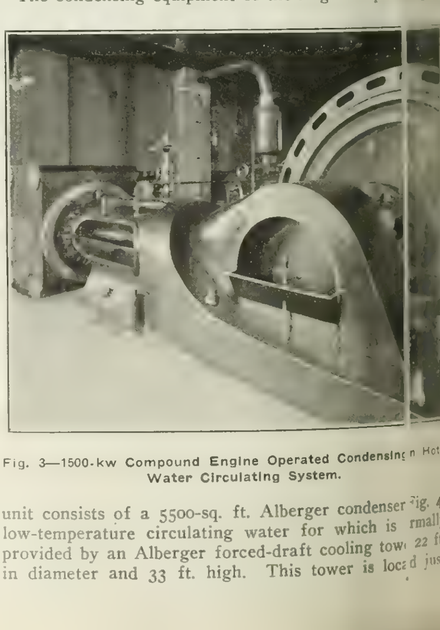
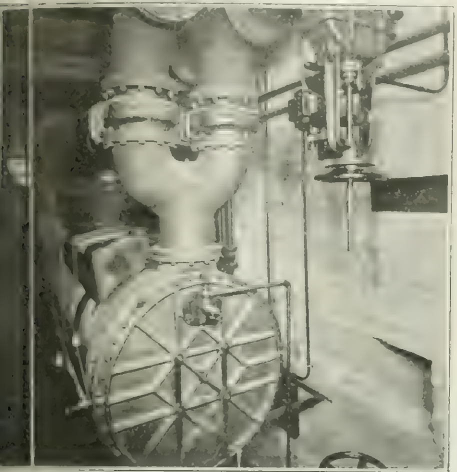


Fig. 3—1500-kw Compound Engine Operated Condensin[g o]n Hot-Water Circulating System.

unit consists of a 5500-sq. ft. Alberger condenser [(F]ig. 4[...] low-temperature circulating water for which is [no]rmally provided by an Alberger forced-draft cooling tow[er] 22 ft. in diameter and 33 ft. high. This tower is loca[te]d just

... of the engine-room wall, and its fan is driven by a 2300-volt adjustable-speed induction motor located ... power house, from which its operation can be ... through a drum-contactor and ... switch. The



... denser for Large Engine, Showing Motor-Operated Valve.

... ondenser is provided with a dry-vacuum pump, ... riven centrifugal hot-well pump and centrifugal ... pump driven by a 2300-volt adjustable-speed in... ...tor. As shown in Fig. 5, the piping of this ... is so arranged that the circulating water from ... g tower may be replaced by circulating water ... hot-water-heating system under certain condi... ...eration, as hereafter explained.

... rage winter daylight load is carried on the non... units as long as the steam demand of the heat... s is great enough to utilize all the exhaust steam. ... n above outlined, the Springfield plant supplies ... st-steam-heating and hot-water-heating systems. ... st-steam service is taken directly from the 22-in. ... der into which the non-condensing units exhaust. ... hot water for the hot-water system exhaust ... from the exhaust header can be passed through ... sq. ft. Baragwanath condensers located under ... f the boiler-room. These special condensers are ... for heating the circulating water of the hot... ...ing system and lack the usual vacuum and hot... s, the condensation returning by gravity to the ... heaters. Hot water can thus be supplied indi... the single-cylinder units during average winter ... nditions.

... he afternoon peak load approaches the compound ... unit is added and the hot-water heating sys... ...ted through the latter's Alberger condenser, the ... the hot-water-heating system from the cool... ...eing effected by six motor-operated valves con... n a switchboard in the engine-room, Fig. 6. ... r the water of the district-heating system then ... perature raised by passing through the conden... same time obtaining a partial vacuum for the ... sure cylinder of the engine.

... circulating water leaving the condenser at a tem... of 150 deg. Fahr., it has been found possible to ... vacuum equivalent to a column of mercury 20 in. ..., although, of course, the vacuum obtainable de... roportionately with the rise of the circulating-... mperature up to 200 deg., at which temperature the exhaust pressure is equal to that of the atmosphere.

In the fall and spring when the heating demand is comparatively light the electric load during the day is carried by the large condensing unit and one of the non-condensing sets. Under these conditions the exhaust from the condensing unit heats the circulating water of the hot-water system, while the exhaust from the non-condensing engine driving the railway generator supplies the steam-heating system. The load between the 2300-volt compound engine-driven generator and the 600-volt simple direct-current generator unit is meanwhile adjusted by the motor-generator sets already mentioned, which divide the demand proportionately to the requirements for steam of the two heating systems.

As the alternating-current load rises and it becomes desirable to increase the output on the condensing unit, further provision is made for tapping steam from the intermediate receiver of the compound-engine unit through an 8-in. reducing valve into the exhaust header which supplies the steam-heating system. Thus practically the full rating may be obtained from the compound unit without impairing the temperature at which the hot-water circulating system would otherwise have to be carried in order to obtain this full load.

Finally, as the lighting peak due to nightfall approaches the circulating water of the hot-water system is by-passed around the Alberger condenser, being replaced by cooled circulating water from the cooling tower already mentioned. The complete layout of the station piping for accomplishing this conversion, which is made about four times daily, is shown in Fig. 5. The six motor-driven valves on the Alberger condenser for controlling the circulating water (one of which is shown in Fig. 4) are manipulated from a panelboard in the engine-room and the conversion can be made without interfering with the engine's operation in the least.

Under peak-load conditions the exhaust steam-heating system is supplied by the single-cylinder units, the circulating water of the hot-water system being heated in one of the Baragwanath condensers. Except in mild weather however, it is necessary to use a great deal of live steam in addition to the exhaust steam released from the engine units. The main steam header is connected to the exhaust header through one 3-in. x 6-in. and two 4-in. x 8-in. Mason reducing valves which lower the terminal pressure to 3 lb. to 10 lb. These reducing valves can be set at the desired terminal pressure, and, although the quantity of exhaust steam varies widely owing to the railway generators, practically a steady head is obtained on the exhaust header, so that the resulting steam demand on the boiler plant is about constant.

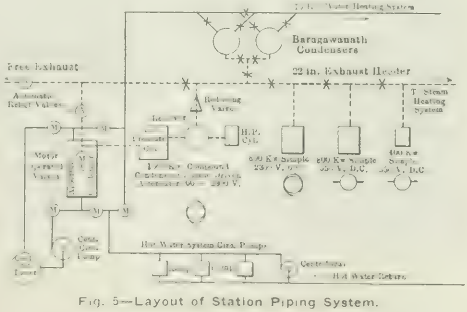


Fig. 5—Layout of Station Piping System.

The number of auxiliaries exhausting steam into the feed-water heater is limited so as to bring the temperature of the water to about 150 deg. Fahr., or above the temperature to produce condensation on the outside of the

economizer tubes. As the demand for steam by the heating system exceeds the supply exhausted by the non-condensing engines, all of the remaining auxiliary steam-using cylinders are arranged to exhaust into the main exhaust header.

The arrangement of interchangeable condensing opera-

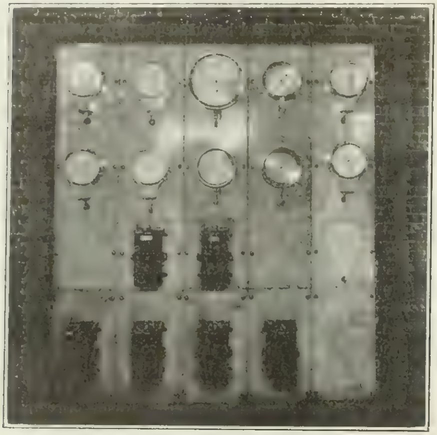


Fig. 6—Gage-Board, with Controllers for Motor-Operated Valves.

tion of the large engine unit on either the cooling tower or hot-water circulating system has now been installed and giving satisfactory service in the Springfield plant for more than three years. The principle of operation was devised by Mr. F. C. Chambers, chief engineer of the company, after a series of tests which convinced him of the economies of condensing operation in connection with the hot-water heating system under the conditions prevailing at certain times in the Springfield station. Evidence of the wholly satisfactory character of operation of this novel scheme is afforded by the conclusion of the company to install the new 1500-kw compound-condensing unit under similar conditions, as already mentioned.

The station switchboard is located along the east wall of

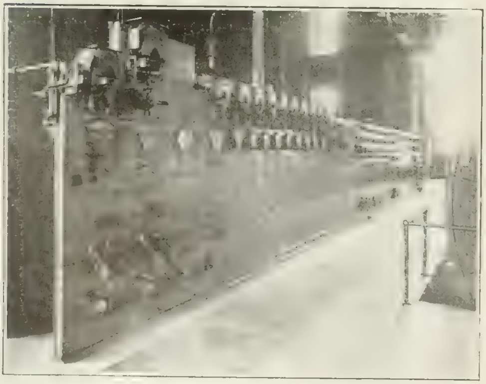


Fig. 7—Switchboard for Railway and Lighting Services.

the engine-room and includes panels controlling both the alternating-current generating and distributing systems, the 250-volt power system and the 550-volt railway system, as shown in Fig. 7. The entire engine-room is spanned by a Pauling & Harnischfeger 20-ton motor-operated crane. The room is illuminated by arc and incandescent lamps hung from bishop's crook and standard fixtures rising from the walls and floor. The power-house structure is of brick with steel-girder supported roof.

DISTRIBUTION OF HEATING SERVICE.

The power plant is located at the extreme southeast corner of the territory served by the heating system. The steam-heating district includes an area in the business section, 3200 ft. x 2000 ft., and has one branch extending 2700 ft. into the residence territory. The mains range in size from 16 in. to 4 in. in diameter and total [illegible] 18,000 ft. of piping, the major part of which is of [illegible] construction. In addition to the 16-in. main [illegible] from the 22-in. power-house exhaust header to [illegible] tribution point, 1800 ft. distant, there is an 8-in. [illegible] line which was originally intended for distributi[ng] [illegible] pressure steam for commercial purposes, but is [illegible] used as an exhaust feeder for the heating system. U[nder] conditions of extreme cold weather the 8-in. line is fed through a reducing valve with a head-end pressu[re] [illegible] aging from 10 lb. to 70 lb. Both steam lines are [illegible] with General Electric steam-flow meters, which [are] read hourly and the total steam passed recorded on [the] station log.

The hot-water heating system serves princi[pally the] residence territory, covering a district very mu[ch] [illegible] than that served by the exhaust-steam lines. Th[illegible] dred and twenty thousand sq. ft. of radiation are [illegible] to the hot-water system, which comprises about [illegible] of double mains, 12 in. to 3 in. in diameter. Th[illegible] are buried 4 ft. below ground in triple wood box[es] [illegible] air spaces between boards, the space surrounding [illegible] being filled with oiled shavings. The mains are d[illegible] tile pipe connected to the city sewers. As in th[illegible] the steam-heating system, the cost of service lin[es] [illegible] for by the consumer and service is furnished on [illegible] system for the heating season, approximately 25[illegible]

The older customers' installations are of the c[illegible] and there are also a number of gravity systems [illegible] lated-plant boilers having been disconnected. N[illegible] lations are of the double-pipe system, controlled b[y] [illegible] stats, air for operating which is furnished from [illegible] ground compressed-air pipe paralleling the mai[n] [illegible] The hot water for the systems is circulated by on[illegible] 16-in. x 18-in. Laidlaw-Dunn-Gordon duplex p[illegible] similar 14-in. x 12-in. x 18-in. pumps and one [illegible]

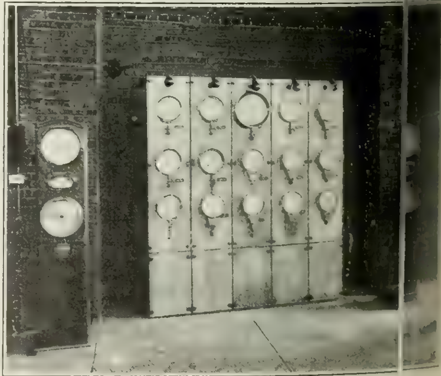


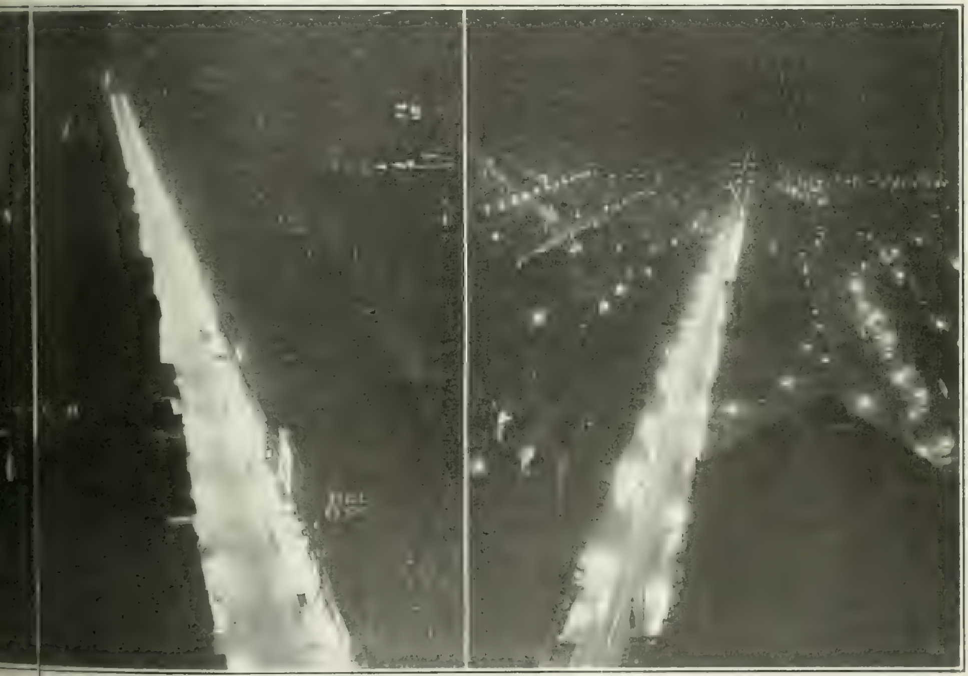
Fig. 8—Gage-Board and Recording Venturi Met[er].

trifugal pump driven by a 175-hp adjustable-spe[ed] direct-current motor. An indicating Venturi meter, [Fig.] 8, [is] used to determine the amount of water circulate[d].

The pumps at the station create a differentia[l] pressure of 60 lb. between the supply and return hot-w[ate]r lines. To avoid nearby installations receiving a greate[r] quantity

circulating water than those in the outlying district, ... the differential pressure falls to only 3 lb. or 4 lb. ... of steel-tube orifices has been worked out by Mr. ...ers, chief engineer for the company, details of ... were given in a paper read by him before the ...tral District Heating Association convention in Pitts-... June.

The orifices were first made up in the form of per-... metallic disks to be inserted in unions in the re-... the openings being proportional to the amount ... required and inversely proportional to the ... pressure. An account of the experiments made ... the amount of water passed through various-... is given in Mr. Chambers' paper, together ...es showing the results obtained. The original ... of installing disks, however, was found to pro-... whistling effect, which sometimes proved annoying ...ers. A number of experiments were then made ...s of different materials and with tapered and ...k orifices. Trouble was also experienced with ... orifices enlarging with use due to erosion. ... experiments then showed that a short piece of ... replace the disk orifice in the return pipe with-



Figs. 1 and 2—Market Street, Philadelphia. Looking East and West from City Hall Tower.

...ing noise. The opening required was found to be ... same as that for the disk. The tubes are made ...-rolled steel, the outside diameter being turned ...ded to the pipe size and an opening being drilled ... the solid block of a diameter proportional to the ... of water to be passed. The installation of these ...ples had the effect of reducing the quantity of ...ter pumped about 35 per cent and also raising the termi-nal pressure at outlying districts. The paper by Mr. Chambers above alluded to also shows some interesting results of the saving effected by thermostat-controlled heating services, resulting in a saving of about 60 per cent of the water otherwise required to be circulated without the thermostat.

Mr. B. C. Cobb is president of the Springfield Light, Heating & Power Company, Mr. A. A. Anderson is manager, Mr. Warren Partridge is general superintendent, and Mr. F. C. Chambers is superintendent of the power and heating departments.

DOWNTOWN ARC-LIGHTING SYSTEM OF PHILADELPHIA.

Installation of Twin-Arc Ornamental Posts on the Principal Thoroughfares of the Quaker City.

UP to Jan. 1, 1910, the city of Philadelphia was lighted by over 12,000 9.6-amp constant-current open-arc lamps, those in the central portion of the city being located approximately 200 ft. apart, while those in the suburban districts were spaced from 400 ft. to 500 ft. The service was furnished from five stations located in various parts of the city and containing for the most part synchronous motor-driven 125-light Brush arc machines. The circuits were made up of groups of 125 lamps, the lay-out being so arranged as to minimize the amount of wire and also readily to locate trouble. The older method of lighting still obtains throughout the greater part of the city, but since the early part of January, 1910, when the new system of lighting was installed on Market Street, east of City Hall, the Philadelphia Electric Company has been engaged in extending it, so that eventually it will take in all of the principal business thoroughfares.

At the present time the new system of ornamental arc-

post lighting is in use on Market, Chestnut and Walnut Streets from Delaware Avenue to the Schuylkill River; on Arch Street from Delaware Avenue to Twenty-first Street; on Broad Street from Vine Street to Spruce Street and on the main streets in the immediate vicinity of City Hall. Besides the 556 twin-lamp posts now in service 287 new ones will be installed this year, on Broad Street from Vine Street to Girard Avenue; on Girard Avenue from Broad Street to East Norris Street, on Spring Garden Street from Fifth to Twelfth Street, and on Broad Street from Moyamensing Avenue to League Island Park (Southern Boulevard). Extensions will be made in the future on Broad Street north from Girard Avenue to the city line and on Broad Street south from Spruce Street to Moyamensing Avenue. In addition the company is at present engaged in hanging lamps between columns of the elevated structure on Market Street from the river to Sixty-third Street. The columns of the elevated structure are spaced approximately 50 ft. apart and the lamps will be staggered on both sides of the roadway, giving a spacing of 100 ft. between lamps on either side. This work will require 7 miles of iron conduit, 88,000 ft. of No. 6 rubber-covered and lead-covered cable, and 358 lamps and lamp brackets. This new system replaces the old mast-arm system in use in Philadelphia since the early nineties.

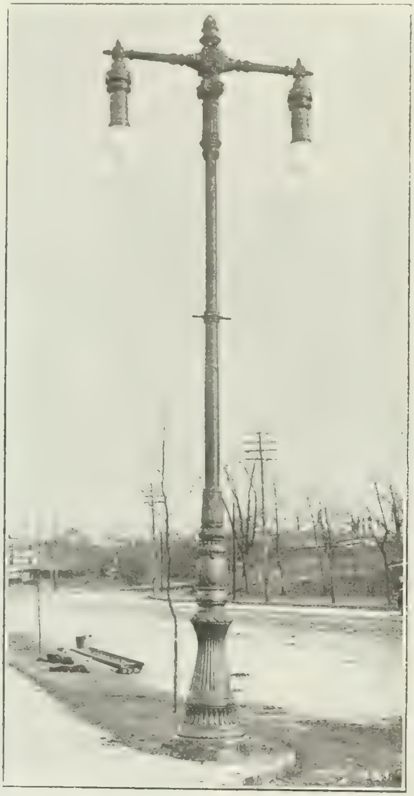


Fig. 3—Philadephia Twin-Arc Post.

The new system of lighting is the result of a number of campaigns of business men's associations for more light. Market Street east of City Hall being the main shopping district of the city, it was only natural that it should receive first consideration and a greater number of lamps than the other thoroughfares. In that section of the city th orna mental posts, each of which has two arc lamps, are ocated on the Market Street curb lines at all intersecting reets The distance between corner lamps was divided int hirds, at which points the intermediate lamps are placed Each block in the shopping district has, therefore, four its, or eight lamps, on each side of the street. On th other thoroughfares the lamp-posts are staggered instea of being placed opposite each other, so that each block the number of lamps. On Broad Street isles of saf twin lamps are erected at its intersection with the ing streets: Spruce, Locust, Walnut, Chestnut A Cherry, Race, Vine, Wood, Callowhill, Hamilton,

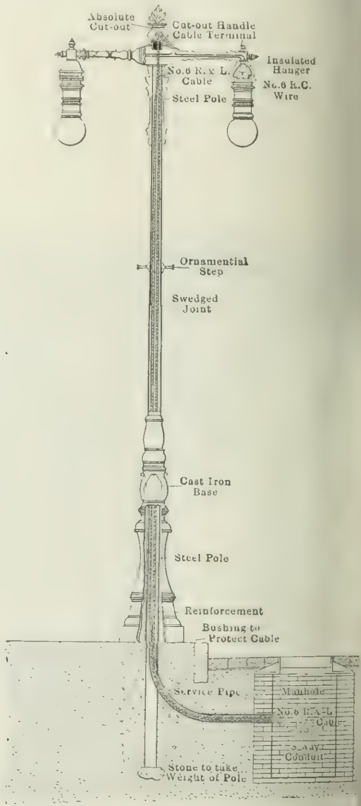


Fig. 4—Details of Post and Connections.

Garden, Brandywine, Green, Wallace, Melon, Fa mount, Brown, Parrish, Poplar and Girard Avenue. Th slands are in the center of the roadway and on an exte of the house line of the intersecting streets.

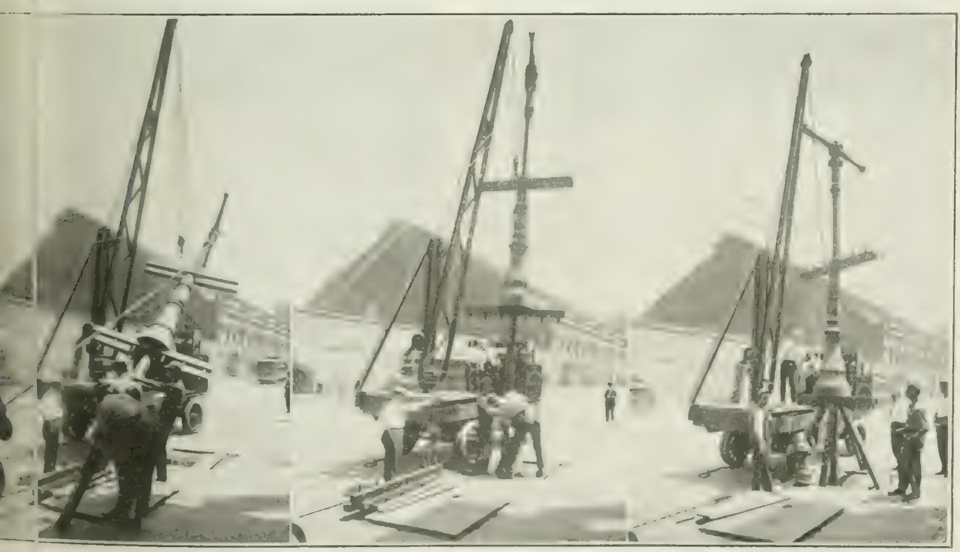
The post shown in detail in Fig. 3 is the res of a prize offered by the T-Square Club for the best iginal design of a twin lamp-post. The pole proper is de of two lengths of steel pipe, the lower section of 5 pipe and the upper section of 4-in. pipe with a swedg joint between. A reinforcing sleeve 2 ft. long and e nding 6 in. under ground when the post is set is place at the ground line to insure longer life to the pole. A sl 3.5 ft. long and 3.5 in. wide is cut in the base of the lowe ection to allow the service pipe to enter the pole. The s l pol weighs approximately 300 lb. The ornamental ba, 8 ft. high, 27 in. lower diameter and 8 in. upper dia ter, is cast in one piece and weighs 1100 lb. When in p e it is

...ed at the top with a compound and at the base by a ... washer to prevent surface water or rain rusting ... covered parts of the post. The top fitting or lamp ... weighs approximately 350 lb. and serves to spread

...g. 5—Broad Street from City Hall Tower.

Fig. 6—Shopping District on Market Street.

... 6 ft. It is made in a number of pieces in order ... be conveniently wired. The entire pole is set ... and surrounded with an envelope of concrete about ... diameter for a distance of 4.5 ft. below the ground. The lamps, which are hung so as to bring the center of the globe 18 ft. above the sidewalk, are of the broad-carbon,



Figs. 7, 8 and 9—Method of Erecting Twin-Arc Posts in Philadelphia.

...en-arc type manufactured by the Philadelphia Electric ...pany itself. A slight change was made in the design of the lamp case in order for it to harmonize with the general lines of the pole. Each lamp is fitted with a 3-in. x 5-in. x 5/8-in. upper electrode and a 3-in. x 5-in. x 5/16-in. lower electrode. The power consumption is 480 watts and the lamps are trimmed every thirty hours. There is an absolute cut-out provided on each pole so that the lamps can be inspected at any time. The cable is continuous from lamp to lamp, without splices, and ends at the top of the pole in a specially designed terminal amply protected by compound. From the cut-out, which is shown in Fig. 4, direct leads run to the lamp. The circuits are arranged so that the lamps on poles directly opposite on Market Street are fed from different machines and each adjoining pole on the same side of the street is on a different circuit, so that should one circuit fail half of the lamps on the thoroughfare would remain lighted.

As the poles are not equipped with steps, means had to be provided for trimming the lamps. At first a 24-ft. two-section ladder was set on a quadrant and arranged on an ordinary express wagon so that it could be swung to either side or made to assume an upright position. While this arrangement answered the purpose it necessitated the services of a horse and driver in addition to the arc-lamp trimmer. An electric tower wagon of special design was then evolved by Mr. A. H. Manwaring, arc-lighting engineer of the company. This wagon can be operated from either the upper platform or the driver's ordinary position, and is equipped with a turntable at the top, enabling the operator to trim the lamps on both the street and house sides of the poles. The wagon is constructed on an ordinary 500-lb. chassis, the weight of which, without the tower and including the battery, is 2600 lb. The weight of the tower is 650 lb. The vehicle is equipped with a forty-two-cell, seven-plate Philadelphia storage battery, which will furnish energy to drive it at an average speed of 15 miles an hour and has a mileage capacity of 30 miles a charge. The controller is mounted on an upper platform and can be operated from either the upper or lower seat by a tube outside the steering shaft. The reversing mechanism is a two-slot bushing, keyed on a controller tube which is worked from the upper seat by the foot and from the lower seat by the hand. The steering gear is mounted in the usual manner and is worked from the upper or lower seat by a shaft which runs through the controller. The brakes may be operated from the lower seat by a foot lever in the usual manner and from the upper seat by a foot-lever rod and crank. The upper foot lever has an extension, enabling the operator to set the brakes from the top seat and to climb down and release the brakes from the lower seat, or vice versa. The electric gong is operated from either the upper or lower seat by a floor push in the toe-board. The platform is 13.5 ft. from the ground and by hanging a portable stand from the side rails the height can be increased to either 14 ft. or 15.5 ft., depending on which rail is employed. A test of the stability of the vehicle was made by suspending a 700-lb. weight from the end of the platform when it was turned in the position occupied by the trimmer in trimming the lamps. This test was made before the battery was installed, so that the tower wagon, under the most severe working conditions, has a very large factor of safety. By means of the automobile the trimmer covers his route in approximately six hours, whereas by the older methods nine hours were required to accomplish the same results.

The inspection of the lamps heretofore necessi... stationing of a horse-drawn wagon and driver at a centrally located point and also the use of a motor-cycle, the ... of which covered the district lighted by the or... lamps in about four hours. The latter reported ... lamps to the driver, who would proceed to the vari... tions with the wagon to start or change the defecti... Since the electric automobile has been installed t... been no further necessity for the horse-drawn w... the motor-cycle, all lamps on ornamental posts ... spected in approximately two and one-half ho... faulty lamps started or changed by the operat... carries a number of lamps for this purpose on t... mobile. The method of trimming or inspecting t...

Figs. 10 and 11—Arc-Lamp Trimmer's Automobile and Its Application.

mental lamps shows a daily saving in the cost of transportation and labor of approximately 33⅓ per cent over the former method.

In installing the ornamental posts a 3-ton electric truck equipped with a winch, driven by energy from the battery on the truck, is employed. On the rear of the truck a portable derrick, having a lifting capacity of 1 ... from the center of the boom, is installed. The ba... arc lamp-post is held in position by the clamps, ... in Fig. 7, and a sling is fastened to the center of ... post, as indicated in the engravings. The pole is t... bodily and warped into position by the erecting cr... after which the concrete is poured about the base; the underground cable connections having been first drawn into the posts.

Needless to state, the displacement of three ...-watt lamps by sixteen lamps having the same power consumption, on Market Street, east of City Hall, and ... eight lamps on the other business thoroughfares, was quite a transformation in the lighting of the section contiguous to City Hall. Views are given herewith of some of the main streets, taken from City Hall tower, approximately 500 ft. above ground, from which some conception of the present lighting of these thoroughfares may be formed.

...LECRICITY IN THE LACKAWANNA VALLEY, PENNSYLVANIA.

...enerating and Distributing System of the Scranton Electric Company.

...ON, which is the third largest city in Pennsylvania, has a population of approximately 130,000 ...gh it is best known as the seat of the great ... coal industry, it is the second silk-manufacturing ... United States and the thirty-sixth in the value of ... products. Prior to ... service was supplied ... of electric-generating ... these and a number of ... in the Lackawanna ...re consolidated in 1907 when ... into the control of the ...s & Electric Company. ... Electric Company at ...ver three electric-light- ...ic live-steam heating com- ...f which were struggling for ... One of the companies was ... a combined direct-current ...phase, 1000-volt system, to- ... an extensive series arc- ...stem. Another of the com- ...perating a two-phase, 4000- ... while still another was ...-2300-volt, three-phase, ... system. In com- ...ree generating companies ...ded to retain the 400-2300- ...phase, 60-cycle Y-connected ... all distribution except in the ...d of the city, where, owing ...rge number of motors of all sizes in use, it was ... employ a three-wire, 110-220-volt system; con- ... old plant of the Scranton Illuminating, ...t & Power Company, on the Lackawanna River, ...me end of the business section of the town, was built and sufficient apparatus installed to take care of ... downtown section of the city. The installation

Fig. ...—...ntown Station of the Scranton Electric Company.

...this station at present comprises one 3000-hp twin Cor...s engine connected to a 2000-kw, 250-volt direct-current ...enerator and two 500-hp cross-compound Ball engines, ...ch of which drives two 135-volt direct-current genera...rs arranged to work on either side of the three-wire system. There are also located in this station a three-unit motor-generator set, consisting of a 1500-kw, 4000-volt synchronous motor direct-connected to two 750-kw, 135-volt generators, and two No. 12 Brush arc machines direct-connected to a 4000-volt induction motor. The latter supply all of the arc lamps in the center of the city. The boiler plant consists of six 500-hp Stirling water-tube boilers fitted with Dutch ovens for burning culm.

Located about eight blocks east of this steam station is a direct-current substation containing two 500-kw motor-generator sets, which feed energy directly into the center

Fig. 2—Map of Territory Served by Scranton Electric Company.

of the three-wire network. Within the past two years all of the wires in the business section have been placed under ground with the exception of wires on some few streets, which will be taken care of this year.

It is so arranged that the steam apparatus in the generating station in this downtown district is closed down during the summer months, the energy being supplied from the motor-generator sets in the plant and in the substation. The alternating-current energy for the motor-generator sets in the station and in the substation is supplied during these months from the main station, formerly owned by the Suburban Electric Light Company.

The main station of the system is that formerly owned by the Suburban Electric Light Company and is located on Green Ridge, a suburban section of the city about 1½ miles from the business center. At this place the company owns 100 acres of land beneath which coal is mined and conveyed directly to the boilers. On the site are also numerous banks of culm, deposited there several years ago when there was no market for the smaller sizes of anthracite coal. The Suburban station at the present time contains one 2000-kw engine-type unit, two 500-kw turbines and one 1500-kw condensing turbine, all operating on a 4000-2300-volt, three-phase, 60-cycle Y-connected system. Early during the present year work was commenced on the remodeling of this station and the installation of one 5000-kw turbine and one 2000-kw engine-type unit. The twelve No. 12 Brush arc machines, at present driven by two 500-hp Erie engines in this station, will be driven by motors when the contemplated improvements are completed. The boiler plant comprises four 600-hp Edge Moor, four 500-hp Stirling and six 400-hp Heine water-tube boilers, all fitted with Dutch ovens.

Exhaust steam for heating purposes is supplied from both of the above-described stations during the heating season, which covers practically eight months of the year.

Until last year this steam was furnished from five live-steam plants located in various sections of the city. The steam-heating system comprises over 11 miles of mains to which are connected various residences and business houses, totaling approximately 700,000 sq. ft. of radiation. The engines in both the generating stations are given sufficient electrical load to meet the demand for steam heating.

Any electrical load in excess of that required to produce sufficient steam for the heating load is taken care of at the condensing unit at the main station, consequently when the heating season is over the Suburban station is operated condensing. Connections are provided so that in case of emergency the engines which operate on the heating system during the winter months can be run as cross-compound units for peak loads in the summer.

The company also has an emergency connection of 5000 kw with the Hampton plant of the Delaware, Lackawanna & Western Railroad Company whereby energy to that extent can be interchanged, the railroad company

Fig. 3—Suburban Plant with Culm Pile at Rear.

using considerable electricity for mining purposes from 7:30 a. m. to 4:30 p. m., whereas should the electric company require an addition of 3000 kw in the evening it is available at the Hampton plant of the railroad company. Should the railroad company require energy during the day the electric company has sufficient spare apparatus during the day for that purpose.

As stated, the population of Scranton proper is approximately 130,000, and the Lackawanna Valley is thickly populated, so that within a radius of 12 miles of the city there reside in the small cities and boroughs half a million people. Built squarely against the city of Scranton and recognized by the postal authorities as a part of the town is the largest borough in the State, Dunmore, having a population of 20,000.

The lines of the Scranton Electric Company cover practically every town in the Lackawanna Valley, extending 8 miles to the south and 27 miles to the north of the city proper. Twenty miles north of Scranton is the thriving city of Carbondale, with a population of 15,000. Here are also extensive mines, silk mills, iron works and several other diversified industries. The city of Carbondale has the distinction of placing the first hard-coal mine in operation some fifty years ago.

As previously stated, the Scranton Electric Company is owned and operated by the American Gas & Electric Light Company, 30 Church Street, New York City, of which Mr. G. N. Tidd is vice-president and general manager. Mr. Duncan T. Campbell is the general manager of the company at Scranton and Mr. D. C. Shain the general superintendent.

OBSERVATIONS ON THE EFFECT OF THE LIGHT OF THE MERCURY-VAPOR LAMP ON THE EYE.

By Charles H. Williams, M.D.

In an investigation of the effect of the light from the mercury-vapor lamp on the eyes of those working under such light twenty-eight cases were examined, divided into four groups, as follows:

1. Eight cases of men who worked all day under unusual conditions of exposure to the light.

2. Twelve cases of draftsmen who have part of their work by daylight and part under the lamp.

3. Six cases of garage employees who work at night with the lamp for their light.

4. Two cases of women who work all day with the light in a photographic printing-room.

In examining these cases the acuteness of vision was measured in each eye separately with Snellen's let- ters at a distance of either 5 m or 20 ft. The c— of the interior of the eye, the optic nerve and ret— examined with the ophthalmoscope, with the — image and also with the upright image, using a — 16-cp incandescent lamp for the illumination, and — condition of the refraction of the eye was measured approximately by the ophthalmoscope, using the upright image. The color sense was tested with a full set of Holmgren's worsteds with tags, such as is often used in railway service, and also with the Williams lantern using three lights with medium-sized opening and full current through the lamps of the lantern. In some cases a spectroscopic examination was also made.

The first group of eight cases included five men who have worked from two to eight years in the testing-room of the Cooper Hewitt Company exposed to the — of scores of tubes on the testing racks; one man who has worked three years in Germany in the laboratory experimenting with the lamp and three years in similar work here, and two men who have done office work under the lamp for five and six years respectively. Their record is as follows, the tests being made during or just after the working day:

1. Twenty-six years old, has worked for seven years in the lamp-finishing and testing-room of the Cooper Hewitt Company. Vision without glasses, 5/5 (normal) in each eye. Fundus (optic nerve and retina) normal in each eye. No appreciable amount of near or far sightedness or astigmatism—that is, refraction normal. Reaction of pupils to light good. With the Holmgren worsteds he selected three confusion colors with the greens as looking like the green-test skein, and one confusion color with the reds with the rose-test skein. With the lantern he made no confusion of red and green, but he confused the greens and reds with the blues.

2. Twenty-one years old, has worked in the testing-room for three and a half years. Vision without glasses 5/5 + in each eye. Fundus normal in each eye. Refraction normal. Reaction of pupils to light normal. With the Holmgren worsteds he selected one confusion color with the greens in the test with the green skein and four confusion colors with the reds when tested with the rose-test skein. With the lantern he confused red and green a number of times and also confused red and green with blue.

3. Thirty-six years old, has worked testing the lamps for eight years. Vision without glasses 5/5 — in each eye. Fundus normal in each eye. Refraction normal. Reaction of pupils to light normal. With the Holmgren worsteds he selected four confusion colors. With the lantern he confused reds and greens, and also often called green blue. Similar mistakes were made when the tests were made in the morning and in the evening.

4. Twenty-two years old, has worked in the testing-department. Vision without glasses 5/5 right eye 5/5 —

... Fundus normal in each eye. Refraction nor... no reaction of pupils to light. With the Holmgren ... one confusion color was selected, and the selection was hesitating. With the lantern there was no con...usic of red and green or blue. With the spectroscope there was quite a broad neutral zone in the blue-green ...

5. Twenty-one years old, has worked two years in the ...-room. Without glasses vision was 5/13 in the right ... 5/20 in the left eye. He has never used glasses, ... ophthalmoscope showed a myopia (near-sighted... considerable amount—between two and three ... in each eye—which accounted for the diminished ... of vision at 5 m distance. The ophthalmoscopic ...n showd a normal fundus in each eye. The ...e slightly larger than normal, with a moderately ...ion to light. With the lantern only a few minor ... were made with the colors, mostly with the blue-...fusion.

... been doing clerical work for the past five years, ... mercury-vapor lamp for the larger part of each ...n without glasses 5/5 in each eye. Fundus and ... normal. With the green-test skein of the ... worsteds he made no mistakes, but with the ...kein he selected four confusion colors.

... done office work under the lamp for the past six ... has some myoptic astigmatism and with his ...e vision is 5/5 — in the right eye and 5/5 in the left. The fundus is normal. He made no mistakes with the Holmgren worsteds and with the lantern made ... minor errors, confusing green and blue.

... worked in German laboratories experimenting ...ght for three years and for the past three years ... work in America. Vision in each eye 5/4 (a ...r than the average normal acuteness of vision). ...d refraction normal.

... second group of cases, as follows, consisted of ... working in an office lighted for part of the day ... mercury-vapor lamp.

1. ...ty-six years old, has worked one season. Vision without glasses, right eye less than 20/70 of normal and left eye 20/20 normal. The ophthalmoscopic examination ...t the poor vision of the right eye is due to old ... changes in the central macular region of the ...ich he said dated back to 1904, before he began to work with the lamp. In the left eye the fundus is normal. With the Holmgren worsteds he readily picked out twenty-one greens as similar to the green-test skein and five reds as similar to the rose-test skein without any mis...

2. Thirty-three years old. With his glasses acuteness of vision was 20/20 in each eye. Fundus normal. Selected seventeen greens with the green skein and eight reds with the rose skein without mistake.

3. Thirty-nine years old, has worked four seasons under ... With his glasses vision 20/20 in each eye. ...rmal. Selected seventeen greens with the green skein and eleven reds with the rose skein without mistake.

4. Forty-two years old, has worked four seasons under ... Without glasses vision is 20/20 — right eye, ... eye. There is a very slight myopia. Fundus ... Selected twenty-one greens with the green skein and ten reds with the rose skein with no mistakes.

5. Thirty-two years old, has worked three seasons under the lamp. Vision with his glasses 20/20 in each eye. Fundus normal. Selected seventeen greens with the green skein and eleven reds with the rose skein without mistake.

6. Forty years old, has worked three seasons under the lamp. Has some myopic astigmatism for which he uses glasses. With them vision is 20/20 in each eye. In the right eye there was a slight haziness in the outline of the optic disk; in the left eye fundus normal.

7. Twenty-five years old, has worked two seasons under the lamp. With his glasses vision is 20/20 in the right eye and 20/20 — in the left. Fundus normal in each eye. With the green skein he readily selected eighteen greens and with the rose skein ten reds, without mistakes.

8. Forty-five years old, has worked four seasons under the light. Without glasses vision is 20/20 in each eye. There is a slight myopia, uncorrected by glasses, and a slight congestion of the retinal veins, but otherwise a normal fundus. There was a slight hesitation in the selection of the colors which resemble the green-test skein, but he picked out seventeen greens and with the rose skeins seven reds, without mistake.

9. Thirty-five years old, has worked two seasons under the lamp. Vision and fundus normal in each eye. He selected twenty green skeins with the green and eight reds with the rose-test skein, without mistake.

10. Fifty-three years old. Has some hyperopia in each eye so that without glasses the vision is 20/70 of normal in each eye, but when tested the next day with his distance glasses the vision came up to normal 20/20 in each eye. Fundus normal except disks very slightly paler than normal, but not enough to be considered abnormal. He selected eighteen greens with the green skein and eight reds with the rose skein without mistake.

11. Twenty-seven years old, has worked two seasons under the lamp. Vision normal 20/20 in each eye. Fundus normal. Selected nineteen greens as like the green skein and twelve reds with the rose-test skein without mistake.

12. Thirty-four years old, has worked four seasons under the lamp. Vision without glasses 20/20 — right eye and 20/30 — left eye. He has a slight uncorrected hyperopia in each eye and a slight congestion of the retinal veins of each eye. Color sense normal.

In the above second group of cases all the ophthalmoscopic examinations were made first with the inverted image and then with the upright image. The color sense was tested with the Holmgren worsteds in clear daylight.

In the third group the examinations were made at night, the men being taken singly from their duties in a garage where they worked at night cleaning automobiles under the mercury-vapor lamp. The color tests were made only with the lantern.

1. Forty-five years old. Vision without glasses 5/50 right eye, 10/50 left eye. The ophthalmoscopic examination shows a very considerable amount (four to five diopters) of myopia with some astigmatism, for which he has never used glasses. Fundus normal. Color sense normal.

2. Thirty-nine years old. Vision 20/20 in both eyes. Fundus and refraction normal. The only mistakes he made in color were the confusion a few times of green and blue.

3. Thirty-eight years old. Vision without glasses 20/30 right eye, 20/40 left eye. Moderate myopia. Fundus normal in each eye. He made a very few mistakes in color, generally a confusion of green and blue.

4. Thirty-seven years old. Vision 20/20 in each eye without glasses. Fundus and refraction normal.

5. Thirty-seven years old. Vision without glasses 20/20 in each eye. Refraction and fundus normal. Slight confusion of blue and green.

6. Twenty-two years old. Vision 20/20 in each eye. Fundus and refraction normal, also color vision.

In the fourth group of two cases of women working all day printing photographs by the light, it was possible to make a much more careful examination, for they came to the writer's office, where the tests were made, directly after leaving work in the afternoon and again before going to work the next morning.

1. Nineteen years old. 5:30 p. m. Has worked with the mercury-vapor lamp for the past seven months. Vision without glasses 5/4 — (a little better than the average normal) in each eye. Fundus and refraction normal, also action of pupils to light. When tested with the Holmgren

worsteds with tantalum-lamp illumination she selected nine green skeins as similar to the green-test skein and four reds with the rose-test skein. With the lantern the only mistake was calling a light-green yellow. With a spectroscope arranged so as to light the upper half of a slit in the eye-piece with light passed through a filter which allowed only the red and green rays to pass, and the lower half with light from a prism which could be slowly moved by the observer so as to match the color in the lower half of the slit to that in the upper half, she set the prism so that the scale of the instrument read 67, 109 and 45 (average, 73). When again examined the next morning at 8 a. m. the acuteness of vision was nearly the same, 5/4 in each eye, fundus normal. In clear daylight she picked out ten green skeins as similar to the test skeins and four reds as similar to the rose skein. With the lantern the only mistake was calling the yellow white and the white orange once. With the spectroscope, however, she made four settings to match the same mixture of red and green in the upper half of the field, and the readings were 59, 59, 69, 65 (average, 63).

2. Eighteen years old. 6 p. m. Has been working three summers and all the past year in the same room printing photographs with the mercury-vapor lamp. Vision without glasses 5/5 — in each eye. There is a small amount of myopic astigmatism, 3/4 diopter in each eye, and the fundus shows a slight hyperæmia of the optic disks in each eye, probably due to the uncorrected astigmatism. With correcting glasses the vision comes up to 5/5 in each eye. With the worsteds under tantalum-lamp illumination she selected nine greens with the green-test skeins and four reds with the rose skein. She made no mistakes with the lantern. With the spectroscope arranged as in the last case she made three settings, 105, 81 and 72 (average, 86). When examined again the next morning at 8:30 the results were the same as above except that the spectroscope readings were 64, 64, and 60 (average 62).

The principal thing to be noted in these two cases is that at the end of a day's work under the mercury-vapor lamp there was a fatigue in the perception for green, so that in the first case the average of three settings was seventy-three and in the second case eighty-six, but after a night's rest the average in the first case was sixty-three and in the second sixty-two. That is to say, the color of the spectrum which was chosen in the lower half of the opening to match the fixed mixture of red and green in the upper half of the slit stood more in the green at the end of the day's work, and the next morning it stood in its normal position as judged by comparison with other observers, when the effect of the fatigue to this particular color had passed away.

The greater amount of green produces an added temporary fatigue of the eye to the recognition of this particular color, which disappears the next morning. In order to determine where the setting of the spectroscope for the lower half of the field would come in supposedly normal eyes to match the chosen mixture of red and green in the upper half of the field, settings were also made by Professor Cannon, Mary Phelan, office attendant and the author, as follows: Professor C., 60, 61, 60, average 60; M. P., 60, 59, 61, average 60; C. H. W., 61, 62, average 61.5.

From this it appears that the average of these three observers is very nearly that of the last two cases mentioned above when tested in the morning, or 63 and 62 respectively.

In comparing all the cases examined the fact which stands out most distinctly is that in no case does a careful ophthalmoscopic examination show signs of trouble with the optic nerve or retina which cannot be more properly attributed to other causes. Of the twenty-eight cases twenty-three showed a normal fundus. One case had old changes in the macula region of one eye antedating the use of the lamp, with the fundus in the other eye normal. Three cases showed a slight congestion of the retinal ... probably due to uncorrected errors of refraction. ... case there was a slight haziness in the outline of the ... disk in one eye, with some myopic astigmatism, and ... fundus in the other eye. In no case was any pathological change found in the crystalline lens or the trans... media of the eye, not even where there had been ye... work under the most trying conditions possible, ... the men were day after day facing the glare of ... of lighted mercury-vapor tubes on the racks of the t... room.

Immediately after leaving work under the mercur... color fatigue was clearly observable, as was to ... pected. This was slight at the junction of red and ... the yellowish and green lines of the mercury sp... apparently tiring the red and green sensations ... equally, and was chiefly observed at the blue-green ... tion where the greater fatigue of the green came int... The fatigue is merely temporary, as is well shown ... last two cases described, and was least noticeable in ... of the cases who had worked longest under the ligh... the eye had acquired a certain degree of immunity ... unusual stimulus.

Except for this temporary color fatigue none ... cases showed any effects whatever ascribable to the ... nation under which they worked.

The thanks of the author are due to Dr. Louis E... effective co-operation in the examinations for color... ness.

DIVERSITY FACTOR.

As already noted in these columns, the Doherty medal for the best paper read before any N. E... company section in 1910 was awarded at the ... national convention to Mr. C. J. Russell, of the ... delphia Electric Company. The title of Mr. R... paper, which was presented before the Philadelphia N. E. L. A. company section in April, 1909, is "Load Factor, Diversity Factor and Power Factor." B... is given a reprint of that section of the paper which treats of the diversity factor. The data employed are in ... the result of investigations of day motor loads made ... the engineering laboratory staff of the Philadelphia Electric Company.

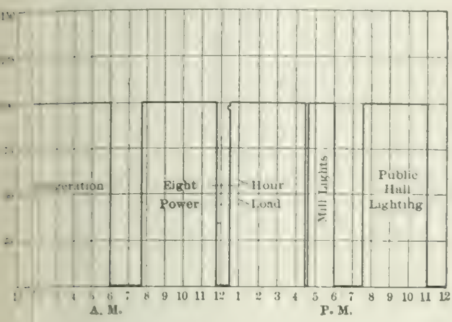
The proportion of the sum of the maximum dema... the consumers to the actual maximum demand up... the generating station is called the "diversity factor." We hear of many kinds of load factor, yet there is ... one standard definition of load factor. Similarly, we ... all kinds of diversity factor. While the above de... has not been made standard, it is to be hoped tha... action will soon be taken on this important matt... diversity factor is the average relation between t... most important points in connection with any inst... upon the system, namely, the maximum capacity de... by such an installation and that part of such capac... manded at the time of the maximum demand upon t... generating system.

Some attempts have been made to consider diversity factor as based upon connected load. This has bee... on account of the ease of calculating such a va... this method were correct we would have only to div... connected load by the maximum demand to obt... diversity factor. This figure would evidently be th... same as the station load factor divided by the average ... of connected load.

Such a method of computation entirely elimin...s an important factor, namely, the relation of the connected load of the installation to the maximum capacity required

…se its highest demand. In motor installations this ratio may be 1 to ¾, and in residence installations it may … to 1.

In order to fix the meaning and importance of diversity factor and its effect upon load factor, investment and earn-



…versity of Demand Shown by Different Motor and Lamp Loads.

… consider Fig. 1, which shows several classifi… business taken from load diagrams. Here we … kw demand of refrigeration apparatus running … m. to 6 a. m., consuming 500 kw-hours; 100 kw … f motor load running from 7:45 a. m. to 11:45 … from 12.30 a. m. to 4:30 p. m., consuming 800 … 100 kw demand of mill lighting running from … to 6 p. m., consuming 150 kw-hours, and 100 kw … public-hall lighting running from 7:30 p. m. to … consuming 350 kw-hours. The total consumption … has thus been 500 + 800 + 150 + 350 = 1800 …

… of the maximum demands was 400 kw, but … maximum demand upon the station, ignoring … been 100 kw. The diversity factor is therefore … average use for the day was

$$\frac{1800 \text{ kw-hours} \div 24}{100 \text{ kw capacity}}$$

= 75 per cent of the maximum use possible.

Had the demands occurred simultanously the average use for the day would have been

$$\frac{1800 \text{ kw-hours} \div 24}{400 \text{ kw capacity}}$$

= 18¾ per cent of the maximum use possible.

These examples illustrate the effect of diversity factor … load factor.

Although we cannot hope to attain this ideal condition … entire business, it may be well to examine the effect … amount of such business as far as investment … charges are concerned.

For this purpose let us assume a plant investment of $200 per kilowatt of rating actually demanded, deprecia… charges of 6 per cent and annual stand-by charges … per kilowatt. Applying these costs to the service indicated in Fig. 1, the plant investment stands at $20,000, with depreciation charges of $1,200 and annual stand-by charges of $2,000.

Had the demand occurred simultaneously the plant investment would have been $80,000 and the annual depreciation charge $4,800, with an annual stand-by charge of $8,000. By this combination of business there has been saved an investment of $60,000 upon which we should have had to pay interest or dividends, besides annual fixed charges of $9,600.

Incidentally, the energy has cost less at the switchboard on account of the more uniform rate of manufacture, and this has also had the effect of lowering the cost of all other units being manufactured at the same time. Economies may also have resulted in the investment and fixed charges upon the distributing system, but this has not been taken into consideration.

The importance of diversity factor being established in our minds, we may proceed to examine where and in what manner it actually manifests itself.

Starting at the origin of diversity factor, let us consider the question of the ratio between the connected load upon the premises of the consumer and the actual maximum demand made upon us for capacity during the year. If we assume that every item of a given installation is connected for use at its maximum rating, and really is used at such a rating at some time within the year, it is evident that the ratio mentioned, if other than unity, results from time displacement in the use of the various items; or, if they are all used simultaneously, that their maximum use does not occur simultaneously. Now, the amount of that time displacement is not important as far as the particular installation is concerned. It may be months, as in the case of an electric fan and a luminous radiator. It may be a fraction of a minute, as in the case of a flasher lighting different circuits of lamps of various colors. The benefit gained by these conditions is, as far as a given installation is concerned, that the capacity leased to that customer is less than his connected load and that the average use in a year is greater than if such diversified use did not take place.

It is therefore apparent that all appliances which consume electricity and are used intermittently increase the load factor of the consumer and may do so to a great extent without increasing the amount of his maximum demand. What occurs as between the time of use of the items of a given installation may and does occur between the various installations connected to the system. Magnified by all the possible diversities of use of all the devices connected to our system the same thing results precisely as it does upon the premises of a consumer. Diversity factor results from this and the station load factor is increased without proportionate increase in maximum demand.

Recognition of the importance of diversity factor has played an important part in recent commercial development in the industry, even if the name has not been applied or mentioned in connection with such movements. Some

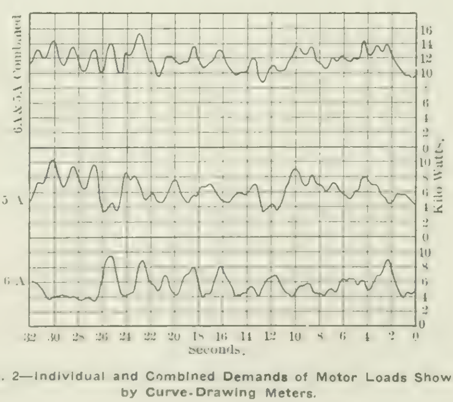


Fig. 2—Individual and Combined Demands of Motor Loads Shown by Curve-Drawing Meters.

companies have made special efforts to build up a large summer business in supply to park and summer resorts. Brooklyn has built up her diversity factor and her annual load factor tremendously by such steps. Extensions into suburban districts where maximum demands occur at

hours different from those in the heart of a great city have resulted in increased load factor through diversity factor in the case of many large companies. Campaigns for the introduction of all kinds of appliances in connection with lighting equipments, as well as for restricted-hour business, are all intended to build up diversity factor.

When the electric motor field was first invaded it was believed that a great increase in diversity factor would result. We can readily understand the aims and results in certain of these directions, but perhaps the effects of motor load and other classes of business whose demand, we know, coincides with our peak period are not quite as obvious.

In the lighting field it is apparent that diversity factor must principally result from the mingling of classes of business in which the maximum use does not occur during peak hours. If only 80 per cent of such maximum use existed on the peak the diversity factor in this class of business would be 1.25.

In the motor field we meet with different conditions. Motor and lighting service are used simultaneously in most cases, but in many lines of manufacturing operations by artificial light have a tendency to proceed at a less rapid rate. Again, the economic law of the fatigue of labor assists us. A study of the curves of output in all lines of manufacture will show that the output, and hence the power required, falls off during the closing hours of the day from this cause.

Diversity factor in the power field, however, is also built up from reasons much more important and significant than those just mentioned. We are all aware that most mechanical operations of manufacture are cyclic in character, ranging from a minimum to a maximum demand for power and not consuming power at a constant value. The length of the cycle varies with the application, and we are all well acquainted with some of these cyclic operations, such as in the use of cutting, rolling and hammering machinery. We can readily conceive that if a number of such machines are driven by motors on our system the periods of their maximum use in the cycle of their operations will not be coincident. This actually occurs, and from this diversity factor also results.

Fig. 2 shows the curves taken from two motor installations by recording wattmeters with a combined curve showing the demand of the two installations.

The maximum demand in the lower curve within the period represented upon the chart was 9½ kw. On the second installation the maximum demand was 10½ kw, or a trifle less. The sum of these maximum demands was therefore a little less than 20 kw, but the actual maximum demand made upon our capacity was only 15 kw. It will thus be seen that the peaks in one chart have been absorbed and smoothed out by the valleys in the other. The actual maximum demand also occurs at a time that does not coincide with the highest demands made by either installation.

It may be remarked incidentally that these charts bring out fully one of the strongest arguments in favor of central-station service. Customers are charged only with the amount of energy actually shown on the chart. They do not pay at the maximum rate, but get the benefit of every instantaneous falling off in the demand. What could be more exact and precise than this measurement of actually useful power?

The study of power curves drawn by correct recording instruments is peculiarly interesting and instructive. Similar curves have heretofore been plotted from instantanous readings and from recording instruments of various types, but the results have been rather doubtful to a close student of mechanical movements. On account of the rapidity of the change of rate of the power demanded by cyclic operations it is impossible to obtain practical data in any other manner than with recording instruments.

OPERATION OF SERIES ALTERNATING-CURRENT STREET ARC LAMPS.

By J. C. Lawler.

THE term "2000-cp arc lights" still appears in most municipal arc-lighting contracts and has perhaps caused as much litigation and feeling against the central station as any one thing. The old franchises were made in good faith, "2000 cp" being the manufacturers' rating for the open 9.6-amp, direct-current lamp which consumed approximately 450 watts. This old open arc for obvious reasons was gradually displaced by the closed arc and, despite the fact that the wattage consumption is as high or higher on the latter type and its general illuminating qualities are better, it could not in all courts of equity be shown that the inclosed lamp legally fulfilled the "2000-cp" clause. Thus it behooves us to beware of any common phrases that could be misinterpreted in the future.

All municipal arc-lighting contracts should specify the type and ampere rating of the arc lamp to be supplied. In addition, the average wattage consumption, number of hours burned, allowable outage, etc., should be clearly specified, and the company in pursuance of its contract should make a periodic statement showing the operation of its arcs in detail.

Two municipalities demand sworn monthly reports (which will be described later), and the contract states

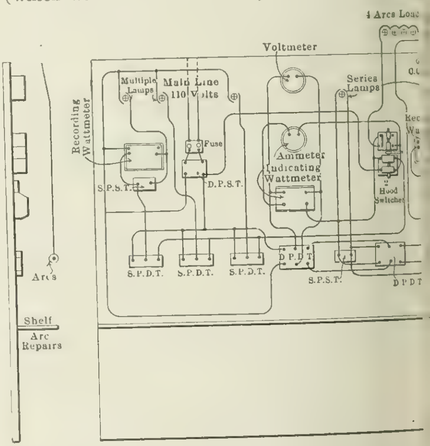


Fig. 1—Testing Board for Multiple and Series Arc

that series 7.5-amp, 60-cycle alternating-current arcs are to be supplied and that the average consumption per lamp must not be less than 490 watts. The lamps must burn from dusk until dawn, which is considered as 4000 hours in the aggregate per annum. These contracts are defective in many ways in that some agreements had to be made afterward in regard to line loss, transformer efficiency, method of inspection and allowable outage; however, they present the possibilities for a new contract which should be satisfactory and free from any misunderstandings.

This form of contract affects the operating department and it must be prepared quickly to test the lamp for a predetermined wattage and maintain its reports in a systematic manner. The following methods and appliances have been adopted by an operating company.

A CONVENIENT TEST BOARD

Fig. 1 is a wiring diagram for an arc-lamp test board. The right end is arranged for connecting two alternating-current series lamps and the left side for three alternating-

...rent multiple lamps. The indicating wattmeter, am... and voltmeter at the center of the board may be ... for testing one lamp at a time of either type by ... operating the switches. The board is prac... fool-proof, and it is impossible to connect the two ... lamps to the instruments at the same time so as ... any damage. The double-pole double-throw switch ... below the instruments controls the potential to the ...er and voltmeter and must be thrown toward the ... lamp under test. On the multiple side the supply ... is preferably controlled by a double-pole, single-thro switch protected by fuses. The three test loops for the multiple lamps are each controlled by a single-pole, double-throw switch. Any one of these switches thrown ... (away from the instruments) permits the lamp ... loop to burn independently of the instruments. ... switches are thrown to the right the lamp is ... to the loop controlled on the instruments unless ... lamps are already on the instruments, in which ... multiple lamp would be extinguished.

...ries circuit is supplied by means of a six-lamp ... current transformer through a bank of four ... load. There are two series test loops controlled ... single-pole, single-throw short-circuiting switches. ...ntial for the voltmeter and wattmeter is con... a double-pole, double-throw switch which must ... toward the series lamp under test. The series ... be thrown off or on the indicating instruments ... of two absolute cut-out hood switches, which ... principal part of the "fool-proof" device. These ... switches are placed end to end so as to be oper... one handle or lever; the lower hood switch, as ... the short-circuiting bar removed and operates ...-pole, single-throw switch. These switches are ...ted that with the lever thrown to the right (away ... instruments) the series lamps are short-circuited ... instruments and the lower switch completes the ...ircuit through the instruments. When the lever ... to the left the series circuit by means of the ... switch is completed through the instruments and ...le circuit is broken by means of the lower hood ... One test circuit of the multiple lamps and one ... of the series lamps are provided with a record... ...meter and short-circuiting switch. The latter ...uld be adjusted for 72 volts, and both for low power factors. The test circuits should be suspended in front of the board at a convenient height.

METHOD OF TESTING ALTERNATING-CURRENT SERIES-ARC LAMPS.

It ... desirable to have all lamps on the circuits consume as near a predetermined rate as possible. The lamp consumption not only depends upon the internal adjustment of ... but there are several things beyond our control ...st be allowed for.

...r affects the consumption on a circuit of series ... much as 10 per cent. This is principally due to ...ion of temperature in the shunt coil. When the ... is at a low temperature and consequently low ... it will pull a shorter arc, thereby reducing the ... across the arc with a resultant lower wattage. The ... is not perceptibly affected by the change in temperature, as the constant-current transformer maintains it at a constant strength. The line loss is less in cold weather, and where this loss is taken at a constant per... the lamps must be operated at a slight percentage ... demanded rating.

The length of carbon also affects the consumption. The longer the upper carbon the heavier, and it tends to produce ... shorter arc. A circuit of arcs newly trimmed will show ... decided decrease in consumption partly caused by the greater weight, but principally due to the low resistance of the carbon tips, and even while the arc may be excessively long the consumption will remain low. It requires approximately forty minutes' burning before the carbons reach a normal condition.

Fig. 2 shows the variation in the average consumption in watts on a circuit of series arcs taken for a continual run of twelve hours with practically constant outside temperature. It will be noted that the minimum occurs when the lamps are first turned on and are cold. The consumption increases over three hours as the lamps become warmer and as the arc becomes longer due to the carbon tips being consumed. Between three and four hours after the arcs are started the "feeding point" is reached. Some lamps will extinguish themselves for an instant and start at a low consumption as the feeding takes place. Other lamps will feed a perceptible amount every few minutes, probably never extinguishing themselves, and will operate at a fairly constant rate. It is the feeding point that causes the watts to drop, but it will be noted that this drop is not as low as at the original starting point. The continual heating and shortening of the carbons cause each successive feeding point to reach a higher consumption than the preceding one. For this reason an eight-hour test will show a lower average consumption than a twelve-hour test. The high consumption caused by the long-hour burning in winter may be offset by the colder weather.

As eight or twelve hours is too long for a practical test in the shop on individual lamps, the following short method may be adopted for the 7.5-amp and 6.6-amp lamps:

The lamp should be trimmed with used carbons of about half length and allowed to burn on the test rack for at least forty minutes. It should then be switched on the indicating instruments and the short-circuiting switch thrown in for an instant until the carbons have dropped together and the magnets fallen. The switch is then opened and the ammeter is noted to see if it indicates the proper

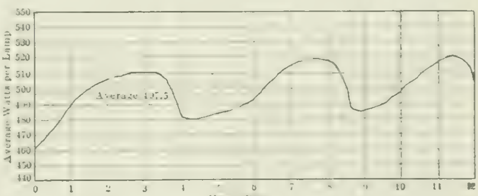


Fig. 2—Composite Curve, Showing Average Watts per Lamp Consumed on a $7\frac{1}{2}$-amp Alternating-Current Arc Circuit.

amperage. If the lamp under test is of the 7.5-amp type the indicating wattmeter should show 470 watts. This may be called the starting wattage. Then the carbon is held firmly against its guide and at the same time the series magnet and mechanism pushed down until the clutch can take a new hold of the carbon at as low a point as possible. The mechanism is then released, and when the clutch has taken hold the grasp on the carbon is released. The indicating wattmeter should within a minute read 510 watts to 515 watts. This is the "feeding point" and the lamp should soon drop its carbons and wattage. This test requires some practice and several trials, but a lamp so adjusted will average from 495 watts to 505 watts on long-hour burning.

Nearly all new lamps are fitted with a clutch stop which prevents the globe cap from melting when the lamp is newly trimmed and the arc is excessively long; however, care must be taken to see that the bar of the stop is placed sufficiently high to prevent the clutch from striking it before the feeding point is reached. The bar should not touch the clutch while the lamp is under normal running condition.

A worn clutch will permit the carbons to slide together, and if a new clutch is placed on the lamp care must be taken that it shall have as much play and grasp the carbon

like the old one, or it may be necessary to readjust the entire lamp.

METHOD OF INSPECTION.

Requiring an exceedingly careful supervision of its street arc lamps, one company placed night inspectors on regular routes to see that all lamps were kept burning. These inspectors carried regular night watchman's clocks and were compelled to visit certain remote stations in order to get their registering keys. They made two rounds of their circuits every night and turned in their clocks to a supervisor every morning with their reports. From these reports the lamp-hour outages are obtained. Following is an arc inspector's report:

Time Found.	Location.	Cause.	Lamp Hour Outage
8:10	5th and A St.	Carbon stuck	1 hr. 10 min.
8:30	9th and B St.	Broken inner globe	1 hr 30 min
9:00	5th and A St.	Carbon stuck changing lamps	40 min
Total lamp hour outage			3 hrs 20 min

A lamp is considered as "out" from the time the circuit was turned on or off from the time of the last inspection. This record enables the superviser to "spot" a lamp which continually gives trouble; also, the greater number of actual outages found prevents the company from having to operate its burning lamps so far above normal in order to maintain the required average watt consumption. Experience has shown that a newly trimmed circuit will show abnormal outages.

Following is a form of monthly arc-lamp report furnished the city:

1.	Total number of hours burned	406 hrs. 27 min.
2.	267 lamps in service first of month, lamp-hours	108,522
3.	One lamp installed 27th, lamp-hours	57
4.	Total apparent lamp-hours	108,579
5.	Total lamp-hour outages	295
6.	Net lamp-hours	108,284
7.	Watt-hours, primary	61,878,000
8.	Watt-hours at lamps (87 per cent)	53,833,860
9.	Average watts per lamp	497.1

The first line indicates the total number of hours the lamps were turned on during the month. The second the number of lamps in service the first of the month multiplied by the hours burned, giving the apparent lamp-hours. The third indicates the lamp-hours of lamps that were installed during the month. The fourth is the sum of the second and third, giving the total apparent lamp-hours for the month. The fifth is the total lamp-hour outages taken from the night inspectors' reports. The sixth is the net lamp-hours burned. As to the seventh line, the recording watt-hour meters were necessarily placed in the primary of the constant-current arc transformer and were agreed to have an efficiency of 94 per cent. The line was entirely of No. 6 copper and the loss was originally taken according to the C^2R losses. This came so near a constant percentage that the combined efficiency of the line and transformers was fully agreed on as 87 per cent. Thus the eighth line shows 87 per cent of the seventh line. The ninth line is the eighth divided by the sixth and gives the average watts at the terminals of the lamps.

SUMMARY OF MONTHLY REPORTS.

Month	Lamps Burned Hours.	Lamps Burned Minutes.	Net Watt Hours Consumed	Number of Lamps.	Apparent Lamp-Hours.	Hours Outage	Net Lamp-Hours.	Per Cent Outage.
January...	406	27	53,833,860	268	108,579	295	108,284	.0027
February..	345	11	47,027,000	270	92,871	352	92,519	.0038
March	344	03	46,895,510	274	93,923	473	93,450	.0050
April	293	00	40,401,930	275	80,431	301	80,130	.0037
May	269	46	36,821,880	276	74,456	207	74,249	.0028
June......	239	36	32,999,100	276	66,130	*1,052	65,078	.0159
July	270	50	37,798,890	276	74,750	161	74,589	.0021
August....	309	15	41,324,478	276	85,353	446	84,907	.0052
September.	332	13	46,666,800	276	91,692	484	91,208	.0053
October....	375	09	50,983,740	276	103,541	613	102,928	.0059
November.	395	58	53,743,380	276	109,287	682	108,605	.0062
December.	424	31	58,056,840	276	117,167	*2,281	114,886	.0195
	4,005	59	546,527,408		1,098,180	7,347	1,090,833	.0067

*High, due to lightning and wind storm.

Owing to sudden weather changes it was found advisable for the superviser to keep his report practically up to date during the month in order not to run short or too far above the required watts at the end of the month. The watts could be changed very readily by making a slight adjustment of the weights on the constant-current transformer, which would cause scarcely any perceptible variation of the ammeter.

PRODUCTION COSTS IN PROGRESSIVE CENTRAL STATIONS.

THE analysis of the cost of producing electricity at the busbars of a modern central station is a problem of constant interest. The steady development of new business in the past five years has been a conspicuous feature of the industry, and its introduction of fresh sources of income has often obscured the importance of generating economies. Multiplication of output inevitably attends the growth of revenue, and consequently there is a constantly greater incentive in a growing plant to bring about small economies of production. It is coming to be usual for even medium-sized stations of a few thousand kilowatts rating to produce between 2,000,000 kw-hours and 8,000,000 kw-hours per year, thanks to the growing industrial and social popularity of electric service. A saving of even one-tenth of a cent per unit thus means that the company's yearly expenses are less by from $2,000 to $8,000, and once an economy capable of making a decided saving is established its good effects are readily maintained.

It is only within the past three or four years that the net manufacturing cost of electricity produced in steam plants of small and moderate capacity and good management frequently ran between 1.5 cents and 2 cents per kw-hour. That is, the net station expense, without allowing for interest, taxes, depreciation, insurance, legal, distribution, collection and other expenses, reached the limits above stated even in the practice of stations which gave special attention to the problems of power production and which were never slow to introduce labor-saving equipment of reasonable first cost and reliable service. To-day these stations are very generally producing electricity at a net manufacturing cost, exclusive of any fixed charges

[illegible] penses outside the station building, of not far from [illegible] per kw-hour. Many causes have contributed to this resu[illegible], which, it must never be overlooked, is in no sense [illegible] of rates, for there is a wide gap between the mer fuel and labor expense, so to speak, of putting a kw-hou[illegible] n the station busbar and the cost of delivering it at [illegible] sumer's meter. The station cost, however, is of pro[illegible] technical and administrative interest, since slight [illegible] es effected all along the distribution system are [illegible] l back to the generating plant, and, in view of the [illegible] of this cost to approximate 1 cent per kw-hour [illegible] of the best plants of moderate size, it is well to [illegible] some of the elements of expense which appear in their records.

Pl[illegible]t 1 is a combined turbine and engine station which [illegible] 2,428,940 kw-hours at its switchboard [illegible] 2,004,026 kw-hours. The company has for several [illegible] n developing an attractive motor load, with the [illegible] last year customers with motors purchased [illegible] hours, or about 60 per cent of the total energy [illegible] te company burned during the year 4230 tons of [illegible] s coal at an average cost of about $3.90 per ton, [illegible] station expense per kw-hour, including fuel, oil [illegible] e, water, station wages, repairs and a few miscel[illegible] tems of small consequence, was 1.18 cents. This [illegible] showing is interesting in view of the size of the [illegible] ich had a normal rating of 2339 kw, consisting of [illegible] rontal Curtis turbo-alternators of 750 kw rating [illegible] three steam engines driving two direct-connected [illegible] elted generator installation. Five engineers and [illegible] nen handled the plant, including all shifts. The [illegible] load on the station during the year was 1200 kw, [illegible] load-factor of 23 per cent. The steam supply [illegible] ided by six water-tube boilers aggregating 1349 [illegible] the operating steam pressure was about 140 lb. [illegible] on is gradually undergoing a transition from an [illegible] to a turbine plant; the condensing-water [illegible] are being improved, with special reference to [illegible] irculation and better cooling arrangements; an [illegible] wheel equipment of about 60-hp rating has been [illegible] by circulating-water conduit facilities of ample [illegible] and assured flowage, and the expansion of the static[illegible] has been effected along lines which tend in the long run [illegible] enable the machinery to be supervised and maintaine[illegible] by practically a stated force of men. Another feature [illegible] the plant which tends toward economical operation is a provision for gravity delivery of coal from cars [illegible] by electric motors to a trestle immediately outside [illegible] er house. The total station expense for the year [illegible] 8,713, the two larger items being fuel, $16,449, or 0.68 [illegible] nt per kw-hour, and labor, $9,399, or 0.39 cent per [illegible]

[illegible] 2 is another station of moderate size, its rating [illegible] 0 kw. The installation is practically new, con[illegible] f four water-tube boilers rated at 2100 hp total [illegible] 1500-kw Curtis turbines of the vertical type. The [illegible] cultivation of new business by the company has resul[illegible] in its enjoying a large sale of energy in proportion to th[illegible] size of the station. Last year the company gener[illegible] 79,038 kw-hours, of which it sold 6,401,778 units. [illegible] ers purchased 2,507,232 kw-hours. In spite of the [illegible] the cost of coal was $4.27 per ton, or 37 cents highe[illegible] than in plant No. 1, the company produced electricit[illegible] at a fuel expense of 0.56 cent per kw-hour. The [illegible] st at the station was 0.29 cent per unit and the net [illegible] turing cost 0.89 cent. The large volume of out[illegible] tributed to the success of the plant in attaining a low c[illegible]t of manufacture, and it is probable that this will be carri[illegible] still lower as the service of the station extends and the e[illegible]ipment can be operated on the average at points neare[illegible] its full-load efficiency. The plant is provided with effici[illegible] mechanical coal-handling apparatus, with modern auxili[illegible]y equipment in connection with the feed-water and condensing service, and the arrangement of apparatus is such as to enable a high capacity in generating machinery to be handled by a limited number of station attendants. Four engineers, three oilers and seven fireroom attendants are at present required, but as the plant expands very small additions will have to be made to the labor account for some time. The installation of the major portion of the condensing apparatus in the turbine-room enables the equipment to be handled and maintained with minimum travel about the plant. The total station expense for the year was $71,766, the two largest items being fuel, $45,438, and station wages, $18,436. It is worth noting that the second station produced about 3.3 times the output of the first with only 2.5 times the expense. The station load-factor for the year was 33.3 per cent, defining it as the ratio of the average to the maximum, and the station factor, so called, or the ratio of the average load to the plant rating, was 30.7 per cent. The operating steam pressure in the boiler-room was 175 lb.

Plant 3 is a station serving a large suburban residential district, with sales of electricity to other communities near by which have more or less off-peak consumption, with a large lighting peak at the seaside in the summer season. The station equipment is mainly driven by steam engines of the compound condensing type, although the latest unit installed is a turbine set rated at 1500 kw. The total station rating is 3400 kw. Last year the company generated 5,513,034 kw-hours and sold 4,738,369 kw-hours. The motor-circuit sales were 1,482,424 kw-hours. In spite of the fact that the design of the station required the services of seven men in the engine-room, two steam fitters, three firemen and two switchboard men, the labor cost for the plant for the entire year was only $13,773, or 0.25 cent per unit. The fuel cost, made up mainly of soft-coal charges at $3.99 per ton, came to $29,851, or 0.54 cent per kw-hour, and the total station cost, exclusive of any fixed charges, was $58,224, or 1.05 cents per kw-hour. A feature of this plant, which is located in a district dependent upon city water, is the use of a large motor-driven cooling-tower installation which has resulted in the efficient handling of water and the repeated use of circulation supplies. The maximum load on this station in the year was 1980 kw, giving a load-factor of about 32 per cent. The steam-generating equipment consisted of a modern plant of four water-tube boilers with a combined rating of 1910 hp, supplied with coal by an installation of mechanical stokers and a complete equipment of coal-handling apparatus, with crusher and conveyors of modern type. The operating steam pressure in the plant was 158 lb. It is probable that the existing operating costs will be somewhat reduced as the campaign for suburban motor load makes further headway.

Plant 4 is that of a company under the same general management as No. 3 and located within tie-line distance of it. The two plants are usually so run that the smaller station is shut down except in hours of loading sufficient to give its equipment good economy, electricity being purchased from the related plant and also from an adjacent central station under a separate management. The equipment consisted of a Westinghouse-Parsons turbine of 500 kw rating and two revolving-field alternators direct-driven by Rice & Sargent horizontal, cross-compound engines. The total rating of the electric generating machinery was 1400 kw. Simplicity of design marked the plant and its operating schedule required the services of but three engineers and three firemen. Hand-firing was used and the steam pressure carried was 135 lb. The plant delivered 2,089,200 kw-hours at the switchboard last year, sold 1,538,793 units and disposed of 111,596 kw-hours to motor users. The latter is almost insignificant and could have but small effect on the station economy, but the plan of operating the equipment so far as practicable during hours when the demand upon it was sufficient to load the machin-

ery favorably resulted in a manufacturing cost at the station of 1.07 cents per kw-hour, the total station expense, excluding annual charges, being about $22,492. The chief items of expense were fuel, $11,993, and station labor, $6,277, the kw-hour costs for coal and attendance being 0.57 cent and 0.30 cent respectively. In this station the cost of water was rather higher than usual in a plant of its size, the company being obliged to pay $1,066 for this supply. Steam-plant repairs during the year also increased the operating expenses at the station by $1,616. Four water-tube boilers of a total rating of 1208 hp supplied the steam service. The maximum load during the year was 1200 kw and the company's chief fuel consisted of Cumberland coal at a cost of about $3.86 per ton.

Plant 5 illustrates the beneficial effects of a well-sustained electric-railway load on a station whose generators are driven in part by belted engines. The station supplies a small electric-lighting business, but of its total energy sales of 4,103,384 kw-hours, 3,636,390 units were purchased by a large electric-railway system. The total energy generated during the year at the station was 4,357,648 kw-hours. The plant produced electricity at the creditable figure of 1.15 cents per unit in 1910, the total station expense being $50,294. The cost of fuel was the chief element of expense in operation, rising to $34,228, or 0.78 cent per kw-hour. The company burned a mixture of soft coal and No. 3 buckwheat during the year, the former costing $3.94 per ton and the latter $3.17. The maximum load during the year was about 1900 kw; the labor cost was $9,610, or 0.22 cent per kw-hour, and the steam-plant equipment repair cost was $2,966. Three engineers, three firemen and two coal passers were on the station payroll. The generators consisted of seven units rated at about 2435 kw, only two of the generators being of the direct-connected type. The boilers were nine in number, of the horizontal, return-tubular type, operating at 115 lb. steam pressure. The striking point in the plant expenses for the year is the disparity between the fuel cost and the balance of the station expenditures. It is impossible to escape the conclusion that if modern direct-connected apparatus should be installed in place of the considerable amount of belted machinery now in use the plant would reap the benefits of a decided increase in production economy. It is a question whether the labor account could be reduced per kw-hour by such changes in the machinery, for the relatively large output of the plant enables the company to enjoy a labor cost per kw-hour considerably below that often encountered in stations of this size.

Plant 6 serves a large city of residential type, with a rapidly developing electric-motor load in a manufacturing section. The company's total output at the switchboard in 1910 was 7,344,392 kw-hours and its sales were 6,566,420 kw-hours. The progressive exploitation of a motor load brought the company during the year the income from 3,027,476 kw-hours. The maximum load during the year was 3100 kw. The company produced electricity at the bus at a net station cost of $69,141, or 0.94 cent per kw-hour. The fuel, New River coal at $3.57 per ton, was brought to the station by barges on a river flowing past the plant and fired into the boiler furnaces by hand. The coal cost per kw-hour was 0.42 cent, the total fuel bill being $34,092 for 1910. The steam-generating equipment consisted of eight 400-hp boilers operated at 160 lb., and the rating of electric generating equipment was about 5200 kw. There were three main generating units, each consisting of a revolving-field alternator direct-driven by a vertical, cross-compound condensing engine. A direct-current motor load was also supplied by means of two 250-kw motor-generator sets in the station. The station payroll covered four engineers, five firemen, three oilers, two coal passers, four switchboard men and one wiper, and the total station labor cost for the year was $21,962, or 0.30 cent per kw-hour. The station-building design is possibly a little more complicated than in many plants of [illegible] construction, and the arrangement and charac[illegible] of machinery—notably the use of vertical engines—t[illegible]d to increase the labor requirements somewhat. The co[illegible]pany is wisely doing all it can to add to its day load; it[illegible] load-factor has now reached 27 per cent for the year ar[illegible] it is planned to increase the capacity of the station in the [illegible]ture by the addition of a low-pressure turbine equipmen[illegible]

Plant 7, a station built on much the same lines [illegible] the preceding installation, produced electricity last yea[illegible] at a busbar net cost of $47,711, or 1.07 cents per unit. The station rating was 2000 kw, and the plant had three [illegible] nating-current generators driven by direct-connecte[illegible] vertical, cross-compound engines of the condensing ty[illegible] a[illegible] the same make as in station No. 6. The fuel co[illegible] mainly of soft coal at $4.31 per ton, with about one-[illegible] as much coke at $3.50 per ton. The two largest it[illegible] the station expense were fuel, $30,009, or 0.67 ce[illegible] kw-hour, and station wages, $12,816, or 0.29 cent p[illegible] hour. The arrangement of the station equipment [illegible] toward a relatively large payroll in reference to the [illegible] the plant, there being the following men required: [illegible] engineers, three oilers, three firemen and two h[illegible] The maximum load on the station was 1650 kw a[illegible] load-factor for the year was 31 per cent. The co[illegible] produced 4,461,580 kw-hours during the year an[illegible] 3,978,987 kw-hours. The motor service consumed [illegible] 440 kw-hours. Five 250-hp water-tube boilers suppl[illegible] engines with steam at a pressure of 150 lb., and hand [illegible] was used as in the larger station. The most strikir[illegible] ference in the operation of plants 6 and 7 appears [illegible] cost of fuel per kw-hour. The smaller station is loc[illegible] a city about 50 miles from the larger plant and all t[illegible] has to be hauled in the former case by rail. The le[illegible] cost of tidewater coal handling in a station of simi[illegible] sign to that of an interior plant is significant. Th[illegible] with tidewater connections produced a 66 per cent [illegible] output with an increase of but 13.3 per cent in th[illegible] fuel bill. Something must, of course, be allowed f[illegible] the superior efficiency of the engine equipment of the [illegible] plant, but the main difference in fuel economy arises [illegible] from the lower initial cost of coal at tidewater i[illegible] parison with its price even two or three score of [illegible] inside the seaboard. Both stations are intelligently [illegible] ated by managements bent on expanding long-hour a[illegible] off-peak business; and in each the percentage of energ[illegible] sold in the year for electric-motor applications is at leas[illegible] sufficient to exert a real influence on the economy of [illegible] production. In fact, if the smaller station had h[illegible] the advantage of the larger plant's fuel cost per ton de[illegible] at the furnaces, it is a question if it would not hav[illegible] duced energy at precisely as high economy as the [illegible] installation, since the 2000-kw station sold 60.5 per [illegible] its total energy marketed to motor users and the [illegible] plant only 46 per cent.

Plant 8, the last of the group examined in con[illegible] with recent performance, is a new turbine station c[illegible] kw rating which produced energy in 1910 at the rate [illegible] cent per kw-hour, always bearing in mind that this [illegible] makes no allowance of any character for fixed a[illegible] distribution charges, general expenses and many othe[illegible] items of cost which must be considered if the rates of th[illegible] company are taken up. The company generated 4,873,2[illegible] hours during the year, sold 3,822,311 kw-hours and [illegible] to motor users 961,207 kw-hours—a moderate day lo[illegible] but one which has now begun to increase steadily under new and progressive administration. The load-factor [illegible] the year was 28.4 per cent and the total cost of station operation, excluding fixed charges, was $48,158. The tw[illegible] largest items were fuel cost, $24,617, or 0.51 cent per k[illegible]hour, and labor cost at the station, $12,255, or 0.25 cent p[illegible] unit. The cost of coal was $3.33 per ton, with tidewater c[illegible] very at the station, and bituminous coal of good quali[illegible] was

[illegible] Six water-tube boilers rated at 350 hp each supplied steam to the turbines, which are of the Curtis vertical type, rated at 500 kw and 1500 kw. The maximum load on the generating plant last year was 1960 kw. There [illegible] doubt that as the rapidly growing motor service of [illegible] company has full opportunity to exert its influence upon the station economy the cost of production within the plant will decrease still further, unless an unprecedented rise in the price of coal occurs or occasion for unusual repairs arises. The company is gradually discontinuing

ENERGY PRODUCTION COSTS OF EIGHT STATIONS.

[illegible]	Kw Hours Manufactured at Bus	Kw Hours Sold to Motors.	Station Rating in Kilowatts.	Cost in Cents per Kw Hour Manufactured: Fuel.	Labor.	Total.	Yearly Load-Factor per Cent.	Approximate Fuel Cost per Ton.
[illegible]	2,428,940	1,329,661	[illegible]	0.68	0.39	1.18	23.0	$3.90
[illegible]	[illegible]	2,507,232	[illegible]	0.56	0.29	0.89	33.3	4.27
[illegible]	[illegible]	1,482,424	3,400	0.54	0.25	1.05	32.0	[illegible]
[illegible]	[illegible]	111,596	1,400	0.57	0.30	1.07	20.0	3.86
[illegible]	[illegible] 648	3,036,[illegible]	2,435	0.78	0.22	1.15	26.0	{ [illegible] 3.17
[illegible]	[illegible] 392	3,027,476	5,200	0.42	0.30	0.94	27.0	3.57
[illegible]	4,461,580	2,401,440	2,000	0.67	0 29	1.07	31.0	{ [illegible] 3.50
[illegible]	4 873,250	961,207	2,500	0.51	0.25	0.99	28.4	3.33

[illegible] use of old equipment and is rearranging its distribu[illegible] to some extent. With the still heavier off-peak [illegible] anticipated within the next few years the plant will [illegible] position to produce electricity under very favorable [illegible].

[illegible] accompanying table summarizes the more important [illegible] foregoing plants.

[illegible] figures may fairly be said to represent the best [illegible] practice now obtaining in steam-driven cen[illegible] of medium size from year's end to year's end, [illegible] price of coal ranging from about $3.50 to $4.30 [illegible] They show that the cultivation of a large elec[illegible] load is most valuable in its effect on plant effi[illegible] by extending the demand upon the machinery [illegible] many hours of the day, year in and year out, [illegible] expenses per kw-hour delivered at the bus may [illegible] down to attractive figures, and that a large [illegible] of business is much to be desired in its effect [illegible] power plant. A tabulation like the above can in no [illegible] used in determining *per se* the equity of rates, but [illegible] clearly shows that scientific management is bringing [illegible] significant economies in electric energy production.

[illegible]CULATION FOR FLYWHEELS FOR PISTON-DRIVEN PRIME-MOVERS.

By George T. Hanchett.

THE energy delivered by a reciprocating engine to its [illegible] crank disk is a periodically varying quantity, and [illegible] this reason a flywheel is required to make the [illegible] approach uniformity. This it never actually [illegible]; it accumulates energy at increasing speed at times of high piston pressure and favorable crank position and returns it at diminished speed at times of reduced piston energy delivery.

The energy of the revolving mass is

$$\frac{a^2 I}{2g} = E_o$$

where a is the angular velocity, I is the moment of inertia and g the acceleration due to gravity.

If a flywheel has a certain permissible variation per revolution—that is, a certain allowable pulsation from a to a_1—the difference in the contained energies at the different speeds, that is to say, the give-and-take energy, is

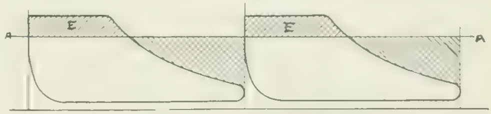
$$E = \frac{I}{2g}(a^2 - a_1^2)$$

The difference in angular velocity is usually fixed by specification, and, therefore, I must be great enough to make the entire expression represent a quantity of energy equal to that obtained above the average energy line.

The energy received by the crank is measured by the engine indicator card, and the energy line is, therefore, a plot of the indicator card, the back-pressure line corresponding to the horizontal axis. That portion of the diagram appearing above the mean effective pressure line A A, Fig. 1, represents the energy absorbed by the flywheel to be given out later when the energy supplied to the piston is below the average. This energy is shown as the shaded area in the diagram and may be determined by the planimeter. It is represented by the value E in the equation above.

If the engine has several cylinders the indicator cards appearing simultaneously must be superposed upon the diagram. It is necessary to combine them by adding together their simultaneous ordinates and producing a resultant curve, and then to determine the mean ordinate and draw in the line A A, whereupon the quantity of energy E may be determined by a planimeter, as before, and will be found to be a periodic time function.

The equations for representing the curves surrounding the engine indicator card are so complicated that the de-



Cyclic Energy Diagram.

termination of the area by mathematical integration is much more laborious than the simple application of the familiar planimeter, which should always be used in this connection.

Transposing equation No. 1 there is obtained

$$I = \frac{E\,2g}{a^2 - a_1^2}$$

and if ρ is the assumed radius of gyration the weight of the wheel becomes

$$W = \frac{E\,2g}{\rho^2(a^2 - a_1^2)}$$

To apply this formula to a practical case suppose that the indicator cards have been combined and that E has been found to be 30 per cent of the energy of the indicator card. Assume further that the permissible pulsation or half revolution be 0.5 per cent and that the engine is a 1500-hp machine receiving 247,500 ft.-lb. per half revolution, which makes $E = 74,250$ ft.-lb. If the radius of gyration is 8 ft., a limiting radius for a cast-iron wheel at

a speed of 100 r.p.m., which speed will be assumed to be used, then

$$a^2 = (200\,\pi)^2 = 394{,}786 \div 3600$$
$$a_1^2 = (199\,\pi)^2 = 390{,}848 \div 3600$$
$$a^2 - a_1^2 = 3938 \div 3600$$
$$W = \frac{74{,}250 \times 2 \times 32.2 \times 3600}{64 \times 3938}$$
$$= 68{,}301 \text{ lb.}$$
$$= 34.1 \text{ tons.}$$

This is a very suitable weight of a flywheel for such an engine, although it is very heavy, because the engine is assumed to have only one simple cylinder.

STEAM "KINKS" AND SUGGESTIONS.

By Charles L. Kintner.

The drip valves on a certain high-speed engine were set at an awkward angle, as illustrated in Fig. 1, the engineer deciding that the wheels could be reached more conveniently in this position than if the stems were at right angles to the cylinder. Fig. 2 illustrates a section of horizontal piping in another plant on which the stem of a globe valve is neither vertical nor horizontal, but half-way between these two; its appearance, therefore, is not symmetrical, as it does not harmonize with any of the pipes used in connection with it. There is a large valve in the vertical pipe, but the stem of it is neither parallel to the pipes above and below it nor at right angles to them. Both of these valves look as if they had been turned on the pipes until the screwed joints were apparently tight enough to prevent leakage and left without further consideration, unless the engineer thought that they were set in the most convenient position possible. Fig. 3 shows a Hancock inspirator with a globe valve about it. The stem of this valve is not set parallel to any part of the inspirator, neither is it at right angles to these parts. The only possible reason for this awkward-appearing position is that whoever set it up cared nothing for the way it looked so long as it "did the work."

Fig. 4 shows a steam pipe in front of a window, although it is not necessary for it to be located there. The longer vertical piece might have been set 12 in. or 15 in. toward the left hand without causing trouble elsewhere, and the horizontal piece with two tees could be lowered to a level with the window sill, thus leaving the window clear of all obstructions; but the designer evidently did not consider these points before the pipes were set up and the awkward appearance afterward apparently did not prove an outrage to his sense of harmony and beauty, as otherwise he would have remodeled the whole section, especially the vertical pipe which is not parallel to the window frame.

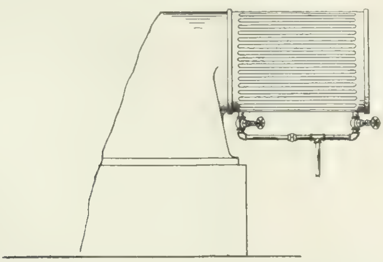


Fig. 1—Drip Valves on Cylinder of High-Speed Engine.

Fig. 5 illustrates something to be avoided on every convenient occasion. Here are two vertical pipes which ought to be parallel. The right-hand part consists of one pipe without a joint, while the left-hand part contains a tee and a union, requiring four screwed joints or which the threads are not properly cut; consequently the pipe as a unit is crooked in contrast with the straight pipe near it. As a general rule, two or more pipes ought ...

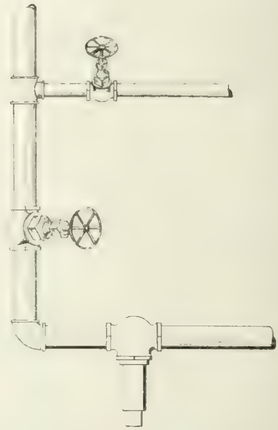


Fig. 2—Arrangement of Globe Valves on Horizontal Piping.

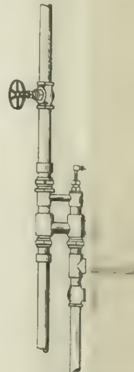


Fig. 3—Ir... Glob...

located close to each other in a prominent pl... difficult to secure perfect alignment at all poi... the joints in a line of pipe are very poorly m... respect they do not attract special attention, pr... are not brought into sharp contrast with somet... much more symmetrical. The above-mentione... caused by lack of care in cutting threads or by ... tapped fittings. The latter fault is difficult to ... fittings are usually tapped the full size for co... pipe and any effort to correct a bad thread resu... ing the fitting too large for the pipe. In the ca... fittings the best plan is to discard those that a... in this respect, provided others can be secured ... not made in the same lot.

Fig. 6 is a pipe vise securely fastened to a sui... It illustrates a "kink" whereby threads may be ...

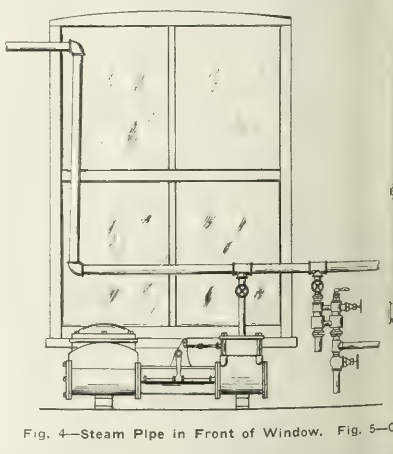


Fig. 4—Steam Pipe in Front of Window.

Fig. 5—C...ked P...

to the axis of the pipe, or, in more common w...ds, ... plan for cutting "straight threads." The bus...ng w... forms a part of the thread-cutting stock is gene...lly lar... than the pipe on which threads are to be cut ar... there...

per.ct alignment of the dies is practically impossible unless hick paper (or something similar) is wound around the ipe until the bushing is a good working fit on it, as shon in the illustration at 2. If the stock is now put in

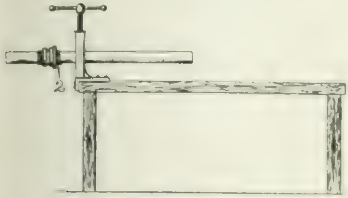


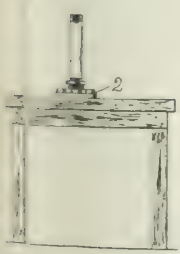
Fig. 6—Pipe Vise.

piac over the bushing and fastened, it is ready for use and he resulting thread will make a straight joint.

Fi 7 shows a very simple plan for testing the threads ... tain kinds of fittings and nipples. One-half of a ... 2 is laid on a metal face plate or a smooth ... A bushing is screwed into it, followed by a nipple. If t upper end of this nipple "wabbles" when the bushing is turned it shows that a "crooked" thread was cut on one ... of the pieces tested. If a defective thread in the ... rows the nipple in one direction and an inferior ... nclines it in another, it may be possible to cause ... fset the other, resulting in a straight joint for the ... ion complete.

... illustrates an application of the above-mentioned ... to a water column. The flange was placed on a ... n surface plate after a bushing was screwed into ... as possible. It was then ground off on an emery ... d hence it is not prominent in the illustration. ... ures an extra strong flange, although selected ... ndard stock, because it is one size larger than the ... hen the combination was placed as shown it did ... plumb, but by holding the flange in a vise and ... a Stilson wrench to the water column the two ... ere brought into different positions relatively, ... the imperfection of one was offset by the other ... column stood plumb. The other half of this flange ... is turned likewise until the face of it was level when standing in its proper place, so that when the two halv were bolted together the column stood plumb.

Fi 9 illustrates the end of a pipe cut off by an ordinary ... itter. Fig. 10 is the same pipe after it is reamed ... the hollow, tapering pipe reamer shown in Fig. 12. ... engineer who set up the water column shown in



F g. —Thread-Testing Device.

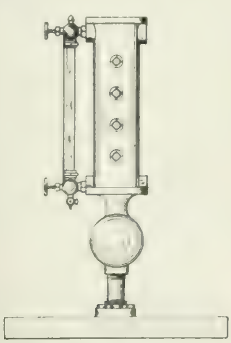


Fig. 8—Water Column.

Fig. ... evidently believes that almost any kind of a piping job i good enough so long as it "does the work." The small gage pipe 2 is not plumb, neither is the combination of valves and fittings at 3. The vertical piece 4 is too long, hence 5 pitches in the wrong direction, and as the latter is also too short it causes 6 to lean toward the brick setting instead of standing parallel to it. This illustration shows the condition of the piping in a small plant when a certain

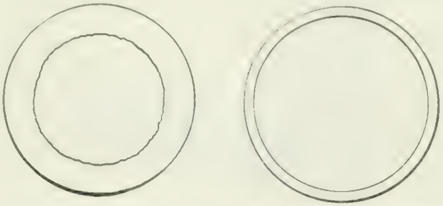


Fig. 9—Pipe Before Reaming. Fig. 10—Pipe After Reaming.

engineer took charge of it. As soon as possible he shortened some of the pipe, lengthened some more and straightened still more, until everybody, including the owners, could see the improvements made. The result was that he secured much better terms for operating the plant than were granted to his predecessors and he held the situation until offered a large increase in salary to go elsewhere—which he promptly accepted.

Fig. 13 illustrates a section of piping in a steam-power and heating plant. The wheel was used to operate a gate valve which admitted steam to the reducing valve below it. After passing this valve the piping is increased to 12 in. to supply one part of the heating system, to which steam is admitted in the morning and shut off at night. Of course, it is necessary to admit steam gradually under such conditions to avoid water hammer in the pipes, and the valve could therefore only be opened to a small part of its capacity until the cold air was expelled. Steam rushing through this small opening scored the valve and rendered it unfit for use.

It was taken out and a globe valve substituted, but inasmuch as this style is longer than a gate valve it was necessary to put in a valve one size smaller, with reducing flanges or else use close nipples with a valve corresponding to the pipes which it controlled. The engineer of this plant avoids the use of close nipples on every possible occasion because they are a source of weakness in any pipe

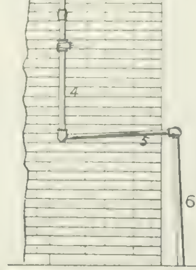


Fig. 11—Water Column on Boiler.

line and where used in connection with large fittings it is impossible to remedy a leak in the threads by means of calking.

Fig. 14 illustrates the job when completed. A globe

valve was adopted with a by-pass one-quarter of the diameter of the main valve. When turning on steam in the morning the by-pass valve is opened to about one-half of its capacity, which heats the cool pipes gradually, thus avoiding shocks and jars. It is then opened wider later on

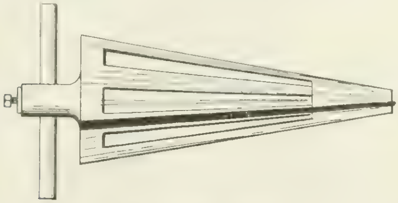


Fig. 12—Pipe Reamer.

until its full capacity is utilized, after which the large valve is opened and the small one closed. This prevents wiredrawing steam through the big valve and consequently it will last a long time and remain tight. Although the small valve may be damaged by the wiredrawing process repairs

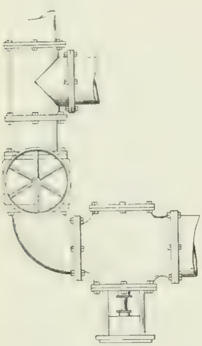


Fig. 13—Gate Valve and Reducing Valve.

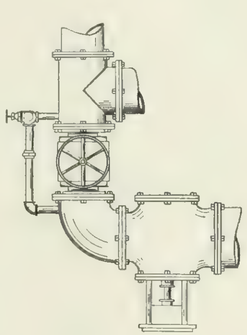


Fig. 14—By-passed Globe Valve When Completed.

to it will not be expensive. As a new by-pass valve will cost only $2 it can be renewed with much less trouble and expense than if required to refit a large gate valve or reseat and renew the disk in a globe valve. This new arrangement, therefore, becomes insurance of the larger valve at low cost and at the same time it provides much more satisfactory means of daily operation.

ELECTRIC FOUNTAIN USED FOR COOLING CONDENSING WATER.

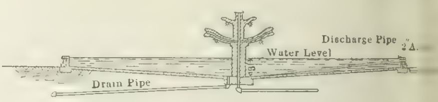
In planning a central ornamental feature for the attractive grounds of the Soldiers' Home near Los Angeles, Cal., the unusual combination of an electrically illuminated fountain and basin for cooling condensing water has been worked out. The fountain is to be erected on the lawn in front of the south entrance to the library building. This is about 1000 ft. from the power house which supplies the heat, electrical energy and water used in the grounds and buildings, and it is proposed to use the handsome fountain as a part of the system for cooling condensing water, thus uniting utility with ornamentation.

In all steam-condensing plants where there is a scarcity of water, with some difficulty in obtaining it from deep-well pumping, as is the case here, cooling apparatus with receiving basins and a circulatory system seems to be needed to reduce the operating expense. With this fact in view, and also in order to maintain the highest p ctical efficiency in the steam plant as economically as pos. le, it was decided to increase the cooling area for con sing water by the utilization of the basin of an ornament tain. A surface condenser is in use at present, but th ing area is only about one-fourth of the requireme

The change proposed will insure the condensation exhaust steam at the power plant and will also vide complete returns from the heating, cooking and l systems. At present only about one-third of the co steam from these utilities reaches the power plant to back pressure and the relatively high altitude power house, as well as the considerable distances traversed. It is estimated that when the new con system is in operation a saving of not less than 15 p in fuel consumption will be obtained. This saving sult about equally from the acquisition of pure, non- water for boiler feed and better vacuum attained provement in the condensing system. The water locality is very hard and has rapid scale-forming cha istics.

To produce the cooling area required it would be sary to provide either a several-stage cooling tower receiving basin and the necessary piping or some equally efficient equipment for the cooling of con water. Fresh water obtained from wells will be u this purpose, and will then be diverted into the water-supply system after being cooled. This hea the water and aeration of it in the fountain will beneficial in adding to the potable qualities of the The pipe lines connecting the fountain with the power-house equipment will be about 1060 ft. long condenser in use is a 300-hp Worthington equipment full complement of pumps compounded on the stea

In view of these considerations it was decided t



Fountain for Aerating Condensing Water.

a reinforced-concrete ornamental fountain, a cross- ction of which is shown above. This fountain will se as an additional cooling device. It is 60 ft. in diamete nd is provided with a central metal pedestal 10 ft. hig sur- rounded by two smaller basins or lavers respective 6 ft. and 12 ft. in diameter, supplied with ornamental sp s for the discharge of the water, which finally reaches th prin- cipal low-level basin. This fountain is equipped w the necessary piping for supplying and maintaining th y-six jets of spray in various forms and dimensions, the of the water being an 8-in. supply pipe incased in t c tral pedestal, as shown in the cut. It is believed th pro- viding a fountain in this manner will cost no more t the ordinary concrete-and-steel construction required the purpose of cooling condensing water in the usual

The electric-lighting feature is simple, but will ad to the attractiveness of the fountain. Under each t the lavers or small upper basins are four pendent incan scent lamps, making eight in all, and the light from these ning through the falling water and spray will produce a p sing effect.

The plan adopted for the fountain provides for an nder- ground connection with the lighting system of the rary building to supply the small amount of energy r uired. The wiring will be incased in $1\frac{1}{2}$-in. iron condu filled with asphalt. Sockets and receptacles will be embe ed in the same material and the lamps will be inclosed in ater- proof globes. Work is about to be begun on this usual installation, and it is expected that the fountain wi be in full operation some time in October of this year.

.ETTERS ON PRACTICAL SUBJECTS

COMMUTATOR LUBRICATION.

All commutators do not require the same kind of treat- ... appears from experience that commutators on ... quire the least care of all, there being days at tim when no attention need be given to them, followed y a light greasing with an oiled cloth. Generators, on ie oter hand, are a more constant source of worry.

... acoma substation a few years ago the writer while ... here noticed that one rotary at a time was always ... l that every day all the brushes were removed ... in hot paraffine oil. The object, of course, was ... them self-lubricating, but at what sacrifice of ... abor! For there was really nothing gained by ... as the commutator was continually black with ... oil and required cleaning after closing down. ... method to use in this case would have been ... an entirely new set of best-grade graphite ... id for lubricating purposes use a little vaseline ... ith a piece of cheap muslin cloth. Excessive ... would then denote that the remedy must be ... iser to its source, usually lying in truing the ... r or adjusting the spacing between the brushes. ... machine oil is not satisfactory, as its body is ... nd on a hot surface like the commutator soon ... from the sparking and, in fact, causes a more ... irking. If used too liberally and frequently, the ... ik into and rot out the mica between the bars, ... attering of the brushes and ultimately ruining ... ng properties.

... applied with a clean cloth is the best all-round ... It quickly dissolves and removes any blacken- ... ming of the commutator, and this can be done ... iachine is in operation. Chronic cases of black ... rs, gumming and singing can be remedied with ... plications of vaseline.

Wash. CHARLES A. STARK.

THAWING A FROZEN PIPE BY ELECTRICITY.

Althugh the season for frozen pipes is past, the follow- ... of interest to readers who, in the coming winter, ... formation on the subject useful.

... ter the writer was called on to thaw out a 2-in. ... listant part of a city. It was ascertained that a ... , 2300-volt line ran past the frozen main, and ... w transformer was available.

... king around for some form of resistance or re- ... occurred to the writer that under the condi- ... ng of this kind was needed and the following ... s successfully carried out:

... that ran past the frozen main was disconnected ... witchboard and connected to an idle alternator ith a ammeter in circuit. The transformer was then auled to the point where the pipe was frozen and con- ected o, the primaries being connected in the usual way nd the econdaries spliced for their lowest voltage, which as 11 volts, and connected directly to the frozen main. he attndant at the power station was then communicated ith ar instructed to start up the alternator slowly (field cited until the ammeter indicated 15 amp. It was pecte that under the conditions the alternator would be nning considerably under speed, but the attendant found ... eping the exciting current low he could run at ... l, thus keeping the frequency at its normal value. he prary voltage at the power house was 1800 volts. Twenty-four minutes sufficed to thaw the pipe, and this without reactances or resistances or trouble of any kind.

Ironwood, Mich. CHARLES SMEETH.

TAPPING AGAINST STEAM PRESSURE.

In spite of all precautions which can be taken there is more or less vibration of steam pipes, and pipes which connect oil cups with steam mains are no exception. It seems to the writer that it is a mistake to pipe any lubricator or oil cup under steam pressure with a pipe less than ½ in. in diameter. There are, however, many connections made of ⅜-in. and ¼-in. pipe and even ⅛-in. pipe has been observed in several instances. The danger of breakage is great where the connecting pipe is small and the strain exerted by a large wrench when removing the blocks or filling oil cups is often very severe, and many a pipe has been broken off at the bottom of the tread just where it enters the steam pipe from this cause. A break of this kind, especially when just above a large engine, is a very disagreeable incident, and when the engineer is obliged to let the steam escape for several hours or perhaps all night it is also expensive. Almost any pipe from ⅛ in. to ½ in. in diameter, when broken as above noted, may be closed against steam leakage by means of a wooden plug driven into the opening. Although this prevents the escape of steam it does not enable the engineer to lubricate the engine cylinder, and he may be forced to close down the engine unless he is lucky enough to have a compression grease cup on hand which can be used to force oil against boiler pressure. In two or three instances the writer has worked his way out of similar troubles by means of a pipe tap fitted to a common butt stock or carpenter's brace. In one of these instances a piece of heavy rubber cupping, such as is used for the valves of hand pumps used for removing water from excavations, was used to prevent the escaping steam from scalding the workman. A small hole was made in the middle of the diaphragm, the shank of the drill was forced through the hole in the diaphragm and then gripped by the bit stock. Behind the protecting shield of the diaphragm the workman was able to drill out a bit of broken pipe which remained in the hole in the large steam pipe. The drill was replaced in the brace by a pipe tap and the hole in the steam pipe was tapped to a full thread, after which a nipple and a valve and another nipple were made up and in turn put into the brace, and with that tool behind the protecting

Fig. 1—Pattern of Shield.

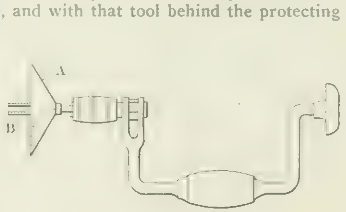


Fig. 2—Shielded Pipe Tap Fitted to Brace.

diaphragm one of the nipples was screwed into the pipe, effectually cutting off the escaping steam. Upon another occasion the convenient rubber diaphragm, with its 24 in. or more of diameter, was not to be found, and a piece of common tin was taken and a cone pattern cut out, as shown by Fig. 1. The pattern was made so that the cone would be very flat, at least 120 deg. Then several holes were punched around the circumference, as shown by Fig. 1. The tap or drill to be used was placed in the butt stock and a tin cone was applied, as shown at *A*, the edges of the cone being lapped over until the cone fitted very closely to the tap, after which a bit of wire was put through a couple of the holes, as shown at *B*, and twisted to hold the cone firmly in position. Nothing further was

necessary except to tap the hole and let the tin cone protect the workman. After doing one job with this cone the writer constructed three cones in a similar manner, so that one could be attached to the drill, the other to the tap, while the third cone was made to fit closely around the piece of pipe which was to be screwed into the opening. Broken oil cup connections had no more terrors for the engineers in that station, neither were they suffered to exist, for a new nipple would be inserted and the steam shut off by a newly connected oil cup.

Scranton, Pa. Tom Scott.

FAILURE AND REPAIR OF A SET OF DIRECT-CONNECTED ROTARY PUMPS.

The rotary pumps in question are located in a modern loft building using central-station service. Being located in the sub-basement, the pumps force water against a head 35 ft. over and above the actual height of the building. The designer of the plant seemed to think that pumping the water over the supply tank (which is located on the roof) was an easier task than to have the pumps discharge the water into the tank at its bottom, hence a greater amount of work was imposed on the pumps by increasing the pressure to be overcome, not taking into consideration the friction caused by the extra bends of the discharge pipe.

A most peculiar thing about the pumps was that both of them failed at the same time and from the same cause, although previously there was no indication of the pumps breaking down. When pump No. 1 broke down pump No. 2 was started and found to be out of order, thus depriving the tenants of water. Because of the large number of people employed in the building every attempt was made to start one of the pumps. The motors, however, "bucked" and the armature and field coils of one of the 15-hp motors were completely destroyed. The burned-out motor was replaced by a new one as quickly as possible, but this motor on being started came up to speed and when full speed was attained flashed over and blew the fuses. The new motor acting in the same way as the old ones indicated there was no trouble with the electrical equipment and all further attempt to start the pumps was abandoned. A small triplex pump was installed which partly supplied the necessary water and afforded an opportunity to investigate the cause of the failure of the other pumps. The company which installed the rotary pumps did not put in the motors and when it was called upon to explain why the pumps would not run it promptly placed the blame on the motors. The company which installed the motors was communicated with about the trouble and immediately sent two expert electricians to locate the difficulty. The motors were found in good order. The owner of the building, tired of waiting for water, decided to employ a pump expert. The latter advised rebabbitting the thrust bearings of both pumps, as shown at *T*, Fig. 1. When the babbitting was

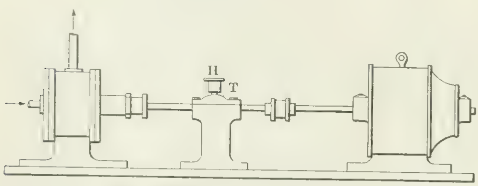


Fig. 1—Motor-Driven Rotary Pump.

completed the pumps were started, but the thrust bearings became overheated and the motors arced across the commutators and blew the fuses. The babbitting having failed to place the pumps in running order, the expert condemned the outfit and advised the installation of a triplex pumping outfit. When the new pump was started it was fou[nd] to be too small to supply the required quantity of [wa]ter. This difficulty was partially overcome by having a p[ort]ion of the building receive its water direct from the [str]eet mains and having the pump supply water for the [up]per

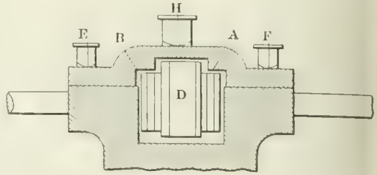


Fig. 2—Arangement of Thrust Bearing.

floors of the building. The installation of the new gave time to discuss the failure of the pumps an best means to effect their repair. It was decided to put the pumps in working order without the assi[stance] of outside help or advice. One of the first suggestion to cut out the babbitt from the thrust pockets and papier-maché washers on both of the sides of the collar.

The motors then came up to speed and worked w flashing across the commutator, but the excessive lo the motors, the heating of the bearings and rapid we washers presented difficulties. The papier-maché ers were then taken out and the propeller and shaft moved longitudinally from one extreme to the This disclosed the fact that the propeller at either ex would bind on the pump heads, thus causing the exc load on the motors. This discovery quickly led to for equalizing the longitudinal travel of the propeller to prevent any further trouble from excessive fr The propeller and shaft were moved to the extrem and this point was marked, then the propeller and were moved to their extreme travel to the right an position was also marked. It was argued that i thrust collar were made to rotate centrally between two marks it would cause the propeller to "float" be the pump heads and hence it would be imposssible to cause friction. Brass washers were placed on sides of the thrust collar *D*, as shown in Fig. 2, at *B*. When all was ready the pumps were started and to work nicely. After a few weeks' running it wa covered that the brass washers at *B* (which are the ers to sustain the thrust when the pump is working) away, and hard-steel washers were substituted and to give better results with respect to wear, but som would develop, which was not desirable. Thin steel ers having a brass washer centrally located between were then inserted and were found to be satisfactory object of displacing thick steel washers by thinner w was to allow the bearing to assume the function of bearing. Placing a brass washer between an equal n of thin steel washers prevented the hard washers fro ting the thrust collar. The manufacturer of the only supplied the bearings with one oil cup, as shown but two other cups were added, as shown at *E*, *F* excellent results.

New York City. William Kavan

SPECIAL CEILING SURFACES FOR INDIRECT LIGHTING

A recent accomplishment of the moving-picture [fol]k in improving the reflecting efficiency of their pro[jec]tion screens should offer a useful hint to those designi[ng] installations of indirect lighting. Having brought the intensity of the arc and the projecting machine up to its practical limit, the moving-picture men next attacked the prob-

of increasing the brilliancy of their pictures from the ... seeking a material of higher reflecting power ... ordinary sheeting commonly used. A picture ...wn on canvas can, as is well known, be seen about ...ally well from the rear of the screen and from the ... indicating at once an efficiency of only 50 ... in either direction. If part or all of these rays ... passing on through the sheet could be re- ... at the single useful side, the illumination of the ...ure would obviously be much increased. This result ... recently been accomplished in the production of an im- ... heralded on the billboards of the 5-cent ... an "incandescent curtain," but really only a ... surface of higher reflecting power than the ordi- ... screen. The results are surprising, the pic- ... far more brilliant and, as a result thereof, more ... cker.

...et-lighting art has now reached the same limi- ...loying reflectors and lamps of the highest effi- ...over-all results are yet tremendously reduced ... reflective coefficient of ceilings and walls. ...r and tint of the coating applied to these sur- ... indirect illumination is to be used should be ... the illuminating engineer as a part of the ...m and not left to the judgment of architect, ...nter, whose selection is made without knowl- ...duty of the ceiling as a reflector. There is ...t, following along the work of the moving- ...n mentioned, special paints could be devel- ... albedoes or reflective coefficients much higher ... use. With such paints and more of the light ... the room and less entering the walls the ...ssive wattage required with indirect lighting ... to one compared with direct illumination) ...stantially reduced and the physiological com- ... system of lighting be more generally secured.

... G. B. COLLIER.

...NDUCTIVE RESISTANCES OF METER-CURRENT CIRCUITS.

...ing electrical energy by a watt-hour meter ...rtain sources of error which are commonly ...pecially where the block of energy being meas- ...ll. The errors referred to are these known ...rs and phase errors of series-instrument trans- ... also of shunt-instrument transformers feed- ...r circuit in question. The ratio and phase ... series transformer are dependent upon the ...he inductive resistances of the meter series ...nd upon the percentage of full-load current ... series transformer is operating. Hence the ...rent ratio of a series transformer cannot be ...t for given conditions. These errors fre- ...ed 1 per cent of the rated full-load amperage the transformer, and where large blocks of energy are ...g measured the correction for these errors will soon ...ay for the trouble and expense of such deter- ... correction. A method has been published of ...ning these errors in the case of a series trans- ...mer for any given ohmic and inductive resistance of ...uit to be fed, and an outline will be given below of a ...el method of measuring the ohmic and inductive re- ...ances of a given meter circuit (which is to be fed ...the series transformer) in order that the operating con- ...ons may be imposed upon the transformer while under ... The inconvenience and expense of ordinary meth- ... of determining series circuit constants and of running ... tests under specific conditions often stand in the ... of making the necessary corrections for errors that ...st. The following method of measuring the above cir- ... constants requires no source of direct current, but ...s the polyphase emf supply which feeds the meter. Several amperes can be drawn from the secondary of a shunt-instrument transformer for a minute or so without running any risk of damaging the transformer. The method consists, in short, of measuring upon a wattmeter the reaction between a certain voltage drop *A-B*, Fig. 1,

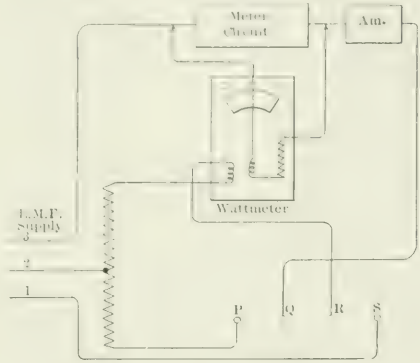


Fig. 1—Diagram of Connections.

and a certain current fed from phases 2-3 through ohmic resistance, and again measuring the reaction between the same voltage drop and the current fed from phase 1-2. The case described is as supplied to an available three-phase emf supply 1-2-3, but the method is easily applicable to other polyphase circuits. In diagram Fig. 1 *P*, *Q*, *R* and *S* are nails driven in a board and connected as shown. The rest of the apparatus shown is self-explanatory. When a jumper is placed from *Q* to *R* it will be seen that current is fed through the series coil of the wattmeter and through the meter circuit to be measured. Now the component of the voltage drop *AB* which is in step with the current will cause the wattmeter to deflect. For example, if the reading is, say, 28 watts and if the amperage is, say, 6, then the ohmic component of the drop *A-B* is 28÷6=4.66 volts and the ohmic resistance from *A* to *B* is 4.66÷6=0.78 ohm. Now remove jumper *Q-R* and place jumpers on *P-Q* and on *R-S*, thus keeping the same current in meter circuit, but changing the phase of the current in the wattmeter series coil. The watt reading now is, say, 42. In diagram Fig. 2 the angle 3-2-1 is 60 deg., representing the two phases of the current against which the voltage drop *A-B* was caused to react in the wattmeter. The distance 2-*X* is

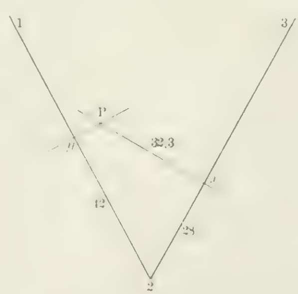


Fig. 2—Graphic Solution of Problem.

plotted to some scale equal to twenty-eight divisions, and the distance 2-*y* is plotted equal to forty-two divisions, as per above readings. Perpendiculars are erected as shown at *X* and *y* and their intersection at *P* is the end point of the vector 2-*P*, which represents the voltage drop *A-B*,

and $2\text{-}X$ is the ohmic component and $X\text{-}P$ is the inductive component. Scaling off $X\text{-}P$ to the same scale it is found to be 32.3 divisions or "inductive watts." Then the inductive volts are $32.3 \div 6 = 5.38$ volts and the inductive resistance is $5.38 \div 6 = 0.9$ ohm. The apparatus required for the above measurements will be seen to be simple and the values of resistances obtained are reliable within a few per cent, which is sufficiently accurate for the purpose in hand, as the total effect of the resistance upon the ratio of the series-instrument transformer is in general under 2 per cent.

Niagara Falls, Ont. H. S. BAKER.

INSPECTION DURING ERECTION OF CONCRETE FOUNDATIONS.

The writer has had brought home to him very strongly the utter absurdity of some of the concrete work constantly being done for foundations of electrical machinery and station buildings. Many of the contractors have learned their lesson and realize what it means to concrete work that it be made and placed properly. But there are still very many makers of concrete who seem to be actuated only by the principle that a certain space is to be filled with concrete as cheaply and as quickly as possible, and, seemingly, they proceed as if it made no difference how, where or when the content of cement was added to the mass of aggregate. The above statement is inspired by the recent work of a contractor who, being detected in underproportioning cement by the engineer, proceeded to put in very rich layers of concrete—rich in cement beyond all use or requirements, and thus proceeded until he had added the amount of cement necessary to bring the amount contained in the entire foundation up to the required proportion. The inspection of concrete should commence, not in the mixer, but with the material itself and before it is dumped from car or cart. The cement if from a well-established manufacturer may be accepted as being properly made, but its physical condition should be looked to closely. One should make sure that the cement has not been wet sufficiently to cause it to cake in the sacks, because cement once set, even though partially, and therefore full of lumps, cannot make as good work as fresh, dry cement which does not contain enough water to cause lumps. The sand and the broken stone or gravel should also receive close attention. Good gravel is preferable and makes better concrete with less labor than sand and crushed rock. The inspection should determine and fix the amount of cement used. This should not be an arbitrary proportion fixed by the architect, but should be determined by the inspector upon the ground, and it should depend upon the material being used. Furthermore, the necessary proportions of cement and gravel may vary with each lot of gravel used. This is not detrimental to the interests of the contractor, for it is only necessary to provide material which shall make concrete with 1500-lb. crushing strength per square inch. It is possible to do this by properly grading ordinary sand and gravel with only 6 per cent of cement. It all depends upon the grading and the closeness of the mixture to the curve of greatest density. Thus it is for the interests of the contractor to grade aggregate very closely. When it is not practical to grade (which is the separation of the gravel into four or five sizes and then recombining them) a very close approximation may be made by rectifying the gravel. Rectifying consists of adding a portion of one or more other kinds of material as tests show it to be beneficial. Usually it is found that too much fine material is present in the gravel. Then the concrete may be improved by adding some coarse gravel or crushed stone. In other cases some very fine sand is needed, and the material is "rectified" by adding certain percentages of one or both, as may be found necessary by a test with the sieves or by the cubical box and water percentage method. After a satisfactory aggregate has been provided the inspector should see that the water is of good quality and free from dirt, grease or acids. The latter are very detrimental to concrete. The proper amount of water should be used in mixing the concrete, such an amount as will barely show on the surface after the concrete has been tamped. In depositing the concrete in place it should not be rolled down a long incline or spout in small quantities. So doing will surely separate the large material from the smaller particles. Rolling the concrete down the edge of a large pile of material has a similar effect. The best way to get concrete in ... to dump it where wanted, either by an improved ... discharge car or skip, or by dumping the concrete ... shovel or from a wheelbarrow directly into the place where it is to be rammed. This being done, and the ramming well performed, the inspector may be ass... good concrete as far as the placing is concerne... much concrete should not be dumped in without r... It will not secure good results to tamp upon the ... 2-ft. depth of loose concrete. The top of the pile ... made hard, but there will be soft places in the ... of the mass or at the bottom which surface tamping ... reach. A small pinch-bar is a most excellent tool for the inspector to use while testing the placing and ram... of concrete. That tool will enable the inspector to lo... and detect soft pockets of concrete and he should see th... such defects are remedied at once, for they are fata... the strength of concrete. The aggregate should ... evenly distributed in the concrete and large pebble... not be allowed to collect at one point while s... cement are in force somewhere else. The concret... be deposited and tamped at once—immediatly af... mixed—for it is very detrimental to concrete to a... the mixed material to lie until the initial set has taken place. The removal of forms should be closely watched by the concrete inspector. Where conditions are such th... portions of the concrete mass must carry conside... the weight of the concrete itself, then the forms should not be removed for a week or ten days. In other cases they may be removed as soon as initial set has taken place. This is the case with footings and similar work which are to be buried in earth. The quicker forms are removed from exposed work the more sprinkling of the finished concrete must be done, for it must be kept moist or it will not harden. Concrete will cure or harden perfect without any sprinkling whatever provided the necessary amount of water is added during the mixing of the mat..., as described above—and that the water is kept in the concrete after it is rammed. This means that none must be lost by evaporation, hence the desirability of keeping the forms in place as long as convenient and also covering the concrete, after forms have been removed, with ear... sawdust, sacking (wet) or any substance which will prevent evaporation. Failing in any of these the inspect... must insist upon the surface of the concrete being k... in a moist condition by frequent sprinklings. When the foundations are complete the inspector must exercise judgment in permitting the loading thereof until two ... three weeks have elapsed after ramming. Concrete ... not come to good strength until it has been kept m... and unfrozen for twenty-eight days, and even then ... has an effect upon it compared with the speed of h... in hot weather. The inspector must be fair to the contractor as well as to the owner, and therefore he must see that the foundations are allowed to remain unloaded until they are ready for use without danger of crackin... The inspector may permit the gradual loading of the foundations as their aging progresses, but should exercise care in the interests of the contractor to insure that gre... foundations are not damaged by the careless hand... of machinery.

South Bend, Ind. JAMES F. H...

QUESTIONS AND ANSWERS

[illegible] for a United States patent for an electrically operated [illegible] will it be necessary for me to prepare drawings or can [illegible] the model which I have already built and operated successfully.—G. E. H.

T[illegible] invention should be illustrated by means of a drawing [illegible] described with such clearness that a person skilled in t[illegible] art to which it pertains can construct and operate the [illegible]vice. The strength of the patent lies wholly in the [illegible] and the patent when issued will be worthless or [illegible] according to the wording of the claims. The [illegible]on of the application and wording of the claims [illegible] be done by a reliable attorney familiar with such [illegible]her than by an inventor without experience along [illegible]

[illegible] does the split-pole converter differ from the standard synchronous converter?—H. L. O.

In the standard synchronous converter the ratio of the direct-current voltage to the alternating-current voltage [illegible]ally constant. Where it is desired to vary the [illegible]rrent voltage it is customary to employ induction [illegible]s or alternating-current boosters or voltage-[illegible]ial switches connected to taps in the transformer [illegible] In railway work it is usual to employ series [illegible] and to vary the wattless component with the load, [illegible]ing the delivered alternating-current voltage and [illegible]tly the direct-current voltage at the expense of [illegible]g power-factor. The split-pole converter gives a [illegible] varying the ratio of the direct-current voltage to [illegible]nating-current voltage by varying the magnetic [illegible]ribution only, thus doing the work of induction [illegible] booster or other voltage-varying device. The [illegible]ge-varying device external to the converter is an [illegible] field rheostat or other field-controlling device [illegible]y be operated manually or automatically. In the [illegible]e a compound winding responsive to the load may [illegible]r automatic regulators responsive to voltage. [illegible] converters are not built except for 25-cycle [illegible]

[illegible] a 600-volt, 500-kw, direct-current, six-pole, compound-wound, [illegible]ilway generator, directly connected to a 2200-volt induction [illegible] set runs in parallel with another set, identically the same [illegible]ay, situated in another substation about 10 miles away. [illegible]urrent circuit-breaker belonging to the machine in question [illegible]000 amp, which is 20 per cent overload. Some months [illegible] noticed that the brushes sparked considerably at a great deal [illegible]l load. This sparking gradually grew worse, till the brushes [illegible]ttle at even no load, and sparked badly at full load. The [illegible] kept perfectly clean, and the commutator was cleaned daily [illegible]ng down in addition to a vigorous wiping off during the [illegible] a very small quantity of oil was used to lubricate the com[illegible] everything else was done that could be thought of to [illegible]sparking, but without avail. The brushes were set and are [illegible] the point indicated by the manufacturer (very slightly [illegible] center of the shunt-field poles). They are set at exactly [illegible]int as are the brushes of the other duplicate machine mentioned, which has always commutated perfectly. By way of ex[illegible] brushes have been shifted forward and backward a short [illegible]umber of times, but this had no effect in reducing sparking. [illegible] after the sparking was first noticed, it was discovered [illegible] three points on the commutator, 120 deg. apart, the commu[illegible] burnt and roughened for a distance of little greater than t[illegible] thickness of the brushes; that is, about two and one-half bars [illegible]ened their entire length at each of three points 120 deg. apart. This condition continued and spread to the adjacent bars in [illegible] that was done to prevent it. The coils attached to these [illegible] no excessive heating nor anything, in fact, to indicate [illegible] of any kind. The entire armature winding seemed perfect in eve[illegible] way. Soon high mica showed up at a number of points [illegible]re the bars were burnt and at other places). The com[illegible] was ground down by holding scythe stones carefully by hand against it. This was the only method available at the time. The result was a smooth commutator, no high mica and everything apparently as it should be. The brushes were then carefully sandpapered to fit the commutator. For the first six hours or so commutation was sparkless and hope was entertained that the difficulty was overcome, but within twenty-four hours the same old trouble had reappeared and steadily grew worse. The negative brushes arced much more than the positive and the negative brush-holder arm which was at the top of the commutator, that is, the point of the commutator farthest from the floor, arced worse than the other two negative holders. The spacing of the brush holders around the commutator was checked and found to be correct. Then the brushes began to chatter badly and no adjustment of the brush-holder spring would remedy this. The commutator was evidently not true and arrangements were made to turn it down. After this was done and the machine put into operation again commutation was perfect for a day or two, from no load up to the opening of the breaker. The opening of the breaker due to overload occurs on an average of from five to forty times a day. Then it was noticed that the same bars 120 deg. apart began to show signs of burning as before the turning. Sparking showed itself at about half load and grew worse. The positive brush holder first ahead of the negative holder at the top of the commutator sparked the worst. The negative brushes sparked very little. The brushes in this positive holder spit and arc viciously at about two-thirds load. This holder is spaced absolutely correctly, as it has been checked several times. The brushes are sandpapered daily and carefully wiped and cleaned. By a daily heroic use of sandpaper on the commutator its surface is kept fairly smooth and the burnt bars are kept down. Two hours spent every morning before the machine is thrown on the line and while the commutator is cold produce a surface which shows but the barest trace of burnt bars in a few spots. Sparing use of good oil for lubrication, constant wiping during the day and the occasional use of coal-oil on a rag to clean off carbon dust (which will come off in no other way) produce upon shutting down at night a commutator darkly stained and with certain bars badly burnt (always the same bars). The brushes, by the way, are the regular brushes furnished by the manufacturer for this equipment. We have considered the possibility of a shorted coil and an open one, but neither of these fit the conditions exactly. An open coil shold arc on no load and a shorted coil should heat up, neither of which things occurs. If you can suggest a possible cause for our trouble or offer a remedy as yet untried you will confer a great favor.—A. D. M.

You will appreciate the fact that it would be practically impossible for a person in New York to form an adequate opinion as to the causes of trouble in a machine in Portland, Ore., when the person who outlines the causes as he sees them in Portland is unable himself to locate the trouble. It is evident, however, that the two machines mentioned by you are not identical in every respect or are not operated identically. It is very probable that the former rather than the latter covers the facts. That is to say, the machine which causes trouble differs in some respect from the machine which causes no trouble. Taking into consideration all of the facts mentioned by you, it would seem that the magnetic circuits of one machine are not properly balanced. That is to say, the three pairs of poles are not spaced magnetically 120 mechanical degrees around the air-gap. If this is the case, troubles such as you describe would exist. We suggest that each brush around the commutator be insulated completely from its holder and from the outside circuit. When the machine is separately excited, or excited by means of one positive and one negative brush, the voltage between any positive and any negative brush should reach its proper value and there should be no resultant emf between the three positive brushes and no resultant emf between the three negative brushes. Unless our guess is incorrect, which is not at all improbable, you will find a considerable voltage between the brushes which should be at equal potential. Such an emf would produce a circulating current at all loads, as may be observed by connecting the brushes together through an ammeter, but the sparking might not become evident except under considerable load, or after the commutator had gradually become roughened. If an examination reveals an emf the trouble caused thereby may be minimized by shifting the individual brushes of each polarity until the emf disappears. The proper positions can be found by means of a low-reading voltmeter and the necessary shifting can be done by changing the brush holders or it can be accomplished by means of properly trimming the brushes.

Central Station
Management, Policies and Commercial Methods

FREE FAN SERVICE FOR THE SICK.

The San Diego Consolidated Gas & Electric Company, San Diego, Cal., has addressed a communication to the daily press of that city announcing that during the remainder of the summer the company will place without charge electric-fan service at the disposal of every sick person who is unable to pay for the fan and service and whose sickroom can be reached from present distributing lines. The conditions are that the attending physician shall certify in writing to the desirability of fan service from a medical standpoint and to the financial inability of the patient, and shall also notify the company when the necessity for the service has ceased. If the house is not wired the company offers to run service wires and install sufficient interior wiring to operate the fan, loaning the latter as long as may be necessary.

DEDICATION OF CLUSTER LIGHTING.

Farmer City, Ill., made the commencement of cluster street lighting an occasion for a celebration that attracted to it a number of visitors from neighboring towns and the surrounding country exceeding several times the population of the town. The local band paraded the town and an orchestra furnished music from a platform erected in the main street, while a neighboring platform was given over to singing and acrobatic dancing. The storekeepers had their windows specially decorated, one showing portraits of the mayor who commenced the electric-lighting system, another of the mayor who completed it, and a third of the chairman of the Council electric-light committee. Other features consisted of wheelbarrow, one-legged, fat men's and other races, greased-pole climbing, tug-of-war, pie-eating contest, parade in costume and a dive from a high building to a net stretched in the street below. The local paper, which pronounced the dedication of cluster lighting a success of which the community should be proud, does not, however, mention the street lighting beyond saying that it was the occasion of the celebration.

WIRING REGULATIONS IN DENVER.

Under a new Denver electrical ordinance the published rules of the city electrician become a part of the ordinance. Under Mr. Joseph F. Reardon, who has held that position for seven years, a remarkable advance in electrical construction methods has taken place in Denver. Conduit is now required in new and rewired work in all classes of buildings throughout the city. Signs are required to be of entirely non-combustible material. The rewiring of old installations is far more frequent than is usual in Eastern cities, and the public's attitude toward the better wiring construction is unusually favorable.

Recently twenty inspectors of the Denver Gas & Electric Company, under the supervision of Mr. Reardon, covered every building in the city, noting particularly the use of brass-shell sockets in kitchens, baths, toilets, basements and similar locations. Upon receipt of their reports the city electrician issued warnings of the personal hazard involved and asked for the removal of such sockets from the reach of the public or their replacement by porcelain sockets. Within a short period over 90 per cent have been replaced by building owners or occupants, only ab... cent refusing.

A new rule for alternating-current motor f... just been made effective requiring three-phase, ... motor circuits to be figured at 3 amp per horse-p... phase. Running fuses must be of a size to pr... size of wire, but starting fuses may be 25 per cen... up to 50-hp motors, and 50 per cent greater fo... above 50 hp. It is anticipated that much difficult... from conflicting sizes of motor feeders as figure... ferent competing contractors will be avoided an... never be reduced to unsafe sizes. No. 12 wire is ... mum size allowable for motor feeds.

ELECTRICITY IN A COLORADO HOT...

Electric lighting and motor service play a prom... part in the operation of the Antlers Hotel, at Colorado ... Col. Energy for motors and lamps is supplie... Colorado Springs Light, Heat & Power Compan... an underground transformer and switchroom, t... service being wired for 550 volts direct current, th... distribution being by 110 volts alternating curren... on the two-wire system. Three 15-kw transfor... installed for the lighting service, the primary le... connected to the 2300-volt circuits of the centr... company. A two-panel lighting switchboard is i... nine main lighting switches being installed. Seve... power circuits are in operation, and the energy co... of the hotel is measured by four recording w... About 28,600 kw-hours per month is consumed by ...

The motor service is handled by about twenty ... tors, ranging in size from ⅛ hp to 25 hp. Incluc... the equipment are an ice-cake cutter, driven by a ½-... motor; an 18-ton duplex, double-acting Carbondale refi... erating machine, driven by a 25-hp motor; a 10-hp vacuu... cleaner, 5-hp brine pump, 3½-hp triplex water-service p... and numerous fans. In the hotel laundry washers, ... tractors and body ironers are group-driven by a 25-hp mo... and a 10-hp mangle is also in service. Seven 6-lb. elec... irons are in use in the laundry, and two 15-lb. irons are ... service in the tailor shop. Three elevators are driven ... motors aggregating 40 hp; menu cards and other stati... are printed on a private press, driven by a ½-hp m... and motors of the latter size are employed in driving ... and buffers in the silver closet, a kitchen fan ... ventilating fans in the dining room, office and p... ⅛-hp motor operates a pump in connection with a electric fountain used at banquets. In the bakeshop a 3-... motor operates an ice crusher and ice-cream freezer, the ... process being handled by brine, instead of ice.

All guestrooms are lighted by from three to f... tungsten lamps of the 25-watt size, and in the kitche... an arc-lighting installation is in service. An extensive ... ephone equipment is in service in the hotel. A prominer... feature of the hotel service is an elaborate Turkish-bath ... ablishment, in which two electric heating cabinets, a... electric tub, blanket and equipment for the application o... various high-frequency currents to the body are in serv... The principal electric cabinet contains fifty-six lamps ... 16-cp rating, with bulbs giving a graduated ray, inclu... red, violet, yellow and orange light. Experience sh... that with the electric cabinet a temperature of 100 d... Fahr. can be attained in 7 minutes, while with the ordin... steam cabinet at least 15 minutes is required. The co... fort ...

tl electric cabinet is also much greater than that of the stm equipment. Medical experts estimate that from 7 p cent to 8 per cent more carbon dioxide is eliminated fm the blood with the electric cabinet. An extensive eipment of electric vibrators is in service at the "Antle," and in the main lavatory antiseptic conditions are mntained by a 110-volt Vohr motor-driven ozonator. All tl steam-heating service of the hotel is supplied by the Corado Springs Light, Heat & Power Company.

ANOVEL LOAD DISPATCHER'S RECORD BOARD.

[illegible] record board recently installed in the office of [illegible] dispatcher of the Edison Illuminating Company [illegible]troit makes use of several hundred miniature knife [illegible]es to represent the actual arrangement of the oil [illegible]es in the various stations operated under the dis[illegible]r's direction. The circuits and bus arrangements o' he generating stations and substations are all faithfully re[illegible]uced on the miniature board, and when the dispatcher [illegible] a switch opened or closed he records the change [illegible] miniature counterpart of the system. All machine [illegible]es, trunk-line switches, tie switches, etc., are shown, [illegible]gh some of the feeder switches have been omitted [illegible] these are normally closed unless out on overload. [illegible]veral stations even the hook-type disconnect switches [illegible] produced by miniature hook switches, when these [illegible]es play a part in transferring or rerouting circuits. [illegible]is purpose the Detroit Edison Company also makes [illegible] jumpers and plugs having carrying capacities equiva[illegible] to the regular bus and cable cross-section. These [illegible] and jumpers are reproduced by miniature [illegible] and U-shaped jumpers on the record board so that [illegible]nsfers of circuits can be duplicated. When work [illegible]g done on a circuit, the corresponding switch is [illegible] on the dispatcher's order and tagged with a red [illegible]g card. At the same time a similar tag is attached [illegible] dispatcher's little switch, guarding him against or[illegible] this switch closed until he has received word from [illegible]n doing the work that the line is clear. Under no [illegible]ions can any switch on the system be manipulated [illegible]t the dispatcher's instruction.

[illegible] record board thus gives at all times a graphic re[illegible]tion of the system's arrangement, and the use of [illegible] switches which are actually thrown into position has [illegible]und to be much simpler and clearer than an adapta[illegible] f painted switches, plugs, etc. The little switch[illegible] used are of about the size of the smallest porcelain [illegible]ted knife switch in use on 110 volts, and more than [illegible]f these tiny blades are employed in the duplication o the Detroit company's system. Generators, transformers a, other apparatus are indicated by the usual symbols, ca es by black lines, and the main buses by copper strips. M. J. Bishop is chief operating engineer for the Detroit Eson Company.

MNICIPAL PLANT AT NAPANEE, ONTARIO, SOLD TO TOWN'S ADVANTAGE.

n July 25 the town of Napanee, Ontario, passed a poer by-law by a vote of 408 to 46 disposing of the micipal electric-light plant to the Seymour Power & Eltric Company, Ltd., of Campbellford, Ont. The plant, wh h was installed in 1906, contains two 125-kw, 60-cycle, twphase generators, each of which is belted to a highspd engine. The apparatus is housed in a substantial stoe building with concrete floor and roof and the streetlig ing equipment consists of two 25-light regulators with a mixed system of series inclosed arc and 80-watt series tungsten lamps. The entire plant is in first-class condition, having been constructed in a thorough and workmanlike manner in the first place and afterward well maintained.

In selling out to the Seymour Power & Electric Company the town of Napanee secures a twenty-four-hour service instead of a dusk-to-dawn service which previously obtained. Moreover, the change will be accompanied by a substantial reduction in rates. The street arcs, for each of which the plant was credited with or received $70 per annum, will hereafter be maintained at a yearly rate of $55. The series tungsten lamps used for street lighting will be reduced in cost from $20 each to $15 each per year. The commercial and residence lighting schedule of rates will be reduced from 10 cents per kw-hour to 8 cents per kw-hour and meter rentals will be abolished. For those who desire it there will be an alternative rate for residence lighting of 10 cents a room per month plus 3 cents per kw-hour for the energy consumed. This rate is somewhat similar to that of the Hydroelectric Commission in Toronto. The rates for energy used by motors will not exceed $25 per hp-year for twenty-four-hour service.

From the above it is evident that the town has been benefited by the sale, and the new rates should result in the expansion of industries now in the town and the acquisition of other industries. The Seymour Power Company's 44,000-volt transmission line is now complete as far as Deseronto and will be extended to Napanee, where a substation will be erected in order to make the necessary delivery of energy. The energy can be delivered from the company's stations at Campbellford or Trenton, so that the duplicate sources of supply will insure a reliable service at all times.

OPERATING COST OF A GAS-PRODUCER CENTRAL STATION.

The operating experiences of small central stations often indicate the direction in which betterments can profitably be made. Close figuring is generally necessary to turn the income into an annual profit and the importance of pushing the commercial development of the small company can hardly be exaggerated. A typical instance is furnished by a central station of 75-kw rating established not long ago in a town of the farther West. The plant consisted of a 2300-volt, three-phase, 60-cycle Westinghouse alternator belt-driven by two 62.5-hp Olds engines operating on Pintsch gas. The apparatus was all housed in a brick station 70 ft. long, 53 ft. wide and 12 ft. high. The gas-producing equipment consisted of a Pintsch generator 10 ft. long and 4.5 ft. in diameter, with the usual auxiliary

FIRST COST OF 75-KW GAS-PRODUCER STATION.

[illegible]	[illegible]
Building	1,150
[illegible]	[illegible]
[illegible]	[illegible]
Freight	800
[illegible]	[illegible]
[illegible]	[illegible]
Installing machinery	500
[illegible]	[illegible]
[illegible]	[illegible]
Transformers	1,050
[illegible]	[illegible]
Meters	3,000
Total	[illegible]

vaporizing and scrubbing apparatus. The plant was provided with a compressor for starting the engines at 150 lb. air pressure, the compressor being driven by a gasoline engine. The main engines were of the horizontal four-cycle center-crank type, each being equipped with a flywheel 9 ft. in diameter and weighing 4 tons. About 5.5 gal. of cooling water was required per hp-hour.

Anthracite coal costing $6 per ton was burned in the producer and the heating value of the resulting gas was found to be 136.2 lb.-Fahrenheit thermal units per cubic foot. The coal showed on analysis 13,620 thermal units per pound, 85.2 per cent fixed carbon, 6.9 per cent ash and 6.2 per cent volatile matter. On a test the plant produced electrical energy upon a coal consumption of 1.71 lb. per kw-hour. A 4-kw belt-driven exciter was also in service. The first cost of the plant is shown in the table on page 569. The relatively high initial cost of a small gas-producer plant installed new throughout is apparent, the investment per kilowatt of rating being about $214. The low fuel consumption secured, however, is noteworthy, considering the small size of the installation.

OPERATING EXPENSES OF PRODUCER STATION SYSTEM PER MONTH.

Coal 22 tons at $6	$132
Superintendence	150
Electrician	90
Two engineers	150
Bookkeeper	35
Office miscellaneous expenses	50
Oil and waste	15
Total	$622

All expenses of handling the property were included in the above, with the exception of fixed charges. The population served by the company at the time the figures were made was about 3000. The revenue per month was $880, of which the company received $550 from the sale of 5000 kw-hours for lighting service at a price of 11 cents per unit and $330 for the sale of 6000 kw-hours to motor users at a price of 5.5 cents. Three-phase distribution was made by the company, there being about 110 hp in motors connected to the system. After the expenses were deducted from the earnings there remained a balance of about $250 per month from which to pay interest, taxes, depreciation and dividends. The operating cost of the system per kw-hour sold was 5.65 cents. On the test of the plant, with conditions as favorable as possible under the circumstances, the cost of production covering operating expenses alone was 5.1 cents.

The plant was handicapped, among other things, by the use of too many small transformers on the distributing system. The service was also subject to interruptions on account of the inexperience of the early management. It was found that a saving of $593 per year could be effected by substituting fifteen 5-kw transformers for the existing installation of 35 units aggregating 75 kw. With the smaller units there was a total loss of 54 kw-hours per day compared with 25 kw-hours when using the larger equipments. Other improvements made were the utilization of a three-wire secondary system of distribution, the realignment of the poles, removal of wires from the limbs of trees and the installation of a new line shaft permitting the operation of the plant in units arranged according to the load, the capacity having been increased by the addition of a new engine, generator and gas producer and by the substitution of four 75-hp engines of the three-cylinder type for the original installation. At present the plant is distributing hydroelectric energy purchased from a large wholesaling company, finding this work more profitable than the generation of its own energy from the producer plant.

FORESTALLING AN ISOLATED PLANT BY CENTRAL-STATION SERVICE.

The problem of securing a contract for central-station service in a new building to be occupied by a number of manufacturing tenants is one of considerable importance in growing cities. In long-established buildings devoted to miscellaneous manufactures it is often possible to substitute central-station motor and lighting services for the system in operation on account of the depreciation of the plant and the inability of the equipment to meet the demands of an exacting clientèle for continuous and increasing service. New buildings, on the other hand, present many difficulties on account of the uncertainty as to the amount of power that may be needed by the tenant, the frequent recommendations of architects on behalf of an independent installation of electric generating equi[pment] and the indefinite cost of operation prior to the esta[blish]ment of the building on a thoroughly substantial com[mer]cial basis.

In a representative instance where a proposed iso[lated] plant was forestalled by aggressive central-station s[ervice] the building was located near the mercantile center [of an] important city and was designed to be occupied [by its] owners, miscellaneous manufacturers and retail stor[es. It] was determined that about 300 hp would be requi[red in] boilers for heating and power purposes, about two-[thirds] of this capacity being needed for power alone. Fro[m the] limited data available it was estimated that two gene[rators] of 50-kw and 150-kw rating would be needed to f[urnish] energy for both lighting and motor service. Coal fo[r] heating and power service cost $4.25 per ton, and wat[er was] to be purchased from the city mains. In order to tre[at the] isolated plant fairly a load-factor of about 65 per cen[t was] assumed for the installation, although this was som[ewhat] higher than was common for installations of this cha[racter] in the community served by the company. An operat[ion of] ten hours per day and twenty-five days per mont[h was] assumed.

The estimated cost of the plant is shown by the f[igures] which follow:

150-kw engine and generator	
50-kw engine and generator	
Foundations	
200-hp boiler and settings	
Switchboard	
Feed-water pumps and heater	
Wiring switchboard and connecting generators	
Piping for engines, pumps, etc	
Extra cost of stack for power purposes	
Cost of meters for tenants' service	
Total	

The estimated fixed and operating costs of the pla[nt per] year are given below:

FIXED CHARGES ON ISOLATED PLANT.

Interest, 5 per cent	[illegible]
Depreciation and obsolescence, 5 per cent	[illegible]
Taxes and insurance, 1 per cent	[illegible]
Repairs and renewals, 4 per cent	[illegible]
Total	$2

OPERATING COST OF ISOLATED PLANT.

Labor (engineer, $20; fireman, $15)	$1
Coal, at $4.25 per ton	4
Water	
Oil, waste, packing, boiler compound	
Tools	
Removal of ashes	0.00
Lamp renewals	.00
Testing and adjusting 30 meters	.00
Overtime electric energy purchased	.00
Superintendence and clerical work	
Total expense of isolated plant per year	$11
Total (Energy being sold to tenants by owners.)	$ 8

The estimated cost of operating the building by c[ent]ral-station service, leaving the heating to the owners, is [sh]own in the table on the following page.

Central-station service was therefore installed, th[e] estimated annual saving by its use being $621. In additi[on] the

company made the important point that the services of its engineering department were worth at least $250 per year [illegible] owners of the manufacturing building. [illegible] point was emphasized that in the case of a private plant this item would include such matters as indicating the engines, testing motors throughout the building, offering expert advice [illegible] boiler economies and tendering assistance in rela[illegible] the various problems which frequently arise in [illegible]gs of this character. Similar problems, with the exception of the engine test, arise when energy is pur-

[illegible]NTRAL-STATION SERVICE, INCLUDING HEATING BY OWNERS.

[illegible] 2 ¼ cents per kw-hour	$[illegible]
[illegible]	1,0[illegible]4 1[illegible]
[illegible] at $4.25 per ton	[illegible]
[illegible]	62[illegible]
[illegible]	[illegible]
[illegible]	2[illegible]
[illegible] meter and lighting service	[illegible] 60
	$10,[illegible]41 50

chased from an outside source. The energy consumption in most factories gradually increases, due to many causes, such as the installation of additional machinery, changed processes of manufacture, increased speed of machines, [illegible] machinery or shafting and other causes. Where [illegible] is sold by meter this increase is recorded, and frequently complaints due to ignorance of the cause arise on the part of the consumer. The central-station officers [illegible]ut that on account of the company's wide experi[illegible] complaints could be better handled by their [illegible]tion, with satisfactory adjustment of any difficul[illegible]g between the landlord and the tenant in the sub[illegible] electricity.

Another item which was not taken into consideration in figuring the cost of service by a private plant was the cost of energy lost in the distributing mains and meters [illegible]t the building. With central-station service the [illegible]st in meters and transmission costs the landlord [illegible] as only the energy passing through the meters is [illegible]. With a private plant the losses have a direct [illegible] the coal consumption, the estimated cost being [illegible] year.

[illegible]erable emphasis was also laid upon the cost of superintendence and clerical work in the case of operating the private plant. This would cover such duties as the [illegible] of coal, oil and other engine-room supplies, read[illegible]nts' meters, figuring bills, keeping account of the cost of power generators and many other items attendant upon the use of a power plant. The generation of power is one of the minor details in the operation of a factory building, and the time of the executive officials can be better spent along lines of increased sales, cheaper production or increased output than in dealing with technical power questions.

In applying central-station service the company installed all necessary meters and wiring on the consumers' premises, arranged to test the meters regularly and to send an [illegible] statement of the monthly readings to the owner [illegible]lding to enable him to base his charges for energy used [illegible] the tenants thereon. The owner was only required to pay for the total energy consumption of the property as indicated by the sum of all the meter readings, this being the same as for one customer with the equivalent total consumption of electrical energy. Under the central-station contract the building is furnished with all carbon incandescent lamps for the first installation and renewals free of charge, and tungsten lamps are sold to tenants for less than they can be purchased outside by private plants. In the awarding of the contract to the central station these important considerations naturally carried no small amount of weight.

REVOLUTIONIZING THE BUILDING TRADE IN DENVER.

By R. B. Mateer.

Heretofore when a new structure was planned in Denver, Col., and contracts were let the first move of the contractor was to get into touch with others of his trade or

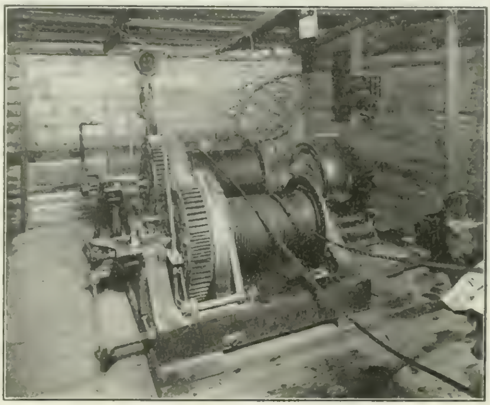


Fig. 1—Hoist at New Federal Building.

with machinery houses and either rent or purchase steam-operated machinery, such as concrete mixers, hoisting engines, etc. Several years ago some large warehouses of the slow-burning type were under construction, and after some effort the contractor was persuaded to purchase a small Chattanooga hoist and a small saw for the cutting of all large timbers. The machines were equipped with small motors of 3 hp and 5 hp respectively.

Realizing the advantages accruing through one installation, a strenuous campaign among Denver contractors by personal solicitation and literature, resulted in others exhibiting some interest in the new and intelligent way of handling building material. To-day several large buildings are completed and others are in various stages of construction upon which all material was and is handled with motor-operated machinery. The new Chamber of Com-

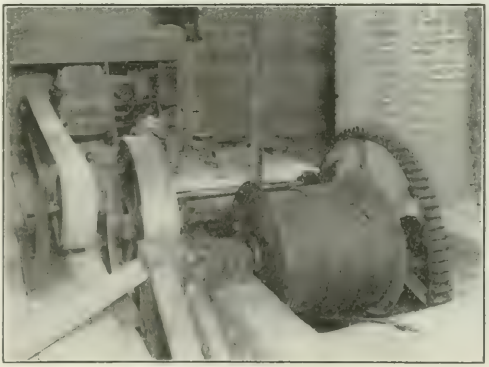


Fig. 2—Hoist for Concrete at Shubert Theater.

merce and the twelve-story Foster Building, for office purposes, were completed without the use of steam-operated machines. The concrete mixers, hoists and pumps were operated with direct-current motors supplied with energy

from the circuits of the Denver Gas & Electric Light Company.

At the new Federal Building, now under construction, a two-drum hoist, manufactured by the Leyner Engineering Company of Denver, is direct-connected to a 20-hp, 500-

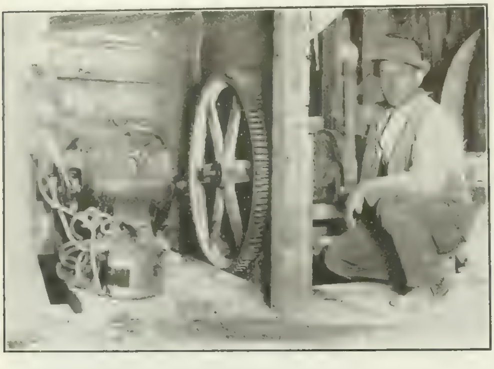


Fig. 3—Combination Hoist and Concrete Mixer.

volt Northern motor. As the building is constructed of Colorado white marble no steam, smoke or soot was desired around the new structure. The new Shubert Theater and office building is rapidly nearly completion and central-station service operates the motors used for the driving of the contractor's machinery. Fig. 2 shows the 15-hp, single-phase, 220-volt Wagner motor used to operate the concrete mixer. All concrete used in the building for floors, etc., is mixed and deposited in buckets, which are rapidly hoisted to the upper floors by means of the 10-hp hoist shown in Fig. 3. This hoist was built by the contractors and has proved very satisfactory. The forms upon which the concrete was poured were built on the premises. Instead of many carpenters a small 6-hp direct-current motor belted to a saw supplied those assembling forms with the necessary cut timber as rapidly as it could be used.

Electricity for contractors' machinery is to-day revolu-

Fig. 4—Motor-Driven Saw for Cutting Lumber for Forms.

tionizing the building trade in Denver. Even the large stones used in the new Episcopal Cathedral were sawed and then finished prior to being put in place by means of electrically operated machinery which was erected on adjoining property.

RECENT TESTS OF THE COST OF ELECTRI[C] COOKING.

In connection with the installation of an electric r[an]ge in the residence of Mr. Charles H. Williams, general [m]anager of the Northern Colorado Power Company, De[nv]er, the owner recently made a thorough study of the co[st] of electric cooking for a family of six persons for a p[eri]od of ten days. Energy was supplied from the comme[rc]ial circuits of the Denver Gas & Electric Light Comp[an]y. The range used was an equipment manufactured by [t]h[e] Simplex Electric Manufacturing Company, of Cambr[id]ge, Mass., the size being the company's No. 6. The range [w]a[s] wound for 220-volt service and contained two 10-amp [and] three 20-amp switches controlling corresponding ba[ke] and stove circuits.

In the table which is printed below are given the ch[arac]ter of meal, materials cooked, maximum demand in [kilo]watts, consumption of energy in kw-hours and cost [per] meal, the data commencing with the installation of the [elec]tric range. The cost of electrical energy is figured [at 5] cents per kw-hour. No previous experience had been [had] with electric cooking. Records were taken by a pen-re[cord]ing wattmeter which was carefully calibrated with a[n in]strument of precision. Much care was taken to kee[p the] range absolutely free from dirt during the progress o[f the] cooking tests.

COST OF ELECTRIC COOKING, FAMILY OF SIX, AT 5 CE[NTS] PER KW-HOUR.

Meal	Materials Cooked by Electric Range.	Maximum Demand in Kilowatts.	Kw-hours Required
Dinner	4.5 lb. roast lamb; baked white and sweet potatoes; baked rice pudding	2.4	2.7
Breakfast	Oatmeal; baked apples, 8; coffee..	2.24	2.5
Lunch	Stewed prunes; tea; potatoes for yeast	0.6	0.87
Dinner..	Clock mechanism disconnected		
Breakfast.	Oatmeal, coffee kettle of water	2.46	1.4
Lunch.	Warming potatoes; finnan haddie warmed; tea....................	2.2	0.65
Dinner...	3.5 lb. veal roast; baked sweet potatoes; 10 baked apples; baked Irish potatoes	2.8	4.35
Evening	Cooking oatmeal	1.0	0.47
Breakfast	Warming oatmeal; coffee.........	0.68	0.55
	Testing oven, raising temperature from cold to hot...............	1.4	0.7
Dinner	Stewing 4.5-lb. chicken; boiled potatoes; toast......................	.2.08	2.0
Breakfast	Baked apples, 8; oatmeal; coffee; baking bread; stewing prunes. .	2.6	3.20
Lunch	Boiled potatoes; coffee; 3-lb. pot roast.........................	....	3.15
	Warming coffee; laundress 2 p. m....	0.05	0.1
Dinner	Boiled sweet potatoes; baked potatoes; baked cornbread..........	2.4	2.75
Breakfast	Coffee; oatmeal..................	1.0	0.55
Dinner	Beef stew; carrots; potatoes; prune stew...........................	2.0	2.5
Breakfast	Baked apples; oatmeal	2.48	2.55
Lunch	Warming meat and coffee...........	1.4	0.7
	Baking three loaves graham bread ..	1.28	1.35
Dinner	Chicken stew, 4.5 lb.; cranberries, 1 qt.; potatoes, boiled (6 large)......	1.00	2.15
Breakfast .	Baked apples; oatmeal; coffee	2.5	3.25
Lunch .	Warming meat; coffee..............	1.6	0.35
Dinner	Meat pie; potatoes boiled..........	2.2	2.5
Breakfast	Oatmeal; coffee...................	0.6	0.6
Lunch .	Warming meat; coffee; potatoes for yeast..........................	0.90	0.6
Dinner .	Baked finnan haddie; boiled potatoes. baked apple, cream sauce.........	2.60	3.5
Breakfast	Baked apple; oatmeal; coffee.	1.0	0.5

Experience showed that some energy was lost by c[ha]ng[-]ing from one heat to another in order to regulate th[e] tem[-]perature properly. It was found that after the ove[n] was once heated baking could be done at small cost. Ro[ughly] the cost of electric cooking varied from 3 cents to 10 cents per day per person upon the basis of the above ra[te] per kw-hour.

[...]LLING AND RECORD SYSTEM OF THE NEW YORK EDISON COMPANY.

[...]siness supplying thousands of customers, aggre[...]ting [...]illions of dollars a year and requiring a clerical [...] [...]00 people to handle its bookkeeping, the New [...] [...]son Company has applied a system which for [...]ence of duplication is second to none. Only one item [...]ll [...] intricacies of the transactions of this electric [...]mpany is kept in duplicate—that of the meter [...] [...]hich in addition to being entered on the ledger [...] [...]n the meter record. From the time the first [...] taken, through all the channels of the bookkeep[...] [...]erks' and collectors' departments to the final [...]nent of the payment of the bill, no other item [...]d in the company's records. Even with this [...]ere are great stacks of old records which liter[...] [...]housands of feet of floor space in the various [...] the company.

[...] elimination of duplication of records there is [...]or which enters largely in the company's book[...] [...]thods. Mechanical devices are used exclu[...] [...]eping the statistical records, and mechanical [...] [...]nd mailing machines are used in sending the [...] customers. It is the combination of the sim[...] record keeping with the adaptation of the [...] features that makes it possible for the Edison [...] handle its business with the dispatch that it [...]

[...] is a brief outline of the company's method of [...] records and collecting its bills: As soon as [...] is signed a connection order is made out and [...] [...]estigation of service conditions is sent to the [...] department, whose men set the meter. The [...] department makes out a charge slip for the [...] slip is made in duplicate and the copy is sent [...] [...]u of receipts, which makes its own record, to [...] [...] binder. The duplicate is then sent to the [...] who enters it on his ledger and opens the [...]

[...]n th[...] regular trip day the meter is read by the meter

Fig. 1—Sorting Machine.

[...] whose report goes to the bookkeeper. The book[...] [...]mputes the consumption of energy, enters the [...] of the reading in his ledger and extends the bill. [...] [...]er record is then sent to the bill clerk, who after [...] [...] extensions returns the bill to the bookkeeper. The bookkeeper compares the bill clerk's extensions with his own ledger extensions, and if all the figures are found correct the bill is sent to the tabulating desk, where the statistical records are taken from it. It is here that the first mechanical devices are used. Cards of different

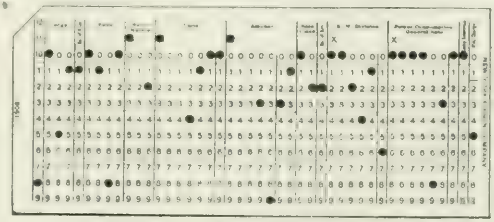


Fig. 2—New York Edison Statistical Card.

colors, known as the "bookkeeper's card" and the "statistical card," are punched with the necessary information. The bookkeepers' cards go through the sorting machine, which separates them in ledger and folio order. The total amount of energy sold and bills rendered for each ledger subdivided into totals for each 100 folios is obtained through this card. Fig. 2 shows an August bill for $39.31 entered in Ledger 51, folio 180. The energy consumption is 4100 kw-hours and is subject to a second rate, 241.6 kw being billed at 10 cents and the balance at 9 cents. This makes it possible to balance the ledgers in a very short time after all the entries have been made for the month.

Through the statistical card are obtained the total number of meters on which bills have been rendered; the monthly consumption of energy; the monthly amount of bills rendered under the various rates; the percentage that each rate bears to the total amount of bills rendered; the average price of income per kw-hour under each rate; the average price of income per kw-hour for the total amount of bills rendered; the percentage of increase over the corresponding months of the previous year, and the percentage of increase over the number of elapsed months during the year. The system was of great value in obtaining data

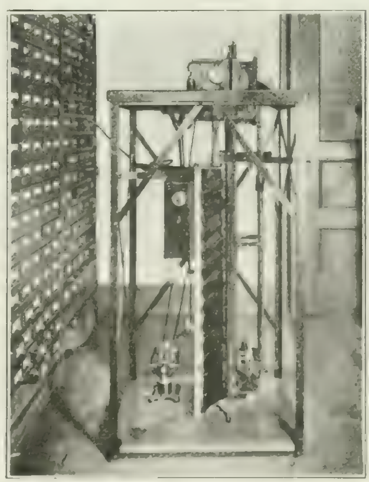


Fig. 3—Sorting Machine.

by which the company ascertained the effects of various rates on the annual income and assisted materially in adopting the rate which went into effect on July 1.

After bookkeepers' and statistical cards have been punched, the bill is mailed to the customer and under

ordinary circumstances is received from two to four days after the meter has been read. The stub of the bill, which has been detached, is kept as a collection record, and ten days after the bill has been mailed, unless payment be made sooner, the first call is made by the collector. As soon as payment has been made, either to the collector, by mail or through one of the district offices, it is posted on the ledger within the working day. The working day is from noon to noon. No cash received is allowed to remain unposted over this period.

The bills are sent out by the mailing department, which uses an automatic sealing and stamping machine for closing the envelopes and affixing a stamp. Envelopes with transparent fronts are used, the bills being addressed on the addressograph before they are sent to the bill clerk for the extensions. The New York Edison Company renders bills on 112,000 meters in the city, and to keep the records there are fifty-four bookkeepers, sixteen bill clerks and hundreds of clerks to handle the miscellaneous work of the department. Thirty-seven meter readers are required to keep track of the consumption of energy as shown on these thousands of meters.

THE TESTING OF CUSTOMERS' METERS.

The committee on meters of the Ohio Electric Light Association, composed of Messrs. John Gilmartin, chairman; O. H. Hutchings and J. T. Kermode, presented its report on meter practice before the Cedar Point convention of July 25-28, covering the several topics of the importance of testing, proper intervals for tests, tabulation of results, definition of accuracy, accuracy data, jewel data, flat-rate controllers, etc.

While shop tests are necessary in order to put a meter in good working condition, said the report, experience has shown that meters do not always maintain their accuracy during transportation and erection, so that installation tests and inspections are advisable. Other factors which affect meter accuracy in service are vibration, moisture, changes in temperature, stray fields, short-circuits, varying voltages and varying wave-forms. To minimize these errors, especially where commutator-type meters are used, installation tests are necessary to adjust the meter to meet the conditions under which it is expected to operate. Meters have a natural tendency to run slow, but sometimes, through accident or changes in their immediate vicinity, a meter will run fast. Therefore, periodic tests assist in maintaining the accuracy of meters, bringing the company revenue that would otherwise escape, and, in addition, indicate the honesty of intention of the company toward its customers. For such tests rotating standards are, in the committee's opinion, best adapted, because of their simplicity of connection, direct reading and lower cost of calibration.

Investigations have shown that the losses in revenue due to the average inaccuracy of meters are much in excess of the expenditure required to carry on this work in a satisfactory manner. Considering individual consumers whose yearly bills are $50, $100, $500 and $1,000, and assuming their meters to be only 1 per cent slow, the losses would be, respectively, 50 cents, $1, $5 and $10 yearly. As the cost of testing meters would probably not exceed 50 cents to 75 cents per test, it is evident that meter testing is a source of revenue to the company besides a matter of simple justice to the customer.

The committee recommends the accompanying test intervals as the minimum for good practice.

The results of all tests should be tabulated and averaged so that the company may have reliable data at hand in case of controversy with customers or in dealing with supervising authorities. These data will also indicate how much revenue is being lost due to slow meters, how much money should be spent on the meters and the best way to spend it. It is therefore strongly urged that every company testing meters should total and average its results at

INTERVALS FOR METER TESTS.

	Yearly Income from Customers.	Proper T[est] Interv[al]
Commutator Meters		
110-220-volt	$20 or less	Year[ly]
110-220-volt	$20 to $50	9 mont[hs]
110-200-volt	$50 to $200	6 mont[hs]
110-220-volt	$200 to $500	3 mont[hs]
110-220-volt	Very large	Specia[l]
500-volt	Up to $200	4 mont[hs]
500-volt	$200 to $500	2 mont[hs]
500-volt	Over $500	Specia[l]
Induction Meters:		
Single-phase	$50 or less	2 year[s]
Single-phase	$50 to $200	1 yea[r]
Single-phase	$200 to $500	6 mont[hs]
Single-phase	Over $500	Specia[l]
Polyphase	$50	Year[ly]
Polyphase	$50 to $300	6 mont[hs]
Polyphase	$300 and over	Specia[l]

least once a year. In tabulating such tests it is ne[ces]s[ary] to divide them into groups according to the purp[ose of] the test. For example, from the viewpoint of re[lation]s with the consumers, it would be desirable to grou[p sepa]rately all tests made on consumers' complaints o[f high] bills so that it may be known what percentage o[f com]plaints are justified by fast meters. Again, from the [stand]point of meter operation it would be advisable to t[abulate] separately the tests made on each make of meter [so that] the results can be compared to show which make [gives] best results.

For definitions and data on average accuracy th[e com]mittee referred to and quoted the reports of the [meter] committee of the National Electric Light Associati[on, the] New York Public Service Commission tests, etc.

METER JEWELS.

If the jewel bearing becomes worn and rough the [meter] will run slow. To show the magnitude of this effec[t, there] are given below the results of tests made by an Ohi[o com]pany on 700 meters having good sapphire jewels a[nd 700] other meters in which the jewels had become worn. The meters were of the copper-disk commutator type a[nd the] test intervals and other conditions were approximat[ely the] same, so that the comparison shows the jewel effec[t only], the meters being identical otherwise:

	Number of Meters.	Average Accuracy 5 per Cent Load. Per Cent.	Average Accuracy Full Load. Per Cent.
Meters having good jewels	700	82.8	98.6
Meters having worn jewels	700	52.4	94.0

General dissatisfaction with the sapphire jewel [has re]sulted in the development of the diamond jewel b[earing,] which is a very great improvement. The value [of the] diamond jewel is shown by a tabulation given on pa[ge ...] on the life of 500 sapphire and 500 diamond jewel be[arings] expressed in revolutions of the meter shaft. The en[tries in] the columns show the percentage of the jewels fo[und de]fective at the number of shaft turns indicated [in the] column headings, which are given in thousands of [revolu]tions.

For example, in the first column it is shown [that at] 200,000 shaft turns 10.2 per cent of the sapphire [jewels] had become defective, although none of the dia[monds]. In the fifth column, after 1,000,000 shaft turns, 6[.. per] cent of the sapphires had become defective and o[nly] 4.2 per cent of the diamonds.

Many companies still have copper-disk commutator meters in service, but it is recommended that diamond jewels be installed in all copper-disk meters unless the revenue from such a meter is less than $15 a year. In aluminum-disk meters the sapphire jewels last longer, and the inaccuracy when they become worn is not so great.

	200	400	600	800	1000	[illegible]	[illegible]	6000	8000	10,000	15,000
[illegible]	10.2	31.6	[illegible]	[illegible]	[illegible]	90.0	98.0	[illegible]	100.0		
[illegible]	[illegible]	.7	2.	[illegible]	4.2	7.4	12.3	20.0	29.3	43.0	[illegible]

[illegible]mittee is therefore not prepared to give a definite recommendation here, except that diamond jewels should [illegible] the more important meters.

EXCESS DEMAND INDICATORS.

The excess demand indicator is a device designed for interrupting the service when the consumer exceeds a [illegible] specified in his contract. An adjustment permits [illegible]ing device to be set for any desired load. Corre[illegible]e with companies having several indicators in use [illegible] at the repair and removal cost has been very small, [illegible]t in general they have given satisfactory results. A feature reported by one company is that, if the indicator is set for 100 watts and a 500-watt iron is connected [illegible]t, the vibration of the contact is so rapid that [illegible] energy to heat the iron is permitted to flow. An[illegible]mpany reports that, when installed on a porch or [illegible] places where the temperature is low, the oil in [illegible] congeals, preventing the satisfactory operation of [illegible].

The voltage drop in some indicators is also too high, which has caused complaints of poor light from consumers. One [illegible] reports from 2 volts to 5 volts drop. Tests made [illegible]mmittee on a 10-amp, 110-volt, 60-cycle indicator showed that with 110 volts on the line side the pressure on the consumer's side of the indicator was 104 volts, or a [illegible] volts. This drop is about one-half ohmic. A meter [illegible] same conditions would not give over one-half volt [illegible] Another test by the committee showed that if a 10-amp, 110-volt indicator was adjusted to trip at 220 watts and then 1100 watts load was thrown on, the vibrator [illegible] work rapidly enough to allow an average of 450 [illegible] 65 volts to be delivered to the load. A 10-amp indicator was short-circuited twice, blowing 30-amp fuses in approximately one second, and sustained no apparent [illegible].

The report of the meter committee was supplemented by a varied exhibit of meters and testing devices and methods in the convention hall.

Discussion.

In discussing the committee's report Mr. W. L. Cook, of Columbus, Ohio, raised objection to the testing of meters on the customer's premises, declaring that in such cases [illegible]dard test meter is subject to the same errors, due [illegible]ing, variations in voltage, frequency, stray field, [illegible]hat the customer's instruments may be wrongly calibrated. The difficult conditions under which customers' meters must usually be tested on the premises also cause [illegible]g of the work and prevent the degree of accuracy [illegible]d be obtained in a well-equipped laboratory, where [illegible]ters are tested under identical conditions. Most electric companies will not permit their representatives to give information to the public, and when a meter tester is asked by the customer regarding his meter's accuracy the indefinite answer given, said Mr. Cook, is sure to create dissatisfaction and suspicion that the meter is registering wrongly. The publication of meter-accuracy data showing the small per cent of meters tested and found in error would according to Mr. Cook, do much more harm than good, since each dissatisfied customer would at once form the notion that his own meter was one of the few erring instruments. For this reason the use of meter-accuracy tabulations in controversies with customers is without effect or conviction upon the consumer, who at once assumes that the company is trying to evade his complaint. Mr. Cook suggested that laboratory tests of meters would also be found much less expensive than tests on the customer's premises.

Mr. R. S. Graves, of Schenectady, N. Y., said that in his estimation the customer's test approaches most nearly to giving correct settings, in spite of varying conditions, moisture, vibration, etc. Mr. G. R. Smith, of the New York Edison Company, reported that special four-pole meters have been used on switchboards in New York City where the presence of stray fields is suspected. Meter tests there are made on the customer's installation, and the customer is invited to have his own expert or engineer present at the time specified in a notice sent out. In many cases, he said, the expense of removing a meter for laboratory test would be too great.

A MODERN CENTRAL-STATION STOREHOUSE AND PLANT OFFICE.

Except in metropolitan centers few central-station properties are equipped with adequate or specially designed storehouses or stockrooms for supplies in constant use, resort usually being had to some unoccupied building, room or corner of the plant often ill adapted to this important purpose. With an 8600-kw electrical system serving 18,000 customers in a city of 75,000 population at a shipping distance one week away from the nearest electrical distributing point, Kansas City, Mo., the necessity of keeping on hand a sufficient stock of supplies grows imperative. To meet this

Fig. 1—Storeroom for Construction Materials and Supplies.

need as well as to furnish offices for plant superintendents and engineers, drafting rooms and educational facilities for its employees the Oklahoma Gas & Electric Company has recently completed on its plant property at Oklahoma City the handsome and well-arranged storehouse building illustrated and described herewith. The new building is entirely distinct from the downtown business offices of the company, and is devoted entirely to the practical ends of plant operation and maintenance.

The building is a two-story structure of red brick trimmed with white stone, and measures over all 210 ft. x 75 ft. Behind it is the company's 80-ft. x 31-ft. garage building, of similar construction, while the entire property is inclosed by an ornamental brick-and-iron fence.

Between the two wings of the main building, as shown

in the accompanying plan sketch (Fig. 2), runs a 15-ft. driveway through which the supplies and line wagons can be driven, stopping at the doors of the storerooms, toolroom, machine shop, etc., to take on or unload supplies. A double row of lamps under the building cornice lights this driveway so that wagons can easily be loaded and checked after dark.

The general storeroom (Fig. 1) measures 86.5 ft. x

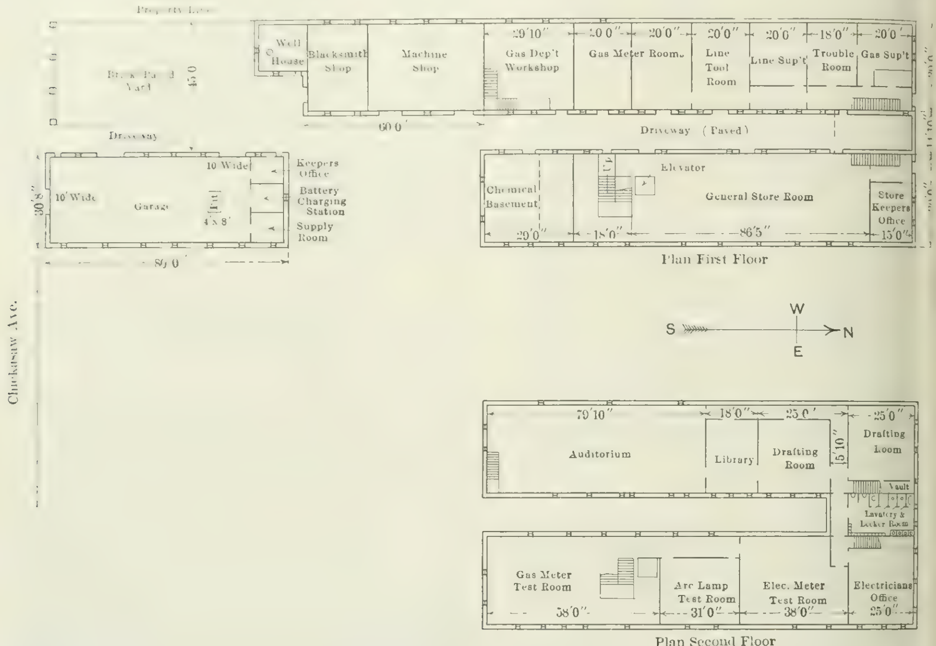


Fig. 2—Plan of Storeroom Buildings.

30 ft., and is arranged with three doors opening onto the driveway court. In this room are stored all line material, transformers, arresters, supplies, wires, etc., withdrawals being recorded by a complete checking system in charge of the storekeeper, Mr. T. A. Gresham, whose office is at the front adjoining the storeroom. Elevators and stairway connect with the second floor.

The west wing of the building on its lower floor contains the superintendent's offices, the troublemen's office, the line toolroom adjoining the line superintendent's office, the gas-meter proving rooms, machine shop and blacksmith shop. The machine shop, which is equipped for making most of the plant repairs, contains one 25-in. and one 15-in. lathe, a 26-in. and a 15-in. drill press, shaper, planer, etc., all motor driven. Together the machine and blacksmith shops occupy a space 60 ft. x 30 ft.

Under the stairway leading to the second floor in the east wing a photographic darkroom has been fitted up. Photographs are frequently taken of progress on new work, line construction, etc., and the darkroom is a convenience to the superintendents, who have their own cameras.

Besides the elevator there are four stairways for reaching the second story. On this floor are the arc-lamp and meter-test rooms, engineering offices, library and auditorium.

Fig. 3—Arc-Lamp Test Room.

Fig. 4—Meter-Testing Department.

The arc-lamp test room, 31 ft. x 23 ft., shown in Fig. 3, contains a five-lamp constant-current test transformer, while 2300-volt alternating-current and 110-volt direct-cur-

... are brought into the room, so that any type of ... be tested as required. The lamp rack is arranged ... lamps, and is equipped with connection plugs for ... voltmeter leads as well as inserting ammeters into ... circuit. The instruments themselves are placed ... table, which can be moved about the room. The ... the lamp racks is protected by a broad zinc

... il lamp department tests and inspects 500 arc ... but twenty-five of which are in use on the ... lighting circuits. Two lamps are replaced and ... to the office for test daily, and this routine, to... the lamps that are removed for cause, results ... ete test of the 500 lamps installed at intervals ... 250 days to 300 days. Record cards are kept for ... showing the location at which it has been in... ts, amperes, watts and other test data, repairs, ... the history and performance of any unit are ... glance.

... the lamproom is the watt-hour meter-test room ... This room is partially inclosed by a wire grilling, ... members of the meter-test department being ... From the shelves the meters are placed on wheel ... rolled over to the test tables. The table at the ... nged for testing large meters, a current trans... rnishing low-voltage currents up to 600 amp. ... volt, 220-volt and 550-volt taps are available for ... al windings. Direct-current meters are tested ... ting current, using non-inductive resistance. ... e other tables arranged for testing meters up to ... ng is fitted with extra racks for warming one ... ng the test of the one preceding it. The meters ... in comparison with rotating standards, which in ... mpared weekly with a standard laboratory volt... mmeter.

... er-testing department takes care of 7500 meters, ... records of which are kept by means of ... alog system. The meters are tested on the con... emises every six months, so that an opportunity ... for checking them soon after installation.

... e of the chief electrician of the company, Mr ... r, adjoins the meter and arc-lamp test rooms, the ... being part of the general department under his

... lge spanning the driveway is occupied by a well ... ilet, lavatory and locker-room. The west front ... drafting-room used by the engineering depart ... behind it is another office. These drafting- ... equipped with fireproof vaults for plant records. ... educational welfare of the company's employees ... rium and a library have been provided. The ... rnished with current electrical and engineering ... and a number of easy chairs invite their perusal ... The company also has a set of standard elec... and reference books which it loans to employees. ... ks are in charge of the storekeeper and may be ... by any employee interested. In addition to the ... library and books, lectures are given to the ... at intervals in the large 80-ft. x 30-ft. audito... west wing of the building.

... s, which are given by men of standing and ex... re on practical electrical subjects and are con... value in stimulating the interest of the men and ... them to understand their own and correlated ... e auditorium is equipped with a projecting lantern ... display stereopticon slides. On week days the audi... rium is also put to use as a lunching place for employees, ... company having under consideration the plan of serv... g coffee or a light lunch at cost.

The electric and gasoline automobiles and trucks of the company are stabled in a separate 80-ft. x 31-ft. brick ... building. The company has six gasoline runabouts ... electric vehicles, four of which are trucks. For charging the batteries of the electric cars a 17-kw motor-generator set has been installed.

The plant storehouse and employees' building of the additions and changes in the adjoining power plant of the company were designed and carried out by the engineering department of H. M. Byllesby & Company, Chicago, who operate and manage the Oklahoma Gas & Electric Company. Mr. F. H. Tidman is local general manager at Oklahoma City.

Wiring and Illumination

THE LIGHTING OF A MODERN BARBER SHOP.

Of the various shopkeepers in a community none is better fitted to advertise the merits of electricity for lighting than the barber. In order to make such an establishment go cleanliness is one of the essentials, and since much of the barber's outfit is susceptible to electrical operation it is but natural that electricity should be employed for illumination.

An excellent example of a modern barber shop is connected to the service of the United Electric Light &

Interior of New York Barber Shop.

Power Company, of New York City. A view of the interior of this shop, which is located at 3795 Broadway, is given herewith. The general illumination of the shop is obtained from six 100-watt tungsten lamps suspended in large diffusing globes. In addition, there are eight "Alba" glassware columns, surmounted by globes, arranged in front of the mirrors which line one side of the shop. Each of these contains seven 16-cp incandescent lamps. Although many patrons would never suspect it, the barber requires good illumination on the face of the customer in order to shave him properly, and this, needless to say, is obtained in the shop herewith described. The system of lighting installed is at once economical and on the whole very satisfactory. The color of the light, combined with the whiteness of the chairs and marble fittings, imparts to the room a soft and pleasing glow unmarred by glare or over-illumination. In addition to the electric illumination of the shop the owner has provided himself with nine electric vibrators and other electrical appliances useful in his trade. The shop is located in a thickly populated section of the city and caters to the average class of trade, so that it is in no sense an establishment maintained especially for the wealthy.

MAGNETITE-ARC VERSUS TUNGSTEN-POST LIGHTING.

The Rochester Railway & Light Company, Rochester, N. Y., has recently erected for demonstration purposes on two adjoining blocks along Main Street an installation of

Fig. 1—Tungsten Ornamental Standards in Rochester.

6.6-amp magnetite-arc lamps. On the block immediately below this installation there is an installation of ornamental posts, each fitted with five tungsten lamps, the idea of

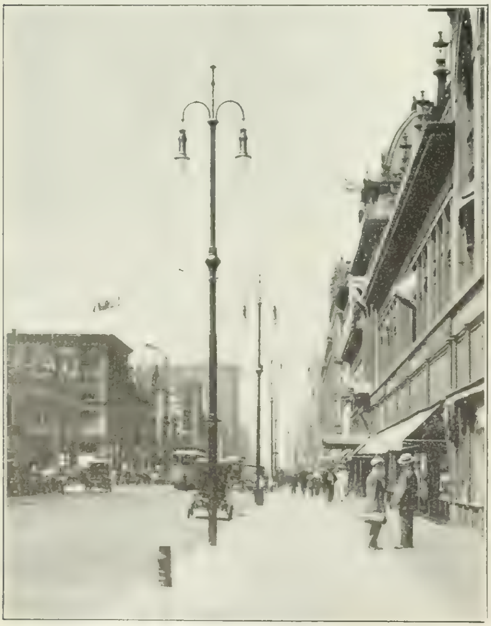


Fig. 2—Magnetite-Arc Posts in Rochester.

the company being to show to the various business men's associations the actual illumination obtained from both types of ornamental street lighting. The magnetite-arc lamps have been erected in pairs on an ornamental extension to the trolley poles on the street, so that the utilize existing poles and do not add to the obstruction already on the sidewalk. The lamps are suspended well in the air, as shown in the accompanying illustration, so to be out of the direct line of vision. The tungsten posts, on the other hand, are spaced very close together, and, of course, add to the obstructions on the sidewalks. At night the magnetite block is brilliantly illuminated, whereas the block with the tungsten lamps presents a very subdued lighting effect, with an entire absence of high light. During the daytime the slender and higher poles on which the magnetite-arc lamps are suspended are scarcely noticeable, whereas the tungsten posts with their white globes present the appearance of a picket fence viewed at a certain angle. Despite the better illumination given by the magnetite installation the general opinion, so far, has been somewhat in favor of the tungsten installation, but as yet no definite action has been taken looking toward the general installation of ...

CONCRETE-POLE LINES ON THE ME... DIVISION OF THE PENNSYLVANIA RAILR...

In a paper entitled "The New York Tunnel E... of the Pennsylvania Railroad Company, Station C... tion, Road, Track, Yard Equipment, Electric Trac... Locomotives," to be presented before the American ... of Civil Engineers Oct. 18, Mr. George Gibbs gi... details of the concrete-pole lines on the Meadows ... of the railroad. This section is a 5-mile continuou... in semi-tidal swamp land except for a short se... rock outcropping at Snake Hill, N. J. The Ha... River is crossed midway of the section. The gro... face is covered with a heavy growth of reeds, and the top stratum is of peaty bog from 8 ft. to 15 ft. deep, ... with varying strata of clay, fine sand and mixed s... for very considerable depths. Across this sect... adjoining the track embankment a concrete-pole ... erected for telegraph and telephone purposes.

The ultimate telegraph and telephone service wil... sixty open wires and two forty-pair cables, and ... desired to make this line entirely secure against ...able interruption by severe storms or fires in the swam... The character of the foundation was bad, and a... consideration it was decided to substitute fo... wooden-pole line, which would be inadequate for th... tions, one of concrete poles, which, while somewha... mental and perhaps somewhat more costly, would p... safe and durable construction. In this section 2...

Fig. 1—Concrete-Pole Line on Pennsylvania Railroad System.

were required. They are spaced from 70 ft. to 35 ft. apart, with an average standard span of 120 ft., the variations in span being due to numerous railway and highway crossings. The heights of the poles above grou... vary

from 25 ft. to 50 ft., and they are from 35 ft. to 65 ft. in total length. The design made by Mr. R. D. Coombs called for transverse loading conditions in case of maximum storms equivalent to 6000 lb. at 6.5 ft. below the top of the pole for the 120-ft. span length. The poles are ... in cross-section, with chamfered corners, and with a taper of ½ in. in 5 ft. The 1:2:4 concrete mixture of which they are made was assumed to have an ultimate unit strength in compression of 2200 lb. The reinforcement is ... of mechanical bond bars tied together into a ... skeleton frame. In the completed pole this reinforcement is covered by a 1-in. minimum thickness of concrete. The skeleton reinforcement was placed in horizontal ...es and the concrete mixture was poured in and ... tamped. The average number of poles made per

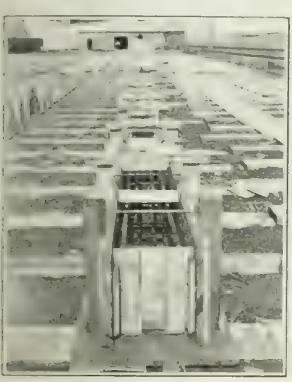


Fig. 2—Method of Making Concrete Pole.

... six, and these were left in place sixteen days to

... number of experiments it was found best to set ... in pits excavated in the marshy stratum. These ... generally about 9 ft. square and 5 ft. deep, and ... grillage was placed around the base of each pole ... 5 ft. below the top of the ground. This grillage ... of six track cross-ties bolted together and to the pole and partly planked over by 3-in. rough lumber. The

Fig. 3—Grillage in Marshy Stratum.

pole, which projected below the grillage, was pointed at the bo... and was jetted down by compressed air into the sandy layer so that the grillage would rest at the bottom of the pit. The pits were then back-filled with rock and clay. The poles on curves are cross-guyed and the terminal and railway-crossing poles are head-guyed with steel cables. Because of the unusually heavy line and the extreme length required for the foundations, the gross weight per pole, exclusive of grillage and cross-arms, is more than would be required for ordinary telegraph poles and varies from 5300 lb. for a 35-ft. pole to 17,300 lb. for a pole 65 ft. in length.

INCREASING USE OF FLAMING-ARC LAMPS.

In the five years that the flaming-arc lamp has been in use in this country it has been adopted for use in three general fields—spectacular or show lighting, commercial and industrial lighting and lastly for municipal lighting.

Fig. 1—Flaming Arcs in Front of New York Restaurant.

For three years after its introduction in this country the flaming arc, while admittedly far superior to the standard arc of the inclosed type as far as efficiency was concerned, was handicapped by the fact that it would burn only from ten hours to seventeen hours as compared with the 100-hour to 120-hour life of the inclosed-arc lamp.

Its dazzling brilliancy, however, more than compensated for this in the theatrical and hotel field, and even in some commercial applications, but civic authorities would not accept the lamp until it had been so improved that at least 100 hours per trim could be obtained from its electrodes. Now that this stage of development has been reached the

Fig. 2—Flaming Arcs in Front of Clothing Store.

city of Chicago has tentatively decided on flaming-arc lamps for all its streets and thoroughfares. The first consignment of lamps of this huge installation—15,000 lamps will eventually be installed in the Windy City—is now being

prepared in this country and will be shipped within a few weeks.

The flaming arc is distinctly a European product and has been used on the other side for about ten years. It was more suited to European conditions, burning on the same voltage as the arc lamps it displaced so largely. In this country the arc lamps burn on a different voltage from those in European cities, thus requiring some changes before the flaming arc could be installed. The flaming arcs that are made in this country are suited to American requirements, and they combine the high efficiency of light with the long life of the electrode.

It is conservatively estimated that on Broadway, New York, below Columbus Circle, there are more than 500 flaming arcs. They illuminate theater fronts, restaurants, roof gardens, "lobster palaces" and dry-goods stores, while the lower East Side of the city, with its Grand Street business interests and Bowery amusement centers, has probably 1000 flaming arcs. Hammerstein's Theater, at Forty-second Street and Seventh Avenue, uses sixteen arcs, most of them on the street sides of the building, although several are placed on the roof; the American Music Hall, at Eighth Avenue, has an installation of flaming arcs, while just across the street a men's furnishing establishment has the two street fronts of the building illuminated with flaming-arc lamps. The conservative Shanley restaurant, the Kaiserhof and Churchill's are among the eating places that stand out in the lurid glare of the flaming arc. The Manhattan Opera House and all the Shubert theaters employ the flaming arcs to attract the amusement seeker.

There is hardly a business place on the Bowery that does not boast at least one flaming arc over its entrance. Interspersed with the Bowery merchants are many moving-picture theaters, each of which uses the flaming arc. Just above the entrance to the Brooklyn Bridge Park Row is one huge glare when all these lights are burning. From a business point of view there is no night, for there are

Fig. 3—Flaming Arcs at Broadway and Forty-ninth Street, New York.

toilers whose work keeps them out until the small hours, and to catch their trade the merchants always have their stores open. Grand Street is so brilliantly illuminated by the flaming arcs installed by the show proprietors and shopkeepers that the street lamps supplied by the city pale into comparative insignificance.

Coney Island, of course, is world-famous fo the brilliancy of its electric lights. Part of this great b liance is furnished by the flaming arcs that are to be fo d everywhere. In Luna Park there are about 150, St plechase Park has about sixty, the Eldorado Carrousel, ich was opened for the first time this season, has an inst ation of

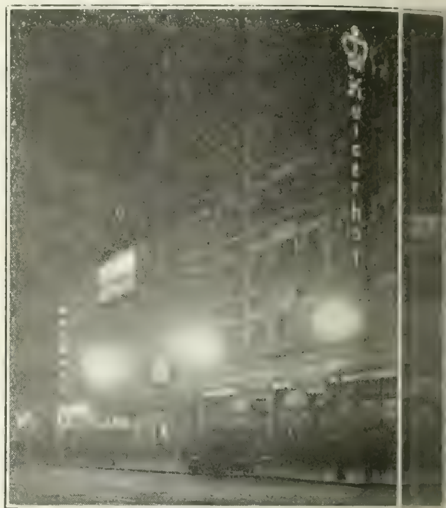


Fig. 4—Flaming Arcs at Thirty-ninth Street and Bro York.

about the same size as Steeplechase, and th l ectric Scenic Railway has ten arcs on its street faça n all there are about 500 arcs of this type on the "Isl d

The industrial plants that use flaming arcs f interior illumination are all outside the city. The Ameri Company, of Pittsburgh, uses about 100, the Un Steel Corporation at Youngstown, Ohio, has se ral hundred, the Union Metallic Cartridge Compan employs about thirty, the Newport News Shipbuilding C pany of Virginia has about twenty flaming arcs in use hen one of Uncle Sam's sea fighters is under constructio the government has about twenty-four at the Rock Isla in Illinois, while the Central Railroad of New rs thirty arcs in its train shed at Communipaw, J United States Motor Company has more than in its various plants.

In building construction in New York City the Starrett Company uses about 140 flaming arcs, t them to their various operations as need arises. dred of these lamps were on hand during the c of the big Gimbel Building, at Sixth Avenue a second Street, for in order to complete the wo it was necessary for the men to toil night and d the grandstand of the Polo Grounds burned d beginning of the present baseball season it w by many that the "Giants" would be withou ground for the ball game. They were permitt of the American League Park for their early mes arrangements were made for the rebuilding of e stands The contractors, Snare & Triest, agreed to have e stands ready for the "fans" by the first of July and to ake on the contract it was necessary to keep their m at night and day. Six flaming arcs were install and job was finished on time.

The Bradley Contracting Company, which building several sections of the Brooklyn subway, uses flaming arcs on the work. The company transfers its rcs fr

various points on its jobs and will probably increase its installation as work progresses on the Lexington Avenue ... in Manhattan. As most of the aqueduct construction is in the nature of tunnel work, incandescent lamps will be generally employed, although the arcs will be used on the surface to light up the working yards and the shaft ...

... adoption of the flaming-arc lamp for general street ... ation appears to be foreshadowed by the recent ... of the city of Chicago providing for the purchase ...000 lamps at once as the first instalment of 15,000 ...ing arcs for street lighting.

DISPLAY LIGHTING IN DENVER.

...ne can visit the more progressive centers of popu... in America at the present time without becoming ... of a general movement in the direction of intensified ...ation. Several reasons combine to increase the use ... tricity in this important service. The power of well-...l sign, outline, window and street lighting to at... transient and permanent inhabitants into the ... district during the evening hours has been settled ... question. The old days of allowing the commercial ... to plunge into the depths of Stygian darkness at ...ll and leaving it deserted by all except the police and wayfarers of questionable aim until the beginning of the next day's business are passing away, and in their place ...ng a time when the early evening will be as valuable ... transaction of business as any other period of the ... fact, the era of increased sales through the banishment of night has already arrived, and it only remains for the larger application of electric illumination to revolu... the business conditions of modern cities, creating ... merchant the same long-hour patronage that renders the cultivation of display lighting so desirable from the central-station standpoint.

Outside the great cities of this country, and with few ...ns surpassing them in the intensity of display ...g effected on main business thoroughfares, the city ...ver, Col., furnishes the most conspicuous example ...ent available of a community which is almost to a ... thusiastic in the adoption and extension of special ...ation for the general benefit of the business area.

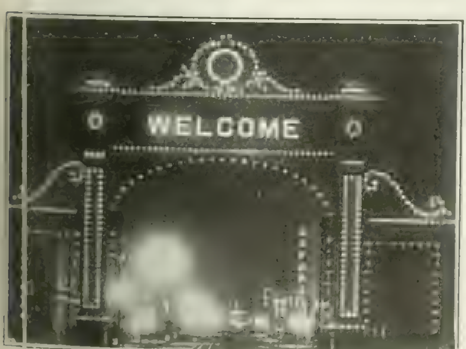


Fig. 1—Welcome Arch at Entrance of City

Seven years ago downtown Denver differed little from any other city of comparable size in the matter of illumination. To-day it is estimated that the amount of display lighting supplied in the mercantile district of Denver is larger in relation to the area covered than in any other municipality in this country. The intensity of illumination upon a given street is probably less than that on Broadway, New York; but, taking into account the remarkable installations of electric sign, window and outline lighting existing on the cross streets, it is doubtful if any other place is making use of so much light per square mile of business district. The effect of this policy has been to change the face of the

Fig. 2—Typical Billboard Lighting in Denver.

entire city at night, to stimulate travel to and from the business center many hours after the retail establishments have closed for the day, and to develop an unknown but certain volume of extra patronage for every business agency thus utilizing the local central-station service. So conspicuous has the display lighting of Denver become that the municipal authorities, Chamber of Commerce and other responsible organizations have turned the use of electricity to account in advertising Denver as the "City of Lights," and this designation has gone far to supplant the earlier titles to fame which have spread abroad its reputation.

The electric service of Denver is supplied by the Denver Gas & Electric Light Company, whose department of illuminating engineering is in the main responsible for the extent to which display lighting has become popularized. At the entrance of the city the first object which strikes the eye of the visitor making an evening arrival is an elaborate "Welcome" arch located at the foot of Seventeenth Street and directly in front of the Union Station. Emblazoned upon the outside of the arch in letters of light is the welcoming word of the city, and on the reverse side the word "Mizpah" bids the parting guest God-speed. The arch is lighted by 1294 4-cp incandescent lamps; it is a permanent design, being operated every night in the year, and is built of steel and bronze, with the seal of the city outlined in incandescent lamps at its crown. The cost of the arch was $22,000, and the city pays the lighting company $900 per year for supplying it with energy. There is no question that the arch is a good investment for the city, Denver being one of the great tourist centers of the Rocky Mountain district, and it is possible upon the daily arrival of the evening trains from outside points to hear expressions of enthusiastic appreciation from incoming travelers. About 2500 arc lamps of from 5.5-amp to 7.5-amp rating and approximately 1000 60-watt incandescent lamps are in service in Denver street lighting. The population of the

city is about 215,000. One of the latest additions to its street-lighting equipment was recently installed on Speer Boulevard, an improved park thoroughfare built under the present municipal administration for a distance of about 3 miles paralleling the banks of Cherry Creek. The boulevard is lighted by 75-watt series-tungsten lamps carried on 10-ft. iron poles surmounted by opal globes, the

Fig. 3—Night View of Fifteenth Street, Denver.

lamps being about 100 ft. apart. The energy supplied to the lamps is distributed through cables laid in ordinary earth trenches, the cables being coated with a moisture-proof preservative. The city pays the company $20 per lamp per year for this service. By the construction of this boulevard and its equipment with tungsten lamps a section of the city formerly given over to dumps and slums has been transformed into an attractive driveway, and the city authorities have decided to provide a similar illumination on all the viaducts crossing railway yards in the municipality.

The city authorities have lately established and maintained out of the general revenue funds a system of decorative arc lighting on Fifteenth, Sixteenth and Seventeenth Streets, the principal avenues of traffic between the Union Station and the up-town centers. This system comprised the removal of all overhead wires on these streets except the trolleys of the local railway company. By agreement with the latter it was arranged to use their trolley poles as a foundation for the standards carrying the lamps. The latter are alternating-current units of about 550 watts rating and are surrounded by translucent globes. The poles are of artistic appearance, and are set eight per block, four on each side of the street, there being seventeen blocks on each of the principal streets covered between Broadway and the Union Station. The cost of the poles was about $160 apiece, the expense being divided between the Denver City Tramway Company and the city. The price charged for arc lamps on all-night and every-night service is $60 per lamp per year, and the price charged for 60-watt incandescents is $28 per year. The cost of street lighting in Denver in 1910 was about $157,000, exclusive of parks. The appropriation for street lights in 1910 was $175,000. New lamps are added monthly in all parts of the city which are not well provided with such facilities, and it is probable that within a few years there will be an electric lamp on practically every corner of the 1250 miles of streets and roadways within the city limits.

During the meetings of conventions in Denver the principal streets in the business district are also illuminated by arches and festoons of colored incandescent lamps, and the Auditorium, a structure owned by the city and seating about 12,000 persons, is outlined by about 7000 tungsten lamps of 4-cp rating. The State Capitol dome, 255 ft. in height, is nightly outlined by streamers of colored incandescents and surmounted by a beacon consisting of about twenty-five 50-cp carbon lamps inclosed in a single globe. The Denver County Court House is also outlined nightly in incandescent lamps. The most conspicuous featu of outdoor lighting in Denver, however, is the new of e building of the Denver Gas & Electric Light Compa , which is located in the heart of the business district at e intersection of Fifteenth and Champa Streets. Thirt n thousand incandescent lamps are installed on the t street sides and cornices of this building, there being nightly service 8000 4-cp tungsten lamps and 5000 unit ranging from 25 watts to 250 watts. The building is a eautiful structure of white marble rising to a height of t stories above the street, and its nightly illumination ca be seen from practically all points in the city. So brilli t the illumination that ordinary newspaper print can t read at night by the light of the building, the reader st ding on the belfry of the Daniels & Fisher campanile, out 325 ft. above the street and nearly 1000 ft. distant.

A striking development has been attained in l er in the fields of electric-sign and billboard lightin here are now about 800 electric signs in service in th 80 per cent of which are operated on flat rates, bu ior the most part from dusk to midnight each day. 100 billboards are electrically illuminated, and b these branches of business are rapidly growing. Las revenue from display lighting increased nearl per cent. Window lighting is to a large extent h dled on flat-rate contracts upon the same terms that app sign and billboard illumination. The advent of the gsten lamp has been utilized by the company to push th tion of larger lighting units, and on account of tising value of brilliantly lighted business esta it has been possible to carry the magnitude of lations far beyond that found in many cities. T ago there were barely 300 electric signs in ice in Denver, and the phenomenal increase of this clas of business can only be accounted for by the skill with company has educated the public to appreciate th power of electric lights skilfully installed in houses. An interesting point in connection with t growth of display lighting in Denver is the increase in e average size of unit installed from 107 watts in 1910 to watts in 1911. The tendency for the density of illum ation to increase is most marked in the city, and the re acement of low-powered installations by larger units spa d closer together is noteworthy as the stress of business c petition is felt more keenly. The first electric sign in th ity was installed twenty-two years ago at the Haymarke Theater Mission. In 1910 there were installed for advert ng pur-

Fig. 4—View of Curtis and Sixteenth Streets, Denver t Night

poses 230,000 cp, and the company is at present istalli new signs and enlarging old equipments at th rate o 1000 cp per day. An organization of 700 busin men also taking up the general problem of cross-str specia lighting, and the accompanying photographs s w wha has been accomplished in the illumination of seve l of th principal longitudinal and lateral thoroughfare of th

busiess district. Within the past six months the company has installed more 250-watt tungsten lamps for display lighting than it has 100-watt units.

[illegible] of the flat rate [illegible] by the company for display lighting, combined with the service rendered in connection with such contracts, led to the installation of the following lamps in 1910:

[illegible] DISPLAY LIGHTING INSTALLED IN DENVER IN 1910

[illegible]	Candle-Power	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible] display lighting is based upon a charge of 15 cents per 16-cp lamp per month, plus 5 cents per kw-hour for six hours' service, plus a meter charge of $1. [illegible] cases where the sale of energy on a meter basis [illegible] lighting yields a lower monthly revenue than [illegible] rate the latter has been accepted by the consumer [illegible] of the convenience of leaving the turning on [illegible] lamps to the company. It has been found that [illegible] rate the tendency is for the merchant to cut [illegible] lighting too early in the evening, whereas [illegible] flat rate the establishment is certain to utilize its [illegible] lighting from dusk to midnight, and sometimes all [illegible] in certain houses which never close. The flat-[illegible] permits the merchant to turn on his lamps as [illegible] the twilight period as he desires, regardless of [illegible] at which the company's patrol throws the load [illegible]. The company is beginning to push tungsten [illegible] the rate being approximately 22 cents per [illegible] lamp per month, the company furnishing [illegible] formers and connections free and giving free [illegible] during the life of the flat-rate contract, which [illegible] years. If the contract is then discontinued or a meter installed all the material reverts to the company. The flat rate is favored on account of its giving the consumer six hours of steady lighting, an assured fixed [illegible] the company derived from energy consumption lasting far beyond the usual peak, and it benefits the consumer by avoiding any possible disputes on account of meter readings. On metered installations the company averages 65 watts per unit placed in service. The small tungsten sign lamps thus far installed by the company are rated at 11 volts.

Fig. [illegible]—Night View, Showing Special Illumination on One Side of Welton Street, Denver.

Special attention has been given by the company to the design of effective billboard lighting. A representative board is illustrated herewith in connection with the publicity work of the Denver, Northwestern & Pacific Railway, or so-called "Moffat Road," which makes a feature of day trips from Denver over the snow-capped crest of the Continental Divide. The illustration shows a roof board about 20 ft. long and 7.5 ft. high, the colored snow scene depicted being illuminated by six 100-watt tungsten lamps installed in three pairs, a special reflector being provided for each pair. The reflectors are placed about 6 ft. apart on centers at the top of the board, and the lamps are of the 110-volt multiple type. The cost of the service, including renewals, is $9.80 per month for the board, and several other similar installations for the same railway are installed at striking points in the business district and along the main thoroughfares of trolley, pedestrian and automobile traffic. The reflectors are loaned by the lighting company, and a typical unit is illustrated herewith. Each consists of a sheet-iron box, 12 in. x 12 in. x 14 in., with interior lining of white enamel paint, the structure being supported at the end of a hollow pipe carrying the feed wires for each pair of lamps. Another representative "Moffat Road" board is 30 ft. long and is illuminated by eight units of 100 watts rating each, the service costing $14.20 per month less 10 per cent discount. In all installations of billboard lighting special care has been taken to keep the direct rays of the lamps out of the eyes of passers-by. One of the largest boards in the city advertises a trust company and is lighted by ten pairs of 100-watt lamps. The cost of the reflectors complete installed is about $6 each.

Fig. 6—Night View of Curtis Street, Denver.

An interesting development has recently been made on Welton Street, between Sixteenth and Seventeenth Streets, in the line of display lighting. Twenty-five 250-watt tungsten lamps have been installed on brackets over the sidewalk on one side of the street, the cost of service being $[illegible] per lamp per month. The expense is defrayed by abutting merchants, and no other street lighting is required in the block. It is estimated that the above flat rate nets from 6 cents to 7 cents per kw-hour, including three renewals by the company in a period of two years. The accompanying photograph shows the difference between the specially lighted and the other side of the street, and a recent traffic count by the company during the evening rush hours showed that five persons passed along the brighter side of the street to every three people who traversed the darker side.

Another traffic count recently made at the intersection of Sixteenth and Curtis Streets showed that 86,000 people passed between the hours of 5:30 p. m. and midnight. Unquestionably many people passed the spot from two to four times, but the well-lighted windows and the striking sign installations reached them every time. At Fifteenth

and Arapahoe Streets, also in the business district, 43,000 people passed between 5:30 p. m. and 9:30 p. m.; at Sixteenth and California Streets 25,000 people passed in the above hours, and 30,000 passed the intersection of Fifteenth and Welton Streets. Another striking point is the

Fig. 7—Store Front Fitted with Ornamental Wall Brackets.

rapidity with which the public disappears from the streets at midnight as soon as the display lighting begins to be cut off.

It is estimated that Denver uses 100 per cent more candle-power per square foot in window lighting than any other city in America which makes anything of this type of illumination. The small store frequently uses more window lighting than the large establishment, the former being, as a rule, quicker to appreciate the value of lighting after 10 p. m. An interesting example of the drawing power of a well-lighted window was recently given in a small establishment which lighted up a newly dressed window display at 11 p. m. A large crowd collected within a few moments, and the proprietors were quickly convinced that the old practice of cutting off lighting at 10 p. m. or 11 p. m. was a mistake, even though the street for the moment might appear to be occupied by but few passers-by. The amount of window lighting in service in Denver on the flat-rate basis frequently runs from 150 watts to 200 watts per front foot in single establishments. A clothing house with a frontage of only 25 ft. has sixteen tungsten lamps of 250-watt rating installed in window and outside bracket lighting; a prominent jeweler having an establishment of but 13 front ft. has an installation of 120 watts per front foot; a drug house of 80 front ft. has 106 watts per front foot, and two other establishments of 15 front ft. and 14 front ft. respectively have 222 watts

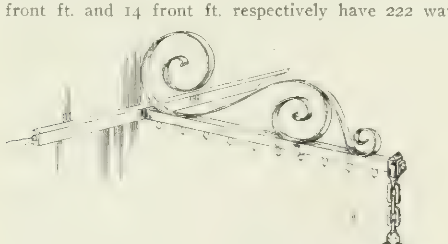


Fig. 8—Ornamental Wall Bracket.

and 214 watts per front foot in nightly service. In the smaller drug stores in residential sections the standards of brilliancy are correspondingly effective. A prominent shoe house with 17-ft. frontage is equipped with four 250-watt lamps in the windows, one 500-watt lamp in the doorway, six 25-watt units in the basement windows and six 16-cp lamps under the shelves. This service costs the consum about $35 per month on a flat rate.

A novel installation has recently been made at tl Broadway store of the Sholtz Drug Company, as shown the accompanying illustration. The display lighting coi sists of ten 5-ft. 2½-in. x 2½-in. brackets, each bein equipped with ten 4-cp tungsten lamps attached to th under side of the arm, the ends of the brackets supportin one 250-watt lamp. The brackets are installed about 6 f apart and have proved a striking success in drawing trade The window lighting of this establishment is also carrie out on a plane comparable with the external illuminatioı. Another branch of this house has lately installed a revolv ing sign operated by a ½-hp motor, the sign making on complete turn every twenty-eight seconds and advertisin the store to all parts of the compass with a minimum con sumption of energy and small investment in equipment. The sign is located on the roof of the store and is visibl for several blocks along the main trunk lines of travel nea the State Capitol.

Besides the outline lighting of the company's building elaborate installations of incandescent lamps for thi service have been made at the principal moving-picture theaters of the city. The bills for display lighting in some of these cases run from $25 to $50 per week. At presen the company is in conference with the Daniels & Fishei Stores Company preparing for the spectacular illuminatioı of the famous campanile lately erected by that house aı the intersection of Sixteenth and Arapahoe Streets. The tower rises to a height of about 380 ft. above the sidewalk and is already a conspicuous object at night on account of the light reflected upon it from the Gas and Electric Building. Plans are also in contemplation for the illumination of the new Shubert Theater offices by upward of 1700 lamps, including 5-watt units for the outlines of the main arch, 20-cp lamps in linolite installation for the coping and 60-watt units behind art-glass shades in the cornice. Great interest has been aroused in outline lighting as a result of the initial illumination of the company's building, and it is anticipated that within the next few years this form of illumination will become general among the more progressive establishments. The amount of outline lighting which can be handled through the use of tungsten lamps of moderate candle-power is surprising when expressed in terms of connected load. The problem of lamp replacement has been worked out by the Denver Gas & Electric Light Company along the lines of an electric telpher with motor-driven elevator cage which will travel around the outside of the building and reach every lamp through a system of push-button control operating the telpher longitudinally upon a track supported on the roof and raising and lowering the cage as conditions demand. The telpher will probably be installed during the coming fall.

The work of the illuminating engineering department is

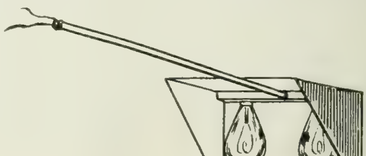


Fig. 9—Billboard Reflector.

carried on under the supervision of Mr. George E. Williamson, reporting to Mr. Clare N. Stannard, secretary and commercial manager of the company. Mr. C. F. Oehlman was associated with Mr. Williamson in the design of the illumination of the company's building, which was first occupied near the close of last year.

Letter to the Editor.

Electric Lighting from Three-Phase Circuits.

...r Editor of Electrical World:

...—Referring to the article in your issue of Aug. 5 ...r. G. P. Hoxie on "Electric Lighting from Three-...e Circuits," and applying to the lighting in industrial ... the following arrangement for circuits of 440 volts or 550 volts, three-phase or higher, will be found very satisfactory.

Each lighting feeder is sectionalized at its center of distribution; two three-phase to two-phase transformers are installed with the secondary of each connected to a section of the feeder. If it is desirable to use three-wire feeders the transformers should have 220-volt and 110-volt secondaries. This arrangement simplifies the wiring and phases are not likely to become unbalanced.

Atlanta, Ga. H. A. Coles

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

...apacity of Induction Motors.—F. Nuerbach.—...e author gives a simple approximate formula for the ...ad capacity of an induction motor which can be used ...he results of the no-load and short-circuit tests are ... The overload capacity u is defined as the ratio of ...ximum torque to normal torque. The formula is

$$u = f\,\frac{i_k + i_0}{2\,i_1}$$

... f is a safety factor, generally = 0.9, while i_1 is the ...ad current, i_0 the no-load current and i_k the short-...t current.—*Elek. Zeit.*, July 27.

...king Induction Motors.—A note on a recent British ...t (17,010, Aug. 3) of E. Rosenberg and J. S. Peck. ...e braking of induction motors, where the motor is disconnected from the alternating-current supply and one of the windings is supplied with direct current, means are provided for a resistance, placed in circuit with the other winding, to be varied automatically by a device which operates in accordance with the motor speed as a genera-...r with the frequency or voltage of the current gen-...l by the secondary member of the motor.—Lond. *Eng'ing*, Aug. 10.

...-Current Armature Windings.—R. Rankin.—...n article illustrated by diagrams in which the author ...plains how the properties of lap and wave windings ...y be demonstrated, and how it may be proved by a simple diagram exhibiting the conductors arranged and numbered consecutively that the usual formulas for sim-...e windings of the kind mentioned are correct.—Lond. ...view, Aug. 11.

Lamps and Lighting.

...Flame Standards.—W. J. A. Butterfield, Haldane and A. P. Trotter.—The authors describe ...atus which they have used for determining the effects ...riation of pressure, degree of humidity and atmos-... vitiation on the candle-power of the Harcourt pen-...nd the Hefner amyl-acetate lamps. As a result of ...ese experiments curves are given which in the case of ...e Hefner lamp show that Liebenthal's formula for cor-...ctions for barometric height does not rest on acceptable ...ta. In conclusion, general correction formulas for both ...mps are given. Fig. 1 gives the effect of variation of ...mospheric pressure on the luminous intensity of the ...arcourt and the Hefner lamps. The curves show that ...e relation between atmospheric pressure and the yield ...f light is not constant or expressed by a straight line. ...he falling off of the light with reduction of pressure is ...uch greater at the lower than at the higher pressures. ...he curve for the Harcourt lamp is, however, nearly a ...raight line for the range of 700 mm to 850 mm, and ...hows that within these limits the light increases or de-...reases by 1 per cent with an increase or decrease re-...pectively in pressure of 12.5 mm or that a variation of 10 mm in pressure is attended by a variation in the same sense of 0.8 per cent in the light afforded by the lamp. The curve of the Hefner lamp is likewise nearly a straight line for the range of 700 mm or 850 mm, and shows that

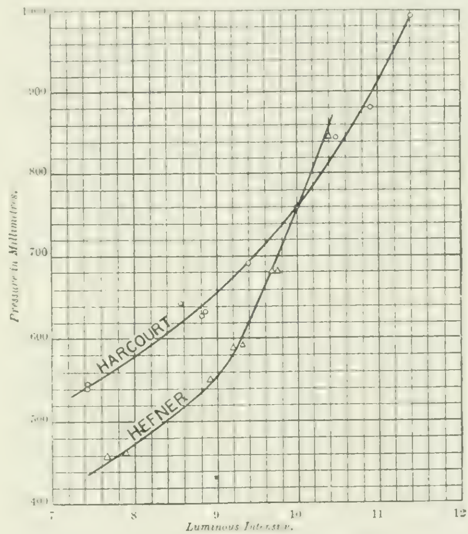


Fig. 1—Effect of Variation of Pressure.

within these limits the light increases or decreases by 1 per cent with an increase or decrease respectively in pressure of 25 mm, or that a variation of 10 mm in pressure is attended by a variation in the same sense of 0.4 per cent in the light afforded by the lamp. Experiments were also made to determine the effect of variations in the humidity of the air on the light. The results show that the light of both the Harcourt and Hefner lamps decreases by 1 per cent for an increase of 0.16 per cent in the aqueous vapor in the air, or that an increase of 1 per cent in the aqueous vapor in the air is attended by a decrease of 6.25 per cent in the light of the lamps. Finally experiments are described in which the effect of different degrees of vitiation of the atmosphere on the light of the standards was determined.—Lond. *Electrician*, Aug. 11

Generation, Transmission and Distribution.

High-Pressure Water-Power Works.—L. Zodel.—A paper read at the Zurich meeting of the (British) Institution of Mechanical Engineers. The author first indicates the method employed in classifying water-power plants into high, medium and low heads, and the conditions

which make the choice of any of these desirable, and when storage reservoirs should be included. A number of recent high-head hydroelectric stations and the more interesting points in the design of their pipe lines are then described. The water-carrying system of a high-head hydraulic power scheme consists of two parts, the low-pressure part to cover most of the horizontal distance between the lake or river intake and the power house, and the high-pressure part to give the operating head for the station. The high-pressure pipe line represents one of the most costly items of the plant, and is, therefore, made as short as possible by taking the low-pressure conduit to the nearest advantageous point above the power house. There are two main types of this conduit, that in which water flows under pressure and that with water flowing freely in an open flume. The former may be subdivided into (1) the pressure-tunnel arrangement leading to a deep penstock chamber, as in the case of the Tyssedalen and Brusio installations, and (2) the low-pressure feeder-pipe arrangement connecting to a receiver with a standpipe, as at Necaxa and Rio de Janeiro. Both of these systems allow the total head available at any time in the reservoir to be utilized even with large variations in water level. The type of conduit with open flume cannot, however, utilize any head in the reservoir and this must be lost. In the case of a long conduit a balancing reservoir must also be constructed to provide for any sudden increase in the load, since the open flume will not draw a greater volume of water to supply a greater demand, as happens automatically with the pressure conduit. This case is illustrated in the Siagne power station. Another example is the well-known Kinlochleven plant of the British Aluminum Company, in Scotland. The choice of the arrangement of conduit most suitable for a power scheme depends entirely on the particular conditions of the works and no rule can be laid down.—Lond. *Electrician*, Aug. 11.

Traction.

Electric Traction on Main Lines and Interurban Roads in Europe.—F. STEIN.—Highly elaborate statistical tables on the status of electric traction in June, 1911, on main roads and interurban roads in various European countries. For each road a very large amount of information on general conditions, equipment of road and rolling stock, details of electrical equipment and operation, literature, references, etc., is given in forty-four separate columns. The statistics comprise twenty direct-current lines and ten single-phase lines in Germany, ten direct-current lines and seven single-phase lines in Austria-Hungary, nine direct-current lines and five single-phase lines in France. The German statistics are given in *Elek. Zeit.*, July 27, and the Austrian and French statistics are given in *Elek. Zeit.*, Aug. 3.

Electric Traction on Trunk Roads in Germany.—The following main-line sections in the Province of Silesia are to be equipped electrically: From Laubau to Hirschberg and Dittersbach and Königszeit, 123 km (74 miles); from Hirschberg to Grüntal 50 km (30 miles); from Hirschberg to Schmiedeberg and Landeshut, 40 km (24 miles); from Ruhbank to Liebau, 16 km (10 miles), and from Niederalzbrunn to Halbstadt, 34 km (20 miles). These are mountain roads, with grades of 2 per cent and 2.5 per cent, the smallest radius of a curve being 188 m (617 ft.). Energy will be bought from a private company, which will erect the power plant and substations. Two types of electric locomotives will be used, one for passenger trains with a maximum speed of 110 km (66 miles) per hour, the other for freight trains with a maximum speed of 65 km (39 miles) per hour. (Since it is stated that the freight locomotives will be practically identical with those of the Dessau-Bitterfeld line, it follows that the single-phase system is to be used.)—*Elek. Zeit.*, July 20.

Installations, Systems and Appliances.

Marseilles.—A long and fully illustrated descripti[on] of the central station of Marseilles, in France, where d[ir]ect current and alternating current at two different freq[ue]ncies and voltages are generated to meet the requirem[ents] of the varying needs of the district. Energy from [the] steam-turbine plant is supplied to the city system at [55]00 volts and a frequency of 25 cycles. This is transmitte[d to] a large substation from which the central district is [su]pplied. From this substation direct current at 220 vol[ts] is delivered to a three-wire network. The station also [su]pplies current at 5500 volts and a frequency of 50 cy[cles] to the outlying districts. Low-tension mains on the a[lter]nating system are fed from small transformer posts pl[ace]d at various points, the secondary voltage being 190 volt[s i]n this case. For industrial service, especially for la[rge] motors, the company is operating a special syst[em] using a pressure of 13,500 volts delivered directly f[rom] the machines at the central station, a frequency of [25] cycles being used. The high-tension lines owned by the co[m]pany have been laid out so that in case of need they [can] be supplied with energy from the network of 13,500-[volt] lines which covers the Maritime Alps region and runs [as] far as the large substation of Allauch, in the neighb[or]hood of Marseilles. This system is the most extensive [in] France and is fed from a number of hydraulic plants ly[ing] in the mountain region. It can be drawn upon if requi[red] and, inversely, the Marseilles station can feed into [the] Allauch substation, so as to afford a reserve supply for [the] latter. In order to satisfy the above-mentioned conditi[ons] the Marseilles plant has been arranged to furnish ene[rgy] at three voltages and frequencies. Energy is produced [by] three 1000-kw turbines at 5500 volts, three-phase, an[d a] frequency of 25 for the supply of the central substations [of] Marseilles. For the transformer posts in the outer d[is]tricts of the town energy is obtained from one 1000-[kw] turbine. While the voltage in these districts is the sa[me] as that in the center of the town the frequency is 50 [in]stead of 25. For interchange purposes a frequen[cy] changer consisting of a 50-cycle motor and a 25-cycle alt[er]nator is used. Either one of these machines can act as [a] synchronous motor so as to operate the other as an alt[er]nator and thus produce energy at either of these two fr[e]quencies if required. For the supply of the high-tensi[on] lines a turbine which delivers three-phase energy [at] 13,500 volts and a frequency of 25 cycles is installed. [In] the station there is also a set of transformers having [a] ratio of 13,500 to 5500, so that the high-tension energ[y] can be fed to the 5500-volt bars or vice versa. Care h[as] thus been taken in laying out the station to make th[e] above three systems interchangeable, and any one of th[e] five turbine groups can be used to supply any of the ci[r]cuits of the station in spite of the different voltages a[nd] frequencies.—Lond. *Electrician*, Aug. 11.

Domestic Uses of Electricity.—G. DETTMAR.—The co[n]cluding part of his very long paper presented before th[e] German Association of Electrical Engineers. In th[e]

	Mean Price of Kw-hour.	Number of Residences Connected.	Kilowatts Connected.	Kw-hours Sold During the Year.
1906	12 cents	246	657	85,859
1907	9 cents	946	885	143,897
1908	9 cents	1,538	1,281	237,180
1909	9 cents	2,271	1,744	367,801
1910	9 cents	2,673	2,027	511,112

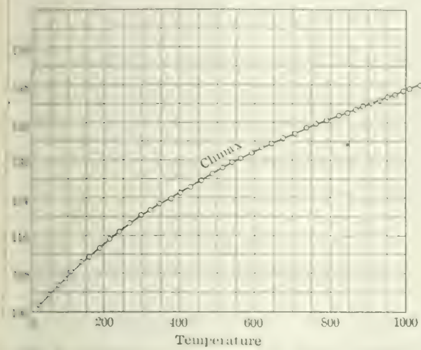
present instalment the author deals with the use of th[e] electric motor for driving elevators, washing machines ventilators, sewing machines, refrigerating machines, etc. and also deals with the use of electric bells and clocks. T[...]

[illegible]rage the domestic uses of electricity an energetic pr[illegible]aganda by the central stations is necessary, together wi[illegible] the introduction of a fair rate. In Erfurt the consu[illegible]rs are divided into different groups according to their re[illegible]irements, and this has led to a considerable increase in [illegible]e use of electricity in residences, as shown in the [illegible] [illegible]n the preceding page.

[illegible]s possible to reduce the cost of electricity for the co[illegible]umers without detriment to the station. Thus in Co[illegible]gne (where a double rate is used) the number of kw-ho[illegible]s sold has increased very essentially, while the maxi-[illegible] load of the station has increased only slightly.—*Elek.* [illegible] July 27.

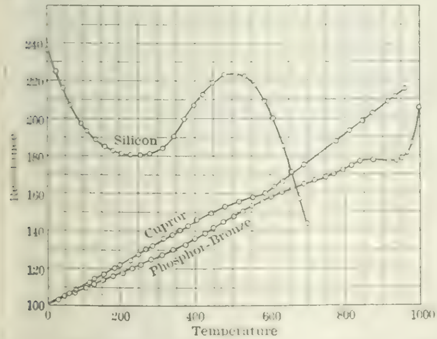
Electrophysics and Magnetism.

[illegible]mperature Coefficients of Electrical Resistors.—A. A. So[illegible]ERVILLE.—The third paper of his serial. The author ha[illegible] now tested various metals and commercial resistor



F[illegible]g. 2—Temperature Coefficient of Climax Resistor Metal.

al[illegible]ys. Fig. 2 gives the curve for the commercial resistor al[illegible]y "climax"; Fig. 3 gives the results for metallic silic[illegible] and the resistor alloys "cupror" and "phosphor bronze"; F[illegible] 4 gives the results for the Krupp resistance alloy, for G[illegible]man silver and for "monel metal." Curves are also given fo[illegible] tin, brass and zinc. In the case of the pure metals, zi[illegible] and tin, having comparatively low melting points, th[illegible] interesting feature is the change of resistance that ta[illegible]s place when the specimen passes from a solid to a li[illegible]id state and vice versa. Another interesting feature a[illegible]ut zinc is that if it is drawn into a very fine wire and w[illegible]pped in the form of a spiral about a quartz tube the su[illegible]face tension of the molten zinc is sufficient to hold it to[illegible]ether for a considerable further increase in tempera-



[illegible]ig. 3—Temperature Coefficient of Silicon, Cupror and Phosphor Bronze.

t[illegible]e, and during this further heating the temperature co-[illegible]cient of resistance is quite unusual, without doubt being [illegible]gative and quite uniform for more than 100 deg. before the thread of zinc pulls apart. On the other hand, if the zinc is drawn into a small quartz tube as a containing vessel and its resistance measured there, the coefficient while molten is almost zero.—*Phys. Review,* July.

Alternating-Current Resistance and Induction of Coils.—A. ESAU.—The skin effect increases the resistance and reduces the inductance of coils. The investigation of the author shows that for single-layer coils the formula of Wien and that of Sommerfeld represent correctly the increase of resistance for frequencies up to 6000 periods per second. For multiple-layer coils the experiments undertaken are incapable of deciding between the two formulas. Both appear to be fairly correct for small frequencies and for a large number of layers. For the higher frequencies (4000 to 6000) the resistances fall below the calculated values, especially when there are

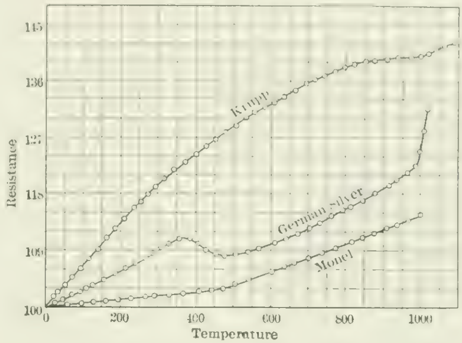


Fig. 4—Temperature Coefficient of Krupp, German Silver and Monel Metals.

only a few layers (two or three). As regards the inductance, it is found to change least when the coil is long and the number of layers is large.—*Ann. d. Physik,* Vol. 34, pages 57 and 547, 1911; Lond. *Electrician,* Aug. 11.

Delta Rays.—N. CAMPBELL.—A long account of an extended investigation. The chief results may be summed up as follows: There is no evidence that the speed of the delta rays is dependent on the speed of the alpha rays exciting them. There is no evidence of any difference in speed between the emergence and incidence radiations. The incidence radiation appears never to be less than the emergence, though it is sometimes not greater. It is doubtful whether the speed of the delta rays varies with the material from which they are emitted. There is no evidence that the number of the delta rays emitted depends on the material from which they are emitted. There appear to be true delta rays emitted from the active substance emitting the alpha rays in excess of those due to the impact of those alpha rays on the support.—*Phil. Mag.*, August.

Electrochemistry and Batteries.

Power-Factor and Load-Factor in Electric Furnaces.—J. HARDEN.—The author emphasizes the effect of power-factor and load-factor upon the first cost of an installation of an arc and induction furnace plant and also upon the operating costs. The author concludes that from the electrical engineer's point of view, apart from the requirements of metallurgists, neither the induction furnace, as such, nor the plain arc furnace work under ideal conditions, the former because of its lower power-factor and the latter for the reason of its unsteady load. The author recommends a combination of the good features of both—that is, the higher power-factor of the arc furnace and the high and steady load-factor of the induction furnace in a new furnace design.—Lond. *Electrician,* Aug. 11.

Edison Storage Battery.—F. H. COLVIN.—A profusely

illustrated paper in which the author describes the various mechanical methods used in the manufacture of the Edison storage battery. A description is given of the different steps in the methods of making the sheet-steel grids, the tubes for the positive element and their filling with nickel flake, the making of the flat pockets for the negative element and their filling with iron oxide, the production of nickel-flake 0.00005 in. thick by electrolytically depositing alternate layers of copper and nickel and leaching the copper out, and finally the manufacture of the battery cases and the cutting of hard rubber for insulation. The many different steps of these processes are explained with the assistance of numerous illustrations.—*Amer. Machinist*, Aug. 10.

Units, Measurements and Instruments.

Units and Notations.—The committee on units and notation of the German Association publishes four proposals. The first deals with the definition of work (Arbeit) and energy, which should be more clearly distinguished in future. The second deals with the definition of Durchflutung und Strombelag. Elektrische Durchflutung (electric flux) is the algebraic sum of all electric currents through any area. In the case of a two-dimensional electric flux (through a film or foil) the current or the electric flux through a unit of length perpendicular to the lines of current is called the "Strombelag." The third proposal gives a list of often recurring signs of notation, for instance, %, v. H for per cent, o/oo, v. T for pro mille, etc. One proposal which differs essentially from American practice is to use the sign ÷ instead of "to" in phrases like 3 ÷ 4 hours for three to four hours, i. e., a time between three and four hours. The fourth proposal is to find a substitute for horse-power. "The technical unit of power is called the kilowatt or newhorse (Neupferd). It is practically = 102 kilogrammeters per second and corresponds to the absolute power of 10^{10} ergs per second. Unit *NP*." The following conversion factors are given (where horse-power is here written instead of the German *PS*):

1 *NP* = 1.36 hp = 102 kilogrammeters per second.
1 hp = 0.735 *NP* = 75 kilogrammeters per second.
1 kilogrammeter per second = 0.0098 *NP* = 1.33 hp.

Discussion of these proposals is invited to the middle of January, 1912.—*Elek. Zeit.*, July 20.

Dynamometers.—A. Amsler.—An abstract of a paper presented at the Zurich meeting of the (British) Institution of Mechanical Engineers. The author described two types of dynamometers, one of which is suitable for high-speed and the other for low-speed machines. The former of these is of the torsion type and consists of three disks, one at one end of the shaft whose torque is required and the other two at the other end. The first disk is provided with a transparent circumferential celluloid scale, which can be observed from the third disk through a fine slit in the second. This fine slit acts, in fact, as a pointer, and the amount of torsion can thus easily be read off when the scale is illuminated by a 50-cp lamp. Provided the shaft be perfectly elastic the angle through which the extreme ends are turned will be proportional to the twisting moment—that is, proportional to the power transmitted. If the shaft is made of a special spring steel of very high yield point—that is, above 6000 kg per square centimeter (90,000 lb. per square inch)—it can be twisted to a considerable degree without breakage or permanent distorsion. In the example given the twist of the rod, 40 cm (15/34 in.) long, is for a twisting moment of 20 m-kg (1736 in.-lb.), about 20 deg. The shaft has a cross-section of 12 mm x 12 mm (0.4725 in. by 0.4725 in.), and is, therefore, subjected to a stress of 5200 kg per square centimeter (78,000 lb. per square inch), which is below the yield point. In the second type of instrument a pulley is provided with two projections, which when in rotation press a small piston into a cylinder filled with oil. This causes a registration proportional to the torque to be given on a ... through a mechanism similar to that of an ordinary ... indicator. A strip of paper passes under the pencil ... registering gear at a velocity proportional to the ... of the shaft of the instrument. The area of any porti... the diagram thus obtained represents the energy abs... by the machine and the mean height the average p... transmitted.—Lond. *Electrician*, Aug. 11.

Localization of Faults.—E. Caudrelier.—The auth... scribes a simple method which enables one to determi...

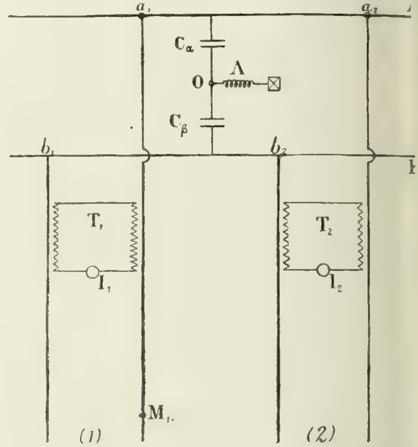


Fig. 5—Diagram of Connections for Localization of Faults [in] Feeders.

once in which of a number of feeders radiating from a ... erating station a fault has occurred. *A* and *B* in Fig... are the main busbars. A neutral point *O* is obtained ... connecting two equal condensers *Ca* and *Cb* across the ... bars. The point *O* is connected through a self-inducta... *A* with the earth. Each wire of a feeder represents ... primary of the transformer *T*, the secondary of which ... connected with the secondary corresponding to the ret... wire of the same feeder. In normal condition the ... emfs are opposite and the needle of the instrument *I* is ... rest. If on the feeder 1 a fault occurs, for instance, at ... the instrument I_1 will always indicate it.—*La Lumi... Elec.*, July 1.

Expression of Resistivity of Electrical Conductors.—H. Dellinger.—The author discusses the desirability ... expressing resistivity as "mass resistivity" rather than v... ume resistivity, the chief reasons being that mass is mo... easily measured than cross-section and conductors are s... by weight rather than volume. The author endeavors ... show: (1) that "ohms per meter-gram" is well establish... as a unit of resistivity; (2) that from a practical star... point the "mass resistivity" is preferable to the "volu... resistivity"; (3) that the advantage of a mental picture ... aid in defining volume resistivity is no less available ... defining mass resistivity; (4) that "specific resistance" ... an undesirable term; (5) that the term "resistivity" ... susceptible of a certain breadth of definition, and (6) th... there are limitations to the proper use of "per cent co... ductivity."—Lond. *Electrician*, Aug. 11.

Mercury Motor Meter.—W. Kesseldorfer.—A long illu... trated paper read before the German Association (Ve... band) of Electrical Engineers, giving a sketch of th... theory and a historical review of the different types ... mercury motor meters and details of the construction ... the latest meter of the Isaria Company.—*Elek. Zei...* July 13.

Book Reviews.

[E]NERGY, WORK, HEAT AND TRANSFORMATIONS. By Sidney A. Reeve. New York: McGraw-Hill Book Company. 238 pages. Price,

An elementary textbook on energetics written from the [st]andpoint of a teacher on engineering concepts as a sub[st]ratum. Formal mathematics are sparingly used, yet the [tra]in of thought is essentially quantitative, although tinged [wit]h a certain realistic philosophy. The book will be use[fu]l to engineers who, not having gone to college, desire to become acquainted with the fundamental principles of heat and energy without delving too deeply into mathematics.

THE LAW AND COMMERCIAL USAGE OF PATENTS, DESIGNS AND TRADEMARKS. By Kenneth R. Swan. New York: D. Van Nostrand Company. 386 pages. Price, $2.

A descriptive treatise of patents and patent law, especially from the British standpoint, for the use of inventors and the public. The book is clearly written, logically arranged, well indexed and not too technical. It will be useful to American inventors interested in the details of British patents and patent practice.

New Apparatus and Appliances

[A]CETYLENE WELDING AND CUTTING MACHINE.

An acetylene welding and cutting machine recently built [b]y the Davis-Bournonville Company, of 90 West Street, [N]ew York City, at its laboratory at Marion Station, Jersey [C]ity, is shown in the accompanying illustrations. The ma[c]hine can be used in sheet metal work where the thick[n]esses range up to 3/16 in. or 7/32 in. and for straight [cu]tting of both thin and thick work, to which it is particu[la]rly adapted because of the precision of the movement of [th]e machine.

A cylindrical upright about 6 ft. in height carries a hollow [h]orizontal arm projecting at right angles for 6 ft. or 7 ft. [a]nd adjustable in height by means of a rack and pinion. [T]he arm in turn carries a long screw mounted in suitable [beari]ngs. At the base of the upright loose and tight driving pulleys are mounted on a short horizontal shaft, at one end of which is a friction pinion which engages with a disk mounted on a vertical shaft. This shaft and a rotatable rod in the hollow arm are put into driving connection by bevel gears. At the outer end of the arm an arrangement of gears enables the inclosed rod to drive the screw, the turning of which operates a traversing carriage upon which the torch and its controlling fixtures are mounted, as shown in Fig. 1. The work is secured on a fixed table and flexible tubes bring oxygen and acetylene to the torch, which is arranged at an angle of about 45 deg. to the horizontal and moves over the work much after the way of a traversing tool.

If a weld is to be a flat one the two pieces are simply clamped in the exact relative positions they are to occupy finally, room being left between clamps for the tip to pass. In welding the carriage with the torch moves evenly along at a proper rate of speed. The countershaft, running at, say, 140 r.p.m., operates the short horizontal shaft at about 70 r.p.m. It is possible to adjust the friction pinion to vary the angular speed of the vertical shaft from about 75 r.p.m. to about 35 r.p.m. Still further reductions of speed may be made by the gears at the end of the arm. For an angular weld the two strips are placed edge to edge at the proper angle on the sides of an angle bar and secured in position with clamping strips inserted between the outer faces of the work and the jaws of the clamps.

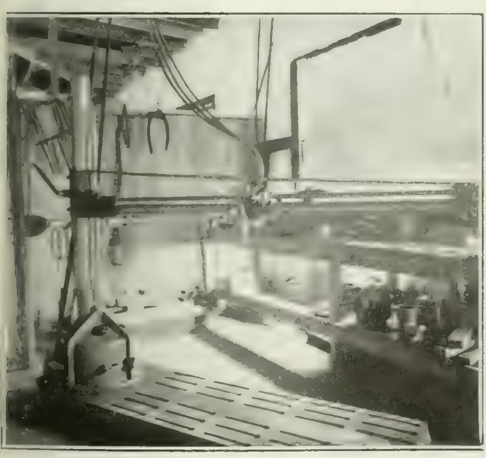


Fig. 1—Machine Equipped for Welding.

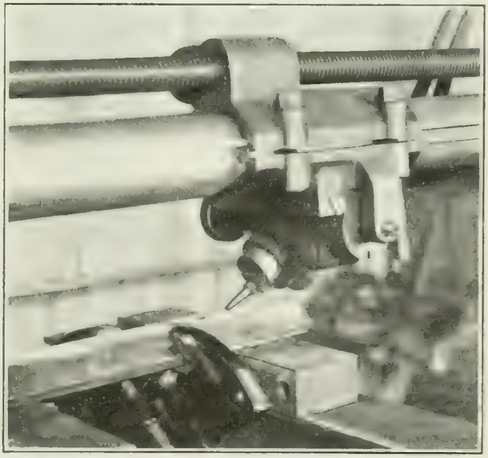


Fig. 2—Arrangement for Angular Work.

Because of the enormous temperature of about 6000 deg. Fahr. which is claimed for the working point of the oxy-acetylene flame, the torch brings steel and other metals locally to or near the melting point. An ordinary flame may, however, supply a large amount of the requisite heat where the form and character of the work do not prohibit. The methods of preheating may be various. With small repetition work the preheating may in some cases be done subsequent to clamping but prior to putting the work on the table, while other cases will require preheating with the work in welding position.

The machine above described as a welding device can readily be used as a cutting apparatus with a different arrangement of jets. Three jets are arranged in a rigidly vertical position in line with the direction of movement. Ahead is a heating jet of oxygen and acetylene; at the rear is another but smaller heating jet. Between the two the cutting jet of oxygen is arranged. An oxygen and an acetylene tube together supply the gases for the two heating jets and an independent oxygen supply is provided for the cutting jet, for the reason that ordinarily the pressure back of this jet is higher than required for the heating oxygen. The forward jet, which provides preliminary heat for the metal, is ⅜ in. ahead of the pure oxygen jet. The rear jet provides additional heat to make up for dissipation by conduction. In the case of thin plates the rear jet may be shut off.

LONG-LIFE FLAME-ARC LAMPS.

The new type "K" long-life flame-arc lamps recently developed by the General Electric Company are of the vertical-electrode type for operation on series and multiple alternating-current and multiple direct-current lighting circuits and on direct-current motor circuits of all standard commercial voltages.

The mechanism is of the focusing type, designed to maintain the arc in the same position and thus afford a constant and even distribution of the light. A new form of clutch permits the use of electrodes varying considerably in diameter, thus obviating all troubles due to the wear on clutch jaws and insuring a perfect feed. In order to prevent the arc from flickering where the lamps are subject to excessive vibration the cores and coils are suspended by means of compression springs. Except in the case of the series lamps no shunt spools are used, thereby eliminating a prolific source of trouble in arc lamps. The dimensions of the electrodes—⅞ in. diameter and 14 in. long—give great mechanical strength and a corresponding reduction in loss by breakage in handling, while their homogeneity affords many advantages over cored electrodes. It is necessary to renew only one electrode at each trim, the stub of the upper electrode being utilized in the lower holder, thereby obtaining a marked reduction in the cost of maintenance.

The lamp is provided with two globes, an inner globe of either clear or opalescent glass held tightly against the machined surface on the under side of the condensing chamber by a phosphor-bronze bail spring, thus making an air-tight joint, and an outer globe furnished in opalescent glass on the standard lamps, but which may be obtained of clear glass if desired.

The method of securing the globe which is in use with this lamp simplifies and facilitates the work of trimming. The complete globe holder is hinged to the condensing chamber, and to lower the outer globe for trimming it is only necessary to loosen the wing-nut and allow the globe to swing downward, where it is out of the way and not liable to be broken by swinging in the wind and hitting the pole.

The principle of ventilation applied causes the hot gases to rise from the arc and circulate through the condensing chamber, where they are cooled and the fumes condensed and deposited, thus keeping the inner globe clean and the illumination unimpaired.

In operation the arc voltage on the multiple alternating-current lamp is regulated by a reactance, on the multiple direct-current lamp by a resistance and on the motor circuit lamp by a resistance and a weight for properly balancing the arc voltages when two lamps are burning in series. All the lamps have their respective reactance or resistance located inside the lamp casing. The clutch r[illegible] regulates the distance from the top of the armature to the clutch lever.

The series alternating-current type has a consumption of 0.20 watt per mean hemispherical candle-power and the multiple alternating-current and the multiple direct-current types have consumptions of 0.28 watt and 0.41 watt respectively. The series lamps have a life of from 90 hours to 100 hours, while the multiple lamps have a life of from 100 hours to 120 hours, thus combining high efficiency with long life.

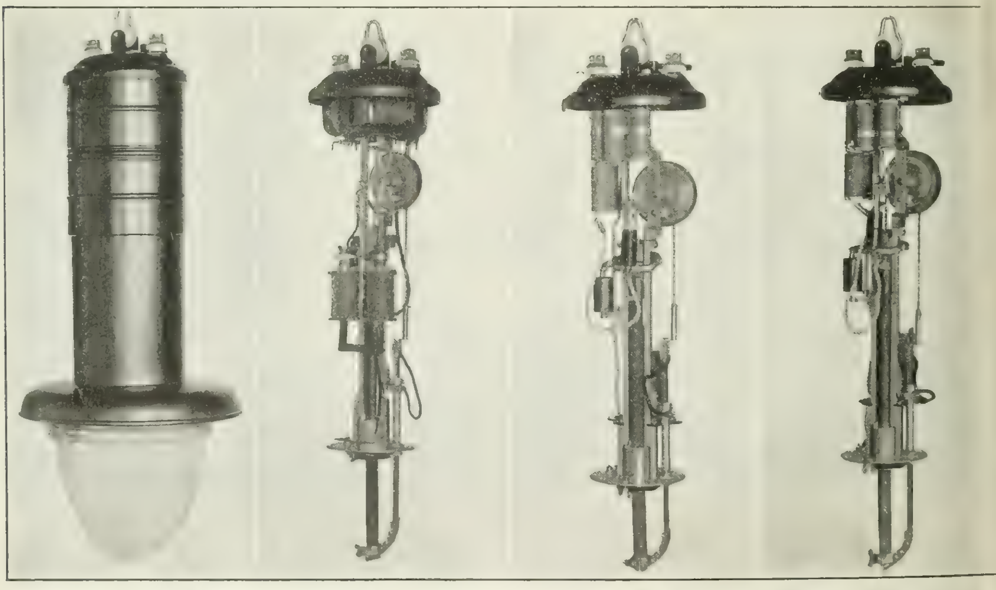


Fig. 1—Long-Life Flaming-Arc Lamps for Multiple Alternating and Direct Current Service.

GOOD SWITCHES VERSUS POOR SWITCHES.

By Granville E. Palmer.

electrical installations each article should be analyzed as to its good and bad points in cost, construction and durability. In this connection the flush push-switch problem is often overlooked and the cheapest article is often selected with bad results. Push-button switches have been in use about eighteen years, and their design and construction have followed two very plainly marked lines, one in which the manufacturer insists upon the best construction experience has developed and the other in which the manufacturer has sharpened his wits to produce a switch at a lower cost than the other manufacturer, to the end that he might either make an excessive profit or be in a position to dominate the switch market on a price consideration. The first class of manufacturer has succeeded in establishing a reputation for thoroughness that makes his product a standard throughout the world. The reputation of the other type of manufacturer who is able to produce fair goods at a ridiculously low price is equally known.

Due to the fact that standard dimensions are essential in the manufacture of push-button switches, good and bad switches have the same general appearance when hidden by a plate, and to the lay mind present no very great points of difference as long as they continue to operate, and when they fail to operate usually produce a general criticism of things electrical rather than a mechanical analysis that would result in a determination of the cause of the trouble.

Complaints are often lodged against non-operating switches, and in the majority of cases defective operation is due to poor insulation, badly designed or carelessly assembled mechanism, or corrosion due to excessive dampness. Considerable difficulty is often experienced in switches presenting an open pocket into which plaster, paint, etc., can lodge during the period of building construction before the plate is installed, and it is remarkable that there is but one manufacturer who is offering a switch in which this important point has not been quite overlooked.

Practically all the cheap switches on the market are insulated with fiber and the mechanism supported on a grounded metal strap. Fiber, being a ready absorbent of moisture, has been condemned as an efficient insulating material, and when it is admitted that the majority of switches on the market are so insulated it is remarkable that the very general demand for a more satisfactory article is so often sidetracked by a consideration of the matter of price.

The moisture that causes a breakdown of insulation also seriously affects the mechanism of the switch, and when steel parts are protected by a thin brass or copper deposit it is not surprising that they readily disintegrate under normal operating conditions, and when placed in damp walls or basements go to pieces very quickly. It is a simple, but nevertheless expensive, operation to treat the metal parts of a switch so that they will not rust, and if the interested purchaser will assure himself on this particular point and insist upon material in which this difficulty is provided for by careful manufacture, one of the most vexatious troubles that arise in push-button switch maintenance will be overcome.

Clean sheet mica, free from impurities, is one of the best known insulating materials, and when so supported that the action of the switch will not cause it to disintegrate mechanically it offers a ready but somewhat expensive method of insulating push-button switches, and is used exclusively by all manufacturers of good switches. In addition to insulating the current-carrying parts of the switch from its spring-operating mechanism it is also considered excellent construction by good switch manufacturers to support the switch mechanism on its porcelain base rather than on the metal support by which the switch itself is suspended, thus giving a double insulation between current-carrying parts and ground.

There is no reason why push-button switches should not be installed with the idea that they will last as long as the building in which they are placed, and the writer is confident that this opinion is fully borne out by the reputation that has been earned by certain good push-button switches that have been on the market as long as a demand was first created for material of this character.

A superficial student of mechanical devices is more frequently impressed with the novelty rather than the practical utility of a device which he may be considering with a view to purchase, and certainly novelty has not been lacking in push-button switch design. It is not the writer's intention to criticise the interest which all good mechanics show in novel devices, as the development of all mechanical structures has been due to the imagination and initiative of some person trying to improve on old-fashioned methods, but frequently a novelty designed to overcome an alleged difficulty will produce more trouble than even the imagination of its inventor could attribute to a standard article.

BATTERY GANG SWITCHES.

A new front yoke which is used to assemble gangs of Cutler-Hammer battery switches can be stamped in long strips so that gangs 1 ft., 2 ft. or 1 yd. or more can be assembled without any difficulty in aligning. To separate into single units or two, three or four-gang units it is

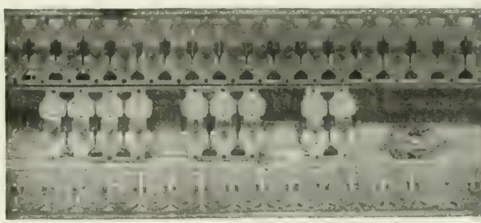


Fig. 1—Front View, Showing Front Yoke.

only necessary to use a nipper or hack saw. The new busbar, which is shown in the rear view, is also stamped in long lengths.

This arrangement eliminates the work of running a wire across the backs of the several switches and provides a neater and more secure connection. The new washers used are cupped so that any size stranded wire from No. 18 to No. 10 can be securely held without solder. Standard

Fig. 2—Rear View, Showing New Busbar Connection.

front yokes and busbars are in four-gang lengths. These features cut down to a minimum the work and time of installing, and make it possible for the jobber or dealer to supply single units or gangs of any size from a minimum stock. The face plates are furnished separately by the manufacturer.

LOW-VOLTAGE TUNGSTEN LAMPS.

The availability of tungsten in the form of drawn wire, having a tensile strength exceeding even that of piano steel, has greatly extended the field of application of tungsten lamps. An important class of service thus in-

Fig. 1—Low-Voltage Tungsten Lamp.

cluded is that of automobile and railroad-train lighting, in which the effects of shock and vibration are maximum, and which, therefore, require the use of lamps having sturdy filaments.

Of the full line of 6-volt Edison "Mazda" lamps now available for this class of service the new upset-filament headlight lamp is the latest development. In this the closely coiled filament of drawn-wire tungsten is placed in the center of the bulb, the axis of the coil coinciding with a line drawn through the center of the lamp base to the tip of the bulb. This arrangement facilitates the adjustment of the lamp in the focus of the parabolic reflector, thereby greatly increasing the amount of useful light projected on the roadway. A 15-cp headlight of this type will illuminate the road to a distance of 2000 ft. ahead of the car. This lamp is made in 15-watt, 18-watt, 21-watt and 24-watt sizes, with bulbs 2 1/16 in. in diameter fitted with Edi-Swan candelabra bases, the light values ranging from 15 cp to 24½ cp. Edison "Mazda" lamps of the train-lighting type are available for electric-vehicle lighting service in 15-watt and 25-watt sizes for 25 volts to 90 volts supply.

For general lighting service the new lamps are made in

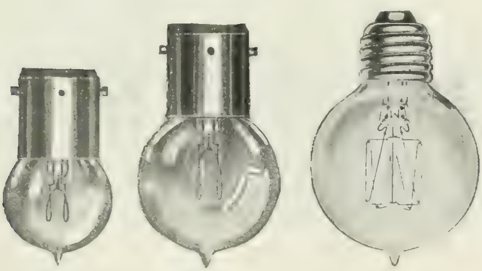


Fig. 2—Low-Voltage Tungsten Lamps.

all standard sizes from 25 watts to 500 watts, with either pear-shaped or round bulbs. The 400-watt and 500-watt units are to meet the demand for large lighting units where it has been necessary heretofore to use clusters of lamps or where arc lamps are inapplicable. They ar par-ticularly advantageous in the lighting of audito ums, armories, warehouses, mills, factories and other rge manufacturing establishments where it is necessa to locate the lamps at a considerable height above the rk-ing plane.

HIGH-TENSION TRANSFORMERS.

The Pittsburgh Transformer Company through its agent, the Republic Electric Company, of Chicago has placed on the market a line of weatherproof tension transformers in all voltages up to 33,000 fo us on both 25-cycle and 60-cycle circuits. Operators of gh tension transmission systems are rapidly beginning to a ize the possibility of selling power to farms, mills, and small communities located within a reasonable dis of the lines, but as the volume of business will not, rule, justify the installation and maintenance of su tions, the present type of transformer has been devel to meet this condition.

As is well known, high-tension systems are subjecte excessive strains due to lightning, surges and static turbances, and in order to operate successfully under conditions transformers must have a very high facto insulation. In these weatherproof high-tension tr formers the coils are so connected that minimum pote stress is developed between turns or layers of the w ing, and, in addition, the coils are given a final vac and impregnating treatment which not only renders t

High-Tension Transformer.

impervious to moisture, but also materially adds to insulation strength.

As an additional safeguard the incoming and outgoi leads have been brought through extremely heavy c rugated porcelain tubes set at an angle to the case, th maintaining a permanently high factor of insulation tween the leads and the ground. As this type of trar former corresponds in a sense to central-station apparat the manufacturers state that care has been taken to secu close regulation under all conditions of both single and po phase operation, and owing to the interconnected syste of coils the effects of low power-factors on regulation a kept at a minimum, thus insuring satisfactory service und a wide range of conditions. With these transforme central stations will be able to take on rural custome at a profit—something which could not be accomplish with the older type of transformers, requiring the co struction and maintenance of substations.

Industrial and Commercial News

The Week in Trade.

WHILE the attitude toward entering into new business on a large scale has become more conservative in the past week, approach of the fall season has assisted expansion of trade in parts of the country. Temporary removal of tariff uncertainties has caused a more cheerful feeling in many lines. Lower prices for cotton prints have attracted buyers, and the operations in the jobbing trade have been enlarged by good demand from retail interests. Demand for cotton goods as a whole is somewhat irregular, but the trade shows a gain over the business of recent weeks. The iron and steel trades are receiving a fair amount of orders, although the volume of new business shows a slight decrease. A number of bridge and rail orders of moderate size have been given in the past week, and increase is reported in the number of inquiries for rails and cars. Pig iron is not in active demand except in small lots for early delivery, and the total orders placed last week amounted to only 50,000 tons. There has been another small decrease in the number of idle cars. Among the causes of the immediate hesitation in general trade have been growth of labor troubles on several of the railroads and in several other industries. The demands of the shop employees of the Harriman lines were refused by the active head of the system, who stated that granting of the requests would mean chaos, and would narrow the ability of corporations to fulfil duties imposed upon them by law. Crop conditions are reported as encouraging and, as full harvest returns will probably be known by the opening of the next session of Congress, it is expected that business will be greatly stimulated and in a position by that time to meet further tariff and investigating agitation. Business failures for the week ended August 24, as reported by *Bradstreet's*, were 198, as compared with 215 for the previous week, 235 for the corresponding week in 1910, 236 in 1908 and [illegible] in 1907.

The Copper Market.

LOWER prices, resulting from freer offerings of lake and electrolytic, were the only features of interest of the copper market in the past week. Reductions of ⅛ cent by the largest producer caused further shading by the independents. The London market was lower, and declines of 5s were made in standard spot and best selected. Buying, in spite of price concessions, was very light, both here and abroad. Domestic consumers purchased in small quantities for September and October delivery, with most of the sales of electrolytic on a basis of 12.40 cents to 12½ cents. It is rumored in the trade that many of the largest agencies are sold ahead for sixty days and that there are several others which have copper available for early delivery. Although the domestic consumers are not buying heavily, the tone of the market at present is steady, and the expectation still holds that the August report of the Copper Producers' Association will show a reduction of some 5,000,000 lb. in domestic stocks. This estimate is based, first, on the demand from abroad, which in spite of irregularity, averages almost half of the total call on the refineries in this country, and secondly, upon the fact that deliveries during the month to domestic users have been nearly equal to those in the corresponding period in July. Total deliveries are expected to be close to 125,000,000 lb. There are few signs at present of early improvement either in the buying or in the prices of copper. The belief is still held that stocks in consuming hands are low and that supplies must be purchased for fall requirements, but the hesitation in general trade is exerting a marked influence upon copper users, so that such purchases as may be made will probably be on the present hand-to-mouth scale. Exports for the month, including August 29, were 24,148 tons. The daily call on the Metal Exchange, August 29, quoted copper as per the accompanying table.

[illegible]	Bid	Asked	Settling Price
[illegible]	12.05	12.20	....
[illegible]	12.05	12.20	12.12½
[illegible]	12.05	12.20	12.12½
October	12.05	12.20	12.12½
November	12.05	12.20	12.12½

[illegible] market, August 29, was as follows:

	Noon. £ s d	Closing. £ s d
[illegible] copper, spot	56 3 9	56 3 9
[illegible] copper, futures	56 16 3	56 16 3

[illegible] fluctuations for this year

	Highest.	Lowest.
[illegible]	12.35	11.57½
[illegible] spot	57 10 0	53 7 6
[illegible] futures	[illegible] 2 6	54 0 0
[illegible]	[illegible] 10 0	57 5 0

Industrial and Commercial Notes.

General Motors Truck Company to Make Commercial Electric Vehicles.—As recently announced in these columns, the General Motors Truck Company has formed an electric division under the management of J. M. Lansden to market a line of electric wagons and trucks. The company by this action states that it is in a position to advise impartially in the selection of a wagon or truck, whatever the service, as well as to sell complete equipments, including both gasoline and electric. The electric division will supply all types of electric chassis and wagons. The announcement states that it has no battery, tire nor electric affiliations, thus permitting the widest range in equipment and assuring that each installation shall fit the service for which it is intended. Every branch of the great organization of the General Motors Company is available for purchasing, production and distribution. The design will be dictated by Mr. Lansden's ten years' experience in the manufacture, operation and maintenance of hundreds of wagons, as well as by the analysis of widely varying requirements to give in general service cheap, but continuous, operation. Eight chassis, varying in load capacity from 1000 lb. to 6 tons, will be built in different lengths of frame and wheel base to give in every instance the proper design for the various styles and sizes of bodies necessitated by service. There will also be established a completely equipped service department with its head at Detroit and branches in various large cities, and there will be a corps of commercial engineers available at all times in connection with the selection, installation or operation of motor wagons.

To Import Plania Carbons.—H. M. Hirschberg, president of the Excello Arc Lamp Company, has made arrangements for the exclusive importation of Plania carbons for New York and Canada. These carbons are the product of the Plania works at Ratibor, Silesia, which employs over 1800 hands and is said to be the largest European plant of its kind, and the only company manufacturing large carbon electrodes for refining and electric smelting purposes. In addition to this product, the company manufactures carbons for all types of flaming, inclosed, open and miniature arc lamps. The New York representatives will carry a large stock of arc-lamp carbons in order to meet the requirements of both domestic and export business. Mr. Hirschberg says that August business in flaming-arc lamps was better than in August last, and that the outlook in this line is exceptionally bright.

General Electric Orders.—The Des Moines City Railway Company, Des Moines, Iowa, has placed an order with the General Electric Company for a 2000-kw, 25-cycle, mixed-pressure turbine, and a 75-kw turbo-exciter. The turbine will take steam from two engines driving 1000-kw, direct-current generators. The Pacific Mills, Lawrence, Mass., have ordered a 1000-kw, three-phase, 50-cycle, 600-volt horizontal Curtis turbine. Over 11,000 hp of General Electric motors are now installed in these mills.

Progress of Tallulah Falls Hydroelectric Development.—Work is progressing rapidly on the hydroelectric development of the Georgia Power Company at Tallulah Falls, where it is planned to generate some 60,000 hp. Contracts have been let for the construction of the dam and tunnel, and the 100,000-volt transmission line is now being constructed. It was stated this week at the office of C. O. Lenz, chief engineer of the Northern Contracting Company, which is doing the construction work, that the system will be completed by December, 1912.

Westinghouse Orders.—Among recent orders received by the Westinghouse Electric & Manufacturing Company are the following: From the Minneapolis General Electric Company, of Minneapolis, Minn., for three 1000-kva, oil-insulated, water-cooled, 13,200-volt transformers; the Great Shoshone & Twin Falls Water Power Company, of Twin Falls, Idaho, for five 75-kva, 24,000-volt, oil-insulated, self-cooled transformers; the Pacific Gas & Electric Company, of San Francisco, Cal., for ten 1000-kva, oil-insulated, self-cooled, tubular type, 11,000-volt transformers; from the Cincinnati Traction Company, for an equipment for generating station and three substations, consisting of one 6000-kva, 25-cycle, 13,200/6600-volt, three-phase turbo-generator, with direct-connected exciter; five 1500-kw, 25-cycle, six-phase, 600-volt, rotary converters, self-starting from alternating end; sixteen 500-kva, 25-cycle, 13,200/6600-volt, oil-insulated, self-cooled transformers; four switchboards for control of the above apparatus; from the Groton & Stonington Street Railway Company, of Mystic, Conn., for three quadruple, direct-current motors with controllers; the Connecticut Valley Street Railway Company, of Gainesville, Mass., for five quadruple, direct-current motors and controller; the Indianapolis Traction & Terminal Company, for two direct-current motors; the Savannah Electric Company, for three double-equipment, interpole railway motors with controller. The Boston Elevated Railway Company has placed an order for fifty quadruple equipments of No. 306 interpole motors with type HL control, for use on the Cambridge division.

Winnipeg Traction Conference.—Messrs. Mackenzie and Mann have had another conference with the special committee of the City Council of Winnipeg regarding purchase by the city of the Winnipeg Electric Railway Company for $24,000,000. The points at issue are agreement on a basis of audit and whether the Mackenzie-Mann interests will include the suburban lines in the sale, which at present they do not wish to do. The city wishes to acquire these as well as the other properties in question, and will not purchase unless they are included. Mackenzie and Mann, it is stated, want the city, prior to the audit, to bind itself to submit a by-law of purchase to the people in case experts show that the stock of the company is paying 5 per cent on a valuation of $250 per share; but the city has been holding out for a 7 per cent dividend on the valuation. After the meeting Mayor Evans said in part: "Very satisfactory progress was made at to-day's conference. It seems probable that an understanding can be reached on all the main features of a proposition which the committee thinks it will be justified in presenting to the people for their vote. One or two matters have yet to be considered, but the prospects of an understanding are favorable." It is understood that no definite agreement was reached on the inclusion of the suburban lines, but the special committee of the City Council made it plain that this point will have to be conceded by the Mackenzie-Mann interests, and that no basis of audit other than 7 per cent will be considered.

Progress of Northern Ohio Traction Plans.—The Northern Ohio Power Company, which is building a combined steam and hydroelectric plant at Cuyahoga Falls for supplying energy to the Northern Ohio Traction & Light Company, is purchasing land for a right-of-way for its transmission lines from the new station, across to the old hydraulic canal and along this canal to the Beech Street station of the railway company in Akron. It is proposed to convert this station into a substation and distribute energy for light and power from it to all parts of the city. The Northern Ohio Traction & Light Company has planned a high-level track along nearly the same route, across the Cuyahoga Valley at Akron on a long bridge. At present the road follows the lay of the land at that point and has a steep hill to climb on each side. It is planned to improve this condition and others, and while these improvements may not be made for some time preparations are being made in readiness for them, as well as for a new terminal at the old Webster, Camp & Lane shops, which have been purchased for that purpose. A new depot will be established there for all the interurban lines entering Akron.

Valuation of Electric Properties.—The value of electric railways in the State of Washington, as given by the report of the Washington Tax Commission, is $30,449,708, and the highest valuation is for the Seattle Electric Company, which is placed at $14,437,987. The Washington Water Power Company is valued at $3,611,526, the Tacoma Railway & Power Company at $3,580,323, and the Seattle-Everett Traction Company at $1,331,420. The lowest on the list is the Loyal Ra ay Company, of Ballard, Wash. A similar list compiled b the State Tax Commission of Wisconsin estimates the val of electric railways in the State at $37,2900,000. The list is h led by the Milwaukee Electric Railway & Light Company, wh is valued at $24,000,000. The Milwaukee Light, Heat & Tra on Company is placed at $6,650,000, and the Eastern Wisc sin Railway & Light Company at $775,000. The lowest valu on is that of the La Crosse & Onalaska Street Railway Com y, which is controlled by the La Crosse City Railway Compan

Aluminum Notes and Prices.—The aluminum mark as of August 29 is reported steady, with ingots for reme held at 20@22 cents spot No. 1, the base for large m Sheets are quoted at 33 cents, and rods and wire at 31 c A recent summary of the aluminum industry, compiled ab d states that the trade is now in the hands of only twelve panies, and that nine-tenths of the entire output is accou for by the following companies: Aluminum Industrie Akt. of Neuhausen; the Société Electro-Metallurgical Françai Froges; the Compagnie des Produits Chimiques d'Alais et Camangue, of Salindres; the British Aluminum Comp Limited, and the Aluminum Company of America. The E pean price of aluminum as quoted in London has recently £60 to £61 per long ton, equivalent to 13 to 13¼ cents pound. The American tariff is 7 cents per pound.

Says Texas Has No Electrical Trust.—A. P. Lightf Attorney-General of the State of Texas, has reported to Legislature his findings in the investigation of an alleged trical trust in Texas. Mr. Lightfoot reports that he made an investigation of combinations of electrical conc the work taking him to New York, Boston and other Nort cities, and says that he has found no violations of the trust law. He states that there seems to be merely a c munity of interests. Mr. Lightfoot will continue his invest tions in this direction and make another report later on.

Electrical Construction.—Among the items printed ur Construction News in the current issue are announcement proposed new plants or considerable extensions to present pl at Red Cloud, Minn.; Pocahontas, Ia.; Nelsonville, Ohio; sum, Wash.; Los Angeles, Cal.; Sumas, Wash.; Olym Wash.; Tombstone, Ariz.; Johnstown, Pa.; Lima, Ohio; Rutl fordton, N. C.; Dorris, Cal.; White Lake, S. D.; Burns, O Owensboro, Ky.; Lexington, Tenn.; Tampa, Fla.; Bar Mich.; Port Stanley, Ont., Can.; Ness City, Kan.; Altoona, Muscoda, Wis., and Missoula, Mont.

General Electric Business.—Estimates place current b ness of the General Electric Company at about 94 per cent the largest in the history of the company. At this rate gr business for the year should be close to $67,000,000, as c pared with $71,500,000 for 1910, and with these returns th will be a large surplus in excess of dividend requireme Reports of an increase in dividends following settlement the government controversy have been in evidence from ti to time, but it is stated that the management has not discus the matter.

Another Aqueduct Contract.—The New York Edis Company has closed a contract with the Mason & Han Company for supplying 2000 hp for operating the construct plant on its section of the Catskill Aqueduct. This exte from a point some 200 feet north of the Yonkers city line University Heights in the Bronx. The closing of this c tract, the fourth which the New York Edison Company on this work, completes arrangements for the use of electric for all construction work on the Aqueduct.

Toledo Railways & Light Company.—The City Solicit of Toledo, Ohio, has filed a suit to prevent the Toledo Ra ways & Light Company from using sections of eighteen stre over which cars are now being operated although franchi have expired. It is stated that the city is seeking a perman injunction. Failure on the part of the company to pay a ren at $250 per day for each of these streets on which franchis have expired is the cause of the suit. About $70,000 rental now due.

Catalogues and Price Lists Wanted.—Kaloust Ko youmjian, Bagdad, Asiatic Turkey, who is commercially int ested in electricity, would be glad to receive catalogues, pric etc., from American electrical manufacturers. Corresponden may be in English.

Financial.

THE WEEK IN WALL STREET.

Bearish operations dominated the market last week, and at its close the entire list of active stocks, excepting Atchison, dropped to the lowest levels thus far in 1911. Evidence of the professional nature of the market was furnished by Monday's transactions, these showing a decrease in selling pressure and an increase in the resistance offered to the pressure that remained. Many of the stocks that had declined in the latter part of the previous week made some recovery during the day, and the advancement took place under the lead of Union Pacific and United States Steel, the two issues that figured prominently in the decline. News of direct bearing upon the financial situation was concerned chiefly with the labor troubles on Western railroads, and with the effect of the recent decline as an influence upon European markets. Prices on Tuesday were steady until near the close, when pressure was applied to a number of stocks, forcing them down-

NEW YORK.

	Aug. 22.	Aug. 29.	Shares sold		Aug. 22.	Aug. 29.	Shares sold.
[illegible]	[illegible]	[illegible]	100	Int. Met., pf.	42[illegible]	43½	[illegible]
[illegible]	[illegible]	[illegible]	400	Mackay Cos.	[illegible]	83½	[illegible]
[illegible]	[illegible]	[illegible]	78,250	Mackay Cos. pf.	72[illegible]	[illegible]	
[illegible]	[illegible]	20[illegible]*	—	Man. Elev.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	34⅞	3,400	Met. St. Ry.	[illegible]	[illegible]	
[illegible]	[illegible]	104¾*	[illegible]	N. Y. & N. J. Tel.	139[illegible]	[illegible]	—
[illegible]	[illegible]	70¾*	—	Steel, com...	72⅞	[illegible]	850,340
[illegible]	133¼	131⅞	8,020	Steel, pfd...	115¾	[illegible]	[illegible]
[illegible]	[illegible]	75¼	7,200	W. U. T.	[illegible]	[illegible]	4,801
[illegible]	[illegible]	151¾	2,800	Westh. com.	[illegible]	64[illegible]	3,600
[illegible]	[illegible]	14[illegible]	9,400	Westh. pfd.	[illegible]	[illegible]	[illegible]

PHILADELPHIA

	Aug. 22	Aug. 29		Aug. 22	Aug. 29
[illegible]	45	44½	Phila. R. T.	23	22¾
[illegible]	117⅝	113[illegible]*	Phila. Elec.	[illegible]	17[illegible]
[illegible]	52¾	52[illegible]	Phila. Trac.	[illegible]	84[illegible]
[illegible]	30*	30*	Union. Trac.	[illegible]	50[illegible]

CHICAGO.

	Aug. 22	Aug. 29		Aug. 22	Aug. 29
[illegible] Rys.	[illegible]	[illegible]	Com. Edison	[illegible]	132[illegible]
[illegible] Rys.	25	25*	Chi. Subways.	[illegible]	2¾*
[illegible] Rys., pf.	90	90*	Chi. Tel. Co.	[illegible]	120½
[illegible] Ser. 1 ...	95*	95*	Nat'l Car.	[illegible]	[illegible]
[illegible] Ser. 2 ...	29¾*	[illegible]	Nat'l Car, pf.	[illegible]	118[illegible]*

BOSTON.

	Aug. 22	Aug. 29		Aug. 22	Aug. 29
[illegible] & T.	[illegible]	131⅞	Mex. Tel.	[illegible]	[illegible]
[illegible]	[illegible]	156*	Mex. Tel. pf.	[illegible]	[illegible]
[illegible]	286½*	286	N. E. Tel.	[illegible]	[illegible]
[illegible]	153½	151	W. T. & T.	18[illegible]	18[illegible]
[illegible] E. Ry.	18¼*	17[illegible]	W. T. & T. pf.	[illegible]	[illegible]
[illegible] Ry. pf.	88½*	88*			

[illegible] quoted.
[illegible] sold for the week, Aug. 21 to Aug. 2[illegible]

ward again, but with few important changes. Fresh rumors of a federal suit against the Steel Corporation assisted in bringing down the prices of its shares, and the labor conditions of the Harriman roads were a matter of discussion in the market. Although many speculators had forecast the government's monthly report on the cotton crop, due on Friday of this week, the Street was awaiting it with interest. It was believed that deterioration would not be in excess of the usual August amount and, even if this were the case, that the crop would be the largest on record. The money market is quiet at present, but will probably reflect within a short time the efforts of outside banks to finance the requirements of the harvests. Rates Aug. 29 were: Call, 2¼@2½ per cent; ninety days, [illegible] per cent. The quotations in the tables are those at the [illegible] Aug. 29.

FINANCIAL NOTES.

Mexican Tramways Company.—During the past six fiscal periods earnings of the Mexican Tramways Company have shown annual increases, the highest total having been made in 1910, as regards both gross and net income. In the last fiscal period the company carried more than 76,000,000 passengers, as against not quite 72,000,000 in the year previous. The gross income and net income have almost doubled during the last six years, being $5,882,534 and $2,996,610, respectively, in 1910, against $3,642,106 and $1,465,732, respectively, in 1905. Average daily earnings from operation during the last fiscal year were also the largest on record, while the average daily expenses were likewise the highest. In 1910 the average daily earnings from operation amounted to $15,986 and the average daily expenses were $7,626, compared with daily earnings of $14,748 last year and daily expenses of $7,183, and with average daily earnings of $9,482 and daily expenses of $5,740 in 1905, six years ago. A noteworthy feature of the exhibit for the last fiscal period, however, was the reduction of about one point in the operating ratio as compared with the year previous, the ratio being 49.06 in 1910 and 50.02 the year previous. This ratio is the lowest reported since the company was organized, indicating that efficiency of operation has been materially increased from year to year. The ratio in 1905 was 59.75. The total amount of equipment on hand, representing motor cars, mule cars, railway engines, etc., was 633, as compared with 652 in 1909 and 569 in 1905. Further details of the record for the fiscal year ended June 30 were given in these columns August 5.

Great Western Power Company.—At the recent meeting of directors of the Great Western Power Company held in San Francisco to effect the change in control resulting from purchase of the City Electric Company, Herbert and Mortimer Fleishacker were elected vice-presidents, and the latter was given the management. Edwin Hawley remains as president and H. P. Wilson as secretary. Mr. Wilson has called a meeting of stockholders of the Great Western Power Company and the California Electric Generating Company for October 26, in San Francisco, for considering an increase in the capitalization of the parent company from $25,000,000 to $27,500,000. A plan to make dividends on the stock of the subsidiary company cumulative after January, 1912, will be presented to the stockholders, and there will be discussion of the advisability of entering into a contract for energy with the City Electric Company. The question of guaranty by the California Electric Generating Company of payment of interest upon $1,700,000 bonds of the City Electric Company will be considered.

Status of Westinghouse Business.—The electric fan business of the Westinghouse Electric & Manufacturing Company this summer is stated to be the largest in the history of the company. Orders called for more than 100,000 fans, and the department was operated at full capacity throughout the summer. Business in other departments is irregular, demand for general supplies being good, but in some other branches a falling off in orders is reported. The entire business of the company at present is regarded as between 75 per cent and 80 per cent of full capacity. One of the large items of expense now borne by the company is due to development of new patents for increasing still further the efficiency of its apparatus. In spite of agitation for dividends on assenting stock there is not likely to be a disbursement in this direction until the management feels that the financial status of the company is extremely sound.

Hudson River Power Companies Sold.—At a foreclosure sale held August 29 at Ballston Spa, N. Y., the franchises and properties of the Hudson River Electric Power Company and subsidiaries were sold to representatives of the bondholders' committee for $7,500,000. This was $3,000,000 more than the upset price fixed by the courts, and resulted from active bidding between the representative of the bondholders and Anthony N. Brady, who is interested in several public utilities in the upper part of the State. The sale includes the properties of the following companies: Hudson River Water Power Company, Hudson River Electric Company, Hudson River Transmission Company, Ballston Spa Light Company, Saratoga Gas, Electric Light & Power Company, the Empire State Power Company, and the Madison County Gas & Electric Company.

Commonwealth Edison May Buy Chicago & Milwaukee Electric.—There are rumors that the Commonwealth Edison Company will bid in the Chicago & Milwaukee Electric Railroad Company at an early foreclosure sale. The road is now in the hands of receivers, and a decree by Federal Judge Grosscup ordering its sale is thought to be forthcoming. In accordance with the terms of the elevated consolidation cars of the Chicago & Milwaukee will enter the city over the tracks of the Northwestern Elevated.

Combination of Southern Lighting Companies.—Chicago capitalists, it is stated, are negotiating for the stock of the Louisville Gas Company, which controls the Louisville Lighting Company, and it is believed that they will endeavor to secure control of the Kentucky Electric Company, with a view of effecting a combine of companies operating in the section.

Oregon Company Changes Hands.—The properties of the Rogue River Electric Company, of Medford, Oregon, have been purchased by the Siskiyou Electric Light & Power Company, of Yreka, Cal., this transaction giving the purchaser control of water resources in Southern Oregon and Northern California.

Pacific Gas & Electric Extension.—D. H. Foote, secretary of the Pacific Gas & Electric Company, of San Francisco, has announced that the stockholders of the company will be called upon to vote at a special meeting Oct. 23 on an increase of the bonded indebtedness of the company to $150,000,000, with a parallel increase in the capitalization to $160,000,000, all of the proposed increase to be common stock. About $60,000,000 of the bonds will be used for refunding the company's present issues, the balance being available for development work during the next ten years. The recently announced plans of the company for extensive power development in Northern California have attracted attention to its growth in business and revenues during the few years past. The company operates, at present, eleven hydraulic plants with a total generating capacity of approximately 93,000 hp, three steam plants rated at 96,000 hp, and has about 1000 miles of transmission lines. It serves with electricity a population of close to 1,100,000 in 158 towns and cities in twenty-six of California's fifty-six counties, a total area of about 32,500 square miles. Plans for development include new hydraulic plants to augment the generating capacity by 71,000 hp, giving a total of 260,000 hp as the gross output of the company. New transmission lines are to be constructed, and additional territory is to be tied in with the system, there being a steady increasing demand to utilize the product throughout the northern section of the State. The work planned is estimated to cost $10,000,000. Dating from 1906, the gross revenues of the company have expanded to the extent of over $1,000,000 per annum. A financial statement for the past five fiscal years follows:

	Gross Revenue.	Net Revenue.	Surplus.
1906	$8,947,162	$4,524,043	$557,687
1907	11,342,140	5,115,911	1,082,789
1908	12,715,746	5,806,145	1,519,101
1909	13,650,075	5,800,925	1,502,957
1910	14,229,228	5,938,623	1,551,844

Electric Bond & Share Company.—The directors of the Electric Bond & Share Company are submitting to the preferred stockholders for their approval a plan to increase the authorized capital stock of the company from $2,000,000 common and $2,000,000 preferred stock to $5,000,000 of each issue, necessity for this increase in capitalization arising from expansion of business. The plan provides, among other things, that the preferred stockholders will later receive, share for share, 6 per cent preferred stock in exchange for the 5 per cent stock deposited. It is also proposed to make certain changes in the certificate of incorporation and by-laws of the company, designed to remove unusual restrictions which, in the opinion of the board of directors, have been shown by experience to be cumbersome and detrimental to the best interests of the company. The common stockholders have assented to the plan and have agreed to purchase $1,500,000 of new common stock at par. The remainder of the stock will be sold from time to time to meet the capital requirements of the company, subject to the provisions of the company's charter that the preferred stock outstanding at no time shall exceed the oustanding common stock. Owners of the preferred stock are now asked, in order that the plan may be carried out, to deposit their stock certificates either with the Standard Trust Company of New York or the Old Colony Trust Company of Boston. Transferable receipts will be issued in exchange for the stock certificates. The Electric Bond & Share Company was incorporated Feb. 28, 1905. Since that date it has been engaged in financing electrical enterprises and has been instrumental in distributing to investors a large amount of public utility securities. The company has paid dividends at the rate of 5 per cent on its preferred stock since organization. The present rate on the common stock is 8 per cent. The company's surplus and undivided profits amounted to $1,280,627, as of Dec. 31, 1910.

Earnings of Detroit Edison Company.—Gross earnings of the Detroit Edison Company for July were $231,396, an increase of $25,475 over the revenue in the same month in 1910. Operating expenses were $144,362, an increase of $17,975, and net income was $87,034, which was $7,500 larger than last year's figure. Interest charges were $50,716, an increase of $5,317, and surplus for the month was $36,318, being $2,183 over the surplus in the corresponding month of the previous year. In the seven months ended July 31 gross earnings were $1,868,587, as compared with $1,563,153 last year. Operating expenses were $1,102,594, as compared with $903,820, and net income was $765,993, which shows an increase of $106,660. Interest charges for the seven months were $337,081, as compared with $302,800, and the surplus was $482,912, against $356,533 in the same period in 1910. Estimates based upc the present scale of earnings place the surplus available for ivi-dends at the end of the year at 15 per cent on the $5,7 000 stock outstanding, as compared with 12.33 per cent fo last year.

United Railways of St. Louis.—Gross earnings o the United Railways Company of St. Louis for July were $1 6,-759, an increase of $28,679 over the returns for the me month in the previous year. Total expenses and taxes ere $686,838, an increase of $24,022, and net income was $33 10, which was $3,996 larger than in 1910. Interest on bonds as $228,312, a decrease of $4,690, and the balance available dividends was $104,898, representing an increase in this of $8,686. In the seven months ended July 31 gross earng were $6,841,998 an increase of $251,854, and net income as $2,145,181, which represents an increase of $128,598 for he period as compared with 1910. The balance available for dends was $539,620, an increase of $155,355. From presen dications the company will have a surplus available for dends at the close of the year more than sufficient to the 5 per cent on the preferred stock outstanding.

Rome (Ga.) Railway & Light Company Bonds.—I mortgage 5 per cent gold bonds of the Rome (Ga.) Railw Light Company are being offered by a New York ban house. The bonds are dated January 1, 1907, are January 1, 1937, and are subject to redemption in whole o part at 105 and accrued interest on any interest date on months' notice. Earnings in the past few years have l over twice interest requirements on these bonds, and from record for the first six months in the present year it is pected that more than three times the requirements will earned.

Southern Bell Telephone Company to Issue Bonds.—' Southern Bell Telephone Company has filed a deed of t covering an authorization of a $50,000,000 bond issue in] ton County, Georgia. The Bankers' Trust Company and J H. Parsons, of New York, are named as trustees, and ten lions have been issued to date. It is stated that a copy the deed will be filed in every county where property is ow by the corporation.

Cuyahoga Telephone Meeting.—Retiring officers w re-elected at the meeting of directors of the Cuyahoga T phone Company. Other business transacted at the meet was said to be merely of routine nature.

DIVIDENDS.

Muskogee (Okla.) Gas & Electric Company, quarterly, p ferred, 1¾ per cent, payable Sept. 15.

Oklahoma Gas & Electric Company, quarterly, 2 per ce payable Sept. 15.

San Diego Consolidated Gas & Electric Company, quarter 1¾ per cent, payable Sept. 15.

West Penn Traction Company, quarterly, 1 per cent, paya Sept. 15.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Ne Surpl
AMERICAN LIGHT & TRACTION COMPANY.					
July, 1911	$284,892	$9,537	$275,255	......	...
July, 1910	250,723	10,669	240,054	......	..
CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.					
July, 1911	$611,108	$368,366	$242,741	$50,681	$192,(
July, 1910	565,555	321,582	243,973	48,802	195,1
MONTREAL STREET RAILWAY COMPANY.					
July, 1911	$437,771	$231,068	$206,703	$72,088	$134,(
July, 1910	398,847	215,224	183,623	58,459	125,1
NASHVILLE RAILWAY & LIGHT COMPANY.					
July, 1911	$154,671	$93,961	$60,710	$38,520	$22,1
July, 1910	144,548	84,134	60,414	37,708	22,7
NEW ORLEANS RAILWAY & LIGHT COMPANY.					
6 m., June, 1911	$3,337,433	$2,036,467	$1,307,966	$881,466	$426,4
6 m., June, 1910	3,142,295	1,928,712	1,213,712	876,701	348,2
NORFOLK & PORTSMOUTH TRACTION COMPANY.					
Yr., June, 1911	$2,091,616	$1,212,404	$879,212	$743,579	$135,6
Yr., June, 1910	1,920,841	1,110,489	810,351	777,216	33,1
NORTHERN OHIO TRACTION COMPANY.					
July, 1911	$278,431	$141,003	$137,428	$44,321	$93,1
July, 1910	262,020	131,937	130,082	43,357	86,7
PHILADELPHIA RAPID TRANSIT COMPANY.					
July, 1911	$1,856,815	$1,144,766	$712,048	$737,289	*$25,2
July, 1910	1,771,954	1,082,201	689,752	734,241	*44,4
TWIN CITY RAPID TRANSIT COMPANY.					
July, 1911	$710,067	$337,555	$372,512	$140,079	$232,4
July, 1910	682,611	318,594	364,018	140,113	223,9

*Deficit.

General News

Construction News.

[illegible]MINGHAM, ALA.—The Birmingham, Ensley & Bessemer Rail[illegible] Company, it is reported, is planning to erect a power plant.

[illegible]LA, ALA.—At an election held Aug. 22 the proposition to issue [illegible] the amount of $40,000, the proceeds to be used for the in[illegible] of a municipal electric-light plant, was carried.

[illegible], ARIZ.—The Ray Consolidated Copper Company contem[illegible] installation of electric pumping machinery for irrigation work.

[illegible], ARIZ.—The Salt River Valley Electric Company, recently [illegible], has applied for a twenty-five-year electric railway franchise in [illegible]. F. M. Winter is interested in the company.

[illegible]X, ARIZ.—It is reported that an extensive system of electric [illegible] to be constructed through the Salt River Valley with Phoenix [illegible] radiating center. As a first step in this direction Epes Randolph, [illegible] of the Arizona Eastern and the Southern Pacific Railroad of Mexico, both Southern Pacific properties, recently acquired control of the street-railway system here. Surveys for proposed extensions to various points in the valley are being made.

[illegible]OMBSTONE, ARIZ.—The Western Mines & Development Company [illegible]well mines) is contemplating the installation of an electric [illegible].

[illegible]ARRISON, ARK.—W. H. Standish is reported to have secured per[illegible] from the federal government to erect a hydroelectric power [illegible] the White River, 10 miles below Fordyce. The work will in[illegible]clude the construction of a tunnel, 3000 ft. long, dam and power house. [illegible] estimated that several hundred hp can be developed.

[illegible]LAMEDA, CAL.—The City Council has adopted a resolution order[illegible] ornamental lamp posts set in concrete base to be erected on certain [illegible] the city of Alameda.

[illegible]KERSFIELD, CAL.—In its budget for the fiscal year commencing O[illegible]ber, 1911, the Kern River Oil Fields, Limited, will make an appro[illegible]priation for motors for oil-drilling operation.

[illegible]AKERSFIELD, CAL.—The Board of Trustees has refused pay[illegible]ment of its regularly monthly account for arc lamps to the San Joaquin Light & Power Company on the grounds that the company had made a reduction of 25 per cent in rates to private consumers and did not [illegible] to the city. If the company does not make a reduction in the rate the present contract will be canceled and the rates fixed by [illegible].

[illegible]OLTON, CAL.—The Southern California Edison Company has awarded the contract for the erection of a substation at Colton to the [illegible]. Engstrom Company, of Los Angeles, to cost approximately $16,000.

[illegible]ORONA, CAL.—The plant and holdings of the Corona Gas & Elec[illegible]tric Company are reported to have been purchased by the Southern Sierras Power Company.

[illegible]OURTLAND, CAL.—The New Freeport Telephone & Telegraph Company has awarded the contract for the erection of a new building to Lindren & Guth.

[illegible]ORRIS, CAL.—Surveys have been completed for the proposed trans[illegible]mission line of the Siskiyou Electric Light & Power Company, of Yreka, C[illegible], from Ashland, Ore., to Dorris. Work will soon begin on the erec[illegible]tion of the proposed line. Dorris will be the distributing station for [illegible]edoel and two large ranches of Yreka. Contracts for material have already been placed.

[illegible]RESNO, CAL.—The Pacific Light & Power Corporation, of Los [illegible], Cal., has filed articles of incorporation with a capital stock of [illegible]000, to enable it to operate in this section. William G. Kerckhoff, [illegible] Freeman, Howard Huntington and H. E. Huntington are dir[illegible].

[illegible]ULLERTON, CAL.—The Southern California Edison Company has submitted a proposition to the Council offering to install and maintain a [illegible] street-lighting system consisting of five 500-watt and five 250-watt tungstens in the business district and forty-five 50-watt tungstens in [illegible]idential section, at the rate of $98.75 a month. The offer, it is said, [illegible] be accepted.

[illegible]OS ANGELES, CAL.—The Los Angeles Railway has filed applica[illegible]tion for a franchise for an electric railway from Boyle Heights to a [illegible] near Eastlake Park.

[illegible]OS ANGELES, CAL.—The Pacific Telephone & Telegraph Company [illegible] awarded the contract for erection of a three-story exchange building [illegible] Vernon Avenue to Carl Leonhardt, of Los Angeles, to cost $30,000.

[illegible]OS ANGELES, CAL.—A power and generating plant will be in[illegible]stalled in the new thirteen-story office building to be erected on Broad[illegible]way by the Los Angeles Investment Company. The cost of building is [illegible] at $1,000,000.

[illegible]OS ANGELES, CAL.—The Union Oil Company has awarded the contract for the installation of a power and generating plant in its new three-story office building on Spring Street to the John W. Catron Company, of Los Angeles, for $11,325.

LOS ANGELES, CAL.—To encourage the installation of ornamental lamps, the City Council has adopted a policy of paying the same price toward such as the lamp service in the district is costing. Heretofore the city has paid one-eighth, the property owners bearing the balance.

LOS ANGELES, CAL.—The new ordinance adopted by the Council recently went into effect Aug. 12. The ordinance does not contain the proposed 35-cent meter charge, but provides that the minimum monthly charge shall be 75 cents and establishes a 7-cent rate for electricity for lamps.

LOS ANGELES, CAL.—The city of Los Angeles has filed on additional power sites on the Owens River and Cottonwood Creek, on the route of the aqueduct, increasing the estimated capacity of the power plants to be installed from 120,000 to 150,000 hp. The Power Bureau is preparing plans and specifications for the power plant to be erected in the San Francisco canyon, known as No. 1, to have a generating capacity of 30,000 hp., and will advertise for bids for machinery at once, to be opened in October. E. F. Scattergood is chief engineer.

LOS ANGELES, CAL.—The Power Bureau has recommended to the City Council of Los Angeles the establishment of a 12-cent rate for electricity for lamps in Independence, Lone Pine and other towns along the route of the Los Angeles aqueduct, and a meter charge of 25 cents per month, except where the consumer supplies the meter, with a minimum charge of $1 per month. Refusal of the City Council to definitely fix rates has led the Power Bureau to act upon its own initiative and establish the above schedule. Electricity is being supplied from the plants already installed for construction purposes, near the intake.

LOS ANGELES, CAL.—City Electrician R. H. Manahan has requested the Board of Public Works to give definite information as to the intentions of the city for street-lighting service when power from the proposed aqueduct plants is available. An addition of 360 arc lamps is provided for in the city budget, making a total of 3560 lamps then in service, at a price of $75.60 per lamp a year, from the Los Angeles Gas & Electric Company. An endeavor to establish lower rates has met with that company's refusal until it learns whether its system will be taken over by the city at just valuation, or whether an entirely new system is to be installed.

MADERA, CAL.—The San Joaquin Light & Power Company, it is reported, is planning to erect a transmission line from Madera to Los Banos. A branch line will extend from a point on the line between Dos Palos and the river to a point three miles west of Mendota, where a substation will be located. Another substation will be built at Los Banos. James Berryman, of Dos Palos, is in charge of the work.

PETALUMA, CAL.—The Petaluma Telephone Company is planning to erect a telephone line from Petaluma to Cotati.

REDDING, CAL.—The installation of the Coleman power plant and other operations in the four completed plants of the company are leading up to the harnessing of the greatest unit in its large system. The company is utilizing the waters of three Battle Creeks and their tributaries east of Redding and Anderson. The Coleman plant when completed will have an output of 21,000 hp, which with the Volta, Kilare, Inskip and south plants of the company will give an aggregate output of 51,000 hp.

RIVERSIDE, CAL.—The Home Telephone Company has applied for a franchise covering Riverside County.

ROSEVILLE, CAL.—The Board of Trustees has directed City Engineer Marshall and City Engineer Gibson to submit estimates at the next meeting on the proposition of the city purchasing an electric-light plant, for which bonds were voted some time ago.

SACRAMENTO, CAL.—The Retail Merchants' Association, it is said, is planning to install an ornamental street-lighting system in the business section of the city. It is proposed to erect electroliers. When completed the system will be taken over by the city.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company is planning to make extensive improvements to the local street car system, which will involve an expenditure of about $1,000,0000. A permit has been obtained by the company for the reconstruction of its car barns, located at Twenty-eighth and M Streets, the cost of which is estimated at $45,000.

SACRAMENTO, CAL.—Work will begin immediately by the Citizens' Light & Power Company on the construction of the conduit which will run from Seventh and M to Seventh and I Streets. Steel conduits will be used. The poles in the residence district will be placed in alleys. Energy is delivered at the substation of the company located at Eighth and R Streets, where it is transformed for distribution throughout the city.

SAN DIEGO, CAL.—Plans are being considered to replace the open [illegible] lamps on the west side of the city with [illegible]

to correspond with those being use on the east side. The proposed change will require some changes to the generators at the west side pumping station. The cost of the entire work is estimated at about $6,500.

SAN FRANCISCO, CAL.—The United Properties Company has completed surveys for an electric railway between this city and Sacramento, and will soon commence work on construction of same.

SAN FRANCISCO, CAL.—Bids will be received at the office of the Board of Public Works, 993 Market Street, San Francisco, Cal., until Sept. 20 for furnishing and installing laundry plant in the power house and laundry building at the San Francisco Building. Also for furnishing and installing steam turbines, generators and main switchboard, sterilizers and disinfectors, ice-making and refrigerating plant in the power house and laundry building at the San Francisco Hospital. Also for furnishing and installing steam, gas and water piping for tunnel in San Francisco Hospital, and for furnishing and installing plumbing, gas fitting and piping in power house and laundry building; for furnishing and installing boilers, boiler-room auxiliaries and piping in power house and laundry building. Plans and specifications are on file at the office of the clerk of the Board of Supervsors.

SAN JOSE, CAL.—The construction of an electric railway between San Jose and Almaden is contemplated by C. A. Nonas, president of the Almaden Quicksilver Mines.

SANTA ANA, CAL.—The Southern California Edison Company has brought suit in the United States Circuit Court at Los Angeles to restrain the city of Santa Ana from enforcing an electric-light ordinance with rate of 7 cents per kw-hour, from 250 to 8000 kw, and 1½ cents per kw-hour above 8000 kw, with minimum of 50 cents. The company claims that physical valuation will show the rates to be confiscatory.

STANTON, CAL.—The installation of electric-light and water-works systems in Stanton is reported to be under consideration.

VALLEJO, CAL.—John W. Danforth, 72 Ellicott Street, Buffalo, N. Y., has secured the contract for furnishing equipment for auxiliary plant at the navy yard, Mare Island, Cal., for $104,420, bids for which were opened July 8.

VENICE, CAL.—It is reported that it is proposed to erect a power plant in connection with the new Polytechnic High School.

VENTURA, CAL.—The power plant of the Union Oil Company, near nere, was recently destroyed by fire.

COLORADO SPRINGS, COL.—The question of improving the street-lighting system and also erecting colored streamer lamps across the streets to be used for special occasions is under consideration by the Chamber of Commerce.

MERIDEN, CONN.—The Berlin Street Railway Company, organized to build an electric railway between Meriden and Berlin, with a branch line from Berlin to New Britain, is planning to begin work on construction of the proposed road at an early date. H. M. Kochersperger is president of the company and J. T. Kelly, of New Haven, Conn., secretary.

PLAINVILLE, CONN.—The Trumbull Electric Manufacturing Company is reported to have awarded the contract for installling equipment at its power plant to the Shaffer March Company, of Bristol, Conn.

WESTPORT, CONN.—The plant and holdings of the Westport Water Company have been purchased by the Housatonic Power Company, of New Haven, Conn. The Westport company supplies both electrical and water service in Westport, Saugatuck and Green Farms.

WILMINGTON, DEL.—The Public Utilities Light, Heat & Power Company has applied for a franchise to erect and operate an electric plant in Wilmington.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until Sept. 23, for furnishing copper conductor bars and splice bars. Blanks and general information relating to this circular (No. 647) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is General Purchasing Officer.

WASHINGTON, D. C.—Bids will be received until Sept. 11 at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing vitrified tiles, mandrels for tile, dynamite, calcium carbide and telephone cable. Blanks and general information relating to this circular (No. 645) may be obtained from the above office or from the offices of the assistant purchasing agents at 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is General Purchasing Officer.

ST. PETERSBURG, FLA.—Arrangements are being made by the St. Petersburg Railway & Electric Company to build an extension from St. Petersburg to Coffeepot Bayou, work on which will begin soon.

TAMPA, FLA.—Judge Bullock, of Ocala, Fla., is reported to be interested in a project to build a hydroelectric plant on the Wekiwa River to supply electricity in that district. Plans are under way to form a company to operate the plant.

HONOLULU, HAWAII.—The contract for furnishing boilers, etc., for auxiliary power plant equipment at naval station, Pearl Harbor, has been awarded to C. C. Moore & Company, 99 First Street, San Francisco, Cal., at $158,000, bids for which were opened July 8.

MIDDLETON, IDAHO.—The Swan Falls Power Company, of mpa Idaho, is reported to have completed plans for the erection of substation in Middleton, to cost about $2,500.

MINERAL, IDAHO.—The Idaho Electric & Power Company i planning to erect a pumping station near Mineral for the purpose of pumping water for irrigating land surrounding Mineral on the Snake iver. The company is now securing the right of way for the erection its transmission lines.

CHICAGO, ILL.—Sealed bids will be received by the Board of rustees of the Sanitary District of Chicago, Room 1500, American rust Building, Chicago, Ill., until Sept. 5 for furnishing and installin electrical apparatus as follows: Division A—electrical equipment fo Wabansia substation; B—tubular poles; C—wrought-iron tubes; D—alateiron cross arms; E—insulators; F—Columbian pole bases; G— meters; H—oil switches; I—line construction; J—watt-hour meter. al for construction of substation building. Plans, specifications an contract form are on file at the office of the electrical engineer o Saitary District, Room 1500, American Trust Building, Chicago, Ill., of which may be obtained on application to above office.

ELLIOTT, ILL.—The installation of an electric-light plant ported to be under consideration by the city.

GEORGETOWN, ILL.—The new electric-light plant of the G town Electric Light Company is nearly completed and will soon be operation. The plant, which is located near the Sharon coal mine supply electricity for lamps and motors in the towns of Ridge Georgetown, Indianola, Sidell, Vermilion Grove and to many o farmers along its transmission lines.

HILLSBORO, ILL.—Surveys are being made for an electric ra from Hillsboro to Taylor Springs. Funds for building the pro railway, it is said, will be provided by the Hillsboro Electric Li Power Company.

MANHATTAN, ILL.—The Village Board has appointed a comm to confer with the Economy Light & Power Company in rega lighting the streets of the village. The company has submitted a sition offering to extend its transmission lines from Elwood an furnish thirty-three street lamps at $44 each per year.

WAUKEGAN, ILL.—The installation of an electric-light plant in nection with the municipal water-works system, to supply electricity street lighting in Waukegan, is under consideration.

SOUTH BEND, IND.—Work has commenced on the addition to power house of the Indiana & Michigan Electric Company. An tional unit will be installed which will double the capacity of the pl plant, making the output about 13,000 hp.

WARREN, IND.—The Mills Electric Company, of Chicago, Ill., ufacturers of electric chafing dishes, toasters, water heaters and electrical devices, has moved its plant to Warren, Ind. The factory be equipped for electrical operation, energy for which will be sup by the municipal electric-light plant. The management of the muni electric plant is making a specialty of supplying electricity for manufacturing plants. W. H. Hickerson is superintendent of municipal electric plant.

BOONE, IA.—Contracts have been placed by the Boone Electric pany for the construction of a new power house and smokestack. building will be 80 ft. x 100 ft., built of brick and concrete, a smokestack 175 ft. high. New equipment will be installed in the power station, contracts for which have already been placed.

NEW SHARON, IA.—The erection of a high-tension transmis line between Oskaloosa and New Sharon is under consideration. W the present legal tangle in which the electric-light proposition is invol has been solved, it is probable that the city will secure electrical ser from the Oskaloosa Traction & Light Company, and a twenty-four h service will be established.

POCAHONTAS, IA.—At a special election held recently the prop tion to issue bonds to the amount of $11,000, the proceeds to be u for the construction of a municipal electric-light plant, was carried.

VILLISCA, IA.—Claiming that the Villisca Electric Company has feited its franchise, the City Council has adopted a resolution cancel the franchise of the company, now known as the Villisca Public Serv Company. Notice has been served on the company that it must rem its poles and wires from the streets of the city within thirty da William Binkley is local manager.

CLAFLIN, KAN.—The local electric-light plant was destroyed by on Aug. 18. At present the city is without street-lighting service.

LECOMPTON, KAN.—At an election held recently the proposition issue $2,500 in bonds, the proceeds to be used to install an electr lighting system, was carried.

NESS CITY, KAN.—At a special election held Aug. 16 the propositi to issue $16,000 in bonds, the proceeds to be used for rebuilding municipal electric-light plant, was carried. Contracts, it is said, will let at once for erection of new building and installation of machine

TOPEKA, KAN.—The contract for erecting an electric transmissi line from the plant of the Topeka Edison Company, in Topeka, to the dustrial Institute, 2 miles east of the city, wiring the grounds street lamps and also wiring the seven buildings of the institution, h been awarded to H. B. Howard, of Topeka, Kan.

HICKMAN, KY.—The Kentucky Southwestern Railway, Light

[illegible] Company, recently organized, is planning to build an electric [illegible] from Paducola to Hickman, Ky., and also to supply electricity for lamps and motors. E. F. Wheaton, of Hickman, Ky., is interested [illegible] company.

[illegible]XINGTON, KY.—It is reported that contracts have been awarded [illegible] Kentucky Traction & Terminal Company for [illegible] and [illegible] for its proposed power plant. Work will soon begin [illegible] the power house. The equipment will include two 2000-kw [illegible] generators, two 750-kw auxiliaries and two 75-kw exciters, [illegible] and four boilers with a rating of about 1000 hp each, each supplied with automatic coal stokers. The company also contemplates the [illegible] of an ice plant and two substations, one on the Nicholasville [illegible] other on the Georgetown line, and will also rebuild substations [illegible] and Paris line. The cost of the work is estimated at [illegible]. Sargent & Lundy, of Chicago, Ill., are consulting [illegible].

[illegible]WPORT, KY.—The contract for supplying the city of Newport with [illegible] has been awarded by the City Council to the Union [illegible] Heat & Power Company, of Covington, Ky. The contract provides [illegible] city shall pay $58 per lamp for arc lamps and $27 per lamp for [illegible]. The rate for commercial lighting has not been fixed, [illegible] amount used is at the scale of 10 cents per kw-hour, with a discount from 10 to 40 per cent according to the amount of energy con[illegible].

[illegible]SBORO, KY.—Improvements are contemplated to the municipal [illegible]ght plant which will involve an expenditure of about $16,000. [illegible]ndenback, manager of the municipal plant, will have charge of [illegible].

[illegible]HENS, MAINE.—Plans are being considered for the construction of [illegible] electric railway from Skowhegan to Athens, via East Madison, a [illegible] about 10 miles. The towns of Athens and Skowhegan have [illegible] to take $15,000 in capital stock and the Maine Central Rail[illegible]pany has promised an equal amount. It is proposed to issue [illegible] capital stock and to secure the remainder of the funds by [illegible]nds. J. E. Chapman is interested in the project.

[illegible]RICK, MD.—The Frederick Railroad Company has purchased [illegible] stock of the Frederick Gas & Electric Company and has asked [illegible] Service Commission to ratify the sale. Improvements to the [illegible]ystem have been promised the city.

[illegible] ROCK, MASS.—The Marshfield Electric Light & Power Com[illegible] applied for a franchise to erect and maintain transmission lines [illegible]stribution of electricity in Brant Rock. E. J. Beattie is pres[illegible] company.

[illegible]A, MICH.—Preparations are being made for the installation [illegible] electric-light plant in Baraga, to cost approximately $3000. George F. Druer, of Duluth, Minn., is engineer in charge.

[illegible]Y CITY, MICH.—At a special election held recently the citizens [illegible] confirm the franchise granted to Alex. J. Groesbeck, of Detroit, [illegible] an entrance into Bay City by an extension of the Saginaw & [illegible]erurban Railway. This city will be made the new terminal [illegible]s, and substation when the hydroelectric development on the [illegible] River is completed. The company agrees to give a local [illegible] service at a three-cent fare, and also to pay the city 3 per cent of its earnings after the gross receipts reach $15,000 annually.

[illegible]AR LAKE, MICH.—At an election held Aug. 17 the proposition to gr[illegible] an electrical franchise was granted. Under the terms of the franchise the company is to begin work on construction of its plant within three months. It is proposed to build a dam on the south branch of little Manistee River first. Power generated by this dam will be utilized in construction of the others, which will be built on the main branch of the Manistee.

[illegible] RAPIDS, MICH.—The construction of a dam and power plant on the Muskegon River at Ryan's Creek is under consideration by the town of Big Rapids, Mich. The cost of the proposed plant is estimated at about $250,000. Options have been taken by the city of the land on both sides of the Muskegon River. Plans are being prepared by Ray [illegible]neer.

[illegible]D RAPIDS, MICH.—The Grand Rapids-Muskegon Power [illegible] planning to extend its service to Spring Lake this season [illegible] to Ferrysburg and Grand Haven. The line will be ex[illegible]om Fruitport. The company had hoped to extend the service [illegible]n to North Park and Mill Creek, but owing to so many de[illegible]r city extensions it has been postponed to next season.

[illegible]ANTON, MICH.—The proposition to issue bonds to the amount of [illegible] the proceeds to be used for the installation of a municipal electric-light plant, was carried.

[illegible]RGUS FALLS, MINN.—The City Council is considering the question of issuing bonds for the reconstruction of the dam in connection with the municipal electric-light plant.

[illegible]D CLOUD, MINN.—Sealed bids will be received by the city of Red Cloud at the office of the Light and Water Commissioner until Sept. 5 for furnishing and installing the following apparatus: One 120-hp high-speed, automatic compound engine with extension bed plate and outboard bearing for direct connection to a 75-kw generator, one 75-kw, three-phase, 60-cycle, 2200-volt, engine type revolving field generator, one 3½-kw, 125-volt compound wound, direct-current, belted exciter, one standard generator switchboard [illegible] 24 [illegible] 48 in. blue Vermont marble with instruments, one syncroscope, one 50-amp, three-phase, 60-cycle, 2200-volt station watt meter. Alternative bids will be received as follows: No. 1—One 120-hp simple high-speed, automatic engine with extension base and outboard bearing for reception of 75-kw electric generator, one 75-kw generator, same as original proposal, one 3½ kw exciter, same as original proposal, one switchboard, same as original proposal, one syncroscope, one station meter, same as original proposal. Alternative proposals No. 2 will be received as follows: One 120-hp simple belted Corliss engine, 65 ft. 12-in. two-ply leather belting, one 75-kw, 900 r.m.p. revolving field, three-phase, 60-cycle, 2200-volt belted generator, rest of the apparatus same as original proposal. Specifications may be seen at the office of the Light and Water Commissioner. D. H. Rich is Light and Water Commissioner.

THIEF RIVER FALLS, MINN.—The proposition to issue $40,000 for the installation of an auxilliary steam plant will soon be submitted to a vote of the people. If the proposition is carried the grounds at the pumping station will be used as the site.

TOWER, MINN.—Contracts have been awarded by the City Council for the construction of the municipal electric-light plant as follows: For construction of dam and power house at Pike River Falls to the H. L. Bartlett Company, at $11,738; transmission line to Bowe & Barker, for $4,474; for turbine and head-gate hoist to Dayton Globe Iron Works, at $2,224, and to the Fort Wayne Electric Works for generators and electrical machinery, at $2,690, making a total of $21,126. Work will begin at once on the construction of the proposed plant.

KANSAS CITY, MO.—Plans and specifications prepared by the McLaughlin Engineering Company, it is reported, have been approved by the City Commissioners. The city clerk has been authorized to call for bids for the construction of the proposed plant immediately.

KIRKSVILLE, MO.—The City Council has accepted the proposition submitted by William Brannan for the construction of the power house for the proposed municipal electric-light plant, for $3,750.

LACLEDE, MO.—The city of Laclede has granted a franchise to Percy W. Markham, superintendent of the Brookfield Electric Light Company, to supply electricity in this city. A company has been organized and a transmission line will be erected at once from the plant of the Brookfield Electric Light Company in Brookfield, to Laclede, a distance of 5 miles.

CHOTEAU, MONT.—It is reported that the local electric-light plant owned by Julius Hirschberg has been purchased by H. McCullough, of Corbin. It is understood that the new owner will make improvements to the plant.

COLUMBIA FALLS, MONT.—The Columbia Falls Telephone Association, recently incorporated with a capital stock of $40,000, is reported to be contemplating the erection of telephone lines throughout Flathead County. The headquarters of the company will be located in Columbia Falls.

MISSOULA, MONT.—The Missoula Light & Power Company is reported to be contemplating the installation of a new street-lighting system, to cost about $10,000.

NEWARK, N. J.—A contract was recently signed at the office of R. Lum, Firemen's Building, Newark, between the Light Committee of Union Township and the Public Service Electric Company for the installation by the latter of a street-lighting system in Union Township, and work is to be commenced at once. The Public Service Company agrees to place 90 lamps in different parts of the township, and maintain them for one year at a rate of $20 each. An appropriation of $1,800 was made in June to cover the cost of this installation.

PATERSON, N. J.—The Public Service Corporation has submitted a proposition to the road committee of the Board of Freeholders offering to supply street lamps for the county roads at $97 each per year until such time as a contract is entered into between the Board of Freeholders and the Public Service Corporation. Under the old contract the county paid $140 per lamp per year.

TRENTON, N. J.—The Trenton Street Railway Company has filed a certificate with the Secretary of State increasing its capital stock from $1,000,000 to $2,500,000. With the exception of one share to be held to qualify each of the directors, the stock is all held by the United Power & Transportation Company.

ELEPHANT BUTTE, N. M.—The contract for machinery for the new power plant of the reclamation service, to be used in constructing the dam at Elephant Butte, has been awarded to W. E. Anderson, of El Paso, Tex.

MOGOLLON, N. M.—The Ernestine Mining Company has commenced work on its proposed new power plant.

BINGHAMTON, N. Y.—At an election held Aug. 25 the proposition to issue bonds, the proceeds to be used for removal of poles and wires from Court Square and for installation of ornamental lamps, was carried. S. W. Murray is city clerk.

FREEPORT, N. Y.—It is reported that extensive improvements are contemplated to the municipal electric-light plant, which will involve an expenditure of about $10,000.

GLOVERSVILLE, N. Y.—The Fulton County Gas & Electric Company has applied to the Public Service Commission, Second District, for permission to make reductions in the rates of electricity for lamps and motors in the cities of Johnston and Gloversville. The rates for lamps are reduced from 5 cents, 8 cents and 10 cents per kw-hour to 4 cents and 9 cents per kw-hour, depending on the amount consumed. The rates for

energy for motors under the new rates will be from 1½ cents to 9 cents per kw-hour, instead of from 2½ cents to 10 cents. The reduction is voluntary on the part of the company.

KEESEVILLE, N. Y.—The Public Service Commission, Second District, has granted the Keeseville Electric Company authority to exercise franchises for the distribution of electricity in the towns of Jay, Essex County, and Ausable, Clinton County, to erect a transmission line 15 miles in length from Ausable Chasm through these towns and also to supply electricity in the hamlet of Ausable Chasm.

LITTLE FALLS, N. Y.—The City Council has granted the Little Falls & Johnston Railway Company a franchise to construct and operate an electric railway from Little Falls to Johnstown.

NEW YORK, N. Y.—The contract for installing electric equipment in the Washington Irving High School, borough of Manhattan, bids for which were opened Aug. 21, has been awarded to the New York Construction Company, for $37,840.

NEW YORK, N.Y.—Bids will be received at the office of the Quartermaster, United States Army, Fort Jay, Governor's Island, N. Y., until Sept. 5, for furnishing at Pier 12, East River, New York, N. Y., one Thompson polyphase watt-hour meter, two current transformers, 36 ceiling bands, 24 crystal ball shades and 75½ ft. rubber matting. Captain F. H. Burton is quartermaster.

NEW YORK, N. Y.—Sealed bids will be received by Patrick A. Whitney, Commissioner of Correction, Department of Correction, 148 East Twentieth Street, borough of Manhattan, New York, N. Y., until Sept. 7 for furnishing labor and material for the installation of a three-wire, 110-220-volt lighting system in building No. 5, known as the branch workhouse, Hart's Island, N. Y., together with a service connection and panel board, etc., in building No. 4. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Department of Correction.

NEW YORK, N.Y.—Bids will be received at the office of the Mayor, Chairman of Armory Board, Hall of Records, Chambers and Centre Streets, New York, N. Y., until Sept. 6, as follows: Item 1—For furnishing labor and material for a complete additional electric-lighting system and wiring in the Twelfth Infantry Armory, located at Sixty-second Street and Columbus Avenue, borough of Manhattan. Item 2—For furnishing and installing electric-light and gas fixtures in the Twelfth Infantry Armory. Plans for items for 1 and 2 may be examined at the office of the Armory Board, Room 6, Hall of Records.

NEW YORK, N. Y.—Bids will be received by Joseph Johnson, Fire Commissioner, Headquarters of the Fire Department of the city of New York, 157 and 159 East Sixty-seventh Street, borough of Manhattan, N. Y., until Sept. 5 for furnishing materials, establishing and equipping an extension of the underground fire-alarm telegraph system on East End Avenue, from Eighty-second Street to Eighty-eighth Street. Bids will also be received at the same time and place for furnishing supplies for the fire-alarm telegraph bureau. Blank forms and further information may be obtained and plans and specifications may be obtained at the above office.

NEW YORK, N. Y.—Sealed proposals will be received by C. B. J. Snyder, Superintendent of School Buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Sept. 5, for repairs, alterations and additions to the electric equipment on Public School 30, Wadleigh High School and High School of Commerce, borough of Manhattan. Bids will be received at the same time and place for repairs, alterations and additions to the electric equipment in Public Schools 12 and 14, borough of Richmond. Plans and specifications may be obtained or seen at the above office, and also at Borough Hall, New Brighton, borough of Richmond.

NEW YORK, N Y.—Sealed bids will be received by George McAneny, president of the borough of Manhattan, City Hall, New York, N Y., until Sept. 5, for furnishing labor and material for alterations and additions to the electric light equipment at the court house building, located at 314 West Fifty-fourth Street, borough of Manhattan, as follows: Item 1—For furnishing, installing and connecting the wiring and gas fitting system, complete, including all switches, receptacles, conduits, wiring panel boards, etc., ready for fixtures to be connected. Item 2—For removing, refurnishing, altering and reinstalling old fixtures, complete as specified; also for furnishing, installing and connecting new fixtures and accessories, complete, to outlets, as specified. Item 3—For furnishing all labor and material to complete the entire contract as specified. Blank forms and specifications may be obtained at the office of the auditor, office of the Commisioner of Public Works, Room 1807, 13 to 21 Park Row, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by George McAneny, president of the borough of Manhattan, City Hall, New York, N. Y., until Sept. 5, for furnishing and installing electric light and power fixtures and wiring in the Harlem court house building, located at 121st and Sylvan Place, borough of Manhattan, as follows: Item 1—For furnishing, installing and connecting the wiring and gas-fitting system complete, including all switches, receptacles, conduits wiring, panel boards, etc., ready for fixtures to be connected. Item 2—For removing, refinishing, altering and reinstalling complete as specified; also for furnishing, installing and connecting new fixtures and accessories, complete, to outlets, as specified on plans. Item 3—For furnishing and installing all labor and material to complete the entire contract as specified on plans. Blank forms and specifications may be obtained at the office of the Auditor, office of the Commissioner of Public Works, Room 1807, 13 to 21 Park Row, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by George McAneny, president of the borough of Manhattan, City Hall, New York, N. Y., until Sept. 5, for labor and materials for alterations and additi[ons to] electric-lighting equipment at the Jefferson Market court house [build]ing, located at Sixth Avenue and Ninth Street, borough of Manhat[tan,] as follows: Item 1—For furnishing, installing and connecting th[e wir]ing and gas fitting system, complete, including all switches, recep[tacles,] conduits, wiring, panel boards, etc., ready for fixtures to be con[nected.] Item 2—For removing, refurnishing, altering and reinstalling o[ld fix]tures, complete as specified, also for furnishing, installing and co[nnect]ing new fixtures and accessories, complete, to outlets, as specif[ied on] plans. Item 3—For furnishing and installing all labor and mate[rial to] complete the entire contract. Blank forms and specifications m[ay be] obtained and plans examined at the office of the auditor, office [of the] Commissioner of Public Works, Room 1807, 13 to 21 Park Row, [New] York, N. Y.

OXFORD, N. C.—It is reported that a company has been org[anized] to erect a hydroelectric power plant on the Tar River, about 8 [miles] from Oxford.

RUTHERFORDTON, N. C.—Bonds to the amount of $35,000 [have] been sold by the city of Rutherfordton for the installation of an el[ectric-]light plant and water works. B. P. Rucker, of Charlotte, N. C[., has] charge of the engineering work.

BISMARCK, N. D.—The City Commissioners have authorized t[he in]stallation of street lamps on the principal streets in the business di[strict.]

CLEVELAND, OHIO.—A contract has been signed by Public [Serv]ice Director Lea with the Fanning Manufacturing Company, opera[ting a] large plant in Big Creek Valley, to supply electrical energy genera[ted to] the municipal electric-light plant at 1¼ cents per kw-hour. Di[rector] Lea states that the past year will show a profit of $50,000 fo[r the] municipal plant and that it can be built up from its own earnin[gs so] that it will eventually supply electricity for the entire city.

DEFIANCE, OHIO.—Work has begun on the construction of the hydroelectric plant of the Anglaize Power Company, on the An[glaize] River, 2 miles south of Defiance. The cost of the entire plant is [esti]mated at about $500,000. Plans have been completed for a second [plant] at Oakwood, about 9 miles farther up the river, and a third plant [will] be located later on. The plans contemplate the development of 17,000 hp. Orders have been placed with the Allis-Chalmers Com[pany,] of Milwaukee, Wis., for equipment of the Defiance plant.

LIMA, OHIO.—Bids will be received by George E. Whitney, sec[retary] of Commmission, until Sept. 15 for 1600-hp water tube boilers, in 2 units; six engines ranging from 135 to 265 hp; six generators ra[nging] from 75 kw to 150 kw; an eleven-panel switchboard and nece[ssary] equipment of heaters, pumps and pipe. Plans are on file at the [office] of J. G. Lorimer, superintendent of construction, at the building near Lima, Ohio, and at the office of F. L. Packard, architect, 1214 Hayden Building, Columbus, Ohio.

MIDDLEPORT, OHIO.—The village of Middleport is contempl[ating] the installation of a combined water and light plant. An option [has] already been taken on the local electric-light plant.

MOUNT VERNON, OHIO.—The contracts for furnishing material [and] installing the feed wires and yard lamps at the Ohio Sanitarium [(bids] opened Aug. 12) has been awarded to the Erner Hopkins Company [of Co]lumbus, for $10,299, with deductions for alternates of $5,320.

NELSONVILLE, OHIO.—John A. Stewart, president of the H[ock]ing Electric Power Company, has secured a site near Nelsonville, [O.,] in the Hocking Valley coal field, and plans have been completed [for] the erection of a power station and installations of a 10,000-kw p[lant.] Electricity generated at this plant will be distributed in the various t[owns] and villages in that section. The company is now operating a small [plant] in Nelsonville and has made a proposition to the Village Counci[l of] Athens to take over the municipal plant and supply electricity for li[ghts] and motors in that place at a price of 25 per cent less than the pr[esent] cost of production.

NEWARK, OHIO.—Announcement has been made that the stoc[k of] the Licking Light & Power Company, of Newark, Ohio, has been [sold] to the American Gas & Electric Company, of New York, N. Y. M[.] Gillette and others of Newark, Ohio, owned a controlling interest in [the] company. It is said that the plant and transmission system will be p[rac]tically rebuilt. H. L. Montgomery, formerly manager of the Aub[urn] Light, Heat & Power Company, of Auburn, N. Y., has been appoi[nted] manager of Licking Light & Power Company and F. C. Morrison wil[l be] assistant manager.

NORWOOD, OHIO.—The City Council is reported to have passe[d an] ordinance providing for a bond issue, the proceeds to be used to in[stall] an ornamental lighting system on Montgomery Avenue.

MULDROW, OKLA.—The installation of an electric-light plant [and] water-works system in Muldrow is reported to be under consideration.

BEND, ORE.—The Bend Water, Light & Power Company has app[lied] to the City Council for franchises to construct and operate water [and] light systems in Bend proper and in Park, North and Central a[ddi]tions. It is proposed to change the ordinance to include Lava R[.] Deschutes and probably other additions.

BURNS, ORE.—James D. Fellows, who was recently granted a twe[nty-]

[illegible] franchise, is making arrangements to install an electric-light [illegible] Burns.

[illegible]NE, ORE.—The Oregon Power Company, owned and operated [illegible] M. Byllesby & Company, of Chicago, Ill., has submitted a propo[illegible] the City Council, offering to purchase the municipal electric [illegible] n the McKenzie River and distributing system at cost price [illegible] cost and to enter into a contract to supply electricity for [illegible] city water for a term of twenty-five years at prices materially [illegible] ever offered before, also to reduce the maximum rate [illegible] for lamps from 15 cents per kw-hour to 11 cents, which will [illegible] of 9.9 cents on all bills paid within ten days. The company [illegible] to install at its own expense ornamental lamp standards for [illegible]g purposes. E. Groesback, of Portland, Ore., is president [illegible]

[illegible]S PASS, ORE.—The Golden Drift Dam Company, it is re[illegible] contemplating building a large hydroelectric plant on Rogue [illegible]

[illegible]TH FALLS, ORE.—It is reported that an electric power [illegible] installed at the new mill being erected by the Pelican [illegible]mpany. About 800 lamps will be installed.

[illegible]RD, ORE.—It is reported that the residents of Griffin Creek [illegible] erect a transmission line along Griffin Creek to supply [illegible] for lamps and motors to the county rock quarry and to [illegible] farms.

[illegible]RD, ORE.—The Siskiyou Electric Power and Light Com[illegible]reka, Cal., has purchased the property of the Rogue River [illegible]mpany, which gives the former company control of the water [illegible]f northern California and southern Oregon. The considera[illegible] to be $3,300,000. When the work now under way is com[illegible]ompany will have a total output of 80,000 hp at low water [illegible]l 800 miles of high-tension transmission lines will be erected [illegible]e energy generated at its plants. J. W. Churchill, of Yreka, [illegible] of the company.

[illegible]TH, ORE.—The Oregon Power Company is making ex[illegible]provements to its system in this section. A new transmission [illegible]en built from Cornvallis. The cost of the work is estimated [illegible]

[illegible]ND, ORE.—The Oregon-Washington Railroad & Navigation [illegible]ill soon commence construction of its private telephone line [illegible]rtland, Tacoma and Seattle, Wash., about 150 miles in length. [illegible]pel, superintendent of telegraph, is in coarge.

[illegible] ORE.—The Portland Railway, Light & Power Company is [illegible] install a system of cluster lamps in Salem.

[illegible]A, PA.—The Penn Central Light, Heat & Power Company [illegible]over a number of newly formed electric companies in Cam[illegible] those at Gallitzin, Cresson, Blacklick, Allegheny and [illegible]nships. The company is planning an extension of its trans[illegible]es into the Cambria field to supply electricity generated [illegible] plant at Warriorsmark. A trunk line has al[illegible] erected as far as Delany to supply energy to the coal [illegible]

[illegible]ON, PA.—The Hardwood Power Company has closed con[illegible] the Lehigh Valley Coal Company, Coxe Brothers, Inc., and [illegible]ng Valley Water Company to furnish electrical energy to [illegible] plants of the respective companies in the Lehigh region. [illegible]act with the coal company is for furnishing electricity at the [illegible]ollieries: Drifton, Oneida, Tomhicken, Derringer, Eckley, [illegible] Shaft, Hazle Mines, Jeanesville and Yorktown, and for the [illegible]pany to supply energy for operating the plant at Harwood [illegible] reservoirs at Dreck's Creek when completed.

[illegible]WN, PA.—The Citizens' Light, Heat & Power Company [illegible]plating extensive improvements and additions to its plant. H. [illegible]r, vice-president and general manager, has resigned the duties [illegible] with the latter position, but will continue as vice-president. [illegible]risey, formerly connected with the Detroit Edison Company, has [illegible]en appointed general manager.

L[illegible]ETTO, PA.—It is reported that negotiations are pending between the [illegible]rough Council and the Franciscan Fathers of St. Francis College [illegible] of securing electricity for lighting the streets and residences [illegible]ough.

[illegible]ELPHIA, PA.—The Philadelphia Rapid Transit Company has [illegible] a charter for the Snyder Avenue Railway Company to build [illegible]ack electric railway on Snyder Avenue from Delaware Avenue to T[illegible]rty-sixth Street in South Philadelphia, Pa. The incorporators are: [illegible] president of the Rapid Transit Company; Alexander Renik, James J. Springer, George W. Mantz and W. L. Maize.

[illegible]ERLY, PA.—The installation of an electric-light plant in [illegible] to cost about $10,000, is reported to be under consideration.

[illegible]SMOUTH, R. I.—The power plant at the Reginald C. Vander[illegible] [illegible]

ARLINGTON, S. D.—Plans are being considered by W. C. Allen and Adam Royin for the installation of an electric-light plant in Arlington.

SIOUX FALLS, S. D.—The power plants of the Sioux Falls Light & Power Company and the Bennett Light & Power Company, recently purchased by H. M. Byllesby & Company, of Chicago, Ill., have been consolidated. Announcement has been made that the new owners will make extensive improvements and extensions to the property, involving an expenditure of about $225,000.

WATERTOWN, S. D.—The City Council has granted Ferris Brothers, owners of the local electric-light and power plant, a twenty-year franchise to construct and operate a street railway with a line to Lake Kampeskia. Work will begin at once on the extension to the lake.

WHITE LAKE, S. D.—The City Council has granted the White Lake Light & Power Company a franchise to construct and operate an electric-light plant in White Lake. It is understood that work on the proposed plant will begin in the near future.

BONHAM, TEX.—The Bonham Gas & Electric Company has awarded the contract for a power house, to be erected on East Second Street. The present power house of the company is located at the terminus of the electric street-car line in Russell Heights, but is to be moved inside of the city limits. New machinery will be installed.

BRISTOL, TENN.—The city of Bristol is considering the question of establishing a municipal electric-light plant. In order to issue bonds it will be necessary to secure authority from the State Legislature.

BRISTOL, TENN.—The Watauga Power Company has nearly completed its hydroelectric plant on the Watauga River and is erecting transmission lines to the nearby cities. The company has contracted for the sale of a large part of the output of the plant to the Bristol Gas & Electric Company.

GALLATIN, TENN.—Contracts have been awarded by the Board of Mayor and Aldermen for machinery and equipment for the combined electric-light plant and pumping station as follows: To the Allen Engineering Company, of Memphis, Tenn., for one Chuse automatic non-releasing Corliss valve engine and two centrifugal pumps, and to the Crocker-Wheeler Company, of Ampere, N. J., for generators and switchboards, etc. The cost of the equipment is estimated at $8,075.

CHATTANOOGA, TENN.—The Georgia Power Company, it is said, has decided to extend its transmission lines to Chattanooga to supply electricity for power purposes. The company will soon apply to the City Council for a franchise. The company will also supply electricity to small towns along its lines.

LEXINGTON, TENN.—The installation of an electric-light plant and water-works system in Lexington is under consideration.

AMARILLO, TEX.—The City Council has granted a severance of the franchise of the Amarillo Water, Light & Power Company, in consideration for which the company has reduced the price of electricity for lamps 25 per cent and increased the supply of water 33 1-3 per cent at the old rate. It is understood that the capital stock of the company will be increased and a larger plant erected.

BRYAN, TEX.—At an election held on Aug. 21 the proposition to issue $20,000 in bonds for the completion of the municipal water, light and sewer systems was carried.

GARRISON, TEX.—R. T. Patterson is installing an electric-light plant in Garrison.

HOUSTON, TEX.—The Tel-Electric Company, of Houston, has amended its charter, increasing the capital stock from $50,000 to $100,000.

TEXARKANA, TEX.—The Texarkana Gas & Electric Company recently filed an amendment to its charter with the Secretary of State increasing its capital stock from $200,000 to $600,000.

WACO, TEX.—The proposition submitted to the City Commissioners by the Waco Gas & Electric Company to furnish street lamps at $72 per lamp per year has been rejected. The city pays $98 per year per lamp under the present contract, which has three years to run.

WEATHERFORD, TEX.—Plans are being considered for removing the power house of the Weatherford Water, Light & Ice Company from its present site to another part of the town. The present plant is located in the thickly settled portion of the city. The citizens propose to assist the company in making the proposed change.

BRIGHAM CITY, UTAH.—The Town Board of the newly incorporated town of Honeyville has decided to call an election to vote on the proposition to issue bonds to the amount of $12,000, the proceeds to be used for the installation of an electric-light system and water works. It is proposed to install a distributing system and purchase electrical energy from some power company.

DANVILLE, VA.—The Scofield Engineering Company, consulting engineer, Philadelphia, Pa., has been engaged to prepare plans and specifications and supervise the construction of the new electric-light plant to be built by the city of Danville. Frank Talbott is purchasing agent and treasurer of the Water & Light Departments.

HAMPTON, VA.—The City Council has awarded the contract for street lighting to the Newport News & Old Point Railway & Electric Company for a period of five years, under the terms of which the company is to furnish arc lamps at $75 each per year with all-night service; tungsten cluster lamps, with all-night service, at $45 each per year, and midnight service at $35 each per year, and also 60-cp tungsten lamps at $20 per lamp per year.

RICHMOND, VA.—It is reported that the Virginia Railway & Power Company is negotiating with the American Railways Company, of Philadelphia, Pa., for the purchase of the Roanoke and Lynchburg traction properties.

BELLINGHAM, WASH.—Preparations are being made by the Balfour-Guthrie Cement Company for the erection of a large cement plant

in the northern part of the city. It is understood that the plant will be equipped for electrical operation throughout.

CENTERVILLE, WASH.—It is reported that the Pacific Light & Power Company is planning to supply electricity in Centerville for lamps and motors and also to supply electrical service to the farmers in this district from its plant located on the Little Klickitat River.

HUSUM, WASH.—T. M. Cole is planning to erect a power plant on Rattlesnake Creek, to supply power for pumping and irrigation work.

LYLE, WASH.—The Northwestern Electric Company, of Portland, Ore., has commenced work on the construction of its large dam on the Klickitat River. An 8000-kw hydroelectric plant is to be erected. Newell, Grossett & Walsh, of Portland, Ore., are engineers.

OLYMPIA, WASH.—The State Board of Control will receive bids until Sept. 15 for electrical equipment for the Northern Hospital for Insane at Sedro-Woolley. Plans and specifications are on file at the office of Saunders & Lawton, architects, Seattle, Wash.

SPOKANE, WASH.—The Inland Empire Paper Company, operating at Millwood, is contemplating the erection of a large power plant. The cost of the plant is estimated at $400,000.

STEVENSON, WASH.—The organization of a new company, to be known as the Cleom Tumwater Light & Power Company, for the purpose of building a power plant on the Wind River, about 18 miles north of Stevenson, is under consideration. It is estimated that about 6000 hp can be developed. E. P. Ash and S. Samson are interested in the project.

SUMAS, WASH.—A municipal electric-lighting system is to be installed in this city, the cost of which is estimated at $7,000.

SUMAS, WASH.—It is reported that the Stone & Webster Management Association has contracted with the Western Canadian Power Company, of Vancouver, B. C., Can., for 6500 hp generated at the Stave River Canyon plant. The Stone & Webster Company, it is said, will erect a transmission line to Sumas, where the energy will be delivered by the Canadian company.

TACOMA, WASH.—The Park Board has awarded a contract for the installation of a conduit lighting system, with ornamental lamp standards, in Wrights Park to Evans & Dickson, to cost about $4,000.

TACOMA, WASH.—A conduit arc-lighting system, consisting of forty-two lamps, will be installed in the Stadium. Estimated cost of work, $2,800, plans for which have been prepared by Frederick Heath, architect.

TACOMA, WASH.—The main lines of the municipal electric-light system will have to be rebuilt before electricity generated at the Nisqually municipal power plant can be utilized. The cost of the work is estimated at about $100,000, funds for which will be obtained from the earnings of the light plants. It is expected to have the Nisqually plant ready to put in operation by July, 1912.

VANCOUVER, WASH.—Application has been made to the Council by Lawrence Harmon for a franchise to install a telephone and telegraph system and also for the construction of a street-car system in Vancouver.

MINOCQUA, WIS.—The contract for installing the new lighting system in Minocqua has been awarded to the Central Construction Company, of Oshkosh, Wis. The cost of the system is estimated at about $7,500.

MUSCODA, WIS.—It is reported that extensions and improvements are contemplated to the municipal electric-light plant, for which bonds to the amount of $5,000 have been voted.

VANCOUVER, B. C., CAN.—Another company, it is said, will soon apply for a franchise to extend its high-tension transmission lines through Vancouver. The company is now securing franchises in the smaller towns in Clark County. It is proposed to utilize the water-power of the east fork of Wind River, where it is estimated that about 5000 hp can be generated. The company is planning to supply electricity to any point along the route to Vancouver from Washougal.

SELKIRK, MAN., CAN.—The Town Council has entered into a contract with the Winnipeg, Selkirk & Lake Winnipeg Railway Company, operated by the Winnipeg Electric Railway Company, to supply electrical energy to the amount of 100 hp at $30 per hp per year. The town will erect its own distributing system. It is proposed to supply electricity for lamps at rates now prevailing in the city of Winnipeg.

WINNIPEG, MAN., CAN.—Bids will be received until Sept. 11 by M. Peterson, secretary of Board of Control, for furnishing and delivering f.o.b. Winnipeg, Man., the following supplies: Section A—Mercury-arc transformers and rectifiers. Section B— Magnetite or metallic flame-arc lamps. Section C—Electrodes. Section D—Inner and outer globes. Specifications, etc., may be secured at the office of the general manager of the City Light and Power Department, 449 Main Street, Winnipeg, Man.

WINNIPEG, MAN., CAN.—Announcement has been made by the Winnipeg Electric Railway Company of a reduction in the rates of electricity for lamps as follows: Beginning Sept. 19 the rate will be 7½ cents per kw-hour, with a discount of 10 per cent on all bills amounting to $10; 15 per cent discount on all bills over $10 and up to $15; 20 per cent on all bills over $15 and up to $20. On bills over $20 larger discounts will be given. Wilfred Phillips is general manager of the company.

PORT STANLEY, ONT., CAN.—Plans are being considered by the city to install a hydroelectric light and power plant, the cost whic is estimated at about $12,750.

SARNIA, ONT., CAN.—The Town Council has adopted by-law authorizing the purchase of the property of the Sarnia Gas & lectric Company at $125,000. It is not expected that the company wi accept this price, but the amount will form the basis of arbitration pro edings to determine the value of the plant, after which another by-law ill be submitted to the ratepayers.

TORONTO, ONT., CAN.—Plans are being made by the city f Toronto to call for tenders for construction of double-track subw , approximately 3 miles in length, on or about Sept. 15. G. R. (is Mayor.

PACHUCA, HIDALGO, MEXICO.—Electricity is playing an i part in the construction of a mining tunnel known as the Nepton which when finished will be a little over six miles long. It constructed by Gabriel Mancera, an engineer, of Mexico City. installed near the mouth of the tunnel an electric power plant t energy for drilling and which also provides electricity for the system and for operating ventilating fans. This tunnel will the underground mineral region at a depth of about 1400 ft. be the surface of the city of Puebla. It was started eighteen years there has been finished up to this time about two miles of th Its special object is to drain the whole Pachuca mining district afford an outlet for the ores of the different mines with which connect. An electric-tramway system will be installed in the when the work has made a little further progress.

New Industrial Companies.

THE ANGELUS ELECTRIC CREMATORY COMPANY, Angeles, Cal., has been granted a charter with a capital stock of $ The incorporators are: J. L. Brown, J. E. Youtz, H. Schroede Parker and C. C. Pierce.

THE ATLANTIC PERFECTED MOTOR COMPANY, of City, N. J., has been incorporated by Frank Brown, Thomas K Samuel S. Phoebus and John S. Ingram, all of Atlantic City, N. company is capitalized at $20,000 and proposes to manufacture engines, etc.

THE BUYER ELECTRICAL & SUPPLY COMPANY, of New N. Y., has been incorporated by Maurice Hogler, Richard Buyer Goldin and Fred Kuehne. The company is capitalized at $5,0 proposes to do general electrical work.

THE COMER MANUFACTURING COMPANY, of boro Queens, N. Y., has been incorporated by John J. Comer, of Spr Road, borough of Queens, N. Y.; Edward C. Baxter, of Smi N. Y., and Albert F. Donnelly, of Springfield Road, borough of N. Y. The company is capitalized at 10,000 and proposes to manu gas fixtures, gas and electric chandeliers.

THE DAVIES ELECTRIC COMPANY, of Albany, N. Y., ha chartered with a capital stock of $5,000 to do a general electric mechanical engineering business. The directors are: William P. William T. Poole and Richard E. Ellis, of Albany, N. Y.

THE IDEAL ELECTRIC INSPECTION & MAINTENANCE PANY, of New York, N. Y., has been incorporated by W. E. M of Brooklyn, N. Y.; S. L. Moxham and F. Lask, of New York company is capitalized at $25,000, and proposes to deal in el supplies and do an electrical contracting business.

THE CHARLES A. JACKSON COMPANY, of Boston, Mas been incorporated with a capital stock of $25,000 for the purp manufacturing electrical fixtures. The directors are: Edith L. son, president; Charles A. Jackson, 55 Stanhope Street, Boston, treasurer, and Harry A. Patterson.

THE GEORGE W. JACKSON ENGINEERING COMPAN Yonkers, N. Y., has been incorporated by Harold R. Griffith, 17 Eighth Street; J. C. Connell, 99 East Eighty-first Street, both o York, N. Y., and Francis L. Madden, of Ossining, N. Y. The pany is capitalized at $300,000 and proposes to do a general mecl engineering business.

THE McDONALD GIBSON COMPANY, of borough of Bronx York, N. Y., has been incorporated with a capital stock of $25, manufacture patent mechanical and electrical devices, etc. The porators are: J. C. McDonald, W. Gibson and D. M. Macdonald, New York, N. Y.

THE NATIONAL UTILITY COMPANY, of New York, N. Y been granted a charter with a capital stock of $5,000 to manu electrical goods. The incorporators are: John T. Booth, John Dill Jeppener and Louis V. Hulse.

THE SALEM BATTERY COMPANY, of New York, N. Y., ha articles of incorporation with a capital stock of $10,000 to manuf electric batteries. The incorporators are: J. Hibberd Taylor, Jo Clement, Samuel D. Heed and Edward D. Palmer.

THE SHEDD ELECTRIC COMPANY, of Elizabeth, N. J., has granted a charter with a capital stock of $50,000. The company poses to manufacture electric fans, vacuum cleaners, etc. The porators are: H. M. Shedd, M. F. Moore, C. W. MacQuoid, of R and N. R. Leavitt, of Elizabeth, N. J.

New Incorporations.

[illegible], CAL.—The Oakland Railways [illegible] $27,000,000 by [illegible], of San Francisco. [illegible]

[illegible] FRANCISCO, CAL.—The [illegible] Gas & Electric Company [illegible] incorporation with [illegible] $100,000. The [illegible] Burks and [illegible]

[illegible], MICH.—The Consolidated [illegible] & Power Company [illegible] purpose of [illegible] River. The company [illegible] two dams [illegible] River [illegible] contemplates the [illegible] seven more. [illegible] probably be supplied [illegible] and Mount [illegible] The officers of the company are [illegible] Hudson, president, [illegible], vice-president and general manager; [illegible] R. Ross, treasurer.

[illegible] MINN.—The [illegible] Electric Railway Company [illegible] incorporated to construct an electric railway, 35 miles in length, to con[illegible] Preliminary arrangements are being made and contracts will soon [illegible]ed for construction of the railway. Application for franchises will [illegible] Mitchell is president [illegible]

[illegible] Articles of incorporation have been filed [illegible] Company by Gilmore Kenney, [illegible] M. Kenney, [illegible] Flint.

Personal.

[illegible]RENCE N. B. BULLOCK, metallurgical engineer, is now [illegible] Mexico Mine & Smelter Supply Company, with headquarters at [illegible]

[illegible] B. FIELDS has been appointed purchasing agent of [illegible] Queens Electric Light & Power Company, succeeding [illegible] Hill.

[illegible] P. CONNOR, solicitor of patents, who makes a specialty [illegible]al patent work, has moved his offices from the Ouray Building [illegible]rroll Street, S. E., Washington, D. C.

[illegible]DNEY RICHARD INCH, secretary-treasurer and manager of [illegible] Light & Water Company, is visiting his home [illegible] England, after an absence of ten years.

[illegible] B. TRIPP has resigned as general manager of the [illegible] Springs Electric Company in order to go to Harrisburg, Pa., [illegible] charge there of the George Bullock interests.

[illegible] D. SMITH, formerly with the Commercial Electrical Company, [illegible]uis, Mo., is now with the electrical department of the Mexico [illegible] Smelter Supply Company, located at Mexico City.

[illegible] WILLIAM H. ARMSTRONG, for many years mill superintendent for the Dos Estrellas Mining Company at El Oro, Mexico, has joined the [illegible] of the Mexico Mine & Smelter Supply Company at Mexico [illegible]

[illegible] A. E. KENNELLY sailed Aug. 26 on the *St. Paul* in order to attend the meeting, at Turin, Italy, of the International Electrotechnical Commission, which will be held in connection with the Turin International Electrical Congress.

[illegible]R. H. J. BUELL, formerly of the commercial department of the [illegible] Colorado Power Company, has been made contract agent for [illegible]dad Electric Transmission Railway & Gas Company, with headquarters at Trinidad, Col.

[illegible]R. E. D. STRICKLAND, assistant to Jupiter (business manager), of the Order of Rejuvenated Sons of Jove, has moved his office, which [illegible] business headquarters of the order, from Chicago to 1412 Syndicate Trust Building, St. Louis, Mo.

[illegible]R. D. B. BUTLER, formerly manager of the Albuquerque Gas & Electric Company, has been appointed manager of the Trinidad Electric Transmission Railway & Gas Company, owned by the same holding company—the Federal Light & Traction Company.

[illegible]R. THOMAS A. EDISON, who is spending a vacation touring in Europe, narrowly escaped serious injury on Aug. 29 when his automobile [illegible] overturned near Geneva. The car was much damaged, but fortu[illegible] Mr. Edison was not in the least injured.

[illegible]R. J. P. JOLLYMAN, formerly connected with the California Gas & Electric Corporation, and electrical engineer for the Great Western Power Company since early in 1910, has been appointed electrical engineer for the Pacific Gas & Electric Company with headquarters at San Francisco.

[illegible]R. W. F. SLOAN and Mr. W. J. Hubble have organized to carry on their advisory and consulting practice under the firm name of Sloan, Hubble & Company, with offices in Madison, Wis. The firm will do a general engineering practice and give especial attention to appraisals, rate-making, engineering examinations and statistical investigations.

[illegible]R. C. A. CUMMINGS, formerly connected with the Commonwealth Edison Company, of Chicago, and later with the Federal Sign System, Electric, has accepted a position in the Chicago office of the [illegible] Electric Company.

[illegible] has resigned his position as general manager of the Winona (Minn.) Railway and Light Company. He has had an exceptional record in building up motor load for central-station companies, not only at Winona, but previously at New Bremen, Ohio, and Hastings, Mich.

MR. ROBERT SIBLEY, formerly consulting hydraulic and electric engineer, of Missoula, Mont., has been appointed associate professor of mechanical engineering at the University of California. He will continue to occupy his present position of editor of the *Journal of Electricity, Power and Gas.*

MR. H. T. PLUMB has not resigned as associate professor of electrical engineering at Purdue University, as stated in these columns in the issue of Aug. 5, but has a leave of absence of two years, which is being occupied in work as an engineer in the Denver district office of the General Electric Company.

PROF. F. W. SPRINGER, of the department of electrical engineering of the University of Minnesota, returned on Aug. 28 from a visit to Germany and France which began on June 11, 1910. Prof. Springer spent his sabbatical year investigating the teaching methods and shop-testing practices in the two countries mentioned.

MR. J. J. CAGNEY, until recently general manager of the Central Georgia Power Company, is now general manager of the Wawaitin Falls power development on the Matagami River, Golden City, Ontario, now under construction, which will supply motor and lighting service to all of the principal towns in the Porcupine district.

MR. S. Z. DE FERRANTI, president of the British Institution of Electrical Engineers, will be in Chicago on private business about the middle of September, and will probably join the party consisting of Messrs. Charles H. Merz, Arthur Wright, H. A. Couves and Mr. Raven, all English visitors, in inspecting various Eastern electrical plants and installations.

MR. J. FRANK DOSTAL has resigned as superintendent of the electrical department of the Denver Gas & Electric Company to become general manager of the Colorado Springs Electric Company. Mr. Dostal started ten years ago as a youth at the bottom of the ladder with the Denver Company, which he has served as engineer, chief engineer and, for the past several years, as electrical superintendent. As national "Jupiter," Mr. Dostal will preside over the approaching meeting at Denver of the Sons of Jove.

MR. ALBERT SCHEIBLE has been appointed secretary of arrangements by the convention committee having in charge the preparations for the annual convention of the Illuminating Engineering Society, to be held at the Congress Hotel, Chicago, on September 25 to 28, inclusive. Mr. Scheible is an ex-chairman of the Chicago section of the society and well fitted to take active charge of the convention arrangements under the direction of the convention committee, of which Mr. John F. Gilchrist, 120 West Adams Street, Chicago, is chairman.

PROF. J. D. HOFFMAN, formerly in charge of mechanical design instruction at Purdue University, on Sept. 1 took up his new duties as head of the mechanical-engineering school of the University of Nebraska, at Lincoln, where he succeeds Prof. Charles Russ Richards, who has been appointed assistant dean of engineering at the University of Illinois. Professor Hoffman, like Professor Richards, was graduated from Purdue in 1890, and has been a member of the faculty of his alma mater ever since. He has devoted special attention to heating, ventilating and refrigerating subjects, on which he has prepared several standard text-books, and is a past-president of the Society of Heating and Ventilating Engineers.

MR. EMIL G. SCHMIDT has been elected president of the County Traction Company, of Chicago, which operates electric surface railways in outlying portions of Cook County adjoining Chicago. Mr. Schmidt, who until a year ago was operating vice-president of the Union Railway, Gas & Electric Company, of Springfield, Ill., is well known to electrical men. That company operated various public-utility properties in Springfield, Peoria and Rockford, Ill., and Evansville, Ind. Mr. Schmidt has been in the public service field since 1887, being for some time connected with the central-station and electric railway interests of Sandusky, Ohio. He is known as an organizer and a builder up of systems, and as such will no doubt weld the somewhat detached lines of the County Traction Company into one complete system.

MR. H. B. BROOKS, of the electrical division of the Bureau of Standards, has been temporarily transferred to the Bureau of Manufactures of the Department of Commerce and Labor, to investigate trade conditions abroad with respect to electrical industries, especially measuring instruments and meters and the materials entering into their construction. He sailed Aug. 22 for Germany, and will spend a number of months in visiting the electrical instrument makers and laboratories of England, Germany, France and other countries. He will act as a delegate to the International Electrotechnical Congress at Turin, Italy, on behalf of the National Bureau of Standards and the American Institute of Electrical Engineers. Suggestions in regard to his work will be welcome, and may be addressed to him "care Bureau of Manufactures, Washington, D. C."

GANO DUNN.—Owing to an office blunder, a personal note relating to Mr. Gano Dunn appeared only in part of our issue of last week, having been omitted from the first copies printed. The note is [illegible]

[illegible] reported Mr. Gano Dunn, who for some years has been first vice-president, chief engineer and a director of the Crocker-Wheeler Company, has resigned from that company in order to accept an important engineering and executive position. Mr. Dunn will sail shortly for Europe to attend, as president of the American Institute of Electrical Engineers, the meeting during the Turin Exposition of the International Electrotechnical Commission, to be held on Sept. 7, 8 and 9, and also the following meeting of the International Electrical Congress, Sept. 10 to 17.

Mr. Dunn sailed on the *St. Paul* on Saturday, Aug. 26, and will return home about Oct. 11.

MR. CHARLES H. MERZ of Merz & McClellan, London and Newcastle, England, consulting engineers, and Mr. Arthur Wright, of London, well known as the originator of the Wright demand system of charging for central stations, arrived in New York on Saturday, Aug. 26, on the *Kaiserin Auguste Victoria.* They were met at the dock by Mr. Samuel Insull, president of the Commonwealth Edison Company, Chicago, and Mr. John W. Lieb, Jr., vice-president of the New York Edison Company. Messrs. Merz and Wright are on a visit to this country partly for pleasure and partly to examine electrical plants and methods in the United States. Escorted by Mr. Insull they left for Chicago on Saturday afternoon, and on Sunday they were entertained by Mr. Insull at his country place at Libertyville, Ill. On Monday the visitors were guests at a staff luncheon of the Commonwealth Edison Company, meeting also Mr. H. M. Byllesby, Mr. O. E. Osthoff and Mr. Frederick Sargent, of Chicago, who were fellow guests. Afterward they visited some of the Commonwealth Edison plants, and in the evening they left for the Pacific Coast. Returning East about the middle of September, Messrs. Merz and Wright will meet in Chicago Mr. H. A. Couves, of Newcastle, one of Mr. Merz's assistants, and also Mr. Raven, chief engineer of the North Eastern Railway of England, and they will thereafter attend the Edison convention at Spring Lake, N. J., leaving for home probably about the last of September.

Obituary.

MR. J. B. HUBBARD, Pittsburgh manager for the Adams-Bagnall Electric Company, died in Niagara Falls, N. Y., on Aug. 16. Mr. Hubbard was making a business trip when he was taken ill with typhoid fever, and he died in a hospital. He had been with the Adams-Bagnall Company for about three years. Previously he was employed by the Doubleday-Hill Electric Company in Pittsburgh.

MR. SAMUEL A. RALL, formerly manager of the city sales department of the Electrical Appliance Company, of Chicago, and well known to Western electrical men, died about Aug. 1. Mr. Rall had not been engaged in electrical pursuits for several years, having established a contracting business at his home in La Grange, Ill. He was ill for some time before his death. Mr. Rall became a member of the Sons of Jove in 1906.

MR. MERTON H. BENTLEY, after an illness which extended through many months, died at his home in Chicago, Aug. 8. Mr. Bentley was born in Chicago thirty-nine years ago and spent the greater part of his life there. His interest in electricity was awakened when a mere child and at an early age he began stretching telephone and telegraph lines between his home and that of neighbors and boy friends. After learning telegraphy in this way and by association with night operators, near his home, he took charge of the railroad telegraph office at Kent, Ill., at the age of fifteen, and had the distinction of being the youngest telegraph operator and agent on record at that time. He then took up electricity as applied to transportation and at the age of nineteen had entire charge of the electrical equipment of the Cicero & Proviso street railway system, of Chicago. With a good knowledge of electricity from a practical standpoint, he received a technical course at the Rose Polytechnic Institute. He then entered the telephone field with the Chicago Telephone Company, holding various positions in all branches of the work. He was prominently identified with the engineering staff, having direct charge of all power work pertaining to the new exchanges, and later occupied the position of assistant to Mr. A. V. Abbott, who was then chief engineer of that company. About 1900 he entered the Independent field as superintendent of the New Telephone Company, at Indianapolis, Ind., now known as the Indianapolis Telephone Company. He then became interested in the manufacturing of telephone equipment and, after spending four months abroad in travel and investigation of the telephone equipment in the principal cities of Europe, he became identified with the telephone engineering department of the Western Electric Company, at Chicago. In 1908 he returned to the Chicago Telephone Company. For twenty years Mr. Bentley was a member of the American Institute of Electrical Engineers and a close student of all subjects pertaining to electricity in its various applications. His pastime was amateur photography, his first attempts along this line being made at the age of twelve. He had about 800 stereopticon slides which he had made himself from his own negatives taken on his many trips through this country and abroad. With a good stereopticon lantern he gave many private entertainments for his friends. He was a member of the Chicago Camera Club. The funeral services were held at his late residence, 155 North Scoville Avenue, Oak Park, Aug. 10, followed later by cremation at Graceland Cemetery and interment later at Forest Home in the family lot.

Trade Publications.

MOTORS AND DYNAMOS.—The Star Dynamo Company, J[illegible] City, Mo., has bound in convenient form two bulletins and a price-l[illegible] one devoted to its direct-connected motors and generators and the o[illegible] to its induction motors. The direct-current motors are built in sizes ran[illegible]ing from ¼ to 25 hp and the generators in sizes from ½ to 20 kw. T[illegible] induction motors are built for two- and three-phase work, in sizes r[illegible]ging from ½ to 20 hp. The various parts of the machines are illustrat[illegible] and described.

TRANSFORMER OIL DRYER AND PURIFIER.—Bulletin No. 37[illegible] just issued by the General Electric Company, describes an outfit f[illegible] the purification of transformer oil of all kinds, crude petroleum for o[illegible] furnaces, insulating varnish and japan, benzine used for cleaning pu[illegible] transformer oil used for impregnating insulating pressboard and [illegible] cylinder oil used in certain types of electrical apparatus, and visco[illegible] insulating compounds. The apparatus consists of a filter press, a [illegible] and a motor for driving. All are mounted on standard steel I-[illegible] which form skids and greatly facilitate handling. The outfit m[illegible] be mounted on iron wheels if desired.

BUSINESS NOTES.

GROUNDING RODS.—The Duplex Metals Company, Chester, Pa[illegible] nounces that it makes copper-clad rods for grounding purposes.

SAN FRANCISCO CROCKER-WHEELER OFFICE.—The C[illegible] Wheeler Company, opened on Sept. 1, offices in San Francisco, Ca[illegible] located at Room 400, First National Bank Building. Motors, gene[illegible] and transformers of various sizes will be carried in stock in San [illegible]cisco for immediate coast shipments. Mr. John S. Baker, well k[illegible] among the electrical trade on the Pacific Coast, has been plac[illegible] charge.

WESTERN ELECTRIC COMPANY'S RICHMOND BRANCH.-[illegible] Western Electric Company announces the establishment of a b[illegible] office at Richmond, Va., where a complete stock of telephone appa[illegible] and general electrical supplies will be carried. Mr. H. W. Hall, for[illegible] manager of the Denver office of the company, will be in charge o[illegible] Richmond office and with him will be associated specialists on the va[illegible] lines handled.

THE EMIL GROSSMAN COMPANY has removed its "Red [illegible] spark plug factory to Detroit, Mich., where its new plant, consi[illegible] of three floors, is located at 844 Woodward Avenue. The local dis[illegible] room has been removed from 874 Woodward Avenue to the [illegible] location. The plant is equipped with a battery of machines designe[illegible] the Emil Grossman Company's engineers especially for the productio[illegible] an augmented line of spark plugs.

TAYLOR STOKERS.—The American Ship Windlass Company [illegible] recently received repeat orders for Taylor stokers from the General [illegible]tric Company of Pittsfield, Mass., making the fourth order for sto[illegible] from the New York, New Haven & Hartford Railroad Company, fo[illegible] new plant at Waterbury, Conn., making two orders for this plant, from the Northern Ohio Traction and Lighting Company, Akron, [illegible] and the Solvay Process Company, Syracuse, N. Y.

NEW BRANCH OFFICES OF BRILLIANT LAMP COMPA[illegible] —The Brilliant Electric Company, Cleveland, Ohio, has opened at [illegible] New Montgomery Street, San Francisco, Cal., a branch office w[illegible] will be in charge of Mr. E. D. Hand, the company's Pacific represe[illegible]tive. A "Brilliant" branch office has also been opened in Los Ang[illegible] Cal., and will be under the management of Mr. Clarence W. Cole, [illegible] until recently represented the company in Cleveland and vicinity.

INSULATING MATERIAL.—A letter has been received from Isolatoren-Werke, Munich, Bavaria, in relation to the use in this cou[illegible] of the name "Gummon" as applied to an insulating material, and [illegible]ferring to an article entitled "New Molded Insulator" which appe[illegible] in the issue of April 6. The communication states that the mat[illegible] thus originally designated was invented and patented by Robert Mu[illegible] formerly employed by the Munich firm, but that the inventor of [illegible] insulating material now known abroad by the trade name "Gumm[illegible] is a director of the firm, Herr Ernest Eppner, Dipl. Engin[illegible] of Grafelfing. Manufacture under the inventions of the latter, w[illegible] are not patented, is carried on by a secret process for which, the le[illegible] states, the rights for the United States, Mexico and Canada are [illegible] exclusively by the Dickinson Manufacturing Company, Springfield, M[illegible]

BUCKEYE SUMMER CONVENTION.—Thirty-one members of [illegible] Buckeye Electric Company's sales force held their annual sales [illegible]ference at Association Island during the week of August 14. Accompa[illegible]ing the party were the wives of six of the men and a number of gu[illegible] closely associated with the Buckeye organization. The conference [illegible] most successful, both the business meetings and the social features be[illegible] enthusiastically attended. Addresses were made by Messrs. F. S. Te[illegible] Ward, Harris, Henneger and Edwards of the engineering department [illegible] the National Electric Lamp Association, and by Mr. C. Walter Jo[illegible] sales manager of the Holophane Company. A fishing excursion, a sh[illegible] dinner, a dance and a "show" composed the amusement features of [illegible] week. In summing up the last year's business and outlining fut[illegible] policies, Mr. L. P. Sawyer, general manager of the company, expres[illegible] complete confidence in the business outlook and mapped out a program [illegible] aggressive development of the coming season.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

[illegible] LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, [illegible] Royal St., Mobile, Ala. Annual convention in November, 1911.

[illegible] ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting at [illegible] Canada, September 21-23, 1911.

[illegible] ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Next meeting at Philadelphia, [illegible] 5, 6 and 7, 1911.

[illegible] INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets [illegible] of every month.

[illegible] INSTITUTE OF ELECTRICAL ENGINEERS. Honorary secretary, Ralph W. Pope; acting secretary, F. L. Hutchinson. Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday [illegible], excepting June, July, August and September.

[illegible] ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, [illegible] Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., [illegible] 13, 1911.

[illegible] ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, [illegible] Litchfield, Interborough Rapid Transit Company, New York. [illegible] onvention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

[illegible]SAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. [illegible], Little Rock, Ark.

[illegible] OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, [illegible]rington, Steubenville, Ohio.

[illegible] OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. [illegible], 135 Adams St., Chicago.

[illegible]ATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreu-[illegible] [illegible]ago & Northwestern Railway, Chicago. Next annual meeting [illegible] Salle, Chicago), November 6 to 10, 1911.

[illegible]ATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. [illegible], Mass. Next convention, Spring Lake, N. J., Sept. 19-21, [illegible]

[illegible]DO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, [illegible] Hagerman Building, Colorado Springs, Col. Annual [illegible]n, Glenwood Springs, Col., Sept. 13-15, 1911.

[illegible]IC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Rob-[illegible] 24 West 42d St., New York. Meetings, fourth Tuesday of each [illegible]

[illegible] CLUB CHICAGO. Secretary, N. I. [illegible], 1500 American [illegible]dg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Cr[illegible], 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. St[illegible]ley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. [illegible] Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, [illegible]

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

[illegible]RICAL TRADES SOCIETY OF NEW YORK (Member National Electrical [illegible] Association). Secretary, Franz Neilson, 80 Wall St., New York. [illegible]f Directors meets second Thursday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

[illegible]RIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. [illegible] West Palm Beach, Fla.

[illegible]S STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, [illegible] Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Sept. 25-27, 1911, Chicago, Ill.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 41 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next convention at Young's Hotel, Atlantic City, N. J., Sept. 12-15, 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. 21 and 22, 1911.

LOUISIANA ELECTRICAL ASSOCIATION. Secretary, W. H. Bower Spangenberg, 627 Poydras St., New Orleans, La. Meets third Monday of each month.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskil, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., second week in June, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga. Next annual meeting at Columbus, Ga., Sept. 26 and 27, 1911.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Next annual meeting at Mt. Washington, Bretton Woods, N. H., Sept. 17-29, 1911.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa. Next annual meeting at Exposition Park, Conneaut Lake, Crawford Co., Pa., Sept. 5-8, 1911.

NATIONAL ELECTRIC INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Joseph B Ware, Grand Rapids, Mich.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct., 16-18, 1911.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore,

39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

Southwestern Electrical & Gas Association. Secretary, D. G. Fisher, [illegible] Commerce St., Dallas, Tex.

Street Railway Association of the State of New York. Secretary, C. G. Reel, Kingston, N. Y.

Vermont Electrical Association. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, [illegible] Monroe St., Chicago, Ill.

Western Society of Engineers. Electrical Section, formerly C[…] Electrical Association. Secretary, J. H. Warder, 1737 Mon[…] Block, Chicago. Regular meetings, first Friday of each month, e[…] January, July and August. Annual meeting, first Tuesday after J[…] each year.

Wireless Institute. Secretary, Alfred N. Goldsmith, College o[…] City of New York, New York.

Wisconsin Electrical Association. Secretary, George A[…] Stephenson Building, Milwaukee, Wis. Next annual meeting, Milw[…] January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 22, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,001,023. CIRCUIT-CONTROLLING SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed Nov. 23, 1910. Magnetically operated switch and resistance with circuits for protecting a motor against overload.

1,001,032. ELECTRIC SWITCH; H. R. Hirst, New Bedford, Mass. App. filed Nov. 5, 1909. Push-button wall type with oscillating arm.

1,001,035. TERMINAL BLOCK FOR HIGH-TENSION APPARATUS; T. Hubert, New York, N. Y. App. filed Oct. 17, 1907. An insulating block with openings and sockets for the terminals.

1,001,046. SIGNALING-HORN; A. A. Kent, Philadelphia, Pa. App. filed Feb. 28, 1910. An integral casing with electromagnetically vibrated diaphragm.

1,001,047. ELECTRICAL POWER TRANSMISSION; H. Kleinschmidt, Berlin, Germany. App. filed Sept. 11, 1909. Two separate machines of unipolar type. The stators form a common casing for the rotors. For automobiles driven by gas engines, etc.

1,001,049. PROCESS OF WELDING SHEET METAL; C. C. Knipe, Palo Alto, Cal. App. filed Dec. 1, 1905. Simultaneously localized heat and pressure are applied to weld thin planished sheet metal.

1,001,054. GROUND-WIRE FASTENERS; M. H. Lawrence, Larned, Kan. App. filed March 15, 1911. The wire is wedged between the tapered portion of a driven ground rod and a tapered sliding sleeve.

1,001,068. APPARATUS FOR GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; W. P. Neubert, Swissvale Borough, Pa. App. filed Jan. 17, 1911. Interlocking system of mechanical and electrical control.

1,001,070. LOCK-OUT TELEPHONE SYSTEM; N. E. Norstrom, Chicago, Ill. App. filed June 6, 1910. For party lines to prevent interference. Step-up devices to control a cycle of operations.

1,001,091. DEVICE FOR INDICATING VARIATIONS IN SYNCHRONOUS RUNNING OF KINEMATOGRAPHS AND GRAMOPHONES; F. A. Thomassin, Streatham, Eng. App. filed April 12, 1909. A hand is rotated in one direction with one mechanism and its support is rotated in the opposite direction by the other mechanism.

1,001,105. MANUFACTURE OF ELECTRIC FILAMENTS; C. A. von Welsbach, Vienna, Austria-Hungary. App. filed Aug. 24, 1899. A filament containing metallic oxid and osmium is electrically heated to expel some of the gases and then reduce the oxid by the remaining gases.

1,001,135. FILAMENT SUPPORT; H. Gilmore, Brookline, Mass. App. filed Jan. 30, 1911. A sheet-metal filament support has a coefficient of expansion greater than that of the glass stem.

1,001,137. INSULATOR PROTECTOR; W. T. Goddard, Victor, N. Y. App. filed June 12, 1908. An arcing member secured on a support has a portion projecting into a flared portion of the insulator, and another arcing member is secured on the insulator.

1,001,152. ATTACHMENT FOR ELECTRIC MOTORS; W. A. Lawrence, Charlotte, N. C. App. filed Nov. 19, 1910. A holder is held by fusible material away from a signal-operating position to give an alarm in case the motor shaft runs loose or hot.

1,001,192. GAS-LIGHTING BURNER; E. A. and E. N. Fray, South Deerfield, Mass. App. filed Aug. 18, 1910. Electromagnetically operated ignition and gas-directing hood.

1,001,227. AERIAL FOR WIRELESS TELEGRAPHY AND TELEPHONY; W. E. D. Stokes, Jr., and G. W. Davis, New York, N. Y., and Galilee, N. J. App. filed Oct. 9, 1908. A series of vertically arranged wires and a switch for connecting any one to the receiving circuit.

1,001,228. RECEIVING CIRCUIT FOR WIRELESS TELEGRAPHY AND TELEPHONY; W. E. D. Stokes, Jr., and G. W. Davis, New York, N. Y., and Galilee, N. J. App. filed Oct. 9, 1908. A large plate connected with an aerial and arranged parallel with the ground to form a condenser.

1,001,236. ELECTROMAGNETIC SOUND-WAVE THERAPEUTIC APPARATUS; E. Bachelet, New York, N. Y. App. filed Aug. 7, 1908. Ear pieces with solenoid vibrators.

1,001,251. TROLLEY POLE; J. Coan, Westville, Ill. App. filed Nov. 13, 1909. Controlling device for holding the pole up, retracting it and assisting in replacing it.

1,001,271. MACHINE FOR ELECTRICALLY WELDING CHAIN LINKS; C. L. Hoff, York, Pa. App. filed Oct. 4, 1909. Mechanical devices for holding individual links and moving the welding electrodes toward and from each other.

1,001,313. ELECTROMAGNETIC SWITCH; H. W. Sheehy, Akron, Ohio. App. filed May 25, 1910. For electric street cars, etc. A movable magnet core carries a movable bar designed to contact with the rail to operate the switch frog.

1,001,330. ELECTRICAL PULL SOCKET; D. P. Wolhaupter, Washington, D. C. App. filed Jan. 28, 1911. A spring contact arm and a rotating cam with an insulating disk between the contacts and the operating member.

1,001,337. MINE-GAGE SIGNAL; L. Bayer, Willisville, Ill. App. filed June 6, 1910. A manually operable switch contact is carried by the car and adapted to engage stationary contacts at the side o[…] shaft.

1,001,339. REVERSING MECHANISM; G. Binder, Rochester, N[…] App. filed April 5, 1911. For washing machines, etc.; driven b[…] electric motor. The reversing mechanism is driven continuall[…] one direction and automatically reverses the driven member of[…] machine.

1,001,358. TRAIN-LIGHTING SYSTEM; J. P. Crouch and J. Etc[…] Manchester, Eng. App. filed Nov. 27, 1909 Secondary battery[…] reversible dynamo and main switches brought into operation by[…] versal of the dynamo.

1,001,382. FILAMENT MOUNTING; E. S. Gardner, Acquackan[…] N. J. App. filed Dec. 28, 1910. The filaments are arranged in[…] cessive conical banks and staggered.

1,001,406. APPARATUS FOR GENERATING ELECTRICITY[…] CHEMICAL MEANS; R. N. Hudson and E. C. Brice, Lexin[…] Ky. App. filed Oct. 28, 1909. Nested cups of vitreous, porous carbon material and alloyed members and electrolyte.

1,001,449. METHOD OF PROCESS OF AND APPARATUS FOR [EX]TRACTING METALS FROM THE ORES THEREOF; J. H. [Rob]ertson, New York, N. Y. App. filed Oct. 12, 1910. A liquid [so]lution containing a powder of the ore is subjected to the elect[…] effect of a plurality of short-circuited conducting elements.

1,001,453. ARC LAMP; W. Rühling, Berlin, Germany. App. filed A[…] 19, 1911. An insulating barrier containing malachite and ca[…] separates the parallel electrodes and forms a conducting bridge w[…] the arc is extinguished.

1,001,466. PROCESS OF EXTRACTING METAL FROM SO[LU]TIONS; E. E. Slaughter, Clifton, Ariz. App. filed Jan. 6, [1…] Iron and carbon are immersed in a copper solution and the co[…] precipitated and then extracted by heat.

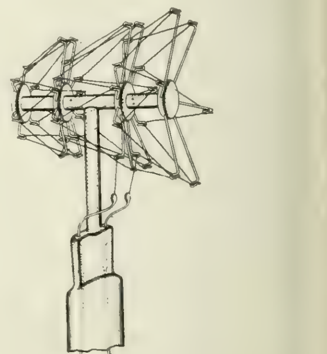
1,001,497. COMPOSITION OF MATTER CONTAINING ALUMI[NA] AND MAGNESIA; T. B. Allen, Niagara Falls, N. Y. App. [filed] July 28, 1910. Homogeneous crystalline product of alumina [and] magnesia with less magnesia than in $MgAl_2O_4$. For abrasive us[…]

1,001,558. ELECTRIC TERMINAL CONTACT; W. E. Russell, [Dan]bury, Conn. App. filed Jan. 31, 1911. The wire passes up thro[ugh] the center of a split post and is clamped down at the top by a ca[…]

1,001,570. COMPOSITION OF MATTER CONTAINING ALUMI[NA,] MAGNESIA AND BORIC OXID; T. B. Allen, Niagara Falls, N[…] App filed Nov. 9, 1910. Abrasive material, homogeneous, crystall[…] insoluble in water and acids. Formed by melting the oxids [with] carbon.

1,001,571. COMPOSITION OF MATTER CONTAINING BERYL[LIA] AND ALUMINA; T. B. Allen, Niagara Falls, N. Y. App. f[…] Nov. 9, 1910. Not more than 18 per cent beryllia; formed by h[eat]ing with carbon; homogeneous and crystalline.

1,001,572. METHOD OF TREATING ELECTROMETALLURGIC PRODUCTS; T. B. Allen, Niagara Falls, N. Y. App. filed Jan. [...] 1911. The products such as impure alumina are heated with a s[ub]stance such as NaCl in the presence of O; to form abrasives.



1,001,382.—Filament Mounting.

1,001,589. ELECTROLYTIC CELL; H. S. Hatfield, Hove, Eng. A[pp.] filed Oct. 12, 1907. For transferring; as when impure copper [is] used as an anode and in the Wright mercury meter. The el[ec]trolyte is soluble and is saturated with an insulating substance [to] be transferred.

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CONTENTS.

DATA OF ELECTRICAL MANUFACTURING.

The Census Bureau has just issued a preliminary report, reprinted elsewhere, dealing with the production of electrical apparatus and machinery, and representing the general results of the thirteenth census of 1909, as applied to manufacturing establishments. The five-year periods for this work do not coincide with those for the electrical industries consuming the apparatus, as such figures were last taken in 1907, and, according to the law, will be taken again in 1912. This absence of synchronism is to be regretted, for if all the statistics of production and consumption were taken together, we could get a better insight into general conditions in the electrical industries as a whole, as one art, and could better understand some features which, as in the present report, are decidedly puzzling.

The gross results show a marked gain in 1909 over 1904, at a rate of about 10 per cent per annum. In earlier years the gain was at a higher rate, even as much at times as 20 per cent; but it is obvious that such gains would be increasingly difficult to maintain as the volume of trade increased in magnitude. The number of establishments rose from 912 to 1255, but the significance of this increase cannot be determined until the figures are published in detail, when it will probably be found that the growth has been largely confined to smaller plants doing a local business. The value of the product at the factories—that is, including no profits—was $243,967,329, as compared with $159,551,402, a total increase of $84,416,927. Our own estimate for the year, published in these pages at the beginning of 1910, was $275,000,000, but that included some figures not embraced here, such as poles and cross-arms, automobiles as such and other items, so that the guess was remarkably close. It is when we come to separate and individual figures that the data become somewhat difficult of comprehension. Perhaps the total and the figures in the table as a whole, given on page 612 of this issue, would have been larger if taken in a year during which the effects of the panic of 1907 were not so distinctly felt. It must be remembered that 1904-05 was the time when our last "boom" was reaching its tremendous crest, and that electrical development has barely yet, in all its lines, got back to the normal.

Turning to the table, one is immediately struck with the small output of dynamos in value. The gain in the five years was only $2,000,000—from $11,084,234 to $13,081,048; and the increase in number was barely 700. The increase in size of generating machinery probably had an influence on the selling price, but, on the other hand, the figures for the single year are most probably not at all representative of average conditions for the five-year period, which remark also doubtless applies to other entries. The great

increase in the double-generator class, which rose from $1,740,534 to $3,154,733, is also puzzling. It will be noted that the figures are very satisfactory in all the motor classes, although the number of motors for automobiles, given as only 2796, is quite disappointing. The revival of the electric automobile had not, however, become very marked two years ago, and it is quite likely that the output of 1909 will be much more than doubled in 1911. The great increase in storage-battery output, from $2,645,749 in 1904 to $4,678,209, or nearly 100 per cent, clearly indicates that power plants continue to be large purchasers of batteries, especially for emergency service, and, of course, the return of the electric automobile to its old activity also means a stimulus to the battery industry, as does also the extension of railroad-car electric lighting.

Another instance of figures that are puzzling is found in the data given as to telephones. It will be seen that the value of this group of apparatus is given as $15,546,852, as compared with $15,863,698 in 1904, an actual falling off, though slight. It is rather hard to accept this showing; but, as in all the other cases, the figures compiled are the manufacturers' own, and there is no apparent reason why they should indulge in understatement. On looking up the Bell telephone report we note an increase of 600,000 stations that year. Some inferences are that the prices were much lower than in earlier years; that the "Independent" activity has slackened appreciably, though that might be denied; and that the disparity is in part due to the figures for the single year not being truly representative of the concurrent expansion of the operating industry. Perhaps the best criterion of the industry is afforded by the figures for insulated wires and cables, which were $34,520,000 for 1904 and $50,338,000 for 1909. A most surprising decrease is to be noted in the number of arc lamps, and with that goes the entire disappearance of the item of carbons. As tungsten street lighting dates only from about 1909, an explanation that occurs is that central stations were holding back awaiting developments in the street use of tungstens, and also in the use of the composite electrode group of arc lamps. As for carbons, the explanation seems to be that the industry has become so concentrated that to give the figures would virtually reveal the actual business of one large concern, and in all such cases the Census Office dumps the item into "all other products." It would be interesting, however, to see the actual figures, for the information they would carry.

Unfortunately, this policy of concealment of data, when it is applied in another manner to other products, utterly vitiates some of the statistics of the report. Thus, it is stated in the report that, for the reason above given, statistics for railway motors cannot be shown separately, and this product is lumped with motors "for elevators and miscellaneous services, including supplies and parts." The totals under this head show only an increase from $10,707,000 in 1899 to $11,036,000 in 1909, thus, so far as these figures alone go, indicating a stagnation in the electric railway industry during the intervening decade. In point of fact, the number of cars increased from 58,569 in 1899 to 91,153 in 1909, while the total capitalization of the industry increased almost $3,000,000,000 during the same period. But the most glaring instance of this policy is with respect to incandescent lamps. The year 1909 may be accepted the commercial beginning in this country of the metal-filament lamp industry, and the figures for that year would have both an industrial and a historical interest a first statistics. We find, however, that the statistics fo this type of lamp are combined with those for the graphitized-filament lamp, thus completely concealing the output of the former. It is just possible that the Census Office i th case was misled by the trade designation—metallized filament—of the graphitized carbon-filament lamp. As be the policy of giving no statistics for a product practi controlled by one manufacturer, such as carbons, and ha of combining the figures for products that have quite di ferent industrial significances, the former appears much the wiser. Moreover, we believe that the Census Office is more solicitous than the conditions of pr commercial competition demand, in concealing the a state of parts of the electrical industry by the me above noted. The aggregate figures of the report ca accepted as meaning something; these are full of en agement and indicate that the electrical manufacturin dustry is still subject to the powerful impetus which made electrical development in general one of the ma of modern times.

APPROXIMATE CALCULATION OF REGULATION.

Extreme refinement in calculations relating to the de mination of the proper wire sizes for certain duties us represents an unnecessary expenditure of thought and la in view of the fact that the final choice will in any fall between two different standard sizes of wire diffe appreciably in cross-sectional area, one or the other which must be selected for commercial reasons quite in pendent of the exact size which theoretical calcula would show to be most advantageous. For this reason s ple approximate methods for calculating line characteris are preferable to the more exact complicated methods practical engineering service. Simple approximate form may readily be derived from complicated equations by n lecting certain terms of higher order, by ignoring cert quantities which are small in comparison with other qua ties with which they are combined, or by substituting trigonometric function for another in cases where the an approaches certain limiting values, such as using the s for the tangent of the arc when the angle is small. combination of algebraic and geometric simplification connection with the approximate calculation of the regu tion of transformers and transmission lines is described Mr. H. Bewlay in an article in this issue. The author velops an algebraic method for determining the ratio b tween certain parts of a graphical diagram of the vo ages involved, which method overcomes the well-known d advantage of the plain graphical method in representing a single scale values that differ too widely to permit accurate measurement. The results obtained by the meth are subject to error in every case, but the error becom of importance only when the quantities involved do n differ widely in magnitude, in which cases the purely grap ical method can be employed advantageously. It wou seem that the method described is well adapted for applic tion in connection with the purely graphical method, the two simple methods covering all cases liable to occur.

PRACTICAL POLITICS AND A GREAT PUBLIC UTILITY.

. example of the unfortunate results that may follow …ntrol of public-service utilities by politicians is …d by the long-drawn-out controversy among the …s of the Sanitary District of Chicago. The Sanitary …ct is a municipal corporation organized under the … f the State of Illinois to build and operate the Chica… …inage Canal, primarily designed to afford an outlet …e sewage of Chicago through the Desplaines and … Rivers into the Mississippi River, to preserve Lake …gan, which is the source of the domestic water sup… f Chicago, from contamination. Incidentally, a con…ble water-power has been created, and electrical en… generated at a hydroelectric station at Lockport, Ill., …uced and sold, principally to the city of Chicago and …nunicipal bodies, for street lighting or other munici…rposes. Electricity is also sold to private consumers, … for industrial use, and thus the District competes …he privately owned electric-service companies of …go and vicinity.

… affairs of the District are managed by a board of ni… trustees elected by the people. One of these serves as pr…dent, but he is not selected by his fellow-members, but …cted directly to this position by the voters, a requisite … of course, that he must also be elected a member of th board. On Dec. 1, 1910, there was a change of adminis…ation by which a president was elected of opposite po…lit al faith to that of the majority of the trustees. Imme…di…ely a difficult situation was created, and since then the b…ness of the board has been in a sad tangle. The presi…d…t and the majority of the other trustees in the preceding a…ministration were of the same political persuasion, and th president was allowed to take the predominant part in th government of the District to which his office would s…m to entitle him. But with a president of one party and a majority of the trustees of another there was trouble, a… plenty of it. A struggle for control ensued, the minor…it having the president's office, being strong enough to b…ck the efforts of the other trustees to take the direction o…affairs. Angry scenes have marked the sessions, and on m…re than one occasion physical encounters have been nar… averted. Pay-rolls have been held up; employees … been discharged by some trustees and told to remain … others; there have been acrimonious disputes delaying t… awarding of important contracts; charges and counter-c…arges have been bandied about with the utmost freedom. I… short, the administration of the District has been marked f… several months by disorder and tumult.

In its engineering aspects the Chicago Drainage Canal i… a great work. The electrical plant is modern and well b…ilt and has been operated efficiently, or at least was so …erated until the deadlock in the governing body brought …out a situation which must have affected all departments …favorably. It is particularly unfortunate that this politi…l squabble has arisen, for a contract was executed in …ctober, 1910, by which the city of Chicago turned over to …e Sanitary District its whole street-lighting equipment, …mprising thirteen stations and substations and approxi…ately 12,200 arc lamps, with overhead and underground …nes, the District agreeing to manage and operate the sys…m for a period of seven years and also to install at least three additional substations and 10,000 additional 450-watt arc lamps. This is a contract of great moment to the people of Chicago and was apparently advantageous to all parties concerned when executed. The Drainage Canal was built by the people's money and there would appear to be no better method of applying the cheap electrical energy created than to use it for public street lighting, especially as the outlying areas of Chicago's wide expanse are notoriously poorly lighted. It may be that the quarrels of the trustees have had no very serious effect, so far, in the carrying out of this contract, for orders have been placed already for a considerable proportion of the new material needed; but such intestine dissension as has been witnessed does not make for confidence in the administration of such a vital utility as the public street lighting of a great city. The unfortunate condition of affairs in the Sanitary District furnishes a recent and conspicuous demonstration of the truth that politics has no place in the administration of public utilities.

RESISTANCE-TEMPERATURE CHARACTERISTICS OF THE NERNST GLOWER.

It is a noteworthy fact that the terms "conductor" and "insulator," although so applied as to have definite significance under ordinary practical conditions, are relative only in that what may be termed an insulator under certain conditions becomes a conductor under certain other conditions. For example, the various metals which are designated as conductors at normal temperature become excellent and almost perfect insulators as the temperature is decreased toward absolute zero. On the other hand, the so-called insulating materials become excellent conductors as the temperature is increased indefinitely. It is upon the latter fact that the operation of the Nernst lamp glower depends, the glower being made from material which is a good "insulator" when cold. By preheating the glower is converted into a fair "conductor," which permits current to be produced to assist in heating the glower until it reaches the temperature of incandescence, which temperature is then maintained by means of a series resistor which acts to limit the current in the glower. A study of the resistance changes in a Nernst lamp glower as the temperature was increased from 400 deg. C. to 1350 deg. C. is recorded in an article by Mr. Albert A. Somerville in this issue. At 400 deg. C. the resistance of the glower tested had the enormous value of 8×10^6 ohms; it decreased to 29×10^3 ohms at 800 deg., to 3.7×10^3 at 1200 deg. and to 2.45×10^3 at 1350 deg. The figures show a conductivity about forty times as large at 600 deg. as at 400 deg., 7.0 times as large at 800 deg. as at 600 deg., 3.1 times as large at 1000 deg. as at 800 deg., 2.5 times as large at 1200 deg. as at 1000 deg., and about 1.6 times as large at 1400 deg. as at 1200 deg.

At the highest temperature which was reached during the tests the conductivity was found to be only one-fourth as large as under normal operating conditions, and hence it would seem that the tests were conducted at temperatures possibly 800 deg. below the operating value. It is to be hoped that the tests will be extended through the higher temperature range and to include a study of the luminosity of the glower at the different temperatures, in view of the departure of the glower from the theoretical black-body radiation.

Convention of Pennsylvania Electrical Association.

By Telegraph.

With a registered attendance of 235 the fourth annual convention of the Pennsylvania Electrical Association was opened at Exposition Park, Pa., Sept. 5, under clouded skies. The reception at the dancing pavilion on Tuesday night to President and Mrs. A. R. Granger was somewhat marred by a terrific downpour of rain, but otherwise the affair was agreeably cordial and thoroughly enjoyable. The convention headquarters are at Hotel Conneaut, fronting on Conneaut Lake, with an overflow in the Hotel Virginia, which is under the same management. Exposition Park itself is a noted summer resort within easy reach of Pittsburgh and Erie. It possesses numerous natural advantages besides the charming lake on which it is situated and abounds with almost every form of outdoor amusement, both on land and water, including a baseball park, race track, large amphitheater, picnic grounds and the usual side shows found in seaside and summer resorts.

The first general session was opened a half hour after the scheduled time. In his address President A. R. Granger, of Chester, Pa., called attention to the remarkable growth of the association during the past year, the membership reaching 954 as against 492 last year, a gain of about 100 per cent.

Owing, he said, to the large number of geographical sections of the National Electric Light Association the executive committee of the national body has decided that it will be impracticable hereafter for the presidents and chairmen of such sections to be ex-officio members of that committee. The geographic sections combined will, however, have two votes in the national committee as provided in a recent amendment to the constitution. During the past session of the State Legislature the executive committee held several meetings regarding bills introduced in the Senate and House of Representatives and action was taken whereby discriminatory and unjust legislation was defeated. President Granger urged that in matters of this kind a greater co-operative spirit be shown than in the past, as it is not always possible for the executive committee to bring about a desired result unless aided by the entire association membership. In view of the very rapid growth of the national body it was felt that in a very short time the state and geographic sections will take up a large part of the work now carried on by the parent body. Therefore the president said it behooved the state associations to continue to broaden their usefulness so that when they are called upon partially to fill the place of the national body they will be in a position to do so. He expressed the hope that in this movement the Pennsylvania Electrical Association would blaze the way.

The reports of the standing committees were then presented. According to the membership committee there are at present eighty-five active, 842 class B (members connected with central stations) and twenty-six associate members. A new set of by-laws was adopted because of the changes incident to affiliation with the National Electric Light Association. All that could be desired in the way of entertainment for the ladies and others present, in addition to the members of the association, has been provided by the entertainment committee.

The first paper of the session was the report of the lamp committee, read by Mr. H. M. Simkins, of Philadelphia, in the absence of the chairman, Mr. A. J. Spillman, who is seriously ill. The committee points out that the tendency of the lighting companies during the past year has been to replace carbon with graphitized-filament lamps and tungsten lamps, a charge being made for the latter depending on the policy of the different companies. The substitutions of the graphitized-filament lamp for the old carbon-filament lamp the committee considered to be a very logical move, giving the consumer 20 per cent additional illumination for the same energy consumption. Experience has shown that where lighting companies have encouraged and at the same time controlled the general use of the tungsten lamp a marked improvement in new business, extension of old business and relations with the consumers has resulted. The committee cited the improvements made in the manufacture of the tungsten lamp and stated that the wire-drawn tungsten filament is several times stronger than the pressed tungsten-filament lamp. For residence work 25-watt and 40-watt sizes are the most popular, being more particularly suited to replace carbon lamps, while the 150-watt and 250-watt lamps make satisfactory substitutes for arc lamps and offer a means of competing with the so-called gas arc. The watt rating with three voltages was explained and it was pointed out by the committee that under general conditions it is most desirable from the consumers' as well as from the lighting companies' viewpoint to operate the lamp at the highest rating. Embodied in the report is a list giving the substance of the replies of member companies to eleven question submitted to them with reference to the tungsten lamps. Commercial practice has been greatly modified since the introduction of the high-efficiency lamp, and with the possibility of these lamps being made more efficient in the future it is necessary, in the opinion of the lamp committee, for central-station companies to adopt policies, programs and methods which will not only take care of the lamp situation at present, but will provide for any increase in efficiencies in years to come.

In the discussion Mr. H. Harris, of Wilmerding, asked the committee if its recommendation was in favor of the wire-drawn tungsten lamp as against the pressed-filament tungsten lamp and if the former is giving better results as regards stability. Mr. E. F. McCabe, of Titusville, expressed his disappointment with the drawn-tungsten-filament lamps. He said from the glowing descriptions given by the manufacturers he was led to expect excellent results, whereas, as a matter of fact, the lamp is no better than the old pressed-tungsten-filament lamp; although it is stronger when new, it depreciated rapidly after being used and the fluttering was just as noticeable. In his estimation there is still room for vast improvement. Mr. H. N. Mueller, of Pittsburgh, said that the flutter of the lamps is due to mechanical and chemical reasons; in his opinion, the tungsten drawn-wire filament is mechanically stronger than the pressed-tungsten filament. The blackening of the bulb, he said, is doubtless due to some chemical in the filament binder. The only improvement made, in his estimation, has been the mechanical strengthening of the filament. Mr. Van Dusen Rickert, of Pottsville, told of difficulties and excessive breakage of tungsten sign lamps operated on a flasher, the lamps apparently all breaking at the same point. By shortening the interval between flashes from 60 per cent to 85 per cent the trouble was greatly reduced. Mr. E. L. Franklin, of Easton, asked about the cost of the change from free carbon to free graphitized-filament lamps. Mr. Mueller suggested that where excessive breakage occurred with low-voltage sign lamps enough energy should be supplied to keep the filament soft and hot at all times without actually lighting the lamps; he said that electric railways do this to advantage. Mr. E. F. McCabe, of Titusville, asked whether the saving in the use of the low-voltage tungsten lamp with transformers was sufficient to justify the expense and complication. Mr. H. N. Mueller, of Pittsburgh, said the series operation of low-voltage tungsten lamps could not be compared with the multiple operation in connection with a transformer, especially where the latter is provided with taps; if the voltage be lowered from 5 per cent to 10 per cent the effect on the brilliancy is not noticeable and the life of the lamps is considerably prolonged. Speaking for the lamp manufacturers Mr. Mason said that the mechanical strength of the drawn-tungsten filament is five times greater than that of the pressed-tungsten filament. After being 100 hours in

service, however, the filament crystallizes, but not so much as the pressed-tungsten filament. The strength then is from two to three times as great as that of the latter filament, but the characteristics are about the same in both. It is impossible at present, he said, to make either the drawn-filament or a pressed-filament tungsten as uniform as the old carbon filament. Mr. E. B. Greene, of Altoona, related his experiences with the tungsten lamp on circuits controlled by a flickering indicator. By substituting tungsten lamps rated 8 volts higher than that of the circuit on which they are burned excellent life is obtained. Previously his experience was identical with that cited by Mr. VanDusen Rickert at Pottstown, the flickering device acting similarly to the flasher in the case mentioned. Mr. [illegible] Pyle, of West Chester, also experienced blackening [illegible] when he used tungsten lamps at the highest rated [illegible]ges. His company now employs 120-volt lamps on 118-volt circuits with good results; one 150-watt tungsten lamp used on a circuit 3 volts lower than that for which the lamp was rated burned over 4000 hours and is still in service, although slightly blackened.

The next paper was the report of the steam-heating committee read by the chairman, Mr. M. J. Fogarty, of Erie, a paper on central-station heating by Mr. E. J. Kiefer, of [illegible]on, forming part of the report. The committee found it difficult to procure data from heating companies and that it is impracticable to give a full detailed statement of [illegible] items involved in steam heating. A uniform rate [illegible] out of the question. The prevailing rate charged by 100 companies in various states averages 45 cents per 1000 lb. of condensation. Many plants have added exhaust steam turbines and others have added ice-making appliances to their equipment. The latter seems to have a tremendous advantage over the ordinary ice plant or over the natural ice harvester, as pure ice can be made by using steam at from 2 lb. to 3 lb. pressure, thus utilizing exhaust steam twelve months in the year if necessary. The paper was discussed by Messrs. L. H. Conklin, Warren E. F. McCabe, Titusville; J. E. Pyle, West Chester; W. J. Kline, Lockport, N. Y.; F. M. Noecker, Renovo; E. H. Davis, Williamsport; Duncan Campbell, Scranton, and R. S. Orr, Pittsburgh.

Following the presentation and discussion of the report of the steam-heating committee the report of the committee on overhead line construction was presented in abstract, the actual reading of the report and its discussion being reserved for Thursday's session. In presenting the abstract the chairman of the committee, Mr. F. M. Noecker, of Renovo, said that the committee made special efforts to get members of the association to consider carefully the questions raised. The report recommends important changes in all the sections of the N. E. L. A. report, but the real bone of contention is Section 4 of the latter. New ideas have been followed up and put into practice on the subject of cross-arms, wooden pins and metal insulator supports, as well as on the methods of secondary distribution in general. The subject of vertical runs on poles jointly used was only briefly touched on in the report, but will be elaborated in the discussion. The reference to the specification for weatherproof wire needs to be supplemented by the views received by correspondence with manufacturers. The purpose of the committee was to criticise the national report and the committee feels that anyone reading it report will admit that it has done its duty. It has not criticised, however, for the sake of criticising, but rather for the sake of securing the greatest good for the greatest number. The report is distinctly a committee report and not a chairman's report. It is supplemented by a paper on the preservative treatment of poles and cross-arms by Prof. J. P. Jackson, of Pennsylvania State College, and another containing additional information on sags and spans by Mr. W. L. Robertson, of Philadelphia.

During the morning the ladies formed card parties and the afternoon was given over to track sports, including a tug-of-war, baseball game and horse racing. At night the entire convention attended a theatrical performance in the hall in which the sessions of the association were held. President Gilchrist was expected to address the convention on Thursday morning, coming direct from the meeting of the incandescent lamp manufacturers at Association Island, New York, for that purpose.

Census Report on Electrical Machinery and Apparatus.

A preliminary statement showing the general results of the thirteenth census of establishments engaged in 1909 in the manufacture of electrical machinery and apparatus has been issued by the United States Census office. It presents a comparative summary of the statistics of the industry for the censuses of 1909, 1904 and 1899, and shows the number and value of the different kinds of electrical equipment manufactured during each census year. The report was prepared under the direction of Mr. William M. Steuart, chief statistician for manufactures.

The reports were taken for the calendar year ended Dec. 31, 1909, wherever the system of bookkeeping permitted figures for that period to be secured, but in some instances where the business year of an establishment differed from the calendar year they relate to the business year falling most largely within 1909.

The value of the machinery and apparatus manufactured for use in the generation and utilization of electricity increased from $105,832,000 in 1899 to $159,551,000 in 1904, and $243,967,000 in 1909, or 130 per cent during the decade. Large quantities of supplies used for electrical purposes are manufactured in foundry and machine shops and other establishments not identified with the electrical industries. These parts are assembled by dealers and others not covered by the census, and it is impossible to obtain accurate information in regard to them. Therefore, the totals given above are less than the true total value of all of the machinery of this character manufactured annually in the United States.

The value of products represents their selling value or price at the plants as actually turned out by the factories during the census year, and does not necessarily have any relation to the amount of sales for that year.

DYNAMOS.

The number of dynamos manufactured annually increased from 10,527 in 1889 to 15,080 in 1904, and 16,791 in 1909, an increase of 59 per cent for the decade. The value of the dynamos for each year was $10,473,000, $11,084,000 and $13,081,000 respectively. As a rule, much larger and more powerful dynamos were manufactured in 1909 than for the prior years, so that while the average value of machines manufactured was greater in 1909 they represented a lower cost for corresponding capacity. The average capacity per machine increased from 55 kw in 1899 to 66 kw in 1904 and 84 kw in 1909. The value of the dynamotors, motor-generators, boosters, rotary converters and double-current generators manufactured increased from $380,000 in 1899 to $3,155,000 in 1909, or 730 per cent.

TRANSFORMERS AND SWITCHBOARDS.

The value of transformers manufactured increased from $2,963,000 in 1899 to $4,469,000 in 1904, or 51 per cent, and to $8,801,000 in 1909, or 197 per cent. The value of switchboards, panelboards and cut-out cabinets for lighting and motors increased from $1,847,000 in 1899 to $3,766,000 in 1904, or 104 per cent, and to $5,972,000 in 1909, or 223 per cent.

MOTORS.

The total value of motors of all kinds, including supplies and parts, manufactured increased from $19,505,000 in

1899 to $22,371,000 in 1904, and $32,087,000 in 1909, or 64 per cent for the decade.

The number of power motors manufactured annually increased from 35,604, valued at $7,551,000, in 1899, to 79,877, valued at $13,121,000, in 1904, and to 244,123, valued at $18,306,000 in 1909, there being an increase of 586 per cent in number and 142 per cent in value for the decade. Many powerful motors were manufactured, but the number of small motors has increased so rapidly that the average capacity per machine has declined, the average horsepower per motor for the three census years being 14.5, 8.5 and 6.7 respectively.

In 1899 there was great activity in the manufacture of motors for automobiles, but the increase in this branch of industry has not kept pace with that for other classes of electrical equipment. The number manufactured decreased from 3017 in 1899 to 1819 in 1904, with an increase to 2796 in 1909. On the other hand, the capacity of motors reported increased 4251 hp, or 52 per cent, during the decade, and the value of these motors has decreased from $192,000 in 1899 to $153,000 in 1904, but increased to $294,000 in 1909.

The number of small motors for the operation of fans has increased very rapidly. There were 97,577 such motors reported in 1899. In 1904 there were 102,535 and in 1909 199,113, an increase of 104 per cent for the decade. The value of these motors increased from $1,055,000 in 1899 to $2,451,000 in 1909, or 132 per cent.

The report states that the statistics for motors for electric-railway cars cannot be shown separately without disclosing the products of individual establishments, but there was a considerable increase in the manufacture of such motors as compared with the production of 1904, which was 12,298, of 713,181 hp, valued at $4,950,000. Considering the group of motors for cars, elevators and similar purposes the combined number decreased from 23,582 in 1899 to 22,112 in 1904, and increased to 58,698 in 1909. The value of these motors was $10,707,000 in 1899, $7,929,000 in 1904 and $11,036,000 in 1909, there being an increase of 149 per cent in number and 3 per cent in value during the decade, the decrease shown for the group in 1904 being entirely due to the decrease in the manufacture of railway motors at that census.

STORAGE AND PRIMARY BATTERIES.

The value of the storage and primary batteries manufactured increased from $3,679,000 in 1899 to $4,244,000 in 1904 and $10,612,000 in 1909, or 188 per cent during the decade. Both storage and primary batteries consist of various elements which are not always combined and sold together as a unit by the same manufacturers, and yet it is not until these are brought together that a complete cell is constituted. Many of the parts and supplies used are manufactured outside of the electrical field, and therefore the statistics shown in this report do not convey a correct idea of the importance attached to this branch of the industry.

[illegible]

The number of arc lamps manufactured increased from 158,187 in 1899 to 195,157 in 1904, and decreased to 123,543 in 1909. The decrease is accounted for by the fact that other varieties of lamps are now used for street light and for other purposes for which arc lamps were formerly used almost exclusively. The value of these lamps decreased slightly in 1904 ($1,574,000) as compared with 1899 ($1,828,000), but owing to the introduction of more costly types of these lamps, such as flaming arcs, increased to $1,707,000 in 1909.

The group of incandescent lamps includes carbon-filament, gem, tantalum, tungsten, glower-vacuum, vapor and similar lamps used for lighting, advertising and decorative purposes. Some of these varieties were not manufactured in 1899 or 1904. A large number of decorati[illegible] and miniature lamps, X-ray bulbs, vacuum tubes, etc., ar[illegible] now manufactured, but the varieties are so numerous tha[illegible] it is impossible to obtain accurate statistics of the number. The total value of the group increased from $3,515,000 i[illegible] 1899 to $6,953,000 in 1904 and $15,715,000 in 1909. The va[illegible] the carbon-filament lamps increased rapidly from 18[illegible] to

TABLE I.—ELECTRICAL MACHINERY, APPARATUS AND SUP[illegible]

Items	1909.	1904.	1[illegible]
Number of establishments..	1,255	912	
Total value of products....	$243,967,000	$159,551,000	$105,[illegible]
Dynamos:			
Number...............	16,791	15,080	
Total kilowatts	1,405,951	996,182	[illegible]
Value.................	$13,081,000	$11,084,000	$10,[illegible]
Dynamotors, motor-generators, boosters, rotary converters and double-current generators......	3,155,000	1,740,000	[illegible]
Transformers for light and power	8,801,000	4,469,000	2,[illegible]
Switchboards, panel boards, cut-out cabinets for light and power.	[illegible],972,000	3,766,000	1,[illegible]
Motors:			
For power—			
Number.	244,123	79,877	
Horse-power	1,623,677	678,910	[illegible]
Value.....	$18,306,000	$13,121,000	$7,[illegible]
For automobiles			
Number...	2,796	1,819	
Horse-power	12,471	19,907	
Value	$294,000	$153,000	$1[illegible]
For fans—			
Number....................	199,113	102,535	[illegible]
Horse-power...............	178,033	30,796	1[illegible]
Value.....................	$2,451,000	$1,168,000	$1[illegible]
For railways, elevators, and miscellaneous services, including supplies and parts—			
Number....................	58,698	22,112	2[illegible]
Horse-power...............	859,237	763,399	[illegible]
Value.....................	$11,036,000	$7,929,000	$10,7[illegible]
Storage batteries, including parts and supplies			
Weight of plates in pounds......	23,119,331	16,113,073	
Value.....................	$4,678,000	$2,646,000	$2,5[illegible]
Primary batteries including parts and supplies:			
Number.....	34,333,331	6,623,162	2,6[illegible]
Value........	$5,934,000	$1,598,000	$1,1[illegible]
Arc lamps:			
Number....................	123,543	195,157	1[illegible]
Value	$1,707,000	$1,574,000	$1,82[illegible]
Searchlights, projectors, and focusing lambs..................	936,000	115,000	22[illegible]
Incandescent lamps:			
Carbon-filament, gem, tantalum, tungsten lamps..............	13,859,000	6,308,000	3,442[illegible]
Decorative and miniature lamps, X-ray bulbs, vacuum tubes, etc. (also includes glower lamps and parts, and vacuum and vapor lamps)........	1,876,000	645,000	[illegible]
Sockets, receptacles, bases, etc....	4,522,000	2,011,000	5[illegible]
Electric-lighting fixtures of all kinds	6,128,000	3,295,000	3,7[illegible]
Telegraph apparatus............	1,957,000	1,111,000	1,642
Telephone apparatus............	15,547,000	15,864,000	10,512
Insulated wires and cables........	50,338,000	34,520,000	21,292
Electric conduits	5,098,000	2,416,000	1,066
Annunciators: Domestic, hotel, and other	236,000	186,000	22[illegible]
Electric clocks and time mechanism	352,000	374,000	132
Fuses	1,002,000	868,000	[illegible]
Lightning arresters............	940,000	587,000	
Rheostats and resistances........	2,675,000	933,000	1,1[illegible] (both rows)
Heating, cooking and welding apparatus	1,003,000	396,000	
Electric flatirons...............	951,000		
Electric measuring instruments....	7,800,000	5,005,000	1,842
Electrical therapeutic apparatus...	1,116,000	1,037,000	
Magneto-ignition apparatus, spark-coils, etc.....................	6,080,000	678,000	
Electric switches, signals and attachments	5,384,000	1,451,000	1,130,[illegible]
Circuit fittings of all kinds........	1,081,000	3,525,000	
All other products..............	34,000,000	26,179,000	15,384,[illegible]
Amount received from custom work and repairing..........	5,691,000	2,799,000	2,064,[illegible]

1904, but there was a slight decrease in 1909, the value [illegible] the respective years being $3,442,000, $6,308,000 and $6,15[illegible] 000. The report states that the manufacture of gem, ta[illegible]talum, tungsten and other metal-filament lamps was [illegible]ported separately for the first time at the census of 19[illegible]

whe they were valued at $7,682,000. Some of these new varieties of lamps were not reported separately at prior censuses, and it is possible, the report says, that they were [illegible] with the carbon-filament lamps, thus accounting in [illegible] the apparent decrease in that variety of lamp. Ad[illegible]g, decorative and all other lamps, including in 1909 [illegible] lamps, vacuum and vapor lamps not separately report in 1904, have increased in value from $645,000 in 190 to $1,876,000 in 1909.

T[illegible] total value of all lamps reported for 1909 was $15,15,000. This does not include sockets, receptacles, bas[illegible] etc., or lighting fixtures of any character.

LIGHTING FIXTURES.

[illegible] value of electric-light fixtures of all kinds manu[illegible] in 1899 was $3,751,000; in 1904, $3,295,000, and in [illegible] [illegible],128,000. Large quantities of combination and [illegible] electric fixtures are now manufactured. At the [illegible] f 1909 it was ascertained that the value of these [illegible]tion fixtures was about $12,884,000. Their value [illegible]r censuses cannot be ascertained, and there were [illegible]dly large quantities manufactured in connection [illegible] manufacture of gas fixtures which are not identi[illegible]h the manufacture of electric supplies and their val[illegible] is not included in this report.

[illegible] AND TELEPHONE INSTRUMENTS.

[illegible]telegraph instruments include intelligence (key, [illegible] etc.) of all kinds, police, fire, district and miscel[illegible] instruments, wireless apparatus, also switchboards [illegible]graph parts and supplies. The total of this group [illegible]ments in 1899 amounted to $1,642,000, in 1904 to [illegible] and in 1909 to $1,957,000, an increase of 19 per [illegible] the decade.

[illegible]one apparatus includes transmitters, receivers, [illegible]e sets of instruments (not included in the separate pa[illegible], interior telephone systems complete, and central sw[illegible]boards, private-exchange boards, parts and supplies. T[illegible] total value of this group in 1899 was $10,512,000 as compared with $15,864,000 in 1904 and $15,547,000 in 1909, a [illegible]ght decrease during the last five-year period.

[illegible]e report also shows the value of the total annual outpu[illegible] miscellaneous apparatus used in connection with the ut[illegible]zation of electric energy. Principal among these may be [illegible]entioned electric measuring instruments, the output for wh[illegible]h in 1909 was $7,800,000; magneto-ignition apparatus sp[illegible]ks, coils, etc., valued at $6,080,000; electric switches,

[illegible]—ESTABLISHMENTS MANUFACTURING ELECTRICAL APPARATUS INCIDENTALLY.

Year	Number of Establishments.	Value of Product Reported.
[illegible]	[illegible]	$22,660,000
[illegible]	[illegible]	18,742,000
[illegible]	[illegible]	13,397,000

si[illegible]als and attachments, $5,384,000; heating, cooking and w[illegible]ding apparatus, $1,003,000; lightning arresters, fuses, et[illegible], valued at $1,942,000; therapeutic apparatus, $1,116,000; ci[illegible]uit fittings, $1,081,000, and electric flatirons, $951,000.

TABULAR SUMMARY.

[illegible]he accompanying Table I summarizes the statistics for th[illegible] principal products as reported at the censuses of 1909, 1[illegible]4 and 1899.

[illegible]able II includes establishments not engaged primarily in the manufacture of electrical products, but incidentally m[illegible]king electrical machinery, apparatus and supplies.

Chicago I. E. S. Convention.

At the fifth annual convention of the Illuminating Engineering Society, which will be held in the Congress Hotel, Chicago, Sept. 25 to 28, a wide variety of topics will be covered by the reports and papers to be presented. The final program has as yet not been arranged, but the following is the tentative program subject to revision.

Presidential address by Dr. A. E. Kennelly on *The Relations of Physico-Physiological Research to Illuminating Engineering;* report of committee on nomenclature and standards, Dr. A. C. Humphries, chairman; report of committee on progress, Dr. Louis Bell, chairman; symposium on illuminating glassware, by Messrs. A. J. Marshall, L. W. Young, G. H. McCormick, F. L. Godinez and Bassett Jones, Jr.; *The Manufacture of Glass from the Viewpoint of the Illuminating Engineer,* by Mr. E. H. Bostock; *An Analysis of Requirements in Modern Reflector Design,* by Mr. F. L. Godinez; *Recent Small Gas-Lighting Units,* by Mr. F. H. Gilpin; *Flames Carrying Electric Current,* by Mr. C. F. Lorenz; *The Production and Form of Natural Gas from the Illuminating Engineer's Standpoint,* by Mr. G. S. Barrows; *Recent Developments in the Manufacture of Incandescent Lamps,* by Mr. J. E. Randall; *The New Quartz-Tube Mercury-Arc Lamp,* by Mr. George C. Keech; *The Law of Conservation as Applied to Illuminating Calculations,* by Dr. A. S. McAllister; *The Photometry of Lighting Units of High Intensity,* by Messrs George H. Stickney and S. L. E. Rose; *Photometry at Low Intensities,* by Dr. Louis Bell; *Evaluation of Lamp Life,* by Messrs. P. S. Millar and L. J. Lewinson; *Distribution of Luminosity in Nature,* by Dr. H. E. Ives; *Light Distribution—Its Influence Upon Illuminating Efficiency and Visual Acuity,* by Mr. A. J. Sweet; *Résumé of Legislative Enactments on Illumination,* by Mr. E. L. Elliott, and *Selling Illumination,* by Mr. F. B. Rae.

ENTERTAINMENT FEATURES.

The following entertainment features have been provided: A two-hour automobile ride for the ladies with afternoon tea on Monday, Sept. 25. On Monday evening a reception and dance will be held at the Congress Hotel. On Tuesday afternoon there will be an automobile ride for the ladies, with light refreshments at the South Shore Country Club. On Wednesday afternoon the delegates will be taken to various places of engineering interest, while a theater party has been arranged for the visiting ladies. A five-dollar subscription banquet will be held at the Congress Hotel on Wednesday evening.

Program of Fall Convention of N. E. L. A. New England Section.

As previously announced in these columns, the New England Section of the National Electric Light Association will hold its fall convention Sept. 27-29, at the Mount Washington Hotel, Bretton Woods, N. H.

On Wednesday evening there will be an informal reception and dance, and at the first session the next morning the following papers will be presented: *Synchronous Converters,* by Mr. C. T. Mossman, General Electric Company; *The National Electric Light Association System of Accounting as Applied to Small Plants,* by Mr. H. E. Gidney, Malden Electric Company. Thursday afternoon will be devoted to recreation, and in the evening there will be a banquet. The meeting will conclude with a session on Friday morning, at which the following papers will be presented: *The Line-Type Tungsten Lamp,* by Mr. Norman Macbeth, Westinghouse Lamp Company; *Application of Electricity to Domestic Uses,* by Mr. W. H. Vorce, Vermont Power & Manufacturing Company, St. Albans, Vt. Miss O. A. Bursill, Boston Edison Company, 149 Tremont Street, Boston, is secretary of the association.

Boston Automobile Show.

Plans for the Pleasure-Car and Commercial Vehicle Exhibitions to be held in Mechanics' Building, Boston, the former March 2-9, 1912, and the latter March 13-20, 1912, are being matured rapidly. The shows are conducted under the auspices of the Boston Automobile Dealers' Association and the Commercial Motor Vehicle Association. Mr. Chester I. Campbell, secretary of the Boston Automobile Dealers' Association, who is manager of the shows, has issued blank applications and diagrams of space and reports that applications are fast coming in. There will be about 114,000 sq. ft. of exhibition space. Mr. Campbell says that the representation of electric vehicles and cars will probably be larger than ever before, and that the electric interests may have a section by themselves. In view of the fact that electric-driven vehicles have trebled in the past year and a half in the section about Boston, the interest in that class of cars will be much greater than before. The allotment of space will take place on Oct. 1.

Lighting Rates in Toledo, Ohio.

Late last week the Toledo (Ohio) Railways & Light Company sent out notices that all lighting contracts which do not come up to the requirements of the Schreiber ordinance—8 cents per kw-hour with a discount of 1 cent per kw-hour if bills are paid by the 10th of the month—will be abrogated on Sept. 30. Officials stated that a number of contracts provide for a rate lower than this, having been made because of the existence of certain conditions that warranted it at the time. It is estimated that there are about 500 of these contracts in force now. Notices were sent only to those who are paying less than the rate fixed in the ordinance. Those who have such contracts, it is stated, may make temporary arrangements to have the service continued pending the determination of the proper charge through the suit which the city has instituted for that purpose. It is not yet known whether any changes will be made in the charges that are made to the business houses for lighting and motor service. The schedules must be furnished the Public Utility Commission by Sept. 30, and the matter will be decided before that time. City Solicitor Schreiber states that there is nothing in the new ordinance to prevent the company from making a reasonable classification of its lighting consumers so long as it does not exceed the rate fixed, and that the City Council has no legal authority to fix rates for energy consumed for power purposes. This lies between the company and the Public Utility Commission, as changes cannot be made without the consent of the latter.

Canadian Hydraulic Plant Opening at St. Timothy.

The formal opening of the generating plant of the Canadian Light & Power Company took place at St. Timothy (Que.) on Aug. 31. Miss Robert, sister of E. A. Robert, the vice-president and general manager of the company, pushed the button which started the operation of two 8000-hp generators. Although the full capacity of the plant has not yet been placed in operation, practically all of the power developed by the company has already been sold. A large number of shareholders and the directors were present, together with a number of ladies, the party having been conveyed to the power house by special train from Montreal. A luncheon was tendered to the shareholders by the directors.

When the whole installation is completed the generating station at St. Timothy will have a capacity of 75,000 hp, which will all be transmitted to Montreal, to be distributed to customers in that city, among which w[ill] be the Montreal Street Railway, control of which was obtained by the Canadian Light & Power interests in November, 1910, at which time Mr. E. A. Robert was elected president of the railway company.

Sanitary District Street-Lighting Contract in Chicago

Apprehension is felt lest, owing to the political squabbles of the trustees, the Sanitary District of Chicago [be] seriously delayed in carrying out its contract with the [city of] Chicago to install and operate 10,000 additional [flaming] arc lamps for street lighting. This contract was [executed] Oct. 27 of last year, and it provides that the new lamps shall be located and platted by the city electrician at the rate of not less than 500 each month, beginning [not later] than six months from the date of the contract (or [Apr. 27,] 1911). When 3000 lights have been located in this [way the] locations and plats are to be submitted to the electrical engineer of the Sanitary District, and then he and [the city] electrician shall determine upon the location of new [sub-sta]tions to be constructed by the District.

According to the terms of the contract, furthe[r, it is] declared that not less than 3000 arc lamps, or their [equiva]lent in other lamps in the consumption of electrical energy, shall be placed in operation in each year for a per[iod] of three years. It will be impossible for the first 3000 [to be] placed in operation within a year from the date [of the] contract, and this situation is said to be due partly [to the] delay of the Sanitary District in awarding the contr[act for] lamps and partly to delay on the part of the city electrician in indicating the location of the lamps. The city elec[trician,] again, is said to attribute his delay to the failure o[f some] of the Aldermen to indicate where they wish ad[ditional] lamps erected in the thirty-two wards of the city.

At present, as already related in the *Electrical Wo[rld], the* Sanitary District has entered into contract with th[e Gen]eral Electric Company and the Stave Electrical Co[mpany] to furnish 250 flaming-arc lamps, each to be tested [under] operating conditions for two or three months. The [result] of this test is intended to influence the awarding [of] the initial contract for 4000 lamps.

Austin Municipal Hydroelectric Plant.

The contract that was recently entered into by th[e] Commission of Austin with William B. Johnson, of [Hart]ford, Conn., representing the Hydraulic Properties [Com]pany, of New York, for the reconstruction of the [old] dam across the Colorado River and the installation [of a] hydroelectric plant, which work shall cost $1,720,00[0, has] just been ratified by vote of the people of the city. [Owing] to the fact that these public works are to be paid f[or out] of the earnings of the municipal electrical plant [the] right to vote on the proposition was not confined t[o] taxpayers. The original dam was washed away e[leven] years ago by a flood in the river. Several attempts [have] been made since then to bring about its reconstruction, but none of the plans was successful. Under the terms of the present contract the city is to pay to Mr. Johnson $10[0,0]00 for the completion of the dam and hydroelectric plant and the rest of the $1,720,000 is to be paid in semi-annual installments of $32,400 each without interest. The contractor is required to operate the power plant during this ter[m] of years and deliver to the city all power generated, being required to install equipment capable of producing 720[0 h]p. A minimum of 600,000 hp-hours per month is guaranteed. The dam will have a height of 65 ft., which is 5 ft higher than the old dam, and will be of concrete construction. In

[illegible] the dam or power plant is washed away the contractor must replace it or lose all unpaid instalments. He is also required to keep the works in first-class repair during the [illegible] five-year period. [illegible] the power of making and regulating the rates for water and electric lighting. One of the important features of the project is the large lake that the dam will create, which the city plans to make one of the greatest pleasure resorts in the South. The contract stipulates that the lake shall [illegible] to the city of Austin. Besides the dam and hydro-[illegible] plant, the contractor must construct a water-storage [illegible]r of 10,000,000-gal. capacity for the purpose of [illegible] on hand a reserve supply for the use of the city, [illegible] must also install pumps to keep this reservoir full. [illegible] works must all be finished within two years. Pre-[illegible] construction work has already been started, and it is stated by Mr. Johnson that the entire works will be finished within one year.

[illegible]s Angeles Aqueduct Hydroelectric Project.

[illegible] communication to the Public Service Commission [illegible] Angeles dated Aug. 23 Mr. E. F. Scattergood, chief [illegible] engineer of the Los Angeles Aqueduct Commission notes that the board of public works, with the approval of the Public Service Commission, has determined that the initial generating station for the development of [illegible]ctric power on the Los Angeles aqueduct shall [illegible] of a partial development at the San Francisquito [illegible] power site, consisting of three generating units with a total rate capacity of 30,000 hp and peak-load capacity of 37,[illegible] hp, together with the necessary transmission lines and a terminal station in the city. The power site is located on the aqueduct about 47 miles north of Los Angeles.

[illegible]ecifications for the main power-house equipment, consisting of waterwheels, generators and transformers, are already prepared and as soon as they can be printed will be advertised. Bids will be received up to about Oct. 20. In the absence of unforeseen delays the engineer reports that the generating station should be ready for operation at the end of December of next year, at which time it is understood the aqueduct will be in operation.

Mr. Scattergood asks that provision be made for the distribution of this electrical energy in the city of Los Angeles. He appears to favor municipal ownership rather than selling the energy at wholesale to existing electric-service companies. The city electrician also asks the city to formulate a policy, as the matter of street lighting is involved.

Workmen's Compensation for Injuries in Electrical Lighting and Power Companies.

By R. S. Hale.

Bulletin No. 90 of the Bureau of Labor for September, 1910, gives considerable information on the subject of workmen's compensation for injuries in various countries and for numerous businesses, including "electrical lighting and power establishments."

The laws in the different countries differ very largely in details, so largely that a complete analysis would be impracticable, but the following is a general outline.

There are four chief items that are of interest, namely: (1) The payments in case of death; (2) the payments in case of disability; (3) the waiting period after the accident before payments begin; (4) the rate or cost expressed as percentage of the payroll.

Below I give these items for the different countries with notes that will bring out certain interesting points.

STATISTICS OF WORKMEN'S COMPENSATION IN VARIOUS COUNTRIES.

	Death [illegible]	Disability Benefit.	Waiting Period	[illegible]	
[illegible]	[illegible] dependents.	[illegible]	4 weeks	1.8 per cent	Average of mutual associations.
[illegible]	Four years' wages..	60 per cent of wages during disability, but not exceeding full wages for six [illegible]	13 weeks	2.4 "	Stock company.
				2 [illegible]	[illegible]
[illegible]	[illegible] years' wages	60 per cent of wages during disability, but not exceeding full wages for six years.	None	3.33 "	Stock company.
[illegible]	[illegible] 40 per cent of wages to dependents.	60 per cent of wages during disability.	6 days	1 [illegible]	Average [illegible] mutual company.
[illegible]	Pensions of 60 per cent of wages to dependents.	66⅔ per cent of wages during disability	4 days	[illegible]	Stock company.
[illegible]	Pensions of 60 per cent of wages to dependents.	66⅔ per cent of wages during disability	13 weeks	1.32 "	Average of mutual associations including expenses.
[illegible]	Three years' wages	50 per cent of wages during disability	1 week	1 to 1.5 per cent	Stock companies.
[illegible]	Five years' wages..	50 per cent of wages during disability, but not exceeding full wages for six years	None	2.[illegible] per cent	Government Insurance Department.
[illegible]	Pensions of 60 per cent of wages to dependents.	70 per cent of wages during disability	1 day	2.4 "	Government Insurance Department.
[illegible]	Pensions of 50 per cent of wages to dependents.	70 per cent of wages during disability.	4 weeks	1.34 to 2.23 per cent	Government Insurance Department has been charging premium of 1.34 per cent, but reports average cost 2.23 per cent, which means [illegible] raised shortly.
[illegible]	Four years' wages................	50 per cent o wages during disability	7 days	3.75 to 6.75 per cent	Stock companies.
[illegible]	Three years' wages...............	50 per cent of wages during disability	2 weeks	2.55 to 4.05 [illegible]	Stock companies.
[illegible]	Pensions of 66⅔ per cent of wages to dependents.	66⅔ per cent of wages during disability	60 days	1.06 to 1.33 per cent	Stock and mutual companies.
[illegible]	Pensions of 66⅔ per cent of wages to dependents.	66⅔ per cent of wages during disability	3 days	1.73 per cent	This is the company that charges 1.33 per cent for waiting period of sixty [illegible]
[illegible]	Four years' wages.	50 per cent of wages during disability; but not exceeding full wages for [illegible]	2 [illegible]	[illegible] "	Stock companies.

In practically all cases the laws provide for compensation for all accidents except those arising from the negligence or gross misconduct of the employee, but do not provide for ordinary sickness not incident to the employment.

Occasionally there is provision for increasing the compensation in case of the employer's gross fault. In practically all cases the laws provide for partial compensation in case of partial disability and for a small sum for funeral expenses. In a few cases there is a provision for payment for medical attendance in cases of disability not resulting in death.

In practically all cases the laws provide for certain maxima and minima payments; for instance, that if the wages exceed a certain amount the payments shall be figured on that amount only, or that only some small fraction of the wages over that amount shall be considered, and, similarly, that the minimum payment shall not be less than a certain amount. These limits, however, are probably wide enough to include the great majority of employees.

In some cases the "waiting period" refers to an absolute waiting period for which no payments are made; in other cases only to a period before which no payments are made, but if the disability continues the payments cover the whole time.

In some cases there are several figures for benefit payments, according to circumstances. I have given a single figure that would express the result as simply as practicable without encumbering the statement with details.

The cost figures given are, in some cases, averages of the net figures for a period of years, and in other cases are the rates quoted by the companies offering insurance. As in the case of the benefit payments, I have made a simple statement in order to avoid cumbersome details.

In Quebec and New York the high rates of the stock companies are probably due to the fact that the laws were only recently enacted (in 1910). In British Columbia, where the statute (of 1903) is substantially the same, and if anything more severe, the rates quoted are distinctly lower. The reports of the experience of the New York Edison Company point to the same conclusion that these rates will come down, although the New York Edison Company, like the English electrical companies, would naturally show a low figure on account of the absence of overhead lines.

SUMMARY.

The ordinary death benefit appears to be either a pension of 50 per cent of the wages to the dependents—that is, widow or children—while they remain such, or about four years' full wages as a single payment.

The ordinary disability benefit appears to be 50 per cent to 60 per cent of wages during disability, reduced, of course, for partial disability.

The ordinary waiting period, excluding, as in Germany, cases where there are sickness insurance societies that take care of the first portion of the disability period, appears to be about a week, with, however, wider variations than in the case of the payments.

The cost when the schemes get in full swing so that full actuarial reserve is provided, and when the companies get down to a normal basis, appears to be from 1.5 per cent to 3 per cent of the payroll.

The actual cost will, of course, vary with the amounts of the benefits provided, with the waiting period required and with other circumstances not considered here, as for instance, the proportion of overhead lines or the efficiency of administration or leniency of arbitrators to those injured.

I think that the above gives a good general outline of the situation and of the costs (as reported in the government bulletin) for electric light and power establishments.

Maryland Commission News.

Mr. James E. Alfred, president of the Consolidated Gas, Electric & Power Company, and Charles M. Cohn, vice-president and general manager of the company, called on the Public Service Commission last week to give notice of a possible request for an extension of the time within which the company is required to answer certain questions put to it by the commission in connection with the complaints of the city against the present rates for gas and electricity. Mr. Aldred told Messrs. Laird and Hering of the commission that, despite the strenuous effo that were made by the company to supply answers by me, it had found the work harder than had been anticipa d, and that it might be necessary to ask for an extensi . Dr. Hering said that he should prefer to have from t company as complete a case from its viewpoint as it ca make so that the result of the hearing may be more r less permanent.

The commission has signed an order authorizing t Susquehanna Transmission Company to issue stock the amount of $1,031,000. The revenue from the sale f he stock will be used to reimburse the Pennsylvania W er and Power Company, which advanced the sum to th trans-mission company.

Massachusetts Commission News.

The Tyngsborough (Mass) Electric Light Comp cently petitioned for approval of an issue of new stock of the par value of $7,500. This company ganized in 1909, and up to the present time has not or operated any electric-light plant. It has never any of the stock authorized, which was $3,000. A ship consisting of Messrs. A. A. Flint and A. L. having built a generating plant and distributing has been carrying on the business of making and electricity in the towns of Tyngsborough and Du Mass., for about a year and a half. The members partnership are among the incorporators of the Ty ough Electric Light Company. The purpose of t posed stock issue is to enable the corporation to p all the property of the partnership used in the electr business and to continue the business.

From evidence brought out at the hearing it appe the Massachusetts Gas and Electric Light Commis that the property will fairly represent the capital asked for. The board says in its decision that the capital stock must first be issued so as to enable the holders to vote to increase the stock to the full amo $7,500.

The board has approved the issue of $7,500, in 300 at $25 per share, the proceeds to be applied to the pu of the property of Messrs. Flint and Derby. Shares r ing unsubscribed for by stockholders entitled to tak he shall be offered for sale in Boston.

The Massachusetts Gas and Electric Light Comm ers have approved the joint application of the Bever G & Electric Company and the Danvers Gas Light Co for consolidation under the name of the Beverly Electric Company. The Beverly company supplies Beverly and electricity in the towns of Wenham, field and Hamilton, as well as the city of Beverly. authorized in 1889 to engage in the business of electricity in the town of Danvers, but never has exe the right. The town of Danvers in 1889 establis municipal electric lighting plant and by consolidatic Beverly company acquires all the rights the Danvers pany has now, but will not gain any new rights as a the Danvers municipal plant; before it can enga supplying electricity in Danvers authority must be ob from the Selectmen of that town for location of li the public streets.

The Danvers company sells gas only in the tov of Danvers, which is a municipality contiguous to Be rly. It was organized in 1861 with a capital of $20,000, hich was increased to $30,000 in 1909. On June 1, 1911, it had a plant with a book value of about $50,000 and other sets of about $2,350. It owed $7,433. It paid dividends ir nly five years between 1885 and 1906. In the latter y it paid 3 per cent, in the following three years 6 per ce , in the last two years 6½ per cent. Since 1903 the company has been owned or controlled by the same interests as ose

...ng the Beverly Gas & Electric Company ... have been physically connected and in all essentials ... plant. With the ... gas will be reduced in Danvers ... per 1000 cu. ft. The Danvers company conveys ... Beverly company all its property and franchises and ...ter assumes all the liabilities and obligations of the ...mpany. The Beverly company is authorized to ...res of stock of $100 par value in exchange for ...standing shares of the par value of $50 each ...rs company.

...er simultaneously adopted the Beverly Gas & ...npany is authorized to issue 1216 new shares ... share, the proceeds of sixty-nine shares to ...ecial shares now out and the proceeds of 1147 ...y for additions and improvements to the plant ... January, 1911.

... Sidney W. Winslow, of the United Shoe Ma...pany, is president of the Beverly Gas & Elec-

CURRENT NEWS AND NOTES.

... ELECTRIC SIGNS.—The ... ...ssed an ordinance providing that electric signs ...ain less than the equivalent of one 16-cp light ...ft. of sign surface.

* * *

...A (CAL.) MUNICIPAL PLANT.—The annual re... Pasadena (Cal.) municipal lighting plant, which ...shed at an initial cost of $200,000, gives the ... the fiscal year ending July 30, 1911, as $110,-... this total $70,268.20 represents the sale of elec... ...er kw-hour.

* * *

... ENGINEERING AT UNIVERSITY OF LOUISVILLE.— ... University of Louisville has equipped a building for ...ring courses, including electrical engineering, and ...ion in these departments will commence this fall. ... W. M. Anderson is in charge of the course in elec-...

* * *

... THE AUTOMATIC TELEPHONE IN CHICAGO.— ...nt Frisbie, of the Illinois Tunnel Company, in a ...ent this week said that his company has now over ... automatic telephones in active operation and 37,000 ... subscribers awaiting installation, and that by Oct. 1 service will be opened to St. Louis, Bloomington, Springfield, Peoria, Indianapolis and intermediate points.

* * *

...TRIFICATION OF SWISS RAILWAYS.—The commission which since 1904 has been studying the subject of the electrification of all Swiss federal railroads, which aggregate a length of 1830 miles, has recommended the adoption of the single-phase system, with overhead construction instead of ...rd-rail. It is estimated that there will be a saving ...lectric traction of about 10 per cent. The first line ...lectrified is the St. Gothard railway.

* * *

... CENTRAL-STATION LOVING CUP.—The Duncan ...c Manufacturing Company, of Lafayette, Ind., presented a handsome loving cup to the winning baseball team at the recent convention of the Ohio Electric Light Association held at Cedar Point, Ohio. The cup was won by the central-station men's team and the name of each player is engraved on one side of the cup. It is the intention to exhibit the cup in the offices of the different players, each man to have the cup for a certain length of time.

* * *

OUTING OF WESTERN ELECTRIC COMPANY'S TELEPHONE DEPARTMENT.—The tenth annual outing of the telephone engineering department of the Western Electric Company was held at Ravinia Park, Ill., Aug. 19. A special train over the Chicago & Northwestern Railroad conveyed the party to the park, where baseball and track games were held, followed by a dinner in the open. A symphony concert concluded the day's pleasures, after which the party boarded the special for Chicago again.

* * *

COMMONWEALTH EDISON COMPANY PURCHASES LAND AT QUARRY STREET.—The Commonwealth Edison Company of Chicago has purchased for $81,250 about 2⅔ acres of land fronting on Quarry Street, the South Branch of the Chicago River, Evans Slip and the Chicago & Alton Railroad. It is part of the site of the large Quarry Street generating station and was formerly held under long lease from the trustees of the Northwestern University, but the company has now purchased the fee.

* * *

ELECTRIC LIGHTING IN RUSSIA.—There are only sixty-two central stations in European Russia. On the other hand, St. Petersburg has the largest number of incandescent lamps in use in proportion to population of any city in Europe, being 440 per 1000 as compared with 240 for Vienna, 185 for Paris, 184 for London and 176 for Berlin. The corresponding figure for the Borough of Manhattan, New York, is over 2000, and for Brooklyn over 1000. The rates per kw-hour in Russia vary from 12½ cents for Kiel to 16½ cents for St. Petersburg and 25 cents for Moscow.

* * *

VERMONT ELECTRICAL ASSOCIATION.—The Vermont Electrical Association will hold its annual meeting at Lake Dunmore, near Rutland, Vt., on Wednesday and Thursday, Sept. 13 and 14. The executive session will be held on Wednesday morning at 10:30 a. m; at 3 p. m. there will be a session for the reading and discussion of papers and in the evening a banquet and smoker. The second day there will be a ball game between the supply men and the central-station men, and the rest of the day will be devoted to trips to points of interest about the lake. Prof. W. L. Upson, of the University of Vermont, will deliver an address at a session on Wednesday afternoon at which one paper will also be presented.

* * *

SEATTLE MUNICIPAL CENTRAL STATION.—In a recent address Mayor Dilling of Seattle spoke of the growth of the municipal lighting system of his city, which to date represents an investment of $3,360,000. He said that on Aug. 1, from records of the superintendent, the city had 15,736 customers, 20,000 poles, 20,000 miles of wire, 921 street arc lamps, 5130 street incandescent lamps and 1398 poles with cluster lights carrying from one to five lamps each. The earnings of the system for the year 1910 totaled $598,500, while the revenue for the current year is estimated at $800,-000. An election on Sept. 5 authorized a bond issue of $1,000,000 for the extension of the lighting system, which will enable the capacity of the plant to be increased from 14,000 hp to 90,000 hp.

* * *

SAN BERNARDINO A DOUBLY LIGHTED CITY.—The contract for lighting the streets of San Bernardino, Cal., has heretofore been held by the Lytle Creek Light and Power Company, the officials of which understood that their agreement continued in force until Sept. 1. The new contract for the next year, obtained by the Pacific Light & Power Company, was scheduled to go into effect Aug. 1. When the Pacific company installed its service on this date the Lytle Creek officials refused to turn off their lamps until Sept. 1. As the result, the city enjoyed a double illumination of its streets until the middle of August, when the municipal officials ordered the Lytle Creek company to discontinue service. The company will demand payment for the entire month of August.

Commonwealth Edison Section of N. E. L. A.—The Commonwealth Edison Section of the National Electric Light Association will hold its first meeting after the summer intermission at Handel Hall, Randolph Street and Wabash Avenue, Chicago, on Tuesday evening, Sept. 5.

* * *

Indiana Central Stations.—According to a map of the electric-lighting plants in Indiana, exhibited by Secretary J. V. Zartman, of the Indiana Electric Light Association, at the association's recent South Bend convention, there are 265 central stations in the State. Of these 191 are privately owned and seventy-four are municipal plants.

* * *

American Electric Fan for British Queen.—An American manufacturer has furnished an electric fan for Queen Mary of Great Britain, which will be used for the purpose of drying her hair. It is mounted in gold and has an ebony switch, and was designed to harmonize with the appointments of Her Majesty's boudoir. It is said to be the most costly electric fan ever manufactured in America.

* * *

Hertzian-Wave Fog Signals.—The French government has ordered the establishment of three stations along the coast of France from which to transmit Hertzian-wave fog signals. Each station will emit a distinctive telephone note every 30 seconds, and repeat during 10 seconds a letter of the Morse telegraph code. The telephone notes selected for the three stations correspond to given wave-lengths or frequencies.

* * *

Gasoline Trucks Not Allowed on Steamship Piers.—The gasoline-truck interests have not yet been able to secure admission of gasoline cars on the piers of large steamship lines, notwithstanding strong effort on their part. Representatives of some of the foreign lines state positively that consent will not be given under any circumstances, while others plead the operation of insurance rules. There is, of course, no objection to electric trucks.

* * *

Annual Outing of Employees of Goulds Manufacturing Company.—The annual outing of the employees of the Goulds Manufacturing Company, Seneca Falls, N. Y., was held at Cayuga Lake Park on Aug. 23. Aquatic and track sports occupied the time of the picnickers, who numbered close on to 2000. The outing was the first given by the company and it is the intention of the management to continue them as a means of cementing their organizations more closely.

* * *

Electricity in Textile Mills.—The backward state of industrial electricity in Great Britain is indicated by the appointment by the British Textile Institute and the Institute of Electrical Engineers of a joint committee to conduct an investigation on the application of electricity in textile mills. Apparently knowledge of the great progress in this country in the utilization of the electric drive in such mills, which dates from about 1894, has not penetrated to the British Isles.

* * *

Electricity Brought to a Head.—In a popular-magazine article relating to a controversy in one of the government departments it is stated that the facts were brought out in testimony before a Congressional committee. This statement is followed by the sentence: "Now the electricity engendered by all this friction has come to a head." This figure of speech would seem to belong to what the rhetoricians style mixed metaphors. The conception of electricity coming to a head, like a boil, is curious.

* * *

Fire Losses and the Careless Use of Matches.—Of 3875 known causes of fire in Chicago in 1910 1089 were due to the careless use of matches. For the United States and Canada fire losses the first six months of this year totaled $129,000,000, compared with $99,000,000 for the same period last year. Since during the latter half of the year the heaviest losses occurred, the total fire loss for 1911 is expected to be $260,000,000. These losses added to the cost of fire prevention total $450,000,000 annually, and represent one-half the value of all new buildings erected in the year. The annual per capita fire waste in Europe averages $0.33 and in the United States $2.51.

* * *

International Congress of Applied Chemistry.—eighth International Congress of Applied Chemist being held in Washington Sept. 4-13, 1912. The orga committee includes the president, past-presidents and tary of the American Electrochemical Society an president of the American Institute of Electrical Engi and among members of the executive committee are E. G. Acheson, W. D. Bancroft and L. H. Baekeland. of the sections will deal with india rubber and plastics, another with electrochemistry and a third physical chemistry, while conservation of natural res will divide a section with political economy. Prof. Burgess is vice-president, and Dr. E. F. Roeber sec of the section on electrochemistry, and Dr. W. R. W is president of the section on physical chemistry, to Dr. G. A. Hulett, of Princeton, is attached.

* * *

Lighting of Elevated-Railway Crossing Subwa Chicago.—In a recent communication Mr. William C city electrician of Chicago, declares that none of the crossing subways under elevated-railroad tracks in C is properly lighted. There is a dispute between th road companies and the city as to who should light subways, and a test case is now in the courts. meantime, Mr. McGann, the commissioner of public of Chicago, has caused to be formed a commission c ing of an electrical engineer from each railroad co affected, the electrical engineer of the Sanitary D and the city electrician to formulate a comprehensiv for the electric lighting of steam railroad grade cr and subway crossings. The plan proposed by th electrician and approved by the commissioner of works provides for one 16-cp lamp for each 400 sq. street surface to be lighted and contemplates the r of all arc lamps and high-potential wires from the c subways.

* * *

Ottawa Lighting Rates.—At a meeting of the directors of the Ottawa Power Company (Canada) an announcement was made that the company would give cons commencing Sept. 1, the choice of two things—either to make contracts with the company for lighting at th ent rates offered by the company or at the same ra now charged by the commission of the municipal lighting plant. The Ottawa Electric Company now supplies 17,000 customers, but as the announcement applies to domestic lighting only, and not to commercial premises, about 12,000 homes will be affected. Mr. A. A. Dion, manager of the Ottawa Electric Company, announced that the new rates of the municipal plant will be copied, but the old rates will main in force until the customers of the company come and request to make new contracts with the Ottawa Electric at the municipal plant's prices, which come into effect on Oct. 1. If any reduction is made in the latter plant's rates the customers of the company will be given the benefit of the reduction. According to Mr. Dion, the reduction in the municipal rates will not mean anything to the individual customer, although the city officials claim that their revised scale will secure a reduction of 12 per cent to 25 per cent on an average.

NEW HIGH-TENSION TRANSMISSION SYSTEM IN CONNECTICUT VALLEY.

AN important addition to the high-tension electric transmission system of New England has been in operation for about a year in the Connecticut Valley district of Massachusetts under the management of the Easthampton Gas Company and the Amherst Power Company. The enterprise includes the introduction of hydroelectric service into the Amherst, Easthampton and Mount Tom districts and the construction of an auxiliary steam turbine generating station and substation at Mount Tom Junction, from which facilities for power distribution throughout a ... are available. A conspicuous feature of the work ... operation of a steel-tower transmission line 8.5 miles ... between Amherst and Mount Tom, the line delivering energy purchased from the Turner's Falls Power ... at 23,000 volts to the Easthampton Gas Company. The construction work of the enterprise has been ... by the local companies under the direction of Mr ... Turner, supervising engineer, and the consulting engineer of the undertaking is Mr. N. J. Neall, of Boston, formerly of the firm of Thomas & Neall, New York ...

... the establishment of the Mount Tom generating station and substation and completion of the steel-tower line from that point to Amherst energy was transmitted from the Turner's Falls plant to Amherst by a three-phase circuit carried on a wooden-pole line, the distance being ... This line has been retained in the new development, the extension to Mount Tom Junction being carried ... towers. The line has been designed for ultimate ... at a potential of 66,000 volts. The auxiliary turbine plant at Mount Tom Junction was installed in order ... continuous service of adequate capacity, the amount of power available at Turner's Falls being somewhat limited in view of the industrial possibilities of the Easthampton region.

The transmission line between Amherst and Mount Tom consists of ninety-three steel towers of the so-called Rockingham type and two river towers carrying the line across the Connecticut River at Mount Tom to the generating station of the Easthampton Company, the latter being located on the west bank of the stream and connected with the local centers of distribution by a 4600-volt, three-phase service.

In the construction of the transmission line nine dead end

Fig. 2—Method of Placing Steel Tower Anchors.

towers, five towers with 7-ft. extensions, one tower with a 14-ft. extension, and seventy-six standard towers were erected. One mile of pole line was built to connect the steel tower line with the old line in Amherst, and the 4600-volt service from Mount Tom station to Easthampton is 4 miles in length, wooden-pole construction being followed throughout.

The standard tower consists of an A-frame built of steel angles, the structure being 12 ft. square at the bottom and about 50 ft. high. In general, the vertical members are built of 3-in. x 3-in. x 3/16-in. angles, the horizontal members being as a rule of 2-in. x 2-in. x 1/8-in. angles, and the diagonal bracing 1½-in. x 1½-in. x ⅛-in. angles at the bottom and ½-in. round rods in the balance. The standard tower is built in seven vertical sections varying in height from 8 ft. to 6 ft. 2½ in., and the tops are approximately 7 ft. in width. The standard height of the nearest conductor to the ground is 45 ft. 1 in. Each tower

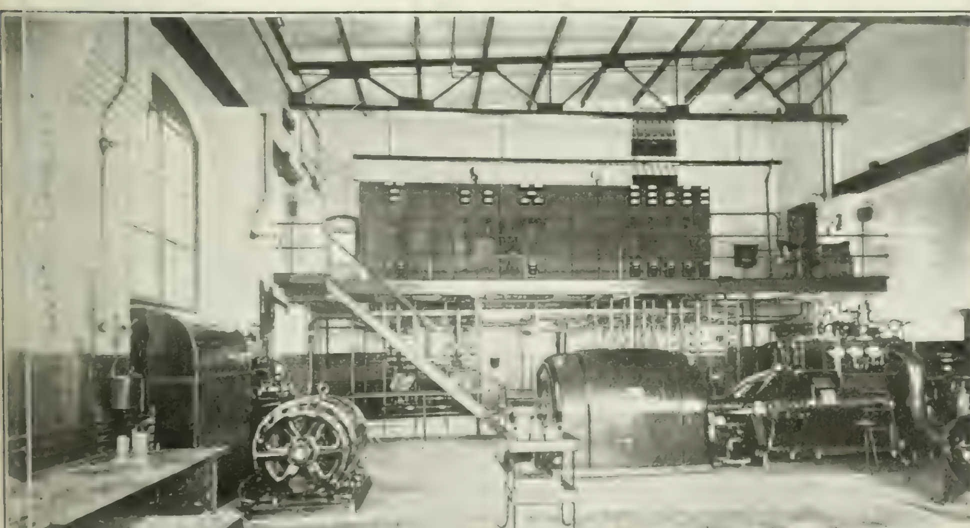


Fig. 1—Interior of Easthampton Power Station.

is surmounted by a ¾-in. pipe 4.5 ft. long, carrying three ⅜-in. round rod lightning projections 2 ft. in length. A 7/16-in. steel ground wire is also carried from tower to tower above the transmission wires. The standard span

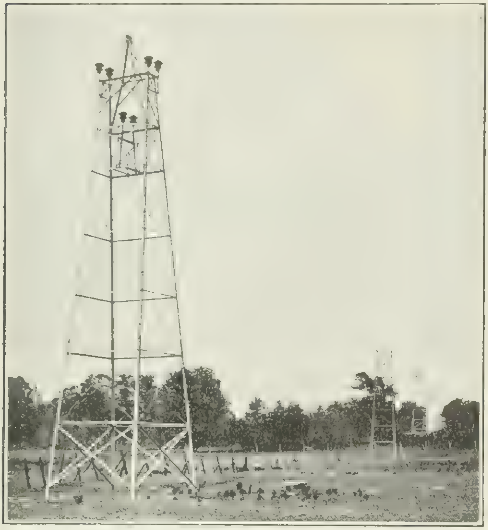


Fig. 3—Transmission Line with Dead-End Tower in Foreground.

between towers is 500 ft., and the maximum span, at the Connecticut River crossing, is 1200 ft. The line wire is seven-strand No. 2 B. & S. copper cable carried on quadruple-petticoated Thomas porcelain insulators 14⅞ in. in height, which are spaced on a 6-ft. 10½-in. equilateral triangle.

The towers are anchored in concrete or earth foundations, according to the nature of the soil encountered. The towers were assembled on the ground, rights of tower location having been purchased from landowners. They were erected by the use of gin poles, a force of twelve men usually being required. The maximum number of towers erected in a single day was fourteen, the contractors for this work being Messrs. Fred T. Ley & Company, Springfield, Mass. The tower anchors were located by the use of adjustable templates built of angle irons and round rods, as shown in the accompanying illustration. In the location of the anchors holes were first excavated at the approximate corners of the tower. Planks were then laid across the holes in a diagonal fashion and the template was lined up against the timbers and leveled. The anchors were then attached to the template at the corners and the holes backfilled or concreted. The templates were then removed and the towers attached to the anchors.

The dead-end towers are provided with slightly heavier angles than the standard structures and are also equipped with two pins, one on each side of the tower, carrying each phase wire. Two transpositions were made in the line between Mount Tom and Amherst. All joints in the wires were made with McIntyre connectors and a telephone circuit of ¼-in. steel wire is carried on the towers about 10 ft. below the transmission circuit and transposed at every tower. The insulators are carried on pins composed of 2-in. extra heavy pipe. On account of the variations in the height of the water in the Connecticut Valley, particularly in the lowlands bordering the river near the crossing of the line from the east to the west bank, the towers near the shore are provided with a foundation facing of concrete 5 ft. in height to protect the structure from floating ice.

The river crossing is supported by two dead-end towers carrying the conductors 60 ft. above the ground, the base of the tower being 18 ft. square in each case. In place of copper the span across the river consists of three special Siemens-Martin steel cables ½ in. in diameter each. The cables were cut to length and pulled to the proper sag by the use of turnbuckles, the construction being shown in the accompanying drawing. The top of each river crossing tower is equipped with an angle-iron framework carrying four insulators in a single row for each phase wire, but in place of the wire the insulators carry a steel plate clamped to their tops, the plate tying the four insulators together in each phase and being provided at each end with a turnbuckle 18 in. in length to which the phase cable is clamped.

The insulators are spaced 2 ft. 8 in. apart in seriatim and the supporting strap is supplemented by carrying the conducting steel cable to approximately the middle point, joining the cable to the No. 2 line wire by a Dossert connector. The strap is 4 in. wide and ½ in. thick and is bolted to the clamps which surround the insulator heads, as shown in the accompanying photograph made before the copper and steel line wires were joined. Each river tower is equipped with a grounding bar installed on each side of the structure and the conductors are each tied into the tower by three strain insulators, so that in case of a break in the line at the tower the phase in trouble will immediately be grounded.

The standard attachment to the insulator employed on the line is shown herewith, and it consists of a double helical tie of No. 4 copper on each side of the insulator, making two pairs of loops around the insulator cap. The main conducting wire is carried across the top of the insulator through a porcelain bushing, and just outside the bushing on each side the helical tying is begun and continued for a distance of 6 in., the end on each side being carried completely around the groove in the insulator head and continued down the phase wire away from the insulator for 6 in. more, so that the total length of tie wire is 12 in. on each side of the insulator.

The generating plant and substation at Mount Tom is a structure of brick, concrete and steel located beside a spur track of the Boston & Maine Railroad and within about a hundred yards of the river. The generating station proper is about 90 ft. long by 70 ft. in width and at the east end of the building is located a substation or transformer room 40 ft. x 25 ft. in plan. A boiler room 67.5 ft. x 47 ft. and a turbine room 57.5 ft. x 40 ft. in dimensions divide the power plant into two fireproof sections, temporary walls being left on the north side of the station to

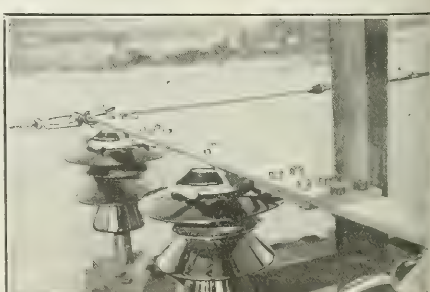


Fig. 4—Mechanical Connector at River Crossing.

provide for future increases in capacity. Beneath the boiler and turbine rooms is a basement about 20 ft. high containing condensing and pumping equipment, turbine foundations and piping. The transformer house is built

wo stories with a 7.5-ft. basement containing a tank and iping for cooling water service.

Coal is brought to the plant by rail and delivered into temporary storage bin at the west of the boiler room, proision for weighing it in hand barrows being made in front of the furnaces. Two 350-hp Heine water-tube boilers urnish the steam supply, these being operated at 160 lb. without superheating. The exhaust gases of the boilers lischarge through short tapering uptakes into a breeching eading to a Custodis radial brick stack 145 ft. high and 8.5 ft. in inside diameter. The stack foundations are carried lown to bed rock at a depth of 12 ft., the base of the founlation being 17 ft. square. In general the station foundaions are carried to bed rock, piles being used only in cases where the rock was over 12 ft. below the surface of the round, and the basement walls are thoroughly waterroofed. Where piles are used they are capped with conrete reinforced by old steel rails to prevent any cracking f the foundation where the concrete rests on the rock in ase of pile settlement. Outside walls are of brick, the ckness being 16 in. The boiler house and turbine room re provided with a concrete roof supported on steel trusses nd the transformer house is furnished with a similar roof arried on steel I-beams.

Water for boiler-feed and condensing service is drawn rom the Connecticut River by a 12-in. x 15-in. x 15-in. Vorthington duplex low-service steam pump, there being 14-in. pipe 700 ft. in length between the stream and a ell located just without the turbine-room doorway. The connections provide for the delivery of feed water to 500-hp National closed heater which raises the temperae to 200 deg. Fahr. before the water enters the boilers. e heater is by-passed and it delivers water to a 6-in. eed main running along the boiler fronts, from which sers lead to the steam generating units. From the boilers -in. steam delivery outlets connect with a 15-in. header rom which branches lead to the turbine and auxiliary pparatus. A 10-in. x 6-in. x 10-in. Warren feed pump andles the boiler water supply.

The present generating unit consists of a 1000-kva Westghouse turbo-alternator delivering three-phase, 60-cycle nergy to the busbars of the station at 4600 volts, the rbine being of the three-stage type, with a normal speed f 3800 r.p.m. It operates on a vacuum of 29 in. and the overnor is equipped with a motor control for the purpose f synchronizing the machine more readily with the inoming service from Amherst. The speed can be varied

Fig. 5—River-Crossing Tower.

bout 200 r.p.m. by the governor control, which is operated y a 1/10-hp, 125-volt Westinghouse direct-current motor. nergy for this machine and for the alternator fields is upplied by two exciters, one being a 50-kw machine directdriven by a 75-hp, 440-volt induction motor running at 2500 r.p.m. and the other a 50-kw turbo-exciter running at 2250 r.p.m. The latter machine is equipped with fan cooling apparatus and the generator winding is of the interpole type. The turbine is provided with a supply of air for cooling the generator through a duct carried under the floor from an opening in the north wall of the building. The turbine exhausts into a Westinghouse LeBlanc condenser located directly under the unit in the basement. The condenser is provided with an 8-in. discharge line to the river and takes injection through a 10-in. line connecting with the exterior well above mentioned. For starting the unit water for injection can be drawn from a tank located on the power-house roof, a 6-in. lead connecting with the condenser. The condenser air pump is driven by a Westinghouse steam turbine, which is operated at 1500 r.p.m.

Fig. 6—Transmission Line Crossing River.

Condensation from the local steam-heating system of the plant, which is served by the boilers through a reducing valve, is collected in a 200-gal. tank in the basement and thence returned to the boilers via the feed pump and heater. Other auxiliaries located in the basement include a 3-in. x 2-in. x 3-in. duplex turbine oil pump; a centrifugal sump pump driven by a 2-hp motor controlled by float switch, and two Kenney centrifugal pumps drawing water from eight driven wells for general plant service, each pump being driven by a 5-hp, 110-volt General Electric induction motor running at 1800 r.p.m. The motor starter for the roof-tank service is located on the switchboard gallery in

REPRESENTATIVE CONSTRUCTION COSTS, STEEL-TOWER LINE.

(8.5 MILES.)

	Cost per Tower	Per Mile
Haulage, all line materials	$8.90	$97.00
Haulage of towers only	4.28	46.80
Haulage, anchors only	.16	1.72
Setting anchors	3.38	37.00
Excavation	6.91	75.50
Stringing wire	13.25	145.00
Tower assembling	8.20	90.00
Tower erection	[illegible]	[illegible]
Tower protection against ice	[illegible]	[illegible]
Total cost of labor per tower, excluding contractor's profit	70.50	772.00
Right-of-way	124.00	[illegible]
Engineering, including preliminary surveys	16.10	
Overhead expenses, general	21.80	
Cost of material for line, $18,212; per tower, $196; per mile, $2,14[illegible].	..	
Cost of one river tower in place, $1375.	....	
Total cost of material and labor complete river span, $[illegible]		

the turbine room and mechanically connected to a float switch in the tank. The general service pumps are directly piped to the roof tank. The turbine room is served by an 8-ton Maris crane and a "Peerless" hoist of the same capacity is installed in the transformer room.

The incoming phase wires from the Amherst power system are brought into the substation through 36-in. Akron pipe bushings and after passing through disconnecting knife switches and choke coils the leads terminate in three 66,000-volt solenoid-operated oil switches located on the second floor of the substation. From this point the leads drop to the high-tension terminals of three 500-kw Westinghouse transformers of the water-cooled type, located on the ground floor of the building. These reduce the potential from 22,000 volts to 4600 volts and deliver energy to a busbar installation in the turbine room which is arranged to permit the separate operation of the steam and hydroelectric service if desired, although normally the two services are handled in multiple. The switchboard is mounted 10 ft. above the floor of the turbine room. It is of the remote-control type, energy being supplied for the operation of solenoid oil switches by the turbine exciter units. The height of the turbine room is 28 ft. and in the section directly below the switchboard are located the oil switches controlling the 4600-volt distribution and bus circuits of the system. The transformer house is 51 ft. in height and it is connected with the bus structure in the turbine-room by cables run in conduit. The high-tension conductors enter the substation from the steel tower line with a spacing of 48 in. apart on centers. The substation is separated from the generating plant by fireproof doors and the second floor is reached by an iron stairway.

Fig. 7—66,000-Volt Entrance Bracket.

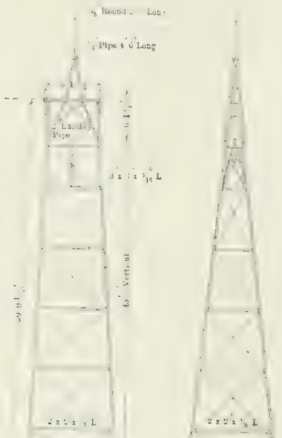


Fig. 8—Standard Type of Tower.

The switchboard is located on a reinforced concrete gallery and contains sixteen panels controlling the various machines, high and medium tension switches. The usual power-factor indicator, frequency indicator, voltmeter, ammeter, regulating and recording equipment is installed. A bus-junction panel is provided which enables the steam and hydroelectric services to be paralleled after the usual synchronizing. Each feeder panel is equipped with an ammeter induction wattmeter and overload relay connecting with the 4600-volt oil switches on the floor below. The switchboard is lighted effectively by eleven 16-cp incandescent lamps mounted in a horizontal tin-lined reflector hung by wrought-iron pipe about 10 ft. above the gallery floor. House lighting and small motor service is supplied through three 5-kw transformers distributing energy from a cabinet situated on the switchboard gallery near the operating desk. By means of a double-throw switch the house lighting can be thrown upon either direct or alternating-current service at 110 volts, providing an emergency means of illumination in case of trouble on the alternating-current systems.

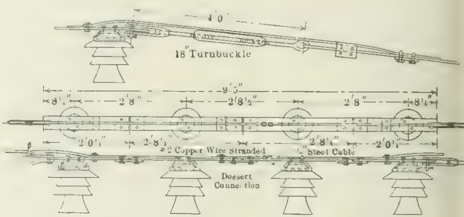


Fig. 9—Conductor Attachment at River-Crossing Tower.

The West Boylston textile mills are the largest consumers of the company's service at present, but it is anticipated that a substantial increase in the amount of manufacturing in the vicinity of Easthampton will result from the introduction of the company's power. The Easthampton company distributes energy in the community within radius of the station, and the large textile mills above mentioned will shortly double their capacity.

The accompanying selected cost data have been obtained through the courtesy of the engineers in charge of the design and installation of the high-tension line.

TEST ON GROUNDS IN IOWA SOILS.

The accompanying table gives results reported on the resistance of different types of grounds and ground plates by the committee on "grounded secondaries" of the Iowa Electrical Association at its recent convention at Davenport. The tests at Ames were carried on under the supervision of Professor Fish, of the department of electrical engineering, Iowa State College, while those at Iowa City were under the supervision of Professor Ford, of the department of electrical engineering, Iowa State University. The committee, which has been in existence several years, made a report at the 1910 convention. Part of the grounds reported upon under the tests at Ames were measured last year. The resistance this year of these grounds as compared to a year ago is given in the table

puted below in the column which is headed "Relative to Last Year."

In its report the committee called attention to the fact that the grounds at Ames were constantly moist, while those at Iowa City were on top of a hill where the moisture was less constant. This accounts for the difference in results. The grounds at Ames were in black soil, where water was found 5 ft. below the surface at the driest time of the year. Tests at certain grounds were discontinued because the results were so variable that it was not considered worth while to continue the test. The Garton-Daniels ground in charcoal, which is practically the same as an iron plate, was discontinued because its resistance had [illegible]sed so much in the first year that it was difficult to [illegible]re with the regular instruments used.

[illegible] committee noted that there is more variation be[illegible] maximum and minimum resistance at different sea[illegible] the charcoal grounds than in earth, and also noted [illegible] all of the resistances are higher than last year. There [illegible]s increase of resistance in the grounds in earth than in charcoal. The grounds using copper plates show higher resistance than grounds of iron plates.

TABLE OF GROUND RESISTANCES

SUMMARY OF RESULTS AT AMES, IA.

	Ohms Maximum	Ohms Minimum	Ohms Mean	Relative	Relative to Last Year	Ratio of Maximum to Minimum
[illegible] earth	12.0	[illegible]	[illegible]	1.18	1.28	[illegible]
[illegible] charcoal	16.8	[illegible]	12.9	1.54	1.55	2.02
[illegible] earth	10.8	7.1	8.6	1.02	1.13	[illegible]
[illegible]tes in charcoal...	32.0	[illegible]	[illegible]	2.34	2.31	[illegible]
[illegible] plates in earth...	15.1	[illegible]	11.3	[illegible]	[illegible]	[illegible]
[illegible] charcoal	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] earth	[illegible]	[illegible]	13.0	[illegible]	[illegible]	[illegible]
[illegible] charcoal...	Discontinued					
[illegible] ft. earth....	[illegible]	[illegible]	11.6	1.38	[illegible]	[illegible]
[illegible] ft. charcoal	[illegible]	[illegible]	22.1	2.63	[illegible]	[illegible]
[illegible] ft. earth	Discontinued					
[illegible] ft. earth	11.6	6.2	8.4	1.00	[illegible]	[illegible]
[illegible] ft. earth	11.8	7.5	9.8	1.17	[illegible]	[illegible]
[illegible]nes in earth.....	34.0	14.2	22.8	[illegible]		[illegible]
[illegible]nes in charcoal....	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]

SUMMARY OF RESULTS AT IOWA CITY, IA.

	Ohms Maximum	Ohms Minimum	Ohms Mean	Relative	Relative to Last Year	Ratio of Maximum to Minimum
[illegible]	540.0	45.8	175.0	8.15		[illegible]
[illegible]niels in coke	[illegible]	15.6	21.5	1.00		[illegible]
[illegible]	119.0	58.0	88.5	4.11		2
[illegible]	236.0	34.4	[illegible]	5.5		[illegible]
[illegible]n earth, 5 ft	139.0	28.5	68.2	3.17		[illegible]
[illegible]	[illegible]	[illegible]	99.5	4.63		[illegible]
[illegible] earth, [illegible] ft	[illegible]	[illegible]	[illegible]	1.9		[illegible]

[illegible]ofessor Ford, of Iowa City, in commenting on the tes[illegible] said that the results upset all previous ideas about the superiority of grounds in coke and charcoal, and other fairly expensive grounds. The simplest and cheapest grounds of old iron pipe show up better than the more expensive types. He thought the reason for the failure of coke and charcoal to show good results was the fact that they are not pulverized as finely as earth. Therefore they do not retain moisture as well as earth, and it is the moisture-retaining qualities of the material surrounding a ground that determine its constancy. He gave the following results of a test he had made on the relative resistance measured between two plates buried in different kinds of material in a vessel filled with water up to the level of the top of the material: Gravel, 1800 ohms; water from tap, 400 ohms; sand, 1000 ohms; black loam, 517 ohms; charcoal, 680 ohms. These tests showed the influence of the size of particles on resistance and the fact that the resistance depends on the moisture.

HYDROELECTRIC STATION AT CLINTON, MASS.

Municipal Plant at the Wachusett Reservoir Dam, Energy from Which Is Sold to the Connecticut River Transmission Company.

By the closing of a switch at the power plant at the dam of the Wachusett reservoir at Clinton, Mass., by an agent of the Metropolitan Water & Sewerage Board on Aug. 10, 1911, the State of Massachusetts entered on the sale of electrical energy for commercial uses. This is said to be the first instance of a public water supply being used for the development of electric energy to be sold commercially. The event was made possible by a legislative act of 1895, which gave the board authority to utilize the fall of water at any dam under its charge for the production of power or electricity and to transmit such power or electricity by pipes, wires or other suitable means, and sell the same, or the right to use such water, by written or other contracts, for a term not exceeding fifteen years.

In the present case the Water Board has entered into a five-year contract to supply the energy that is generated at the Wachusett dam to the Connecticut River Transmission Company, of Brattleboro, Vt. It is probable that most of the energy will be used by the Lancaster mills at Clinton, to which it has been resold by the transmission company. The energy will be paid for at the rate of 5.3 mills per kw-hour.

The Metropolitan Water Board will draw daily about 100,000,000 gal. from the Wachusett reservoir for the supply of the metropolitan district. This water has a fall of about 90 ft. at the dam. The Legislature of 1908 made an appropriation of $115,000 for the installation of a power plant and last December the board entered into a contract with the S. Morgan Smith Company, of York, Pa., for the construction of the plant, the price being $71,500, and the work was begun in February of this year. The plant is installed in the granite gate house and consists of four turbine units of the spiral-case, horizontal-shaft type, direct-connected to 1000-kva, 60-cycle, three-phase generators. Each turbine takes its supply of water from a vertical pipe having an outlet 4 ft. in diameter. The outlet area of the draft tube measured at right angles to its axis is 38½ sq. ft. The size of each turbine unit is such that when the wicket gates are fully open and the speed is 400 r.p.m. the discharge under a head of 90 ft. is between 160 cu. ft. and 170 cu. ft. per second. The gates are of the wicket pattern, made of steel forgings, with gate and spindle in one piece. The mechanisms for opening and

Fig. 1—Dam and Power Plant.

closing the gates are on the outside of the spiral cases. Each unit is equipped with a governor of the relay type made by the Lombard Governor Company and the governors are fitted with a remote controlling device operating on 60-cycle alternating-current energy from the station switchboard. In addition to the four main Westinghouse generators there are two auxiliary direct-current generators to be used as exciters, connected to two turbines, one

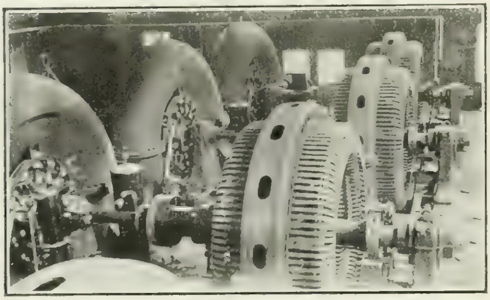


Fig. 2—Interior of Power Plant.

of 90 hp, the other of 110 hp. The completed plant is designed to deliver three-phase, 60-cycle energy at a nominal pressure of 13,800 volts.

The Connecticut River Transmission Company, to which the energy is supplied, has a substation at the Lancaster mills, ½ mile from the dam, and the energy hitherto supplied the mills was brought over its high-tension line from Vermont. There are connected to the lines two frequency chargers, each of about 2000-kw rating. The new plant is designed to operate in parallel with the plants of the Connecticut River Company.

There are three 25-kw air-cooled, oil-insulated transformers in the station so connected that polyphase energy will be available in the station whether the plant of the board is operating or not. The secondary terminals are connected to the three-phase bus on the service panel. The connection with the high-tension bus is made through fuses on the station side of the main meter.

Each of the two transmission lines is provided with electrolytic lightning arresters installed in a concrete lightning-arrester house at the end of the underground cables.

Mr. Dexter Brackett is chief engineer of the Metropolitan Water Works and Mr. E. R. B. Allardice, local works superintendent, to whom the *Electrical World* is indebted for the interior views reproduced, has charge of the plant. Mr. B. C. Thayer is electrician. Prof. W. L. Puffer acted as consulting electrical engineer for the installation.

In order to adjust matters of taxation by the town of Clinton, in which the plant is located, the Legislature of 1909 passed special legislation which fixes the value of the works at $125,000, on which the town may levy its tax.

On the first day of its operation, Aug. 10, only one unit of the plant was operated, but a second unit was put in operation on the following day and before the end of the month the third unit will be used. The fourth unit is to be held in reserve as an auxiliary should repairs be need

The Wachusett reservoir contains when full ab 65,000,000,000 gal. of water and has a surface of 41 acres. The main dam is 850 ft. between terminal stru tures. It is 185 ft. thick at the bottom and 25 ft. thi at the top and has a maximum height above rock foun tion of 207 ft. The water is 129 ft. deep. The dam a reservoir cost the State $11,000,000 and required ten ye to complete. The basin formerly contained a popul village, mills, schoolhouses and churches.

A STEAM-PLANT TRANSMISSION SYSTEM F HARRISON COUNTY, IA., AND WASHINGTON COUNTY, NEB.

By W. A. Trussell.

The old central station in small towns, operated sing seems to be losing ground in favor of the transm sion system supplying service to a half dozen more towns. The latter system, moreover, appears to the only means whereby certain territory with small po lation may be profitably served.

In 1909 the Bullock Public Service Company bought old electric-light plant at Missouri Valley, Ia., 3800 p lation, and also the plant at Blair, Neb., 3500 populat 15 miles distant; later the plant at Logan, Ia., population, and 9 miles from Missouri Valley, was chased. Because of the small size of the towns and adverse conditions under which the older central stat were operated, these plants had never made any m for their owners. They have now been replaced b modernly equipped central generating plant.

A 625-kva turbo-alternator has just been installe

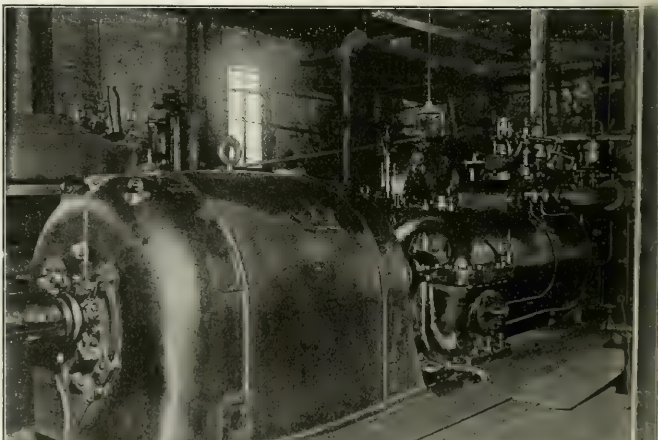


Fig. 1—650-kva Turbine at Missouri Valley, Iowa.

Missouri Valley, and 16,500-volt transmission lines b Logan and Blair, with a 2-mile branch from the gan line to Magnolia, Ia., 300 population. A number of ter prising farmers who had been operating a gasoline ant built a 2-mile line to connect with the 2300-volt loc dis tribution in Missouri Valley and are now enjoying r able twenty-four-hour service. Other towns in the ter tory will have service as soon as arrangements can be m e.

At Missouri Valley 2300-volt, three-phase service is used for the local distribution, and at Blair and Logan 150 volts. Owing to the small size of Magnolia, voltage is stepped down from 16,500 to 230-115 volts, three-wire, for local distribution. On Sundays the old Blair plant is run and carries the load for the entire system. This keeps

Fig. 2—Span Over Missouri River at Blair, Neb.

the Blair plant in order for emergencies and gives time to clean boilers or make repairs at Missouri Valley.

One of the interesting features of this installation, from an engineering standpoint, is the crossing of the transmission line over the Missouri River near Blair, Neb. As the town is 2½ miles from the river and it is intended to serve other towns near Blair, the main line of 16,500 volts, three-phase, was carried across the river to that town.

Two 100-ft. steel towers were used at the river. They were bought with holes punched and sections numbered, and were built up on the concrete foundations. The towers are 20 ft. square at the base, tapering to a double A at the top 10 ft. wide. A 10-in. x 12-in. x 10-ft. oak cross-arm is

Fig. 3—Details of Tower and Break Insulator for Main Line of 16,500 Volts.

fastened to the top "saddle." The towers are double-guyed on three sides to concrete anchors with ⅜-in. galvanized messenger cable.

The three cables over the river are spaced 4 ft. apart for the 1200-ft. span and have 30-ft. sag. These cables are seven-strand, ⅜-in. steel, with a heavy copper jacket, and are fastened to double-break insulators at the towers. Guy cables of ½-in. messenger are fastened to the other side of the break insulators, and passing over the cross-arm are anchored in concrete set in the ground 200 ft. back from the towers. This construction leaves very little strain on the towers, except the holding weight of the guys and span cables. A large factor of safety has been provided for all strains.

Extra heavy windmill-type towers were used at all railroad crossings, and 30-ft. white cedar poles were set for country lines.

The turbo-alternator, switchboards, transformers and aluminum cell lightning arresters were made by the Westinghouse Company. The river towers were built and the switchboards and all high-tension apparatus were installed under the direction of Mr. W. A. Trussell, of St. Charles, Mo. Mr. E. A. Bullock, Omaha, Neb., is president and general manager of the Bullock Public Service Company.

A SEMI-GRAPHICAL METHOD FOR DETERMINING THE REGULATION OF TRANSFORMERS AND TRANSMISSION LINES.

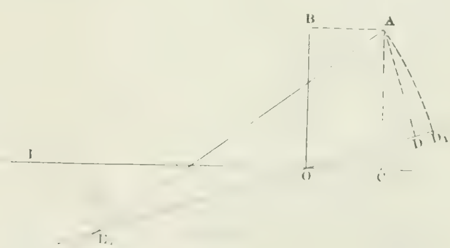
By H. Bewlay.

The simplest method, theoretically, of calculating the regulation of any inductive circuit is doubtless the one involving the use of the circle diagram. While this method is all that could be desired theoretically, and is satisfactory for some purposes, like all graphical methods it is accurate in practice only when the various quantities involved in the construction are of similar magnitude. This, unfortunately, is a condition seldom if ever found in practical work of the kind under consideration.

To obtain satisfactorily accurate results when considering the regulation of large modern transformers, a diagram having a radius of 50 in. to 100 in. is necessary. The drawing instruments for diagrams of this size require two men to handle them and are, at best, very cumbersome.

The problem as applied to transmission lines has been solved by the use of a table of factors[1] for various frequencies, wire sizes and angles of lag. These factors may be found in the *Electrical World*, Vol. 46, in an article on "Regulation and Efficiency of Transmission Lines," by Dr. Harold Pender.

Having a large number of problems involving inductive circuits, the writer worked out the following method which will be found simple, convenient and sufficiently accurate for all practical purposes. The error in the first result is appreciable only under conditions of very large drop and



Method of Determining Regulation of Transformers and Transmission Lines.

can easily be eliminated by again substituting the value found by the first calculation in the equation and then obtaining a second approximation.

[1] A very complete table giving the physical and electrical constants of wire and the inductance of transmission lines for the various standard spacings will be found in the "Standard Handbook for Electrical Engineers," p. 627.

In the accompanying illustration let

OE_x be the delivered voltage;

AE_x be the generated voltage;

OC be the IR drop;

OB be the IX drop, and

$\overline{OA}$ be the IZ drop.

The power-factor of the receiving circuit is the cosine of angle IOE_x, which is the angle of lead of the emf. Draw AD perpendicular to $\overline{OE_x}$ and with E_x as a center draw an arc through A intersecting OE_x prolonged at D_1. The triangle E_xOA is the familiar triangle of pressures. As ADE_x is a right angle

$$\overline{AE_x}^2 = E_xD^2 + AD^2 \qquad (1)$$

$$AE_x = E_xD_1$$

$$E_xD^2 + AD^2 = E_xD_1^2 = E_xD^2 + \overline{DD}_1^2 + 2\,\overline{E_xD} \times \overline{DD}_1 \qquad (2)$$

$$\overline{DD}_1 = \overline{AD}^2 \div (2\,E_xD + \overline{DD}_1) \qquad (3)$$

As $\overline{DD}_1$ is generally very small compared to $2\,E_xD$ it may be dropped from the fraction (3) without great error, and

$$\overline{DD}_1 = \overline{AD}^2 \div 2\,E_xD \qquad (3A)$$

If $\overline{DD}_1$, $\overline{AD}$ and OD are expressed in per cent of E_xO then

$$\overline{DD}_1 = \overline{AD}^2 \div (200 + 2\overline{OD}) \qquad (3B)$$

In using this method the drops, OC and OB, are laid off on cross-section paper to a suitable scale and point A is thereby located. Draw an arc having a radius of 100 arbitrary units and with O as a center for a power-factor circle Draw OD for any desired power-factor and erect AD perpendicular to OD. Measure AD and OD and, by formula (3A) or (3B), calculate DD_1. This first approximation is usually sufficiently exact, but if the value of $\overline{AD}$ is large or great accuracy is necessary a second value may be obtained by substituting in equation (3) the value of DD_1 found by equation (3A).

The accuracy of the method when the graphical work is done to a convenient scale may be shown by solving Case 1 in the *Electrical World* article mentioned above, using a sheet of 8-in. x 10-in. cross-section paper, a 5-in. compass and a 10-in. slide rule for all calculations.

Data.—Three-phase, three-wire balanced system.

Power delivered, kw, 500.

Voltage delivered (between wires), 10,000.

Power-factor, per cent, 80.

Resistance (one wire), ohms, 18.72.

Reactance (one wire), ohms, 1.078.

Calculations.

$$\text{Current per wire, amp,} \quad \frac{500{,}000}{10{,}000 \times 0.8 \times \sqrt{3}} = 36.1 \text{ amp.}$$

$$\text{Emf, neutral point to any wire, volts,} \quad \frac{10{,}000}{\sqrt{3}} = 5780.$$

$$\text{Per cent } IR \quad \frac{36.1 \times 18.72}{5780} \times 100 = 11.7.$$

$$\text{Per cent } IX = \frac{36.1 \times 1.078}{5780} \times 100 = 0.673.$$

Per cent $AD = 6.5$; $OD = 9.77$; DD_1 by (3B) $= 0.192$;

$$OD_1 = OD + DD_1 = 9.96.$$

The correct regulation as given in the article is 9.92 per cent, and hence the error in the drop is 0.4 per cent. This error is well within the limits of error of the slide rule and the graphical work and the allowable error in practical calculations of this nature.

The error due to dropping DD_1 from equation (3) is very small for diagrams of the usual proportions. The following table gives the amount of this error in terms of E_xD for various values of AD.

$AD \div E_xD$.	**Error** Equation (3A).	**Error** Second Approximatio
0.1	+0.000013	
0.2	+ 0.0002	— 0.000002
0.4	+ 0.003	— 0.0001
0 8	+ 0.04	— 0.0042

From the above table it will be seen that a second a proximation is necessary only when $AD > \frac{E_xD}{4}$; in e treme cases where $AD > \frac{E_xD}{2}$ a third approximation m sometimes be desirable.

VARIATION OF RESISTANCE WITH TEMPER TURE SHOWN BY NERNST GLOWER.

By ALBERT A. SOMERVILLE.

THE Nernst lamp is the development of Prof. Walth Nernst, of Göttingen University, who produced t glower which bears his name while investigati certain substances, such as thorium, cerium, zirconiu erbium, tythrium and glucinum, used in the Welsba mantle. Among these Dr. Nernst experimented with ma nesium oxide mixed with porcelain, which, while an ins lator when cold, he found to be a good electrolytic cond tor when hot. The present Nernst glowers or filaments a made from kaolin.

Owing to the high resistance of the glower when co the lamp is started by heating the glower with a match by means of an automatic electric heater. This elect heater is cut out of circuit by an electromagnet as soon the glower begins to conduct. The glower resistance creases rapidly as its temperature increases, so a ballast balancing resistance having a large positive temperat coefficient of resistance must be used in series with it. T ballast usually consists of an iron wire, sealed in glass prevent its oxidation and surrounded by hydrogen to c duct heat away more rapidly.

Since the glower in operation is intrinsically very bri it must usually be inclosed in a ground-glass shade wh used as a light source for interior illumination. This hi intensity also permits its use as a point source of light be reflected from the moving mirror of a galvanomet giving an excellent mark on a scale or screen.

On account of the electrolytic nature of the conduct occurring in the glowers they are used generally on alt nating-current lines and last longer under this condit than when on a direct-current line. The platinum hea is also gradually destroyed due to vaporization of platinum below its melting point, but the iron ballast n last for years. The watts consumption per candle-po varies with the number of filaments in parallel, due to mutual heating effect of one filament upon the other, radiation varying as the fourth power of the absolute t perature.

The usual form in which these filaments are put on market is that of comparatively short, thick rods which connected in multiple to make up the required candle-po of the unit. Each rod or filament is about 13 mm in le and 1 mm in diameter. In the present series of tests, h ever, most of the measurements were made by using single-glower filaments connected in series, the resist of the pair being, of course, four times that of the s units connected in parallel. The resistance was meas by means of a dial bridge, no dummy leads being since the resistance of the lead wires could easily be lected in comparison with that of the filament itself. greatest source of possible error was due to thermal e for the thermal emf set up between a Nernst filament a platinum wire connected to it is larger than that for other two elements or alloys known to the writer. By connecting in series the glowers lying parallel with

ther, however, their terminals could be brought to within lmost 1 mm distance and thus to almost exactly the same mperature, unless the temperature gradient was quite rge, which could be prevented by inclosing the glowers a suitable furnace. Thermal emfs were thus neutralzed or reduced practically to zero, for the arrangement sed gave four junctions, with the emfs set up in adjacent oints neutralizing each other in case the two ends, about 3 mm apart, were not quite at the same temperature. The lowers could be insulated either by suspending the whole pecimen in the air or by placing a strip of mica between e lead wires, mica being the only substance known to the

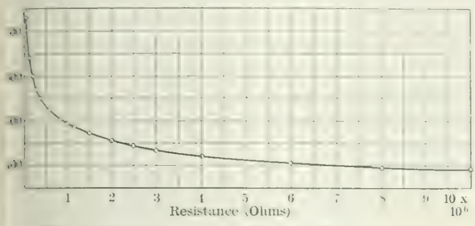


Fig. 1—Resistance Between 400 and 700 Deg. Cent.

ter that does not become a conductor at temperatures 1100 deg. C. or higher.

The heating was done in a 110-volt direct-current electical resistance furnace which could be readily controlled y means of a rheostat. The furnace, which takes a aximum current of 12 amp at 110 volts, is similar to one ready described in the *Physical Review*, September, 1910, nd in the *Electrical World*, Nov. 17, 1910.

As there was no difficulty due to oxidation or danger of e specimen melting at the temperature attainable in such furnace, the principal points to be observed after mountg the specimen, in good condition, horizontally in the bular furnace were to measure its resistance frequently, eanwhile gradually increasing the temperature of the rnace and measuring this temperature at the same time at resistance readings were being taken. Usually the mperature could be run up to a maximum in about three urs' time.

A platinum resistance thermometer was used to deterine temperatures up to about 1000 deg. C., while a platium platinum-rhodium thermo-junction was employed beond the range of the platinum thermometer. The resistce thermometer was connected to a Callendar automatic

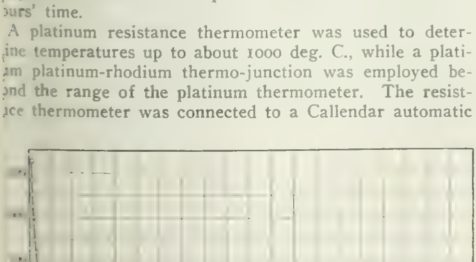


Fig. 2—Resistance Between 500 and 1100 Deg. Cent.

mperature recorder and so gave a temperature-time cord of the first part of the run. As it was not advisable use the resistance thermometer much above 1000 deg. the latter was taken from the furnace when this temperature was reached, and the run continued without interruption. Temperatures above this were read by means of a potentiometer and the thermocouple, one junction of which had been in the furnace during the entire time the furnace had been heating. An excellent calibration was obtained on the resistance thermometer and a fairly good

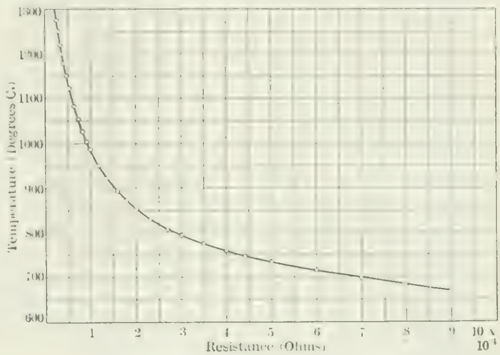


Fig. 3—Resistance Between 700 and 1300 Deg. Cent.

one was secured for the thermocouple. The actual temperatures were then computed, and the resistance of the Nernst filament was plotted against temperature, as shown in the accompanying curves.

The upper limit of the Wheatstone bridge was 10,000,000 ohms, so that this value was the first resistance measured, as shown in Fig. 1, the temperature being about 390 deg. C., as nearly as could be determined. The resistance then drops very rapidly with increase in temperature, decreasing about 9,000,000 ohms in 100 deg. rise in temperature. Using a scale, which is necessary to show the first part of the curve to advantage, that part of the curve above 700 deg. is of little or no value, as it appears to be simply parallel to the X or temperature axis.

In Fig. 2 a second curve has been prepared, plotting resistance on a scale ten times as large as in Fig. 1, and discarding the upper part of the curve above 1,000,000 ohms. In Fig. 3 the scale of the resistance axis is again expanded to ten times that in Fig. 2, and, finally, in Fig. 4 the same axis is once more magnified until it reaches a scale 1000 times as great as in Fig. 1, the scales of the temperature axes meanwhile remaining the same for all the curves. The smoothness of the curves indicates the accuracy with which the work can be done.

The resistance of two filaments in parallel on a 110-volt circuit is about 100 ohms measured by the fall-of-potential method. The resistance of the same two filaments con-

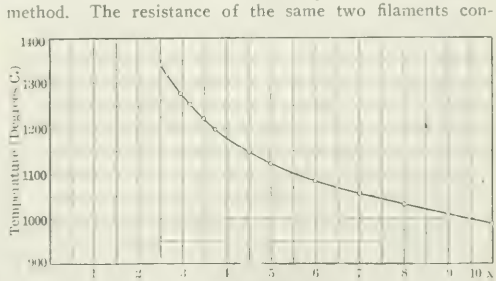


Fig. 4—Resistance Between 1000 and 1350 Deg. Cent.

nected in series would be about 400 ohms, but without knowledge of the temperature at which they operate the curve beyond that shown in Fig. 4 can only be conjectured.

The experimental work herein reported was performed at the physical laboratory of Cornell University.

THREE-WIRE BALANCERS.

By George T. Hanchett.

The direct-current balancer commonly consists of either a dynamotor comprising one armature with two similar windings and two commutators or a motor-generator consisting of two similar machines coupled together. The per-

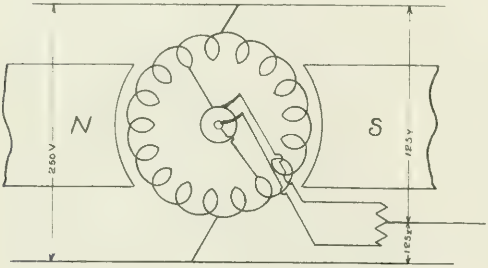


Fig. 1—Three-Wire Balancer.

missible output of such a machine is theoretically the rating of one winding, but practically the armature drops and brush contacts become determining elements before such an output is reached. The brush-contact effect is often serious; the writer has noted cases where improvement in brush contact has restored a lack of voltage balance of 2 per cent or 3 per cent.

The three-wire machine offers some advantages over the types commonly used for direct-current balancer. This machine consists of a rotary converter, single-phase or polyphase, the collector rings of which are connected to the terminals of an auto-transformer balance coil, the neutral being taken from the common center. Such a machine is shown in Fig. 1. The mechanical advantages of the three-wire balancer over the two-machine balancer may be listed as follows: One commutator versus two, reduction of brush-contact trouble, two bearings versus three or four, compact structure, absence of torque in shaft or couplings. These advantages are to be considered seriously for the reason that the duty of the balancer is often a long-term duty, for it is frequently installed without reserve and must run continuously.

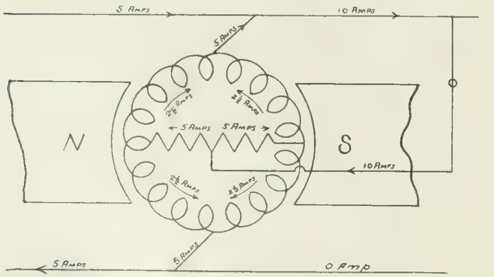


Fig. 2—Current Distribution in Balancer.

The writer has found that in spite of the elemental simplicity of this machine and its prototype, the three-wire generator, there is much misconception as to the action of the auto-transformer balance coil as well as pronounced confusion in considering emfs and currents existing in the system.

Referring to Fig. 2, it is most convenient to study first the current distribution within the system and second t voltages that obtain. In each case the collector rings ha been omitted to facilitate simplicity.

It is well to consider first the machine as one of perfe efficiency requiring no power to supply its losses and th to superpose the driving currents and the balance-coil cu rents in a manner which will be shown in the followin

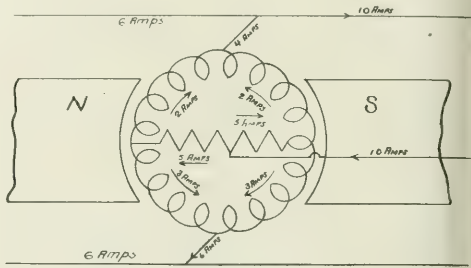


Fig. 3—Current Distribution in Balancer.

In the position indicated in Fig. 2 the balance coil is cc nected between equal potential points on the armatu winding. In other words, the alternating emf is in tl instance zero and the direct current from the neut: passes through the balance coil, which acts mer as a wire connector. It will be observed that t current splits at the common center and again at the t to the armature winding, half going upward to the pc tive brush and half downward to the negative. The up half of the armature acts as a generator supplying t extra 5 amp; the lower half is a motor supplying torque necessary to compensate for the back drag on upper half. The torques are balanced, there being as ma current-carrying wires in one direction under the no pole as there are in the opposite, and it is curious to n that both positive and negative brushes of the machine supplying current outward from the winding, one to load and the other back to the mains.

As the balancer requires current to drive it, say 1 a the current distribution is as shown in Fig. 3, the genera half of the armature carrying less current than the mo half and the negative brush supplying less current tl the positive. The torques are now unbalanced in favor the motor side, which causes the machine to revolve.

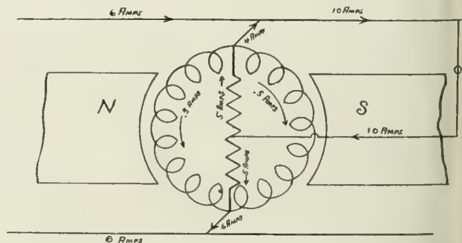


Fig. 4—Current Distribution in Balancer.

the condition shown in Fig. 4 the duty of supplying ne neutral-wire unbalanced current is deputed solely to ne balance coil, which now, being between points of oppc te potential, is on the crest of its emf wave and acts a transformer carrying 5 amp locally in the upper half and 5 amp locally through the lower half. he magnet-carrying current is supplied from the arma re

winding and should in this case be represented by an increased lower current and reduced upper current, but has been omitted for the sake of simplicity. In this position the armature winding carries only the current necessary to drive the armature, the torque current, it will be observed, being half the current carried in the case of Fig. 3 distributed through all the windings.

In intermediate positions, as for instance the 45-deg. position, the same current relations still remain. The effective torque remains the same, although it is now accomplished by surplus of "motor conductors" in front of the south pole to compensate the reduced "motor conductors" in front of the north. The emfs which produce these currents are due to a combination of the emfs in the balance coils and in the armature, and it will be observed by those who care to go into the mathematics of the case that the sum of the instantaneous emf in the balance coil and the integral of the emfs of the armature between the brush and the transformer tap to the winding is equal to one-half the commutator voltage, and, furthermore, this relation is true whatever electric angularity the balance coil with reference to the taps may have with the brushes.

There exists, therefore, the curious condition of a constant direct current in the balance coils, although the latter is subjected to alternating emf, this direct current being alternately propelled by a portion of the armature voltage and by the transformer action on the balance coil itself, the one supplanting the other in perfect symmetrical gradation.

It will also be observed that while the current in the balance coil is a constant load the current in the armature windings is variable, according to whether the portion under consideration is acting as a generator or motor. It is plain that in practice the brushes of such a machine will have to be set at the theoretical commutation zone, for one is commutating as a motor and the other as a generator. Fortunately for the commutation, the armature reactions of the balance currents neutralize one another and the one disturbing reaction is that due to the torque current, which is practically constant no matter what the load on the balancer may be and is always small, being merely enough to spin the armature in its bearings at the required speed.

A further feature of interest about this machine is the fact that the neutral cannot be shifted by changing the connection on the auto-transformer balancer. Considering the extreme case of the neutral tap being transferred to the end of the balance coil and tapped to the armature windings, the voltage would obviously rise from zero to double the normal half voltage in a succession of pulsating crests. If the frequency were high enough and the thermal inertia of lamp filaments great enough, practically no change in their brilliancy would be noticed. As the neutral tap is moved down the balance coil toward the center the surges of direct voltage begin to disappear and at center the emf is smooth and constant, but in no other position is the average value materially disturbed.

The neutral voltage can be shifted to either one side or the other only by virtue of the *IR* "drops" in the winding. These could be corrected very largely by splitting the pole pieces on the median line and winding the split halves with turns carrying current from the neutral winding, the effect of which would be to strengthen the generator half of the balancer and weaken the motor half. The operation would be automatically reversed if load were thrown to the other side of the three-wire system, thereby requiring a reversal of functions of the two halves of the armature. This device has never been employed, so far as the writer is aware.

Central Station
Management, Policies and Commercial Methods

INSTALLATION OF MOTORS IN DENVER.

The Denver Gas & Electric Light Company has made standard the use of 2200-volt motors for all sizes above 5-hp. All such installations are made with lead-covered cable in conduit and protected at service entrance with an overload no-voltage-release, oil-immersed circuit-breaker, covering the requirements of the National Electrical Code and Denver electrical ordinance.

MAKING BUTTER TO ORDER BY ELECTRICITY.

One of the customers of the New York Edison Company has a very up-to-date grocery store and has recently added to his list of electrically driven appliances a 1½-hp motor for driving a churn. His patrons purchase cream at the store and for a small charge have it made into butter on the spot. The method is not only an excellent advertisement for the grocer, but is also instructive for the children and others in the neighborhood.

THE FIELD FOR THE ELECTRIC COMMERCIAL VEHICLE.

It is estimated that at least sixteen times as much freight is handled by wagons as by rail, and that 3,000,000 power vehicles would be required in the United States to handle the freight and packages that can advantageously be transported by electric vehicle. In Boston alone about 25,000 tons of freight are hauled daily through the streets for distribution. The above figures indicate the great future of the commercial electric vehicle, and should be of particular interest to central-station men owing to the prospect opened for the sale of electric power for charging batteries under ideal load-curve conditions.

HIGH-TENSION DISCONNECTING SWITCHES IN CENTRAL STATIONS.

A central-station practice rapidly growing is to place disconnecting switches in series with the busbar side of high-tension oil circuit-breakers or switches so that when it becomes necessary to adjust or inspect the breaker mechanisms this can be accomplished without danger to the operator. Another useful feature is that should the oil breaker prove defective or develop short-circuits within itself the trouble can be localized by opening the disconnecting switches.

In station lightning-arrester installations the use of disconnecting switches is necessary if it is desired to maintain the arresters in operative condition. By locating the switch between the line and arrester section a circuit can be opened and the units, being entirely disconnected, can be safely cleaned, inspected and adjusted. Sectionalizing of high-tension busbars is also most economically effected by location of disconnecting switches in the busbar compartments.

Where the busbars are carried through trenches of concrete or brickwork the switches can be secured to the floor or side walls, as desired.

In a recent installation made by the Delta-Star Electric Company, of Chicago, Ill., illustrated herewith, the switches are mounted directly in the busbars of the heavier capacity circuits and on pipe framework for the smaller capacities. A flexibility of operation is thus secured which is very desirable and tends to increase the continuity of service by permitting instant localization of trouble. Proper use of such sectionalizing devices also insures a uniform workmanlike construction, the importance of which is obvious.

HOTEL PFISTER, MILWAUKEE, CHANGES TO CENTRAL-STATION SERVICE.

The Hotel Pfister, of Milwaukee, which has been the scene of many electrical conventions, has discarded its isolated plant and now obtains all its electrical energy from the Milwaukee Electric Railway & Light Company and the Milwaukee Central Heating Company. The hotel is located at the corner of Wisconsin and Jefferson Streets

Advertisement of Hotel Pfister Service.

and consists of nine stories, each 180 ft. x 117 ft. in floor dimensions. The building, with the servants' quarters and garage, contains 2,125,000 cu. ft. The elevator equipment consists of two passenger elevators, two freight elevators and one dumb-waiter rising the entire height of the building. These elevators are of the hydraulic type, operated by steam pumps.

The old steam plant consisted of four return tubular boilers rated at 100 hp each and equipped with Hawley down-draft furnaces. The boilers were built for 100-lb. working pressure, but this was reduced recently by order of a boiler insurance company. The old plant also includ three 110-volt Thomson-Houston dynamos rated respectiv ly at 40 kw, 50 kw and 90 kw, belted to a jackshaft, in tu belted to two Allis-Corliss simple non-condensing engine

Steam heating is maintained by direct radiation su plied by a single-line gravity system of piping. Lo pressure steam is used for heating the hot water us throughout the building and high-pressure steam is utiliz in various parts of the hotel as follows: Kitchens, 40 l pressure; Turkish bath, 25 lb. to 30 lb. pressure; laundr café and bakery, 80 lb. pressure. This steam was tak directly from the boilers.

In replacing a private plant with central-station servic and especially where hydraulic elevators are installed, tw serious problems arise. The first of these is the extensi use of steam for many purposes, and the second the oper tion of the elevators. In Milwaukee the central-stati company also supplies steam in the business district throu an allied company, and so the question of steam supply this instance was met by connecting the customer's i stallation to the company's steam mains in the street.

In the matter of the elevators, after carefully conside ing the advisability of replacing the hydraulic elevato with new elevators of the electric traction type, the co mercial engineering department of the Milwaukee Elect Railway & Light Company recommended the installation electrically driven three-stage turbine pumps, feeling th even if in five years the present elevators were replac by electric elevators the expenditure for the electric pum would be warranted, even though the traction type elevat could be operated somewhat more economically. The e vator service will be maintained by three 4-in. three-sta turbine pumps operated by 50-hp motors turning at 15 r.p.m. and equipped with Cutler-Hammer pressure reg lators and self-starters. These motors are of a late inn pole type, built by the General Electric Company und specifications of the National Board of Fire Underwrite The pumps were installed by the Alberger Pump Compa

Of course, the existing lamp and motor circuits in t hotel were supplied directly from the central-station co pany's mains. In summing up the recommendations to t management of the hotel the commercial engineering partment of the central-station company urged the stallation of a refrigerating plant operated by an elect motor whereby a saving of 50 per cent could be effec over the cost of ice purchased from local dealers.

Herewith is given a reproduction of an advertisem referring to the change of utility service in this w known hotel, the central-station company having ta advantage of this important accession to direct attention the fact.

ELECTRICAL PUMPING FOR MUNICIPALITI AND FOR IRRIGATION.

Among the largest potential customers for electrical ergy in this country are our cities, said Mr. B. H. Ga ner, power engineer for the Dayton (Ohio) Lighting C pany, in a paper on electric pumping read before the rec Ohio Electric Light Association convention at Ce Point. Practically every city owns and operates its o water system, and in the operation of these systems la amounts of power are used. Up to the present time v little has been accomplished by central-station compa in securing this business. Each year, however, see greater amount of this pumping being done with elec power, and the indications are that this business will g very rapidly during the next few years.

Of course the chief field for the possible use of elec power is in the main city pumping stations for the su of water for drinking as well as other domestic purpo

This load offers a great many attractive features from the central-station man's point of view.

In a general way there are two kinds of water-works systems in use in this country, one a direct system where no reservoir capacity is provided, the rate of pumping water varying directly as the demand for water, and the reservoir system, where a reservoir is provided so that water may be supplied after the pumps are shut down. Of the two systems the most attractive and the easiest to get on a profitable basis is, of course, the reservoir system. With such a system the pumping can be very largely done at such times as best suits the load conditions of the central station and so can be made practically "off-peak" business. For such business the central station can offer very low rates and still make a profit.

In a direct system of course the reservoir feature is lacking, and for this reason this pumping business does not offer so great an attraction for the central station. It must be remembered, however, that the greatest demands for water are during the months from April to October, when the demand for electric energy is least; and the demands for water are least from October to April, when the demand for energy is greatest. There is thus an annual diversity factor offered, even in direct systems, which is most attractive. Practically all new systems being installed have the reservoir feature, so that there is an opportunity for the central stations of the country to secure most of this business as "off-peak" business. For the direct systems that are already installed, probably the best method of securing this business is by advocating a combined station, the old steam equipment to operate during peak months, etc., and motor-driven pumps to carry the summer peaks. This arrangement gives the central station a diversity factor that should be most acceptable.

In many cities the suburbs are built upon hills that are often considerably above the city proper. In many cases the water pressure which is suitable for the main portion of the city is entirely too low for the suburbs, so that the pressure of the water furnished the suburb has to be boosted. Sometimes special high-pressure mains are provided for such suburbs, but a simpler way is by installing local motor-driven boosting stations in the suburb. This is business that the central station should have little difficulty in securing.

Mr. Gardner quoted from the *Electrical World* an account of the extent of irrigation pumping in Colorado and remarked that many persons have formed the erroneous idea that while irrigation is a good thing for the Far West, where there is little rainfall, it is not practicable in the East. But Eastern farmers will soon use irrigation for the same reason that they now use fertilizers, because the increased production of the land will much more than pay the cost.

Dr. Bailey, of Cornell University, a prominent agriculturist, said in a recent speech: "Now and then a forehanded farmer in the humid region, growing high-class crops, installs an irrigation plant to carry him through the dry spells. As our agriculture becomes more developed we shall greatly extend this practice. We shall find that even in humid countries we cannot afford to lose the rainfall from hills in floods, and we shall hold at least some of it against the time of drought, as well as for cities and for power. We have not yet learned how to irrigate in humid regions, for the practice of draining is equally involved, but we certainly shall apply water as well as manures to supplement the usual agricultural practices."

The president of the Western New York Horticultural Society in a recent address before 1500 fruit growers also said: "Last summer's drought, lasting three months, injured a great many crops, especially the apple crop, the fruit not being, on an average, over half size; all due, in my opinion, to the dry season in July, August and September. If we had had an abundant supply of water to turn upon the orchards the crops would have been saved."

When irrigation does come into its own the central-station load should be greatly increased. The ease and economy with which electricity can be transmitted over wide areas and used to drive motors make electric pumping preferable to the gravity system of irrigation in many ways. The pumps can be in comparatively small units, each supplying a local area. The distributing ditches are small, thus leaving maximum area for crops, and the water supply to each area is always under perfect control. There is minimum danger of broken ditches and flooded crops such as sometimes occur with large ditches.

The maximum practical cost of such pumping depends on the value of the crop and the cost of transportation to market. The height to which water can be pumped economically also depends on the same factors.

The quantity of water needed for irrigation varies with the location of the land, the nature of the soil, the kind of crop, the state of growth of the crop, etc. Some crops require more moisture than others and all require their greatest quantity of moisture during the season of most vigorous growth. An average of eight acre-inches per month during the irrigation season is considered ample in most cases. The irrigation season usually lasts about three months for each crop.

Tests made by the United States government indicate that where the water does not have to be lifted more than 25 ft. and where the cost of energy is 3 cents per kw-hour the cost of irrigation will not be more than $3 per acre-foot, or an annual cost of $6 for two acre-feet, the quantity usually needed per year.

When we take into consideration the enormous loss that the farmers each year suffer on account of droughts this seems a rather cheap way of overcoming this loss. To those companies which are so situated that water may be easily obtained it seems that irrigation offers an excellent opportunity to improve the central stations' load factor and raise their income.

Discussion.

An instance where a small town planning to install motor-driven pumps for its water works was threatened with an increase of 35 per cent on the rates of all insured property in the town unless steam was maintained was cited by Mr. Kaylor, of Norwalk, Ohio. The community had planned to purchase transmitted energy from a neighboring town, but the insurance companies declared any kind of electrical pumping to be a serious hazard. Refuting this charge, Mr. Gardner told of the use of motor-driven water works in many cities, including Duluth, and mentioned New York's electrically driven high-pressure fire-protection system. Mr. W. S. Culver, of Schenectady, N. Y., pointed out that the pressure of a standpipe would doubtless lower such a rate. The chief danger of discontinuity in electric service, he said, lies in the transmission line, which is most likely to give trouble during high winds, when serious fires are likely to occur. Mr. D. L. Gaskill, of Greenville, Ohio, advised against any central station's taking over the operation of a water-works system not equipped with a standpipe. Mr. J. C. Martin, of Wilmington, Ohio, observed that a profitable use for electric pumping lies in small individual outfits for pumping cistern and well water to houses, etc.

STEAM VS. CENTRAL-STATION ENERGY IN A MATTRESS FACTORY.

By F. B. Fletcher.

In getting the business of the Oates Mattress Company, which was the only mattress factory in the city of Little Rock, Ark., not upon the lines of the Little Rock Railway & Electric Company, that company submitted the following report of a test run upon the plant under actual operating conditions.

In this plant steam was supplied from the boilers to a 225-hp Corliss engine driving the furniture factory, to a 125-hp engine driving the mattress factory and to the dry kilns, hot rooms and heating system. Since steam was necessary for the operation of the main factory the item of labor saving in the boiler and engine-room could not be taken into the operating costs, but in spite of this electricity effects a considerable saving. Water is free, the plant being situated on the river bank. The capacity of the factory is 125 mattresses per day.

REPORT OF TEST.

Boilers and Engines

Two 125 rated horse-power fire-tube boilers, natural draft.
One 125 rated horse-power simple Corliss non-condensing engine, 14" x 36"; average clearance 5 per cent; connected to shafting by belt; diameter piston rod, 3".
Boiler feed pump, simplex, 7" x 5" x 12"

Total and Average Quantities

Method, alternate	
Duration of test	9 hours
Total quantity of coal fed to boilers	7,200 lb.
Total quantity of shavings fed to boilers	2,770 lb.
Total quantity of fuel	9,970 lb.
Per cent coal per pound of fuel	72.3 lb.
Total quantity water fed to boilers	60,250 lb.
Maximum horse-power required, all machines full load	57.7
Minimum horse-power required, shafting alone	24.6
Friction loss in shafting, horse-power	23.1
Average horse-power required to drive	40.5
Average horse-power required to drive less friction (40.5—24.6)	15.9
Average steam consumption of engine in pounds of steam per hp-hour	48.44
Average evaporation of boiler in pounds of water per pound of coal	6

Average pounds coal used per day equal $\frac{48.44 \times 40.5 \times 10 \times 72.3\%}{6}$

TOTAL MONTHLY COST OF STEAM PLANT.

Initial cost of engine and piping		$2000.00
Fixed charges—		
Depreciation—5 per cent on $2,000	$100.00	
Interest —6 per cent on 2,000	120.00	
Taxes and insurance—3 per cent on $2,000	60.00	
Total fixed charges		$280.00
Fixed charges per month		$23.33

OPERATING EXPENSES.

Coal at $2 per ton (average)	$61.50	
Repairs	6.25	
Engine and cylinder oil	6.00	
Belts	5.00	
Shafting oil	5.00	
Waste	.50	
Total	$84.25	
Total monthly expense		$107.58

Since the average actual consumption of power at the machines is 40.5 — 24.6 equals 15.9 hp, and since all frictional losses would be excluded by an individual motor drive, the number of hp-hours used per month would be $16 \times 10 \times 26$, or 4160 hp-hours, or 3120 kw-hours per month.

The maximum possible demand is 57.7 — 24.6, or 23.1 hp. It is proposed to install a Wright demand meter, and, assuming a maximum demand as registered by this meter of 25 hp and a monthly consumption of 3120 kw-hours, the monthly charge for energy would be $95.22, according to the company's power rate. This is equivalent to electrical energy at 3 cents per kw-hour.

In addition to the saving thus effected the importance cannot be emphasized too strongly of using central-station energy, since it insures absolute certainty and complete independence of operation. The mattress factory frequently operates thirteen hours per day, thereby entailing the necessity of keeping the boilers fired up and retaining the engineer and fireman over time. The cost of a breakdown at the engine or shafting is an intangible matter in a report of this character, but it is a very real item in the daily and economic operation of the plant.

Two tables accompany the report, one of which (A) gives the result of an economic time study of the power requirements of making one common mattress, includ-

TABLE A.—UNIT COSTS OF POWER REQUIRED TO PRODUCE ONE COMMON MATTRESS—WEIGHT, 45 LB.

Operation of Manufacture.	Weight of Material, Pounds.	Time Required, Hours.	Hp-Hours.	Cost in Cents. Steam.	Cost in Cents. Electricity.	Saving by Use of Electricity
Cutting coarse excelsior	57	.0925	.666	1.750	1.50	.250
Cutting fine excelsior	5	.025	.072	.190	.160	.030
Felting cotton	3	.0187	.027	.070	.060	.010
Wooling cotton	3	.0094	.0081	.02	.018	.003
Making ticks		.0333	.0143	.037	.032	.005
Stuffing ticks		.0084	.0047	.012	.011	.001
Sewing end of mattress		.0166	.00078	.002	.0017	.0003
Elevating mattress to second floor		.0082	.00236	.006	.005	.001
Total		*.2121	.79624	2.087	1.7877	.3003

*This does not represent the actual time, as these operations are simultaneous.

TABLE B.—SIZES AND TYPES OF THREE-PHASE, 60-CYCLE, 220-VOLT MOTORS.

Machine.	Make	Capacity per Hour.	Horse-power, Motors.	Form	Net Price F.O.B. Chicago.	Shipping Weight, Pounds.	Revolutions per Minute, Motor.	Size Motor Pulley in Inches. Actual.	Size Motor Pulley in Inches. Necessary.	Revolutions per Minute, Machine.	Pulley on Machine in Inches. Actual.	Pulley on Machine in Inches. Necessary.
1	2	3	4	5	6	7	8	9	10	11	12	13
Horizontal coarse-cut excelsior	L. T. Kline Co	400 lb.	25			1470	1200	10	6	209	35	57½
Vertical fine-cut excelsior	Fischer-Davis.	200 lb.	5			840	1200	5	3½	175	24	34⅜
Two felting machines (each)	Phila. Textile Co.	160 lb.	5			840	1200	5	3⅜	202	20	29¾
Excelsior baler	Indianap. El. Mfg. Co.	8 bales	5	..	....	420	1200	5	3½	172	22	34⅜
Exhaust fan	Garden City		3			190	1800	4½	5	1000	6	8
Wooler	Phila. Textile Co.	300 lb.	5			420	1200	5	5¼	390	16	21
Mattress hoist		60	1		...	100	1800	3½	⅝	40	24	157
Four sewing machines	Union	12 ticks each	1½	..	....	150	1200	4½	1⅞	270	8	20
One sewing machine		12 ticks each	½			50	1800	2½	....	270	8	16½
Cut-off saw			3			190	1800	4½	....	1000	...	8
Emery wheel			1		...	100	1800	3½	....	1000	....	6⅜
*Stuffer		12 ticks each	2		....	150	1800	4½	....	....	....	....
			56⅔	..	$1,150.00	4920						

*Note: Steam stuffer must be replaced by special electrically driven one.

[givin]g the unit costs of steam and electricity for each [op]eration. Table B contains an estimate of the physical [co]st of installing a motor drive, together with recommenda[tio]ns as to the capacity, type and speed. Column 10 gives [th]e necessary size of the pulleys on the motors, if the pul[ley]s on the machines are not to be changed; column 13 [gi]ves the necessary sizes of the machine pulleys in case [the] motors are purchased with the standard-size pulleys as [sho]wn in column 9.

From Table B the following table of initial cost is [de]rived:

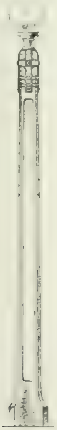
[illegible]	$1 [illegible]
[illegible]	[illegible]
[illegible]	250.00
[Conti]ngencies	48.00
[To]tal	$1 [illegible]
[illegible] on engine minimum	[illegible]
[Revi]sed total	$750.00

[Wi]th a net saving of $144 per year for power this produces $\frac{144}{750}$ = 19.2 per cent interest on the investment.

Wiring and Illumination

DENVER CONCRETE POLE.

The accompanying illustration shows a concrete lighting [st]andard, of which fifty will be placed by the Denver city [go]vernment along a section of Seventeenth Avenue boule[vard], twenty-five on each side at intervals of 100 ft. The



Concrete Pole Used in Denver.

[st]andards are made of Portland cement, with an aggregate [of] Tennessee marble, and will carry a 75-watt series-tung[st]en lamps. The poles are made in Denver, and cost $20 [a p]iece, exclusive of the ornamental bronze cap and the [ot]her details, which cost $16 additional.

INTERIOR WIRING SYSTEMS FOR FEDERAL BUILDINGS—II.

By Nelson S. Thompson.

In a previous issue a description was given of the in[te]rior-conduit work in federal buildings under the con[tr]ol of the supervising architect of the Treasury Department. The conduit work does not differ greatly from that required in regular practice nor does the wiring, but figures are given on wiring which if used in connection with an accurate bill of material for the job will give a close approximation of what such a job would be worth in the average federal building.

GENERAL ILLUMINATION.

The required light intensity for general illumination and the planes of illumination for the several classes of rooms are as follows:

GENERAL ILLUMINATION REQUIRED IN FEDERAL BUILDINGS.

Space	Ft.-Candles.	Plane of Illumination
Storerooms, machinery and boiler-rooms, corridors, halls, mailing vestibules, stairs	1.20	3′ above floor
Post-office workroom, lounging room, offices, large toilet-rooms, large vaults..............	1.50 to 2.0	2′6″ above floor
Courtrooms, jury-rooms, money order and registry rooms, main lobby.......	2.0	
Civil service examination rooms	3.0	2′6″ above floor
Drafting-rooms.........	5.0 to 6.0	2′6″ above floor Drawing board
Other spaces are treated as special cases.		

The following table gives the lumens per watt per square foot for the lamps and reflectors generally used. The total watts required to produce this general illumination with this equipment is obtained from the following formula: Watts = floor area in square feet × by ft.-candles ÷ K.

LUMENS PER WATT FOR LAMPS AND REFLECTORS USED.

Lamps.	Walls.	K*
Tungsten....	Light	4.0
Tungsten....	Dark	3.4
Carbon (3.1 w.p.c.)	Light	1.7
Carbon (3.1 w.p.c.).....	Dark	1.4
Nernst	Dark	3.3
Mercury vapor	Large areas	6.6
Arc lamps..............................	Large areas	3.0

*The value of K used is generally taken at 4 for tungsten lamps and light walls.

The above values apply to small and medium-size rooms. Very large rooms receive special consideration.

WIRING.

The standard wiring for lamp circuits in all buildings is three-wire feeders, three-wire subfeeders and two-wire branch circuits. In some cases this is varied to suit local conditions, as in a four-wire distribution system the four wires are brought to the main feeder tablet or switchboard and three-wire feeders run from this point to distributing cabinets.

The even-number wire sizes are used for feeders and subfeeders. In the smaller buildings as few wire sizes for feeders are used as is practicable. All branch lighting circuits are of No. 12 wire except circuits to special junction boxes on basement ceilings for furniture lighting, which are made of No. 10 wire.

The maximum allowance for branch circuits is 660 watts, except for circuits which supply a combination of outlets for general illumination and local illumination, in which case a maximum of 800 watts is installed; in this case, however, not more than three-fourths of the total watts supplies general illumination.

All lighting feeders and subfeeders (or mains) are calculated on the following basis: The assumed lighting load is the total watts for general illumination plus the total watts for local illumination (50 watts per receptacle) plus 1 watt per square foot of post-office workroom floor space. The load-factor for small buildings one to one and one-half stories high is taken as the full connected load for feeders and subfeeders. For buildings containing more than four distributing tablets the load-factor for feeders is considered to be 70 per cent of the connected load and for

subfeeder 80 per cent of the connected load. Subfeeders to workroom and court-room tablets are calculated for full load in all cases.

The voltage drop allowed is 3 per cent for feeders and 2 per cent for subfeeders. Feeders and subfeeders for all buildings containing not more than four distributing tablets are calculated on the basis of two-wire circuits and 110 volts. The wire size given by formulas is that of the neutral, and each outside wire is made one-half the neutral size, so that the systems may be used either for two-wire or three-wire service. No feeder or subfeeder wire is smaller than No. 8 and no single wire is made larger than 300,000 circ. mil.

In buildings containing more than four distributing tablets, if the supply is the usual 110-220-volt service, a straight three-wire system is used up to the distributing cabinets. The wire sizes are calculated for the outside voltage (220) and the neutral wire is made the same size as one of the outside wires. The feeders and subfeeders are calculated for full connected load and with 2 per cent drop in subfeeders and 3 per cent drop in the main feeder. The three wires of a three-phase circuit and the four wires of a two-phase circuit are all made of the same size and each conductor is of the cross-section given by the formula hereinafter stated. Branch circuits to single arc lamps are increased in size 50 per cent to provide for the extra current at starting.

The current-carrying capacities of all feeders and subfeeders at the load-factors given are not allowed to be less than specified in the National Electrical Code for rubber insulation, regardless of the voltage drop. This requirement will generally determine the wire size, but in all cases the voltage drop on feeders and subfeeders is calculated. As a rule, the drop is less than the allowed maximum in subfeeders 60 ft. long and under and in main feeders 100 ft. long and under.

WIRING FORMULAS AND TABLES.

The following formulas and tables are used by the Treasury Department in calculating wire sizes:

Circ. mils $= D \times W \times K \div P \times E^2$.

Volts lost $= P \times E \times B \div 100$.

Current in main conductors $= W \times T \div E$.

Where W equals total actual watts delivered; D equals distance one way in feet; P (a whole number) equals loss in line in per cent of W, that is, of power delivered; E equals voltage between main conductors at the lamps or motors, and K, B and T are constants the values of which are tabulated herewith.

VALUES OF K.*

System.	Per Cent Power-Factor.				
	100.	95.	90	85.	80
Single-phase	2,160	2,400	2,660	3,000	3,380
Two-phase (four-wire).	1,080	1,200	1,330	1,500	1,690
Three-phase (three-wire)	1,080	1,200	1,330	1,500	1,690

*K for direct current equals 2160.

The value of K for any particular power-factor, single-phase work, is:

$$K = \frac{2160}{(\text{power-factor})^2}$$

For three-wire, three-phase and for four-wire, two-phase work

$$K = \frac{2160}{2\,(\text{power-factor})^2}$$

The value of T depends upon the system and the power-factor. The constants for alternating-current circuits are based on wires spaced 18 in. on centers. The volts loss in conduit wire will be somewhat less than that given by the formula.

VALUES OF B.*

Wire Size	25 Cycles. Power-Factor per Cent				40 Cycles Power-Factor per C		
	95	90	85	80	95	90	85
0000	1.17	1.16	1.12	1.06	1.32	1.26	1.36
000	1.12	1.09	1.05	.99	1.24	1.26	1.24
00	1.08	1.04	.99	.92	1.18	1.18	1.14
0	1.05	1.00	.94	.87	1.13	1.11	1.06
1	1.02	.96	.90	.83	1.09	1.05	1.00
2	1.00	.93	.86	.79	1.05	1.01	.95
3	.98	.91	.84	.76	1.02	.97	.90
4	.96	.89	.81	.74	1.00	.94	.86
5	.95	.88	.80	.72	.98	.92	.84
6	.94	.86	.78	.70	.97	.90	.82
8	.93	.85	.76	.68	.94	.87	.79
10	.92	.83	.75	.67	.93	.85	.76

Wire Size.	60 Cycles Power Factor per Cent.				125 Cycles. Power-Factor per C		
	95	90	85	80	95	90	85
0000	1.53	1.64	1.67	1.66	2.21	2.54	2.72
000	1.41	1.49	1.50	1.47	1.97	2.22	2.34
00	1.32	1.36	1.35	1.31	1.77	1.96	2.04
0	1.24	1.26	1.24	1.19	1.61	1.74	1.80
1	1.18	1.17	1.14	1.08	1.47	1.57	1.59
2	1.12	1.10	1.06	1.00	1.37	1.42	1.42
3	1.08	1.05	.99	.93	1.27	1.30	1.28
4	1.05	1.00	.94	.87	1.20	1.21	1.18
5	1.02	.97	.90	.83	1.15	1.13	1.09
6	1.00	.94	.87	.79	1.10	1.07	1.02
8	.97	.89	.82	.74	1.03	.98	.92
10	.94	.86	.79	.71	.99	.92	.85

*B for direct current equals 1.

VALUES OF T.*

System.	Per Cent Power Facto			
	100	95	90	85
Single-phase	1.00	1.05	1.11	1.17
Two-phase (four-wire).	.50	.53	.55	.59
Three-phase (three-wire).	.58	.61	.64	.68

*T for direct current is unity.

In direct-current circuits the volts drop per wire $= IR$ and the total volts drop $= 2\,IR$. I is the current per wire and R is the resistance in ohms per wire. In alternating-current circuits the volts drop depends on both resistance and reactance; with wires close together, as in conduit work, the reactance will generally be small. However, for all alternating-current circuits the drop should be calculated at the assumed power-factor, load and corresponding current, using the following formula:

Volts drop per wire = ohmic volts $\times \cos \Phi +$ inductive volts $\times \sin \Phi$.

$\cos \Phi$ = power-factor of the load.

Volts drop two-phase circuit = 2 (volts drop per wire).

Volts drop three-phase circuit = 1.73 (volts drop per wire).

In direct-current circuits the volts loss in per cent is the same as the per cent power loss. This is not the case in alternating-current circuits except at unity power-factor.

WIRE-SIZE DETERMINATION.

A convenient method of determining wire sizes is to ascertain first the current per wire and select a wire size which will carry this current, then to calculate the volts drop for the wire thus selected.

The power-factor of an unbalanced three-phase circuit obtained from the following formula:

ower-factor = total real watts ÷ volts across lines × average amperes per phase × 1.73.

APPROXIMATE COST OF WIRING.

The average total cost of lighting systems complete in lace in Eastern sections of the country is about $12 per utlet; in the West and South the cost will be about $15 er outlet, and in the extreme West the cost per outlet will e $20. The number of outlets upon which these figures

POWER-FACTORS OF VARIOUS LOADS.

	Per Cent.
[illegible] lamps	[illegible]
[illegible]	[illegible]
[illegible] lamps and induction motors	[illegible]
[illegible] motors, full load	[illegible]
[illegible] motors, constant-speed type, starting	[illegible]
[illegible]ction motors, elevator type, starting..	[illegible]

e based does not include switch outlets, but only the ctual lamp outlets. In old buildings the cost of the conuit and wiring work is $20 to $25 per outlet and $30 in e extreme West.

When it is necessary to approximate closely the cost of e conduit and wiring system in a federal building the [illegible]rial is taken off accurately from the drawings and the [illegible]es given below are used.

[illegible]e total amounts of conduit and wire are the lengths [illegible] on the plan plus the following: Number of ceiling tlets × 2 ft.; number of bracket outlets × 10 ft.; numer of switch outlets × 10 ft.; number of baseboard outlets × 4 ft.; number of two-gang switches × 15 ft., and numer of three-gang switches × 20 ft.

The average length of a branch run in federal buildings is [illegible] ft. The size of branch conduits is generally ½ in., and ranch circuits are generally of duplex wire. For obtaing lengths of feeders a diagram is made of all feeder nd subfeeder circuits.

COST OF CONDUIT IN PLACE (NEW BUILDING).

[illegible]	$8 [illegible] per 100 ft
[illegible]	1[illegible] 25 " 100
[illegible]	1[illegible] 75 " 100
[illegible]	1[illegible].25 100
[illegible]	22 [illegible] 100
[illegible]	[illegible] 100
[illegible]	47 [illegible] " 100
[illegible]	[illegible] " 100

Add 50 per cent to above for underground-service conections in place and for work in old buildings where walls nd ceilings are cut and plaster must be replaced.

COST OF CONDUIT ELBOWS IN PLACE.

[illegible]	$ 1.00 each
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

The cost of all kinds of outlet boxes in place is 25 cents ach in new buildings and 50 cents each in old buildings here plaster must be repaired. The cost of large juncon boxes in place is 5 cents per pound; plug receptacles n place cost $1.30 each, and snap switches (single-pole, [illegible] amp) in place, $1 each. Fixture studs cost approxiately 5 cents each in place.

Standard floor outlet boxes (such as are used in federal uildings) cost $3 each in place; telephone cabinets (such s are used in federal buildings) cost in place $20 each; outlet bushings, 5 cents each in place, and lock nuts, 1 cent each in place. One should estimate three bushings and three lock nuts per outlet. Reinforced silk-covered lamp cord (No. 16) costs approximately $55 per 1000 ft. in place, and knife switches, 250-volt, single-break, with extension for fuses unmounted, polished, cost as shown below.

COST OF DOUBLE-BRAIDED RUBBER-INSULATED WIRE (IN PLACE).

Size	Cost per 1000 Ft.	Size Circ. Mils.	Cost 1000 Ft.
Solid Single Conductor			
16	$15.00	250,000	$275.00
14	18.60	300,000	327.00
12	21.70	400,000	405.00
10	25.85	500,000	500.00
Stranded Single Conductor		Duplex Conductors	
8	35.40	14	30.00
6	48.25	12	34.00
4	62.65	10	40.25
3	75.25	8	49.25

STRANDED SINGLE CONDUCTOR.

Stranded	Single Conductor	Stranded.	Single Conductor
2	$82.00	00	$156.00
1	101.30	000	184.25
0	128 00	0000	217.00

COST OF KNIFE SWITCHES IN PLACE.

Rating	Double-Pole.	Triple-Pole
25	$ 1.80	$ 2.30
50	3.05	4.35
100	4.65	6.75
200	7.45	10.95
300	10.45	15.20
400	13.00	19.55
500	18.10	27.00
600	23.10	34.45
800	27 95	41.80
1,000	53.35	63.65
1,200	67.25	87 40

The cost of mounting, not including drilling of marble, is $1 per switch.

Inclosed fuses (in place) cost approximately as follows:

5 to 65 amp	10 each
65 to 100	25 "
110 to 200	50
225 to 400	90
450 to 600	$1 30

Other cost entering into a contract may be estimated as follows: Busbars for switchboards, 50 cents per pound, in place; structural steel work, in place, for switchboards, 10 cents per pound; blue Vermont marble, 2 in. thick, $2 per square foot; slate panels, 1¼ in. thick, 50 cents per square foot; drilling holes, slate and marble, 25 cents each; labor on switchboard panels in shop, $25, and on the job, $12 each; tablets and cabinets, complete in place, $5 per switch. One should ascertain if possible the actual cost of cabinets and tablets (which are special design) and add $1 per circuit for installation.

To this list may be added motor connections, 5 hp and under, $2 per horse-power; motor connections, 10 hp up, $1 per horse-power; freight and drayage, 3 per cent of total cost of material and labor; railroad fare, depending on location of the job; board and lodging, depending on location of the job; superintendence, 1 per cent of total cost of materials and labor, and profit, 20 per cent of total cost of materials and labor.

RECENT TELEPHONE PATENTS.

IMPROVED SWITCHBOARDS.

With the two-wire, common-battery, multiple-switchboard system the cut-off relay is usually operated upon a grounded circuit, being legged off to ground from the

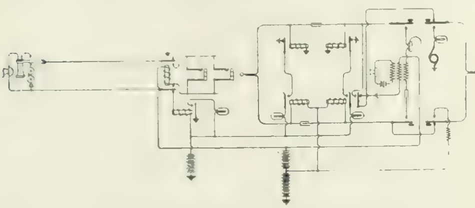


Fig. 1—Arrangement for Cut-Off Relay.

live or battery side of the circuit. The cut-off relay may, however, be arranged upon a metallic circuit basis, and this is done in the system patented by Mr. H. G. Webster, of Chicago. He uses independent batteries for the talking and cut-off relay circuits. These are oppositely poled and connected in series, the connection to one side of the cord circuit being made between them. The arrangement is shown in Fig. 1. The patent for this system has been assigned to the Kellogg Switchboard & Supply Company.

Mr. C. A. Simpson, of Chicago, has been granted a patent, which has been assigned to the same company, covering a switchboard system in which the cut-off relay is omitted. The jacks are provided with auxiliary contacts which break when a plug is inserted. The line lamp circuit is carried through all these in series.

A patent granted to Mr. H. J. Roberts, of Evanston, Ill., and assigned to the Homer Roberts Telephone Company, describes the key and circuit system necessary to control party lines equipped with his selective signaling system.

To the Dean Electric Company have also been assigned two patents issued to Mr. F. B. Allen, of Elyria, covering trunk circuits with automatic ringing features. There is also included a busy back feature to indicate when the called-for line is in use.

RINGING SYSTEM.

The usual ringing systems require the use of an alternating-current generator. In the system patented by Mr. F. R. Parker, of Chicago, direct current suffices. A biased polarized ringer is arranged in series with a condenser Auxiliary make-and-break contacts are associated with the

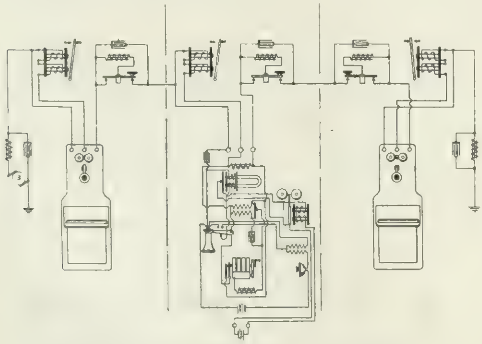


Fig. 2—Relay Arrangement for Dispatch System.

ringer armature. The ringer is poled so that the bias spring assists the pull, corresponding to current from the battery as normally connected. If the battery connections be reversed from normal a momentary rush of current takes place as the condenser in series with the ringer charged. Driving the interval of its auxiliary conta the ringer moves to such a position that the condenser connected directly across the ringer. The discharge a bias spring together drive back the armature, when t process is repeated until the normal connection of t battery is restored.

IMPROVEMENTS IN DISPATCH SYSTEMS

The use of selectors upon dispatch systems is now qu common. These selectors pick out the desired station the exclusion of all others. Mr. J. F. Graf, of Scrantc Pa., has extended this application to the selection of branch line. The connection of the branch line is effect through a relay, the circuit of which is in turn clos when the main line selector is set in the required positic

The combined telegraph and telephone line is concern in a patent granted to Mr. O. M. Leich and assigned to t Cracraft-Leich Electric Company. Fig. 2 shows the : rangement, which includes a high-frequency calling ge erator and a howler signaling instrument for telepho calling signals.

DESK STAND.

Mr. N. Pedersen, of Genoa, Ill., has patented a de stand, the improvements in which lie wholly in details construction to facilitate manufacture. All auxiliary pa such as induction coil, switch springs and terminal blc are carried upon a metal spider within the base piece. cushion ring is arranged upon the bottom and the b: cover piece is secured by a slight angular twist by the ı of buttons and buttonholes.

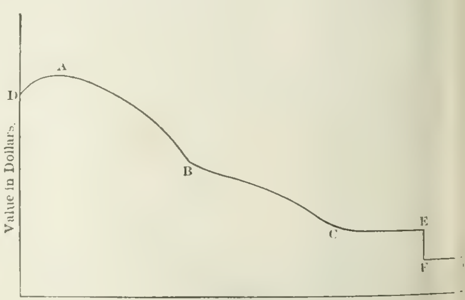
Letters to the Editor.

Depreciation.

To the Editor of Electrical World:

Sir:—I have read with interest the criticism of my aı cle on "Depreciation" in your issue of Aug. 5 by Mr. W. Del Mar and Mr. Frank F. Fowle.

Mr. Del Mar raises the question of the meaning of word "value" and how it is measured. Those who h: had occasion to think broadly upon the meaning of t word will agree with me that it may mean almost anyth reasonable, depending upon the circumstances, and can measured in dollars, diamonds or wampum or even in t intangible thing called "good will." I agree with him t "utility" is what is really meant, and in view of the f that we must necessarily work with practical things :



Curve Showing Depreciation of Apparatus.

actual physical apparatus how shall we measure uti unless it be in dollars? After all, things are only rela e and have magnitude only with respect to each ot r. Under certain conditions it is just as easy to meas e

weight with a yardstick as with a pair of scales, and in many engineering works it is easier. For example, the weight of a flywheel once installed can be measured by a yardstick near enough for many practical purposes when it would require considerable labor and expense to weigh it. The point is that while money may not be the correct measure of utility, it is the nearest to a correct measure that we know of and will be used as such until some one brings out something better.

Replacing the words on the curve "value in dollars" by the word "utility," the curve still holds true in the average case, but not in every case. The sharp corners at E and F are explained by the fact that at a certain time in the life of every piece of apparatus it changes from a useful machine to an inert mass of scrap metal. That is, its utility becomes zero, although it still has value. This change takes place suddenly in most cases. For example, the writer is now installing a new pump to do the work of one that has been used for twenty years and is both practically worn out and obsolete by virtue of inefficiency. The old pump will be left in its place for an indefinite time as a reserve unit, and by slightly stretching the imagination it is possible to see that there will be a time when this old pump will suddenly be converted from a useful machine to scrap in the course of about two hours' time. This condition accounts for the sudden drop in the curve and for some of the "corners and kinks."

While I have stated that the curve shown represents the usual history of the average piece of apparatus, I agree with Mr. Fowle that, as a practical thing, under certain conditions, the use of the straight-line method of depreciation is reasonable. This I believe to be true more on account of the uncertainties of prediction regarding the future history of apparatus than because of the philosophy of the thing. In other words, the introduction of a new machine may and often does completely upset the reasonableness of the whole matter, so that the best a utility can do is to charge off to depreciation a conservative amount from income based on the straight-line method. In using depreciation in connection with appraisals, whether the sinking-fund method or the straight-line method should be used depends upon the past history.

I note by reading Mr. Henry Floy's discussion of my article that I seem to have conveyed the impression that I believe that all apparatus follows the curve shown. The table of actual experience given in the same article emphatically shows this is not true. The curve is given to show the history of what might be termed the average piece of apparatus, and in practical use must be modified by conditions. It is a sort of foundation on which to build depreciation curves. In certain cases various parts of the curve are entirely changed. As Mr. Floy states, much apparatus has no increase in value after installation. In many cases there is no reserve period, represented by BC on the curve, and in some cases no period represented by CE. I would therefore emphasize the fact that the curve is intended to be the general curve for depreciation, to be modified according to the judgment of the engineer in specific cases.

Ft. Atkinson, Wis. H. G. D. NUTTING

Acuity in Monochromatic Light.

To the Editor of Electrical World:

SIR:—I have been exceedingly interested in reading Mr. Luckiesh's valuable article in your issue of Aug. 19 on the difference in visual acuity found between monochromatic light and that covering a considerable range of the spectrum. I am particularly glad to have my own investigation of the matter checked by other observers and by a totally different method, leading, as it theoretically should, to substantially the same results. Mr. Luckiesh's figures show plainly the immense advantage of monochromatic light when it comes to the simple matter of defining power. The method he adopted does not, of course, show the difference between monochromatic light and the continuous spectrum at its worst. Since his absorbing screens limited the range of radiation from the continuous spectrum to about half that corresponding to an unscreened incandescent source, this lessened range of radiation, of course, rendered the acuity observations somewhat more difficult; but the result is none the less striking. I particularly admire the success with which he succeeded in getting comparisons with the sodium line and I hope he will be good enough to publish the method by which he got the requisite steadiness. I must, in the most friendly way, take exception to Mr. Luckiesh's somewhat careless remark to the effect that I had assumed the mercury tube to be monochromatic. On the contrary, I described the mercury spectrum at some length and what I said about the monochromatism of the light was this:

"In a strict technical sense the light of the mercury-vapor lamp, like that of the flaming-arc lamp, is far from being monochromatic, but so far as effective luminosity goes the spectrum of the former is perhaps the closest approximation to monochromatism of the light of any commercial illuminant."

This statement I do not think anybody would be inclined to dispute, and in addition it is undoubtedly true that for the line 0.546μ and the pair 0.578μ the focal surfaces in the eye are so nearly coincident that it would be difficult to determine any difference in acuity based on so small a quantity.

Also, while I am gratified that Mr. Luckiesh adopted a method of experimenting which in no way involved the question of heterochromatic photometry, I am strongly of the opinion that one makes no mistake in assuming the substantial correctness of the flicker method where heterochromatic comparisons have to be made—that is, if in a heterochromatic comparison there is a substantial difference between the results obtained with the flicker instrument and with an equality-of-brightness photometer it is altogether probable that it is the latter which is in error. Dr. Ives' admirable experiments merely showed that with instruments presenting identical fields of sufficiently strong illumination the flicker and equality-of-brightness methods could give practically coincident results. That they do not give such results when one considers the general case of flicker photometers as compared with equality-of-brightness photometers is a fact which has been too long familiar to photometrists to admit of a discussion. Moreover, when there is a substantial difference between the results the equality-of-brightness instrument varies from the flicker always in one direction.

Finally, as regards my comment on the measurements of Broca and Laporte this difference was actually found to exist in following their method of equality-of-brightness determination, which happened to give results particularly aberrant as compared either with the flicker photometer or with a Lummer-Brodhun screen. However, this comment does not detract from the value of Mr. Luckiesh's beautiful experiments nor from the neatness of the method he adopted for avoiding any conceivable objection which might be raised to the use of heterochromatic photometry in solving this particular problem.

Apropos of his experiments with Dr. Ives' visual acuity screen, it may be worth mentioning that Hastings has shown (*American Journal of Science*, Vol. XIX, 1905, page 203), both from his own experiments and those of Dr. Wolf, that the dispersion of the lens of the human eye is greater than that of ordinary crown glass. Hence the combination with a concave spectacle lens would not tend to be achromatic. As all the observers wore spectacles it is probable that part of the difference between their re-

sults in this particular experiment may have been due to the fact that in prescribing glasses the oculist, however skilful, has to make his corrections for the best average conditions considering the particular errors of the eye with which he has to deal. Hence spectacles often do not give the full theoretical correction for a particular reading distance, and the distance of 1 m used in this case, lying as it does between ordinary distant vision and ordinary reading vision, would be quite certain to show residual errors enough to disturb acuity measurements.

Boston, Mass. Louis Bell.

Loading of Telephone Circuits.

To the Editor of Electrical World:

Sir:—A perusal of the article in your issue of July 15 by Messrs. Samuel R. Parker and J. Cavers entitled "Notes on the Loading of Telephone Cable and Open-Wire Circuits" indicates that the authors appear to have an erroneous conception of the theory of "neutralizing" the effect of capacity in telephone circuits by the introduction of lumped inductance in accordance with the Pupin system. On page 167 the authors compute the inductance necessary to "neutralize completely" the capacity of a circuit at 800 frequency. They do this as though the capacity and the inductance were simply lumped in a series circuit and speak of the impedance of the circuit as being equal to

$$\left[R^2 + \left(L\omega - \frac{1}{C\omega}\right)^2\right]^{\frac{1}{2}}$$

As is well known, this method of computing the line impedance does not apply to a circuit containing capacity and inductance distributed along its length in the manner of a loaded telephone circuit.

At the bottom of the second column on page 167 the authors start out with a line 1200 miles long having a total attenuation of 3.96, and determine the attenuation constant necessary on a 1600-mile circuit, in order that the latter may have the same transmission efficiency—that is, the same total attenuation. An arithmetical mistake in the solution of this problem of simple proportion gives them a resultant attenuation constant of 0.00284 instead of 0.00248, or a total attenuation for the 1600-mile circuit of 4.5—that is, a value greater than the figure 3.96 with which they started. Without apparently noticing this inconsistency the authors attempt to explain the result by a process of reasoning which leads them to the remarkable conclusion that ". . . . thus, although loading improves the articulation, it reduces the volume of sound, or the amplitude; and as the value of R_c increases with the inductance of the coils, it will be readily seen that, if a line is overloaded or loaded more than absolutely necessary to get the standard of transmission required, the efficiency of the circuit is reduced instead of increased for long-distance transmission." Continuing, the authors state that for a value of $\beta d = 4.60511$ or $e^{-\beta d} = 100$, the limiting point at which loading is commercially of value has been reached. No explanation of these particular figures is given and apparently the only reason for determining the value of βd to six significant figures is to make $e^{-\beta d} = 100$. Later in the paper they give a "practical" value for βd of 4.1446 and use this value in the preparation of Fig. 1. This value, which is exactly 10 per cent less than the theoretical value quoted, is given with five significant figures although the authors state that ". . . . but in practice this value has to be reduced approximately 10 per cent to allow for extraordinary losses, such as leakage, eddy currents and hysteresis losses, which exist on the circuit but which *cannot be calculated*." (The italics are mine.)

New York. Frank B. Jewett.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Pendulum Converter.—E. Falkenthal.—An illustrated description of a new type of pendulum converter for transforming direct current into alternating current, especially for purposes of telephone stations. The main feature of this type is that there are no condensers required as in other similar designs. The construction is shown in Fig. 1, the direct-current circuit from a storage battery being shown at the top and the alternating-current circuit at the bottom. By the motion of the pendulum the left-hand and the right-hand halves of the circuit are alternately connected to the circuit. The pendulum is moved by the attraction of a permanent magnet bar at the top moving in an artificial stray flnx of the transformer core. The necessity of using condensers in order to prevent sparks when contacts are broken is avoided in the following way: Before the contact of the pendulum with the left-hand half of the coil (as in the moment represented in the illustration) is broken the right-hand half is connected in parallel with the left-hand half for a very short time. Since the two halves of the coil are identical but wound in opposite directions an opposite emf is induced and the primary current is reduced for a moment to zero, so that there will be no spark when the contact between the pendulum and the left-hand half of the coil is broken. The mechanical method of making the parallel connection is clearly shown in the illustration. The time during which the two halves are connected in parallel can be adjusted by means of the large screws illustrated. The proper position of these screws can be found by using an ammeter in the primary circuit and adjusting the screws until the ammeter shows a minimum of current. For this position sparking at the contact is a minimum and the alternating-current wave

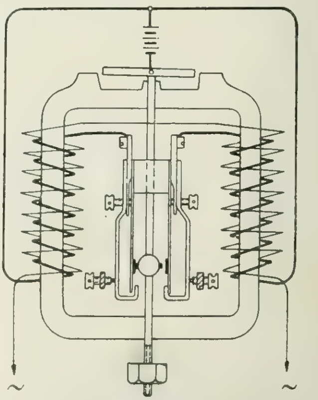


Fig. 1—Pendulum Converter.

produced has the most favorable form.—*Elek. Zeit.* July 20.

Grinding Carbon Brushes.—A note on a recent British patent of Mr. A. Watkins (17,236, Aug. 10, 1911).

achine for grinding the contact surface of dynamo rushes is provided with a rocking frame with inclined les and carried by a spindle. The spindle is mounted in le frames supporting a cross-piece which carries a oden block with a curved surface to correspond to that the commutator. One end of the spindle is fixed to a ndle for rocking the frame to and fro, and over the ck a sheet of glass paper is placed and fixed by clamps t each end of the frame. The brushes are held in a fixed osition by carriers attached to the center of the side rames and are adjusted to the desired angle by a pivoted late holding the same. This may be set to any angle by a d engaging with radial slots formed in the carriers and d by screw nuts. The grinding is effected by working handle backward and forward.—Lond. *Elec. Eng'ing,* g. 17.

Lamps and Lighting.

hromoscope Measurement of Colors.—Leo Arons.—An strated description of a new instrument which permits to produce any tint of mixed colors and to define it merically. The simple chromoscope consists of two chol prisms P and A (Fig. 2). Between these two ns quartz plates Q of different thickness, cut perpenlarly to the crystallographic main axle, can be ined. Diffused white light from a porcelain disk is wn through the circular hole B, through the lens L, P. Observation is made from R. Instead of the e disk a colored one is seen. The color depends on two ntities; first, the thickness of the quartz plate Q, and, nd, the angle between the plates of polarization of the hol prisms A and P. This angle may be read directly a dial. Six quartz plates are used in thicknesses of mm, 0.5 mm, 1.0 mm, 2.0 mm, 4.0 mm and 8.0 mm ectively and mounted in brass plates arranged one after ther. Each brass plate has two identical holes. One is filled with a quartz plate, the other is empty. By ing any of the brass plates to the side any number of rtz plates can be arranged one after the other so that s possible to adjust the total thickness of the quartz plates from 0.25 mm to 15.75 mm in steps of 0.25 mm. The different colors are produced by reason of the fact that the rays of different wave-length contained in white light, after their passage through P, undergo different deflection of the planes of polarization in the quartz plates Q and, therefore, pass more or less weakened through A. In contradistinction to the colors of the spectrum, mixed colors are here obtained. A still greater variety of mixed colors can be obtained by using two sets of prisms and quartz tubes in series. For this purpose the end of the tube between B and x in Fig. 2 is taken off and the piece from B' to y in Fig. 3 is substituted for it. The white light enters through B', passes through L', is polarized in P', so that after the different deflection of the planes of polarization of the different colors in Q' a colored light is now made to pass through the quartz plate Q. The author thinks it is sufficient to use for Q' always one and the same plate; he has employed a quartz plate Q' of 3.75 mm. With this arrangement the colors in the composite chromoscope are measured by three figures; first, the thickness of the quartz tube Q; second, the angle between the prisms A and

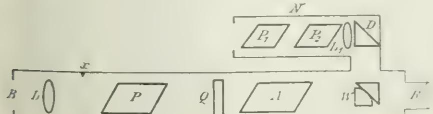


Fig. 2—Simple Chromoscope.

P, and, third, the angle between the prisms P and P'. As shown in Fig. 2, a Lummer-Brodhun photometer cube may be inserted at the point W. It permits the colored image to pass through the circular contact surface while the free hypothenuse surface sends toward R the rays which are thrown to it from the side tube N by the totally reflecting prism D. The side tube is parallel to the main tube. Besides the lens L_1 it contains the two Nichol prisms P_1 and

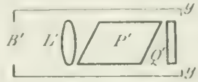


Fig. 3—Addition for Composite Chromoscope.

P_2, of which P_1 can be rotated, and the angle of rotation can be measured by means of a circular dial. The side tube is directed toward a white porcelain disk which is placed at the side of the other white porcelain disk from which white diffused light is sent into the main tube. Both white porcelain disks are identical and equally illuminated. The lens L_1 is so chosen that the colored image from the main tube, which is observed through R, appears surrounded by a concentric ring. By rotating the Nichol prism P_1 equal illumination of both surfaces is produced while all quartz plates are removed. In this case the boundary line between the inner circle and outer ring disappears. This is the normal position in which the color determinations are made, especially the choice of the colors which serve as standard colors. If the white porcelain disk for the side tube is replaced by a surface of a certain color (a colored paper or cloth) the central picture of the image in R can be made to assume the same color by adjusting the quartz thickness Q and the angles between A and P and between P' and P. The color tint is, therefore, determined by these three figures. For determining the color of transparent bodies (glass or solutions) the glass is placed directly before the side tube and the solution, held in a suitable absorption vessel, is also placed directly before the side tube, which is again directed toward a white porcelain surface. Then the adjustments are made again in the main tube. The chromoscope can also be used for determining the color tint of a source of light. For this purpose the normal position is first obtained while both surfaces are illuminated by the same standard light. Then the standard light is screened off from the white porcelain disk before the side tube and this disk is now illuminated by the lamp the color tint of which is to be determined. Then the angles between the prisms and the thickness of the quartz plate are adjusted until equality is reached again.—*Elek. Zeit.,* July 27.

Impregnated Carbon Electrodes.—J. Escard.—An article giving a review of the history and properties of impregnated carbon electrodes for arc lamps. The following effects of impregnation are first discussed: Greater steadiness of the arc; increase of luminous efficiency; prevention of slag formation, and adjustment of the color tint of the arc. Inconveniences of impregnated electrodes are then taken up, namely, the effect on electrode consumption and the production of fumes. Finally the manufacture of impregnated electrodes is briefly discussed.—*L'Industrie Elec.,* July 25.

Generation, Transmission and Distribution.

First 110,000-Volt Plant in Europe.—E. G. Fischinger.—The first part of a long illustrated description of the transmission system from the main plant of the Lauchhammer metallurgical works to two other plants of the same company and for the supply of energy to the district around the towns of Grossenhain, Oschatz and Meissen in Saxony. There is a mine of bituminous coal at the Lauchhammer works, but formerly it was found more advantageous to ship the coal to the two other plants of the company than to transmit electrical energy. Since the demand for power has increased rapidly, recalculations have shown that an electric transmission system would be far more economical. When this had been decided upon an arrangement was made by which the three towns mentioned above, instead of erecting their own central station,

will buy up to 12,000 kw for thirty years from the company. This will be supplied to the towns in the form of 60,000-volt and 15,000-volt energy, and will be metered as such. For transmission a voltage of 110,000 is to be used, which is the highest thus far employed in Europe. The generating station will contain four three-phase turbo-generators, each of 5000 kw rating, at a power-factor of 0.8 and a voltage of from 4740 to 5500. For the present only three of the generators will be installed. The article is to be concluded.—*Elek. Zeit.*, Aug. 17.

Turbines.—F. Prasil.—An abstract of a paper read at the Zurich meeting of the (British) Institution of Mechanical Engineers on the results and experiments with Francis turbines and tangential (Pelton) turbines. Within the last ten years the Francis turbine and the Pelton wheel in the most varied forms of construction have quite taken the place of the older types, such as the Jouval and Girard turbines. Capacities as high as 16,000 hp in single units have now been reached. The Francis turbine is applied with success to falls of from 1 m to 150 m (3.3 ft. to 492 ft.), the Pelton wheel to falls from 40 m to 950 m (131 ft. to 3116 ft.). In this progress is to be noted not only a steady improvement in the details of construction of the turbine, but also in the efficiency of the automatic governing and the safety mechanism. Particularly in modern plants with long supply pipes and conduits, with their severe specifications for high-standard reliability in the safety apparatus, these requirements make large claims upon the skill and ability of the engineers. The result has been, however, a large measure of success in the production of successful designs. In regard to efficiency, much further advance in the future is not to be expected. The problem of governing can be considered as not yet completely solved, since there still appears in view a series of applications which would influence the further development of this problem. The electrification of railways might be mentioned as one example.—Lond. *Electrician,* Aug. 11.

Water-Power Plants in Switzerland.—An account of the recent Swiss tour of the (British) Institution of Mechanical Engineers and its convention at Zurich. (Abstracts of the papers presented at this meeting have been or are given elsewhere in the Digest.) At the city of Basle a 2000-kw steam turbo-generator has been added to the steam plant, while large extensions of the water-power plant near by are about to be completed. Ten km (6 miles) above Basle, between the towns of Augst and Wyhlen on the south and north side of the Rhine, the river is completely dammed, giving a gross fall of from 5 m to 8½ m (16 ft. to 28 ft.), with mean 6.7 m (22 ft.), to ten Francis turbines of 15,000 hp total on the south, or Swiss, side and to other ten turbines on the German side yielding about the same total horse-power. The turbines are direct-coupled to three-phase, 1600-kva generators on horizontal shafts with periodicity of 50 and speed of 107 r.p.m. From the south side the energy is taken to Basle at 7000 volts—that is, without transformation. On the north side part of it is raised to 45,000 volts and transmitted over six aerial lines, while four other lines transmit the rest without transformation. Another excursion was made to the Rheinfelden works (rating, 17,000 hp) and the Laufenburg works (50,000 hp). The manufacturing plants of the Brown-Boveri Company, of Escher, Wyss & Company and of the Oerlikon works were also visited. Excursions were made to the Rhine Falls near Schaffhausen, to the Schaffhausen hydroelectric power plant and the plants at Lontsch and Beznau.—Lond. *Elec. Review,* Aug. 11.

Colliery Power Plant.—J. Burns.—A paper read before the South Staffordshire and Warwickshire Institute of Mining Engineers in which the author compares the advantages of gas and exhaust steam for colliery power plants. His conclusions are generally in favor of exhaust steam. He contends that the maximum of simplicity with economy is obtained in the average existing colliery b[y] improving the steam conditions of the winders and ut[i]lizing the exhaust to drive a low-pressure turbine. The[se] plants are absolutely independent of each other. Th[e] winders are under the absolute control of the drivers a[nd] are run under exactly the same conditions whether t[he] turbine is running or not. The power supplied by th[e] turbo plant, whether the transmission medium be ele[c]tricity or compressed air, will drive all the undergrou[nd] plant in addition to the outlying plant on the surface, an[d] finally, the turbines use all the low-pressure steam avai[l]able to its utmost advantage and automatically use on[ly] as much extra high pressure steam as is required to ma[ke] up the exact output.—Lond. *Electrician,* Aug. 11.

High-Tension Transmission in Spain.—M. Neustätte[r].—The conclusion of his illustrated article on the tran[s]mission system of the Hidroelectrica Española Compa[ny] and its Molinar power plant. The most remarkable fe[a]tures of the system are the voltage of 70,000 and t[he] distance of the different cities which are supplied wi[th] energy from the plant. These distances are 254 km (1[5?] miles) to Madrid, 80 km (48 miles) to Valencia, 82 k[m] (49 miles) to Alcoy and 180 km (108 miles) to Cartagen[a]. The first two lines are in operation, the latter two in cour[se] of construction. In the present instalment the constructi[on] of the line, the protective devices, the substations and t[he] telephone system are described, and an account of t[he] opening of the system is given. The whole tramway sy[s]tem of the city of Madrid is supplied with energy from t[he] plant 254 km away.—*Elek. Zeit.*, Aug. 3.

Hydroelectric Plant in Silesia.—An article giving not[es] on various plants in the province of Silesia in German[y] with special reference to the Weistritz dam, from whi[ch] water is to be supplied to a plant containing three 600-h[p] turbines, of which one is used as reserve. For transmi[s]sion voltages of 10,000 and 30,000 are used. The furthe[st] distance is 70 km (42 miles). The plant is to operate [in] conjunction with the large steam-power plant at Walde[n]burg, which furnished last year about 22,000,000 kw-hou[rs].—*Elek. Zeit.*, July 27.

Traction.

Manchester Municipal Railways.—An abstract of la[st] year's account of the municipal railway system of the ci[ty] of Manchester, which is quite successful financial[ly]. The annual contribution in relief of the rates has shown [a] tendency to increase from year to year. The amount pa[id] over for this purpose for the year ended March 31, 191[1] was $375,000, bringing the total contributions during t[he] last ten years to $2,635,000. The number of passenge[rs] carried shows a greater increase than for several yea[rs] past; the total of 165,800,077 represents 184 journeys p[er] year per head of population served (approximately 90[0,]000). The number of car-miles was 17,367,200, as again[st] 17,161,774 a year ago, the number of passengers per ca[r-]mile having risen from 9.26 to 9.55. The total numb[er] of kw-hours used was 29,063,006, or 1.673 per car-mi[le,] compared with 1.709 in the previous year. As regards t[he] financial results, the average traffic revenue per car-m[ile] was 22.086 cents, as against 21.738 cents last year. T[he] working expenses were 64.08 per cent of the receipts a[nd] amounted to 14.348 cents per car-mile. The average fa[re] paid per passenger was 2.32 cents, as against 2.34 cents [a] year ago. The parcels department of the tramways co[n]tinues to make progress. The number of parcels carri[ed] in 1911 was 950,000, the receipts $50,000 and the to[tal] profits from this department $12,000. The total expens[es] including capital charges, etc., per car-mile were 18.[..] cents, the total revenue from all sources 22.70 cen[ts,] hence the balance is 4.58 cents. Of this 2.38 cents was us[ed] for reserve, renewals and depreciation fund; 0.12 cent f[or] street improvements, and 2.08 cents represented the cont[ri]bution to the city in aid of rates.—Lond. *Electrici[an],* Aug. 11.

Rack-Railway Locomotives.—I. WEBER AND S. ABT.—paper read at the Zurich meeting of the (British) Institution of Mechanical Engineers. The authors describe e various railways in Switzerland which are operated ther wholly or partially on a rack system. Details of oth the steam and electrically worked lines are given.—ond. *Electrician*, Aug. 11.

Electric Traction on European Main Roads and Inter-rban Roads.—F. STEIN.—Continuation and conclusion of is very extensive and elaborate statistical tables. Switzernd has eight direct-current, six single-phase and two ree-phase roads; England, fourteen direct-current and o single-phase roads; Italy, eight direct-current, five e-phase and two three-phase roads; Norway, one di--current and two single-phase roads; Sweden, two sin-phase roads; Holland, one direct-current and one single-se road; Belgium, one single-phase road, and Spain, single-phase and one three-phase road. For each road ry large amount of statistical information is given.— Aug. 10 and 17.

Installations, Systems and Appliances.

... for Electrical Energy.—F. WIKANDER.—A paper before the German Association (Verband) of Elec-l Engineers. In view of the great importance of the allic-filament lamp to central stations the author thinks the rates at present in use should be revised. This is necessary in view of the increased importance of ric cooking and heating apparatus. He recommends introduction of a special price from 2 cents to 2.5 s per kw-hour for cooking; an extra discount of from er cent to 10 per cent for residences in which only ric light is used; a flat rate with a limiting device ich limits the maximum power which can be taken the supply mains), but without meter, preferably in ay similar to a rate recently introduced in the city of men. The price difference of $3.75 and $5 between the of a meter and a simple limiting device may be usey employed for paying the cost of installation of the lamps for small consumers. A new rate may be oduced in which energy is furnished for cooking at a ery low price which could otherwise not be obtained. The consumer should have a free choice between different tes. In general the price of energy should be reduced. introduction of lighting by electricity should be facili-d in the same way as this is done for gas by making allations free of charge, etc., so that in the competition ween gas and electricity, which in itself is sound and irable, electricity should not be held back artificially.— t. *Zeit.*, Aug. 3.

London Central Station.—An abstract of last year's ncial report of the St. Marylebone electricity supply nt. The total sales of electrical energy during the year e increased by 14.5 per cent over the previous year, figures for last year being 9,152,000 kw-hours for pri-e lighting, 1,398,000 for public lighting and 1,788,000 motors and heaters. The average price received was follows: For private lighting, 7.652 cents per kw-hour, and for motor service, 2.954 cents, the average for the whole of the private supply being 6.88 cents. The load-factor during the last year was 16.9 per cent as against 15.7 per cent in 1909-10, 14.5 per cent in 1908-9 and only 11.8 per cent in 1906-7. The total operating cost last year, including generation, distribution and management costs, but not including capital charges, was 2 cents per kw-hour sold. The total capital charges were 4.46 cents, hence the total cost was 6.46 cents, while the total revenue was 6.92 cents.—Lond. *Electrician*, Aug. 18.

Electrophysics and Magnetism.

Nature of Light Action in Selenium.—F. C. BROWN.—An account of an experimental investigation, the chief results of which are as follows: Light produces two changes of opposite sign in the conductivity of all light-sensitive selenium. The amount of the change is a function of the time of illumination as well as the intensity and character of the illumination. The character of the conductivity curves for the four known varieties of light-sensitive selenium can be explained by assuming the existence of three components in dynamic equilibrium, under given illumination, temperature, pressure and electric potential differences. The effect of any agency that affects the conductivity of selenium is of such a nature that it alters the rates of interchange between the components. The experimental results can be explained to a first order approximation on the assumption that only the B kind is conducting of the three components which are in equilibrium according to the reaction $A \leftrightarrow B \leftrightarrow C$. If the view thus proposed is accepted the failure of Ohm's law becomes only an apparent and not a real failure.—*Phys. Review*, July.

Number of Electrons in Metallic Conduction.—J. W. NICHOLSON.—The electron theory of the conduction of electricity through metals, first developed by Drude, has in the hands of later investigators been placed on a firm footing. However, no certainty exists as to the number of free electrons which must be supposed to be present in the atoms of the various metals at ordinary temperatures in order to account for their optical properties. In the present highly mathematical paper the author attempts to discriminate between certain hypotheses with the aid of experimental results. While the present paper is only preliminary it would appear that the exact number of free electrons per atom in a metal can be determined and results can be obtained which may tend toward a comprehension of the structure of the atoms of the elements. Thus five free electrons seem to be attached to every two atoms of silver, while an atom of manganese seems to have three free electrons and it is possible that a solid magnesium molecule contains seven atoms and has twenty-two electrons to spare.—*Phil. Mag.*, August.

Electric State of the Upper Atmosphere.—A. J. MAKOWER, W. MAKOWER, W. M. GREGORY AND H. ROBINSON.—An account of a great many experiments in which the electric state of the air at different heights above the ground was investigated by means of kites and balloons during three summers. The authors conclude that results of considerable interest are obtainable by the methods employed. The problems of atmospheric electricity are, however, so complicated and seem to depend on so many conditions that there is little hope of arriving at an understanding of the different influences at work by intermittent experiments. It is thought that continuous observations will enable one to separate the effects of barometric pressure, temperature, humidity and wind velocity respectively. —Lond. *Electrician*, Aug. 18.

Units, Measurements and Instruments.

Units of Resistivity.—D. ROBERTSON.—A letter with reference to the recent article of Dellinger. The author criticises the laxity in definition and notation of the units of resistivity. He considers the following two to be the best definition: Resistivity is that property of the material in virtue of which it converts energy into heat when an electric current flows through it, and it is measured by the resistance per unit length of a rod (or wire) having a unit cross-section. The mass resistivity is measured by the resistance per unit length of a rod (or wire) having unit mass per unit length. Instead of ohms per centimeter-cube, one should speak of ohm-centimeters, etc.—Lond. *Electrician*, Aug. 18.

Vibragraph.—An illustrated description of an instrument which permits one to record and measure all kinds of vibrations. The instrument is shown in Fig. 4. A mercury cup is provided with a floating mirror, so pivoted as to avoid lateral movement, and the mercury ripples caused by vibration result in an angular movement of the mirror.

The beam of light emanating from a small incandescent lamp and reflected by the mirror records on photographic paper a straight line if the vibration is in one plane only, or a complex figure if the vibration be in planes at different

Fig. 4—Vibragraph with Side and Lamp Cover Removed.

angles, such as is nearly always the case in actual practice. When no records are required the photographic paper can be replaced by a screen, thus permitting of direct visual observations. Each mercury cup has its own constants, and three different cups are usually supplied with the instrument so as to make the vibragraph suitable for recording strong (say, 0.3 mm), medium (0.08 mm) and small (0.02 mm) vibrations. With each cup is supplied a set of calibration curves which permit of the determination from the photographic record of the actual movement of the vibrating body in fractions of inches or millimeters. Fig. 5 shows a typical vibragram obtained from the crank casing of an engine driving a 1250-kva alternator at 188 r.p.m. The apparatus has been used in practice in connection with litigation in respect of alleged nuisance through transmitted vibration of central stations.—Lond. *Elec. Review,* Aug. 18.

Measurement of Magnetic Fluxes.—P. Sève.—An abstract of a paper presented before the French Academy of Sciences on the measurement of magnetic fluxes in absolute value. For this purpose either electrodynamic or induction phenomena may be used. The method most employed is that of the Cotton balance. But it is nevertheless useful in all cases to compare the results of the balance with the results of ballistic measurements. The author gives results of the two methods used in combination.—*L'Industrie Elec.,* July 25.

Measuring the Fluctuations in a Rapidly Varying Re-

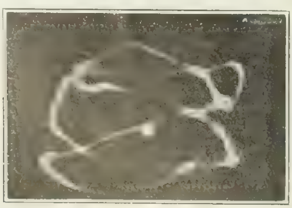


Fig. 5—Crank Casing of Engine Driving 1250-kva Alternator at 188 R.P.M.

sistance.—F. C. Brown and W. H. Clark.—Sometimes it becomes necessary to measure a variable resistance which changes during short intervals of time. By placing the resistor of variable resistance in one arm of a Wheatstone bridge circuit the average resistance can be expressed fo any interval of time in terms of the throw of a ballisti galvanometer where the galvanometer is thrown into th circuit by means of a pendulum for the desired interval o time, which must be small compared to the period of th galvanometer. How small this interval should be is als determined by the rapidity with which the resistanc changes. If the time is made sufficiently short the averag resistance practically becomes the actual resistance at th middle of the interval.—*Phys. Rev.,* July.

Optical Pyrometry.—C. E. Mendenhall.—An illustrate paper in which the author describes a convenient mounting a method of calibrating the spectroscopic eye-piece for th Holborn optical pyrometer, and gives a comparison of th "spectroscopic" and "red-glass" temperature scale whicl justifies the use of Wien's law with the ordinary "red glass" form of pyrometer.—*Phys. Review,* July.

Localization of Faults in Cables.—A brief description o an instrument made by a German company which permit one to read off directly the distance of a cable fault i meters from the point where the test is made. The appa ratus contains a storage cell and the instrument prope which operates according to the voltage-drop method.—*Elek. Zeit.,* Aug. 3.

Telegraphy, Telephony and Signals.

Directed Wireless Telegraphy.—An article in which th author gives results of work of the Bellini and Tosi wire less compass on board ship.—Lond. *Electrician,* Aug. 18.

Miscellaneous.

German Association of Electrical Engineers.—The firs parts of a full stenographic report of the business session of the recent convention of the German Association (Ver band) of Electrical Engineers. The discussions whic followed the presentation of the different papers are als reported in full. (The papers themselves are not include in the report, but are printed separately. Abstracts c the different papers have been given, or will be given, i the Digest.) The official addresses of welcome and th presidential address of Prof. E. Budde on the preser status of electrical industries are given in *Elek. Zeit.,* Jul 20. The annual report of the secretary, Mr. G. Dettma gives a review of the work of the Verband and of th different committees during the year. The finances are i satisfactory condition, there being a surplus of $6,500 fo last year.—*Elek. Zeit.,* July 27. Further committee report as well as the discussions of papers by Nowak on a machin for calculating wiring networks, by Eppner on the safet of insulating materials against fire, and by Kesseldorfer o mercury motor meters, are given in *Elek. Zeit.,* Aug. . The very extended discussion of Ossanna's paper on th design of single-phase commutator motors is given in *Ele Zeit.,* Aug. 10.

Patent Attorneys.—C. Weihe.—The author gives a his tory of patent attorneys in Germany and the laws whic regulate their activity. These laws are criticised, an recommendations for their amendment are made. Th position of the patent attorney is thought to be midwa between that of the engineer and that of the lawyer.—*Elek. Zeit.,* Aug. 3.

Exhibition of Instruments.—J. Saphores.—The conclu sion of his long illustrated description of various exhibits a the recent exposition of the French Physical Society. . Carpentier exhibited ohm standards of manganin wire the Abraham-Villard electrometer for measuring directl continuous or alternating-current emf of the order of mag nitude of 200,000 volts to 800,000 volts; a new design of th Ricardo Arno galvanometer; the Abraham frequenc meter; an induction wattmeter; an angular speed indicato and the Abraham rheograf without iron. Mr. J. Richar exhibited various laboratory instruments, a recording wat meter for automobiles, and a recording milliammeter fo thunder storms.—*L'Industrie Elec.,* June 10.

New Apparatus and Appliances

IFTEEN-YEAR-OLD MOTOR IN A PATTERN SHOP.

It is in the service of the relatively small industrialist ıat electricity often proves its value and demonstrates the ependability of electrical apparatus in general, where the ıability to fulfil a contract through interruption of ma-

Fifteen-Year-Old Motor.

ery operation may mean the failure of the firm with ·ger capital. In a corner of the pattern shop here ·wn there will be seen in operation a motor which has · in constant service every day for fifteen years, being ·act the first Wagner motor sold in St. Louis. The ··r is of 2 hp running on 110-volt alternating current · 1800 r.p.m. and has never received or required any ·ntion other than that of the shop hands. That there · remain possibilities along the line of electrification in · special instance is evidenced by the use of the oil- ·ted glue-pot. The service supplied by the motor should ·e a good talking point for the adoption of an equally ·iceable electrically heated outfit.

RECENT IMPROVEMENTS IN DISTRIBUTING TRANSFORMERS.

bout three years ago marked improvements were em- ·ed in the "type S" transformer developed by the ·estinghouse Electric & Manufacturing Company, East ·ittsburgh, Pa. They consisted principally in a radically ·ew shell design of magnetic circuit whereby low mag- ·etic reluctance is obtained without increasing the mean ·ength of turn of the winding, and which was especially ·dapted for the use of the new silicon steel for the mag- ·etic circuit. These improvements resulted in a marked ·ncrease in efficiency, better regulation and a reduction in ·xciting current, all important characteristics. Notwith- ·tanding the radical changes made at that time, develop- ·nent of the same type of transformers has continued and ·everal marked improvements have been recently an- ·ounced.

These recent improvements have resulted from improved ·naterials and better mechanical design. The subject of ·nsulation has been given special attention, as upon this the ·ife of the transformer largely depends. The insulating materials now used are of better quality both mechanically and electrically, with the result that a further increase in efficiency and reduction of exciting current has been obtained. For example, the 7½-kva transformer, which formerly had an iron loss of 62 watts and copper loss of 125 watts, now has only 57 watts iron loss and 110 watts copper loss. The exciting current has been reduced from 2.2 per cent to 1.7 per cent and the regulation at 100 per cent power-factor improved from 1.69 per cent to 1.55 per cent. Other sizes show corresponding improved performance.

A very uniform temperature is maintained throughout the entire transformer and in no place does the tempera-

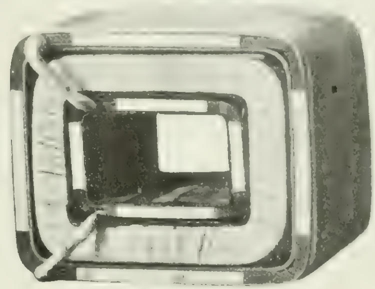


Fig. 1—Improved High-Tension Coil.

ture rise exceed 50 deg. under normal conditions. This insures long life and high all-day efficiency. In line with the question of insulation, the high-tension coils have been further subdivided to reduce the voltage between layers of the windings as well as between coils and thus relieve the strain on the insulation. A view of the improved coil is shown in Fig. 1.

Slight changes have also been made in the terminal bushings to insure no possibility of grounding to case due to the collection of dust between the bushing and the case and still further to make the siphoning of oil from the case impossible. The new bushing is shown in Fig. 2.

A highly flexible weatherproof cable is used for the leads, which are rubber-insulated with a grade of rubber

Fig. 2—Terminal Bushings.

that would deteriorate very slowly if exposed to the weather. The rubber insulation is protected by a braided covering and the cable meets the rigid new requirements of the National Board of Fire Underwriters, which some of the cables now used on transformers do not.

"DIELECTRITE" INSULATION.

Announcement is made that the Staunton Dielectrite Rubber Company, of Muskegon, Mich., has completed a new plant to be devoted to the manufacture of Dielectrite, a molded insulation for high-tension and low-tension electrical work. This material is the invention of Mr. Gray Staunton, who has been conducting experiments for a

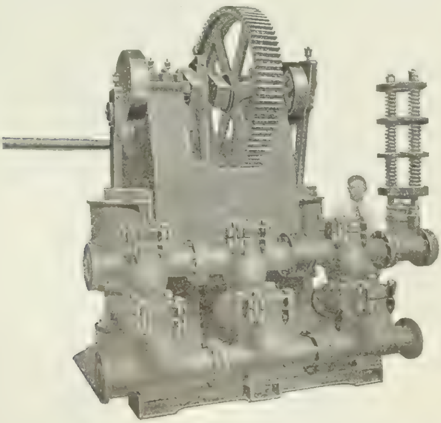
number of years in a laboratory in Chicago. The material has the appearance of hard rubber and is usually black in color, although it can be produced in various tints. The exact composition of this insulating substance is not revealed, but it has been said that the greater part of it is made up of vegetable fiber, the remainder being of mineral origin. The ingredients are mixed and milled into the consistency of a hard gum and the mass is then placed in a mold and subjected to great pressure in a hydraulic press. While subject to this pressure it is vulcanized by the application of heat and it emerges in shape designed for electrical use.

Various types of insulators and insulating devices are made from this material, such as petticoat insulators, busbar supports, oil-switch tubes and bushings for switchboard work. Dielectrite is said to possess great dielectric strength and to show an excellent resistance to heat. It does not absorb moisture and is not easily attacked by acids or alkalis. It may be molded to nearly any form desired and easily machined. Accurate threads may be formed on the inside or outside of tubes made of this material. The specific gravity of this substance is only about 1.31 and it is not brittle or friable and possesses reasonable mechanical strength.

Dielectrite has been used for insulators on lines carrying 44,000 volts and over. It is said that about $100,000 has been expended on experimental work relating to this interesting insulation during the last twelve years. During this time comparatively small quantities of material have been produced and it has been used to a considerable extent in the substations of the Commonwealth Edison Company and also in other electrical installations in Chicago.

SINGLE-ACTING TRIPLEX PLUNGER PUMP FOR HIGH PRESSURES.

The Goulds Manufacturing Company, Seneca Falls, N. Y., has just placed on the market a new high-pressure triplex power pump. The pump is similar to the type which is in general use in mines, waterworks and with hydraulic elevators, fire-protection systems, hydraulic presses, oil-pipe lines, etc., the chief difference being in the gearing. As shown by the illustration, the new pump



High-Pressure Triplex Power Pump.

has only one gear and pinion, which are located between the standards. Placing the gearing in this manner necessarily lengthened one side of the pump somewhat and increased the distance between the two valve boxes on that side. Instead of lengthening the pipe connection betwe the valve boxes on one set and making each set of a di ferent shape, as they are in many pumps, a distance pie is put in as shown.

By making use of this arrangement the three sets of valv boxes are kept identical in form and interchangeab. This duplication of parts, which is a feature of Goul pumps, saves valuable time when repairs are needed a also reduces the number of parts kept in stock by the us who may be located a great distance from the manufa tory.

MERCURY-ARC RECTIFIERS FOR FIRE-ALAR SYSTEM.

The use of mercury-arc rectifiers and storage batteri in connection with fire-alarm systems tends to effect marked reduction in operating expenses. The new syste

Fig. 1—Old Battery for Fire-Alarm System.

installed in Plymouth, Pa., by the Dugan Engineeri Company, of Wilkes-Barre, Pa., is an interesting examp The old system consisted of a battery of seventy-thi bluestone cells; the new comprises forty-four stora battery cells and a General Electric mercury-arc rectif

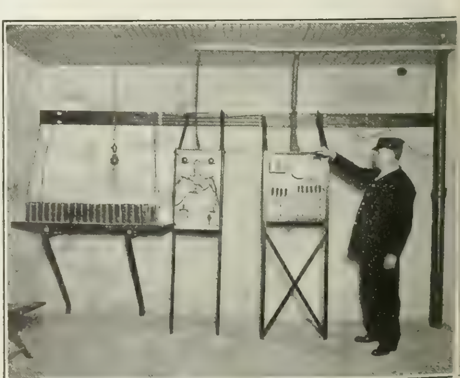


Fig. 2—New Battery Equipment for Fire-Alarm System.

for converting alternating-current supply into direct-c rent for the battery. The cost of operating the old s tem was $15.30 per month, while the cost of the new s $1.35 per month.

750,000-VOLT TESTING TRANSFORMERS

Two 500-kva, 750,000-volt testing transformers have recently been built at the Pittsfield works of the General Electric Company, one of which transformers is for permanent use at the Pittsfield factory, where it will aid particularly in the research and investigation of corona and other phenomena in connection with transformers, oil circuit-breakers, insulators, etc.

Fig. 1—750,000-Volt Testing Transformer.

The transformers are oil-insulated and follow an adaptation of the vertical-core type used generally on high-voltage transformers. The low-tension winding consists of long cylindrical coils placed next to the core on each leg. The high-tension winding consists of a number of double-section circular-disk coils with conductor wound one turn per layer. The terminal coils, which are at the top of each stack, have smaller outside diameters than the coils lower down, so that greater distance is provided between these coils and other parts.

Fig. 2—Core and Coils of 750,000-Volt Testing Transformer.

The insulation between high-tension and low-tension windings consists of a number of pressboard cylinders which divide the space into a number of generous oil ducts greatly assisting in the circulation of oil and increasing the dielectric strength. The insulation between the two stacks of high-tension coils consists of a number of flat pressboard barriers with oil ducts between. The insulation material used is especially treated to give high insulation resistance and low specific capacity.

The supports for the high-tension coils are unique in that they consist of metal upon which the winding directly rests and to which they are electrically connected. These metal supports act as shields to the terminal coils, protecting them from any discharge which may be induced to ground. While there is a metal shield at both the top and bottom of each stack, the windings are supported only at the bottom, where the metal shield rests upon heavy porcelain insulators attached to the iron framework of the transformer.

The tanks are constructed of heavy wrought iron with riveted seams and are provided with substantial cast-iron feet. The cover is of cast iron. Both high-tension and low-tension leads are brought out through the transformer cover. The low-tension leads follow the usual construction of flexible leads passing through porcelain bushings. The high-tension leads are of the sectional filled type, which consists of rings of insulating material filled with a semi-viscous compound. To obtain sufficient creeping surface on the outside of the leads collars are assembled between the annular sections.

Tests for corona have been taken at night with the transformer operated at normal voltage by ratio, both high-tension terminals being free. While the protective reactances on the top of the high-tension leads showed considerable corona, very little was noted elsewhere on the transformer or leads.

The approximate weights and dimensions are as follows: Floor space, 8 ft. x 13 ft.; height to top of cover, 15½ ft.;

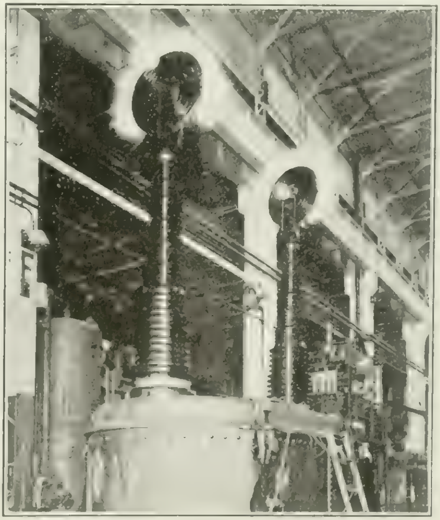


Fig. 3—Corona Tests at 600,000 Volts.

Total height, including protective reactances and spark-gap, 28 ft.; weight of core, 13,150 lb.; weight of copper, 1100 lb.; weight of tank and cover, 14,000 lb.; total weight less oil, 28,250 lb.; weight of oil, 50,400 lb. (7000 gal.).

PRIVATE ELECTRIC AND PUMPING PLANT.

On the estate of Mr. Thomas E. Proctor, near Topsfield, Mass., is to be found one of the most complete and best-arranged private plants in New England. The power plant proper is located in one corner of an attractive building, the other divisions of which serve as garage and

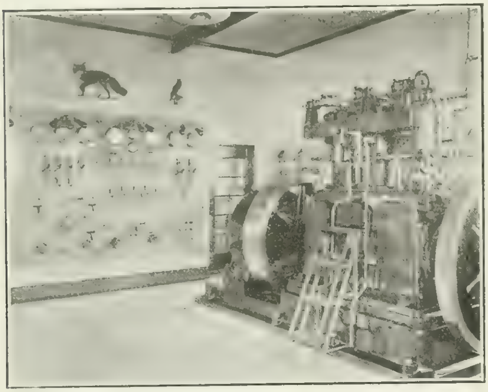


Fig. 1—Generating Set and Switchboard.

machine repair shops. In this small section of the building the energy for the lighting and water supply of the entire estate is generated and stored. The main unit consists of a 40-hp, four-stroke-cycle Westinghouse gasoline engine direct-connected to a generator. The estate is provided with an ample private water supply pumped to a reservoir located on the top of a hill 180 ft. above the level of the springs and then distributed by gravity to the various service pipes of the house and the estate. This reservoir has a capacity of 100,000 gal.

The pumping equipment is installed in the basement of the building under the power room. The pump is of the vertical, triplex, single-acting type made by the Goulds Manufacturing Company, Seneca Falls, N. Y., and has a rating of approximately 132 gal. per minute. The pump is driven by a 15-hp motor mounted on the pump base. A rawhide gear meshes with the driving pinion of the pump and insures practically noiseless operation. The motor and pump, having a capacity of about 200,000 gal. of water per day, occupy a floor space measuring but 7 ft. x 4 ft. and are placed between the engine foundation and the foundation of the building. The motor is so wired that it may be run either directly from the generator or from storage batteries. The battery when fully charged will deliver enough energy to operate the pump for eight hours continuously, during which time about 65,000 gal. of water will be forced into the reservoir. The triplex pump at times operates at practically a zero suction lift, although the source of water is several feet below the intake end.

This zero suction head is obtained by a device which provides for the use of a sand and vacuum pump. The sand and vacuum chamber is a steel cylinder 6 ft. long and 3½ ft. in diameter which is located just beyond the pump between the generator foundation and the foundation of the building. The intake pipe from the pump is coupled to this cylinder at the center of its nearest end and a 2-in. pipe leading from the top connects with a Goulds motor-driven vacuum pump. As a partial vacuum is created by the operation of the suction pump, the water from the springs is supplied to the sand chamber above the level of the intake pipe of the triplex pump. The water is automatically kept within certain limits above its outlet pipe, the triplex pump and the vacuum pump interacting automatically so that the one cannot suck air and the other cannot pump water. This automatic interactio is obtained by a ball float operating two tumbler switche to which it is connected by means of a set of chains, pul leys and weights. This float is located in the sand cham ber and operates a few inches from the top. When it i desired to pump water into the reservoir the operato throws a single switch that starts either the triplex pum or the vacuum pump, depending upon the level of th water in the sand chamber. Assuming that this latte was left nearly full when the pump was last stopped, th closing of the electric circuit will start the 15-hp moto and the triplex pump, and this will continue to operate a long as the water in the sand chamber remains at a cer tain level above the intake pipe of the pump. If the leve of the water in the sand chamber is lowered 11 in. with out inducing a sufficient suction to draw from the sourc of supply, the large ball float will have dropped to th point at which its lever will release a 5-lb. weight attache to a tumbler switch. When the weight pulls this switc down another electric circuit is closed which serves t start the 2-hp motor driving the vacuum pump. Th same lever arm that closes this small switch release another 5-lb. weight connected to a second tumbler switcl

This action opens the switch in question and serves t stop the 15-hp motor and triplex pump. As the level c the water in the sand chamber at which this action occui is well above the outlet pipe, the triplex pump is stoppe automatically before it can draw air. As the vacuum formed in the sand chamber, the level of the water rise the float moves upward, and when the extreme of its trav is reached the two weights are raised by the lower ar and the small switch is opened and the large switch close This serves to stop the vacuum pump and start the tripl pump again which, now having a full tank from which draw, will continue to operate until the level of the wat is again reduced or until a sufficient supply has be

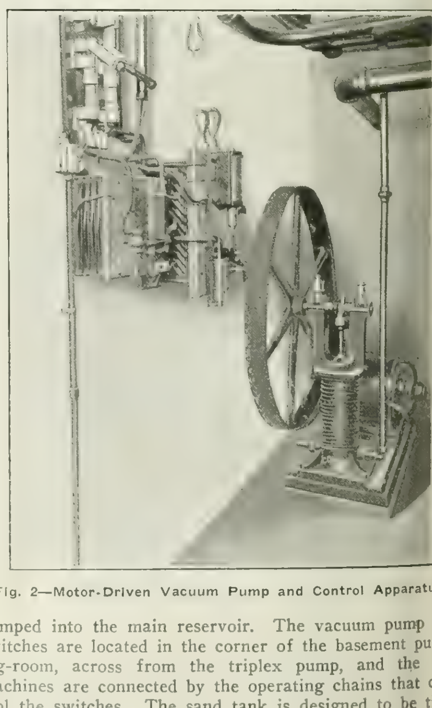


Fig. 2—Motor-Driven Vacuum Pump and Control Apparatus

pumped into the main reservoir. The vacuum pump a switches are located in the corner of the basement pun ing-room, across from the triplex pump, and the t machines are connected by the operating chains that co trol the switches. The sand tank is designed to be tig under a 29-in. vacuum.

Industrial and Commercial News

The Week in Trade.

OWING to approach of harvesting, advancement in general business is more pronounced in the Middle West and Southwest than elsewhere in the country. Actual ntact with the crops is causing an optimistic tone in these ctions, and it is expected that the volume of fall business ill be close to the average, on account of low stocks and the read of the buying movement. Confidence is not fully esblished in the East, and new business is due in a large meas- e to the approach of the autumn season. Numerous opinions the state of trade concur in the statement that conditions are und, but none suggest the stimulus that is needed to infuse tality in business at this time. There has been a small inease in distribution of actual necessities, but retail trade nnot be regarded as anything but quiet. Buyers are more erous in the various markets, but they are proceeding very usly, and show no disposition to buy in large amounts. s are wavering in the steel trade. A cut of $1.00 per ton by one of the independent companies last week was met e larger producers, including the Steel Corporation, and r reductions are expected in other steel products. In its atement of unfilled orders as of Aug. 20, issued late st week, the Steel Corporation recorded larger tonnages in ugust than in July. Business with the independents is fair, all of the steel mills are working well below capacity, ugh present output is favorable, referred to the average the past few years. There are many scattering orders for uipment of various kinds, but there are no large orders in ght. Labor difficulties are a retarding influence at this time, d the outcome of the Union Pacific case is awaited with rong interest. In view of the large number of disturbing eleents, advancement must necessarily be slow. Business failes for the week ended August 31 as reported by *Bradstreet's* re 164, as compared with 198 for last week, 179 for the corsponding week in 1910, 166 in 1909, 210 in 1908, and 130 in 1907.

The Copper Market.

CONSUMERS were not especially interested in the market last week, and placed only a few orders, most of which were for small amounts. The majority of melting ints continued to await developments in the price situation, showed little concern over the present position of the t. The stocks in the hands of many consumers are beincreased by deliveries on contracts placed earlier in the n, and since these supplies are apparently adequate for nt needs in view of the dullness in general trade, consum-

[illegible] Copper.	Bid	Asked.	Settling Price.
[illegible]	12.00	12.15	....
[illegible]	12.00	12.15	12.07½
[illegible]	12.00	12.15	12.07½
[illegible]	12.[illegible]	12.15	12.07½
[illegible]	12.00	12.15	12.07½

[illegible] London market, September 5, was as follows:

	Noon. £	s.	d.	Closing. £	s.	d.
[illegible] copper, spot	55	13	9	56	0	0
[illegible] copper, futures	56	11	3	56	12	6

[illegible] fluctuations for this year:

	Highest.			Lowest.		
[illegible]	12.35			1[illegible].57½		
[illegible] spot	57	10	0	53	7	6
[illegible] futures	5[illegible]	2	6	54	0	0
[illegible]	61	10	0	57	5	0

terests can afford to withhold purchases at this time, and doing, strengthen their position in the market. Efforts the producers to create a buying movement resulted in r prices in the latter part of August, but the concessions e small, and met little response. Although the official price the United Metals Selling Company is 12⅝ cents, sales of ctrolytic for thirty days' delivery were made at 12.55 cents the latter part of the week, and many agencies are willing contract for September business at this figure. As is usual, e trade is expecting improvement to follow announcement of e Copper Producers' report and the August report will be of ore than ordinary interest, for it will be the first issued since piration of the curtailment agreement between the larger oducers on the first of the month. Foreign business was good throughout the month, and will contribute largely to the tone of the August statement. Exports during the month were 27,976 tons, and for the year ended August 31, were 222,620 tons as compared with 280,118 tons during the corresponding twelve months ended August, 1910. For the current month, including Sept. 5, exports aggregate 3914 tons. The daily call on the Metal Exchange, Sept. 5, quoted copper as per the accompanying table.

Industrial and Commercial Notes.

H. M. Byllesby & Company Interested in Southern Combination.—It is learned that H. M. Byllesby & Company are the Chicago capitalists interested in effecting the combination of Southern utilities mentioned in these columns last week. They have offered the stockholders of the Louisville Gas Company $120 a share for their holdings, and the directors of the company have recommended that the offer be accepted. It is likely that the deal will go through, including the transfer of the stock held by the city, amounting to a little over one-third of the entire outstanding stock. The interest which the situation holds for electrical men lies in the fact that this is believed to be the forerunner of a movement to combine the public service corporations of Louisville, including the electric companies. Such a plan has been discussed and attempted heretofore, but for various reasons has failed. It is believed locally that if the deal goes through it will likely mean the joint operation of the Louisville Lighting Company (control of which is held by the Louisville Gas Company and would pass to the new owners of the latter in the event of a sale), the Kentucky Electric Company and the George G. Fetter Lighting & Heating Company. Another gas company, the Kentucky Heating Company, would also be affected.

Officers of Chicago Elevated Railways.—Under the reorganization of the executive staffs of the elevated railways of Chicago, due to the combining of the companies by the organization known as the Chicago Elevated Railways, in which Samuel Insull, as chairman of the executive committee, is the guiding spirit, a full list of officers for each of the three constituent companies (Northwestern, Metropolitan and South Side) has been chosen. Each of these operating companies has elected the same set of officers, and the list is as follows: President, Britton I. Budd, formerly president of Metropolitan; general manager, E. C. Noe, formerly of Northwestern and Chicago & Oak Park; treasurer, William V. Griffin, formerly of Northwestern and Chicago & Oak Park; secretary, P. D. Sexton, formerly of Metropolitan; assistant treasurer and assistant secretary, E. C. Adams, formerly of South Side; auditor, T. B. MacRae, formerly of Metropolitan. The Chicago & Oak Park Elevated Railroad Company was not taken into the combination directly, but it is controlled by the Northwestern Elevated Railroad Company, which is in turn controlled by the Chicago Elevated Railways.

Westinghouse, Church, Kerr & Company.—Present engineering and construction engagements of Westinghouse, Church, Kerr & Company include the following shop work: Chesapeake & Ohio Railway, at Silver Grove, Ky., thirteen-stall roundhouse, power house, planing mill, storehouse, pumping plant for delivering 1,000,000 gal. per twenty-four hours from Ohio River, coaling station, fuel tank, water tank; Chesapeake & Ohio Railway, at Summit, Ohio, five-stall roundhouse, power house, storehouse, sand house, water tank and cinder pit; New York, Ontario & Western Railway, at Middletown, N. Y., erecting shop with complete crane service; alongside of erecting shop, a low bay with crane for heavy machine tools, addition to power house and equipment, tunnels and yard piping, necessary yard wiring and other miscellaneous works.

Northwestern Power Development.—J. A. Coram, of Boston, has announced that a Massachusetts syndicate will spend some $6,000,000 in developing 80,000 hp in Kootenai Falls, Mont., for distribution to the mining districts and other localities in western Montana, northern Idaho and northeastern Washington.

Government Ownership of Telegraph a Burden on British Taxpayers.—In discussing the commercial aspects of telegraph operation by the British government, the *Spectator* says that the working cost per thousand words telegraphed in Great Britain to-day, is more than it was thirty years ago. It states further, that the incapacity of the British government to conduct a business enterprise has been demonstrated in this instance, beyond all question. These charges are substantiated by statistics showing that not only was the $35,000,000 paid for the lines at the outset, in 1869, more than three times the original estimate, but in addition to this cost, the government had to pay another $20,000,000 to railroad companies for right of way, making a total first cost of $55,000,000 upon which interest charges have not been earned in the past thirty-nine years. The deficit has been paid from the treasury, entailing a loss upon the taxpayers. When this condition had been experienced for some time, rates were reduced upon the belief that increased business, with larger profits would result, but the change had the opposite effect. Under government ownership, costs of operation and maintenance have been enormous, and, including the original cost of the lines, which has never been repaid, advances by Parliament upon which no interest has been charged, and the annual deficits in operating expenses, the commercial loss to the country through purchase of the telegraph is close to $170,000,000. There is no disposition to regard the government control as an asset, since each year's operation brings an additional loss of over $5,000,000.

Westinghouse Orders.—Recent orders for railway equipment received by the Westinghouse Electric & Manufacturing Company include the following: City & Country Contract Company, of West Chester, N. Y., for an 80-ton switching locomotive with quadruple equipment of motors and control; from the Morris County Traction Company, Morristown, N. J., for fifteen double-equipment motors, with control; from the Hutchinson Interurban Railway Company, of Hutchinson, Kan., for one double equipment of motors, with control; from the New York, New Haven & Hartford Railroad Company, one 80-ton central-control switching locomotive with four motors and unit-switch control, and fourteen 80-ton switching locomotives, with quadruple motors and "HL" control; from the Denver & Intermountain Railway Company, Denver, Col., for two quadruple equipments of motors, with control; from the Portland, Grey & Lewiston Railway Company, Lewiston, Maine, for one 35-ton locomotive, with quadruple motors and control; from the Richmond & Henrico Railway Company, Richmond, Va., one motor equipment, with control; from the Springfield Traction Company, Springfield, Mo., for six double-equipment motors, with control; from the Sapulpa & Interurban Railway Company, Sapulpa, Okla., for one double-motor equipment, with control; from the Trenton, Bristol & Philadelphia Street Railway Company, Trenton, N. J., for two motors, with control, and from the Lehigh Valley Transit Company, Allentown, Pa., for four quadruple motors, with control.

Gainesville (Fla), Gas & Electric Power Company.—Charles W. Morse, of Haverhill, Mass., president of the Gainesville Gas & Electric Power Company, of Gainesville, Fla., has asked the Superior Court of Massachusetts to issue an order restraining the State Street Trust Company, of Boston, from foreclosing a mortgage which is secured by bonds of the Gainesville Gas & Electric Power Company. The plaintiff alleges that seven bonds valued at $3,500, which were pledged to him by George I. Doig, vice-president and secretary of the Gainesville Company to secure a loan, were taken wrongfully from the company's office last April. The foreclosure proceedings were undertaken at the request of present holders of these bonds. Mr. Morse, who owns over half of the stock and bonds of the company, claims that the company is solvent and is doing a profitable business, and states that the party accused of taking the bonds is now under indictment in the Circuit Court of Florida. An order of notice returnable Sept. 7 was issued by the court.

August Incorporations Below Average.—In the month of August papers filed in the Eastern States for companies with an authorized capital of $1,000,000 or over, including increases in capital, aggregated $87,350,000. This is a decrease of $106,000,000 as compared with July, and $20,150,000 as compared with the total in August, 1910. Charters taken out during the month by other companies, with a capital of $100,000 and over, including states other than those in the East, made a total capital of new incorporations of $144,509,000, a substa tial decrease as compared with $361,820,000 in June, and $19 520,500 in July last year. The total incorporations for t present year of companies with an authorized capital of $ 000,000 or over was $1,334,662,000 as of Aug. 31, as agai $1,564,212,400 for the corresponding period in 1910.

British Columbia Electric Railway Company, Ltd.—C. Moore & Company, of Seattle, Wash., have been awarded contract by the British Columbia Electric Railway Compa Ltd., of Vancouver, B. C., for the extension of the compan auxiliary steam-power plant. The original steam-power pl of the company was installed by this concern. The appro mate expenditure for the new work will be about $250,0 and the terms of the contract call for completion by D 18, 1911. The new equipment includes four Babcock Wilcox boilers, each of 500 hp, and one 2000-kw Allis-Ch mers turbo-generator, with condensers, piping, etc. With t additional equipment the capacity of the steam auxiliary pl will be 12,000 hp.

Exhibits for Traveling Engineers. — At the recent C cago convention of the Traveling Engineers' Association, cc posed of men supervising the work of steam locomotive en neers, there was an attractive exhibit of apparatus, altho few of the exhibits were of electrical interest. The Pyle N tional Electric Headlight Company, of Chicago, and the M Manufacturing Company, of Chicago, exhibited electric he lights. The H. W. Johns-Manville Company and the De born Drug & Chemical Works made exhibits of appara familiar to electrical men.

Additions to Iowa Power Station.—The Des Moines C Railway Company is building an extension to its power stat in Des Moines, and has recently purchased equipment as lows: One 300-kw rotary converter from the Westinghc Electric & Manufacturing Company and one 500-kw rot converter, together with three 750-kw transformers, from General Electric Company. No contracts have been awar for new switchboards. Bids have been invited on a trave crane and coal-handling apparatus for the station.

Electrical Construction.—Among the items printed un Construction News in the present issue are announcements proposed new plants or considerable extensions to pre plants at Morrillton, Ark.; Pasadena, Cal.; High Springs, F Shelbyville, Ind.; La Cynge, Kan.; Battle Creek, Mich.; P land, Ore.; Scranton, Pa.; Maryville, Tenn.; Trenton, Te Denton, Tex.; Sinton, Tex.; Colonial Beach, Va.; Fond Lac, Wis., and Scott, Sask., Can.

Additions to Louisville Lighting Plant.—The Gen Electric Company has completed the installation of a 10, hp turbo-generator, in the plant of the Louisville Ligh Company. A new condenser was also installed at the s time. Water is secured through several artesian wells by the company, and is stored in a reservoir, in whic is cooled by artificial means. G. Wilbur Hubley is chief e neer of the company.

Foreclosure Sale of California Traction at San Franci —On Oct. 30 the property of the San Francisco, Va & Napa Valley Railway will be sold under foreclosure. sale is a result of an action brought against the compan the Mercantile Trust Company, of San Francisco, for de of bond interest in June, 1911.

Foreign Trade Opportunity.—Under Schedule 7264, file at the Bureau of Manufactures, Washington, D. C. American consular officer in the Far East reports the corporation of a hydroelectric company in his district, wi capital of $10,000,000. The company will furnish about 8 hp in the locality.

Many Switchboard Orders.—During the month of Au over 800 panel boards were turned out at the East Pittb shops of the Westinghouse Electric & Manufacturing C pany. This is slightly in excess of the output in July, the total was 751 panels.

Chicago & Milwaukee Electric Railway Company.—S uel Insull, chairman of the Chicago Elevated Railways, has denied the rumor that the consolidated companies ar to purchase the Chicago & Milwaukee Electric Railway Company.

Aluminum Notes and Prices.—Quotations as of Se 5 give ingots for resmelting at 20 cents to 22 cents spot No. the base for large ingots; and 31 cents for rods and wire. Sets are held at 33 cents. The market is reported steady.

Financial.

The Week in Wall Street.

B[illegible] in the latter [illegible] course influenced by the holidays, but, in spite of the quietness, the prices and transactions on Friday were [illegible] nber. Many fractional advances were made, and at the the list was in a much stronger position than in the great- rt of August. This cheerful feeling was in evidence on lay and, although opening prices were low, a rally was early in the day and the higher prices maintained to the The early weakness was caused in a large measure by nditions on foreign exchanges. Declines in Canadian c in Berlin, resulting from agitation over the Moroccan le, were reflected in London by a drop of 4 points, and by e of 3 points at the opening in Wall Street. Other rail- issues held in Berlin were weak here in the early trans- ns but recovered their losses and nearly all made small ces over Friday's prices. While the volume of trading not large, it was in excess of that on Friday, and prices

NEW YORK.

	Aug. 29.	Sept. 5.	Shares sold.		Aug. 29.	Sept. 5.	Shares sold.
[illegible]	[illegible]	[illegible]	——	Int. Met., pf.	[illegible]	[illegible]	[illegible]
pf..	18*	18	[illegible]	Mackay Cos.	[illegible]	[illegible]	[illegible]
[illegible]	58	[illegible]	[illegible]	Mackay Co., pf.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	——	Man. Elev....	[illegible]	[illegible]	[illegible]
co....	34⅞	[illegible]	2,200	Met. St. Ry..	15*	15*	
[illegible]	[illegible]	105[illegible]	125	N.Y.&N.J. Tel.	[illegible]	[illegible]	
[illegible]	[illegible]	80[illegible]	[illegible]	Steel, com.	[illegible]	[illegible]	[illegible]
& T..	131⅞	135	15,155	Steel, pfd....	114¼	115¾	[illegible]
[illegible]	[illegible]	76[illegible]	3,5[illegible]	W. U. T.	74	75	[illegible]
[illegible]	[illegible]	150[illegible]	[illegible]	West'h.	[illegible]	65½	1,1[illegible]
[illegible]	[illegible]	15[illegible]	3,400	West'h, pf.d.	114*	114*	

PHILADELPHIA.

	Aug. 29.	Sept. 5.		Aug. 29.	Sept. 5.
[illegible]	44	44½	Phila. R. T.	[illegible]	22
[illegible]	11	11¾	Phila. Elec..	17	16
[illegible]	52¼	53	Phila. Trac.	84	85
St. Ry., pf...	30*	30*	Union Tr.	50	50

CHICAGO.

	Aug. 29.	Sept. 5.		Aug. 29.	Sept. 5.
[illegible] Ry.	186*	186*	Com. Edison	132⅜	133
[illegible] Rys.	25*	25*	Ch. Subway	2¾*	2 *
[illegible] lev. Rys., pf..	90*	90*	Ch. Tel. Co........	120½	120½
[illegible]s., Ser. 1.....	95*	[illegible]	Nat'l Car.	100*	100*
[illegible] Ser. 2	27	2[illegible]	Nat'l Carbon	[illegible]	118[illegible]*

BOSTON.

	Aug. 29.	Sept. 5.		Aug. 29.	Sept. 5.
[illegible] & T.	131⅞	135¼	Mex. Tel.	4	4¼*
[illegible]	156*	156*	Mex. Tel. pf.......	6*	6*
[illegible]	286	284½	N. E. Tel.	145	145
[illegible]	151	151	W. T. & T......	1[illegible]	1[illegible]
E. Ry., pf.	88*	86	W. T. & T., pf.	[illegible]	[illegible]
[illegible]	17¼	17			

[illegible] quoted.
[illegible]es sold for the week, Aug. 28 to Sept. .

marked by absence of the selling pressure that was evi- in the trading of the past two weeks. Features of the actions on Tuesday were gains in American Tobacco and initial trading in Standard Oil certificates on the asis. While no plan of readjustment of the former com- has been presented to the committees representing se- holders, the day's transactions served as an indication of ss in rearranging the affairs of the company. Public st in the market continues to be very light, although is a fair degree of outside participation in the bond t. While the labor agitation on the Harriman lines is leading factor in the market, the financial district is ng developments with interest. The roads at this time a strong position to meet the demands of the unions, an amicable settlement is expected. Withdrawals of cur- ncy for meeting harvest requirements in the South and est have increased and prospects of reductions of surplus serve of Clearing House banks have caused a slight harden- g of rates for time money. Rates Sept. 5 were: Call, [illegible] per cent; ninety days, 3[illegible] per cent. The otations in the tables are those at the close Sept. 5.

Financial Notes.

Pacific Power & Light Company.—A limited amount of 7 per cent cumulative preferred stock of the Pacific Power Light Company is being offered by New York banking uses. The stock is preferred as to dividends and assets, and redeemable at 115 and accrued dividend. The company was corporated in June, 1910, under the laws of the State of aine, and is a consolidation of various established proper- ts serving thirty-five communities and the surrounding country in the States of Washington, Oregon and Idaho. The company now owns electric power plants having a capacity of approximately 20,735 hp, of which 13,300 hp is hydroelectric. In addition to these, there is now under construction additional hydroelectric capacity of 1,350 hp. There are now in operation over 300 miles of high-voltage transmission lines, and 175 miles of line are under construction. The company owns street railways in Astoria, Oregon and Walla Walla, Washington, and water works in North Yakima. In addition to these properties the company also owns and operates a number of gas plants in the locality. Its gross earnings for the twelve months ending July 30, 1911, were $1,155,526; net earnings were $553,423; bonds and other interest was $254,771, and the surplus for dividends was $298,652. Deducting from this preferred stock dividends amounting to $65,625 there was left a surplus of $233,027. The expenditures of the company for new construction and for the acquisition of additional properties between July 1, 1910, and May 31, 1911, have aggregated $1,800,938. The majority of the franchises of the company are unlimited as to time, and the others are for long terms. All are free from objectionable restrictions. J. G. White & Company estimated that the physical property of the company, as of Nov. 1, 1910, after deducting depreciation, had a value of $4,510,103 cash, no allowance being made for water rights or for intangibles, such as going business, good will or franchises. The Pacific Power & Light Company is under the management of the American Power & Light Company, which owns the entire outstanding common stock of the company. The American Power & Light Company is controlled by interests associated with the Electric Bond & Share Company, which in turn is controlled through stock ownership by the General Electric Company.

American Light & Traction Company.—As has been the case with the majority of public utility companies, the American Light & Traction Company has shown improvement during the dullness in general business and judging from the returns in the seven months of the current year, the company will earn more on its stock than in any previous year. Gross income in this period was $2,395,203 as compared with $2,050,754 in 1910, and net earnings were $2,229,620, as compared with $1,982,408. The company earned 27.65 per cent on its common stock in 1910, and if the present rate is maintained, as is probable in view of the approach of the winter season, over 28 per cent will be earned on the $10,339,300 outstanding common stock. This is entitled to 10 per cent after 6 per cent has been paid on the $14,236,200 preferred stock. There has been a steady increase in dividend disbursements since 1902, dividends at that time amounting to $499,947, as compared with $2,849,296 in 1910. In the past seven months, the operating ratio was 28.57 per cent, which compares with 31.23 in 1910.

New Orleans Railway & Light Company.—Gross earnings of the New Orleans Railway & Light Company increased about $231,000 in the seven months ended July 31, and the surplus over charges was 5.33 per cent on the $10,000,000 outstanding preferred stock, as compared with 4.61 per cent in the corresponding period in 1910. It is expected that the American Cities Company, which was recently formed to take over the properties of the New Orleans Railway & Light Company and the American Cities Railway & Light Company, will earn about 3¾ per cent on its outstanding common stock during the twelve months ended June 30, 1912.

Public Service Corporation of New Jersey.—Notice has been given by the Public Service Corporation of New Jersey that the 5 per cent, five-year collateral gold notes issued by the corporation under date of Oct. 1, 1910, amounting to $4,000,000, and secured by a trust agreement between the corporation and the Fidelity Trust Company, of Philadelphia, as trustee, will be redeemed and paid with accrued interest at the office of the Trust Company in Philadelphia on Oct. 2, 1911. After this date interest will cease to accrue.

Crocker-Wheeler Company.—The balance sheet of the Crocker-Wheeler Company, as of July 30, 1911, as given in a circular issued by the company's fiscal agents, states as follows: Assets: Plant, $1,338,678; patents, $25,000; stocks and bonds, $32,788; merchandise, $751,333; accounts receivable, $565,978; cash, $120,165, making a total of $2,833,943. Liabilities are given as follows: Common stock, $1,700,000; preferred stock, $500,000; bills payable, $215,000; accounts payable, $19,517; surplus, $399,426.

Virginia Railway & Power Company.—In the fiscal year ended June 30 the statement of the Virginia Railway & Power Company, including that of the Norfolk & Portsmouth Traction Company, shows that a surplus available for dividends of 8.37 per cent was earned on the $7,689,900 outstanding preferred stock, as compared with 5.89 per cent in the previous year, indicating that the consolidation of the two companies has been as beneficial as was expected. The gross earnings of the two companies were $4,335,206, an increase of $356,758 over the same item in 1910. Operating expenses were $2,340,676, and the net revenue was $1,994,530. Other income was $46,296, making a total income of $2,040,826, which is an increase of $162-436 over the corresponding item of the previous year. Interest, taxes and other charges were $1,396,943. The surplus for the year was $643,883, an increase of $191,029. The individual incomes of the two companies were but little different from the showing in the previous year. The individual income of the Virginia Railway & Power Company was about $2,250,000, while that of the Norfolk & Portsmouth Traction Company was about $2,000,000.

Burke Electric Company.—The statement of the Burke Electric Company, of Erie, Pa., for the fiscal period ended April 29 shows net profits available for dividends of 8.03 per cent on the $1,250,000 outstanding capital stock. The balance sheet as of April 29 showed as follows:—Assets: Cash, $12,479; investments, $3,878; accounts receivable, $114,248; inventory, $434,128; patents, good will, etc., $901,454, making a total of $1,466,087. Liabilities were given as follows: Preferred stock, $250,000; common stock, $1,000,000; notes and accounts payable, $31,682; previous surplus $103,982; surplus for 1911, $80,423. The dividends paid during this fiscal period were $20,000, which left a balance of $80,423 to be carried to profit and loss surplus. Under inventory were included $154,630 for material and merchandise; $99,818 for real estate, buildings and fire-protection system, and for merchandise, equipment, tools, etc., $179,680.

American Telephone & Telegraph Company.—As stated in these columns July 1, payment of subscriptions to the $50,-000,000 capital stock of the American Telephone & Telegraph Company issued at that time may be made in full or in four equal instalments payable Nov. 1, 1911; Feb. 1, May 1 and Aug. 1, 1912. To subscribers who have purchased the rights and wish a negotiable instrument between September and Nov. 1 the company will issue a temporary receipt upon either full or part payment. No interest will be paid upon this receipt. This may be used for convenience of the purchaser until full paid or partly paid stock is issued by the company on Nov. 1. The right to subscribe to the new issue expired last week.

Susquehanna Transmission Company.—The Susqeh nna Transmission Company has been authorized by the Maryland Public Service Comission to issue $1,031,000 5 per cent bonds at 90, for meeting its obligations to the Pennsylvania Water & Power Company. The issue was approved by the commission in June, but the order was withheld pending guarantee by the Pennsylvania Water & Power Company of principal and interest, this being authorized by the directors of the company on August 24. A mortgage and deed of trust securing the bonds will be filed with the Knickerbocker Trust Company, of New York.

Chicago Telephone Company.—It is expected that the Chicago Telephone Company will shortly issue an additional $5,000,000 first-mortagage 5 per cent bonds for financing new construction work in the city and the districts in which it operates. The new issue will be the first financing on the part of the company since the sale of the present $5,000,000 outstanding bonds in 1909. The remainder of the $50,000,000 bonds authorized may be issued, in accordance with the terms of the mortgage, at a rate of not more than $5,000,000 per year, but not to exceed 50 per cent of the total assets of the company.

Buffalo General Electric Company.—The report of the Buffalo General Electric Company for the six months ended June 30, 1911, shows that operating revenue in this period amounted to $597,405, an increase of $74,655 as compared with this period in the previous year. Expenses and taxes were $358,680, an increase of $47,253, and net earnings were $238,728, showing a gain of $27,401. Other income was $25,602, making a total of $264,327, as compared with $233,257 in the corresponding period last year. Interest charges were $73,606, and the surplus for the period was $190,721, comparing with th $166,494 shown in the first six months of 1910.

Sherbrooke Railway & Power Company.—The stockhol ers of the Sherbrooke Railway & Power Company have au thorized an issue of $300,000 additional consolidated first-mor gage 5 per cent bonds, in connection with the recent purcha of the Eastern Townships Electric Company, the Lenox Lig & Power Company and the Haustead Electric Company, ar for extending the distribution systems of these companies. banking house has been authorized to offer $150,000 of tl bonds at 95 and interest, carrying a bonus of 40 per cent cor mon stock.

Oklahoma Utility Merger.—A plan for consolidating number of traction interests in Oklahoma City is under co sideration. If the merger is effected the Oklahoma Railw Company, which controls practically all of the street-railw systems in Oklahoma City, will absorb the Oklahoma Centr Railroad Company, which now operates between Chickas and Colgate, with a view of transforming a portion of tl line into an electric interurban system. The plan includ connecting the Oklahoma Street Railway lines with those the Oklahoma Central Company.

Mississippi River Power Company.—Right of way for transmission line from Keokuk, Ia., to Florissant, Mo., h been secured by the Mississippi River Power Company. T company is having surveys made for extending the line fro Florissant to St. Louis, where it plans to supply energy in 19 through the Mississippi River Distributing Company, whi was formed for this purpose. Most of the distribution sy tem in St. Louis will be underground.

Commonwealth Edison Company.—There is an unoffic statement to the effect that the Commonwealth Edison Co pany will arrange such financing as is needed this fall throu the sale of between $4,000,000 and $5,000,000 new stock at p instead of selling additional issues of first-mortgage 5 per c bonds.

Long Acre Electric Light & Power Company.—The Lo Acre Electric Light & Power Company has executed a gene mortgage of $50,000,000 to the Empire Trust Company, of N York, with a deed of trust covering all of its properties Manhattan and the Bronx. The mortgage is to run for fi years and will bear interest at 5 per cent.

Boston Traction Merger.—The stockholders of the W End Street Railway Company, at a meeting this week, vo to accept the terms of consolidation of the Boston Eleva Railway Company, and 221,770 shares of the 301,119 rep sented at the meeting voted in favor of this plan.

DIVIDENDS.

Brooklyn Rapid Transit Company, quarterly, 1¼ per c payable Oct. 1.

Butte Electric & Power Company, quarterly, 1¾ per c payable Oct. 2.

Consolidated Gas, Electric Light & Power Company, of B timore, semi-annual, preferred, 3 per cent; quarterly, comn 1¼ per cent; both payable Oct. 2.

Safety Car Heating & Lighting Company, quarterly, 2 cent, payable Oct. 2.

Twin City Rapid Transit Company, quarterly, prefer 1¾ per cent; common, 1½ per cent; both payable Oct. 2.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Ne Sur
BANGOR RAILWAY & ELECTRIC COMPANY					
July, 1911	$55,677	$26,809	$28,868	$13,056	$1
" 1910	54,007	24,775	29,232	11,921	1
CHATTANOOGA RAILWAY & LIGHT COMPANY.					
July, 1911	$84,175	$50,362	$33,813	$19,870	$1 [illegible]
" 1910	88,412	46,501	41,911	18,601	2 [illegible]
PORTLAND (ORE.) RAILWAY, LIGHT & POWER COMPAN					
July, 1911	$543,704	$258,938	$284,766	$130,660	$15 06
" 1910	490,724	237,378	253,346	116,507	13 39
ST. JOSEPH (MO.) RAILWAY, LIGHT, HEAT & POWER COMPANY.					
July, 1911	$92,375	$60,202	$32,173	$19,239	$1 34
" 1910	90,928	51,289	39,639	18,274	2 65
UNION RAILWAY, GAS & ELECTRIC COMPANY.					
July, 1911	$244,931	$141,736	$103,195	$62,924	$4 71
" 1910	232,318	134,084	98,234	59,480	3 54

General News

Construction News.

[illegible]OTHAN, ALA.—Bonds to the amount of $70,000 have been voted, proceeds to be used for the construction of an electric-light plant.

[illegible]OBE, ARIZ.—The Miami Copper Company is planning to increase [illegible] at its power plant. New machinery will be installed.

MORRILLTON, ARK.—The Morrillton Light & Power Company is [illegible]ing preparations to install new machinery in its plant. The company, it is understood, is planning to establish a twenty-four-hour service. G. [illegible] is vice-president.

[illegible]RSFIELD, CAL.—Bids are being asked by the [illegible] Pipe Line Company for the erection of a telephone system between Midway [illegible] and Ventura, a distance of 70 miles. The cost of the work is [illegible] at about $15,000.

[illegible]TON, CAL.—Electricity for operating the substation now being [illegible] by the Southern California Edison Company in Colton will [illegible]mitted from the Long Beach power plant on high-tension [illegible]ssion lines. Private right-of-way has been secured for the entire [illegible]. The Edison Company has commenced work on the erection [illegible] new transmission line from the mouth of Santa Ana Canyon to [illegible], a distance of 6 miles. The substation at Colton will supply [illegible] for Colton, Riverside, San Bernardino, Redlands, Highland [illegible] other points in this end of the valley.

[illegible]SNO, CAL.—The San Joaquin Light & Power Company has de[illegible] reconstruct its private telephone system between Fresno and [illegible]ld at a cost of about $18,000. The company has begun work on [illegible]ruction of a new substation in Fresno and the erection of a new [illegible]on system from the Madera County transmission line to Dos [illegible] Banos and Gustine, a distance of about 80 miles.

[illegible]NDALE, CAL.—It is reported that preparations are being made [illegible] Glendale & Eagle Rock Railway Company to extend its electric [illegible] from Glendale into the country, which ultimately will reach Sun[illegible] miles distant. Other improvements will also be made to the [illegible]

[illegible]LTON, CAL.—Plans are being made by the Sacramento Valley [illegible]mpany to install new pumping machinery and motor equipment. [illegible] & Robinson, of San Francisco, Cal., are engineers.

[illegible]SEYVILLE, CAL.—Application has been made to the County [illegible]rs by James A. Gunn, Jr., for a fifty-year franchise to erect [illegible]te electric transmission lines on the public roads in Kelseyville [illegible] County.

[illegible] BEACH, CAL.—The City Club has authorized C. E. Jarvis, [illegible]t of the club, to appoint a committee to confer with the City [illegible] of Los Angeles relative to the construction of an electric rail[illegible] miles in length, to connect Long Beach municipal docks and [illegible] with the Los Angeles municipal railway.

[illegible]ANGELES, CAL.—The residents of the Laurel Canyon district [illegible]ning to establish a lighting district and install a tungsten lamp [illegible] system.

[illegible]ANGELES, CAL.—The Otis Elevator Company has secured the [illegible] for installing four traction electric passenger elevators, one [illegible]assenger elevator and one hydro-air sidewalk elevator in a thir[illegible]ry building being erected by the Los Angeles Investment Company [illegible] Street and Broadway, at $37,000.

[illegible]ANGELES, CAL.—The Southern Pacific Company has decided [illegible] the oil burner lamps now in use and to equip its engines with [illegible]tric headlights. Electricity for operating the lamps will be [illegible] by a small dynamo attached to an axle of the engine. The [illegible] is estimated at about $200,000.

[illegible]ANGELES, CAL.—Specifications have been completed for the [illegible] equipment of the San Francisquito No. 1 power site, located [illegible] miles north of Los Angeles. This station will have a generating [illegible] of about 30,000 hp. The cost of the machinery is estimated at abo[illegible] $350,000, bids for which will be received until Oct. 20. E. F. Sc[illegible]rgood is chief engineer of the department.

[illegible]STO, CAL.—The Sierra & San Francisco Power Company is [illegible] to make extensive improvements to its distributing system and [illegible]anches, including the erection of a new substation, work on which [illegible] started.

[illegible]ADA CITY, CAL.—The Northern Water & Power Company is [illegible] to have acquired property on Shady Creek as a site for a larg[illegible] reservoir and hydroelectric plant. Other storage dams and power pla[illegible] will be erected at French Corral and other points on San Juan [illegible]

[illegible]COVILLE, CAL.—Arrangements are being made by the Great We[illegible]rn Power Company and the T. B. Walker and Curtis, Collins and Ho[illegible]ook timber interests for the construction of a railroad from a [illegible] on the Western Pacific Railroad to the Big Meadows. The proposed railroad will be about 18 miles in length and will extend along the north fork of the Feather River at the junction of north fork and the east branch. The plans also include the construction of a large saw mill. The cost of the entire work is estimated at about $1,750,000.

PASADENA, CAL.—The city clerk has been authorized to advertise for bids for the installation of an ornamental street-lighting system on South Orange Grove Avenue, the cost of which is estimated at $50,000.

RIVERSIDE, CAL.—The contract for installation of an ornamental street-lighting system on Twelfth Street, between Main and Pepper Streets, has been awarded to the Southwestern Electrical Company for $2,395.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has submitted a bid to the Board of Supervisors for lighting the suburbs of Oak Park, Highland Park, Curtis Oaks and East Sacramento, offering to supply arc lamps at $6 each per month; under the old contract the charge was $6.30 each per month. The South Sacramento Power Comapny submitted a bid asking $6.20 per lamp per month for the service.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company has been granted a franchise to erect and operate an electric transmission line in San Bernardino for a period of fifty years. Under the terms of the franchise the company is to pay the city 5 per cent of its gross earnings after the first five years. The company paid $150 for the franchise.

SAN FRANCISCO, CAL.—Surveys have been completed by the United Properties Company for its proposed railway between Oakland and Sacramento.

SAN JOSE, CAL.—Plans are being considered for installing an electric-light system on Market Street. It is proposed to erect luminous arc lamps. The service will be supplied by the Great Western Power Company.

SAN JOSE, CAL.—Preparations are being made by the Great Western Power Company to extend its system to San Jose. The company expects to reach this city by Jan. 1, 1912, with its long-distance transmission lines and will probably erect a steam plant here without delay to furnish electricity for lamps and motors until the lines are completed. The transmission line to Livermore will be completed about Sept. 15. The present plans of the company involve an expenditure of about $250,000.

SANTA ANA, CAL.—The Southern California Edison Company has submitted an offer to the City of Santa Anna offering to sell its local distributing system, exclusive of transmission lines and other property, for $165,000, on condition that the city enter into a fifteen-year contract with the company to purchase energy at the rate of 2 cents per kw-hour.

SANTA MONICA, CAL.—The city has entered into a contract with the Southern California Edison Company for street lighting, under the terms of which the company is to supply arc lamps at the rate of $5 per lamp per month, on a moonlight schedule. If lamps are operated all night the rate is to be increased 75 cents per lamp per month. About 134 lamps will be used.

SUSANVILLE, CAL.—Water locations have been filed on Eagle Lake and Willow Creek by Alva Udell for hydroelectric development.

BOULDER, COL.—The City Council is considering the question of establishing a municipal electric-light plant in Boulder.

DURANGO, COL.—The San Juan Water & Power Company is reported to be contemplating extending its service to Creede. It is proposed to erect a transmission line from the Tacoma plant to supply the city of Creede with electricity for lamps and motors and also the mines and mills in that vicinity.

JOHNSTOWN, COL.—The Johnstown Milling & Elevator Company is making arrangements to equip its machinery for electrical operation, energy for which will be supplied by the Northern Colorado Power Company. The company has purchased a 50-hp motor to replace the gasoline engine now in use.

PYRAMID, COL.—The Chuckawalla Development Company is making preparation to construct a large dam at Bull's Head Canyon, below Pyramid, on the Colorado River. A power plant will be installed to supply electricity to operate the pumps to supply water to irrigate a large tract of land in the Chuckawalla valley.

NEW HAVEN, CONN.—Plans have been completed by the United Illuminating Company to erect an ornamental lighting system on Chapel and Church Streets in the business district. It is proposed to erect eighty lamp standards, each carrying a group of five lamps. The expense for extra lighting is to be borne by the merchants and business houses in that section.

SOUTH NORWALK, CONN.—The Housatonic Power Company is planning to extend its service to Georgetown as soon as improvements to the power plant and power and lighting systems in the Norwalks are completed.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has awarded contract for the erection of the addition to its

power plant on Buena Vista Street to A. S. Reed & Brother Company, at Wilmington, Del. The cost of the plant complete is estimated at $60,000. The company is rebuilding its distributing line extending along Vandever Avenue and across Eleventh Street bridge, the cost of which is estimated at about $10,000. Preparations are being made by the Wilmington & Philadelphia Traction Company to install ornamental lamps on Market Street, to cost about $15,000. It is expected to have the system ready in October.

HIGH SPRINGS, FLA.—The local ice company is contemplating the installation of an electric-light plant in connection with its ice factory. The company will soon apply for a franchise to supply electricity for lamps on Main and First Streets.

NEW SMYRNA, FLA.—The installation of an electric-light plant, water works and sewer system is under consideration. A. D. P. Smith is chairman of committee.

BOISE CITY, IDAHO.—It is reported that W. S. Kuhn, of Pittsburgh, Pa., and associates are contemplating the construction of a chain of large hydroelectric plants along the Snake and Salmon Rivers, where it is estimated that from 125,000 to 200,000 hp can be developed. The Snake River from Milner to Payette has been selected as the site for several power plants.

CANTON, ILL.—The Illinois Central Electric Railway Company has awarded the contract for the construction of its extension from Norris to Farmington to the Porter Construction Company, of Mackinaw.

COLUMBIA CITY, IND.—The Farmers' Mutual Telephone Company is rebuilding its telephone system and is placing its wires in underground conduits.

DUGGER, IND.—The Sullivan County Electric Company has applied to the Town Board for a franchise to install and operate an electric-light plant in Dugger.

EVANSVILLE, IND.—The Evansville, Henderson & Owensboro Railway Company, recently incorporated to construct and operate an electric railway between Evansville, Henderson and Owensboro, is planning to erect and operate an electric transmission line to supply electricity for lamps and motors in the cities named. The company also proposes to operate a ferry to transport interurban cars across the Ohio River. The directors are: W. A. Carson, W. H. McHurd, M. S. Sontagg, Philip Speck, C. H. Battin and C. C. Tennis.

GARY, IND.—Work will be started at once on the construction of the Gary, Hobart & Eastern Traction line, which is to connect Gary and Hobart. Citizens of Hobart and farmers residing along the line are financing the railway.

INDIANAPOLIS, IND.—The Postal Telegraph Company will place its wires underground in the business district of the city in compliance with an order of the Board of Public Works. The contract for building the underground conduit has been awarded to Gest & Company, of Cincinnati, Ohio.

KENDALLVILLE, IND.—F. H. Fradick, of Toledo, Ohio, consulting engineer in connection with remodeling and improvements to the municipal electric-light plant and water works system, has recommended the construction of spurs from the railroads entering the city to the power house, the cost of which is estimated at about $20,000. He also recommends the installation of a three-phase electric system and the installation of gas and oil engines for motive power. The cost of the entire work is estimated at about $60,000.

LOGANSPORT, IND.—The contract for building the concrete power dam on the Eel River at Tenth Street has been awarded to J. Yawger & Company, at $10,985. The dam will replace the present wooden structure.

NEW CASTLE, IND.—Preparations are being made by the Indianapolis, New Castle & Toledo Railway Company for making a survey of its proposed extension from New Castle to Richmond, via Millville, Hagerstown and Greensfork. It is expected that work will begin on this extension this year.

NOBLESVILLE, IND.—The plant and holdings of the White River Light & Power Company, of Noblesville, Ind., which was sold at receivers' sale recently, have been acquired by the Noblesville Heat, Light & Power Company and the Indianapolis Water Company for $30,000. It is understood that the transmission lines and such part of the steam plant as can be used will be taken over by the Noblesville Heat, Light & Power Company. The dam, located on the White River 2 miles north of this city, will not be completed at present. The Indianapolis Water Company, it is understood, hopes eventually to secure part of its supply from the reservoir at the dam.

OAKLAND CITY, IND.—Plans are being considered for the installation of a central heating plant to supply all the buildings on the campus of the Oakland City College.

RUSHVILLE, IND.—The Rushville Furniture Company is building a new factory which will be equipped for electrical operation.. The company will install an electric generating plant and will soon be in the market for machinery and equipment for same.

SHELBYVILLE, IND.—The City Council has appropriated $8,000 for the purchase of new machinery and equipment for the city pumping station.

SOUTH BEND, IND.—It is understood that work will soon be resumed by the South Bend & Logansport Traction Company on its railway from South Bend to Logansport, at which point connection will be made with the Indiana Union Traction Company for Indianapolis.

VINCENNES, IND.—Contracts have been awarded by the Vincen North & South Traction Company for the construction of its propo railway from Vincennes to Sullivan. B. M. Willoughby, of Vincen Ind., is president.

VINCENNES, IND.—Arrangements are being made by the Vincen & Southeastern Interurban Railway Company to secure the right of w for its proposed electric railway from St. Meinrad to Troy, and fr Troy through Tell City to Cannelton. Right of way from Vincennes St. Meinrad has already been obtained.

WORTHINGTON, IND.—The Indiana Water & Light Company sold its plant and holdings to W. H. Yule, of Hartford City, Ind. I understood that the new owner will take charge of the plant at o

CHARLES CITY, IA.—The Western Electric Telephone Company is reported, is contemplating extensions and improvements to its sys involving an expenditure of about $40,000. F. M. Win, of Des Moi is engineer.

CLARION, IA.—The Jenson Construction Company has secured contract for rebuilding the local electric-light plant, owned by Mo & Mack, which was recently destroyed by fire. The cost of the wor estimated at about $4,500.

COLFAX, IA.—The Colfax Electric Light Company has been gr a franchise to erect a transmission line from its Colfax plant to P City to furnish electricity for lamps and motors in that city.

COON RAPIDS, IA.—The installation of a three-lamp elect lighting system in Coon Rapids is under consideration. The local tric-light company agrees to supply electricity for operating the lam the same rate the town is now paying for arc lamps.

KEOKUK, IA.—The Mississippi River Power Company has sec all the right of way for the transmission line from its plant at Ke Ia., to Florissant, Mo., and surveys are now being made for the from Florissant into St. Louis, Mo. The selection of a site for a t forming station in St. Louis is now under consideration. It is ex to furnish electricity in St. Louis in 1913. The Mississippi River tributing Company has been formed to distribute the energy i Louis. Most of the cables and wires in St. Louis will be placed u ground.

OGDEN, IA.—The City Council has decided to enter into a tract with the Boone Electric Company, of Boone, Ia., to supply tricity to operate the municipal electric-light system. In order to demands for electrical service it would have been necessary to extensive repairs to the municipal plant and it seemed more feasil purchase energy from Boone, giving the city a twenty-four service, to rehabilitate the plant.

LA CYGNE, KAN.—Plans have been prepared by the J. S. W Company, Reliance Building, Kansas City, Mo., for the construction electric-light plant and water-works system in La Cygne, bids for it is said, will be called for in the near future. The cost of the is estimated at about $30,000.

MANHATTAN, KAN.—The Manhattan City & Interurban R Company will soon be in the market for material for its proposed e railway from Manhattan to Fort Riley, including rails, ties, machinery, overhead material, etc. The railway will be about 15 in length. Joseph T. West, of Manhattan, Kan., is general manag

FRANKFORT, KY.—The State Board of Control is consideri the question of building an electric railway from the Western Ke Asylum for the Insane to Hopkinsville, a distance of about 2 miles cost of the proposed railway, including equipment, is estimated at $35,000.

LOUISVILLE, KY.—The installation of a 10,000-hp turbo-ge set in the power plant of the Louisville Lighting Company ha completed by the General Electric Company. A new condenser w installed at the same time. G. Wilbur Hubley is chief engineer.

WATERVILLE, MAINE.—Bids have been submitted to City for street lighting by the Waterville & Fairfield Railway & Light C and the Central Maine Power Company for a period of five year Waterville & Fairfield Railway & Light Company offers to furnis tricity to light the city with the present equipment at $5,560 pe and for additional service will charge $10 for each additional a and $5 for each incandescent lamp, equipment to be furnished the city, and $5 each for additional fire alarm boxes and police signa oxes. material to be furnished by the city. The Central Maine Powe pany agrees to supply the servcie at $5,740 per year and to supp additional arc lamps at $50 each, 32-cp incandescent lamps at $6 e per year, and for additional fire alarm and police signal bells, $4.50 e per year. The Central Maine Power Company also agrees to presen the city a check for $6,000 to be used in the construction of the posed central fire station upon signing of the contract. The company h been furnishing the service for the past five years at $5,300 per year.

BALDENSBURG, MD.—The Washington, Westminster & Ge sburg Railway Company, it is reported, has purchased a mill building, ich it proposes to remodel for electric power house. W. H. Saunde 1407 F Street, Washington, D. C., is president of the company.

HAGERSTOWN, MD.—Announcement has been made that resdents of Washington County have subscribed to $90,000 of bond of the Hagerstown & Clearspring Electric Railway Company and the construction of the railway is assured. The company will appl the Public Service Commission for permission to begin work on same

[illegible]OOKLINE, MASS.—The [illegible] has granted the [illegible]ston Electric Illuminating Company, of Boston, permission to extend [illegible] underground conduit system in [illegible].

[illegible]HARLTON, MASS.—The Selectmen have granted the Southbridge G[illegible] & Electric Company a franchise to erect transmission lines through th[illegible] town. The company has a contract to furnish electricity to the [illegible]onic Home and will supply electrical service along its line.

[illegible]ELROSE, MASS.—Mayor Eugene H. Moore has signed a contract w[illegible] the Malden Electric Company for lighting the streets of the city fo[illegible] a period of ten years. The new contract calls for an all-night moonli[illegible] schedule. Under the old contract the lamps burned until 12.30. [illegible] appropriation for this year is $[illegible] for street lighting.

[illegible]ORTH ADAMS, MASS.—It is reported that the power plant to be [illegible] the Deerfield River by the New England Power Company [illegible] [illegible]ply electricity to operate trains through the Hoosac tunnel and [illegible]kshire Street Railway Company's system. It is understood that [illegible] plant in Zylonite will be used as [illegible]. [illegible] N[illegible] England Power Company is planning to build a storage reservoir at [illegible]earsburg, Vt., in the upper waters of the Deerfield.

[illegible] CREEK, MICH.—[illegible] [illegible] Power Company [illegible] [illegible]ek, to be located on Union Street near the Battle Creek River. [illegible]sed to make Battle Creek the distributing center of the hydro-[illegible]evelopment on the Au Sable River for this district when com-[illegible] The dam now being built, which will develop about 9000 hp, [illegible]e of thirteen to be erected on the river.

[illegible]Y, MINN.—The Citizens' Electric Light & Power Company, it [illegible] contemplating the installation of [illegible] electric-light plant [illegible] to cost about $25,000.

[illegible]RT, MINN.—The installation of a municipal electric-light plant [illegible] is reported to be under consideration.

[illegible]SVILLE, MINN.—Plans are being prepared by the Consumers' [illegible]mpany, of Mankato, Minn., to extend its system from that place [illegible]ille to furnish electrical service in the town. The company also [illegible] to extend its transmission lines to Eagle Lake and Waseca.

[illegible]H BRANCH, MINN.—It is reported that the Eastern Minnesota [illegible]mpany is contemplating the installation of an electric lighting [illegible] North Branch during the coming Fall.

[illegible]S CITY, MO.—Plans are being considered by John Rowe, [illegible] George Casebeer, A. L. Howard, of Louisburg, and associates [illegible] electric railway between Kansas City and [illegible].

[illegible]TT, MO.—The contract for equipment and machinery for the [illegible] municipal electric-light plant has been awarded to the Squire [illegible] & Construction Company, of Kansas City, Mo., for $28,000, [illegible]onstruction of power house to H. T. Bramer, of Monett, Mo., [illegible] Rollins & Westover, of Kansas City, Mo., are consulting [illegible].

[illegible]GFIELD, MO.—The Green County Court has granted the Ozark [illegible] Water Company permission to build and maintain conduits and [illegible]ugh the highways of Greene County for the transmission of [illegible]m its proposed light plant near Hollister, Mo. The company [illegible] to furnish electricity to all cities and towns between its plant [illegible].

[illegible]SEPH, MO.—The City Council is reported to be considering the [illegible]f issuing bonds for improvements to the municipal electric-light [illegible]s to supply electricity for commercial purposes as well as for [illegible]ting. A special election will probably be called to submit the [illegible].

[illegible]SEPH, MO—The contract for electrical work on the new Bur-[illegible]wift-Armour bridge, which is being erected on the old Winner [illegible] been awarded to the American Electrical Company, of which [illegible] Reid, of St. Joseph, Mo., is president. The contract calls for [illegible]iture of more than $25,000.

[illegible]ENSBURG, MO.—It is reported that plans are being considered [illegible]stallation of an electric-light plant at the State Normal School [illegible]sburg, to cost about $20,000.

[illegible]Y, MONT.—The Sidney Electric & Fuel Company has been [illegible] franchise to install and operate an electric-light plant in Sidney.

[illegible]Y, MONT.—The installation of an electric-light plant in Terry [illegible]d to be under consideration. Edward Phillips is said to be [illegible] the project.

[illegible]VELL, NEB.—It is reported that Messrs. Reasoner and Beards-[illegible], Neb., who are planning [illegible] Riv[illegible] north of Burwell, have secured subscriptions amounting to $10,000 tow[illegible] the project. The plans include the development of 1000 hp and sup[illegible]ing electricity to light towns and the construction of an electric [illegible] Taylor and Almeria.

[illegible]ON, NEB.—The Johnston Electric Company, of Omaha, Neb., is [illegible] to have secured the contract for installation of an electric-light [illegible] Gordon. H. D. Huntington is city clerk.

[illegible]SON CITY, NEV.—The construction of an electric railway from [illegible] to Lake Tahoe is reported [illegible] Willi[illegible]ms, one of the owners of the Glenbrook golf links on Lake Tahoe, is i[illegible]terested in the project.

[illegible]STFIELD, N. J.—The construction of an electric railway between Westfield and Newark, via Irvington, Germantown, and along Echo Lake, is reported to be under consideration by L. P. Naylor and as[illegible].

BALLSTON SPA, N. Y.—The properties and franchises of the Hudson River Electric Power Company, including subsidiary companies and the large generating plant at Spier Falls, were sold Aug. 29 at foreclosure sale to Frank M. Edwards, of Boston, Mass., representing the [illegible].

EPHRATAH, N. Y.—The Mohawk Hydro-Electric Company is reported to have purchased the Yauney Woolen Mill and about twelve acres of land for $13,300. The company, it is said, will equip the mill and operate it, providing the electric railway goes through the town.

PINE BUSH, N. Y.—At an election held recently the citizens voted to authorize the Commissioners to enter into a contract with the Wallkill Valley Light & Power Company, of Walden, N. Y., to light the streets of the village for a term of five years.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to increase the output of its power station No. 6 by 2000 hp.

LENOIR, N. C.—It is reported that negotiations are under way between the Board of Trade and H. L. Millner, reported to represent Baltimore capitalists, relative to building a hydroelectric plant on Catawba River. It is proposed to furnish electricity in Lenoir to the amount of 2000 hp.

RALEIGH, N. C.—It is reported that the Southern Power Company, of Charlotte, N. C., is contemplating making a connection with the lines of the Carolina Power & Light Company, of Raleigh. The transmission lines of the Southern Power have been extended as far as Durham and it is proposed to extend the line to Raleigh. It is understood it is proposed to connect up the two systems so as to place the companies in a position to connect their lines in case of emergency. The Carolina Power & Light Company is erecting a substation near Raleigh and is also making surveys for the erection of transmission lines to Henderson and Oxford and to Goldsboro and the East.

SHELBY, N. C.—The City Council, it is reported, is contemplating purchasing the electric plant of the Shelby Light & Power Company or building a new plant. The company offers the plant to the city for $20,000.

BISMARCK, N. D.—The contract for the installation of ornamental lamp standards in the business district of the city has been awarded to Grambs & Peet, of Bismarck, N. D., at $12,157.

BELLEFONTAINE, OHIO.—Plans are being considered by the Belle Center Commercial Club and Eastern capitalists for the construction of an electric railway, 60 miles in length, to connect Findlay, Russell's Point, Lewiston, Reservoir, Kenton, Belle Center, Huntsville and the reservoir resorts of Lakeridge and Orchard Island.

COLUMBUS, OHIO.—It is reported that bids received by H. S. Holton, Director of Public Service, on Aug. 22, for ornamental cast-iron lamp standards to be used in connection with the installation of cluster lamps in the city, have been rejected. It is understood that new bids will be called for.

TOLEDO, OHIO.—The Toledo Factory Company, recently organized by the factories committee of the Commerce Club, proposes to erect an industrial power plant building, which was projected by the old Chamber of Commerce. The company is capitalized at $300,000. Isaac Kinsey is chairman.

WARREN, OHIO.—The Mahoning & Shenango Railway & Light Company is planning to build a belt line railway in Warren, Ohio.

WOODSDALE, OHIO.—The Miami Power Company, of Hamilton recently incorporated, is reported to be contemplating the construction of a hydroelectric power plant on the site of the Catfield & Woods paper mill. Electricity generated at the plant will be transmitted to Hamilton, Middletown, Miamisburg and Franklin. The cost of the plant is estimated at about $500,000. Post office address is Trenton, Ohio.

FALLS CITY, ORE.—The Van Zandt & James Company is contemplating the construction of a hydroelectric plant in the Willamette Valley.

MARSHFIELD, ORE.—Surveys are being made by the Coos Bay & Eastern Electric Railway Company for its proposed railway from Marshfield to Roseburg, via, Myrtle Point.

PORTLAND, ORE.—The Valley Improvement Company will soon begin work on construction of its hydroelectric plant near Randle, Wash. The cost of the plant and transmission system is estimated at $15,000,000.

HARRISBURG, PA.—The Central Pennsylvania Traction Company has placed orders with the Hooven-Owens & Rentschler Company, of Hamilton, Ohio, for a cross-compound, condensing engine to be connected to General Electric 1600-kw, 500-volt, direct-current generator to be installed in its Harrisburg plant.

HAZLETON, PA.—The erection of another large electric power plant in the Hazleton region is under consideration. Surveys are being made at Hazle Creek, 7 miles east of Hazleton, along the Lehigh Valley Railroad, with a view of locating a power plant at the point where the streams meet others flowing from the Hazleton district. Edmund Coxe, of Philadelphia, Pa., is said to be interested in the project.

PHILADELPHIA, PA.—Permits have been granted to the Philadelphia Rapid Transit Company for the erection of a concrete and brick substation on East Ledderly Street, to cost about $23,000, and a storage

building on East Cumberland Street, to cost $7,000. H. B. Nichols, 820 Dauphin Street, Philadelphia, Pa., is chief engineer.

PHILADELPHIA, PA.—The Pennsylvania Equipment Company, West End Trust Building, Philadelphia, Pa., is reported to be in the market for a second-hand 300-400-kw, 250-volt, direct-current generator direct connected to engine; also a second-hand 300-kw, 250-volt, direct-current generator with steam turbine, steam pressure 150 lb., 26 to 28 in. vacuum.

PHILADELPHIA, PA.—The Luzerne County Gas & Electric Company, recently incorporated with a capital stock of $2,090,000, has taken over the following companies recently incorporated in Luzerne County: The West Wyoming, Warrior Run, Union Township, Hunlock Township, Sugar Notch, Shickshinny, Larksville, Pringle Township, Wyoming Lake Township, Lehman Township, Forty Fort and Jackson Township electric companies and the Gas Company of the West Side. The office of the company will be located in Philadelphia. M. W. Stroud is president of the company.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company, recently chartered with a capital stock of $4,542,500, has taken over the following companies recently incorporated, all located in the vicinity of Philadelphia: The Gas Company of Delaware County, the Gas Company of Rock Ledge, the Gas Illuminating Company of Delaware County, the Horham, Southampton, Upper Dublin, Whitpain, Warminster and Township Electric companies; Warwick Suburban Electric Company, of Upper Pottsgrove, West Pottsgrove, Lower Pottsgrove, Upper Providence, East Pikeland, Limerick, East Vincent and East Coventry. The office of the company will be located in Philadelphia. M. W. Stroud is president.

PITTSBURGH, PA.—The City Council is making investigations at the municipal electric-light plant on the North Side with a view of making improvements to same. An appropriation of $18,000 was made by the old city of Allegheny but was not used. New machinery is needed at the power house, and the Council is considering the advisability of enlarging the plant.

PHOENIXVILLE, PA.—The construction of an electric railway from St. Peters to Phoenixville is reported to be under consideration. David J. Knauer and associates are said to be interested in the project.

SCRANTON, PA.—The United Service Company, which operates the Tuscarawas County Electric Light & Power, which supplies electrical service in New Philadelphia and Canal Dover, Ohio; the New Philadelphia Heating Company; United Electric Company, of Dennison, Ohio, which supplies electricity in Dennison, and operates the Uhrichsville Street Railway, which connects Dennison and Uhrichsville, is planning extensive improvements and extensions to its Ohio plant, involving an expenditure of several hundred thousand dollars and including the erection of new power houses, reconstruction of transmission lines and other improvements. The company recently took over the property of the Warren Light & Power Company, of Warren, Pa. L. H. Conklin is manager of the company. The main office of the company is located in Scranton, Pa.

SOMERSET, PA.—It is reported that all bids for the construction of the power house for the new water-works plant have been rejected.

WAYNESBORO, PA.—Rights of way are being secured by the Chambersburg, Greencastle & Waynesboro Street Railway Company for the construction of an extension of its railway from Chambersburg to Shippensburg.

YORK HAVEN, PA.—E. F. Baker was dismissed as receiver of the York Haven Water & Power Company on Aug. 26 by Judge Wanner. The plant will be operated under the direction of Mr. Baker, who was general superintendent of the York Haven plant prior to the receivership. The receivership has been in force since Feb. 24, 1910.

STA. YSABEL, P. R.—Plans have been prepared by Blas C. Silva, civil engineer, of Ponce, P. R., for installing an electric-light plant with sufficient output to supply electricity for incandescent lamps for about 400 families and for street lighting. The equipment is to include a gasoline engine, generator, switchboard, lamps and accessories.

JAMESTOWN, R. I.—The erection of an electric-light plant in Jamestown is reported to be under consideration.

PROVIDENCE, R. I.—William D. Marks, of New York, N. Y., has been engaged by the City Council committee on lights to investigate the street-lighting system in Providence. Investigation will also be made of both the electric and gas commercial lighting systems.

CHARLESTON, S. C.—Bids will be received at the office of Ione Simons, city electrician, until Oct. 18 for lighting the streets of the city of Charleston, S. C., for a term of one, two or four years with electricity, gas or some other illuminating power equivalent thereto. The estimate requirements are 300 arc lamps, of the inclosed type, of 1200 cp. Specifications will be furnished on application. The service is to be furnished by June 30, 1912.

PIERRE, S. D.—The Twentieth Century Transportation Company, recently incorporated, proposes to construct an electric railway from Chicago to Rapid City to cross Illinois, northeast Iowa, Minnesota and South Dakota by the way of Decorah, Minneapolis, Watertown and Pierre. The company is capitalized at $1,000,000. The headquarters of the company are located in Pierre.

KNOXVILLE, TENN.—The City Council has granted the Eastern Tennessee Power Company a franchise to supply electricity in Knoxville for a period of thirty-five years, under the terms of which the compa is to pay the city of Knoxville 1 per cent of its gross receipts for t first fifteen years, 2 per cent for the second fifteen years, and 3 cent for the remaining five years. The company also agrees to sup electricity to all consumers for lamps and motors at 10 per cent less th is now paid for the service and to supply arc lamps for street lighting $60 each per year. The city now pays $72.50 per lamp per year.

MARYVILLE, TENN.—The Maryville Electric Light, Heat & Pow Company, recently incorporated, is planning to erect a large hyd electric plant at Abram's Falls on Abram's Creek, 25 miles from Ma ville. It is proposed to supply electricity for lamps and motors in t place and other towns and cities in the county. The incorporators a I. B. Zeigler, John M. Clark and James A. Goddard, of Maryville, J. G. and William Sterchi, of Knoxville, Tenn.

TRENTON, TENN.—The City Council has passed an ordinance a orizing a bond issue to the amount of $12,000, the proceeds to be for the installation of a municipal electric-light plant. An election be held Sept. 28 to submit the proposition to a vote.

WINCHESTER, TENN.—Plans are being considered by the Light Water Department for the erection of a new pumping station. A stage, 250-gal. turbine pump will be installed. The station will be loc about three-fourths of a mile from the town. William J. Dodge is su intendent of the Light and Water Department.

DENTON, TEX.—Plans are being considered for improvements to municipal electric-light plant, including the installation of a new g rator.

FT. WORTH, TEX.—The Ft. Worth Power & Light Company filed for record a mortgage and deed of trust in favor of the Citiz Savings & Trust Company, of Cleveland, Ohio, to secure a bond issu $10,000,000.

GALVESTON, TEX.—It is reported that financial arrangements been made for the construction of a large dam across the Devil Rive Western Texas, for the purpose of irrigating a large cotton field sisting of 156,000 acres in McKinney, Valverde and Maverick cou The plan also includes the erection of a large cotton mill to be ope by electricity generated by water power created by the dam. The of the work is estimated at about $5,000,000.

SINTON, TEX.—The plant and holdings of the Sinton Ice & P Company have been purchased by R. V. Covey, of Houston, Tex., J. K. Ross, of Oklahoma City. The company will be known as Sinton Ice, Light & Power Company. It is proposed to enlarge electric plant and supply electricity for the entire town. A new rator will be installed.

OGDEN, UTAH.—The Ogden Rapid Transit Company is contempl the construction of an extension from Brigham City to Grace, Ut

OGDEN, UTAH.—The Merchants' Light & Power Company has pleted the erection of its electric system, including 275 arc lamp street lighting, and is now negotiating with the City Council to hav street-lighting contract start from Sept. 1 instead of Sept. 27 as inally planned. The contract with the Utah Light & Railway Com expired several months ago and the city is at liberty to turn the co over to the new company at any time. Under the new contract th will save $250 per month on the cost of street lighting and wil secure a number of lamps for the city buildings and parks free of

SALT LAKE CITY, UTAH.—The City Council has granted the Light & Railway Company a franchise to extend its railway syst Capital and University Heights districts. The Utah Light & R Company is contemplating raising its dam at the east end of the canyon.

RUTLAND, VT.—The Rutland Light & Power Company has s an injunction against the Clarendon Power Company, recently in rated to build a power plant at the Clarendon gorge on Mill which has undertaken to condemn forty acres of land along th River with water power, which is now owned by the Rutland Co

ARLINGTON, VA.—Arrangements are being made by the Arl Electric Company to extend its system from Columbia pike to Clar a distance of 2½ miles. The line will eventually be extended to Church. Electricity for operating the system will be supplied Alexandria County Electric Light Company.

COLONIAL BEACH, VA.—Bids will be received until Oct. 11 H. W. B. Williams, Mayor, for the construction of a power house. Stevens, Union Trust Building, Washington, D. C., is consulting neer.

WEST POINT, VA.—The Town Council has granted the F Light, Heat & Power Company an exclusive franchise for a per of thirty years.

ABERDEEN, WASH.—It is reported that the installation of a municipal electric-light plant in Aberdeen is under consideration.

CHEHALIS, WASH.—Application has been made to the County Commissioners by A. W. Van Arsdell for a franchise to erect transmission lines in Lewis County to supply electricity for lamps and motors.

CHEHALIS, WASH.—The Chehalis & Cowlitz Railroad Company, which was organized to build a railway between Chehalis and point on the Cowlitz River, has entered into an agreement with the Washington-Oregon Corporation, of Chehalis, Wash., to build and operate its railway in Chehalis and east and south for 1½ miles. The last-named company will operate the railway temporarily.

YLE, WASH.—The Northwestern Electric Company has purchased [illegible] miles of water rights on the Klickitat River, near [illegible], from [illegible] Parsley & Ryrie, of Spokane, for $75,000. Plans are being made for the erection of additional power plants in this section. The company is now building a large power plant near here. Herbert Fleischhacker, of San Francisco, Cal., is interested in the company.

NEWPORT, WASH.—The Interstate Telephone Company has applied for a franchise to erect its system in Newport, Wash. J. W. Fisher is [illegible].

OLYMPIA, WASH.—The Olympia Light & Power Company is reported to have awarded the contract for construction of the Lake Lawrence reservoir on the Des Chutes River to A. A. Borey & Company, of Tacoma, [illegible].

SEATTLE, WASH.—George W. Dilling, Mayor, has authorized the City Council to sell $800,000 of municipal street-car bonds, which were authorized by the voters last March, to provide funds for the acquirement by purchase or condemnation proceedings or for the construction of a new railway through the Ranier Valley, paralleling the line of the Seattle, [illegible] & Southern Railway, between Fyan Street, at the southern city [illegible] and Stewart and Blanchard Streets on the north. The ordinance provides for an extension from Stewart and Blanchard Streets and [illegible] Avenue to Salmon Bay at Thorndyke Avenue, a distance of 4 [illegible]. City Engineer R. H. Thompson has completed the valuation of the property of the Seattle, Renton & Southern Railway and an offer of $386,063 was made for the railway by the Board of Public Works. [illegible] D. O'Brien, assistant superintendent of public utilities, estimates that the property of the company can be duplicated at a cost not to exceed [illegible]0, leaving $250,000 for the extensions to Ballard and for better[illegible].

SPOKANE, WASH.—The Home Automatic Telephone Company is making arrangements to build a telephone station on Fourth and Napa Streets. J. B. Langely is manager.

SPOKANE, WASH.—The Interstate Telephone Company is planning [illegible] new exchange building on Trent Avenue. Connection will be [illegible] with the system of the Home Automatic Telephone Company, thereby rendering service over the entire district.

TENINO, WASH.—The Washington-Oregon Corporation has acquired the property of the Tenino Light, Power & Water Company, of Tenino. [illegible] consideration is said to be $40,000.

TOPPENISH, WASH.—The Town Council is reported to have granted [illegible] Reservation Electric Company a franchise to install and operate an [illegible] light and power plant in Toppenish for a period of fifty years.

WARWOOD, W. VA.—The Warwood Power & Light Company, re[illegible]organized, will soon apply to the Council for a franchise to con[illegible] and operate an electric-light plant in Warwood. William Emsley, [illegible] Helfenfine, R. A. Alexander, Edward Kilver and Earl Bell are [illegible]ed in the company.

FOND DU LAC, WIS.—Plans are being considered by the Eastern [illegible]sin Railway & Light Company for an addition to its power house [illegible] North Main Street and Rees Street in Fond du Lac, to cost about [illegible].

RED DEER, ALTA., CAN.—The Board of Trade has engaged the [illegible] Engineering Company, of Calgary, to make preliminary surveys for the construction of a hydroelectric plant. R. T. Davidson is secretary [illegible] of Trade.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company is planning to build an extension from New Westminster to [illegible].

VICTORIA, B. C., CAN.—The City Council is contemplating extend[illegible] the ornamental street-lighting system on View Street. It is under[illegible]od that provision will be made for installing conduits for wires for [illegible] lamps in the James Bay district.

HAMILTON, ONT., CAN.—The Board of Control has recommended to the City Council the erection of a transmission line through the [illegible] for the purpose of utilizing power from the hydroelectric power [illegible] under the bylaw passed July 25. It is proposed to erect a tem[illegible] line through the city from the end of the present line to supply [illegible] Gore, the City Hospital and various other municipal buildings and several other institutions of the city. It is also proposed to sell power to consumers along the route to defray the expenses of construction of [illegible].

LONDON, ONT., CAN.—Petitions are being circulated in the city asking the residents to petition the City Council to extend the ornamental street-lighting system. The petition asks for 325 lamp standards, each carrying five lamps, making a total of 1625 lamps.

NORTH TORONTO, ONT., CAN.—The Town Council has entered into a contract with the Hydroelectric Power Commission to supply electricity to operate the municipal electric-light system for a term of [illegible] years. The Toronto Electric Light Company submitted a bid offering to maintain and operate the plant and supply street lamps at $14 each per year and to furnish electricity to private consumers at city rates, and in addition to pay the town 5 per cent per annum on the cost of the plant as rental. The tender submitted by the Interurban Electric Company, Ltd., offered to operate the plant and furnish street lamps at $9 each per year and supply electricity for lamps at 3 cents per [illegible] hour.

PRINCE ALBERT, SASK., CAN.—At an election held Aug. 27 the by-law authorizing an appropriation of $700,000 for the construction of a hydroelectric power plant at La Colle Falls was carried.

SCOTT, SASK., CAN.—Tenders will be received by G. M. Phillips, secretary and treasurer, until Sept. 25 for furnishing and delivering the following machinery and supplies: Tender A—Generator, exciter, switchboard, transformers, meters, series tungsten street-lighting system and pumping system. Tender B—Two pneumatic storage tanks. Tender C—Approximately 2200 ft. of 3-in. steel wire pipe; 7000 ft. of 6-in. water pipe; 5400 ft. of 4-in. steel water pipe and approximately 15 hydrants and 24 valves. Tender D—Trenching and laying steel water pipe, setting hydrants, valves, etc., and back filling. Tender E—Erection of power house and reservoir. Plans and specifications may be seen at the office of MacArthur & Murphy, engineers, Bottomly Block, Saskatoon, Can.

New Industrial Companies.

THE AUTO LIGHTING & ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated by G. S. Montfort, C. R. Brown and F. C. Parker. The company proposes to manufacture electrical lamps for vehicles. A plant will be established in Indianapolis, Ind.

THE BAIRD ELECTRIC SCORE BOARD COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000. The directors are: George E. Baird, president; Roscoe F. Potts, 163 Hemenway Street, Boston, Mass., treasurer, and Stuart N. Lake.

THE CARTHAGE ELECTRIC COMPANY, of Carthage, Ill., has been granted a charter with a capital stock of $500 to do a general electrical manufacturing business. The incorporators are: William Mathiesen, Victor W. Olff and H. C. Hall.

THE COPEMAN ELECTRIC STOVE COMPANY, of Flint, Mich., has been organized with a capital stock of $500,000 to manufacture a patent electric heater. Samuel H. Abbott is interested in the company.

THE ELECTRIC MOTOR CAR COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $10,000 by Noble H. Davis, Arthur E. Keller and A. B. Davis.

THE FLEXIBLE CONDUIT COMPANY, of Guelph, Ont., Can., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in textile materials, conduits, cables and other electrical supplies. The directors are : George Edmund Coutrice, of Clinton, Ont.; James Ernest Carter and John McPherson Taylor, of Guelph.

THE GRANGER ELECTRIC & MANUFACTURING COMPANY, of Warren, Ind., has filed articles of incorporation with a capital stock of $50,000 to manufacture household electrical devices, including toasters, irons, etc. The directors are: Francis Granger, R. L. Tobin and Frank Canady.

THE GREENSBORO CONSTRUCTION COMPANY, of Greensboro, N. C., has been organized by John J. Dunnigan, J. A. Armfield and J. M. Hunt. The company proposes to construct electric plant and waterworks systems, etc.

THE MARQUETTE COMPANY, of Jersey City, N. J., has filed articles of incorporation with a capital stock of $10,000 to manufacture motors, engines, machines, etc. The incorporators are: B. S. Mantz, H. A. Black and John R. Turner, all of Jersey City, N. J.

THE SERVICE ELECTRIC COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $5,000 for the purpose of manufacturing electrical machinery. The incorporators are: Gerald G. Barry, Andrew W. Little and Lee Cohn.

THE THOMPSON ENGINE STARTER COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $500,000 to manufacture machinery, etc. The incorporators are: W. M. Kingsley, G. F. Scott and F. I. Eldridge, of New York, N. Y.

THE WICKER ELECTRIC LINOTYPE POT COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000. The incorporators are: F. Hendrick, J. S. Lewis, of New York, and H. M. Wicker, of Brooklyn, N. Y.

THE WOODHOUSE ELECTRIC COMPANY, of Norfolk, Va., has filed articles of incorporation with a capital stock of $50,000 for the purpose of dealing in electrical supplies and doing a general electrical business. The officers are: Jonathan Woodhouse, president; John S. Woodhouse, vice-president, and H. C. Woodhouse, secretary and treasurer, all of Norfolk, Va.

New Incorporations.

PHOENIX, ARIZ.—The Salt River Valley Electric Railway Company has been incorporated with a capital stock of $600,000 for the purpose of building an electric railway 60 miles in length to connect Phoenix and Peoria and intervening towns. The officers of the company are: F. M. Winters, president; Jacob Kleck, vice-president; C. C. Lewis, secretary, and J. M. Swetman, treasurer.

BAKERSFIELD, CAL.—The Bakersfield Gas & Electric Light Company has been incorporated with a fully-paid capital of $100,000 by H. A. Jastro, H. A. Blodget and L. C. McAfee. Head offices will be established at Los Angeles.

WAKARUSA, IND.—Articles of incorporation have been filed for the Home Electric Company with a capital stock of $15,000 by James E. Gall, Jacob E. Bollingbacher and Victor H. Schalliol. The company proposes to supply electricity for light, heat and motors in Wakarusa.

HAZARD, KY.—The Hazard Light & Water Company has been incorporated with a capital stock of $25,000 by Jesse Morgan, J. B. Hoge and T. S. Ward.

PORTLAND, MAINE.—The New England Power Company of Maine has filed articles of incorporation with a capital stock of $5,000,0000. The incorporators are: C. E. Eaton, T. L. Croteau, Albert F. Jones, A. A. Richards and B. M. Maxwell, of Portland, Maine.

BOSTON, MASS.—The New England Water Power Company has filed articles of incorporation under the laws of the State of Massachusetts with a capital stock of $1,500,000. The incorporators are: Robert H. Bresnahaw, Norman J. MacGaffin and Harold W. Cairns. The company is contemplating a hydroelectric development on the Deerfield River.

LACLEDE, MO.—Articles of incorporation have been filed for the Laclede Electric Light Company with a capital stock of $5,000 by Z. T. Stanley, E. B. Alten, R. L. Wheeler and others.

LEWISTON, N. Y.—The Lewiston & Lake Ontario Shore Power Company has been incorporated with a capital stock of $25,000. The incorporators are: A. Mackey, of Youngstown; C. H. Tugwell, of Wilson, N. Y.; J. B. Scovell, of Lewiston, N. Y., and H. M. Clark, of Niagara Falls, N. Y. The company proposes to supply electricity for lamps and motors in the village of Lewiston and the towns of Wilson, Porter and Newfane. A franchise has already been granted the company in Lewiston.

OKLAHOMA CITY, OKLA.—A charter has been granted to the Oklahoma City & Eastern Railroad Company to build a railway to be operated by steam or electricity, from Oklahoma City and Henryetta, a distance of 90 miles. The company is capitalized at $3,000,000. The directors are: J. J. Johnson, Charles Hoppes, W. J. House, F. S. Combes and M. L. Spitler.

HOOD RIVER, ORE.—The Hood River Terminal Company, of Portland, has been incorporated by W. A. Delashmutt, A. B. Ireland and W. Chapman. The company is capitalized at $5,000 and proposes to construct either a steam, gasoline or electric railway from a point on the Oregon-Washington Railroad & Navigation Company line in Hood River to the steamboat landing, ½ mile east of the city.

DOUGLASSVILLE, PA.—The Manatawny Railroad Company has been incorporated by Milton J. Person, of Bethlehem, Pa., president; John Palmer, Jr., of Jersey City, N. J.; Stephen Robinson, Jr., of Audubon, N. J.; Lewis F. Huthmacher, of Bethlehem, Pa.; Charles M. Allen, of Bayonne, N. J.; Daniel J. Driscoll, of Reading, Pa., and Robert L. Runyon, of Allentown, Pa. The company is capitalized at $100,000 and proposes to build an electric railway between Douglassville and Spangville, a distance of 8 miles.

FREEPORT, PA.—The Freeport Electric Power Company has been granted a charter with a capital stock of $5,000 to supply electricity in Freeport. The incorporators are: F. W. Diven, Jr., of Ingram, Pa.; W. B. Wallis, of Crafton, Pa., and W. R. Hamer, of Pittsburgh, Pa.

GETTYSBURG, PA.—The Conewago Township Electric Light, Heat & Power Company has been granted a charter with a capital stock of $5,000. The company proposes to supply electricity for lamps and motors in several places in Conewago Township, principal among which are Edgegrove and Mount Rock. The incorporators are: Raymond F. Topper, George J. Benner and Stella I. Raffensberger. Ellis S. Lewis, of York, Pa., is treasurer. The main office of the company is located at Gettysburg, Pa.

HARRISBURG, PA.—Charters have been granted by the State Department to the following companies: East Donegal Township Electric Light Company; the East Hempfield Township Electric Company; the East Lampeter Township Electric Company; the Lancaster Township Electric Company; the Manhein Township Electric Company; the Manor Township Electric Company; the Mount Joy Township Electric Company; the Mountville Electric Light Company; the Penn Township Electric Light Company; the Rapho Township Electric Light Company; the Warwick Township Electric Company; the West Lampeter Township Electric Company; the West Donegal Township Electric Light Company, and the West Hempfield Township Electric Company. Each company is capitalized at $5,000 and the directors are: John S. Graybill, Jr., of Lancaster, Pa., treasurer; W. W. Griest, C. Edgar Titzell, all of Lancaster, Pa. The companies will do business in the districts indicated by the names they bear. The headquarters of all the companies will be located in Lancaster.

LEBANON, PA.—The Lebanon & Campbelltown Street Railway Company has been granted a charter with a capital stock of $60,000 to build an electric railway, 10 miles in length, to connect Lebanon and Campbelltown, via South Londonderry, South Annville and North Comwall. M. S. Hershey is president.

McSHERRYSTOWN, PA.—A charter has been granted to the McSherrystown Electric Light, Heat & Power Company with a capital stock of $5,000. The company proposes to supply electricity for lamps and motors in McSherrystown, for which a franchise has already been applied for. The incorporators are: Raymond F. Topper, George J. Benner and Stella I. Raffensberger. Ellis S. Lewis, of York, Pa., is treasurer. The main office of the company is located at Gettysburg, Pa.

MOOSIC, PA.—The Moosic Electric Company has been incorporated with a capital stock of $5,000. The directors are: Duncan T. Campbell, of Scranton, Pa., treasurer; J. G. Osterhout, and Max F. Henkman, all of Scranton, Pa.

NEW OXFORD, PA.—The New Oxford Electric Light, Heat & Pow Company has been chartered with a capital stock of $5,000 by Raymc F. Topper, George J. Brenner and Stella I. Raffensberger, for the p pose of supplying electricity for lamps and motors in New Oxford. 1 company has applied for a charter to operate in this town. The m office of the company is located at Gettysburg, Pa. Ellis S. Lewis York, Pa., is treasurer.

PITTSTON, PA.—The Piedmont Electric Company has been gran a charter with a capital stock of $5,000. The directors are: J. McMillan, of West Pittston, treasurer; W. S. Tompkins, and Le Jones, all of West Pittston, Pa.

PLYMOUTH, PA.—A charter has been granted to the Consum Light Company with a capital stock of $5,000. The directors a Thomas J. Conelly, of Wilkes-Barre, Pa., treasurer; John F. l Groaty, of Edwardsville, Pa., and Charles M. Powman, of Will Barre, Pa.

SCRANTON, PA.—The Taylor Electric Company has been grante charter with a capital stock of $5,000. The directors are: Duncan Campbell, of Scranton, Pa., treasurer; J. G. Osterhout and Max Kenkelman, all of Scranton, Pa.

SOUTH BETHLEHEM, PA.—The South Bethlehem Light, Hea Fuel Company has been incorporated with a capital stock of $5,(The directors are: Henry T. Duke, 510 North Thirty-ninth Str Philadelphia, Pa., treasurer; C. Jess Young, of Philadelphia, Pa., Elmer S. Myers, of Wilmington, Del.

SOUTH BETHLEHEM, PA.—The Moravia Electric Light, Hea Power Company has been incorporated with a capital stock of $5,(The directors are: H. M. Ueberroth, of South Bethlehem, Pa., tr urer; A. C. Graham, P. F. Enright, James M. Degnan, C. A. Buck Charles H. Green, all of South Bethlehem, Pa.

SOUTH BETHLEHEM, PA.—Articles of incorporation have b filed for the Fountain Hill Electric Light, Heat & Power Comp The company is capitalized at $5,000 and the directors are: H. Ueberroth, of South Bethlehem, Pa., treasurer; A. C. Graham, P. Enright, James M. Degnan, C. A. Buck and Charles H. Green, al South Bethlehem, Pa.

SPRINGFIELD, S. C.—Articles of incorporation have been filed the Springfield Light & Power Company with a capital stock of $20, The company proposes to build a plant on Dean Swamp Creek, 2½ n out of the city. About 100 hp will be developed. John B. McB. D is president of the company; Michael Chattin, vice-president, and J Smith, secretary and treasurer.

SOUTH PITTSBURG, TENN.—The South Pittsburg Light Com has been granted a charter with a capital stock of $10,000. The i porators are: W. C. Houston, A. L. Kelly, Charles Houston, J. A. I and J. B. Phillips.

AUSTIN, TEX.—The South Austin Street Railway Company has granted a charter with a capital stock of $25,000, to operate an ele railway in South Austin. The directors are: J. H. Green, F. H. F T. M. West and C. V. Birkhead, of San Antonio, Tex., and E. B head, of Dallas, Tex.

SPOKANE, WASH.—Articles of incorporation have been filed the International Power Manufacturing Company by W. S. Yea and Martin H. Gerry, Jr. The company proposes to construct a across the Spokane River at the site of the new paper mill at Millw

CASCADE, W. VA.—The Preston County Development Company been incorporated with a capital stock of $100,000, by Everhart Bi of Morgantown, W. Va.; C. C. Clear and A. W. Hawley, of Masont W. Va.; Roy Clear and D. B. Davis, of Cascade, W. Va. It is u stood that the company proposes to develop the water power of Cheat River on the Big Sandy River along the banks of the river o by the Preston County Coke Company, to generate electricity for t mission to Masontown, Kingwood and Morgantown.

CHILLIWACK, B. C., CAN.— The Chilliwack Tramway Company been incorporated to build an electric railway within the mun limits of Chilliwack.

Personal.

MR. W. W. REESE, formerly of the Corn Products Refining pany, has recently taken charge of the power plant economy depart m of the W. H. Zimmerman Company, engineers and constructors, Chi go

MR. W. GODFREY BOYD has been retained as consulting eng er by the Haskins Glass Company, Wheeling, W. Va., which he will a ise in the development of a full line of indirect and semi-indirect lig ng units.

MR. D. C. BARNES, superintendent of the Pawtucket, (R. I.) El ric Company, has been appointed manager of the Everett Railway, Li & Water Company and the Seattle-Everett Traction Company, Ev tt Wash.

MR. WILLIAM MARCONI is spending the present week at St. J ns, N. F., conducting experiments with the object of ascertaining th ad visability of installing a more powerful station on the spot wher h first wireless telegraph tests were made.

MR. H. K. MADDOX has been appointed superintendent of the new municipal central station of Terre Haute, Ind. Mr. Maddox had been with the Terre Haute, Indianapolis & Eastern Traction Company since his graduation from Rose Polytechnic Institute in 1909.

MR. FRANK H. McCORMICK has resigned as private secretary of General Manager J. E. Davidson of the Pacific Power & Light Company, Portland, Ore., to take up the duties of local manager of the Pacific Power & Light Company's property at Pomeroy, Wash. Mr. P. N. ...rens, who has resigned at Pomeroy, will take up new duties in the ... department.

MR. F. H. FRANCK, of Toledo, recently engaged by the City Council as consulting engineer in the remodeling and improving of the city water-works and electric-lighting systems, has recommended the construction of spurs from the railroads entering the city to the power house, the installation of a three-phase electric system and the substitution of steam for gas and oil engines for motive power.

MR. S. W. CHENEY, a member of the engineering staff of the Railroad Commission of Wisconsin, has been appointed inspector in charge of the Milwaukee district. This district was recently established by the commission and includes all the public utilities within the city of Milwaukee and immediate suburbs. Mr. Cheney is a graduate of the University of Wisconsin and has for several years been engaged in gas and electric central-station work.

MR. T. C. MARTIN, secretary of the National Electric Light Association, goes to the Pacific Coast the coming week to make preliminary arrangements at Seattle for the convention of 1912. He will also attend the convention at Spokane of the Northwest Electric Association, which is proposing to affiliate, and while on his trip will address the company sections at Vancouver and Milwaukee, returning in time for the convention of the New England section in the White Mountains at the end of the month.

MR. E. C. NOE, who has been general manager of the Northwestern Elevated Railroad Company, of Chicago, and general superintendent of the Chicago & Oak Park Elevated Railroad Company, has been made general manager of the Metropolitan West Side Elevated Railway Company and the South Side Elevated Railroad Company also, his authority covering all of the elevated railways of Chicago, now combined under the ownership and control of the Chicago Elevated Railways. Mr. Noe was for several years connected with the old Thomson-Houston Electric Company and the General Electric Company in Chicago.

Trade Publications.

COMPOUND CORLISS ENGINES.—Bulletin No. 1512 issued by the Allis-Chalmers Company, Milwaukee, Wis., describes the company's various types of compound Corliss engines for all classes of service. The engines are built in sizes up to 10,000 hp and over.

MOTOR-GENERATOR SETS.—An attractive publication recently issued by the General Electric Company on the subject of motor-generator sets (Bulletin No. 4849) contains brief descriptions of generator sets of different styles and sizes. These sets are made up of various combinations of alternating and direct-current generators and motors, and range in capacity from 95 kw to over 7000 kw.

ILLUMINATING GLASSWARE.—A 100-page catalogue issued by the Fostoria Glass Specialty Company entitled "Illuminating Glassware" lists and illustrates by means of half-tone cuts more than 1500 different styles of clear, cut and etched globes, shades and reflectors for electric and gas lamps, being, in fact, a reference work on the numerous schools of design exemplified in modern decorated illuminating glassware. The book itself is most attractively put together, and in spite of its scope is not at all unwieldy.

CONVENIENT DECIMAL EQUIVALENTS.—The Electrical Manufacturers' Equipment Company, of 310 South Desplaines Street, Chicago, issues a little vest-pocket reference book containing a conveniently arranged table for finding the decimal equivalents of halves, quarters, eighths, sixteenths, thirty-seconds and sixty-fourths of an inch, as well as the decimal equivalents of drams, ounces and pounds. The table, which is copyrighted by Mr. F. B. Segur, also contains a brief account of the Segur hairpin-loop armature coil winding machine, designed for the use of manufacturers of generators and motors.

LOCOMOTIVE CRANES.—The Browning Engineering Company, Cleveland, Ohio, has issued an attractive illustrated booklet on its locomotive cranes. By this is meant a traveling crane operating usually, but not always, upon a railroad track and having the function of hauling and rotating in a full circle, traveling along the track or roadway, hauling cars or trucks and varying the boom or jib radius. This makes the crane applicable to almost every line of industry for handling heavy or bulky materials. A few of the more important details of construction are illustrated and described briefly, as well as some of the many uses for which the cranes and various attachments are adapted.

ELECTRIC LOCOMOTIVES FOR SWITCHING AND LIGHT FREIGHT SERVCE.—Bulletin No. 4867, issued by the General Electric Company, describes and illustrates electric locomotives for switching and light freight service, varying in weight from 22 to 35 tons, according to the service requirements and type of electrical equipment employed. The electrical equipment of these locomotives is of medium capacity, arranged for slow speeds, and it is essential that the design be as simple as possible and that all parts should be readily accessible. In general, the equipment comprises four 50-hp motors and Sprague-General Electric Type M control. Where two locomotives are operated together multiple-unit couplings are supplied.

AUTOMATIC STOKER FURNACES.—The Model Stoker Company, Dayton, Ohio, has issued a bulletin describing its automatic smokeless furnace, including not only grates and suitable fronts, but also double coal magazines, one on each side, stoking and cleaning mechanism and an engine with connections for operating all the working parts. The grates are arranged in pairs and inclined from the sides to the central bearer, one of each pair on each side being stationary and the other movable. The latter are hinged to the stationary grates by a pin lug, which fits into a hole at the upper end of the grate, the lower end of the movable grate being held to place and rocked by a bar. The furnace can be adapted to any of the regular types of boilers, and handles and burns soft coal.

HYDROELECTRIC AND IRRIGATION PLANT.—The Priest Rapids development of the American Light & Power Company, Hanford, Wash., is a good example of a highly economical and efficient method of utilizing low-head water-power which is subject to extreme variations in head resulting from flood conditions. It is also an example of modern engineering practice in irrigation work where the head is insufficient or the topography makes it impossible to deliver water to the surrounding country by gravity. The station is designed for an ultimate development of 9800 hp from a minimum head of 18 ft., although a total of about 90,000 hp is available from the Columbia River at this point. The present station is designed for a normal rating of 2600 hp and the electricity is transmitted and drives apparatus in pumping stations located at other points of the river, thus taking water from the river and elevating it to high-level irrigating ditches. A complete description of this interesting installation is contained in Bulletin No. 1623 issued by the Allis-Chalmers Company, Milwaukee, Wis.

CIRCUIT-BREAKERS.—The General Electric Company has just issued seven bulletins (Nos. 4837 to 4843 inclusive) illustrating and describing in detail all of the circuit-breakers manufactured by that company. Bulletin No. 4837 contains a general description of the applications of circuit-breakers, and also notes and diagrams descriptive of standard practice in the use of carbon-break circuit-breakers for various requirements. Specifications are suggested for the use of engineers, architects, and others wishing to secure uniformity in quality of apparatus, and illustrations are given of typical installations of circuit-breakers on modern switchboards. Bulletin No. 4838 is devoted to circuit-breakers of large capacity for severe service, used in railway, motor and lighting installations, while Bulletin No. 4839 deals with intermediate capacities for any service used in lighting, motor and railway installations. Bulletin No. 4840 is devoted to circuit-breakers that are specially adapted to motor-driven tool applications, for use in mills, machine shops, factories, foundries and office buildings, and for general motor work, automobile-charging outfits, storage batteries, rectifier sets, etc. Bulletin No. 4841 describes circuit-breakers for small capacity motor, lighting and heating circuits. Bulletin No. 4842 refers to remote-control circuit-breakers for use in railway, lighting and power installations, especially in those cases where economy of space, ease of operation and distant control are deciding factors. Bulletin No. 4843 describes magnetic blowout circuit-breakers for railway and power service, and for use especially where the arc must be confined.

BUSINESS NOTES.

THE HASKINS GLASS COMPANY, Wheeling, W. Va., will develop a full line of indirect and semi-indirect lighting units, and with that end in view the company has retained as consulting engineer Mr. W. Godfrey Boyd.

THE ST. JOHN CORPORATION, 180 Broadway, New York, and the Mohawk Electric Company, Albany, N. Y., have consolidated and are now under the same management with two departments—sales department and manufacturing department.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., announces the resignation of Mr. Gano Dunn, adding that for a great many years he filled the position of chief engineer and first vice-president in the Crocker-Wheeler Company with conspicuous ability and that he leaves with the very best wishes of the company and his many friends and associates in it for his future success.

NICHOLSON ARC RINGS.—The Locke Insulator Company, Victor, N. Y., has taken over the exclusive handling of the Nicholson arcing rings for high-tension transmission lines. These rings are already in service on the lines of the Niagara, Lockport & Ontario Power Company, Chicago Sanitary District, Syracuse Rapid Transit and several other smaller installations, and their efficiency has been abundantly proven.

ENAMELED WIRE.—Alfred F. Moore, Philadelphia, has recently notified the trade that he is prepared to furnish enameled magnet wire, either plain or insulated, with silk or cotton, as desired. A complete stock is carried at the factory in Philadelphia and a supplementary stock at Cleveland for the Middle West trade. All of the bare wire used for enameling is specially drawn and has to pass a rigid examination before it is available for use, being subjected to physical and electrical tests that insure a uniformly high standard of quality throughout.

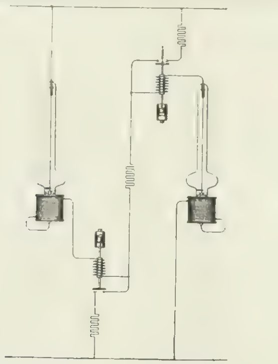
Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 29, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,001,627. ART OF COOKING; A. C. Dunham, Hartford, Conn. App filed April 14, 1911. An insulated cooking chamber is continuously heated by a continuous flow of low-voltage current through a resistance of small capacity.

1,001,630. FILAMENT MOUNTING; E. S. Gardner, Acquackanonck. N. J. App. filed Nov. 17, 1910. A group of spaced carriers each



1,001,710.—System of Electrical Distribution.

having a filament arranged in a plurality of sections of different lengths. Particularly for car-lighting with tantalum, tungsten, etc.

1,001,636. TROLLEY; C. A. Gouty, Springfield, Ill. App filed June 23, 1910. Lubricating washers; spring-pressed wheel; yieldingly supported shaft.

1,001,637. ELECTRICAL OVEN; H. Gray, Accrington, Eng. App. filed April 20, 1911. Passages for circulation of the heated air.

1,001,643. DYNAMO-ELECTRIC MACHINE; F. B. Howell, Schenectady, N. Y. App. filed Dec. 30, 1909. A ventilating tube is embedded in the winding of the field coil.

1,001,647. SPEED REGULATOR FOR ELECTRIC MOTORS; J. T. Kalweit and W. H. Gaulke, Milwaukee, Wis. App. filed Oct. 20 1910. An electromagnet holds the contact arm in any position by means of a slide.

1,001,654. APPARATUS FOR HEATING WATER BY ELECTRICITY; C. Kratt, Glasgow, Scotland. App. filed Oct. 10, 1910. Water is passed through glass tubes containing particles of carbon through which an electric current flows.

1,001,685. TELEPHONE; A. G. Remhilt, Philadelphia, Pa. App. filed Sept. 7, 1910. The receiver is movably mounted on the mouthpiece of the transmitter and is adjustable to either ear. The line is automatically connected and disconnected when the receiver is moved into position for use.

1,001,694. FUSE PLUG. H. R. Sargent, Schenectady, N. Y. App. filed Jan. 8, 1910. A cup-shaped base carries the fusible element and terminals and has ventilating passages and grooves.

1,001,709. VAPOR-ELECTRIC APPARATUS; E. Thomson, Swampscott, Mass. App. filed March 14, 1904. An insulating tube contains a small thread of mercury beneath the surface of the electrode and is vaporized for starting the lamp.

1,001,710. SYSTEM OF ELECTRICAL DISTRIBUTION; E. Thomson, Swampscott, Mass. App. filed March 11, 1905. Mercury-vapor lamps are connected in parallel to start, and then changed over to series.

1,001,711. SYSTEM OF VOLTAGE REGULATION; A. A. Tirrill, Schenectady, N. Y. App. filed Jan. 4, 1909. A booster generator is in series with the exciter for a main generator, and the fields of the exciter and booster are simultaneously varied by a voltage regulator.

1,001,716. OIL SWITCH; J. M. Wallace, Newbold-Upon-Avon, Eng. App. filed Nov. 2, 1906. Hand-operated panel type with means for preventing twisting or bending of the leads.

1,001,723. TELEPHONE SYSTEM; C. S. Winston, Chicago, Ill. App. filed Nov. 22, 1907. Central-office signaling apparatus and circuits for three-wire central energy type.

1,001,737. CURRENT-LIMITING DEVICE; M. G. Diaz and A. A. y Gresillon, Madrid, Spain. App. filed Aug. 22, 1908. A thermostatic device to prevent the use of more current than that for which contract has been made.

1,001,742. ELECTRIC TRAIN SIGNAL; E. F. Von Dreden, New York, N. Y. App. filed Aug. 16, 1910. The closing of the car doors by the guards signals the motorman.

1,001,758. INCUBATOR TEMPERATURE REGULATOR; I. I. Havourd, Elkhart, Ind. App. filed Sept. 16, 1909. A damper and lamp-wick regulator is moved by a motor controlled by a thermostat

1,001,765. MOTOR-STARTING DEVICE FOR POLYPHASE CIRCUITS; W. O. Lum, Schenectady, N. Y. App. filed July 24, 1908 A relay in each phase controls an electromagnetic switch in another phase to open the circuit of one phase in case of failure of another.

1,001,796. SELF-ADJUSTABLE CONTACT MAKER FOR ELECTRIC SWITCHES; F. W. Young, Everett, Mass. App. filed Dec. 26, 1905. A yielding support to insure perfect seating of the bridge contact upon the blocks in a circuit-breaker type.

1,001,808. ATTACHMENT PLUG; D. E. Bown, Pittsburgh, Pa. A filed April 6, 1911. For incandescent-lamp sockets. The side minals may be attached or detached through the side of the casin

1,001,876. ELECTROLYTIC CELL; P. McDorman, Dayton, Ohio. filed Dec. 29, 1910. For decomposing a salt solution to form ble ing liquid. Baffles to prevent loss of current passing through liquid around the electrodes.

1,001,828. ELECTRIC SIGNAL FOR RAILWAYS; T. J. Empfield, Moines, Ia. App. filed Oct. 8, 1910. Block system with a matically car-operated unlocking devices and auxiliary hand-oper devices.

1,001,864. FASTENING FOR ELECTRICAL CONDUCTORS; R. Klauder, Philadelphia, Pa. App. filed Dec. 15, 1910. Spring j interlocked for holding the ends of wires of different sizes.

1,001,888. ELECTRIC-WELDING MACHINE; A. F. Reitzel, Cha town, R. I. App. filed Dec. 24, 1908. A templet for the worl mounted upon, but insulated from, a current-bearing pressure bl For making two or more welds at the same time.

1,001,915. ELECTRIC FURNACE; J. Yngström, Falun, Sweden. filed March 15, 1910. A crucible forms the melting chamber the material is fed down from a stack. A space between is fi with the material and forms a substitute for the usual vault.

1,001,948. COMBINED COVER AND SOCKET-PIECE; J. Hamil Jamaica Plain, Mass. App. filed Dec. 16, 1907. The cover has cuit terminals and is made of insulating material to fit a metal j tion box.

1,001,959. TELEPHONE SELECTIVE-SIGNALING RINGER; H. Johnson, Topeka, Kan. App. filed March 3, 1908. For use combined direct-current and alternating-current system of call Has an auxiliary magnet to increase the power and the volum sound.

1,001,967. GAS BURNER; H. Lyon, Gloucester City, N. J. App. Oct. 7, 1910. Electric ignition for an inverted Welsbach.

1,001,975. APPARATUS FOR PRODUCING ELECTRIC OSCIL TIONS; J. Murgas, Wilkes-Barre, Pa. App. filed April 12, 1 A member (having fans) rotates between two electrodes and f therewith the spark-gap.

1,002,036. ELECTRICAL SOUND-PRODUCING DEVICE; E. Clement, Washington, D. C. App. filed Aug. 11, 1905. Two ele magnets induce different vibrations (as in an organ pipe) so a vary the tone.

1,002,049. SIGNALING BY ELECTROMAGNETIC WAVES; R Fessenden, Ft. Monroe, Va. App. filed Aug. 8, 1903. Two cir having suitable electric constants are arranged to neutralize the e on the receiver of disturbing influences.

1,002,050. RECEIVER FOR SIGNALING; R. A. Fessenden, Was ton, D. C. App. filed April 11, 1904. One member is yieldingly against a revolving disk so as continuously to change the poi contact.

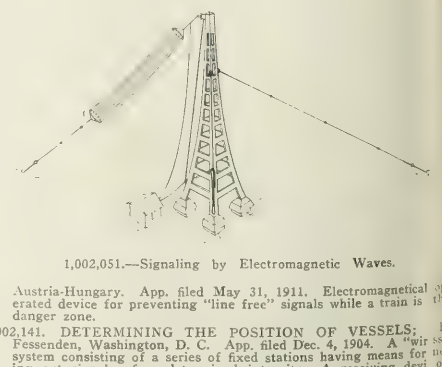
1,002,051. SIGNALING BY ELECTROMAGNETIC WAVES; R Fessenden, Washington, D. C. App. filed Feb. 8, 1907. An lated ferro-concrete antenna support and an antenna arrange that part of it shields the support from the electromagnetic wave

1,002,052. ELECTRICAL SIGNALING; R. A. Fessenden, Brant R Mass. App. filed Dec. 23, 1907. A telephone transmitter has a responsive good contact of different materials. The impulses t transmitted cause variation in the pressure of contact.

1,002,061. DROP-CORD CAP FOR ELECTRIC-CONDUIT OUT BOXES; C. S. Homsher, Denver, Col. App. filed Sept. 8, 1910. connection without soldering. A porcelain block has a neck projects inside the casing.

1,002,069. PROTECTIVE DEVICE; A. B. Marvin, Jr., Schenectad Y. App. filed Feb. 15, 1907. A selective device readily transmi high potential and high frequency, but opposing lower potential lower frequency. A plurality of aluminum electrodes with c surfaces approaching each other but separated by sodium nitra

1,002,087. RAILWAY SIGNAL; R. Skalicky and F. Mikulka, Vi



1,002,051.—Signaling by Electromagnetic Waves.

Austria-Hungary. App. filed May 31, 1911. Electromagnetical erated device for preventing "line free" signals while a train is the danger zone.

1,002,141. DETERMINING THE POSITION OF VESSELS; F Fessenden, Washington, D. C. App. filed Dec. 4, 1904. A "wir system consisting of a series of fixed stations having means for ing out signals of predetermined intensity. A receiving devi the vessel and means for comparing the signals received w standard signal produced on the vessel.

1,002,181. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App filed June 23, 1908. Division from the application of Paten No 927,602. A selector system for railway telegraphy.

Electrical World

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CONTENTS.

THE PENNSYLVANIA STATE CONVENTION.

The convention last week of the Pennsylvania Electric Association served to emphasize the fact that small central-station bodies, when representative, can handle to advantage matters of great importance. Considering the character of the papers generally, the meeting was not unlike other state meetings, save possibly in the matter of attendance, which exceeded 300. The feature of the convention which took lead of all others, not only on account of the questions involved, but also because of the extent and freedom of their discussion, was the report of the overhead-line committee. The association through its committee again voiced the needs of the smaller companies, and criticised the enactment of standards for distribution systems of a monetary value reckoned by the hundred millions without giving the minutest consideration to the legal as well as to the engineering questions involved. In the estimation of the state committee, the national overhead-line report in its present form involves the relinquishment by electric-light companies of certain of their legal rights, and in bringing forward and insisting on this consideration the assocation has rendered a distinct service to the industry. Honest differences of opinion may exist regarding what should and what should not be considered standard practice, and certainly the industry is old enough and large enough to have evolved something worth while standardizing; but the fact should always be kept well in mind that a standard adopted by the National Electric Light Association will legally be given great weight or at least accepted as evidence of proper usage, and used as a criterion by which all overhead line work throughout the country will be judged. Hence the need of caution in its adoption. If a company does not adopt this method of construction it might have difficulty in showing that its construction is as safe as that called for by the standards of the N. E. L. A., for certainly the burden of proof will be placed on its shoulders. All of the smaller companies, and they number over 5000, use overhead line work, and the consensus of opinion at the Pennsylvania meeting was that it would be unjust to commit these to any standard that might jeopardize investment or rights.

JULY ELECTRICAL EXPORTS.

The first figures of the new fiscal year are to hand in regard to electrical exports and are not devoid of interest. As our readers will probably remember, the gain for some time past in miscellaneous small electrical apparatus has been quite marked; while, on the other hand, the lesser activity in electrical machinery has been notable. For last July the statistics equalize the conditions. The export of electrical instruments in July, 1910, was not less than $839,059; the corresponding month this year it is down to

$707,214. On the contrary, the export of machinery in July, 1910, was $745,419, and this year it is $584,715. It is a long time since there was a setback in the development of this branch of trade, and presumably it was but temporary. The decline was very largely in Mexico, in both classes of goods; and now that that country appears to be settling down again and resuming work, a sharp upward turn may become noticeable. Otherwise the data do not seem to call for special comment.

EXPERIMENTAL DETERMINATION OF HYSTERETIC TORQUE.

It is an experimental fact, familiar to many who work with dynamo machinery, that when a direct-current machine is disconnected from its load or driver, as the case may be, and the rotor is turned by hand a very marked increase in resistance to rotation is encountered as soon as the field magnets are excited. Exciting or "killing" the field magnets commonly makes the difference between easy and hard turning of the rotor. It is well known that the extra quasi-frictional torque of the rotor on exciting the field magnet is due to magnetic hysteresis—that is, to the magnetic resistance which the iron of the rotor develops to reversal of its magnetic state. When a rotating magnetic field is developed in a machine, either by mechanical or alternating electromagnetic means, it is sometimes debated whether the hysteretic torque is constant at all slips. That is, there can, by general agreement, be no hysteretic torque when an iron rotor revolves in exact synchronism with a pure rotating magnetic field if the magnetic poles induced in the iron of the one element, say, the armature, are exactly in phase with the magnetic poles rotating in the other element or field. But suppose the armature begins to lag behind the field or to develop a slip? Now, of course, a hysteretic torque will be exerted between the elements tending to oppose the slip and to maintain synchronism. Will this torque be constant at all speeds and slips or will it increase up to a certain critical slip and thereafter diminish?

The above question, although it has been answered at various times in the past on theoretical grounds, is answered by experiment in an article of Herr Hermann Zipp printed in the *Elektrotechnische Zeitschrift* and recently referred to in the Digest. It is shown that the hysteretic torque is constant at all slips. At synchronism the hysteretic torque disappears, and above synchronism or at negative slip the hysteretic torque reappears reversed in direction and magnitude. At synchronism there is then a reversal or discontinuity in the torque, which reversal is not instantaneous—that is to say, in changing from a negative to a positive slip the discontinuity of hysteretic torque from backward to forward is not accompanied by sudden collapse. At synchronism as the phase shifts from forward to backward the hysteretic torque undergoes a change like that in the magnetic flux of a ring when the magnetizing force is reversed. The change is at first slow and then it is rapid. Consequently at synchronism there may be either a positive or a negative hysteretic torque, depending on the phase, but a small change of phase will reverse it.

A LOGICAL UNIT OF POWER.

The committee on units and notation, representing th German electrical engineering profession, has recently pul lished, as already noted in the Digest, several proposals f the improvement of electrical nomenclature. Some of the are in the direction of necessary and desirable standardiz tion of practice, but one strikes us as being, although som what revolutionary, decidedly pertinent and importan This proposition is to abandon the time-worn and somewh indefinite horse-power for the kilowatt, which is just good a mechanical unit as it is an electrical one. It is fact, the point of contact between the electrical a mechanical absolute systems. When the electric motor w new and totally unfamiliar to non-technical men it w reasonable to rate it as steam engines were, and are, rat in horse-power; but as time has gone on and the electi motor has replaced the steam engine to a very large exte it seems like an obsession of conservatism to cling to illogical unit of power bearing no simple relation to t modern absolute system and based upon ancient expe ments never precise and possessing nothing more than h torical significance. The German proposition is to christ the kilowatt as a mechanical unit the "Neupferd." T seems to us a totally unnecessary concession to an old-ti blunder. The kilowatt, just as it stands and with change of name, is a perfectly good unit for mechani purposes, being equivalent as it is to 10^{10} ergs per seco We see no reasonable excuse for offering an apology the way of a new name. To rate a motor in kilow mechanical output is an entirely simple and straightforw proposition and one that deserves very serious con eration.

It is an interesting bit of history, not in the least detr ing from the merit of the German proposition, that substitution of the kilowatt for the horse-power was vig ously advocated during and for some time after the Ph delphia electrical exhibition of 1884; and that the earl of the three-phase motors built in this country were de erately rated in kilowatt output. The time was, howe not ripe in the early eighties for dropping the horse-po and the attempt later to put motor rating on the basi the absolute system proved futile. Now after nearly tw years of familiarity with the electric motor the time w seem to be ripe for the change, and we trust that the man proposition will meet with acceptance in Germany out. There is, besides the logical reason for the cha the practical one that the French *cheval-à-vapeur* and horse-power used in England and Germany are not the same. The difference is not enough to prove confu it is true, but it exists, and in nice measurements w have to be allowed for. The new rating, too, would the considerable advantage of being a real rating as ap to electric motors, and not a more or less hypoth rating like the horse-power as applied to steam eng and leads to the simplest possible relation between i efficiency and output. By all means let us escape fr cumbersome and worn-out unit of indefinite signific when there is so good an opportunity to establish a lc rating in definite relation to the absolute system of urements in general use for scientific purposes.

MPOUNDING POLES FOR DIRECT-CURRENT MACHINERY.

The action of the so-called "split-pole" converter has become well known on account of the numerous discussions that arose when the machine was first announced. The field structure is so arranged and the field coils so operated that the field flux distribution is regulated as may be desired in order to vary the measurable voltage at the commutator without varying the collector-ring voltage. It is evident that the split-pole arrangement can be used in the same manner to regulate the commutator voltage when the machine is used as a direct-current generator rather than a synchronous converter. However, when used for this purpose the machine would possess no operating advantages over the usual compound-wound generator and would be somewhat more expensive to build. In a similar manner the split-pole scheme could be applied to direct-current three-wire balancers of the two-unit motor-generator type, without any advantages to compensate for the extra cost over the arrangement commonly employed. It is possible to build a direct-current three-wire balancer with two armature windings mounted on a common core situated within a common field structure. The disadvantage of this arrangement when use is made of the common form of field core is that when the load is unbalanced the voltage on the more heavily loaded side decreases, while that on the other side increases, and no amount of field-current adjustment can alter this condition. In the Digest of this issue is described a form of three-wire balancer in which this disadvantage has been overcome by the use of the split-pole arrangement. The series-wound poles are mounted between the main field poles and the brushes on the two commutators are so placed that the flux in the interpoles tends to increase the emf between one set of brushes, while it decreases the emf between the other set. The two sets being connected in series and subjected to a constant total emf, the division of emf by the balancer depends only on the relative loads on the two sides of the system. The balancer can be arranged to maintain a constant division of emf or to compound as may be desired. It would seem that the machine can be given operating characteristics well suited for balancer operation, but in this respect it appears to be neither better nor worse than a motor-generator balancer with compounded machines. However, it should require somewhat less material to construct than the complete two-machine unit, and hence should be able to compete successfully with the unit on the basis of first cost and operating efficiency.

RAILROAD INVESTIGATION OF THE ELECTRIFICATION PROBLEM.

The Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals—to give it the full official title—is now at work in a suite of offices which has been taken for its use in one of Chicago's downtown office buildings. In due course a comprehensive report from this committee may be expected, and it is, therefore, of interest to the electrical industry, which is deeply concerned by the possibilities of railway electrification, to pay some attention to the manner in which this investigation is being made, as Chicago is such an important railroad center that the report of the committee will no doubt receive wide attention. The committee is organized under the auspices of the Chicago Association of Commerce with the purpose of making an investigation of the practicability of electrification of the railroad terminals of Chicago, particularly with reference to smoke abatement. The committee is made up of business men, including a number of steam-railroad officials, and its chairman is Mr. Jesse Holdom, a lawyer and former judge. The railroads are defraying all the expenses of making the investigation, and the chief engineer retained by the committee is Mr. Horace G. Burt, former president of the Union Pacific Railroad and an engineer by profession. Assisting him are Messrs. Louis H. Evans, terminal engineer; Hugh Pattison, electrical engineer, and Theodore H. Curtis, mechanical engineer. Mr. Evans was recently chief engineer of the Chicago Junction Railway; Mr. Pattison was connected with the electrification of the Pennsylvania Terminal, New York, and Mr. Curtis was superintendent of motive power and machinery for the Louisville & Nashville Railroad. Mr. Burt and his three engineering assistants are men of high character and professional attainments. Electrical men cannot fail to remark, however, that as the expenses of the committee are borne by the steam railroads, and as the engineers employed by the committee are men of long connection with steam-railroad practice, it may be difficult for them to study the possible use of electricity, however honestly they may intend to do so, with absolutely unbiased minds. It is a case where the railroads are investigating themselves, no doubt with the most honorable intentions, and electrical men should be conversant with the situation.

At the recent convention of the American Institute of Electrical Engineers in Chicago, when the subject of the electrification of railroads was under discussion, a steam-railroad engineer of prominence declared that there is no work in heavy trunk-line service that the electric locomotive cannot perform more efficiently than the steam locomotive. This gentleman said that steam-railroad men are making a mistake in attempting to ward off something that is inevitable, and he intimated that the engineers making the present electrification investigation in Chicago might report that it would cost $250,000,000 to electrify the Chicago railroad terminals and that it would be impracticable. He said, however, that the entire terminal situation should be revised and that electrification was desirable within a certain reasonable limit. No one will dispute that the general electrification of the Chicago railroad terminals will prove a task of great magnitude, involving serious and careful consideration. No doubt this consideration will be given to it by the engineers of the Chicago Association of Commerce committee. However, as has been pointed out, these gentlemen are all, or nearly all, men of steam-railroad antecedents, and if they have any leaning it is not to be imagined to be toward electrification. Further, it may be remembered that the railroads are providing the funds for making this investigation and, although they are no doubt as anxious as any one to discover the true ultimate solution of the problem, it is possible that there exists the hope that electrification may not be found to be immediately necessary.

Convention of the Electric Vehicle Association of America.

The second annual convention of the Electric Vehicle Association of America will be held in the Engineering Societies Building, New York City, Oct. 10. A program has been arranged tentatively by Mr. Frank W. Smith, of the United Electric Light & Power Company, chairman of the papers committee, as follows: *Electric Vehicle Commercial Problems*, by Messrs. R. L. Lloyd and John Meyer; a paper dealing with the *Work Done by the Boston Edison Company in Its Electric-Vehicle Campaign* will be prepared by Mr. E. S. Mansfield; a paper dealing with the *Electric-Vehicle Problem for Commercial Trucks* from the manufacturers' viewpoint will be prepared by Mr. E. W. Curtis, Jr., of the General Vehicle Company; *Proper Illumination of an Electric Garage*, by Mr. J. C. Henninger; *Vehicle Battery Practice in Central-Station Companies*, by Mr. S. C. Harris, of the New York Edison Company; *Gasoline vs. Electric Vehicles*, by Mr. Hayden Eames; *Advertising the Electric Vehicle*, by Mr. Louis Ferguson, of the Commonwealth Edison Company, and papers on the *Electric Pleasure Vehicle, Care and Maintenance of Tires*, and *Electric-Vehicle Service in the Fire Department of Springfield, Mass.*, the authors for which have not been chosen. In addition to these, a representative of the General Electric Company will present a paper on the *Storage-Battery Locomotive*. Inasmuch as the convention will be held at the time of the electrical show at the new Grand Central Palace, New York City, the association will have an exhibit consisting of photographs of garages, installations, etc., of electric vehicles on the third floor of the palace.

Convention of Georgia N. E. L. A. Section.

The first annual convention of the Georgia Section of the National Electric Light Association will be held at Columbus, Ga., Sept. 26 and 27. The sessions will be held in the Masonic Temple and the registration bureau will be located in the Muscogee Club. There will be no exhibition, but members are invited to visit the showroom of the Columbus Railway Company. The entertainment will include visits to the various clubs, golf courses and theaters of the city and a trip to the Goat Rock dam of the Columbus Power Company and an evening boat ride. Following is a list of the papers to be presented:

Advantages of Co-operation Between Central Stations and Insurance Inspectors, by Mr. A. M. Schoen, of Atlanta; *Low-Pressure Services*, by Mr. E. H. Ginn, General Electric Company; *Supply of Electric Energy to Textile Mills*, by Mr. George K. Hutchins, Columbus Power Company; *Ice Making as Associated with Central Stations*, by Mr. Burdett Loomis, Jr., of Waycross, Ga.; *Electric-Heating Utensils*, by Mr. L. L. Warfield, of the Westinghouse Electric & Manufacturing Company. Mr. Thomas W. Peters, Columbus Railway Company, Columbus, Ga., is secretary of the association.

Convention Program of the Association of Edison Illuminating Companies.

The following papers are scheduled for presentation at the convention of the Association of Edison Illuminating Companies at Spring Lake, N. J., Sept. 19-21: *Accuracy of Meter-Testing Methods*, by Messrs. Burleigh Currier and J. B. Seaman; *Effect of Width of Maximum Demand on Rate Taking*, by Mr. Louis A. Ferguson; *Thermal Application of Electricity*, by Dr. William Stanley; *Presentation of Technical Facts to the Laity*, by Mr. John C. Parker; *What the Central Stations Can Gain from the Latest Progress in Electric Energy Transmission*, by Mr. Philip Torchio; *Life Valuation of Incandescent Lamps, as Deduced from Their Performance*, by Messrs. P. S. Millar and L. J. Lewinson; *Improvements in the Incandescent Lamp*, by Mr. John Howell; *Securing the Business of Office Buildings, Department Stores and Hotels*, by Mr. E. W. Lloyd; *A General-Service Depot*, by Messrs. C. A. White and C. H. Crockett; *Tests of Large Boiler Units at the Detroit Edison Plant*, by Dr. D. S. Jacobus; *Practical Experience with Employees' Welfare Plans*, by Mr. W. W. Freeman; *Notes on Industrial Movements Abroad*, by Mr. Arthur Williams; *Electric Light Accounting from the Standpoint of Public Service Commissions*, by Mr. H. M. Edwards. In addition to these papers reports will be made by the meter committee, heating committee, storage-battery committee, electric-vehicle committee, committee on the national code, committee on incandescent lamps, committee on high-potential disturbances, committee on steam turbines, and an address by Dr C. P. Steinmetz.

Conference of Governors of States.

The third conference of governors of states was held a Spring Lake Sept. 12 to 16, at which two subjects wer considered that have an interest to several branches of th electrical industry. One of these dealt with workmen' compensation for injuries, which formed the subject of remarkably able report of the N. E. L. A. public polic committee, presented at the May New York convention o that body, and is a matter now under serious consideratio by electrical operating companies. The other subject wa public-service regulation. An abstract of the discussion c the first-mentioned topic is given below, and a report wi appear next week of the discussion on public-servi regulation.

EMPLOYERS' LIABILITY AND WORKINGMEN'S COMPENSATIO

Two papers on the subject of employers' liability ai workingmen's compensation were submitted on Wednesda Sept. 13, one by Governor Foss (Massachusetts) and t other by Governor Hay (Washington). Chairman Bur (North Dakota), who presided at the meeting, said th in his opinion, the subject of workingmen's compensati is the most important to come before the conference.

PAPER OF GOVERNOR HAY OF WASHINGTON.

Governor M. E. Hay of Washington in his pap gave details of a workman's compensation act passed t year by the Legislature of his State. In introducing t paper Governor Hay denounced indemnity, casualty a liability companies as "fungoid social parasites." Out the $600,000 collected from the employers of the State Washington in 1909, only $100,000, he said, ever reach the injured workman or his family, $500,000 thus be withdrawn from the avenues of commerce and indus and transferred to the army of officers, agents, adjust and stockholders of liability companies. He denoun the system of technical defense in indemnity suits wh has grown up and been distorted by court precedent the point where the recovery of damages becomes a m question of skilled lawyers, sympathetic juries and l When Oregon abolished its technical defenses the indem companies raised the rates 400 per cent.

Governor Hay said that when the industrial condit in Washington had become intolerable the Tacoma Chan of Commerce called a meeting of the leading manufactu and labor men of the state to discuss employers' liab and workmen's compensation for injury, and invited Governor to preside during the conference. As a resul this movement a commission consisting of ten mem was appointed to draft a workmen's compensation which, with some amendment, was passed by the Legisla during the present year.

The new law applies only to extra-hazardous occupat

which are classified under forty-seven heads. One of these classes includes the construction of electric-light and power plants, telegraph and telephone systems and electric railways. Three other classes cover respectively the operation of electric-light and power plants, of street-railway and of telegraph and telephone systems. The Governor in his address cited as a notable example of the spirit in which employers are accepting the act the cases of the Seattle, Tacoma, Bellingham and Everett electric railway, lighting, power, telephone and telegraph companies, which are not only voluntarily segregating their pay-rolls into hazardous and non-hazardous classes, but are taking advantage of the "elective-adoption" feature of the law, whereby the employer and employees may jointly agree to place themselves under the provisions of the act, even though their work is not hazardous in any degree.

The fund for the payment of compensation is obtained by assessing the employer a sum equal to a definite percentage of his total pay-roll for a year. The percentages are different for each of the forty-seven classes, and each class of the industry is assessed for the accidents occurring in that class and for no other. The rates are subject to readjustment, depending upon the number of accidents and need for compensation of injured workmen. The first assessments are levied on the pay-rolls of October, November and December of this year, and no further assessments will be made on any class, unless the accidents occurring in that class deplete its fund to a point when it is necessary to call for more money.

Injured workmen, their families or dependents are paid ...ain sums out of the fund, and cannot recover by law ...pt where the injury is caused by intent of the employer, ...hich case the workman or his family may recover not ... the sum due under the act, but may sue for any de...l in excess of this sum. Where a workman is injured ...use an employer has neglected to observe the safeguards ...ired by law or by the regulations of the department the employer must pay 50 per cent more than the fixed amounts. Where the workman injures himself intentionally he receives no benefit. No part of the premium can be deducted from the wages of the workman, the violation of this section by the employer being made a gross misde...nor, punishable by one year in the county jail or a fine ... $1,000, or both. The State provides for the administration of the law, and for this purpose sets aside $150,000, so that none of the money in the general fund is used for the expenses of the commission. The act enables the commis... to raise the rate of a particular industry or firm which ...ducts its business in a notably careless or negligent manner thus tending to compel a closer observance of factory laws and assist the work of the labor commissioner in the inspection of mills and manufacturing plants.

Governor Hay said that the wisdom of the classification of industries is already seen in a certain class pride, many ...istries making a concerted effort to hold their casualties ...n and thus lower the net cost of carrying insurance. ... lumbermen, for example, are considering a system of ...te inspection to guard against negligence and accidents ...heir own class, thus preparing for a satisfactory annual adjustment, such as is provided for by law, and a possible reduction of their rate by the next Legislature.

The schedule of payments for various injuries is as fol...: First, in case of death, the expenses of burial, $75. Payment to widow or invalid widower of $20 per month while unmarried, or $240 in a lump sum on remarriage of widow. For each surviving child under sixteen, $5 per month, the whole monthly payment being limited to $35. If no widow or widower survives, $10 a month to each child under sixteen, the same rule applying to children who become orphans by death of the surviving parent, with a monthly limit of $35. Dependents get 50 per cent of the average monthly support formerly received from the deceased workman, limited to $20 per month. The parents of deceased unmarried workmen receive $20 per month up to the time the deceased would have been twenty-one years old. When totally disabled, which disability is specifically defined in the act, the payment is $20 a month if unmarried; if supporting a wife or invalid husband $25, or if the husband is not an invalid $15; for each child under sixteen an additional $5 a month up to a total of $35. In case of death of the totally disabled workman the wife or widower receives $20 a month until death or remarriage and $5 per month additional for each child under sixteen; orphaned children receive $10 a month. When partially disabled as defined in the act a workman receives a certain cash lump sum up to $500. The parents of an injured workman under twenty-one and unmarried also receive 10 per cent of the amount awarded the injured minor. If the injured workman resides or moves out of the state the commission may lump the monthly payments into one sum not to exceed $4,000, as based on the American mortality table.

PAPER BY GOVERNOR FOSS OF MASSACHUSETTS.

Governor Foss said that workingmen's compensation is essentially a business subject, and as such it ought to be brought to a uniform level throughout the United States. In his inaugural message he urged on the Massachusetts Legislature immediate and equitable legislation on the subject, setting forth that the criterion of such a law must be definite, certain and speedy adjustment of all claims, so that they may be discounted alike by capital and by labor, and that the results of such a law should not be measured merely by financial considerations, but by the better relations which will be brought about between the employer and employees. He also urged that it was not sufficient to say in answer that Massachusetts had a just law, giving compensation to an injured workman at once and without the necessity of a lawsuit. Referring to the desirability of uniformity of state legislation on the subject, he said that at present the award of compensation for industrial injury may be acceptable to the highest court in Massachusetts and yet be declared unconstitutional in New York State. While, he said, we like to think of our states and our country as the home of popular rights, yet in this matter of simple justice to workmen it is painful to realize that almost all of the rest of the industrial world has abandoned the old principles of employers' liability in favor of the broader and more liberal spirit of workmen's compensation. In this country we are behind the times in this matter, which situation ought to incite vigorous effort toward the establishment of this fundamental right of labor throughout all the states of the Union.

The federal government five years ago applied the principle of automatic compensation for injuries to workmen in its employ on the Philippine Islands, and three years ago this was followed by a similar law protecting all workmen working in government arsenals, navy yards, fortifications and other hazardous employment under federal jurisdiction. Later, protection was extended to federal employees working in the Panama Canal zone, and legislation is now pending which will include a still larger number of men and women employed by the federal government.

Governor Foss then took up the discussion of the recent Massachusetts law on the subject, which, he said, had been sanctioned by the Supreme Court as constitutional. The law will not go into full effect until July, 1912, thus giving employees an opportunity to study its provisions and to meet them. As originally drafted the bill eliminated the private insurance companies and substituted a state insurance association, the purpose being to do away with the great loss both to employers and employees through the large profits made by these companies. This could not, however, be achieved, the insurance companies being strong enough in the Legislature to defeat the provision. The law as it stands permits a corporation to insure itself against accident casualty in any of the established liability

companies or in a specially created state association. The act establishes a mutual liability insurance company, which has fifteen directors appointed by the Governor. Any employer may become a subscriber, and each subscriber is entitled to one vote, with another vote for each additional 500 employees, up to twenty votes. It is not, however, of fundamental consequence in the act how the employer shall insure himself, provided always that he makes suitable provision for the payment in full of all compensation which may be due from him to his injured workmen.

The law does away with the defenses of negligence on the part of the injured employee or fellow employee and with the assumption that he assumed the risk of injury as a condition of employment. The schedule of compensation provided is as follows: For two weeks after an injury a workman is entitled only to receive medical and hospital services; in case of death the dependents, if any, are to receive a sum equal to one-half of his weekly wages, extending over 300 weeks, the maximum being $3,000, the compensation being less when there are only partial dependents; in case of total incapacity the payment is up to a maximum of $3,000, figured at one-half of the average wages for 500 weeks; in the case of partial incapacity a similar schedule holds, with a maximum of 300 weeks. For certain specified serious injuries, as, for example, the loss of both eyes or both hands, an additional compensation up to $1,000 is paid. There is no compensation if the injury results from the workman's seriously wilful misconduct; and if the injury results from the seriously wilful misconduct of the employer the nominal compensation is arbitrarily doubled. An employee has no right under the act to recover damages by common law unless he gives the employer notice in writing that he claims such a right, and even in this case the claim may be subsequently waived. A wife living with her husband, a husband living with a wife, a child or children under eighteen years of age, or older if physically or mentally incapacitated, are presumed to be totally dependent upon the injured party. If an injured employee refuses to submit to a physical examination by a physician or surgeon the right to compensation is suspended. No employee can waive his rights to compensation or enter into an agreement to that effect, and no payment made under the act is assignable, subject to attachment or liable in any way for debt.

For the administration of the act the Governor appoints an industrial accident board of three members, maintained by the commonwealth, the chairman receiving $6,500 a year and the other members $6,000 each a year. Provision is made for a secretary at $3,000 a year, and the board is allowed $10,000 a year for other expenses. Claims for compensation, if agreed upon by the employer and employees, are filed with this board, and if approved by it the agreement becomes enforcible as equivalent to a decree of the Superior Court. In cases where the employer and the injured employee fail to agree the board calls for a committee of arbitration of three members, one a member of the board and the other two named respectively by the injured workman and by the employer or the association which represents the latter. This committee shall investigate the case and its decision shall be enforcible as equivalent to a decree of the Superior Court. If, however, the findings of the committee are not satisfactory to both parties, then the board itself shall pass upon the case. If a case brought before the board is found not to rest upon reasonable grounds the whole cost of the proceedings is assessed upon the party who brought or defended the action.

Governor Foss laid stress upon the fact that the Massachusetts law provides for payment of claims to relatives who are non-residents. In twenty-two states such relatives are compelled to enter suit for the purpose of establishing their claim, with the result that many employers actually prefer to hire foreign workmen for the reason that if these men are killed the non-resident families cannot readily make an appeal for compensation. The attitude of the Massachusetts Supreme Court has been clear and fearless on this point.

Governor Foss referred to the past system of workmen's compensation as vicious for a number of reasons. An industrial accident, for example, instantly lines up the employer and employee as parties in a lawsuit, from which i is difficult to keep out a spirit of hostility. At present only one-half or less of the amount of money paid out by employers for compensation gets to the injured employee For instance, 327 firms in New York State spent $192,53 in 1907 on account of accidents, legal expenses, etc., o which the injured workmen received only $104,642. Th casualty insurance companies during the years 1906 to 190 took in premiums to the amount of $23,000,000 and dis bursed in payment to injured men and their families onl about $8,500,000. In the latter case there was thus a direc loss to the employer and to the employees and a tax on th industry of about $15,000,000 in three years through nin insurance companies.

The latter part of Governor Foss's paper is devoted t a discussion of the legality, ethics and economics of work men's compensation laws. The conclusions are that suc compensation is fully justified in the basic industrial la of costs; that it has excellent claims to recognition as proper exercise of the general peace power of the stat which cuts through a good many personal rights in order establish and maintain in general life, safety and orde that in its broad working such compensation will not in crease but only distribute the total burden of payment fo injuries and deaths, and that the only obstacle which im pedes the establishment of workmen's compensation law in all states uniformly is that an employer in any one i dustry can successfully oppose the imposition of any sc of tax which some neighboring industry or enterprise do not share. The final conclusion is that when such charg are equitably distributed, then there will be as sound basis for them as there is now for personal property tax The final paragraphs of Governor Foss's paper related the avoidance of accidents, the establishment of workmen compensation laws, necessarily bringing this matter shar to the attention of manufacturing interests and causi them to provide more adequate provisions for safeguardi workmen from dangerous conditions.

Discussion.

Governor McGovern (Wisconsin) said that his St had now a law in operation like that of Massachuse Its application is voluntary, and both employers and e ployees have shown a willingness to come within its ope tions. An important difference between the laws of Mas chusetts and Wisconsin is that the latter has confer upon its industrial commission not only the administrat of the compensation act, but also has given it cogniza of all conflicts between employers and employees. That the whole matter of the legal relation, so far as the pu is concerned, between the employer and employees been turned over to the commission. This body has under its jurisdiction free employment bureaus, factory spection, truancy, application of safety devices, etc. considered it as making for economy and for efficient ministration of the law to confer upon the commis having jurisdiction of industrial disputes authority to spect factories, mines, etc., where such disputes arise.

Governor Wilson (New Jersey) said that his State pased a law similar to that of Massachusetts. Ow however, to the limits imposed by the constitution of State, the Legislature has not the right to pass compul measures of this character. What therefore most in ested him in the papers presented was the discussion of constitutional difficulty. The New Jersey act is divided two parts, the first of which abolishes the common defenses and the second provides a scheme of compens

ilar to that of Massachusetts. The indemnity companies, he said, had created trouble, having raised their ates in some cases as high as 1000 per cent. He believed these companies were singularly unwise and that they were adopting an attitude which would ultimately compel the establishment of state insurance. Under present conditions employers doing a small business, or small corporations, may not be able to stand the strain of the exactions of these companies. In this case the security afforded by the law is extended only to those employers who can meet the exigency. New Jersey, therefore, cannot protect all classes of workmen until it can assure that all claims for injuries will be paid, whatever the circumstances. All employers of the State have not been inclined to meet the law half way and some of them have determined to test its

Governor Hadley (Missouri) recalled that the workmen's compensation law enacted by the New York Legislature had been declared unconstitutional by the Court of Appeals of that State, and called the attention of the conference to a report of the law committee of the Civic Federation which deals with the decision of that court. The argument ... is that the common law is not a "strait-jacket"; that it is elastic and can be made to conform to particular classes of problems. Governor Hadley said that ... $95,000,000 contributed by employers of the country ... emnity companies only $40,000,000 had reached the ... l workmen or their families. He also pointed out ... e lives lost and injuries sustained annually by work... the pursuit of their occupations exceeds the number ... and wounded in modern warfare between nations.

...ernor Stubbs (Kansas) gave an account of the Kansas law, which, he said, is quite different from the laws of Massachusetts and Washington. The provisions of the ... e voluntary in application and apply only to hazardous ...ries, such as railroads, mining, gas, explosives, etc., ...ly to employers of fifteen persons or more. Employ... ay elect not to come within the provision of the act ...tten notice. In certain cases there is a right of choice ...n the existing liability law and the compensation ...led for in the act. The workmen of a sub-contractor may recover indemnity from the principal, who in turn may recover from the sub-contractor. An employer shall not be liable for compensation to an employee if the latter drinks or if the injury is caused by the violation of a statutory regulation, or for any injury which does not disable him for at least two weeks from earning his wages. The amount of compensation allowed is as follows: In the case of his death, to dependents upon the workman's wages, ... times his earnings for the preceding year, or not less ... $1,200 nor more than $3,600; if employed less than a ... fifty-two times the weekly earnings. If the deceased ...ured has no dependents, then only reasonable medical ...rial expenses are allowed. Arbitration is provided ... means of a committee representing the employer ... e workman, or through an arbitrator agreed upon by the parties, or appointed by the court. Governor Stubbs believes that the compensation for workmen killed or injured in the interest of society should be borne by the re... e classes of society. Since a railroad has to pay for ...int, its machinery, etc., it should, on the same principle, be made to pay for the lives of the men killed while in the railroad service.

Governor Harmon (Ohio) said that the feature in which the Ohio law differs from the other compensation laws is that the act makes no classification, leaving this matter to the commission appointed to administer the law. It was thought that the commission could, from the results of investigation, form a better classification than the General Assembly. It seemed to be the general desire in Ohio to make the law a success, and there had been no threat of interference with its application, except from the indemnity companies.

Governor Burke (North Dakota) expressed the opinion that the state had through its police power ample authority to pass compulsory compensation laws.

Pittsburgh Branch Meeting of A. I. E. E.

The first meeting of the season of the Pittsburgh branch of the American Institute of Electrical Engineers was held Tuesday evening, Sept. 12, in the rooms of the Engineers' Society of Western Pennsylvania, Oliver Building. The meeting was called to order by Mr. H. N. Müller, the retiring chairman, who announced that the officers for the ensuing year should be elected and reported the ticket nominated by the committee, which was unanimously elected. The officers chosen were: Chairman, Mr. K. C. Randall, of the Westinghouse Electric & Manufacturing Company; secretary and treasurer, Mr. E. L. Farrar, of the General Electric Company; executive committee, Messrs. R. S. Feicht, Westinghouse Electric & Manufacturing Company; E. P. Van Kirk, Westinghouse Air Brake Company; S. P. Grace, Central District & Printing Telegraph Company; R. W. Atkinson, Standard Underground Cable Company; E. Friedlander, Carnegie Steel Company; R. V. Bingay, Pittsburgh Transformer Company.

Mr. Müller, as delegate from the Pittsburgh Section to the Chicago convention, gave a brief report of the proceedings of the convention and later spoke of the section work. Mr. Paul M. Lincoln, chairman of the sections committee of the parent body, spoke along the same lines.

The topic of discussion for the evening was high-tension transmission as discussed in the Chicago convention papers. The discussion was opened by Mr. W. M. McConahey, engineer on transformers of the Westinghouse Electric & Manufacturing Company, who briefly reviewed the various papers presented on the subject and gave his own views on the topic. The paper by Messrs. Pender and Thomson, he said, dealt with the subject from a very mathematical standpoint and required close application to follow it. Some of the formulas in this paper were discussed later on by Mr. C. Fortescue, who suggested some easier solutions than those given by the authors.

The paper on corona by Mr. Piek, the speaker said, covered a subject that heretofore has been of little importance, but lately has become very important because of the increasing use of high-tension transmission systems—that is, those using 100,000 volts and upward. This subject was discussed later by Mr. S. W. Farnsworth, of the Westinghouse Electric & Manufacturing Company, who explained the action of corona and its cause in a most interesting manner by the use of two metallic spheres and the lines of force passing between them. He said that it seemed from reading a discussion of the subject that many engineers were really unaware of what corona and its cause actually were.

The design of transformers to protect them against heavy surges was discussed by Mr. H. C. Soule, who explained the necessity of insulating the end turns very heavily and bracing the coils by means of blocks or clamps.

The equipments of the four high-tension transmission companies—the Great Falls Power Company, the Central Colorado Power Company, the Great Western Power Company and the Southern Power Company—were discussed and compared.

Mr. McConahey stated that all the companies use ground wires and reported great success from their use, but he was inclined to think they gave excess credit to the ground wires to the exclusion of the lightning arresters, which undoubtedly did much toward lessening the damage done by lightning.

Mr. McConahey also spoke of the connection of transformers, whether delta or star, and stated that it does not

seem to be very generally known that one can remove a damaged transformer from a star-connected bank under certain conditions and thereby gain the other advantages of the star connection, such as least cost and lower voltage transformer. The general consensus of opinion seemed to be that high-tension transmission has not developed sufficiently to enable construction methods to be standardized, as equally capable engineers are using widely different methods under practically the same conditions.

Association Island Meeting of Lamp Manufacturers.

The fall meeting of manufacturers of incandescent lamps was held at Association Island during the week of Sept. 3. Two days, Sept. 6 and 7, were devoted to a commercial program consisting of discussions of numerous subjects pertaining to the development of electric lighting.

The general theme of the occasion was "co-operation"—co-operation on the one hand between the lamp manufacturer and buyers and users of lamps, and, on the other hand, co-operation among the several factors in the industry, such as jobbers, dealers, central stations, etc., all for the purpose of accomplishing the most widespread possible use of electric light. The entertainment features, which were much enjoyed, were also of a co-operative nature. There was co-operation between Mr. L. P. Sawyer, of the Buckeye Electric Company, and Mr. E. H. Haughton, of the Bryan Marsh Company, each of whom was the chief of a co-operative black-hand organization. Each assessed the people in attendance on the assurance that he needed protection from the other. After the assessments had been paid the proceeds found their way into a common pot which, it developed, was to be used to purchase a pirate ship for the use of the black-handers next season. There were about 100 people present at the meeting, among them being jobbers, contractors, central-station men and representatives of the electrical press, as well as the lamp manufacturers.

Mr. A. D. Page, of the General Electric Company, presided at the several sessions of the convention. Mr. F. S. Terry, chairman of the executive committee of the Association Island Corporation, at the opening session spoke briefly on the subject "Association Island." He explained what the island is and what it is for. It contains about 67 acres of land and is located in Lake Ontario, about 3 miles from Henderson, N. Y. The property is owned by forty individuals, all of whom are more or less directly connected with the business of manufacturing incandescent lamps. The charges to those who use the facilities of the island are made just enough to pay expenses. The life is delightfully simple and primitive. The buildings on the island are a general office or store, a dining hall, a bowling alley, a boathouse and meeting hall and a general storehouse. All of these are permanent buildings. The islanders sleep in tents, of which there are upward of seventy. In the spring and the fall the place is used for business meetings by the lamp people. In the summer it is a playground for their families and friends.

Mr. Terry said that the original purpose or motive, as a business matter, was to have some place away from the hotels and offices in which business conferences were usually held. It was believed that when men meet in an informal spirit under informal surroundings they can sometimes see things more clearly and act more fairly than they otherwise would. That, Mr. Terry declared, was the idea of the island.

Mr. E. L. Elliott discussed tungsten street lighting from the citizen's viewpoint. He claimed that civic pride is the one factor most effective in the introduction of decorative street lighting along the main thoroughfares, but presented arguments to show that investment in ornamental street lighting pays from the business standpoint. Reports from real-estate experts in various cities, including Billings, Mont., and Des Moines, Ia.; Toronto, Canada; Montgomery, Ala., and Chicago, showed an appreciable increase in property values along streets equipped with decorative lighting installations. The increase in rental of the adjacent property alone is sufficient to pay the cost of the lighting equipment. He explained the fact that the results from decorative lighting installations in Salt Lake City had been unsatisfactory as due to lack of co-operation among the various parties interested.

In discussing Mr. Elliott's paper Mr. Henry L. Doherty remarked that the introduction of incandescent lamps for street lighting has been attributable to the desirability of a single illumination system, rather than a multiplicity of different systems. He outlined tests which showed the ineffectiveness of arc lighting as compared with incandescent lighting. He has observed the flaming-arc lamp in use abroad to a considerable extent for street lighting, with results that would not be considered satisfactory in America. From the viewpoint of appearance it is offensive and its use is detrimental to the central station in that it tends toward a low degree of illumination. Mr. Doherty predicted increased success as a result of the continued application of the methods employed in America.

Mr. V. R. Lansingh, of the Holophane Company, reported the results of tests which indicated that the effectiveness of lighting by clusters of incandescent lamps is from 35 per cent to 50 per cent greater when the balls are pendent than when they are upright. Fifteen per cent of the flux produced by the lamp is absorbed by the socket and the covering of the opening through which the unit is inserted. When the ball is placed upright above the cross-arm this amount fails to reach the ground. Moreover, the glass of which the ball is constructed is thicker surrounding the opening than it is diametrically opposite the opening. On this account the thick glass acts to increase the illumination by reflection when the balls are pendent, but to decrease the effective flux by absorption and detrimental reflection when the balls are upright.

Mr. William Coale, of the Sterling Electrical Manufacturing Company, explained that the results obtained with the incandescent street-lighting system at Warren, Ohio, have proved so satisfactory that the installation is a source of much pride to the citizens, who consider the place exceptionally well lighted. In a recent mayoralty contest, the cost of the street lighting being one of the points at issue, the candidate advocating reduction in the expenditure for this purpose was defeated.

Mr. Henry L. Doherty stated that information concerning the street-lighting equipment in Warren would be freely given to parties interested either by the management of the Warren company or by himself.

In his paper on "Competitive Illuminants for Street Illumination" Mr. Ward Harrison, of the National Electric Lamp Company, stated that for the purpose of illumination the streets of a city can be divided into three classes: the chief business streets, residence streets and the outlying streets, parks, etc. Along the business streets the illumination should be designed for advertising purposes, in order to attract people to that portion of the town. A cheap lighting unit for use where high intensity is required is found in the magnetite arc lamp. This unit possesses a disadvantage in that the glare is pronounced. The ornamental incandescent post lighting has proved highly satisfactory along business streets. The intensity of illumination is good, the appearance, both by day and night is satisfactory, while the cost is low. Along residence streets lighting by incandescent lamps is cheaper and more satisfactory than by arc lamps. The author claimed that the cost for energy and maintenance of one 4-amp magnetite arc lamp is equal to that of five 60-cp tungsten units. With the magnetite lamps placed at 440-ft. intervals at street corners, and four of the tungsten lamps placed at 100 ft.

tervals, with one along the side street, the illumination the incandescent lamp is much more satisfactory than the arc lamps. At a point midway between the street rners the horizontal illumination from the incandescent mps is 75 per cent better than from the arc-lamps, while e illumination in the maximum position is 300 per cent tter by incandescent than by arc lighting. Moreover, the iformity of the lighting along the street is much better ith incandescent than with arc lighting. The author aimed that of all arc lamps the magnetite lamp is the eapest unit, and hence the above comparison would be en more favorable for the incandescent system in comrison with any arc lamp other than the magnetite.

Mr. W. D'A. Ryan, of the General Electric Company, pressed his agreement in general with all the conclusions Mr. Harrison. He stated, however, that it is not proper assume that the arc lamp is losing ground, the fact being at more arc lamps have been sold during the past year an in any other twelve months. He stated that the most ractive business decorative street-lighting installation th incandescent lamps is the five-lamp standard, with all the units placed upright. It is not proper to ignore the ct that the light which is in the upper hemisphere is ective in illuminating the buildings, and thereby serves useful purpose. In connection with the business-street hting equipment in Minneapolis, an arrangement has en made by which temporary festoons of lamps can be nnected to the post circuits by simply inserting a plug ere desired.

Mr. A. M. Klingman, of the Adams Bagnall Company, eveland, Ohio, in discussing the efforts of the post manuturers in developing the incandescent street-lighting siness, explained that the so-called Daniels system of andescent-lamp installation represents a modification om the earlier arc-lamp equipment to render it suitable r use with tungsten lamps. He complained of the prace of certain municipalities which obtain samples of posts the manufacturers on a competitive basis and then y local designers to copy the posts and have them manutured in local foundries.

Mr. Eugene Creed called attention to the fact that in lumbus a total of 866 ornamental posts will be installed supplant the arch-lighting system. He stated that hough large cities prefer the arc to incandescent lamps r street lighting, the smaller cities prefer the five-lamp uster incandescent-lighting equipment. He stated that the nental street-lighting installation in Toronto has not found to interfere with the show-window and signg business.

J. L. Minick, of the Pennsylvania Railroad, expressed pinion that, while incandescent lamps are most satisry for the lighting of business streets, arc lamps may tter for the outlying streets.

r. C. O. Baker, of the Wheeler Reflector Company, in ing the work of the reflector manufacturers in deng the incandescent street-lighting business, remarked vith the introduction of tungsten lamps reflectors were ed for street lighting, the demand for these units produced initially by effective advertising. Subsey the satisfactory results obtained from each system effective in inducing other towns to install similar stems. He claimed that in too many instances price rher than quality is the factor which determines the e of street-lighting reflectors. The prime requisite eflectors for this purpose is ruggedness.

r. V. R. Lansingh called attention to the recently inced prismatic street-lighting fixture, which provides naximum effective flux along the street surface, with flux in the upper hemisphere properly minimized. This fiure has proved both ornamental and efficient, the lightit equipment being twice as effective as is the round-ball ut.

Ir. C. W. Bender, of the National Electric Lamp Company, outlined the policy which has been pursued in furthering the introduction of tungsten street lighting. Bulletins prepared especially for the purpose have been sent out, together with personal letters addressed to parties known to be interested in the subject, such as civic committees, etc. A collection has been made of data on street lighting, obtained from various cities, and offers were made of aid by the engineering department in instances where this was believed to be desirable. Maps were obtained of cities, in order to suggest lighting installations for the principal streets. The author claimed that the keynote of success in this connection is publicity, in order to obtain the necessary assistance founded upon civic pride in good lighting.

Mr. Philip S. Dodd, of the National Electric Lamp Company, offered certain suggestions for co-operation for the purpose of increasing the electrical business. He stated that in seven cities use is now being made of the plan of utilizing an electrical page in local daily papers at certain regular intervals. Such a page consists, for example, of articles in simple language devoted to subjects of general electrical interest. In connection with these articles are advertisements of electrical devices inserted by the local supply dealers, wiring contractors and central stations. He claimed that it is highly desirable for the central stations, jobbers and contractors in each city to co-operate in some such manner. He mentioned the book on electric-light publicity prepared by the sign committee of the National Electric Light Association and the book on house wiring arranged by the National Electrical Contractors' Association. Mr. Dodd entered a plea for co-operation immediately, at least along the line of publicity, and suggested the preparation of an elaborate book on street lighting and the formation of a committee to work through the National Electric Light Association to harmonize the electrical interests in each locality.

In his paper on "Lamp Testing" Mr. Preston S. Millar, of the Electrical Testing Laboratories, remarked that the testing of lamps is conducted for two different purposes, namely, to ascertain the characteristics of lamps and to determine the selection of lamps for various duties. The methods now employed in interpreting acceptance tests of incandescent lamps are illogical and unsatisfactory. It is improper to assume that when supposedly representative lamps, taken from a group selected from a large quantity of lamps, show very poor or very good performances all of the lamps in this group are either very poor or very good, the fact being that the group contains a large number of good lamps and a large number of bad lamps, just as would another group the representative lamps of which showed different characteristics under tests. The specifications for acceptance tests should be based upon a standard performance, and only a limited variation therefrom should be permitted. All lamps varying too widely from this standard should then be rejected. Life tests should be performed only upon a very large number of lamps, since the results obtained from tests made upon a limited number of lamps cannot always be properly interpreted. The maintenance of such a standard and the elimination of too wide a variation from this standard would result in an improvement in the life and performance of the lamps being manufactured.

Mr. J. L. Minick outlined briefly reasons for the present form of the specifications employed by the supply department of the Pennsylvania Railroad, on the basis of an evolution as needs arose from time to time. Representative samples are inspected and tested in order to insure proper manufacture, the use of good material, correct design and proper installation. Specifications are decided upon only after the holding of a conference of all of the parties interested. Mr. Minick's remarks related to specifications for all classes of supplies, and were general in their application to electric lamps. He stated that the supply department of the Penn-

sylvania Railroad carries in stock more than 200,000 separate parts. For financial reasons it is essential for the supply department to minimize the stock on hand, and hence it insists upon prompt delivery of goods as ordered.

Mr. Henry Schroeder, of the General Electric Company, presented data showing the advantages to the central station of giving graphitized-carbon instead of plain-carbon lamps in renewal. He stated that the power consumed by the so-called 60-watt graphitized-carbon lamp, when operated at the lowest voltage, is equal to that consumed by the 16-cp plain-carbon lamp, although the light from the former lamp is 20 cp. Thus, for the same power consumption there is an increase of 25 per cent in the light. The increase in the cost of the lamp to the central station on a free-renewal basis is about 0.01 cent per kw-hour, which is truly negligible. If this lamp is operated at medium or high voltage the power consumption is proportionately increased, with a very large increase in the candle-power. The income to the central station is thereby increased, while the service to the consumer is much improved. From these data the author concluded that the central station can ill afford to neglect the advantages offered by the graphitized-carbon over the plain-carbon lamp for free-renewal purposes.

Mr. Caryl D. Haskins, of the General Electric Company, presented a paper devoted to the development of electrical service in rural districts. He stated that of the 90,000,000 people in the United States only about one-third take advantage of the electric service offered by the central stations. In the United States at the present time there are about 2000 towns of sufficient size to support individual electric plants which have no electric service. There are about 4000 towns which have poor or relatively unsatisfactory service. On the basis of the per capita deposits in banks, the introduction of individual telephone systems, the extensive use of sewing machines, etc., the author claimed that the small community is better able to expend money for electric service than is the large community. In each of the three States of New York, Massachusetts and Wisconsin the ten towns having the highest central-station income per capita have populations smaller than 4000. The State of California, the larger portion of the population of which resides in small towns rather than in large cities, expends 80 per cent more per capita for electric equipment and service than does any other State in the Union. Mr. Haskins stated that the returns obtained by central stations from serving outlying communities have always proved to be much better than predicted from preliminary study. Even in certain negro-shanty communities in the South the central-station income has been very satisfactory, reaching as high as $11 per year per capita in certain cases. The author claimed that it would be better for central stations to exert efforts to increase the service in outlying or rural communities rather than in the more densely populated districts. He expressed the belief that two-thirds of the people not now receiving the benefits of electric service can be induced to become customers of the central station.

Prof. J. E. Latta remarked that the small communities throughout Kansas demand a twenty-four-hour service, which can be given most advantageously when the source of supply is a large transmission system rather than a local lighting plant.

Mr. William J. Hiss, of the American Bell Telephone Company, Buffalo, explained the methods employed in increasing the telephone business. A careful study is made of each community, its industries and prominent citizens. A house-to-house canvass is made not only to determine who are willing to become subscribers at once, but to ascertain the possibilities of installing a telephone for each family at some future time. Letters are sent to each possible subscriber at suitable intervals to maintain personal interest in the subject until the next visit of the solicitor. This method has been thoroughly effective, not only in urban, but also in rural communities. Rural telephone lines are of immense convenience to the farmers, and have proved profitable to the telephone companies.

Mr. M. L. Barnes, president of the National Electrica Contractors' Association, in discussing the co-operation be tween the lighting, lamp and contracting interests, statec that the membership of the National Electrical Contractors Association, which now numbers 1000, is limited to mei whose principal business is electrical contracting. Th purchases of these men approximate the large sum o $50,000,000 annually, and hence their interests should b considered. He complained of a practice pursued b numerous central stations of selling electrical supplie directly to the consumer at or below cost. Such a policy i detrimental to the contractors and unprofitable to the cen tral stations. He claimed that the central station, suppl jobbers and manufacturers should co-operate. The cor tractors would thereby become solicitors for the centr stations and would prove of great benefit to them. H called attention to the price data prepared by the Nation Electrical Contractors' Association, which is always ke up to date by means of loose leaves. At the present tin about 1300 copies of this book are in use.

Mr. V. R. Lansingh described one case where the centr station sold lamps and reflectors below cost, and the jobbe and contractors in that locality induced the central stati to abandon this policy by threatening to advocate isolat plants rather than central-station service.

Mr. Barnes remarked that many of the central statio are now co-operating properly with the contractors a expressed the hope that such co-operation would beco more widespread.

Mr. W. S. Bissell, of the F. Bissell Company, Tolec claimed that the jobber is the natural outlet for the man facturer and that co-operation between the jobber and t manufacturer begets reciprocity. For example, many the jobbers distribute printed matter advertising the artic built by the various manufacturers.

Mr. John F. Gilchrist, president of the National Elect Light Association, in discussing the relation between t central stations and the lamp manufacturers, expressed t desire of the central stations for slowness in the introd tion of revolutionary developments in the electric-lighti industry in order that equipments, business methods, rat etc., can be gradually adjusted to the new conditions. stated that the small central stations are dependent larg upon manufacturers for suggestions as to the equipme s to be purchased. He expressed the opinion that the incre in membership of the National Electric Light Associat will be quite as rapid in the future as in the past, s statement being based on the fact that there are perhaps an average fifty people in each of the 6000 central stati s of the country interested in the work being accomplis d by the N. E. L. A.

Mr. W. E. Robertson, of the Robertson Cataract C pany, of Buffalo, described the relations between Jovian n and the whole electrical business by stating that the pr r plan for conducting business is one involving co-operat n, each member contributing a little to the general interes of the electrical business as a whole. This spirit is ident al with that of Jovianism, which stands for everything e c- trical all the time for everybody. He advocated stro ly co-operation among the electrical interests in each loca y, as exemplified by the electrical page inserted in the c ly papers in Cleveland.

The session on Wednesday evening was devoted to an address on business co-operation by Mr. Elbert Hubb d. The speaker claimed that that which distinguishes civi a- tion from the lack of civilization is the spirit of co-op a- tion, which means mutuality. That is to say, as civiliz on increases the individual ceases to work alone, but comb es his efforts with those of others to the increased be fit of all.

Convention of Vermont Electrical Association.

e Vermont Electrical Association held its tenth annual ing at the Mountain Spring Hotel, Lake Dunmore, n r Brandon, Vt., Sept. 13 and 14. At 10 o'clock the first d the executive session took place, when it was voted to in rse the resolution initially adopted by the St. Louis S tion of the American Institute of Electrical Engineers, dugned to promote the better security and greater value o ndustrial property by the government's introduction of a system of supervision in patent, copyright and trade-m k laws and requesting President Taft to call the attenti of Congress to the subject and urge the establishment o department of supervision of patents. A suggestion th the association come into closer relations with the U versity of Vermont's electrical engineering department w favorably received.

following officers were chosen for the ensuing year: nt, Mr. Frank Barney, Jr., Springfield, Vt.; first esident, Mr. William M. Hughes, Bristol; second vi -president, Mr. C. C. Wells, Middlebury; secretary and tr surer, Mr. A. B. Marsden, Manchester, Vt. Executive ttee, Messrs. George S. Haley, Rutland; Walter H. St. Albans; Wilfred Smith, Woodstock; F. H r, Burlington; H. D. Larrabee, Montpelier.

t 3 p. m. an address was made by Prof. W. L. Upson, he of the department of electrical engineering, University nont, the subject being "Electrical Engineering Edu- The address was carefully studied, incisive and

he author remarked that electrical engineering is taught in wo classes of school, the university and the trade school. Th former lays stress on "education" and the latter on "e gineering." The aim of the university is to teach the st ent to see in his life a much broader field for service es the uneducated person.

next speaker was Mr. Fred M. Kimball, of the Bosto office of the General Electric Company, whose subje was "The Value of Power Load for Central Stations." reviewing the process by which the small beginnings rical experimentation have been developed into the pr ent-day enormous activities in connection with comm ication, transportation and motor service Mr. Kimball sp e of the particular uses to which electricity is being nd more adapted as follows:

rinting machinery, where its value in cleanliness, va ations in speed, safety and economy are well recogni d; to elevators, where devices for securing control in sp d and direction of movement are more simple and ef- than when any mechanical drive is used; for oper- woodworking machinery requiring essentially a high speed; for use in stores, markets, jewelry shops and cians; in shipyards and erecting works, in conjunc- th machine tools that can be carried to various porti s of floor or yard; in driving fans and exhausters, be ws, etc.; for use of bakers and confectioners, where pe ect cleanliness is highly desirable; in pumping w er for irrigation, a field recently entered upon and w h promises large returns both to farmers and central- companies; in lumbering operations, enabling e mills to be operated anywhere on the lot; in small re igerating apparatus; on docks, to move and load merch ndise; in building operations, to raise material; in ca -carrier systems in stores; in laundry machinery, ho ls, etc.; for quarry work, in drilling.

he output of motors is not far from 1,000,000 hp a year in he United States alone. The lighting end of station bu ness is better developed than the motor-service depa ment, the speaker asserted. He urged increased effort to ound out the load of the central station by developing th motor-service business that is latent in every com-

valuable portion of the address related to methods of getting business. Mr. Kimball divided the business tributary to every plant into three classes, the "spontaneous" business that comes unsolicited, the "obvious" business that comes by a certain amount of publicity, and the "latent" business that will come if systematic advertising and solicitation are brought to bear. He urged that an advertisement must call attention to definite uses that may be served by the application of electricity, and that these advertisements must be couched in terse, interesting language. Reading notices are also a valuable form of advertising. He suggested that several central-station companies, in as many small communities, employ an expert business getter and share the expense. Finally, the cultivation of a sense of co-operation and loyalty is essential. The last 5 per cent of an employee's energy is the really valuable part, he said.

A banquet in the evening closed the first day's festivities. On the day following a baseball game was played between a team of supply men and one from central stations. About 125 members and guests were in attendance.

Convention of the Pennsylvania Electric Association.

An account was published in these columns last week of the first day's session of the fourth annual convention of the Pennsylvania Electric Association at Exposition Park, on Conneaut Lake, Pa. When the convention closed on Friday afternoon, Sept. 8, there were 302 members and guests registered. Despite the lowering clouds which prevailed throughout the week, there was not enough rainfall at any time to mar the sessions on Thursday or Friday, nor to interfere with the entertainment program arranged for by the committee. Electric manufacturers and supply men were well represented; in fact, there were more of these registered than at any previous convention of the association. A brief account of the exhibits, with a list of the manufacturing companies and supply houses represented, is given elsewhere in this issue.

MOTORS.

The session on Thursday morning was opened with the reading of a paper by Mr. A. M. Dudley, of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., on "Motors." This was an elementary and didactic treatise, in which the author first described the different types of alternating-current and direct-current motors employed in industrial service, with their starting and controlling devices; then the characteristic curves of these motors, with particular reference to speed and torque, followed by a dissertation on the type of motor best fitted for some of the commoner applications, and concluding with a few general remarks on the relation of the central station to motors and industrial service. Diagrams of connections and engravings of starters and motors were scattered throughout the paper. The classification and nomenclature for motors adopted by the American Institute of Electrical Engineers were followed by the author, who pointed out that all design is a compromise, and that the best motor for service is one in which all the conditions are nicely compromised and the motor starts well and runs well. In discussing the alternating-current, wound-rotor type of variable-speed motors, the author stated that, while it is possible to run at any speed at will by merely inserting enough resistance, there are two very serious objections to operating a motor of this type at a reduced speed, either of which may be prohibitive for a given application. The first is poor regulation and the second poor efficiency. The author also called attention to one of the broad and elementary principles in industrial work in the application of an adjustable-speed motor, to wit, that one should not attempt to get variable-speed operation on individually driven machine tools by using a direct-current motor with

resistance in series with the armature, or by using a wound secondary induction motor with external resistance. The author drew attention to the fact that variable-speed motors must be used in connection with flywheels of all sorts, and added, as a second elementary principle, never to put a motor on a flywheel with less than from 8 per cent to 10 per cent drop in speed from no load to full load, the exact amount depending on the peaks in the load. As showing how this may be worked out and elaborated to a nicety in the case of flywheel-motor-generator equalizing sets, Mr. Dudley mentioned an instance of a motor of some thousands of horse-power which is reversed from full speed forward to full speed backward in four seconds. Hardly a tremor is felt at the generating station, because the motor speed is adjusted to decrease under the peak, whence the flywheel comes into effect. The paper closed with the following reasons for purchasing electric energy for driving motors in industrial plants: Continuity of service initially; expert consulting advice free on the initial installation and on operating performances; facilities for indefinite expansion; motor stock of the local central station to draw upon in case of breakdown or hurry-up installations; ability to run part of the establishment or run individual machines overtime without firing up the boilers for the whole plant, and interchangeability of apparatus with all the users connected to the same central-station service.

Discussion.

There was no very general discussion on the paper. Mr. W. L. Robertson, of Philadelphia, inquired as to the desirability of using a high-speed motor with high mechanical reduction, as against using a lower speed motor. Mr. Dudley stated that while a higher speed motor was usually lower in first cost it is well to stick to a moderate-speed motor, using conservative ratios of gearing. In answer to an inquiry of Mr. E. F. McCabe, of Titusville, as to the absence of a no-voltage release on auto starters, the author stated that a squirrel-cage induction motor up to 50 hp in rating would not be injured if the system to which it was connected was temporarily disabled and then started again. However, other circumstances might dictate the use of a no-voltage release in connection with an auto starter.

PRESIDENT GILCHRIST'S ADDRESS.

After the reading of Mr. Dudley's paper Mr. J. F. Gilchrist, the newly elected president of the National Electric Light Association, addressed the convention. In introducing the speaker Mr. Granger told of the strenuous time Mr. Gilchrist had in reaching the convention from Association Island, automobiles and a motor boat being pressed into service, in addition to the railroad, in order to effect the journey on time. Mr. Gilchrist confined his remarks to the functions of the National Electric Light Association. Of the nearly 10,000 members now enrolled in that body Mr. Gilchrist said that 1300 to 1400 of them were electric-lighting companies. The primary function of the association, he said, should be the protection of the electrical business generally. He gave as the secondary function the development of business and expressed the opinion that the papers read at the conventions constitute the most up-to-date literature in the industry. By acting as a clearing house of information for members the association, he said, fulfilled its third function, while its fourth function is to preserve the records of the electric-lighting industry. Mr. Gilchrist then took up the relations between the national and state associations, and outlined the functions and rights of each. He said that the best convention and committee work can be developed in the state organizations and intimated that a scheme is on foot for limiting the attendance at the national conventions, closing with a plea for an increase in the number of company sections.

Mr. T. C. Martin, the executive secretary, was scheduled for an address, but owing to preparations for a trip Seattle Mr. Martin was unable to be present.

SERVICE CONNECTIONS.

A paper with the above caption was prepared by M P. H. Bartlett, of the Philadelphia Electric Company, w described his treatise as a series of notes and comments existing methods, in which certain points were emphasiz which it was hoped would provoke some discussion tendi toward a standardization of practice, in so far as is co patible with local conditions. As treated in the paper t service connection included all of the apparatus and c nections between the transformers, secondary circuit underground mains of the company up to the house side the meter. In compiling the notes the author avoi making any recommendations or indorsing to any ext any particular practice, although he has quoted libera from the rules of a company operating in Pennsylva (the Philadelphia Electric Company), not from the vie point of indorsing these rules, but merely as a basis argument and discussion. An endeavor was made bring out certain points regarding which a diversity opinion or practice exists and to cite their effect on relations of the electrical contractor and the compa together with the methods by one company to overc such difficulties as may arise in connection therewith. this were added some brief specifications covering tain methods bearing directly on the subject matter of paper, which the author hoped would be of use. On presumption that what is justifiable in one city is, gener speaking, good policy in another the author sugge that the overhead-line committee of the National Elec Light Association should extend the scope of its worl cover these points or else that some separate commi should formulate some satisfactory standard practice w could gradually be worked up to in the future. It realized that it might be impossible to formulate any se rules or regulations covering service connection w could or would be wholly followed by all the member c panies, even if indorsed by them.

Discussion.

The discussion on this paper was put over until Fr morning's session, in order that the remaining portio of the morning's session and all of the afternoon session m be devoted to the report of the committee on overhead construction. In opening the discussion on Mr. Bart paper Mr. H. N. Mueller, of Pittsburgh, drew attentio to the necessity of the company exercising supervision the installation of the conduit and cable used in makin service connection, even though this part of the work paid for and became the property of the consumer Pittsburgh 3-in. conduit is the smallest size permitte the company and No. 6 the smallest wire used in the the specification of which was as exacting as that us the company itself. He questioned the desirability of pelling all installations exceeding twelve 16-cp lamps be connected to a three-wire system, owing to the incr sed cost of the latter, and stated that in Pittsburgh as ma as 100 lamps were permitted on a two-wire distribution s tem and that the variation in voltage on a three-wire ne or did not exceed 0.75 volt on one side of the system.

Mr. J. E. Pyle, of West Chester, drew attention t the fact that the author made no provision for a cut-out ead of the circuit in the conduit to protect the rest c the system from a breakdown at that point. In West C ster it is the company's practice to install a cut-out fo this purpose. Mr. E. F. McCabe, of Titusville, asked f information concerning the relative advantages of ead-covered cable over rubber-covered wire in conduit-s vice connections, intimating that the relative advantage the cable over the rubber-covered wire was not suffici t to offset its increased cost. Mr. J. F. Cole, of Altoon said

at his company used both cable and rubber-covered wire r service connections in conduits, ranging in size from in. to 2 in., and that it had no reason to regret the nployment of rubber-covered wire instead of lead-covered ble in both the galvanized and inside-enameled iron nduit.

Mr. A. R. Granger, of Chester, then proposed a number questions which it was desired that member companies ould answer. The first of these had reference to the int at which the company's work ceases and the cus- mer's work begins. Mr. E. B. Greene, of Altoona, stated at it was the practice in that city to stop the company's ork at the outside of the building at the point of service trance, but that the company is now planning to run all the service connections up to the house side of the meter. r. E. L. Franklin, of Easton, said that in the latter city, here there were two competing electric-light companies, it as the custom of the older company to install the cut-out neter; the customer, however, is required to bring the 2 ft. outside of the building to a point indicated by e company. Mr. G. E. Wendle, of Williamsport, said at it is the practice of his company to carry the service the main cut-out, which is supplied by the customer.

In answer to the second question propounded by Mr. anger, as to the proper location of the meter, Mr. F. M. ecker, of Renova, said that his company places the meter a cabinet flush with the outside wall on the side porch residences and in the hallways of the first floor of office gs, stores, etc. The advantages of this, he said, are he service lines are always open to inspection, the ring is not costly, the weather has little effect on the ter and the reader is greatly expedited in his work. At esent 70 per cent of the meters in Renova are thus in- alled, and the meter reader averages 300 meters a day, as ainst 80 to 90 meters where the instrument is located in attic, bathroom or cellar in the interior of the residence. Renova the minimum rate for energy is 75 cents per nth, and on the assumption that the meter reader receives cents an hour, if a meter is located in the residence in- rior and circumstances are such that it necessitates two more calls to effect a reading, the cost of the reading is eater than the revenue derived from the installation.

Mr. J. E. Pyle, of West Chester, said that in the latter ace the service is run concealed to the meter, which is aced in the cellar. Concealed knob and tube work is ually installed at the time of the erection of the building r this purpose. Mr. H. Harris, of Wilmerding, told of e attempt of the Pittsburgh Booster Club to standardize ecifications for wiring the ordinary type of building, in hich the architect usually provides for a meter in a bath- om. and after a long discussion with the contractors of e city no definite conclusion was reached. Mr. E. B. reene, Altoona, stated that his company first installed eters in the attics of residences, but since then the prac- te has changed, so that now they are being located in the llar. To overcome the loss incident to repeated calls of meter reader, when the meter is not accessible at the te a printed post card with a picture of the dial is left th the consumer, with the request that he indicate the sition of the hands on the dial and mail the card, which stamped and addressed. Ninety per cent of the cards us left are returned, and the effect is salutary, inasmuch the customer appreciates the confidence placed in him the electric-light company in reading the meter for that nth.

The third question asked by Mr. Granger dealt with the nership of all the connections on the street side of the eter, and it was asked if a company could lawfully prevent person from tampering with his own property on the rvice side. Mr. E. H. Davis, of Williamsport, stated that en though the consumer might own a part of the service nnection on the street side of the meter he could not mper with it, and that he would be just as liable for theft of energy from his own meter as from one which the company installed. Messrs. Greene, Wendle and Cole also spoke on this question.

The last question had to do with the recommendation of the author of the paper as to whether the subject was of sufficient importance to be intrusted to a separate committee, or whether the scope of the overhead-line committee's work should be enlarged so as to include the subject. By vote of the association the suggestion of the author was referred to the executive committee of the national association. Prior to the vote, however, Mr. Bartlett, in closing the discussion, replying to Mr. Pyle's criticism of the absence of a cut-out ahead of the conduit, said that experience with 10,000 to 15,000 such installations showed no serious trouble from this source. He also expressed the opinion that it was bad practice to run the service to a meter by concealed-knob and tube work, stating that in the rehabilitation of an old company he found 100 or more houses in which the lamps were connected ahead of the meter, due to the ignorance of the owner or contractor, neither of whom knew whether the wires tapped were service wires or distribution wires.

PRESERVATIVE TREATMENT OF POLES AND CROSS-ARMS.

The report of the committee on overhead-line construction was read in part at the morning session on Thursday and concluded at the afternoon session. The report was divided into five sections, not including a criticism by Prof. J. P. Jackson, of State College, Pa., on the preservative treatment of poles and cross-arms, and some additional data on sag and span calculations by Mr. William Le Roy Robertson, of Philadelphia. At the morning session Professor Jackson read his portion of the report, which constituted a résumé of the N. E. L. A. report and all bulletins of the United States Department of Agriculture concerning the preservative treatment of poles and cross-arms. His conclusions are: First, that the proper cutting and seasoning of poles prepare them for preservative treatments and reduce their weight in transportation. Second, preservative treatment is profitable financially, particularly so for the softer woods. Third, the preservative treatment enables the use of less expensive timbers. Fourth, the size of treated poles may be determined upon strength, with less reference to the question of decay. Fifth, the best preservative material is apparently coal-tar creosote, and is probably the most economical in the end. This is not intended to exclude the use of other preservatives under special conditions and where creosote oils are unavailable. Sixth, the high-pressure process is the most thorough. It, however, requires treatment of the whole pole, and is therefore more expensive. It is also frequently unavailable. Seventh, the open-tank process is quite efficient, and small plants can be erected at comparatively little expense. Eighth, the brush process, where the more efficient methods are unavailable, is advisable. Gains, roofs and other cross-cuts, where not otherwise treated, should have applications of the hot creosote oil by the brush process. Although practically all of the report had been given to creosote oils and their use, the author stated that other materials are also used, that in dry places zinc chloride has been found to give good service. and that in cases where better materials were unavailable tars have been used with some satisfaction.

Discussion.

Mr. Thomas Sproule, in opening the discussion, stated that the Philadelphia Electric Company uses from 250 to 400 new poles a month, so that any treatment would be expensive. Almost all of the literature devoted to the preservative treatment of poles is confined to the open-tank process, and Mr. Sproule said that it is almost impossible to get the company to make any appropriation for the preservative treatment of poles, owing to the lack of authentic information on the saving effected. Oftentimes it is neces-

sary to buy and erect the poles immediately, but it is the practice of the company to keep a two-year supply on hand, so that at least all of the poles have one year's seasoning. The company has been experimenting with the brush treatment for the past two years, and inasmuch as this treatment can be applied by even the smallest stations, Mr. Sproule suggested that energy be directed to securing all the information possible on this kind of treatment before the open-tank process is taken up.

Mr. H. N. Mueller, Pittsburgh, stated that with scattered pole yards the cheapest open-tank process would be expensive, since it would mean the duplication of equipment unless a portable process could be invented. Experience also shows, he says, that the brush treatment is useless unless the poles have been well seasoned.

Mr. W. C. Sharp, of Pottsville, stated that his company paints gains and butts by the brush process, but the treatment has not been practised long enough to enable accurate results to be obtained. Mr. E. F. McCabe, of Titusville, said that he had experimented with the brush treatment for three years, but without definite results. He felt that any method of pole treatment was too expensive for the average-size plant in Pennsylvania, and suggested that pole dealers be encouraged to erect such treating plants, from which the companies could purchase their poles. Mr. C. G. MacAvoy, Bellefonte, cited a case where poles treated some years ago were removed and found to be in good condition. Mr. E. B. Greene, Altoona, who had charge of the plant at the time these poles were erected in Bellefonte, vouchsafed the information that these were treated about twenty-six or twenty-seven years ago with boiled linseed oil and willow charcoal. Poles were also treated with tar from pine, and in not a few cases gas tar was employed. Seasoning poles for two years resulted in an increased life of 40 per cent, and Mr. Greene suggested that good results could be obtained by treating seasoned poles with dead oil.

Mr. S. C. Pohe, of Bloomsburg, called attention to the defects of the brush treatment, in that rain usually washed the creosote out. Mr. J. H. McDonald, of the Pennsylvania Railroad Company, stated that his company has established a large creosoting station at Mount Union, where ties were treated by the pressure method. Some old poles were also reinforced along the Philadelphia division. A tar-paper band was fitted about the pole and filled with 2½ in. of asphaltum to a point 6 in. above the ground. The pole remained dry under the portion treated, and the results are promising. The life of the pole thus treated is extended about five years, and the cost of the treatment is about $1.05 a pole. Mr. McDonald also described another treatment in which the decayed portion of the pole near the ground line is surrounded with a band and the space between the band and the pole filled in with a certain cement mixture.

Mr. E. F. McCabe, Titusville, said that he had treated poles with creosote at a temperature of 140 deg., whereas Professor Jackson suggested creosote at 200 deg., and he thought that owing to the volatilization of the oil the higher temperature was undesirable.

Mr. R. D. Coombs, of New York City, said that inasmuch as what practically corresponds to the brush treatment has been tried on bridges with excellent result the brush treatment of poles should prolong the life of the wood. Incasing a wooden pole in a concrete base was also fraught with good results, although in his estimation the creosote treatment was preferable and cheaper. Professor Jackson, in closing the discussion, said that it might be possible for a station to take any old tank at hand and fit it with some old coils for heating the creosote and by this means employ the open-tank method of treatment with fair financial results. In reply to Mr. McCabe's question he stated that volatilization of the creosote is not excessive under 205 deg., moisture being the chief ingredient passing off at that temperature.

SAG AND SPAN CALCULATIONS.

The first business of Thursday afternoon was the readi[ng] of the last part of the overhead line committee's repo[rt] devoted to sag and span calculations, by Mr. W. Le R[oy] Robertson, of Philadelphia. The question of sag and sp[an] was treated in a preliminary manner at last year's conve[n]tion by the same author, and in the present paper an attem[pt] has been made to give the proper sag and stress values to [be] used in the erection of overhead lines. The calculatio[ns] are based upon a load of a ½-in. coating of ice, a wi[nd] velocity of 60 miles an hour, acting upon the wire surfa[ce] only, and not on the ice surface; a temperature of 20 d[eg.] Fahr. below zero, with an allowable stress not to exce[ed] three-quarters of the elastic limit and a factor of safety [of] about 2.2. The data have been calculated with the aid [of] solutions presented in a paper entitled "Solutions to Pr[ob]lems in Sags and Spans" by the author, which appeared [in] the June, 1911, *Proceedings* of the A. I. E. E. Tables [are] given for No. 6 and No. 2 solid hard-drawn copper, w[ith] three-braid weatherproof covering, and No. 0000 stran[d] hard-drawn copper with three-braid weatherproof coveri[ng]. Additional data are also given for annealed-copper w[ire] with three-braid weatherproof covering, the data in [the] latter case having been calculated somewhat approximate[ly]. The sag values and the data on annealed copper differ fr[om] those given in the national report. There was no discuss[ion] on Mr. Robertson's contribution to the report.

OVERHEAD-LINE CONSTRUCTION.

The criticism of the report of the national committee [on] overhead-line construction was divided into five secti[ons]. Section 1 covers specifications for overhead-line constr[uc]tion for 2300-volt distribution and for street lighting [and] specifications for materials covering secondary-distribut[ion] systems. Section 2 covers specifications on methods [of] overhead-line construction for secondary voltages, inc[lud]ing pole wiring for street-lighting work. Section 3 co[vers] inter-company agreement forms and specifications for [the] joint use of poles by lighting and telephone compa[nies]. Section 4 deals with specifications for overhead cross[ings] of electric lines. Section 5 is devoted to consideration [of] maintenance and inspection. The first and second sect[ions] were presented and elaborated by Mr. H. N. Mue[ller], of the Allegheny County Light Company, of Pittsbu[rgh]. Sections 3 and 4 were presented and elaborated [by] Mr. G. E. Wendle, of the Edison Electric Illumina[ting] Company of Williamsport, and Section 5 was read, in [the] absence of Mr. W. C. Sharp, of the Eastern Pennsylv[ania] Light, Heat & Power Company, of Pottsville, by Mr. F[.] Noecker, of the Renova Edison Light, Heat & P[ower] Company.

Mr. Mueller called attention to the fact that the c[ross]-sectional diagrams of cross-arms in the national report [are] marked 3½ in. by 4½ in., whereas the generally acce[pted] standard, as established by electric-lighting companies, [tele]phone interests and the various telegraph companie[s, is] 3¼ in. by 4¼ in. He enumerated certain tests whic[h he] suggested should be made by the national committee[, in]cluding the average wire-carrying capacities of the [arms] for spans of 150 ft., with specified sags; the weake[ning] effect of bored pin holes; the comparative strengt[h of] arms when the arms are not bored and clamp pins are [used] and when standard bored arms using 1½-in. pins are [em]ployed. After such data have been obtained the comm[ittee] feels that the national committee can then advisedly re[com]mend the standard which can be taken up by the m[anu]facturers of cross-arms and made commercially practi[cab]le. Objections were also made against certain of the spec[ifica]tions for wooden insulator pins, specifications for [met]al pins, specifications for copper wires and cable [with] weatherproof insulation, specifications for aluminum [wi]res and cables with weatherproof insulation, specification for rubber insulator tree wire braided and specification for

ethods of construction. With reference to the latter the mmittee is of the opinion that while the meaning and tent of the term 2300 volts nominal are clear, in a legal nse it is limiting, and that the term be defined as covering erating voltages between the limits of 2000 and 3000. he committee also suggests that poles be numbered by eans of metal stencils of either the cut-out or embossed e.

With reference to the second section covering methods overhead-line construction for secondary voltages, inuding pole wiring for street-lighting work, the Pennsylvania state committee recommends that this section of the tional report be eliminated, on account of the fact that whole mode of secondary distribution is undergoing l change and development. The latest development in dary-system construction, particularly for stringing condary mains, differs so radically from the methods oposed that the committee believes it expedient to proceed y in adopting standards which may shortly be super- Furthermore, secondary-system work is so largely tter of local conditions that no standards will be gen- accepted. The Pennsylvania state committee again rates its criticism against connecting lightning-arrester ound wires to grounded neutral wires and asks that this eliminated from the national report. The line of fixtres shown in the national report, the state committee ims, is poorly designed as regards the manner of fasteni to the arms.

the matter of joint use of poles the state committee es that it would be well to distinguish between poles ere permanent rights of occupancy exist and poles where achments are by license and revocable. Where one comny already has its line at a particular location and another mpany desires the joint use of the poles the committee ggests that the latter should pay its pro rata share of the nual maintenance and inspection cost of the poles and tes and other expenditures peculiar to pole lines, so that ere two parties use the pole line jointly each will be one-half of the total expense. The company having the iginal line would be the actual owner and the other would ceive permanent rights to use the poles. In order to oid subsequent friction the parties to the joint-pole agreent should determine the space to be used on the poles by ch, and these limits should plainly be set forth in the ntract. Then in subsequent operation each of the joint f the poles could construct as many wires and attach- as he wished. When the pole requires renewal the ny owning the pole renews it at its own cost, but one of the joint users of the pole desire additional e which would necessitate a higher pole or more expense construction the applicant should pay for the additional st for renewing with a higher pole or for the extra conuction. In case the existing pole does not require renewal e applicant for the additional space shall pay the total st of replacement of the existing pole by such higher le. Where attachments are made under a license the rge therefor shall be independent of the number of es actually attached, provided the construction is accordi to the specifications. In case an isolated pole is erected b the junior company co-linear with the poles and extendi through and above the wires of the senior company the mmittee is of the opinion that the latter company should hve the right to place cross-arms on the isolated pole and ach its wires thereto in a standard manner without any rge whatsoever for the attachments, provided the distce between the poles of the senior company on either se of the isolated pole does not exceed 150 ft.

Under the specifications for construction on poles jointly d the committee believes that the vertical clearance been wires should be 40 in., but does not consider it isable to make mandatory any greater distance than can be maintained legally. Under the standard specifications f overhead-line construction the vertical distance between electric-lighting wires, except at junction poles, is made 24 in., the center to center distance between gains on the poles. The committee suggests that either the minimum clearance be made 24 in. or the mandatory feature be eliminated. With reference to the part of the national report dealing with telephone companies and specifying that a standard wooden cross-arm not less than 4 ft. in length shall be fastened at its center to the pole by the equivalent of at least two lag bolts, the committee points out that the standard method of attaching cross-arms is by through bolts and braces, and inasmuch as the cross-arm in question is to be used to stand on it should be fastened in the same manner as any other cross-arm. The committee also points out that at the present time there is a decided tendency to eliminate completely the running of conductors down on the surface of the pole, either by insulated supports, through ducts of solid insulating material or with the various forms of armored cable. A system of open wiring, by which the electric-light conductors are carried from the ends of the electric arm above and secured to special brackets attached to the telephone arm below, the wires being carried thereon to the lower position on the pole, is suggested as being worthy of careful examination in connection with the service to arc and incandescent lamps. The committee feels that this promises to prove a much safer and more satisfactory solution of the problem of bringing electric-light wires down through the telephone wires than is outlined in the national report.

The state committee objects to the entire specifications for overhead crossings of electric-light lines in the national report for the following reasons: (1) They require special construction of all electric-light wires (except trolley-contact wires) crossing over railroad right-of-way, tracks or lines of wires, regardless of the voltage carried by the crossing wires, and crossings constructed over telephone, telegraph or other similar lines when the electric-light and power wires carry over 5000 volts constant potential. (2) They are not definite in one important particular. (3) They require relinquishment of the legal rights of electric-light companies. (4) They require unnecessary clearances. (5) They require unnecessary and unduly expensive construction at wire crossings. (6) They require construction which is insufficiently tried and experimental. (7) They require sags which do not agree with the experience of operating light and power companies. (8) They do not cover the cases when electric-light wires are crossed over by railroad lines of wires, telephone, telegraph or other similar lines. (9) If adopted they will injuriously affect the legal position and liability of electric-light companies. In order to place this matter clearly before the members Mr. Wendle took up the objections seriatim and pointed out the clauses of the national report which he stated justified the objections.

The committee endeavored to obtain from the members of the national committee a direct answer to the following question: "Will the regular standard construction specified for 2300 volts nominal be accepted for wire crossings over railroad right-of-way, tracks or line of wires?" Mr. Wendle stated that the answers received did not indicate agreement among the members of the committee on this point and that the fact was apparent that a railroad company could if it so desired require special construction at all wire crossings for all voltages. The ambiguity of the wording of the paragraph relating to the methods of supporting the conductor at the poles or towers was pointed out and the inability to detail a practicable and commercial construction which would meet requirements. Much of this part of the report was devoted to the specified minimum vertical and side clearances called for in the national report, and the Pennsylvania state committee pointed out that an electric-light company has the right under its franchise to construct, maintain and operate wire crossings independently of any consent on the part of the railroad crossed.

the only obligation being to construct, maintain and operate the crossings with safe vertical and side clearances. The railroad has no greater rights over highways than other users, except to the extent of their special use. When private crossings are desired it was pointed out that the railroad may demand any type of construction and impose any conditions which it deems proper. The committee stated that examination of the specifications in the report generally fails to disclose any agreement on the part of the railroads throughout the country to permit private wire crossings, even if constructed in accordance with the specifications, and that in view of these conditions the members should not voluntarily limit their legal rights and impose upon themselves duties in clearances with regard to railroads which are not demanded by safe construction and are not legally enforcible. Exception is taken to the general demand that alternating-current circuits clear all existing wires not less than 8 ft., since the courts of Pennsylvania have held that a junior company could not be compelled to maintain a greater clearance at a crossing point than the vertical distance which the senior company maintains between its own wires of similar alternating-current voltage, which in the case cited was 24 in.

Objection is also raised to the relative clearances required for bare and insulated wires when used on direct-current, constant-potential circuits not exceeding 750 volts, the committee pointing out that commercial insulated wire after a few months' exposure to the weather has a doubtful insulating value, and that a clearance of 4 ft. with the bare and 2 ft. with insulated wires is not justified by operating experience.

In order to collect data on the question of the hazard at railroad crossings the committee submitted a list of questions to seventy-seven of the member companies in the association, and answers were received in full from seventy of the companies, or 90 per cent of the companies in the association, which control about 95 per cent of the poles. A summary of the replies is given in the report, from which it appears that the total number of wire crossings with special fastenings or protective devices is not over forty-nine, while the total breakdowns or interferences at these crossings were sixteen. Of these breakdowns five were caused by galvanized-wire cradles, ten were caused by special wire-clamping devices required by the railroads and one by a line constructed by the railroad across its tracks at too low a level. The companies reporting the fifteen breakdowns have removed the cradles and special clamping devices and substituted therefor the regular double-arm construction with standard insulators and ties, since which no trouble has been experienced.

The committee feels that the question of crossings is a very vital one. In Pennsylvania the courts have held that an electric-light company "must construct, maintain and operate its overhead wires with the highest practicable degree of care," which means that a company must do all that human care, skill and vigilance can suggest and must adopt the most modern appliances and methods in its construction. If the specifications for overhead crossings in the national report are the best, and if adopted will result in safer construction, then, the committee points out, a company is legally bound to use these specifications in its construction everywhere on its system. In a lawsuit involving overhead construction the specifications approved officially by the representatives of the industry would in the estimation of the committee be offered in evidence and be accepted on the point at issue. The burden of proof would therefore be placed on any company attacking such standards. Where the jurisdiction and control of the industry are delegated to a commission which has the right to specify overhead-line construction and materials, such a commission would most certainly make as its minimum requirements the specifications adopted by the National Electric Light Association. In view of the foregoing the committee asks why specifications should be adopted which will injuriously affect the legal position and increase the responsibilities of member companies, especially since these have not been thoroughly tested and proved in service and are not accepted as unquestionably the best and safest.

Discussion.

Mr. J. H. McDonald, of the Pennsylvania Railroad Company, called attention to the desirability of having standard specifications for railroad crossings. He said that the smaller companies were the worst to deal with, inasmuch as they could not command the best engineering advice. Mr. R. D. Coombs, of New York, a member of the national committee on overhead-line construction, said that many of the objections raised had to do with matters of policy. The national committee was particular not to state how a thing should be done, but what the companies should do and it made every attempt to compile reasonable specifications.

Mr. J. H. Perkins, of Lancaster, drew from Mr McDonald an admission that in all permits for crossing the electric-light company is forced to sign an agreemen absolving the railroad from all damages in case of acciden due to the presence of the wires at the crossings. This Mr. McDonald said, was insisted upon by the legal depart ment of the railroad, which felt that inasmuch as the rai road was invariably on the highway first it could dictate t subsequent users.

Mr. E. F. McCabe, of Titusville, also called attention t the clause in agreements with railroads whereby the latte could compel the removal of the crossing on demand. H pointed out that the railroad did not own the property ar merely possessed a right-of-way, but that it was oftentim expedient for the lighting companies to sign the agreemen in order to effect the crossings without undue delay.

Mr. Thomas Sproule, of Philadelphia, stated that cros arms having a section of 3½ in. by 4½ in. were in gener use among the larger companies. He was of the opini that clamp pins would eventually come into general use a defended the national report in many points. He felt th some of the recommendations of the committee were wea although he admitted that the report was the best sta report ever presented. Mr. J. F. Gilchrist, of Chicag stated that engineers of the Commonwealth Edison Co pany had examined the report and found it satisfactory the company. He said the men on the national commit were well selected for the work and their deliberations r resented the best judgment of the industry. While so features could doubtless be improved upon, he urged t the national report should be adopted, after which s changes as practice dictates could be brought about.

Mr. McDonald, answering the objections of the st committee to the specifications on wire and its fe that small companies could only obtain such wire as market affords, stated that the Pennsylvania Railroad specifications for all of its wires used and found no diffic in finding a manufacturer to turn out the product for th

Mr. E. H. Davis, of Williamsport, discussed the sp fications from the legal viewpoint and claimed that no g eral changes should be made or standards recommende adopted without the most careful consideration of the main factors involved—greater safety and increased pense. He maintained that no mere experimental sug tions should be recommended as standards, and that consideration should be given to the effect of prop standards upon the smaller companies and upon sp types of construction in many localities due to local co tions. He said that the final test of a proposed standa its general acceptance by the industry. If it is unt debatable or experimental it should be rejected unt proves its merit. He cited the prejudicial legal effe of doubtful, untried and expensive standards and called at tion to the very important legal questions involved in the

ration of the electric-lighting industry to the telephone companies, competing lighting companies, trolley companies, steam railroads and other interests, including the state and municipality. He contended that no standards involving such other interests should be proposed without the fullest consideration of the legal rights of all parties in interest, and certainly the legal rights of members should not be surrendered and additional responsibilities imposed without their full knowledge and consent. He said that proposed standards based upon engineering data alone cannot do justice to member companies and to the other interests affected. In order to emphasize the importance of the questions at issue Mr. Davis considered the money value of the investment of the industry affected. He cited the United States report on commercial electric-lighting companies for 1907, which showed an increase of investment over the previous period in 1902 of about 100 per cent. Assuming that the present figures will be 80 per cent in excess of the report of 1907 Mr. Davis gives the gross income of all companies for 1911 as approximately $[illegible]0,000,000. The cash investment, he claimed, would certainly be five times that, or $1,500,000,000, and likely much more. The cost of the distributing systems will average from 40 per cent to 50 per cent of the total investment, or from $600,000,000 to $800,000,000, the major portion of which investment will be affected by the standards proposed. The accident branch of the business, Mr. Davis said, costs annually on a conservative estimate 1 per cent of the gross income, or about $3,000,000. How much the standards proposed in the national committee's report will increase the investment or the annual cost of maintenance on overhead-line construction can only be conjectured, but Mr. Davis maintained that it will certainly be large enough in the aggregate to justify the most careful scrutiny of the entire report before its adoption. So far at least as appearances in the report itself are concerned, Mr. Davis said this phase of the question was never considered by the national committee. Passing thence to a consideration of the expense that would be involved if Section 4 of the national report were put into effect in the State of Pennsylvania alone, Mr. Davis said that the 1659 crossings over steam roads at a moderate estimate of $50 for each crossing would involve an expense exceeding $80,000 and that the increased legal liability could only be guessed at. If the same type of construction would be legally required over all highways the cost would run into millions.

Mr. L. H. Conklin, Warren, Pa., agreed with Mr. Davis that the legal side of the report should be given the utmost consideration. The discussion, which was quite spirited throughout, occupied the entire session, and at its close it was voted to refer the entire report of the state committee to the national committee, with the suggestion that it be considered in connection with the report of the national committee on overhead line work.

ELECTRICAL APPLIANCES.

The first paper read at Friday morning's session was prepared by Mr. E. B. Greene, of Altoona, Pa., on the value of electrical appliances to the central station. The paper was somewhat reminiscent in character. At Altoona a [illegible] rate system of charging for electrical energy is in [illegible], so that almost all the appliances obtain the advantage of the low rate, which is 4 cents per kw-hour. Mr. Greene called attention to the advantages of suiting a flatiron to the woman, recommending in the case of a quick worker an iron rated at approximately 10 volts below the standard voltage on the line, care being exercised to instruct her not to leave the iron on the circuit for any longer time than is necessary to heat it up for work. The Altoona company has met with phenomenal success in introducing the flatiron in that city. The company engages young men for the purpose of selling heating units and pays them at the rate of 50 cents each for each article sold.

Discussion.

Mr. H. P. Swayne, of Altoona, said that from July, 1910, to July, 1911, his company added to its already large heating load 2460 electric flatirons and 472 toasters. One hundred of the latter were given away through an advertising contest, by which means 300 more were sold. Mr. J. E. Schute, of Altoona, stated that the greater part of the irons and toasters were sold at the office, the women using the devices being the best advertisers. So great is the heating load that the peak on Tuesday occurs at 10 o'clock, and Mr. J. F. Cole, of the same company, stated that this oftentimes necessitated the employment of an extra man on Tuesday in the boiler-room and the starting up of an additional unit. Mr. Greene drew attention to some curves for seven consecutive days which were displayed on the wall of the convention hall, which showed that the heating load, which is greatest on Tuesday, also was apparent on Wednesday and even on Thursday morning.

CENTRAL-STATION SERVICE VS. ISOLATED PLANTS.

An excellent paper on this subject was prepared by Mr. T. E. Spence, of the Luzerne County Gas & Electric Company, Plymouth, Pa., and was read in his absence by Mr. W. C. Anderson, of that company. The author endeavored to show that the question of costs should not always be the deciding factor in favor of purchasing energy from central stations, but that the many contingent, or rather accruing, advantages are largely in favor of the central station and should be given due consideration in balancing the central-station supply against the isolated plant. The author showed that in order to keep pace with the advancement of the art a central station is forced to install modern apparatus, whereas the manufacturer cannot readily afford to replace his apparatus for newer types and must usually use his plant continuously until it is relegated to the scrap heap. Moreover, the manufacturer never knows how future trade conditions will affect his business. The latter may increase extensively, and in order to keep pace with this growth it would be necessary to install additional units, which usually results in a very undesirable type of plant, needing more attention, more repairs, etc. On the other hand, if his business decreases, he will suffer loss by reason of fixed charges. Mr. Spence also asks if it is not better, from an investor's point of view, to avoid investment in a power plant which if destroyed will cause greater loss, due to interruption of business, than the loss due to the destruction of the plant itself, which latter can be covered by insurance. He states that continuity and reliability of service should be given due consideration in balancing the central-station supply against the isolated plant, and, further, that whatever makes for continuity and reliability, at some sacrifice of economy and detail, may be installed and will ultimately prove of greater economy through the insurance of uninterrupted output. The central station is in business for the purpose of producing and marketing electrical energy. Its reputation for reliable service, consequently, must be safeguarded, and a complete shutdown is almost unknown. There is, moreover, sufficient reserve apparatus installed in the plant of a central station to permit one or more of its units to remain idle without crippling the service. Such is not the case in isolated plants. The author gives a most convincing demonstration of the efficiency of the central-station idea in that his company supplies energy to coal mines and breakers from a coal-burning central station located several miles from the mines. The plants in the anthracite region can purchase fuel for about $1.30 per ton or less, and the energy can be purchased by the large mines for 2 cents per kw-hour or less. At such a rate the mine operators, especially those with smaller holdings, find operation with central-station service more advantageous than by isolated plant, with cheaper fuel but heavy investment cost per unit of work done.

Discussion.

Mr. E. B. Greene, of Altoona, called attention to the fact that the main drawback in producing energy at the coal mines is the lack of water. His company supplies about 4500 hp to mines in the bituminous coal regions contiguous to Altoona. Mr. W. R. Kenny, Connellsville, Pa., told of the immense load which the West Penn Electric Company has in the coal mines in that section. Most of the mines there have abundant water supply, but the maintenance cost is so excessive that the central station can compete. Moreover, for mine operation electricity possesses advantages superior to any other form of energy. Mr. H. N. Mueller, Pittsburgh, Pa., spoke of the difficulty of dealing with consulting engineers, who usually find it advantageous for their clients to install isolated plants. Mr. Mueller also showed how municipal plants tie up the business development in towns in which they are located and how boards of trade and boosters for various localities manage to attract business with the assurance of abundant and cheap electric supply for manufacturing purposes. Mr. Anderson said that his company recently was able to shut down two municipal plants, giving in lieu of payment street-lighting service to cover the cost.

ORNAMENTAL STREET LIGHTING.

A paper on this subject was presented by Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, an abstract of which is published elsewhere in this issue. Mr. B. F. Fisher, Jr., of the Westinghouse Lamp Company, and Mr. Thomas Sproule, of the Philadelphia Electric Company, discussed this paper briefly.

RATES.

The last paper of the session was the report of the committee on rates, of which Mr. J. H. Perkins, of Lancaster, Pa., is chairman. The committee reviewed the report of the national committee so as to bring out as distinctly as possible its more important features. Passing thence to cost determination, the committee thought that to gain the confidence of the public in the fairness of central-station methods of charging and at the same time place central stations in a position unassailable on the part of commissions or other business-regulating bodies the central station must have schedules of rates to reach all classes of business, which should be public and as few in number as possible. These schedules, in the opinion of the committee, should be based on costs logically determined. An actual case was cited in which the expenses are proportioned to three elements of cost: Those that deal wholly or in part with the number of customers, those that deal with the demand or size of the installation, and those that deal with the energy delivered. The committee indorsed the plea of the national committee for uniformity in the form of rates and recommended that a vote be taken on the question of a minimum charge and of flat-meter versus differential-meter rate for residence lighting, and that the result of the vote be transmitted to the national association as a definite recommendation.

Discussion.

The discussion on the paper on rates was taken up in the executive session, so that the details are not open for publication.

ELECTION OF OFFICERS.

At the Friday morning session the report of the nominating committee was received, and on its recommendation the following officers were elected: President, Mr. R. S. Orr, Pittsburgh; vice-president, Mr. Van Dusen Rickert, Pottsville; secretary-treasurer, Mr. W. E. Long, Philadelphia. The three members elected on the executive committee, according to the provisions of the constitution, were Messrs. E. H. Davis, Williamsport; Duncan Campbell, Scranton, and S. C. Pohe, Bloomsburg.

Mr. R. S. Orr, the newly elected president of the Penn sylvania Electric Association, is superintendent of th Allegheny County Light Company, Pittsburgh, Pa. He ha taken an active part in the association since its formatio and has been among the foremost in advancing its interest Mr. Orr was born Oct. 14, 1867, in Clarion County, Pa and was educated in the public schools, Washington an Jefferson Academy and Washington and Jefferson Colleg receiving the degree of B.A. from the latter in 1891. Fo two years after his graduation Mr. Orr taught in the Wash

R. S. Orr.

ington and Jefferson Academy, leaving there to becor principal of the Ninth Ward public schools of Allegher In February, 1904, Mr. Orr forsook teaching as a profe sion and became general contracting agent of the compa with which he is now connected. So effective and aggr sive was his work that within a short time he was ma acting general superintendent and within less than a ye general superintendent, a position which he has since fil with credit to himself and his company. Mr. Orr effect many improvements in the service and is the inventor o method of reinforcing decayed wooden poles with concre used generally by telephone, railway and lighting co panies throughout the country. He is a member of Engineers' Society of Western Pennsylvania, Americ Electrochemical Society and an associate member of American Institute of Electrical Engineers. Outside of engineering profession Mr. Orr is a member of the U versity Club, Pittsburgh Athletic Club, Board of Alleghe School Controllers, a trustee of St. John's General H pital, a director of the Ohio Valley Bank and one of board of managers of the Woods Run Industrial Home.

ENTERTAINMENT FEATURES.

As was the custom at previous conventions of the asso tion, abundant entertainment features were provided dur the week to occupy the time of the members and guests required at regular sessions. While the convention was session Wednesday morning the ladies played cards in hotel parlors, and in the afternoon the delegates took in track events, including a 100-yd. dash, a 50-yd. dash fat-man's race, a three-legged race and a sack race. races were hotly contested and afforded no end of amu ment. Following these events there was a baseball ga between the central-station men and the supply men, and a finale to the day's outdoor sports there were four ho races at the excellent track with which Exposition Par provided. The track presented a holiday appearance, w the pennants of the association everywhere in evidence. The attendance included, besides those at the convention, about 2000 persons from the nearby country. Wednesday evening was given over to a theater party, the talent including headliners from the various companies represented. Motion pictures and a minstrel troupe from Pittsburgh furnished the bulk of the entertainment, the sallies of the latter being directed at some of the best-known members of the association. Following the theater party, at the invitation of the Westinghouse Electric & Manufacturing Com-

..., the party boarded the steamer *Helena* for a moonlight sail on Conneaut Lake. Refreshments were served during the sail and an electric search lamp served in lieu of the moon. The food was prepared for the most part on electric stoves, chafing dishes, percolators, etc.

On Thursday morning the ladies were taken in automobiles to the fish hatcheries of the State, and in the afternoon they held a salmagundi on the hotel veranda. Bowling and rifle contests were provided for men during the afternoon, and in the evening a cotillon, led by Mr. E. L. Smith, of Towanda, was given in the dancing pavilion. Beautiful favors were distributed, and the evening's entertainment concluded with a cake walk. The Sons of Jove held a rejuvenation in the Japanese tea garden later.

On Friday morning there were bowling and rifle contests for the ladies, and in the afternoon the men engaged in boat races and swimming contests, the entertainment program closing with a balloon ascension. Attached to the balloon, which reached a height of approximately 6500 ft., was an immense pennant of the association. Abundant prizes were provided for the contestants, including chafing dishes, percolators, sewing-machine motors, irons, table lamps and other electrical devices for the ladies and suitable prizes for the men as well. Mr. G. B. Muth, of Philadelphia, was chairman of the entertainment committee.

Wisconsin Commission News.

The commission has dismissed a case brought against the Elk... municipal electric-light plant. A petition alleged that the rates for electric service were excessive and that certain consumers were discriminated against in the matter of meter rentals. At the hearing the municipality contended that the rates were not high enough to guarantee a reasonable return. The testimony showed that some consumers owned their own meters, while others paid an annual rental on meters owned by the plant. This rental was not uniform, however. It also developed that the consumers who usually are metered were on the flat-rate basis. From an approximate estimate of the plant's earnings gained from the very crude accounting system in use by the municipality the commission was of the opinion that the present rates yielded a somewhat small rate of return and consequently this portion of the petition was dismissed. The decision stated in this connection that when meters are in general use and the plant accounts properly kept a revision of rates may be necessary. The practice of charging a meter rental was condemned by the commission and the order provided that all meter rentals now in force should be abolished and a minimum bill of 50 cents per meter per month substituted. The municipality is also ordered to acquire all meters now privately owned or pay to the consumer owning his own meter an annual rental of $2 per meter.

New York Commission News.

The commission has been requested by the municipal authorities of the village of Catskill to fix the price to be paid for street lighting under a new contract proposed to be entered into with the Schoharie Light & Power Company, the parties having been unable to reach an agreement. The Board of Trustees of the village submitted several lighting specifications to the company and is particularly desirous of securing reasonable rates upon thirty-five 200-watt lamps, fifty 60-watt lamps and 200 50-watt lamps. This plan contemplates the elimination of all arc lamps now used, with the consequent saving in cost of maintenance and without any necessity of a change in station apparatus. The company has offered to light the streets of the village all night and every night as proposed in this plan for the period from the termination of the present contract to May 28, 1912, at the annual rate of $53.78 for the 200-watt lamps, $22.50 for the 60-watt lamps and $20 for the 40-watt lamps. These prices the village believes to be excessive and unreasonable and in turn has offered to the company a compromised price of 6¼ cents per kw-hour for such service. The company refuses to accept the compromise, and the village authorities, therefore, appealed to the commission to adjust the difficulty; the commission is also asked to request the company to continue furnishing light to the village under the same hour schedule and at the same price as at present until the matter is heard and determined.

The Public Service Commission, Second District, has instructed its counsel to commence actions to recover a penalty provided by law against twenty-two gas and electrical corporations for failure to file the annual report required by the commission for the year ended Dec. 31, 1910. The companies were given until Feb. 15 to file these reports, and repeated requests for reports from the statistician of the commission and its counsel since that time have been unavailing.

CURRENT NEWS AND NOTES.

NATIONAL ELECTRICAL CODE.—The new biennial edition (1911) of the National Electrical Code will be issued in about a month.

* * *

N. E. L. A. MEMBERSHIP.—The present membership of the National Electric Light Association is 9570, an increase of 900 since the May convention.

* * *

METRIC SYSTEM FOR MAGNETIC TESTING.—At the meeting in July of the American Society for Testing Materials the committee which submitted a report on a standard method for the magnetic testing of iron and steel used the metric system in the report, partly on the grounds that nearly all electrical work in this country is done, at least in part, by the metric system, and in the European countries universally so, and also because the European technical press entirely and the American technical press in great part use that system in articles dealing with magnetic quantities.

* * *

THE HORSE IN HOT WEATHER.—Mr. F. D. Pembleton, of the Public Service Electric Company, New Jersey, has compiled statistics showing that the loss of horses during the recent hot wave was 3752 in four cities alone, namely, New York, Chicago, Philadelphia and Boston, the respective figures being 1708, 1483, 351 and 210. The money loss was probably considerably in excess of $1,000,000. In commenting on these figures the editor of the "Question Box" of the *N. E. L. A. Bulletin* says that during the period of great heat manufacturers of electric trucks and vehicles were swamped with orders, but few of which could be filled.

* * *

MEETING OF EMPIRE STATE ASSOCIATION.—The annual meeting of the Empire State Gas & Electric Association will be held in the Engineering Societies Building, New York, at 10 a. m. on Friday, Oct. 6. The program will consist of the reports of numerous committees and discussions thereon. Several of the recent opinions of the Public Service Commission which are of particular importance and the question of the extent to which public-service corporations should enter into civic relations will also be discussed. The election of officers for the ensuing year will take place at this meeting. Those who attend the meeting will lunch together at the Engineers' Club during the noon recess.

Old-Time Telegraphers.—The Old-Time Telegraphers' Association and the United States Military Telegraph Corps held their annual reunion at Atlantic City on Sept. 5, 6 and 7.

* * *

Output of Gasoline Automobiles in 1912.—It is estimated that the output of gasoline pleasure vehicles in 1912 will reach 210,000. The largest annual output in the past was 186,000 cars, which sold at an average price of $1,533.

* * *

Milwaukee Section, N. E. L. A.—The Milwaukee Electric Railway & Light Company Section of the National Electric Light Association will hold a meeting on Sept. 25 or Sept. 26 at which Mr. O. M. Rau, chief electrician of the company and also the recently elected president of the section, will deliver an address on "The Distribution System of the Milwaukee Electric Railway & Light Company."

* * *

A Correction.—The following correction should be made in the article entitled "New High-Tension Transmission in Connecticut Valley," page 619, issue of Sept. 9. The final part of the first paragraph should read "and the consulting engineers of the undertaking were the former firm of Thomas & Neall, New York, represented throughout by Mr. N. J. Neall, of the Boston office." In the next to the last paragraph it is stated that the mills mentioned are shortly to double their capacity, which should read "double their demand." In the tabulation of costs the item "Engineering, including preliminary surveys, $16.10 per tower," should read "Engineering, including all surveys, $37.40."

* * *

Brooklyn Edison Library.—In keeping with its spirit of progressiveness the Edison Electric Illuminating Company of Brooklyn has opened a library in its main office building for the benefit of its employees. About 100 volumes relating to the industry, and the leading trade journals comprise the initial equipment. Among the present reference books are the proceedings of the National Electric Light Association, reports of public service commissions of various states, books on welfare work and various industrial questions, and a number of engineering and law books of interest to central-station men. Additions to the library will be made from time to time and it is planned to have a library that will be of interest and value to all progressive employees.

* * *

Central-Station Baseball News.—The baseball teams of the Philadelphia Electric Company and the New York Edison Company met at the Bronx Oval, New York, Sept. 9. The game, which was keenly contested, resulted in a victory for the New York Edison team by a score of 7 to 0. A dinner was provided by the New York Edison Company at the Park Avenue Hotel, and the participants were conveyed thence in automobiles after the game and spent a most enjoyable evening. The team of the Brooklyn Edison Company has also scored numerous victories this season, including a recent game at Baltimore. It is expected that the New York and Brooklyn teams will meet soon to try conclusions, which will practically decide the championship among the teams of the public-utility companies of Greater New York.

* * *

Coney Island Mardi Gras.—Over 300,000 persons were present each evening this week at the annual Mardi Gras festival at Coney Island, New York, one of the features of which was the electrical decorations. Amusement places were brilliantly ornamented with electric lamps and lamps were strung from curb to curb along the principal street; these arches extended for nearly twenty blocks and formed an effective setting for the fantastic parade that was held each night. As in past years, there were a number of illuminated floats in the parade, lighted by contact with the trolley service along the route. At Steeplechase Park where the king and queen of the carnival were crowned the decorations were particularly elaborate, and the lighting effect was enhanced by the rows of ornamental street lamps fronting the resort.

* * *

St. Louis League of Electrical Interests.—An inaugural dinner was given by the St. Louis League of Electrical Interests at the Mercantile Club in St. Louis on the evening of Sept. 8. Eighty members were present, and they discussed plans for the coming season's work. The league has taken a leading position in the discussion of civic and industrial questions relating to St. Louis. It has installed recently five illuminated signs in as many Eastern cities calling attention to the advantages of St. Louis as a manufacturing center. The league will take part in the entertainment of President Taft on his visit to St. Louis on Sept. 23. The first of the noonday luncheons for the coming season will be held on Tuesday, Sept. 19. The meetings are held at the City Club and visiting electrical men are assured of a cordial welcome if they will make their presence known to any member of the league.

* * *

Convention of the Northwest Electric Light & Power Association.—The convention of the Northwest Electric Light & Power Association will be held at Spokane, Wash., Sept. 21 to 23, inclusive, at which the following papers will be presented: *Problems of Power Transmission and Distribution*, by Mr. J. B. Fiskin, Washington Water Power Company; *Central-Station Publicity and Commercial Policy*, by Mr. W. B. Grambs, Seattle Electric Company; *New Business Methods for the Small Central Station*, by Mr. Arthur Gunn, Wenatchee, Wash.; *Legal Aspects of the Light and Power Business*, by Mr. N. W. Brockett, Seattle-Tacoma Power Company; *Methods of Accounting in Connection with the National and State Legislature*, by Mr. C. N. Huggins, Portland Railway, Light & Power Company; *Central-Station Problems, Line Extensions and Question of Meter or Flat Rates in Small Towns*, by Mr. A. C. McMicken, Portland Railway, Light & Power Company; *Meter Accuracy in Relation to Central-Station Increase*, by M. Thatcher, Seattle Electric Company; *Electric Heating and Kindred Uses of Electricity*, by Mr. F. F. Barbour, Portland Railway, Light & Power Company. Mr. N. W. Brockett, Cataract Building, Seattle, is secretary of the association.

* * *

Commonwealth Edison Section, N. E. L. A.—The first meeting of the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association since the summer intermission was held in Handel Hall on the evening of Sept. 5 with an attendance of 311. Mr. Ernest F. Smith, the chairman, who presided, announced that the present membership of the section is 1264, an increase of 160 per cent since Nov. 1, 1910. It was also announced that the nomination ballots, which have been mailed to members, must be returned to the secretary, Mr. E. Doyle, before the close of business on Sept. 30. These are primary ballots and the persons receiving the highest number of votes and the next highest number for each office will be voted on at the final election. The annual banquet of the section will be held about Nov. 1. Mr. O. J. Bushnell, superintendent of the meter department, read an interesting paper entitled "Turning the Company's Product Into Cash." It related to meter reading, billing customers and making collections. After an intermission some excellent instrumental music was given by five members of the N. E. L. A. orchestra, and the meeting concluded with a moving-picture show given by Mr. C. F. Stark, of the advertising department.

GEORGIA'S GREATEST POWER DEVELOPMENT.

Water-Power Generation and Distribution for Industrial Plants in the New South.

ALMOST within a stone's throw of the point at which Gen. William Tecumseh Sherman with his troops crossed the historic Ocmulgee River on his memorable march from Atlanta to Savannah, Ga., in the troublous days of 1865 there now stands the largest hydroelectric development in Georgia, one of the most modern of its size and kind ever built. Even to the layman this plant of the Central Georgia Power Company offers a striking example of the thrift, enterprise and rapid development of the New South.

In the *Electrical World* of April 27 this year an account of the generating station and transforming substations was given. The present article relates more particularly to the hydroelectric features of the development, giving additional data on the plant equipment and methods of operation, with special reference to the market for the electrical energy developed.

Like the Savannah, the Chattahoochee and other rivers in Georgia, the Ocmulgee rises in the mountains and on the Piedmont plateau and flows in a succession of rapids until it comes to its fall line. Like the other rivers, the fall of the Ocmulgee also occurs within the distance of a comparatively few miles of its course.

All of these Georgia rivers are subject at intervals to extreme droughts as well as great floods, causing a very wide range between minimum and maximum flow, but since the Ocmulgee possesses in a high degree natural features permitting the storage of great quantities of water in reservoirs it can readily be used for the development of power.

HYDRAULIC FEATURES.

The point of development utilized by the Central Georgia Power Company is midway between the cities of Atlanta and Macon, Ga., which are about 100 miles apart and between which the Ocmulgee River undergoes a fall of some 527 ft. The exact site is at the foot of Capps and Lloyds Shoals, immediately below the point at which the Ocmulgee is formed by the confluence of the South, Yellow, Alcovy and Tussahaw Rivers, as shown in the accompanying map, Fig. 4.

The dam is erected between two high bluffs in a narrow neck of the river. Both bluffs and river bed are of solid gray granite, constituting an admirable foundation for the dam and its abutments.

Fig. 2—Water-Power Development of Central Georgia Power Company at Lloyds Shoals, Ga.

As will be seen clearly from the map, Fig. 4, the union of the four streams mentioned affords a storage reservoir which consists of a large main body of water with the beds of the several streams forming, as it were, extensive arms, thus giving a far greater storage and volume of water than would be afforded by damming a single stream. It is doubtful whether there exists elsewhere in the South a water-power site combining these valuable features to the same extent. The creation of the reservoir resulted in backing up the water in the streams above the dam to a distance of about 15 miles.

The surface area of the reservoir is about 4000 acres and it is estimated that it contains upward of 7,000,000,000

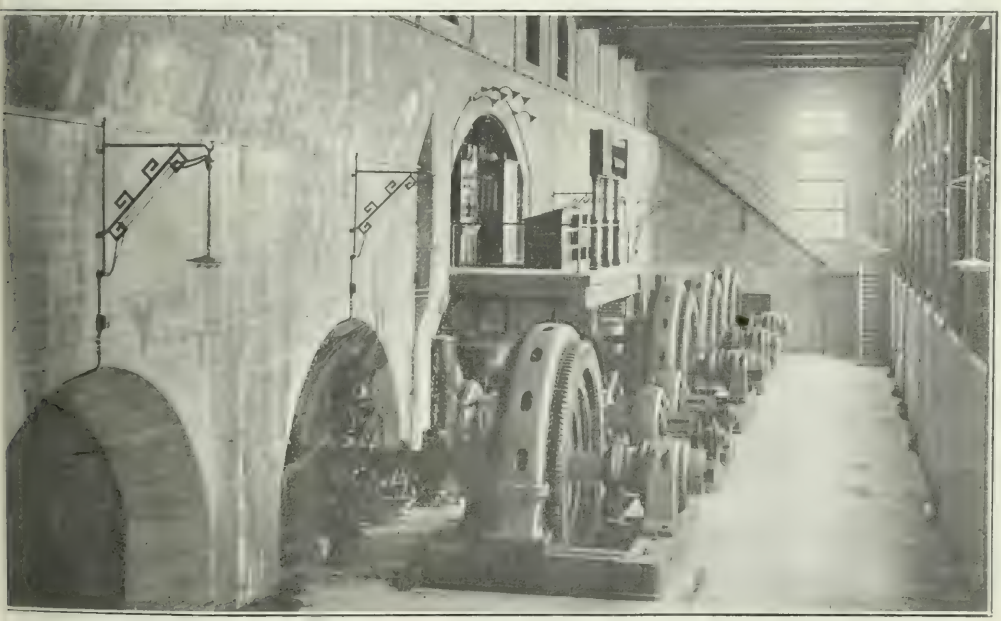


Fig. 1—Interior of Station, Showing Initial Installation of Four Generators.

cu. ft. of water. The storage area serving the reservoir is about 1350 square miles, while the discharge at the dam averages about 1800 cu. ft. per second. Like other similar reservoirs, that on the Ocmulgee River has already proved its value from the standpoint of practical conservation in that it regulates the flow of the river and is admitted to be of inestimable value alike to water users and property located below the dam.

All timber and underbrush in the area covered by the reservoir was cut and thoroughly burned before the water level was raised, as a precaution against fever or other illness arising from the creation of the reservoir. In order to secure the greatest possible storage area it was also found necessary to flood public roads at several points above the dam, as the result of which ten highway bridges, consisting of steel trusses on concrete piers, had to be constructed. These substantial bridges replaced flimsy old wooden structures which were usually flooded and, therefore impassable in times of high water. Thus the reservoir has also been a distinct benefit to the "good roads" movement in central Georgia.

The dam, a photograph of which appears in Fig. 2, measures at its crest 103 ft. above the surface of the water in the tailrace. It is constructed throughout of cyclopean concrete—large blocks of stone, forming about one-fourth of the entire mass, being embedded in a concrete mixture of cement and broken stone, the latter in the proportion of one part of cement, three parts sand and six parts broken stone, with the proper quantity of water. In all, 160,000 cu. yd. of masonry entered into the dam and abutments. The dam is 11 ft. wide at the crest and 95 ft. wide at the extreme base of the spillway, which is formed on a curve to take the water downstream in an absolutely smooth flow. The masonry section of the dam between abutments is 1070 ft. long, the east abutment 540 ft., and the west abutment 100 ft., making the total length 1710 ft. The power house, which is integral with the dam, is 200 ft. long, while the spillway occupies 728 ft. of the dam.

It is a matter worthy of note that the only imported material entering into the construction of the dam proper was the cement, fine sharp sand for the making of concrete being found in abundance in the channel of the river immediately below the dam, granite being quarried from the banks and bed of the river, and all the timber required in the construction of cofferdams, railways, etc., being cut

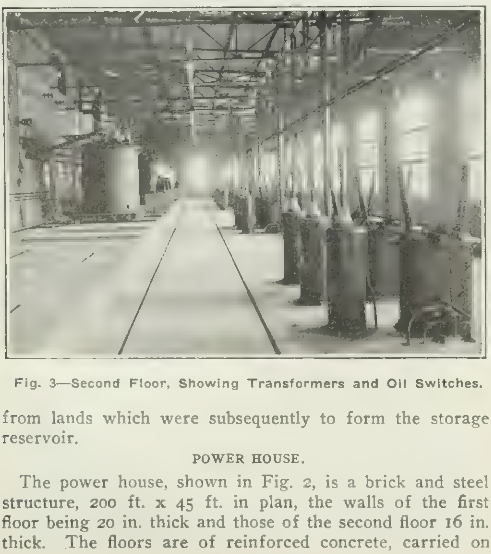


Fig. 3—Second Floor, Showing Transformers and Oil Switches.

from lands which were subsequently to form the storage reservoir.

POWER HOUSE.

The power house, shown in Fig. 2, is a brick and steel structure, 200 ft. x 45 ft. in plan, the walls of the first floor being 20 in. thick and those of the second floor 16 in. thick. The floors are of reinforced concrete, carried on steel beams, while the roof is of similar construction covered with five-ply tar paper and gravel. The plant is designed for six main generator units connected to water turbines. Four of these 3000-kw alternators are already installed, and it is the intention of the Central Georgia

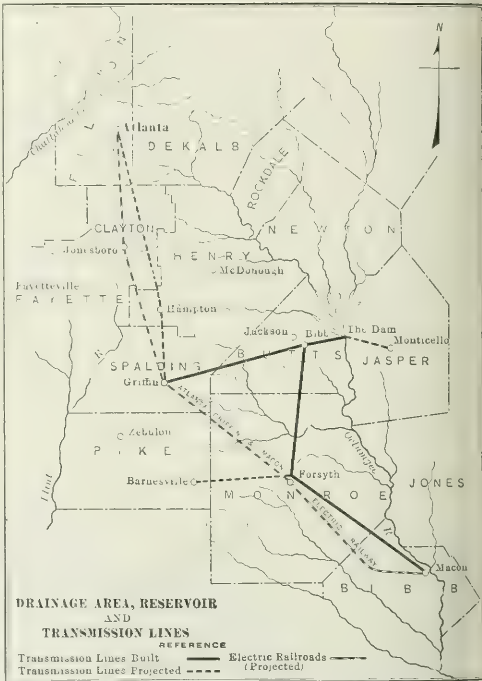


Fig. 4—Map of Drainage Area, Reservoir and Transmission Line

Power Company to install the two remaining units at a early date.

Cross-sections of the power house, showing the relative location of the dam, penstock, draft tubes and general arrangement of apparatus, were given in the preceding article As there pointed out, the generator equipment is installed on the main floor, while the high-tension switching apparatus and transformers are on the upper floor. The operating switchboard is placed on a gallery immediately ove the exciter units on the main floor.

The hydraulic equipment throughout was furnished b the S. Morgan Smith Company, of York, Pa. The generator turbines, which are of the twin wicket-gate type, ar 39 in. in diameter and are designed to develop 5500 h each. Each generator unit is governed by a 30,000-ft.-lb motor-controlled Lombard governor. The two exciter turbines, which are of 535-hp rating, are equipped with Woodward governors and are directly connected to two 400-k generators. These exciter sets are located in the cent of the station, the intention being that one exciter sha serve the three generators located in the east half of tl power house, while the other shall serve the other thr generators in the west half.

The chambers containing the waterwheels, and also tl short penstocks which admit the water, are built in tl dam.

The electrical equipment of the Central Georgia syste was furnished by the Westinghouse Electric & Manufa turing Company, of Pittsburgh, Pa. In the power hou there are four 3000-kva, 60-cycle, three-phase, oil-insulate water-cooled transformers. The high-tension voltag

...al from these units are 38,100, 36,945, 35,790 and ...5 volts delta, giving 66,000, 64,000, 62,000 and 60,000 ...ar-connected, the low-tension ratings being 2300, ...oo and 2000 volts delta.

...own in Fig. 5, each generator circuit is led to a ...-amp, 2300-volt solenoid-operated automatic overload

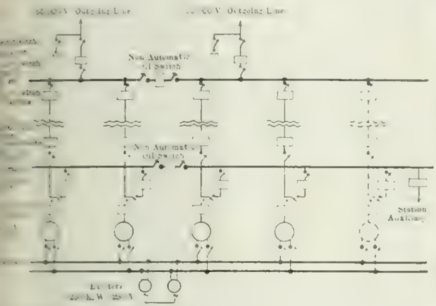


Fig. 5—Simplified Circuit Diagram of Power-House Wiring.

...it-breaker, equipped with definite time-limit relays. ...er normal operating conditions each generator feeds ...ctly from this point, through disconnecting switches ...a circuit-breaker (similar to the one above described), ...he low-tension side of the three-phase transformer, ...ch steps the pressure up to 66,000 volts. Between two ...nnecting switches a tap is taken off to another ...nnecting switches and circuit-breaker leading to ...f busbars or transfer bus. With the aid of ...ment any generator can be connected by the ...of the proper circuit-breakers to feed through to ...step-up transformer. From the high-tension side of ...transformer the circuit is led through a 300-amp, ...00-volt oil circuit-breaker and thence through oil-im...sed choke coils and disconnecting switches to the 66,-...busbars.

... busbars the energy is taken to the substations ...r one or both of two feeders, each of which is ...d to carry 18,000 kw. These feeder circuits pass ...ugh automatic oil circuit-breakers and disconnecting ...d are protected by electrolytic lightning arrest... horn-gap disconnecting switches.

...he ...oo-volt and the 66,000-volt buses are thus divided

Fig. 6—Branch-off and Sectionalizing Tower at Bibb.

...two sections, each section being connected to one ...er. The bus sections can be tied together, however, ...sets of disconnecting switches and non-automatic oil ...uit-breakers. The 2300-volt tie switch is rated at 2000 ...amp. the high-tension breaker at 300 amp. The oil ...uit-breakers are erected in structures of masonry, each ...being entirely inclosed in a separate fireproof compartment and each line terminal being separated by soapstone barriers from adjacent terminals.

The 66,000-volt wiring, following the latest engineering practice, is all open, consequently no inclosing struc-

Fig. 7—Griffin Substation.

tures are provided either for the circuit-breakers or the busbars. The 2300-volt wiring, on the other hand, is inclosed, the busbars, circuit-breakers and disconnecting switches being incased in masonry work.

The 400-kw, 250-volt exciters are controlled from one panel of a black marine-finished slate switchboard containing the switches and indicating meters. This switchboard also contains, in addition to a panel for each exciter, one for the control of the station lighting and motor circuits, the panel carrying a 2300-volt, automatic-overload, hand-operated, oil circuit-breaker and three two-pole single-throw knife switches.

The main switchboard is of the desk-type control, equipped with a complete set of mimic busbars installed on the top of the control desk, enabling the operator to tell at a glance the connections that have been made by the positions of the electrically operated switches. This board has been designed for the control of the four 3000-kva, three-phase generators and transformers, with provision for two spare sets of each, and also the two 18,000-kva, 66,000-volt feeder circuits. The top of the control desk is of slate slabs, the sides, front and rear being of steel plate in the form of removable panels, so arranged as to provide

Fig. 8—Transformers in Macon Substation.

ready access to the interior of the bench for inspection and adjustment.

All circuit-breakers in the station, except that on the station lighting panel, are electrically operated, being manipulated from the control desk by drum-type controllers mounted thereon. The operating handle and dial plate are on the top of the bench, the contactors themselves

being mounted inside, so that there is no possibility of the operator coming in contact with even the 250-volt auxiliary circuits. All of the instruments and synchronizing devices are operated through series and shunt transformers, so the operator can by no chance make contact with any live circuits.

In addition to the usual red and green oil-switch position lamps the positions of the disconnecting switches are shown by two miniature 10-volt lamps connected in series, one being mounted on the control desk and connected in the mimic bus and the other mounted near the disconnecting switches. These lamps are fed from the 10-volt secondary of a small transformer and the lamp near the high-tension switch has connected in parallel with it a snap switch. When the attendant opens a disconnecting switch he turns the snap switch, thus short-circuiting the adjacent lamp and causing the lamp in the mimic bus with which it is in series to burn at full candle-power. This arrangement indicates to the operator that the disconnecting switches are open.

Complete sets of synchronizing plugs and receptacles are included in the generator sections. The closing circuits of the oil circuit-breakers are so wired that the breakers cannot be closed unless the synchronizing plugs are in their receptacles.

A full complement of indicating instruments of the vertical, edgewise type is included in the equipment. The instruments are mounted on a framework back of the control desk, being so placed that the operator facing the generator room when standing in front of the desk can look above the top of the desk and underneath the instrument frame to observe the operation of the machines. Watt-hour meters are installed on the rear of the control desk. Each section of the control desk is 18 in. wide, 32 in. long on top, 36 in. high in front and 44 in. high in the rear.

TRANSMISSION LINES.

As shown on the map, Fig. 4, the main transmission line extends 6 miles from the dam to Bibb, at which point it branches, through a switching tower, 41 miles to Forsyth and Macon on the south and 18 miles to Griffin on the north. The system as thus far completed comprises 65 miles of line and reaches only the cities of Macon, Forsyth and Griffin, but it is understood that these lines will be extended to Atlanta in the very near future. It is also the intention to extend the system from Forsyth to Barnesville and thence to Griffin, thus completing a loop which will constitute the center of the system and into which will be fed energy from the three other plants on other rivers in central Georgia which the company contemplates developing as market conditions warrant. As will be seen from the map, such a loop will materially lessen the chances of interruption to service in that it will provide a means of supplying energy to any of the cities mentioned over either of the legs leading from the switching tower at Bibb. This switch tower is shown in Fig. 6.

Arrangements have also been made to extend a separate line from the power house, over the top of the dam, to the city of Monticello, on the east side of the river at a distance amounting to about 9 miles from the site of development.

The transmission towers, which were furnished in part by the Riter-Conley Company, of Pittsburgh, Pa., and in part by the Milliken Company, New York, stand 80 ft. high from the ground to the pinnacle of the ground-wire support. They are anchored at each of the four corners, each anchor being required to stand a strain of 30,000 lb. without failure. The insulators were furnished by the R. Thomas Company, East Liverpool, Ohio. The tops of the lowest insulators on the towers are 50 ft. above the ground level.

The towers are located with reference to the contour of the country, but average about 500 ft. apart. The conductors are sagged between the towers to a point wh[...] the resultant tension is minimized. These sags ver[...] about 25 ft. at the center, but in no case do the li[...] within less than 20 ft. of the ground. The clear[...] tween line wires is 7 ft. 6 in. A copper-clad stee[...] wire is carried on the center pinnacle and grounde[...] tower.

From the dam to the switching tower at Bibb [...] are of No. 2-0 B. & S. gage copper, while from [...] to the cities mentioned aluminum wire, equivalen[...] tion to No. 0 copper, is used. The general desig[...] line was very carefully worked out with a view [...] nating the troubles common to high-voltage syste[...] transmission line right-of-way is owned by the [...] It is 100 ft. wide and was entirely cleared of [...] timber before the construction of the line was [...] upon.

On the transmission towers telephone circuits [...] installed, the wires of which are so transpos[...] insure good voice transmission. The telephone [...] also carefully protected against lightning discharg[...] stantial booths with permanently installed tele[...] struments are located at many points along t[...] mission line, while at other places drop connec[...] provided so that the line patrolmen, all of wh[...] portable telephone sets, may have ready comm[...] with headquarters at all times. In addition to th[...] telephone system the company's power house, br[...] tion, substations, etc., are all connected to the li[...] Southern Bell Telephone & Telegraph Company[...] the prospects of total interruption to telephone s[...] very remote.

SUBSTATIONS.

Fig. 7 shows a view of the station at Griffin, in [...] ground being seen one of the cotton mills which [...] tracted to use service from the company's lines. [...] for slight differences this station is similar t[...] Forsyth.

The buildings are all of brick and steel co[...] with concrete floors and foundations. The roof[...] of timber with tar and gravel covering, is carrie[...] trusses and is surmounted by a steel tower into [...] led the incoming high-tension lines from the po[...] These lines are equipped with electrolytic lig[...] resters and horn-gaps. In Fig. 8, on the prece[...] are shown the interior lay-out and electrical eq[...] the Macon station.

Four 1500-kva, 60-cycle, single-phase, oil[...] water-cooled transformers are installed in the M[...] tion, transforming from 63,000 volts star dow[...] volts delta. The four Griffin transformers a[...] units of the same type.

In the Forsyth station there are four 200-k[...] phase, oil-insulated, self-cooled transformers o[...] type. Like the preceding units, the high-tensi[...] wound for 36,400 volts and insulated for star co[...] give 63,000 volts, while the low-tension side is [...] 6900 volts.

The high-tension lines are carried up throug[...] of the station through porcelain insulator thiml[...] concrete cones, and thence through disconnectin[...] to the high-tension feeder oil switches located o[...] opposite the transformers. A bus tie line co[...] two feeder lines.

DISTRIBUTION AND MARKET.

As the Central Georgia Company is distinctl[...] saler of energy, service is delivered to its cust[...] pressure of 6600 volts. The consumer in all [...] structs a small brick or concrete compartment [...] commodation of his transformers and protecti[...] To standardize such installations, as well as t[...] the mutual interests of the consumer and the co[...] latter has drawn up a standard set of specificat[...]

with the company's recommendations as to the general ar..er and the minimum apparatus which the consumer oul install in his transformer station. Copies of these eci ations are furnished to the prospective consumer, get..r with plans showing suggested design of the sta- n :d layout of apparatus therein.

In ,e case of large motor users a consulting engineer is ual retained by the customer, but for smaller con- me, who do not or cannot afford to retain an engineer, ny lays out the work. For this purpose the com- ns skilled engineers, who are always available e consumer with his electrical equipment.

rket for energy in central Georgia is a very fertile business offered is of a much more desirable n that obtained in many other localities, for many sections of the South the motor business f some single industry, such as cotton mills or mi e factories, the business that presents itself in the rt of Georgia is of an extremely diversified nature, of cotton mills, knitting mills, cotton-seed-oil l-working mills, railway plants, fertilizer plants, flour mills, brick plants, packing plants, etc.. n be readily appreciated, with this varied class s offering, the company is in a position to build favorable load factor.

rtant feature about the development is the fact gh the plant has been in operation only a com- short time contracts have already been written

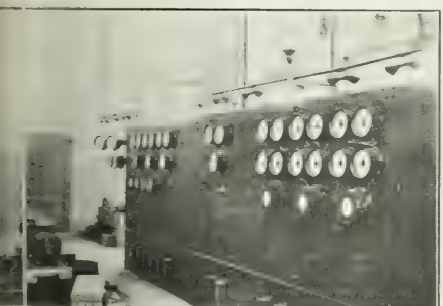


Fig. 9—Switchboard in Macon Substation.

re than 10,000 hp, most of which is already con- ted and being served from the system. Indeed, it is ecd that before the end of the present year the business ritt will require the installation of the two remaining ner ors in the power house and doubling of the trans- ipment in the substations.

d, Greene & Company, of Boston, Mass., were ing engineers for the Central Georgia Power J. G. White & Company, of New York and ting supervising engineers in the construction em.

ganizing and systematizing of the various depart- ents of the company, as likewise many of the special atus of the plant, were due to its first general manager, J. J. Cagney, who remained with the company for me ne after the successful starting up of the plant and bsecently resigned to accept the management of the aw in Falls power plant, which is now being con- ruct on the Mattagami River in Ontario, Canada, to ply the demands of the numerous mines and towns in e Pcupine gold district. Since Mr. Cagney's removal e pl t of the Central Georgia Company has been oper- ed the remaining officers of the company, who are: W. J. Massee, president; Mr. O. A. Farrar, assistant resident, and Mr. L. H. Marr tte, genera super-

LIGHTNING ARRESTER INSTALLATION OF PITTSBURGH RAILWAY SYSTEM.

By Terrell Croft

NEAR the western portal of the Mount Washington street railway tunnel the Pittsburgh (Pa.) Railways Company has erected a substation. Because of its location it is known as the Tunnel Station, and three syn-

Fig. 1—Tunnel Substation, Showing the Location of the Lightning Arresters.

chronous motor-generators, having an aggregate rating of 3500 kw, are housed within the structure. These receive three-phase current at 11,000 volts, 60 cycles, and convert it into 600-volt direct current, which is distributed to railway circuits. Two sets of transformers are located in one end of the station, which raise the incoming pressure from 11,000 volts to 15,000 volts for a transmission line. In Fig. 8 is given a diagram of the essential connections and apparatus in the substation.

Electrolytic lightning arresters protect the high-tension incoming and outgoing transmission lines and carborundum block arresters protect the 600-volt railway feeders. All of the arresters are located on the roof of the substation, as shown in Fig. 1. It is with these lightning arresters, their arrangement, accessories, installation and operation, that this article will mainly deal.

Two 11,000-volt, three-phase, ungrounded-neutral, 60-cycle transmission lines enter the substation and each is protected with a Westinghouse type A electrolytic arrester. These two arresters are designated in the illustrations ac-

Fig. 2—Structural Steel Supports for Outgoing Trolley Feeders.

companying this article by the letters *C* and *D*. The 11,000-volt wires are brought to the station on a wooden pole line (Fig. 1) and are terminated on a structural steel frame on the roof of the station, which is shown in Figs. 3

and 4. Choke coils are inserted in the line wires just outside of the station, as shown in Figs. 3 and 4. The termination structure is conveniently located, between the arresters and the choke coils, so that taps from the line wires can be readily carried to each. The line wire taps

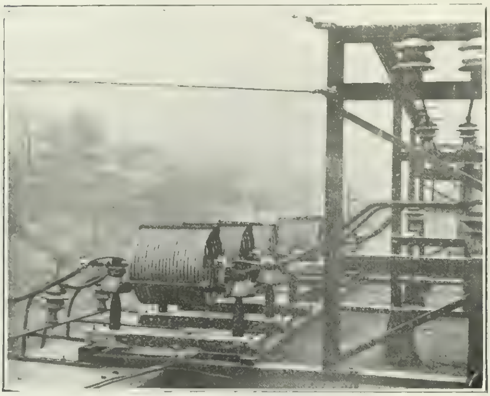


Fig. 3—Structural Steel-Line Wire Supports and Choke Coil Mountings.

from the choke coils are connected to the latter through lugs and, as an auxiliary connection, jumper wires are clamped around the choke coil terminal castings with improvised clips. These clips are pieces sawed from the clamps of high-tension termination insulators. The clips and the method of their application are illustrated in Fig. 3.

In Fig. 5 is given a connection diagram for each of the 11,000-volt arresters. Because of space consideration it was the desire of the operating company that all electrolytic arresters for the station be installed out of doors. However, the horn-gaps on the arresters described were given the standard indoor spacing for 11,000 volts, ⅜ in., and no trouble has been experienced due to their being short-circuited by rain or snow. The arresters have been in service for over a year.

Electrolytic arrester groups, designated as *A* and *B* in

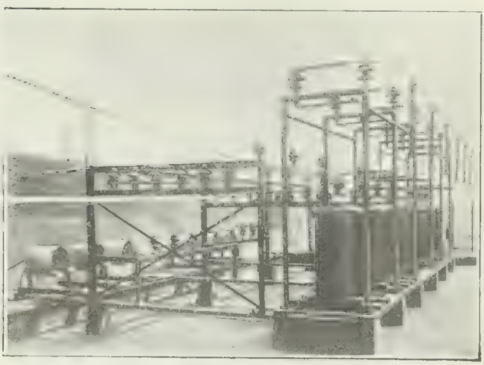


Fig. 4—Electrolytic Arrester and Choke Coils Before Any Connections Were Made.

the illustrations, protect a 15,000-volt ungrounded-neutral line. At present the two groups of outgoing wires from the arresters are both connected to the 15,000-volt line, just outside of the station, as shown in Fig. 8. Fig. 6 shows the connections of each of the 15,000-volt electrolytic arresters *A* and *B* and their choke coils. In Fig. 9 [illegible] tional details of the supporting structure are show[illegible] horn-gaps of the 15,000-volt arresters are given [illegible] equal to the diameter of a 5-cent piece, or a tr[illegible] 13/16 in.

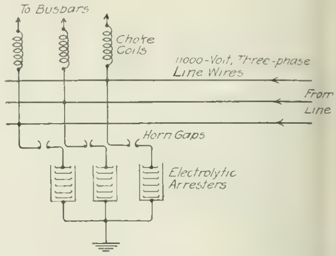


Fig. 5—Connection Diagram for Electrolytic Lightning Groups C and D.

Each wire of the two branches of the outgoin[illegible] volt line is terminated on a disk-type strain insul[illegible] ported on a structural steel bent, as shown in F[illegible] tap from each line wire is carried up to each

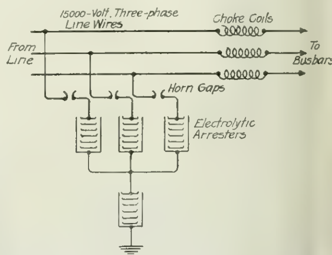


Fig. 6—Diagram of Connection of 15,000-Volt Electrol[illegible] ning Arresters A and B.

terminal and another tap from each line wire carri[illegible] down to the choke coils which are inserted in each [illegible] the six wires just outside of the entrances.

One of the most interesting features of this installati[illegible]

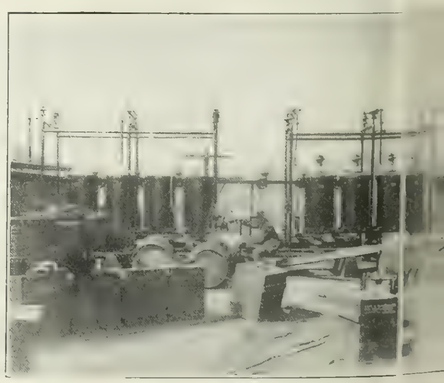


Fig. 7—Arrester Group in Course of Erection, Show[illegible] Rotar[illegible] Hand Oil Pump.

is the construction that was adopted for supportir[illegible] the elec[illegible] trolytic arrester tanks, the choke coils and the [illegible] trans[illegible] mission insulators. Practically all of the suppor[illegible] struc[illegible] ture is of either concrete or structural steel. Concret[illegible] piers, which are bonded to the concrete roof of [illegible] station

are used to support the structural steel members forming the frames.

The arrester supporting frames were assembled during the winter months. The steel sections were cut to length, drilled and bolted together on the roof. Although the sup-

rester tanks with a rotary, hand oil pump. This pump was found to be a very satisfactory appliance for its purpose. It is shown in Fig. 7 standing in an oil cylinder.

Each night at about 1 a. m. all of the arresters are charged—that is, their horn-gaps are closed for an instant

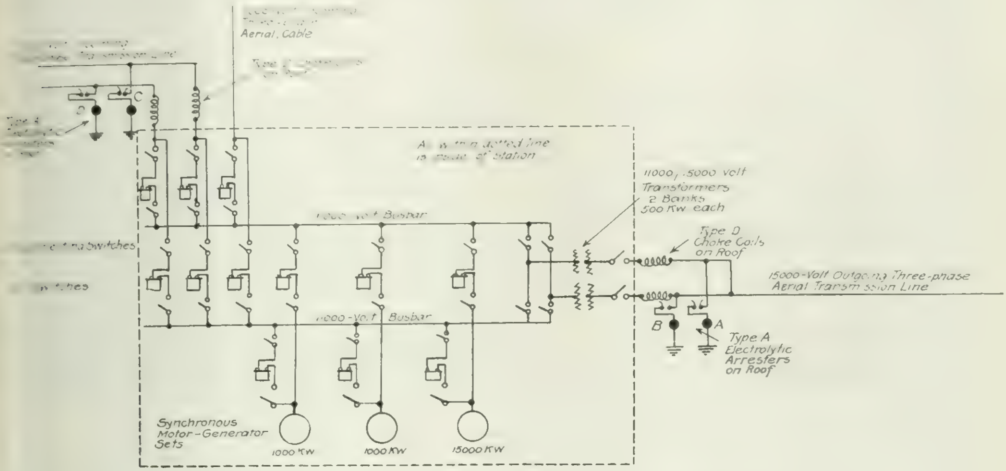


Fig. 8—Diagram of Alternating-Current Lines in Tunnel Substation.

-ting structure was erected during the winter of 1910, the arresters were not placed in service nor filled with electrolyte until the following spring. Fig. 7 is from a photograph taken while arresters *A* and *B* were being erected. The electrolyte for the arresters was received in carboys, and in filling the arrester trays a couple of quarts of electrolyte were poured from a carboy into a glass vessel and from this a quantity was dipped with a small aluminum measuring cup and poured into each tray. The tray structures of the arresters are divided into sections. Three are shown in Fig. 7. A man can readily handle a section full of electrolyte and place the section within the tank. After

to reform the films of aluminum hydroxide on the arrester trays, upon which the arrester depends for its successful operation. The station operator goes to the roof so that he can note the appearance of the arc that forms between the horn-gaps. From this he can judge of the condition of the arrester.

During normal service discharges are frequently shunted to ground by the electrolytic arresters. Most of the disturbances arising are due to slight surges caused by switching, but some severe lightning discharges have been handled with perfect satisfaction and without interruption to service. The arresters are inspected frequently and an elaborate

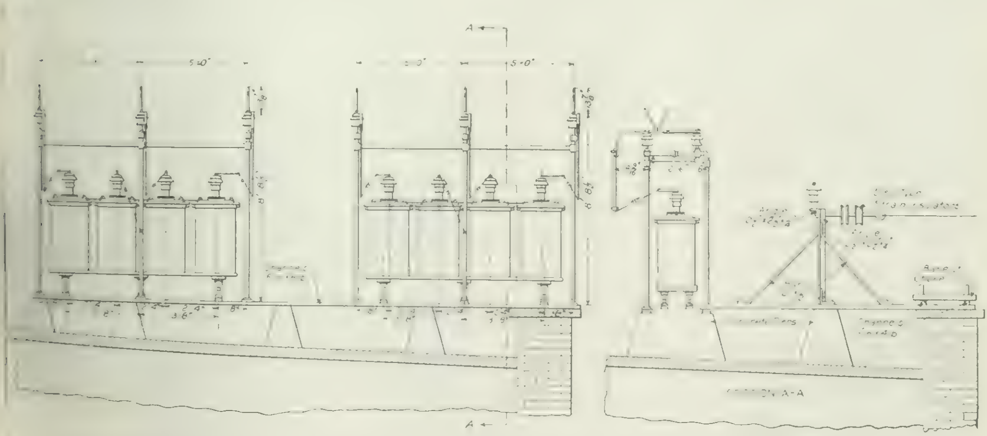


Fig. 9—Diagrammatic Drawing Showing Steel and Constructional Details of Frame for Arrester Groups A and B.

a tray section, filled with electrolyte, had been placed in its position in a tank the remaining volume was filled with a special oil.

The insulating oil was received in the steel cylinders shown in Fig. 7 and was pumped therefrom into the ar-

inspection will be made yearly. The annual inspection will involve removing the tray structures from the tanks and a minute inspection of the trays, tanks and supporting structure. New electrolyte and oil will be supplied if it is found necessary.

For the protection of the outgoing 600-volt trolley feeders twelve Westinghouse type MP arresters are used. They are installed, as shown in Fig. 10, on the side wall of the station, just over the points where the feeders enter the building. They can be easily inspected from the roof and, although they are weatherproof and do not really need protection from the elements, the eaves keep snow and ice

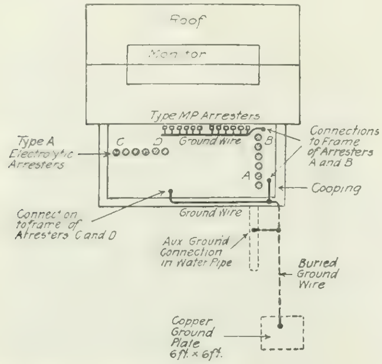


Fig. 10—Diagram Showing Details of Connections of 600-Volt Arrester.

from forming on them. The ground wire from the arresters is carried along the wall just above them. These arresters are of a very simple construction, but have protected the trolley feeders perfectly. No choke coils are inserted in the trolley feeders.

There are two ground connections for the lightning arresters and they are located as indicated in Fig. 10. One connection is a copper plate 1/32 in. thick and 6 ft. square, buried at a depth of about 5 ft. in the bed of a creek where the earth about it is always moist. The other and auxiliary connection is made by attaching a branch ground wire to a 2-in. galvanized-iron water pipe that supplies the station. The attachment was effected by serving the No. 0000 copper ground wire around the pipe, as shown in Fig. 11, for a distance of about 12 in. and soldering it thereto. Both the pipe and the wire were thoroughly "tinned" before the serving was made.

The main ground wire consists of two strands of No. 0000 copper trolley wire and the auxiliary ground wires each consist of one strand of the same size. The main ground wire is connected to the *C* and *D* arrester supporting frames, as shown in Fig. 3, by steel bolts which pass through lugs soldered on the ends of the wires. The ground wire is then carried along the coping, as shown in Fig. 10, makes connection with the supporting frame of arresters *A* and *B* (providing a ground for them), and

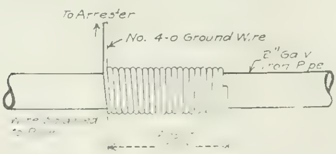


Fig. 11—Method Followed in Attaching Ground Wire to Water Pipe.

passes down the side of the station to the buried ground connections.

The entire Tunnel Station installation was engineered by the operating department of the Pittsburgh Railways Company. Mr. P. N. Jones is general superintendent, Mr. J. W. Welch is electrical engineer and Mr. H. A. Pharo is superintendent of overhead lines.

AN INDUSTRIAL INTERNATIONAL TRANSMISSIO SYSTEM.

An industrial high-tension transmission line has jus been built to connect the generating station at th Copper Queen Smelter at Douglas, Ariz., with a sub station at Tigre Mine Inn at Sonora, Mexico. The line which is 65 miles long, crosses the international borde

Fig. 1—Douglas Substation.

between the United States and Mexico and its completi and successful operation is particularly interesting in vie of the fact that much of the work was done during t violent disturbances incident to the recent insurrection Mexico. The construction work was in progress duri the battles which took place opposite Douglas and alo the Nacazari Railroad, which the line follows as far Ysobel. The construction gangs were repeatedly driv back from their work by the insurrectos and considera damage was done to the completed portions of the tra mission circuits and the telephone line. Notwithstandi these obstacles energy has been transmitted from the sm ter of the Copper Queen Consolidated Mining Company, Douglas, to the Tigre mine since June.

The system consists of a single wood-pole line carryi three conductors of No. 4 copper arranged on 6-ft. ce ters in an equilateral triangle, one conductor on the top the poles and one on each end of the cross-arm. The c

Fig. 2—Entrance Into Tigre Substation.

cuit is three-phase, 60-cycle, and the tension 44,000 vo The poles, which are 35 ft. long and not less than 7 in diameter at the top, are spaced 200 ft. apart on the re lar sections of the line with corresponding heavier c struction and closer spacing to meet special conditions n certain localities. The poles were burnettized or zi treated throughout and have creosoted butts. The regu

les are set with butts 5.5 ft. in the ground. The lower oss-arms employed are of standard construction, 4¾ in. x 5¾ in. x 6 ft. 10 in. long, bored vertically for ¾-in. pin lts 5 in. from each end and horizontally with a ¾-in.

Fig. 3—Transmission Line.

in the center. The small top cross-arms, shown in are 4¾ in. x 5¾ in. x 12 in. long, bored vertically -in. bolt in the center of the arm and horizontally -in. hole for a U-bolt which clasps the pole top. uble cross-arms are used on all turns.

The insulators are of porcelain 13¼ in. high with cast-n thimbles cemented in. Each insulator was subjected a dry test of 150,000 volts, a rain test of 110,000 volts a steam test of 100,000 volts. The leakage distance of sulator is 37.5 in. and the arcing distance 9.5 in. insulator pins are of the all-metal separable-thimble of the Lee type. The insulators were made by the e Insulator Manufacturing Company, Victor, N. Y. telephone line comprises standard Western Electric in-nts with reducing transformers and drainage coils, res of the circuit being carried on the cross-arm 7 ft. the transmission wires. The telephone wires are posed between each four poles.

The plant of the Copper Queen smelter is modern in the, the generators being driven by two General Electric ontal, low-pressure turbines rated at 750 kw each.

Fig. 4—1650-ft. Span at Barispe Crossing.

From the switchboard a three-phase circuit of 2300 volts ds through an underground system to a substation 700 f distant containing four 400-kva, oil-insulated, self-cooled transformers which step up the potential to 44,000 volts. The transformers, switchboard and lightning-arrester equipment are of General Electric manufacture. At Tigre Mine Inn the substation is equipped with four 400-kva transformers of similar characteristics, and the switchboard and lightning arrester equipment corresponds to that installed at Douglas. The line and stations were designed and constructed by Messrs. Sanderson & Porter, of New York and San Francisco, Mr. H. Hartwell being the resident engineer.

THE ELECTRIFICATION OF A GOLD REDUCTION MILL.

THE extension of electric power service into the gold-mining industry of Colorado is one of the most important developments of the State. A wide movement toward more scientific mine management is well under way in Colorado, and in the direction of improved economy of operation electric power applications are largely displacing less efficient methods of machinery driving. One of the most highly developed systems operating in the mining districts is that of the Central Colorado Power Company. The work of displacing older forms of motive power by this organization proceeds along the lines of a thorough engineering investigation and report upon all important propositions, comparing the cost of electrical operation with the expense of maintaining the existing service and pointing out the benefits to be gained by motor driving as contrasted with the handicaps of mechanical operation. In the following paragraphs are given the essential features of a typical report which led to the adoption of the electric drive in a gold reduction mill, the former installation being a combination steam and water-power outfit.

The test covered by the report was made with the object of determining what saving, if any, could be effected in the operation of the mill by using the electric company's service to carry the entire mill load for six months of each year and to carry the mill load in excess of the capacity of the existing waterwheel equipment for the rest of the year. The test showed that the electric drive would effect a saving of about $2,000 per annum, which was over 30 per cent of the existing cost of energy.

The mill equipment consisted of the following machinery:

A. Coarse Crushing and Sampling Plant.—1-9-in. x 15-in. Blake crusher; two Vezin samplers, 36 in. x 24 in.; two 10-in. x 6-in. belt and bucket elevators, 60 ft. long, 53 ft. 7 in. center to center; two Mitchell sample crushers; one sample grinder.

B. Fine Crushing Department.—Twenty 800-850-lb. gravity stamps, 7-in. drop, eighty-eight drops per minute.

C. Concentrating and Regrinding Department.—Seven concentrating tables; one vanner; three tailing pumps; one mill water pump; 1-5 in. diameter Colorado Iron Works grinding pan; one agitator, not operated during test.

D. Miscellaneous.—One 3-kw, 1150-r.p.m., 115-volt Fairbanks-Morse lighting dynamo; one 4-kw, 6-volt, 1300-r.p.m. dynamo, for energizing mercury traps and agitator; one 17-kw, 700-r.p.m., 125-volt dynamo, not operated.

The mill operates twenty-four hours daily, treating from 60 tons to 75 tons of auriferous sulphide custom ores. The stamp batteries, concentrating and regrinding machines are operated continuously; the coarse crushing and sampling plant is usually operated on the day shift only, but when necessary another shift is added.

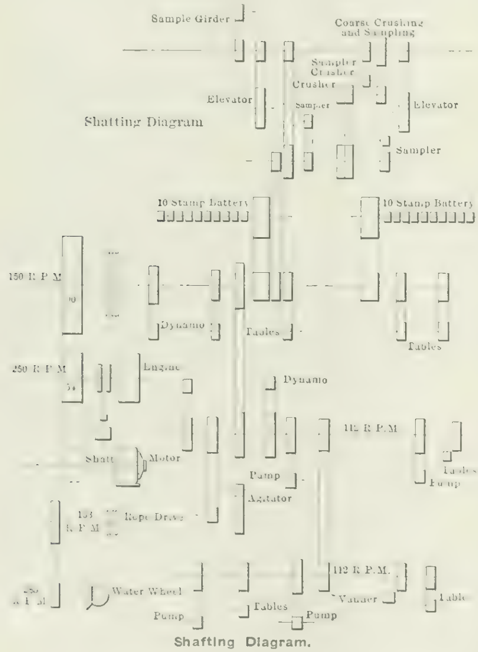
The coal used was lignite lump, from northern Colorado, costing $4.25 per ton in the bin. The boiler-feed water was decanted from the mill-supply water drawn from a nearby creek, the charge for water being $5 per month for all used.

The power-plant equipment consisted of one 12-in. x

14-in. Frost high-speed, automatic engine; one 100-hp, 66-in. x 20-ft. horizontal return tubular boiler; one boiler-feed pump and injector, and one closed feed-water heater.

In the summer months one of two No. 23 Samson turbines operating at 283 r.p.m. under a head of 16 ft. is rented from an adjoining concentration establishment, and from the test a minimum of 33 hp was found to be available for driving the gold mill. The concentrating works have prior water rights and at times, when operating, require water in such quantity that the gold-mill turbine must run under greatly reduced gate opening.

The test was run for one week, excluding Sunday, a record of apparatus in operation being kept continuously during the period. The horse-power demand for operating the mill under various conditions was ascertained by indicating the engine cylinder every half-hour, and more frequently under wide changes in load. Representative averages of horse-power demand were obtained for almost all conditions of operation. These averages, when combined with the recorded time of operation of the mill equipment, furnished a convenient method for obtaining the energy in indicated hp-hours for the entire week. Records of the weight of coal burned, checked and weighed back every



Shafting Diagram.

eight hours and of the feed water pumped into the boiler provided a convenient check on the hp-hours consumed. Boiler pressure was recorded every fifteen minutes and temperatures of the feed water before and after passing the heater were recorded at intervals of from sixty to thirty minutes. On two days of the test the water turbine was operated intermittently at full-gate and quarter-gate openings, supplementing the power of the engine. The records of the maximum power supplied by the turbine at full-gate opening were obtained by subtracting the indicated horse-power of the engine from the average horse-power required for operating the mill under the particular condition existing at the time the card was taken. Similar treatment was accorded the records when the turbine was operating under one-quarter gate opening. All steam outlets from the boiler other than the pipes leading to the engine, boiler-feed pump and injector were valved off, the valves being approximately tight and the pipes on the side being cold. The exhaust from the boiler-feed pu and the overflow from the injector were piped to the fe water suction so that practically all steam made was us by the engine.

The test showed that on the first four days of operati an average of 9010 lb. of coal was consumed per d The coal per ihp-hour was 7.8 lb.; steam per ihp-ho 47.5 lb.; average load, 48.2 hp; maximum load, 58.5 l evaporation, 6.11 lb. per pound of coal; feed-water te peratures entering heater, 50 deg. Fahr.; leaving heat 176 deg. Fahr.; boiler pressure, 84.5 lb. average. I banking fires on Sunday 300 lb. of coal was required.

SUMMARY OF RESULTS OF TEST.

April 26-May 2, inclusive, 1911. Altitude about 8,000 feet

Average load on plant in indicated horse-power	
Maximum demand observed during test, indicated horse-power	
Load factor, excluding Sundays, per cent	
Load factor, including Sundays, per cent	
Energy consumption in six days' run, indicated hp-hours	6,8
Energy consumption per month on above rate, indicated hp-hours	29
Mechanical efficiency of engine, assumed, per cent	
Equivalent input to electric motor of 50-hp rating, monthly kw-hours	20,8
Maximum horse-power demand on electric motor, horse-power	
Average coal consumption per indicated hp-hour, pounds	
Average steam consumption per indicated hp-hour, pounds	

the two days in which the waterwheel was operated v the engine the average load varied from 41.1 hp to 50.7 The total hp-hours required for the week's run were 6 or a daily average of 1139, and the average load for week was 47.5 hp. The total indicated hp-hours requ for a run of one month of twenty-six days were 29, The total coal consumption required per month was 1 tons, including 1.5 tons required for banking fires raising steam on Mondays.

The maximum power required by the coarse-crusl

ESTIMATED MONTHLY COST OF POWER.

ENTIRE MILL LOAD CARRIED BY	
(A) *Steam Engine*	
Coal, 116.5 tons at $4.25	
Labor, one extra fireman at $3	
Oil, waste, supplies	
Repairs, power plant	
Total	
(B) *Electric Motor*	
Fixed charge on 55 hp	
Energy charge, 20,880 kw-hours	
Total	
(C) *Steam Engine and Waterwheel.*	
Coal, 60 tons at $4.25	
Labor, one extra fireman	
Oil, waste and supplies	
Repairs	
Rent of waterwheel	
Total	
(D) *Electric Motor and Waterwheel*	
Fixed charge for motor amperes (25 hp)	
Energy charge, 8,000 kw-hours	
Rent of waterwheel	
One extra man	
Repairs	
Total	
Summary of Annual Saving:	
During six months of low water (A) and (B)	
During six months of high water (C) and (D)	
Total annual saving	
Present cost of power, six months (A), six months (C)	
Saving over present cost	33 1-3 p

and sampling department was 8.6 hp, the average ing 6 ihp. As the rock was fed to the crusher intermit itly the peak occurred when feeding hard rock and whe the elevator buckets were loaded. Of the four centri gal pumps there were three used for pumping tailings th igh lifts of 4 ft., 5 ft. and 12 ft., comparatively little wer being needed. The fourth pump was used for water rvice, the head being 30 ft., diameter of discharge 3 in. and the power required 4.5 hp. The estimated power fc the grinding pan when operating at a little below full ing

was about 5 hp. The detailed tests showed that the addition of each ore stamp required about 1.2 hp more from the engine.

The company pointed out that in addition to the direct saving the proposed change offered many advantages, particularly from the fact that concentration is an important factor in the reduction mill's operation. The assured steadiness of speed and consequent perfection of the regulation offered by the electric-driven plant were of great importance. The power company's service also afforded all the usual features of cleanliness and convenience and the elimination of power-plant and labor supervision from the manager's duties. The installation ... freed from dependence upon a coal supply which ... be interrupted by strikes. Another point brought out was that if the supply of water in the flume for any reason was diminished to such an extent that there was water enough for only one turbine, the electrical installation is on the spot ready to furnish the full quota of power. It was installed without any material change in the transmission, as is apparent from the accompanying drawing ... mill installation. The saving in labor of one man ... shift per month, mentioned under case (B), was made ... by the fact that the electrical installation requires ... no attention and during the day shift can be under supervision of the foreman of repairs. The removal ... boiler plant also offered space for the installation of ... le equipment. In view of the above results and ... ges the owner of the mill installed the electric drive ... replaced steam.

REGENERATIVE CONTROL FROM A COMMERCIAL VIEWPOINT.

By J. Gustaf V. Lang.

In earlier articles it was shown from the results of a number of tests that a saving in energy consumption of 25 per cent can be looked upon as a fair average to be gained by substituting double or single series-parallel regenerative control in place of the standard method. The question now arises whether the saving in energy, together with other advantages obtained by the substitution, really has a commercial value; in other words, whether the cost of the regenerative equipment is not so much greater than the interest and depreciation on the additional cost, together with possible increase in maintenance due to complications of the equipment, as to absorb more than the monetary value of the energy saving and of the other advantages.

As regards the motors, the additional cost of a double series-parallel regenerative equipment over that of a standard of the rating used at Norwich was found to be mainly due to the double armature winding and commutator and to some extent to the finely subdivided winding of the field coils. The controllers of the regenerative equipment naturally needed a number of extra fingers, since four armature circuits had to be controlled independently, and the shunt-field current and its control had to be taken care of. Moreover, the fact that the series field current of each motor had to be varied independently necessitated a couple of extra contacts. It is to be noted, however, that, the current being split up and divided over four armature circuits, each contact was of smaller size. The number of wires on the car was increased for the same reason, but their size was somewhat reduced. The field-changing switch (field-changer) and the shunt resistors were additions in their entirety. In consequence the cost of erection was increased.

The actual figures as determined by a concern in high standing in the electrical field from complete drawings of the equipment were based on the assumption of the regenerative equipments being manufactured in similar quantities with the standard. Changed into round figures of American money they were as follows:

ADDITIONAL COST OF DOUBLE SERIES-PARALLEL REGENERATIVE EQUIPMENT OVER STANDARD EQUIPMENT.

Two motors	[illegible]
Two controllers	72.00
One field-changer	75.00
Shunt resistors	13.00
Car wiring	[illegible]
Erection	20.00
Total	$435.00
One-fourth for freight and installation charges	109.00
Royalty and development	75.00
Total	[illegible]

If the regenerative equipment were of the single series-parallel type the motor complications would be reduced to that of the field coils. The controller complications would be reduced by half and the car wiring would also be considerably simplified. After due but conservative consideration of the reduction in complication the figures would then be modified approximately as follows:

ADDITIONAL COST OF SINGLE SERIES-PARALLEL REGENERATIVE EQUIPMENT OVER STANDARD EQUIPMENT.

Two motors	$50.00
Two controllers	[illegible]
Field-changer	75.00
Shunt resistors	13.00
Car wiring	[illegible]
Erection	20.00
Total	[illegible]
One-fourth for freight and installation charges	66.00
Royalty and development	75.00
Total	$405.00

Figures were also obtained for the estimated cost of exchanging an existing standard equipment for a regenerative double series-parallel equipment. In this case the dismantling of the old equipment has to be considered. Some of the existing resistors may be retained. The old standard equipment is estimated to have a scrap value of $125.

COST OF REPLACING OLD STANDARD EQUIPMENT WITH DOUBLE SERIES-PARALLEL REGENERATIVE EQUIPMENT.

Two motors	$800.00
Two controllers	200.00
One field-changer	75.00
Car wiring	105.00
Shunt resistors	[illegible]
Labor and dismantling and erection	75.00
	$1,268.00
One-fourth for freight and installation charges	317.00
Royalty and development	75.00
Total	$1,660.00

For a single series-parallel regenerative equipment the figures would be modified as follows for the same reason as given above for the modification of additional cost:

COST OF REPLACING OLD STANDARD EQUIPMENT WITH SINGLE SERIES-PARALLEL REGENERATIVE EQUIPMENT.

Two motors	[illegible]
Two controllers	[illegible]
One field-changer	[illegible]
Car wiring	[illegible]
Shunt resistors	[illegible]
Dismantling and erection	[illegible]
	[illegible]
One-fourth for freight and installation charges	274.00
Royalty and development	75.00
Total	$1,446.00

Subtracting the scrap value, there is for the double series-parallel regenerative equipment a net cost of exchange of $1,535 and for the single series-parallel regenerative equipment a net cost of $1,321.

It is impossible to say offhand how these figures would have to be modified by the adoption of a battery or motor-generator as the source for the excitation which gives to the motors the necessary shunt characteristic. Mr. Lundell advocates this in his letter to the *Electrical World*, published in the issue of Feb. 9, 1911. It is clear that motor complications can then be done away with entirely, as the subdivision of the field coils is no longer necessary. Mr. Lundell proposed the use of compensated motors with distributed field windings, and by means of this complication the motors are put on a plane even above the interpole motors and the size and cost are reduced on account of the improved ventilation and commutation. The change of excitation method also makes the field-changer superfluous, or if this device is retained it becomes simplified to a switch connecting the sources to the field coils when regeneration is desired. In place of the complications which have been dispensed with comes the battery or motor-generator. It is likely, therefore, that the figures given would not be changed enough to have any appreciable influence on the deduction which will be made with the above figures as the basis.

The next question to be investigated is that of the relative cost of repairs and maintenance of the standard equipment and the regenerative equipment of the double series-parallel and single series-parallel type. For this comparison the different cost items of the standard equipments at Norwich have been used as a basis.

Because of the regenerative action the mechanical brakes are required only for the final stop. In the previous article it was estimated that as far as kinetic energy was concerned the regenerative braking would take care of 99.5 per cent with a double series-parallel equipment and 93.7 per cent with a single series-parallel equipment. Since the potential energy is mainly absorbed at a speed above 3 ft. per second only a negligible part would fall on the mechanical brakes. As far as the wear of the brake-shoes depends on actual braking work it is evident that in case of a regenerative equipment even of the single series-parallel type it would be less than 10 per cent at any rate. There is no doubt, however, that a great deal of brake-shoe wear is due to poor adjustment. Since adjustments are less frequent for a regenerative equipment the wear on that account should be very much reduced. To figure very conservatively, the brake-shoe renewals of the regenerative equipment will be assumed to be one-fifth those of a standard equipment.

The same reasoning applies to the wheel rims, since naturally the wear on the rims will be reduced as well as the wear on the brake-shoes. Moreover, the regenerative braking is automatically non-skidding, and consequently the chances for flat places on the wheels are reduced very considerably—practically eliminated.

The gear wheels and pinions really belong to the motor equipment. It seems reasonable to expect that the additional duty on these parts due to the regenerative braking action will shorten their life in a proportion even somewhat greater than that which the regeneration bears to the input with the standard equipment. However, the increased renewal cost is amply offset by the saving in renewals to the wheel tires, and it is thought to be very conservative to assume that the latter does not more than balance the former, when in all probability it leaves a certain amount to the credit of the regenerative equipment.

The cost of motor repairs at Norwich was divided under the two general headings of mechanical and electrical repairs. In view of what has already been said as regards the gear wheels and pinions, the mechanical repairs should not be any greater than with the standard motors. Because of the existence of two commutators, double the number of brushes and the increased number of field-circuit and armature leads it was considered that the electrical repairs on the regenerative motors would be greater than on the standard. After making due allowance for [illegible]e fact that owing to the double commutator each commutator deals with only half the current dealt with by [illegible]e single commutator of the standard motor, it was beli[illegible]d that the electrical renewals of the regenerative m[illegible]rs would be 50 per cent greater than with standard mo[illegible]s Most of the causes on which this increase is based di[illegible] pear when the motors are those of a single series-par[illegible] regenerative equipment. The increased number of l[illegible]d and the extra regenerative duty are the only remai[illegible] causes, and in consequence the 50 per cent increase ca[illegible] conservatively modified to 30 per cent for a single se[illegible] parallel equipment.

Experience has shown, it is claimed, that for a g[illegible] size of motor equipment the cost of renewals to contr[illegible] and car wiring varies in direct proportion to the nu[illegible] of fingers and segments in the respective controllers. [illegible] total number of fingers and segments in the two re[illegible] erative controllers and field-changer is about 150 per [illegible] greater than in the standard controllers at Norwich. [illegible] after taking into consideration the small currents ha[illegible] by these fingers in the regenerative controlling appa[illegible] and the limited movement of the field-changer, it wa[illegible] lieved that the item of controller and car-wiring ren[illegible] would be 75 per cent greater for the regenerative e[illegible] ment than for the standard. This statement also r[illegible] to the double series-parallel regenerative equipment [illegible] should consequently be modified when a single s[illegible] parallel equipment is considered, as both the n[illegible] of fingers and the wiring are simplified in this ty[illegible] equipment. To what extent the 75 per cent increa[illegible] renewal cost should be cut down is rather difficult t[illegible] termine; to be entirely on the safe side 75 per cen[illegible] be used for the comparison.

The average costs of renewals per car per year ([illegible] car-miles) of the standard equipment at Norwich we[illegible] follows:

Brakes	[illegible]
Motor, mechanical	[illegible]
Motor, electrical	[illegible]
Controller and wiring	[illegible]
Total	[illegible]

Using these figures as a basis and applying to the the percentages above mentioned, a fair idea of the m[illegible]ntenance cost of a single series-parallel regenerative [illegible]uipment is obtained.

Brakes, .20 x 41	[illegible]
Motors, mechanical	[illegible]
Motors, electrical, 1.3 x 26	[illegible]
Controller and wiring, 1.75 x 15	[illegible]
Total	[illegible]

Thus the total cost of maintenance and repairs [illegible] pares at $83 to $96. In other words, the regen[illegible] equipment has $13 per annum to its favor. Where [illegible] renewals are heavier than at Norwich the saving i[illegible] of the regenerative equipment would be still great[illegible]. It should be observed that the Norwich cars were [illegible] truck cars and not particularly heavy. The average [illegible]ule speed was very low, being from 5.5 miles to 6 m[illegible] per hour. An increase in schedule speed, and thus in maximum speed, would naturally tend to increase the w[illegible] the brake-shoes very materially on a standard c[illegible]. It must also be remembered that the routes at Norwic[illegible] were not very hilly—that is, the brakes were not calle[illegible] upon very frequently to check the descent on long an[illegible] steep

gr[illegible]es, which naturally would have a decided influence on th[illegible]rake renewals. All these considerations simply go to sh[illegible] that under conditions more favorable to regeneration a [illegible]ry substantial saving in cost of repairs and mainte-na[illegible]e will have to be credited to the regenerative equip-me[illegible] in spite of the complications.

[illegible]n the basis of the average saving in energy, of the ad[illegible]tional cost of equipment, or cost of substitution, and of th[illegible]omparative cost of maintenance and repairs it is feasi-bl[illegible]o obtain an adequate idea of the commercial value of re[illegible]nerative control by applying the figures arrived at to av[illegible]age cases of energy consumptions and at different costs [illegible]

ELECTRICAL DEVELOPMENT IN CHINA.

By L. R. Freeman.

[illegible]LTHOUGH the rich coastal provinces of China have [illegible] no sites for hydroelectric plants of sufficient size to [illegible] prove important factors in the development of the co[illegible]try, the natural conditions for such water-power de-ve[illegible]pment are practically ideal in the great interior prov-in[illegible] where mighty rivers undergo great changes in level on [illegible]eir courses from the Tibetan plateaus to the sea. None [illegible] f [illegible]e principal cities, however, is within economical trans-[illegible] [illegible]istance of a point where electrical energy could [illegible] rated in large amounts. Canton, Tientsin, Hankow, N[illegible]king, Soochow and Shanghai are all located in the midst of [illegible]at river-valley or delta country, with no mountains of [illegible] t height near at hand to give birth to swift-flowing [illegible] such as might be utilized for electrical develop-[illegible] Peking is within 20 miles of a fairly high range of [illegible]untains, but the precipitation in that part of China is in[illegible]fficient to keep large streams running the year round. F[illegible]how, with a half million or more people in its imme-di[illegible] vicinity, lies in a mountainous and well-watered coun-tr[illegible]and, though there are no data available on the subject, [illegible] [illegible]ry probable that practicable sites of great value [illegible] [illegible] the River Min or some of its swift tributaries w[illegible]in easy transmitting distance of this rich and populous [illegible]

[illegible] lotes told of the Governor of Chekiang at a recent [illegible]onal dinner at Hangchow show the interest which [illegible] of even one of the so-called anti-foreign prov-

Fig. 1—Head of Gorges on the Yangtse-Kiang River, Containing Numerous Power Sites.

ind[illegible] take in matters relating to material progress, and this att[illegible]de is indicative of what that of the officials of the gre[illegible] interior provinces, where the natural conditions for hy[illegible]oelectric development are near the ideal, will be when the [illegible]alue of such development is brought home to them.

[illegible]early all of China's great rivers take their rise in the snows of the Tibetan plateaus at elevations of over 20,000 ft., and the largest part of their 4-mile drops to sea level is made in the course of their journeys through the rich interior provinces of that extensive empire. This is notably true of the mighty Yangtse-Kiang, one of the five largest rivers in the world, which descends nearly 12,000 ft. in

Fig. 2—Power Site with 80-ft. Head, Province of Szechuan, China.

traversing the province of Szechuan alone. It is in this province, rich, populous but almost wholly undeveloped, that the greatest field for hydroelectric endeavor will probably be found.

This remarkable province, in spite of the fact that it is cut off from the lower valleys of the Yangtse by a high range of mountains through which precarious communication with the rest of the empire is maintained only by caravans on land and junks on the river, has a population that is estimated at from 50,000,000 to 60,000,000, and is generally credited with being more prosperous, as well as richer in natural resources, than any other state of the empire. The cities, while not of great size as in the coastal provinces, are numerous, and there is hardly one of them but is within easy transmitting distance of a great water-

Fig. 3—A Modern Plant Which Is Now in Operation in the South of China.

fall, cascade or rapid where a power plant could be built.

The gorges of the Yangtse itself, in which the great river cuts through the mountain range dividing upper and lower China, descending 500 ft. in a series of rapids rivaling any in the world for swiftness and grandeur, have been the subject of conjectures from the standpoint of water-

power possibilities for many years. The mean flow of water at Ichang, near the lower end of the gorges, is reckoned at 750,000 cu. ft. a second, and, though the average fall through the several hundred miles of chasms is not great, there are places where the drop for a short distance is very considerable.

A prohibitive factor in the way of developing power in the Yangtse gorges seems to be the tremendous rise and fall of the water not only between season and season, but, at times, between day and day. The difference between the winter low-water level, when the river's sources are locked hard and fast in Tibetan snows and ice, and summer high-water level, when the snow and ice are being thawed and the flow further augmented by warm rains, is sometimes over 100 ft., and a 20-ft. rise in a night is not unprecedented. The difficulty of devising a system of diversion to meet such conditions is obvious.

At Hankow last summer the writer discussed this subject with a German electrical engineer who, while admitting it to be almost hopeless to try to turn the power of the Yangtse gorges to practical advantage in the ordinary way, was sanguine of the success of a plan involving the use of huge barges, with water-wheels at the ends and sides, which

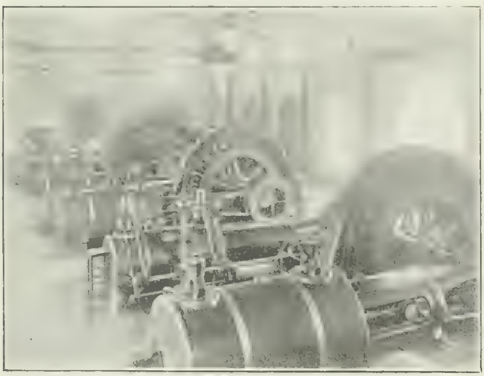


Fig. 4—Electrical Installation in Tongshan Colliery.

were to be anchored at favorable points in the swiftly flowing current. He was only in the "model" stage of his scheme at the time and since then nothing has been reported of his having experimented on a larger scale.

Yunnan, which, with the great province of Szechuan, forms the eastern portion of China, is to have the first hydroelectric plant to be erected in the Celestial Empire. The conditions there for power development are hardly as favorable as in Szechuan, nor is it by any means so rich and populous as its sister province, but the completion of the French railroad from Haiphong, on the coast of Tongking, to the capital, Yunnan-fu, furnished adequate transportation facilities for the requisite machinery and the enterprising city lost no time in taking advantage of the opportunity offered of securing a modern lighting plant. The success of this pioneer plant will assure the installation of similar ones at various points in the same province, while only the completion of the Hankow-Szechuan railroad or the inauguration of a safe and regular steamer service through the Yangtse gorges is necessary to set the ball of progress rolling in China's rich and prosperous northeast province.

The work on the hydroelectric plant at Yunnan-fu is now well under way, and through the courtesy of the Shanghai office of Carlowitz & Company, the German firm which has the contract for its construction, it is possible to furnish here the first details of this important project that have been given to the public.

Yunnan-fu is a city of about 70,000 inhabitants, and point of distance is farthest from Peking of all of t provincial capitals of the empire. Formerly a journey junk of from six to eight weeks up the Yangtse and overland trip of a month across Szechuan and Yunnan we required to reach it. The recent completion of the 535-m railway has brought the city within a day's journey of t coast of the French colony of Tongking. The followi is a translation of a letter written by Messrs. Carlow regarding this project,

"The electrical plant now in course of construction Yunnan-fu is a municipal undertaking and is erected f the purpose of lighting the numerous yamen, or pub buildings, besides the schools, police stations and the ma streets. It is the first project of its kind in China, b we hope, only the forerunner of many more which w doubtless be built when the people of this province learn t facility and cheapness with which power may be develop from their rivers and waterfalls.

"At a distance of about 15 miles from Yunnan-fu t water of one of the outlets of the Yunnan Lake on the Ts yu-tan plateau forms a suitable head in a very short d tance, from which a channel is being constructed for ge erating the necessary power. Where the outlet touches t Tsin-yu hill a feeding channel will run through the roc slope of the hill to the power station. The feeding chan will be built from quarried stone and hydraulic-cement m tar. Most of the stone material will be obtained in course of blasting for the channel and the power house

"The power plant consists of two waterwheel turbir each developing 300 hp at a speed of 375 r.p.m. These t bines, supplied by the German firm of J. M. Voith, Heid heim-on-the-Brenz, are arranged for direct coupling to t 275-kva, 10,000-volt, three-phase alternators. There are a two exciter sets to be direct-coupled to the generators, w all the necessary measuring and controlling instruments.

"The high-tension line from the power station to Y nan-fu will be fitted on timber masts and will end at great west gate of the city. The transformer house be erected here at the northwest corner of the wall, wh the incoming energy will be transformed from 10,000 v down to 3000 volts. The transformer house is provi with two switch boxes, from which the energy will supplied to the main distributing ring of lines in the in city. All distributing transformers are to be fitted wooden poles. Near the Viceregal Yamen a large tra former will be erected, and the whole line of high ten will be protected by a safety network.

"Three-phase energy will be distributed throughout 110-volt low-tension system, the low-tension side of transformers being protected by three-pole fuses incl in water-tight iron boxes."

Such is China's first hydroelectric plant-to-be. It small affair as far as size goes, but great in importanc being the forerunner of many more that must follo before many years have gone by.

For machinery for steam plants for electrical genera China may be characterized as one of the most rapidly veloping markets in the world. The conditions un which most of the municipal undertakings are prom however, are such that American and British manufac ers, with their insistence on cash-down transactions, ar a disadvantage for orders. The British commercial att at Peking writes as follows on this phase of the matter

"Almost all contracts require to be financed by the tractors, and British firms, finding British manufactur unwilling to supply plants except for cash, have somet es co-operated with German firms, the latter arranging he finance in return for being allowed to participate. ty-ment is generally spread over two or three years en proper security is given."

Contracts were let last year for new electric-lighting installations at Chungking, Chengtu, Changsha, Nanking nd

Ningpo, and for more or less important extensions at Shanghai, Hankow, Peking, Swatow, Mukden and several other places. Negotiations are now proceeding for a large plant at Hangchow and at several Manchurian cities. Indeed, there may be said to be an electric-lighting project in almost every city in China, the only difficulty being to find funds to carry them into execution. Among larger projects which are being seriously considered are electric-car lines for Canton and Peking. At present Shanghai and Tientsin are the only cities in the empire enjoying the advantage of such transportation, but they are not likely to enjoy this distinction long.

Central Station
Management, Policies and Commercial Methods

A 15-TON BOTTLE SIGN.

...ttle sign surmounts the new Emerson Tower Build... in Baltimore which weighs 15 tons, and it is made to ...lve by a 3-hp motor, so delicately is it adjusted. The ... cannot be seen at night, but the huge illuminated let... spelling "Bromo-Seltzer" may be seen in two counties ... far down the bay. The lettering is on the bottle in ... a manner as to make the word readable as the bottle ...lves. There are 314 lamps used in lighting the letters, ... letter being 10 ft. high and 5 ft. wide. The bottle is ...t. above the sidewalk, and it requires 35 seconds for ...ake a single revolution.

NIGHT VIEWS IN OKLAHOMA CITY.

... cities of the size of Oklahoma City have more progressive central-station companies than the Oklahoma Gas & Electric Company, which is controlled by H. M. Byllesby & Company. At night the streets and many of the ...gs are brilliantly illuminated, giving the city a met...n aspect and making it one of the most attractive ... Southwest. A booklet entitled "Night in Oklahoma ... which gives night views of many of the streets and ... shows convincingly that Oklahoma City is excep... well lighted. The pictures are well executed and ...graved in such a manner as to give a much more realistic view of general night lighting effects than is ordinarily the case with pictures of this character.

SAN DIEGO LIGHTING AND MOTOR RATES.

The San Diego (Cal.) Consolidated Gas & Electric Company on Sept. 1 adopted a new schedule, reducing its lighting rate from 10.8 cents to 9 cents net per kw-hour, or about 16 per cent, with corresponding reduction in motor rates varying from 11 per cent to 27 per cent. Prior to 19.. the lighting rate was 25 cents per kw-hour, at which time it was reduced to 20 cents. The present management, which assumed control April 1, 1905, has, with the present ...n, lowered the rates approximately 55 per cent ... a period of six years. The new rates in detail are ...:

...r lighting, first 100 kw-hours, per month, 10 cents; between 100 kw-hours and 200 kw-hours, 9 cents; between 200 kw-hours and 300 kw-hours, 8 cents; between 300 kw-hours and 400 kw-hours, 7 cents; between 400 kw-hours and 500 kw-hours, 6 cents; in excess of 500 kw-hours, 5 cents. There is a minimum charge of $1 per month per meter installed.

...r motors, first 100 kw-hours, per month, 8 cents; between 100 kw-hours and 200 kw-hours, 7 cents; between 200 kw-hours and 300 kw-hours, 6 cents; between 300 kw-hours and 400 kw-hours, 5 cents; between 400 kw-hours and 500 kw-hours, 4 cents; between 500 kw-hours and 1000 kw-hours, 3 cents; in excess of 1000 kw-hours, 2 cents. There is a minimum charge of $1 per month per horsepower connected.

Both schedules are subject to a cash discount of 10 per cent if paid within ten days from date of bill, thus reducing the basic lighting rate to 9 cents per kw-hour.

THE ELECTRIC VEHICLE IN BOSTON.

The campaign to further electric-vehicle business started last March by the Edison Electric Illuminating Company of Boston is bearing good fruit in frequent sales and abundant inquiries throughout all New England. This is true of both pleasure and commercial vehicles. As an example, the Chase Express Company, of Brookline, which has one 5-ton electric truck now in operation, is about to add another. Another instance is John F. Fleming, of Brookline, who is erecting a large garage to be used in connection with his present extensive establishment, and who will have in the new building facilities for charging electric cars, which are enjoying an increasing popularity in this residential suburb of Boston. Agents for electric vehicles report a growing interest among central-station people in the matter of charging cars, and the problem of how to do this most advantageously, economically and profitably is being studied and worked out by a large number of superintendents of plants.

LOUISVILLE STREET-LIGHTING CAMPAIGN.

An interesting method which was used by the Kentucky Electric Company, of Louisville, acting in conjunction with the Federal Sign System, has enabled it to make a beginning in street-lighting service, the municipal contract for which is held by the Louisville Lighting Company, the older central-station company of the Kentucky city.

The Kentucky company, of which R. E. Hughes is president, arranged to light two blocks in the congested district, Second to Fourth Street on Jefferson being the district chosen. The Federal company arranged for the erection of ornamental iron standards, surmounted by five opalescent globes. Four of these, each 10 in. in diameter, are pendent, containing each a 60-cp tungsten lamp, and the larger, 18 in. in diameter, contains a 100-cp tungsten.

The standards are placed at close intervals on both sides of the street for the two blocks referred to, and the cost of maintaining them is borne by the storekeepers affected. There was little difficulty, it was reported, in securing the co-operation of the merchants, and the Board of Public Works of Louisville also agreed to the erection of the standards without objection.

The newspapers gave a good deal of space to the lighting of the street, referring to it as "the great white way," and special editions, filled with copious advertising of the stores along the thoroughfare, as well as the lighting and sign

companies, were issued by several of them. It is stated that in all probability other sections of the city will be treated in this way.

A few years ago Louisville was not conspicuous as a brilliantly lighted city, but activity in developing electric signs, of which there are now many notable ones, as well as such work as that just described, has resulted in the business section being as well illuminated as any other city of 250,000 inhabitants in America.

MILWAUKEE CENTRAL-STATION STATISTICS.

At the recent Manufacturers' Exposition in Milwaukee the Milwaukee Electric Railway & Light Company displayed a large picture of the Commerce Street generating station, which is now undergoing extension and which will have an ultimate rating of 80,000 hp. The company also gave on placards some interesting information about the extent and growth of its business. The connected motor load consists of 21,822 hp, while the lighting load amounts to 521,740 16-cp lamp equivalents. For the year ended July 1, 1911, the increase in the number of power customers was 25 per cent, while the motor load on the buses increased no less than 68 per cent. During the year the company sold to its customers more than $40,000 worth of electric motors.

THE NEW YORK EDISON COMPANY NOW HAS NINETY-FIVE ELECTRICS.

Twenty-one new electric vehicles have recently been put into the service of the New York Edison Company, swelling the total number now in use to ninety-five. Six of the new electrics are for the use of the meter department. They have a capacity of 3000 lbs. apiece and are equipped inside with iron racks running along the sides for holding the meters. There is an alley way in the center, while the spaces for the meters are of different sizes in order to accommodate the various kinds of meters, each wagon carrying forty-two.

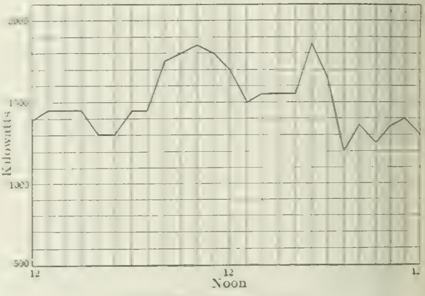
The idea was originated by the men of the meter department, and was suggested by the manner in which pies are carried in a bakery wagon. Each meter compartment is cushioned on the bottom and part way up the sides, as well as over the sill. A meter is placed in one of these compartments as soon as it is tested and taken directly to where it is going to be used. Too much handling and rehandling is apt to throw the delicate mechanism out of adjustment. These vehicles are Lansdens, Detroits and Walkers.

Ten 1000-lb. lamp delivery wagons are among the new cars, eight for Manhattan and two for the Borough of the Bronx. Five of these cars are the Baker and five are General Vehicle. Two others of the new wagons are the lightest the company possesses, having a capacity of 750 lb. each. One of these is used in the Bronx to take the foremen to the different jobs and for the delivery of light material. The other distributes advertising literature and flatirons. These were also made by the General Vehicle Company.

There is also a 4000-lb. wagon for the Third District distribution department, used to carry crews and material for all service jobs. This has a solid top with wire netting on the sides, giving light and air. The netting can be raised and lowered. This makes nineteen commercial vehicles added to the transportation department, while the other two are Baker runabouts used by heads of departments in going about on company business.

A CREDITABLE LOAD CHART.

The accompanying load chart of the Winona (Min Railway & Light Company for July 20, 1911, is of usual interest. It indicates a pretty close approach to central-station ideal and is a credit to Mr. Frank H. Pla until recently general manager of that company. maximum load on the busbars on that day was 1850 at 5 p. m. and the minimum was 1200 kw at 7 p. m. average load for the twenty-four hours was 1537 kw, load-factor reaching the astonishingly high figure of per cent. The total output for the day was 36,900 hours. This record is exceptional, even for Winona, for the entire month of July (744 hours) the load-fac on this station was 70 per cent, while for the first se months of 1911 (counting 212 days of twenty-four ho each) it was 52.5 per cent. The earnings for the mo



A Creditable Load Chart.

of July were a trifle over $1 per capita for the en population of the city.

Mr. Plaice is a great believer in motor load for cent station plants, and the results of his campaign justify expectations. The load-factor for the year 1910 was per cent, but, with the growth of motor load, it mounted up steadily, as shown by the figures given. may be added that the increase in total earnings, compa July, 1909, and July, 1911, was 100 per cent. As the c pany is controlled by the La Crosse Water Power C pany, it is able to make a low rate, undoubtedly, for trical energy obtained from water-power developn Furthermore, the company operates a street railway transmits energy to nearby communities, thus helping load-factor. However, with all these favorable condi taken into account the showing is an excellent one. earnings of $1.01 per capita for the month of July, 1 were divided as follows: Lighting and motor departn 83 cents; railway, 18 cents.

TESTING UNDERGROUND CABLES.

An interesting adaptation of apparatus is abou be introduced into the operation of the Edison Ele Illuminating Company of Boston. A problem was prese in the providing of facilities for the testing of under-ground cables, either after they had been first installe or after repairs to them had been made. The Edison Com-pany has twenty-seven or twenty-eight generator stations and substations, about two-thirds of which have under-ground conduits. Permanent testing outfits, one for each station, would have involved a large outlay. Consequently it was decided to provide a special testing set installed on electric vehicles.

The company has bought a special motor-generator set, with the necessary transformers, reactances, etc., constructed very light to reduce the weight to the minimum.

id so built as to be put on two vehicles, on which it will carried to any station where testing is required, and ere used for the test. The input to the motor-generator taken right off the busbars, and the voltage built up to e requisite test pressure.

The weight of this outfit is about 10 or 11 tons. It being heavy to go on one vehicle, it was decided to erect it two 5-ton General Vehicle Company's electric trucks, th battery equipment sufficient to make the run from the ntral point to any of the company's stations at a reasonle rate of speed in any sort of weather. The motornerator set is installed on one of the cars and the rest the apparatus on the other.

e apparatus consists of the following: Eight hundred-2200/30,000-volt transformer, 850-kva, 2200-volt reactce and 100-kw, four-bearing motor-generator set, consting of a 100-kw, 1200-2200-volt generator, a 100-hp, 0-2300/4000-volt motor, a 125-volt exciter mounted on en base and connected by a flexible coupling, together a starting compensator and two field rheostats. Other paratus consists of two motor-driven blower sets, two 00-220-volt transformers, twelve lifting jacks, canvas covs, ammeter, voltmeter, portable current and potential insformers, one 50-watt potential transformer and a artman & Braun frequency meter.

The truck will have a clear loading space 6 ft. wide, ft. long and 6 ft. high. Its weight without battery and ad will be 7500 lb., and the weight of the battery will be out 2400 lb., it being of the sixty-cell Edison type. The eel base will be 139 in., wheel gage 69 in., front tire in. x 7 in., rear 36 in. x 5½ in. twin. Its rated speed, ded, on a hard, level, asphalt road, will be 7 miles per ur, and the estimated mileage, one charge, on hard, level ad, 30 miles.

The outfit is intended to have sufficient capacity to test miles of underground cable consisting of 34-0 conductors, d-sheath cable, built for 15,000 volts working pressure.

ECTRIC POWER DEVELOPMENT AT DENVER.

An interesting phase of the electric power situation the West is the remarkable diversity of business handled progressive central stations. In comparatively few mmunities has general manufacturing attained a developnt comparable with the cities of the East, and outside e fields of mining and transportation motor applications ve of necessity been made throughout multiplied rather an highly centralized industries. This is notably the case the system of the Denver Gas & Electric Light Comny, whose service in the capital city of Colorado is pularized to the extent of a present connected load of er 20,000 hp in motors, or about 1 hp for every eleven habitants of the district covered by the company's lines. anufacturing on a large scale is chiefly related to the tallurgical industries of Denver, but on a smaller scale wer is required in a great variety of mercantile and oductive establishments.

Within the past ten years the connected motor load of e company has increased from a total of 1173 hp to over ghteen times that amount. The population of the city s increased about 60 per cent during the decade. In bruary, 1901, the company had no alternating-current otor service; in January, 1905, the direct-current motor rvice had increased to a connected load of 5447 hp, and e alternating-current connected motor load was only hp in three-phase motors, while on Jan. 1, 1911, the concted motor load was as follows:

Direct-current motors	12,599 hp
Three-phase motors	6,890 hp
Direct-current fan motors	298 hp
Alternating-current fan motors	550 hp
Total	20,337 hp

The local street railway system generates its own energy, and the above motor load is almost entirely the result of a vigorous policy of making the most of the business of the comparatively small consumers. A recent survey of the total demand of the city outside the electric-traction field disclosed that the company is now supplying about two-thirds of all the industrial power that is utilized in the city.

RATES.

An important factor in this development has been the schedule of rates applied to motor installations. A rate of 4 cents per kw-hour is charged, with a minimum of $1 per month gross per horse-power for motors in excess of 3 hp, smaller motors being billed at a minimum of $3 per month. All bills are subject to a 10 per cent discount for prompt payment. An alternative rate is a fixed charge of $9 per year per consumer, plus $24 fixed charges per year per horse-power connected, plus 3 cents per kw-hour for all energy used. One-twelfth of the foregoing fixed charge is payable with the monthly bill for energy consumed. A 10 per cent discount also applies to the second rate, which is made on the basis of a year's contract.

A minimum charge of $5 net per month is made for 30-amp rectifiers on lighting circuits operated under an off-peak schedule, a charge of $6.75 being made for rectifiers operated each month without regard to the peak load of the company. Motor service in the commercial district of the city is supplied at 220 volts direct current for motors of 2 hp and under. Above 2 hp service is supplied at 440 volts direct current, and in sections of the city removed from the immediate business center energy is supplied at 220 volts, three-phase. The frequency of the system is 60 cycles and energy is generated in three steam plants located in Denver, one of which is kept in reserve for emergency service only. The company purchases a large amount of energy from the Central Colorado Power Company's hydroelectric system, which distributes energy from generating stations located at Shoshone, which is 150 miles west of Denver, and at Boulder, which is 30 miles northwest.

A flat rate of $3 per month is made for use of 8-in to 16-in. desk or ceiling fans, with 10 per cent discount. The consumer installs the necessary wiring at his own expense, and in other applications the company prefers to leave the wiring and installation of equipment to local contractors. Fans are also rented at a rate of $1 per month plus $3 for energy, with the usual discount. The amount paid in rental applies on the purchase price of the fan if the consumer desires to buy it at the end of the season. The company sells fans at prices varying from $10 for the 8-in. size to $18.50 for a 16-in. outfit, an additional charge of $4.50 being made for an oscillating equipment. All single-phase motors and rectifiers operating on a lighting circuit are governed by an off-peak schedule which prohibits their use on a graduated scale of hours varying from 5 p. m. and 7:30 p. m. to 10 p. m., according to the season. The company requires auto starters to be installed on all single-phase motors of 5-hp rating and over and on all three-phase motors of 7.5-hp rating and above. All motor wiring is required to be inspected by the city electrician and the company before energy can be supplied to the installation. Since Jan. 1 last a cast-iron meter board costing about 25 cents must be installed with each motor group whose energy consumption is measured by watt-hour meters, from whose readings the bills are prepared. Only one set of outlets is allowed per building, whether the service be for lighting or power. In general, the direct-current service covers the district between Wynkoop and Twenty-first Streets, Broadway, West Colfax Avenue and the company's West power station.

REPRESENTATIVE POWER APPLICATIONS.

Special efforts are made to cultivate long-hour, off-peak and day loads, although the company's power service ex-

tends over all hours of the day and night. Electric energy is used exclusively in all the paint factories of the city, in all but one foundry, in all the brick plants which are situated on the company's distribution system, in all but one of the principal hotels, in all the stone-crushing plants in town, in refrigeration service, in the operation of contracting plants and erection of buildings, in the principal railroad shops, United States Mint, lumber, box and iron works. Among the recent important contracts obtained by the company are the Union Pacific Railroad shops, 1000 hp; Mint, 708.5 hp; Griffin Wheel Company, 500 hp, and Call Switch & Frog Company, 115 hp. A recent development is the planning of loft buildings for groups of small manufacturers located under a single roof. A six-story structure of this character will shortly be completed and each of four floors will be provided with special circuits capable of delivering about 100 hp to the tenants. One high-speed passenger and one freight elevator will also be installed. It is probable that the company will deal directly with tenants in structures of this kind, metering each consumer's load separately.

ELECTRICITY IN BUILDING CONSTRUCTION.

A valuable class of day motor-load business has of late come into much prominence in Denver in connection with the erection of new buildings. Contractors are rapidly doing away with inefficient and costly steam engines for building operations and handling their work by central-station service. At the new Episcopal Cathedral under construction in the Capitol Hill district the contractor's work was greatly facilitated by the service of a motor-driven stone-cutting plant, including a traveling crane operated by one 7.5-hp motor and one 3-hp motor, and a marble saw driven by a 15-hp, 220-volt, three-phase induction motor. The absence of a steam-driven plant was much appreciated by the residents of the district surrounding the structure and further advantages accrued to the contractor through the facility with which marble was cut and handled upon the ground, much time being saved through the use of electrically driven apparatus. A temporary transformer installation supplied energy to the motors from the regular distribution circuits of the company. A prominent contractor owns two concrete mixers operated by 15-hp and 10-hp motors of the single-phase, 220-volt type, a bucket conveyor for concrete, driven by a 7.5-hp direct-current motor, a circular rip saw driven by a 6-hp direct-current motor and a 3-hp hoist of the Chattanooga type. A prominent electric supply company has five brick hoists, each driven by a 7.5-hp single-phase motor, and these are in constant use at a rental of $1 per day apiece.

Electric energy is being used in the erection of the new post-office building, there being in operation a 20-hp sand screen and a 20-hp marble hoist, the motors being of the 550-volt direct-current type. In the erection of the new First National Bank Building a 30-hp concrete mixer and a 7.5-hp brick hoist were used. In the work on the new Foster Building a 25-hp air compressor, a 5-hp brick hoist and a 15-hp concrete mixer were operated. Three concrete mixers, each driven by a 10-hp, 220-volt, three-phase induction motor, were used on the new Tramway Building, with a circular rip saw and planer driven by a 5-hp motor, and the work on the new Daniels & Fisher Building and tower was facilitated by the use of a 25-hp air compressor, a 15-hp concrete mixer, a 5-hp rip saw and a 5-hp brick hoist. All the steel members of the framing of the new Chamber of Commerce Building were elevated by a 7.5-hp electric hoist, a 15-hp concrete mixer and a 3-hp brick hoist also being used on this work. As a rule the contractors leave the making of connections to the company. In the finishing trade seven hardwood floor planers of the motor-driven type are in operation. Each is driven by a 3-hp, 220-volt, single-phase motor and a watt-hour meter is placed on each machine. A meter reader is sent by the company each month to the place where any given machine is at work. The labor cost of floor finishing is cut about 60 per cent by these devices, which are portable, and which perform their work far more rapidly than is possible by hand and without the unpleasant noise of the hand planer.

MISCELLANEOUS POWER SERVICE.

In the plant of the Western Box & Lumber Company 165 hp in motors are in service operating saws, planers and branding machines. The plant of the Sundquist Lumber Company handles a large amount of interior finishing product for residential construction. Planers, molding machines and a cut-off saw are operated by an installation of 30.5 hp in motors. In a representative lumber mill the sawdust is drawn by motor-driven fans into a storage space from which it is shipped in carload lots to powder mills. At the plant of the Longmont Milling & Elevator Company a steam-engine installation aggregating 375 hp was displaced by motors of much reduced rating and the operation of steam boilers was cut down 33⅓ per cent. The satisfaction which the company gained from the motor service led to the displacement of gasoline by electrical equipment in other localities covered by its operations.

Electric power is used in many laundries in Denver with excellent results. In one case a 10-hp installation produces a net revenue of $33.85 per month; in another instance a 12.5-hp motor equipment yields the company $30.95 per month, and in a third case an 18-hp installation yields $44.60 per month. In one laundry one of the largest mangles in the city is operated by a 3-hp direct-connected motor at a cost of about $6.50 per month. The number of sheets and flat pieces turned out is far in excess of the production under the former conditions of belt driving.

At the principal brickyards served the larger energy demand occurs mainly during the summer season. In a representative case a 40-hp motor drives a machine capable of producing 20,000 bricks per day of eight hours. In a yard producing 20,000 bricks per day, with two 50-hp motors on the circuit, the revenue to the company from the sale of energy was $150 per month.

Ice machines driven by electricity are in service at various points in Denver, including groceries, clubs, markets, restaurants, packing houses and florists' establishments. A 5-hp motor-driven equipment in grocery service will easily bring from $5 to $8 per month to the company. At the Denver Athletic Club an energy consumption of 4000 kw-hours was registered in February, and the equipment produced all the ice which was used by the club and handled all the refrigeration necessary for the preservation of meats and fruits. Elimination of dirt and maintenance of even temperatures have followed the introduction of the apparatus. A prominent florist, whose bills for energy for operating a refrigerating machine are about $18 per month with a 7.5-hp equipment, states that the cost is only about one-third that which he had to meet in purchasing ice, considering the amount of dirt encountered in it. The company's experience shows that from 50 kw-hours to 60 kw-hours are required to produce 1 ton of ice at Denver by central-station service, the cost ranging from $1.50 to $1.80.

Among the other representative power installations in Denver are motors operating machinery for organ blowing in churches, elevators, coffee grinders, chopping machines, pumps, vacuum cleaners, shoe-repairing shops, hat cleaners, exhaust fans, automobile-tire pumps and numerous other appliances whose individual loads are small, but which play an important part in the aggregate. A recent development of importance is the installation of motor-driven pumps of from 3 hp to 5 hp each in connection with irrigation service in market-gardening sections of the suburban territory adjacent to the city proper. About a dozen of these pumps have now been placed in service and in one case the value of the land has been raised from $100 to $500 per acre as a result of electric irrigation. Not only

.. this means can existing water supplies be applied more fficiently, but large areas of land useful only for grazing an be reclaimed for agricultural purposes and the load rom the central-station point of view is excellent on ac- ount of its attaining its maximum during the summer nd calling for a sustained consumption of energy during he warm season. At the State Rifle Range a 2-hp motor- lriven pump has been installed to save the haulage of lrinking water 3 miles in connection with target shoots. This business is entirely a day load and the pumping equip- nent is provided with automatic control located at the well. Motors are being installed to operate pumps in apartment iouses to reinforce the water pressure in the supply piping f the city company. Another installation recently made at St. Anthony's Hospital, Denver, a 30.5-hp motor equipment taking the place of isolated plant service. This service was formerly handled until 9 p. m. by the hospital plant, after which the load was carried by the company and the superiority and economy of the central-station service led the hospital authorities to discontinue the isolated plant. In the drug-store trade a 2-hp motor-driven pill- making machine is making a place for itself. At Crown Hill Cemetery a 10-hp motor has been installed on a pump used in irrigating lawns, and a 15-hp pump has been placed in similar service at the Colorado Golf Club. At the Denver Auditorium, seating 12,000 persons, two 7.5-hp motors are in service for the purpose of swinging the sides of the building interior in and out to form a theater or large hall as the conditions require. Five motor-driven exhaust fans are also in service in the Shubert Theater. The power-load business of the company is handled by the commercial department, of which Mr. Ross B. Mateer is power engineer and Mr. Clare N. Stannard, manager.

Wiring and Illumination

COMPETITIVE ILLUMINANTS.

At the recent annual convention of the "Verband Deutscher Elektrotechniker" in Munich a very interesting paper was read by Mr. George Dettmar, secretary of the Verband, on "Electricity in the Household," abstracts of which have appeared in several issues of the Digest. Supplementing the latter notices, we print herewith a table showing the ratio of candle-power per unit of illumination in different rooms of an apartment lighted by gas which the author occupied previously and corresponding figures for his present residence, which is lighted by electricity.

This table shows strikingly the important fact that the efficiency of electric light as regards the conversion of candle-powers into illumination is very much higher than with gaslight, owing to the fact that the disposition of electric lamps can be made much more favorable than with gas. The article says: "The simple comparison according to candle-power, cubic feet of gas and kw-hours is absolutely wrong. It must be emphasized that a reasonable comparison can be made only on the basis of illumination, and it is always to be considered that the same illumination can be obtained with a considerably smaller intensity in case of electric light."

COMPARATIVE RATIO OF CANDLE-POWER PER UNIT OF ILLUMINATION IN ROOMS LIGHTED BY GAS AND ELECTRICITY RESPECTIVELY.

Room	APARTMENT LIGHTED BY GAS				RESIDENCE LIGHTED BY ELECTRICITY			
	Area of Room, Square Feet.	Intensity in International Candle-Power.	Ft.-Candles Obtained.	Candle-power per Ft.-Candle.	Area of Room Square Feet.	Intensity in International Candle-Power.	Ft.-Candles Obtained.	Candle-power per Ft.-Candle.
[illegible]	[illegible]	[illegible]	1.01	285	[illegible]	299	3.99	[illegible]
[illegible]								
[illegible]	[illegible]	[illegible]	1.92	[illegible]	[illegible]	90	[illegible]	129[2]
[illegible]	[illegible]	[illegible]	[illegible]	116	[illegible]	22.5	[illegible]	7.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.36	[illegible]

[1] The distance of the light from the centre of the desk was with gas 6 ft. 11 in., with electricity, [illegible] ft. 8 in.
[2] This is the figure obtained by computation from the corresponding German [illegible]. The figure, however, by some mistake seems to be double the size it ought to be, as can be seen from division of the figures in the two preceding columns, 90 ÷ 1.4 = 64.5.

ORNAMENTAL STREET LIGHTING.

In a paper read by Mr. C. E. Stephens before the Pennsylvania Electric Association at its fourth annual convention Sept. 6, 7 and 8, 1911, the features of ornamental street lighting from the viewpoint of the illuminating engineer and the central station were well presented. The author claimed that good street lighting is the most convincing evidence always available by which citizens judge the success of the lighting company. The appearance of the streets gives the visitor a favorable or unfavorable impression of the city's thrift, depending very largely upon whether or not the illumination is adequate. In many cities one street or section thereof, or perhaps one side of a particular street, is congested with traffic, while other sections in the immediate locality are practically deserted. In some cases this condition can be attributed to the character of the business houses, but in a large proportion of the cases there is no doubt that the illumination of the several sections is responsible for the condition.

The fundamental problem to consider in the illumination of any street is the intensity of the illumination required and its production at a minimum cost. The cost includes the expenditure of energy, cost of maintenance and interest and depreciation for the lamps, plant and all auxiliary equipment. If the problem could be solved on an energy basis alone it would be logical to use a maximum number of light units with a corresponding reduction in their light flux and energy consumption. It is to be noted, however, that increasing the number of units also increases the installation and maintenance cost of the system. There is a point beyond which the cost for any increase in the number of units will exceed the saving in energy consumption. A point cannot be fixed which will apply generally on account of the innumerable variables (such as the intensity requirements in different sections of the city, obstacles which prevent a proper location and distribution of lamps, energy costs, etc.) which are involved.

The factors to be considered in arranging for good street illumination are uniform intensity, diffusion, intrinsic brilliancy of the light source and shadows. Assuming the minimum intensity of illumination as unity, the ratio between maximum and minimum illumination for business on other sections of the street where a high intensity is maintained should not exceed ten to one. For residence sections, parks and outlying districts the ratio should not be greater than five to one. This ratio of maximum to minimum illumination is smaller in the latter case because of the fact that where intensities of illumination are quite low the effect of the comparatively light and dark spots produces objectionable glare. Furthermore, it is in these sections of our streets that are found the fast-moving cars, automobiles and carriages.

In any illumination scheme it is objectionable to use a source from which the light flux issues from a point. This is particularly true in street lighting where relatively large units are employed, since it is impracticable to support a lamp at such a height that it will not come within the field of vision at a time when the eye is quite near the lamp. It is not feasible to change the nature of the light source, but by an intelligent use of the available glassware for modern street-lighting units it is possible to diffuse the light quite satisfactorily.

The author outlined the general characteristics of a suitable lighting unit as follows: The maximum intensity of the light unit should be from 15 deg. to 20 deg. below the horizontal and decrease rapidly above and below this angle; the total light flux from a single unit should be as small as conditions will permit—that is, for a given intensity of illumination use a maximum number of small units spaced at frequent intervals; the light should be diffused—that is, emitted from a large area; the lamp should be supported at the maximum height above the illuminated surface, especially so if it is of high candle-power and the light is not diffused.

In comparing the festoon arc and post systems of decorative street lighting the author said that the festoon system is rarely installed at present, having been superseded by the other two systems.

The flaming-arc lamp system operates at high efficiency and low maintenance cost. The maximum candle-power of this type of lamp is near the horizontal, and it is, therefore, possible to place the posts at great distances apart and at the same time secure a uniform intensity of illumination. This makes it possible to use a minimum number of poles —and possibly to make use of existing trolley or arc lamp-posts. The lamps can be supported at great heights above the street, above the critical angle of the eyes. The principal defect noted in a large number of arc-lamp systems is the tendency to support the lamps too close to the ground. This is particularly objectionable on account of the fact that the glare effect produced by the bright light in the eye causes a contraction of the pupil, which limits the amount of light entering the eyes and no advantage is gained by a high intensity of illumination.

The ornamental post system is perhaps the most popular of the three systems classed as ornamental. There are many post designs on the market arranged for from one to five lamps. They are installed on or near the curb on both sides of the street and comparatively close together. The lamps are supported in a pendent or inverted position and are usually supplied with energy from an underground system. The lamps and globes are easy of access for renewals and cleaning. The maintenance cost is reasonably low, particularly when the series type of lamp is used. The illumination of the street, when the units are properly spaced, is quite uniform and the required intensity is readily secured by a proper selection of lamp sizes. The first cost of installation varies with local conditions and the type of post adopted and the available source of energy supply. The principal objection to this system is the large number of posts required. This is a particularly objectionable feature in districts where there exist also a large number o[f] trolley, telephone and other service poles. Some criticism has also been heard from installations in which the post[s] are quite near the curb, in that large moving vans, ice wagons and other vehicles strike the fixtures and shatte[r] the lamps and glassware.

In summing up the general situation the author remarked that no one system can be adopted as the best for all installations. Local conditions very largely determine the best system to be installed. It behooves the central-station man to keep thoroughly posted on the advantages and valu[e] of the various systems available; to explain these items to interested officials and citizens, and to insist continually o[n] superior street illumination, previous to the time when th[e] unsatisfactory street illumination has prompted action o[n] the part of the city authorities or civic organizations. Th[e] co-operative spirit of the central-station man and the manufacturer of illuminants should inaugurate a system of education for the public, to teach it that the glaring appearance of a street lamp should not be used as a measure of it[s] excellence, and finally to strive to raise the standard o[f] street illumination in the cities to a point where superio[r] results will compensate for the increased cost.

Letters to the Editor.

Calculation of Flywheels.

To the Editor of Electrical World:

Sir:—In the article on page 559 of your issue of Sept. [.] on a calculation for flywheels of piston-driven prim[e] movers, Mr. George T. Hanchett gives a theory which, a[l]though apparently of alluring simplicity, appears to b[e] fundamentally incorrect for the following reasons:

With particular reference to steam engines, the indicat[or] card is a direct measure only for the work done by th[e] steam on that side of the piston to which the card relate[s]. The work done by the steam for any part of the pist[on] stroke is not identical with the energy delivered to th[e] crank for the same part of the stroke.

The mean effective pressure has no other meaning tha[n] the constant steam pressure, which, if acting in the cylind[er] instead of the actual and variable pressure, would do th[e] same work. It is in no way identical with the constant lo[ad] at the crank shaft. In explanation, it may be added th[at] the pressure exercised on the wrist pin is a direct measu[re] of the difference of steam pressures existing simultaneous[ly] on both sides of the piston (or pistons). If the indicat[or] card is used to ascertain this pressure, it is necessary [to] consider two cards taken simultaneously at either side [of] the piston.

This pressure is delivered to the crank pin minus t[he] pressure necessary for the acceleration of the reciprocati[ng] masses during the first part of the stroke, plus the pressu[re] liberated by the retardation of the reciprocating mass[es] occurring toward the end of the stroke. With high-spe[ed] engines the influence of the reciprocating masses is ve[ry] pronounced, and this influence does not appear on the [in]dicator card. The torque delivered to the crank shaft [is] finally derived from the tangential component of the [re]sultant pressure delivered to the crank pin. As the torq[ue] delivered to the crank shaft is the basis for the calculati[on] of the weight of the flywheel, it follows that no calculati[on] can be correct which does not consider the simultaneou[sly] existing pressures on either side of the piston, together w[ith] the influence of the reciprocating masses, and in case ve[ry] accurate results are required, the friction. Consideratio[ns] like those given by Mr. Hanchett lead to errors.

New York. F. Hymans

Specialization in Electrical Engineering.

To the Editor of Electrical World:

SIR:—That electrical engineering in the older sense of the term has fallen into a somewhat parlous condition is a statement that appears to represent the present-day professional situation. As a general profession it is in much the same dismal case as mechanical and civil engineering in their turn. Time was when all three offered a promising career with many opportunities. In the days of swift competitive railway building men in the profession of civil engineering rose rapidly, if of any marked ability, and won a fair meed of fame and fortune. That day passed on and now, unless a young engineer is willing to chance it at the ends of the earth, his opportunities are not likely to lead beyond a modest competence in a position of hard work and small renown. The average graduate in mechanical engineering likewise may commonly be found ten years after in a position of minor responsibility in the drafting-room, with the privilege of writing M.E. after his name as about the only thing to distinguish him from other and more humble wielders of the ruling pen. In electrical engineering the men who entered the profession a score of years ago had golden opportunities in the swift growth of the art and the multitude of electrical enterprises. Yet few of them have ever made the income won by the same class of ability in other pursuits, and even now one can count upon one's fingers all the electrical engineers who are winning the income, from strictly professional work, that falls to the lot of the successful lawyer. If the engineer gets rich it is usually because he has had the chance to mix financiering with his legitimate work in the proportion of about nine parts of the former to one of the latter.

We grant that this is not a cheerful outlook for the young man who believes that electricity is still in its infancy and needs him as a nurse. He can reasonably look forward to a decent livelihood, if he fancies the simple life, and to a respected position in the community, if it is not too large. If he is connected with a large concern and charged with grave engineering responsibilities he may even get the salary of a competent traveling salesman in a wholesale dry-goods house. If his affiliations are less important his earnings are correspondingly smaller. He may perhaps find comfort in the thought that he is better rewarded than the average clergyman, whose mean pay is about that of an experienced street-car conductor. But the situation is really not helped by the comparison. The fact is that general engineering is about in the case of general everything else. There used to be an opportunity for the engineer as constructor of plants and designer of apparatus. Now the contractor and the draftsman have ousted him. It does not take a high grade of capacity to take the catalogs of three or four prominent makers, pick out the one favored by the powers who finance and put together from the accepted list the necessary parts in faithful imitation of some recent plant of which blue prints are at hand. To be sure, the result may be costly, but it will be all the better from the standpoint of those who regard it merely as a raft upon which bonds are to be floated. The slightest departure from precedent is against the spirit of standardization and must be repressed.

The situation is undeniably bad, yet perhaps it is not by any means hopeless. There are a few electrical engineers who are successful in the practice of their profession, without any question and from any reasonable standpoint. They are to be found both in private work and in the higher ranks of great industries. It is not enough to retreat behind that dismal "bromide," "There is always room at the top." There isn't—at least for the man who is drearily crawling up the lower rungs with everyone above him heaving bricks. There is an extremely good reason for finding a man at the top. If one looks over the list of electrical engineers who belong to the first rank it will be found that practically every man has become a fairly well-defined specialist—a man who, letting the general work of the profession take care of itself, has won the reputation of doing some particular things better than anyone else.

The whole story is that electrical engineering has reached the stage that every art and science is bound to reach, in which general capacity is of far less moment than special insight into particular things. The profession as a whole is too big to be manageable and progresses line by line. It was one of Dr. Holmes' characters, if we remember aright, who could not in the least aspire to being called an entomologist, but might, if his labors were rewarded, be reckoned as a coleopterist. That is about the state in which the electrical engineer finds himself. He stands a very poor chance of fame or fortune if he has the temerity to spread his energies over too large a territory. He must make an attack in force at some point where it will tell and break his way through. And although the chance for this is denied to most men it is one that must be taken if it offers. At least, one may back out of a cul-de-sac and try it somewhere else. In no profession is the way easy; it means fighting from the drop of the hat and never giving up. In electrical engineering the chances are not of the best, yet they are as good probably as in other branches of engineering. They are best when they provide opportunity for work in some of the directions which lie off the well-worn track. The engineer is essentially a pioneer—who may be a splendid frontiersman, but often proves a mighty poor truck farmer when civilization really catches up with him. There are plenty of the truck-farming class among engineers, and the only chance for the pioneer is not to settle into competition with them, but to find a new frontier for himself and leave them behind, dawdling with their cabbages or their catalogs, while he seeks the passes into the undiscovered country.

CHARLES L. SOMERS.

Boston, Mass.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Boosting Poles.—R. POHL.—"Boosting poles" (Zusatzpole) are auxiliary poles arranged between the main poles of direct-current machines for the purpose of varying the voltage available at the brushes. This purpose distinguishes them from interpoles (Wendepole), which are employed for improving the commutation. However, both effects are sometimes intermixed. The author first discusses the use of boosting poles in direct-current rotary converters; the disadvantage of the fixed ratio of the two direct-current voltages of a converter is thereby overcome. In Fig. 1, N_1 may be the flux through a main pole, N_2 the flux of the boosting pole. The two sets of brushes AA and BB for the two armature windings are placed in the neutral zones. Then the useful flux for the brushes AA is

$$N_a = N_1 + N_2$$

and for the brushes

$$N_b = N_1 - N_2$$

A change of N_2 can therefore be used for varying the transformation ratio of voltages which is proportional to

the ratio of $N_1 + N_2$ to $N_1 - N_2$. If the boosting poles are provided with a shunt winding the dynamo voltage can be adjusted at will by means of a regulator in this winding. If a series winding is used (excited either by the motor

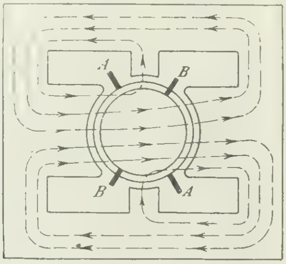
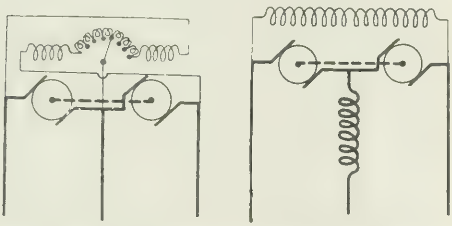


Fig. 1—Magnetic Circuits of Boosting Poles.

current or by the generator current) the dynamo side of the converter has the characteristic curve of a compounded or overcompounded machine. By using both a series and a shunt winding the no-load voltage may be adjusted at will and automatically maintained constant for any load. Finally, by reversing the direction of the current in the series winding of the boosting poles, a characteristic curve showing a rapid drop may be obtained as is desired, for instance, for automatic charging of accumulators. Boosting poles may also be employed in balancers for three-wire



Figs. 2 and 3—Shunt-Wound and Boosting-Pole Balancers.

systems. The connections of an ordinary balancer are shown in Fig. 2, those of balancers with boosting poles in Fig. 3 and Fig. 4, in which the boosting windings are indicated by heavy lines. There is a common field structure, but the armature is provided with two equal windings in series, connected across the outers. The boosting poles are either excited by the current in the neutral wire (Fig. 3) or are connected in equal halves in the two outers (Fig. 4). The accuracy of the voltage regulation in the two halves of the network can be adjusted by means of a shunt in parallel with the boosting pole winding. The application of the same principle to boosters is next discussed, but it

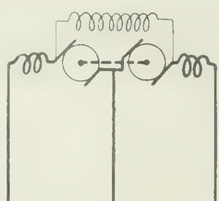


Fig. 4—Boosting-Pole Balancer.

is shown that it is unsuitable for charging accumulators and hardly practicable for feeders. Finally, the application to alternating-current and direct-current converters is discussed and the well-known split-pole converter is represented as a special case of the general machine with boosting poles.—*Elek. Zeit.*, Aug. 24.

Lack of Symmetry of Three-Phase Transformers.—W. Genkin.—An unloaded three-phase transformer with thre iron cores, the axes of which are in the same plane, repre sents a non-symmetry in its magnetic circuit which mani fests itself in a distortion of the electric equilibrium of th primary circuit. This phenomenon has a particular featur which may be seen by using the arrangement of Fig. 5 where A are ammeters; V, voltmeters, and W, wattmeters. The indications of the wattmeters will be found to chang when the connections between the terminals 1, 2, 3 an 1′, 2′, 3′ are changed. But there exist only two systems o characteristic values according to the two directions o rotation of the vectors in such a manner that a simpl

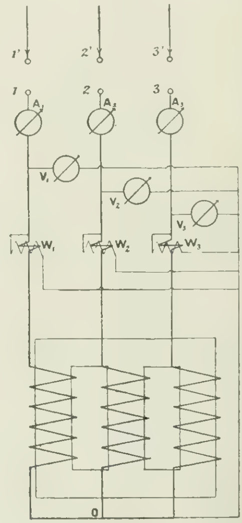


Fig. 5—Three-Phase Transformer Test Connections.

cyclic permutation of the terminals in the connections do not produce any change in the indications of the wa meters.—*La Lumière Elec.*, July 15.

A General Property of Collector Rings.—E. Guillaum —A mathematical paper in which the author compares t emf due to the rotation of the armature in its proper fie with that due to the mutual induction between the sho circuited coils and the other coils and finds that the forn is in all cases equal to the mean value of the latter.— *Lumière Elec.*, July 15.

Lamps and Lighting.

Drawn Tungsten-Filament Lamp.—An illustrated scription of the new tungsten lamp factory of the Brit Thomson-Houston Company. Until quite recently this fa tory was devoted to the manufacture of pressed-filame lamps, but developments have recently taken place resu ing in the replacement of the old equipment by plant a apparatus for the manufacture of drawn-wire tungst lamps in large quantities.—Lond. *Electrician*, Aug. 25.

Generation, Transmission and Distribution.

Conversion Factors for Power Cost Calculations.—C. Hering.—An article giving two elaborate tables of co version factors for power cost calculations. A disti tion is made between a full year of 365¼ days of twen four hours each and a working year of 300 days of 1 hours each. The first table gives the conversion facts for the different units of power and American mon while the second table gives the conversion factors

ifferent units of power and American and foreign money. —*Met. and Chem. Eng'ing, September.*

High-Tension Cable and Protection System for Cables. —H. BIRKENBACH AND M. HOCHSTADTER.—An illustrated rticle on an extended new cable ring system around the

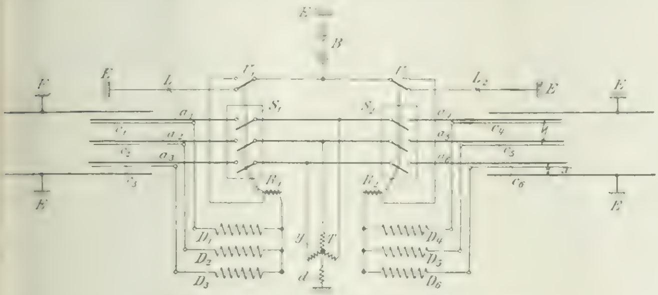


Fig. 6—Arrangement of Cable-Protecting Apparatus.

y of Cologne in Germany. The total power of 10,000 mperes is transmitted in the form of three-phase curs at 25,000 volts from a power station to a substation suburb of Cologne, where it is supplied directly to able system in the form of a ring passing through the rbs. Transformer stations are provided in the different rbs for reducing the voltage from 25,000 to 6000. For ring-system three single-conductor cables are used. the protection of cable systems a new method has been oped by M. Höchstädter, which is different from the -Price system and which automatically disconnects faulty cable part from the system. Fig. 6 shows the cation of this system to a three-conductor cable carrythree-phase currents. The principal feature of this m is that around each copper conductor $a_1, a_2 \ . \ . \ . \ a_6$ pper ribbon $c_1, c_2 \ . \ . \ . \ c_6$ is wound in spiral form h forms a concentric ring around the conductor. se copper ribbons $c_1 \ . \ . \ .$ are isolated from the copper luctors $a_1 \ . \ . \ .$ and in three-conductor cables these ns are also insulated from each other. Whenever the lation breaks down at any point of the cable, for ince at the point x, where an arc develops between a luctor and the lead armor, then the arc represents n if only for a very short time) a conducting connecbetween the copper conductor and the surrounding er ribbon or between the copper ribbon and the lead r, or it makes both connections at once. In this way lay circuit of an auxiliary battery B connected with pole to earth is closed and the relay coil R_1 or R_2 rates the switch S_1 or S_2 so as to cut off the cable poron which the fault has developed. The switch is thus nce closed. Exactly the same thing happens at the r end of the faulty portion of the cable, so that this ion is separated from the network at both ends, while ther switches are not actuated and all other cable ions remain in circuit. In the case of a breakdown

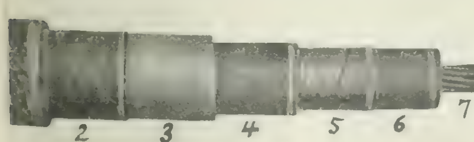


Fig. 7—Details of Cable.

tween two conductors, for instance a_4 and a_5, which does ot effect the lead armor, the arrangement acts as follows. he different phases, or if transformers are used the utral points y of these transformers, are connected in one more stations through choking coils D to earth. The battery current then passes from the protective copper ribbon through the arc to one or two of the conductors and then through the earth connection referred to into the earth and back to the battery. In the connections between the spirals c_1 and c_6 and the relay coils of the switches S_1 and S_2 choking coils D_1 and D_6 are connected in star fashion. They have a small ohmic resistance for the battery current, while in normal operation as well as in the case of a breakdown they suppress the alternating current which would flow otherwise through the copper ribbon spiral. A detailed description is then given of the construction of the cables for the Cologne system. The cable construction is shown in Fig. 7, where 7 is the copper conductor of 95 sq. mm cross-section, 6 is the paper insulation of 8 mm thickness, 5 is the protective spiral of copper ribbon, 4 is paper insulation of 2.55 mm thickness, 3 is the lead armoring, 2 is a double layer of paper impregnated with asphalt and 1 is the external jute layer. The specifications of the cable are given and the method of testing is described in detail.—*Elek. Zeit.*, Aug. 10 and 17.

Swiss Water-Power Plant.—An illustrated description of the Schaffhausen water-power plant. Since the night load is very light and no water storage is possible near the works a pumping station has been arranged. A motor generator which is alternately used as motor and as generator carries at one end of its shaft a high-pressure water turbine and at the other end a centrifugal pump. During the night the motor receives electrical energy from the station and drives the centrifugal pumps, which deliver water to a high-level reservoir 2.1 km (1¼ mile) distant. During the times of peak load in the daytime water flows back from the reservoir and drives the turbines, which again drive the generators and thus supply electric energy to the transmission network. The overflow level of the reservoir is 155 m above the pumps. In view of the friction, mechanical and electrical losses in the different machines the overhaul efficiency is not more than 42 per cent. The capital investment in this storage plant has been high on account of the long, expensive pipe line.—Lond. *Elec. Review*, Aug. 18.

Traction.

Glasgow Tramway System.—An abstract of the last annual report of the municipal tramway system of Glasgow. The receipts, which a year ago were $4,483,600, have risen to $4,747,445, an increase of $263,845. The working expenses rose only by $151,340 to $2,665,895. This resulted in a greater contribution to the "common good," namely, $343,390, as against $265,140 in the previous year. The cost per car-mile was made up as follows: Traffic expenses, 5.98 cents; general expenses, 2.32 cents; repairs and maintenance, 2.66; energy, 0.84; capital charges, 8.64; hence total expenses, 20.4 cents. The total revenue per car-mile was 21.96 cents.—*Lond. Electrician*, Aug. 25.

Paris Subway.—An illustrated article on the opening of the new electric subway in Paris, the North-South Line, which is an entirely distinct enterprise from the old Metropolitan subway. Motor cars and trailers of the same general appearance as those employed on the Metropolitan are also used on this line, though there are some differences in detail. One of the main differences in operating the trains lies in the use of the track rails as an earthed neutral conductor and the employment of both a third-rail and overhead trolley wire for supplying energy to the motors. In the case of two 600-volt, direct-current motors, which is the standard equipment per train here as well as on the other subway, one motor is supplied from the third-rail,

returning to the track or earth, and the second from the trolley to earth, using 1200 volts between the third-rail and trolley. To keep the voltage constant at 600 volts on each motor the balance is maintained by the multiple-unit control apparatus on the motor cars. As this does not allow the use of an uneven number of motor cars (three cars are sometimes used on the other line) the capacity of the motors is increased, so as to make them capable of drawing the maximum train load with two motor cars in all cases. Each motor car thus carries four motors, each of 125 hp. Economy in wiring over the 600-volt system is secured by the use of a pressure of 1200 volts and there will be less earth leakage. The energy is brought in bulk from existing central stations and transmitted in the form of three-phase currents at 10,000 volts to 15,000 volts to two substations. Each of the substations is equipped with transformers and rotary converters, from where 12,000-volt direct current is supplied to the line. Owing to the short length of the subway (9 miles) not more than two substations were needed.—*Lond. Electrician*, Aug. 25.

Wires, Wiring and Conduits.

Wiring System.—G. Graf.—An illustrated paper read before the German Association of Electrical Engineers on a universal system of wiring and fittings which can be used in workshops of any kind. It has been developed by the Allgemeine Electricitäts Gesellschaft.—*Elek. Zeit.*, Aug. 24.

Wiring.—P. Stern.—A paper presented before the German Association of Electrical Engineers on the esthetics of electric wiring. He discusses in detail how the wiring installations in a house can beautify it or distract from its appearance.—*Elek. Zeit.*, Aug. 10 and 17.

Electrophysics and Magnetism.

Energy and Temperature.—Max Planck.—A lecture presented before the French Physical Society on the relation between energy and temperature. According to the viewpoint of pure energetics the temperature is a factor of the energy, the relation between temperature and heat energy being the same as between mechanical force and mechanical work or between electric potential and electrical energy; the temperature difference between bodies determines the direction in which heat will pass from one to the other in the same way as the potential difference determines the direction of an electric current. But such a view is too narrow, as it ignores the one essential point that mechanical motion is possible in a direction opposite to a mechanical force; that an electric current can be made to flow in a direction opposite to a potential difference, while a stream of heat energy opposite to temperature drop is absolutely impossible. To solve the problem of the relation between temperature and energy not even the second principle of thermodynamics is sufficient, but atomic and molecular conceptions must be taken into account. According to the kinetic gas theory, the temperature of a perfect gas is represented by the mean energy of the progressive motion of a single gas molecule, independent of its molecular weight. This simple rule seems to permit an answer to the question as to the relation between energy and temperature. For it seems easy to generalize this rule so as to apply to imperfect gases, vapors, liquids and solids. It is only necessary to assume that temperature equilibrium between two bodies is obtained when the different molecules of the two bodies in contact with each other have the same mean energy of motion. From Hamilton's general equations of motion, with the aid of probability calculations, Boltzmann and Gibbs have succeeded in deriving a general theorem which is called the principle of uniform distribution of energy. A consequence of this theorem is the conception that the temperature of a body is a measure of the mean kinetic energy of any velocity component of any of its molecules. The Boltzmann-Gibbs theorem has assumed, in the opinion of many, the rank of a fundamental principle of thermodynamics, and it has indeed been confirmed i various special applications, especially to monatomic gas However, the present author shows in great detail tl this principle cannot be upheld in general. He traces different steps in the mathematical deduction of the Gib Boltzmann theorem and investigates at which point a c rection must be applied. This he finds necessary with spect to the assumption of the number of independent grees of freedom with which the different atoms, ions electrons move in a molecule containing several ato He concludes that it is wrong to assume that all the diff ent constituents of a molecule are "free" and that it necessary to assume that the number of degrees of fr dom in a molecule is smaller, often much smaller, than number of the constituents of the molecule. To just such an assumption a new hypothesis is required. author's fundamental new hypothesis is that the rapid os lations within a molecule, which cause the absorption emission of radiant heat, cannot have any amount of ergy, but that their energy must be necessarily a mult of a finite unit quantity of energy which depends on frequency. This hypothesis of energy made up of quantities leads to a mathematical equation which c tradicts the Gibbs-Boltzmann theorem in general. W the author thinks that the new hypothesis can still be proved in details, yet it has already proved very us as a working hypothesis in many directions.—*Phys. Z* Aug. 15.

Resistance and Emf of Selenium.—J. Luterbacher.— investigation of the phenomenon of the decrease of resistance of a selenium cell with the emf. In all the t the variations due to illuminations and heating were el nated by keeping the cells for several days together temperature of melting ice and in absolute darkness. author calls the effect the "voltage effect" or "ten effect." It had the same sense, that of an increase of ductivity with rising emf, in all cells except one, w showed an inversion. The voltage effect is greater

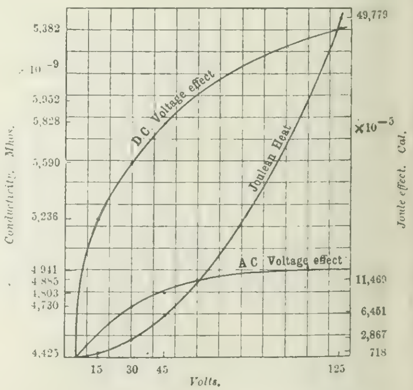


Fig. 8—Voltage Effect Compared with Joulean Heat.

direct current than with alternating currents. The is in general no proportionality between the applied vo ge and the voltage effect, a given difference in voltage l ng less effective at high voltages. The voltage effect is not instantaneous, nor does it disappear at once after ta ing off the high emf. The time of recovery increases in general with the voltage and the time during which it i applied. The photoelectric sensitiveness is not affect in any way by the voltage effect. That the Joulean he ing is not the cause of the voltage effect is shown by the a ect of the curves of Fig. 8, which show that the Joule ect increases very slowly at low voltages, whereas the v age effect rises abruptly even for alternating currents. Be ies,

if the Joule effect were the cause, there is no explanation fc the difference between the direct-current and alternating-current curves. On cutting off the voltage abruptly ar letting the selenium cells discharge through the galvanometer, a polarization of from 7 to 22 millovolts was ob[illegible]rved for a few seconds. The author suggests that this polarization (always in the same direction as the original current) may be much stronger when the current is on ar may thus explain the voltage effect.—Abstracted from *An. d. Physik* in Lond. *Electrician*, Aug. 18.

[illegible]ncrease of Magnetic Induction in Nickel Bars Due to [illegible] Joints.—E. H. W[illegible] [illegible] o[illegible] very thin layers of iron is much weaker than that of g[illegible]ter masses, whereas in the case of nickel the opposite [illegible]-that is, thin layers are much more strongly mag[illegible] [illegible]an thick layers. The influence of a plane of trans[illegible] [illegible]ection on the magnetic induction of an iron bar is [illegible] [illegible]luce a large magnetic resistance which, however, ca be reduced by longitudinal pressure. Now, if the surfa[illegible] layers of nickel are more strongly magnetic than the m[illegible] of nickel, it would seem that in this metal transverse [illegible] would tend to increase the magnetic induction rather [illegible] [illegible]crease it as in the case of iron. The author has [illegible]ned the effects of surface layers in bar magnets of [illegible] [illegible]l of nickel, produced by cutting the bar in planes [illegible]sverse section under various conditions of field st[illegible]ngth and longitudinal pressure. The results show that th effect of transverse sections on the magnetic induction [illegible]ys a negative quantity in the case of iron—that is, [illegible]nsverse joints in a bar of iron tend always to de[illegible]ease the magnetic induction by increasing the magnetic re[illegible]stance. In the case of nickel the results are very diffe[illegible]nt. Beyond magnetic fields of twenty or twenty-five [illegible] [illegible]r square centimeter the per cent change is a posi[illegible] [illegible]antity—that is, the effect of transverse joints is to [illegible]e the magnetic induction. However, the curve giv[illegible] [illegible] increase of magnetization as a function of the mag[illegible] [illegible]g force reaches a maximum value at a certain point, a[illegible] it is evident that the effect of the surface layers is due to two or more causes and that it does not follow any si[illegible]ple law.—*Phys. Review*, July.

[illegible]revious Magnetic History and Temperature.—E. WILS[illegible] AND L. C. BUDD.—A paper presented before the Physic[illegible] Society in London. The effects of previous magnetic h[illegible]ory upon permeability and hysteresis have already been st[illegible]lied at ordinary atmospheric temperature. The object o[illegible] the present paper is to examine the effect of variation o[illegible] temperature upon the influence of wide previous history. T[illegible] conclusion is that the influence of large previous magn[illegible]ic history in a 3 per cent silicon alloy of iron is seriously affected by variation of temperature, being largest at th[illegible] low temperatures and ultimately becoming very small, if [illegible] vanishing, at the point near which the material bec[illegible]es non-magnetic. In addition, both heating and cooli[illegible] have permanent effects upon the magnetic quality of th[illegible] alloy. Previous heat treatment must also be consi[illegible]red.—Lond. *Electrician*, Aug. 18.

Electrochemistry and Batteries.

[illegible]ectric Tin Smelting.—J. HARDEN.—An account of a tr[illegible]l made recently in England with electric tin smelting o[illegible] a commercial scale. From the figures given it would a[illegible]ear that a saving in tin could be effected by means of e[illegible]tric smelting if energy could be obtained at a reas[illegible]able rate. The process is thought to be applicable to the S[illegible]aits Settlements.—*Met. and Chem. Eng'ing*, September.

[illegible]efining of Silver and Gold Alloys.—E. F. KERN.—A p[illegible]er illustrated by diagrams giving a concise summary of th[illegible] different methods in commercial use for the refining o[illegible] silver and gold alloys. He first gives a review of the p[illegible]ting of Dore bullion with boiling concentrated sulphuric a[illegible]d and of the electrolytic process of parting bullion, both th[illegible] Moebius cell and the Balbach-Thum cell being described and illustrated. The treatment of the silver anode sludge, either by a chemical method or by an electrolytic method, is next taken up. The second part of the article deals with electrolytic refining of gold by the Wohlwill process and the use of a pulsating current in this process. —*Met. and Chem. Eng'ing*, September.

Units, Measurements and Instruments.

[illegible]—[illegible] H[illegible]RRMANN.—Three letters on the distinction between field and flux. Emde emphasizes that the field is a space and cannot be measured numerically. The flux can be measured numerically. In a transformer the iron core is the main field and the stray field is between the primary and secondary circuits. But we must say that the stray flux is 5 per cent of the main flux and that the fluxes through different cross-sections of the same pole are different on account of the stray fluxes, while all these cross-sections are situated in the same field. Herrmann thinks that field and flux are about the same and he does not like to use the term flux because he wants to avoid the idea in students that anything is flowing.—*Elek. Zeit.*, Aug. 10.

Meters at Varying Voltages.—W. GENKIN AND A. SCHILLES.—A description, illustrated by numerous diagrams, of a graphical method which permits one to determine easily the errors of the readings of a meter due to fluctuation of voltage. By properly selecting the field strength of the permanent magnet of the meter these errors can be maintained within given limits.—*La Lumière Elec.*, July 8.

Analysis of Periodic Curves.—J. F. ANDOUIN.—A paper on the resolution of a periodic wave into a Fourier series of sine waves. Graphical methods of analysis permit one to get great accuracy only with difficulty and do not indicate how approximately the results are true. Among arithmetic methods the author deals especially with the new method of Schleiermacher, described in his recent German paper, and shows how it simplifies the calculations. The simplifications are such as to make the multiplications less troublesome by a judicious choice of the number and the position of the ordinates under consideration.—*La Lumière Elec.*, July 15.

Telegraphy, Telephony and Signals.

Recent Telephone Systems.—C. L. VAN DER BILT.—The author emphasizes that a comparison between manual, semi-automatic and automatic exchanges is by no means simple, since manual systems do not represent a well-defined group. He thinks that among the manual system the so-called "distribution systems" (Verteilersysteme) are not sufficiently taken into consideration, although they are best adapted to save attendance and insure quick service. The purpose of such systems is to distribute the work of the operators as uniformly as possible over all of them. For this purpose two departments are provided. The first is called the distribution department and its purpose is to turn over all call-ups as quickly as possible to those operators in the second department, called the connection department, who are free at that moment. The operators in the second department test the desired connections and make the connection. A good many statistical data are given from the experience with such a system in a European exchange and figures are given on first cost and cost of operation. A comparison is made with semi-automatic and automatic systems; it is thought that the latter should be used only in a system comprising several exchanges and especially in sub-exchanges. In general the semi-automatic system is considered to be preferable. The advantages of careful compilation of statistical data are pointed out.—*Elek. Zeit.*, June 29 and July 6.

Tuning of Antennas.—A. GUYAN.—A paper giving the mathematical theory of the effect of a self-inductance and a capacity inserted at the base of a single-vertical-wire antenna.—*La Lumière Elec.*, July 8.

New Apparatus and Appliances

MILWAUKEE MANUFACTURERS' EXPOSITION.

Beginning Sept. 2 and scheduled to be closed Sept. 12, the Manufacturers' Exposition of Milwaukee-made products was held in the Auditorium Building, Milwaukee, Wis. The display was an interesting one and to many visitors it

Fig. 1—Interior View of Main Arena Floor at Milwaukee Manufacturers' Exposition.

was a revelation of Milwaukee's varied manufacturing interests. Several of the exhibits were of an electrical nature or related to the electrical display, and the following paragraphs are devoted to features of the exposition of especial interest to readers of this journal. It may be noted that the Auditorium in which the exposition was held is a comparatively new building especially erected for events of this kind and one which is spacious, carefully constructed and well adapted to different gatherings of this character. The attendance was good and at night the streets leading to the Auditorium were made conspicuous by arches of incandescent lamps erected by the Milwaukee Electric Railway & Light Company. The exhibition was given in celebration of the fiftieth anniversary of the Merchants and Manufacturers' Association. Mr. Otto H. Falk is president of this association and Mr. C. N. Duffy, general sales agent of the Milwaukee Electric Railway & Light Company, is chairman of the committee on industrial exposition. There is also a publicity and poster committee, of which Mr. C. L. Benjamin, of the Cutler-Hammer Manufacturing Company, is a member.

Centrally located in a graceful open pavilion surmounted by a large ball made of incandescent electric lamps was the display of the Milwaukee Electric Railway & Light Company. This exhibit constituted the most prominent display of electric lighting at the exposition, although the hanging-basket effect in lighting fixtures, illustrated clearly in the accompanying picture, was also effective. The Milwaukee Electric Railway & Light Company supplies the street-railway service and the major portion of the electric light and power service of Milwaukee. Its exhibition consisted mainly of devices intended to demonstrate the uses of electrical energy for industrial purposes. One conspicuous mechanism was a working exhibit of Cutler-Hammer automatic controllers for 50-hp direct-current motors used for driving pumps of hydraulic elevators, illustrating the equipment in the Hotel Pfister, lately taken over by · central-station company. Another exhibit was a mercu arc rectifier and panel intended to illustrate the simplic of the apparatus for charging storage batteries for elect vehicles—a branch of the business which is being pusl in Milwaukee. Incidentally, the rectifier was utilized to · tain direct current for use in the exhibit, as the building supplied with 60-cycle alternating current. The direct c rent was used for the operation of various motors wh were employed for demonstrating purposes and which not, of course, carry heavy load. However, the use o mercury-arc rectifier to supply energy for the operation direct-current motors is unusual, and therefore this plication was of especial interest to electrical men. Th were several other industrial demonstrations, including small blacksmith's forge electrically operated and vari pumps and blowers.

Of much popular interest was a model of an airship pended from the roof and equipped for control by me of electrical energy transmitted by Hertzian waves fr a "wireless" sending station in a balcony. This interest exhibit was in charge of the School of Engineering Milwaukee.

Allis-Chalmers Company displayed both portable and tionary electrically driven air compressors. Several tra formers were also shown, as well as some small motor

Julius Andrae & Sons Company exhibited telephonic s plies and electric motors, as well as a country lighting consisting of a small dynamo, storage battery and a swi board panel with the necessary instruments.

Battery, Light & Power Company displayed its stora battery lighting system for country homes. This comp makes storage batteries and also supplies complete light outfits of small size.

Cutler-Hammer Manufacturing Company devoted its teresting exhibit largely to various forms of electric h ing and cooking appliances, although there was also a

Fig. 2—View of Typical Booth at Milwaukee Manufact rs Exposition, with Glimpse of Wirelessly Operated Airship M del Overhead.

play of push-button switches. Women demonstrators i strated the use of electric flatirons and disk stoves.

The Falk Company, among other machinery, show a 10-hp kerosene engine coupled to a dynamo of like ra g. Electrical energy from this set was used for operatin n-

c lescent lamps placed around the exhibit and also a
ntor-driven machine employed to demonstrate the double
hical gears made by this company.

I. W. Johns-Manville Company displayed fuses, fiber
c·duit, tapes and splicing compounds, electrotherm, lino-
li, etc.

Iechanical Appliance Company exhibited Watson motors
o·various sizes and for various applications. Both direct-
c'rent and alternating-current motors were displayed, and
a electric riveter shown in operation was a prominent
f ture.

Vational Brake & Electric Company displayed air-brake
e·ipment and air compressors.

Vorthwestern Manufacturing Company exhibited its
·os and motors in the Andrae exhibit.

·wling & Harnischfeger Company had an interesting
m·chinery exhibit made up of several types of electrically
o·rated hoists. A two-motor hoist arranged for cage and
fl·r control and a recently designed lumber conveyor were
·

·er Manufacturing Company attracted attention by
·icational exhibit showing the practical use of elec-
·y operated ice-making and refrigerating machines.
·frigerated sign" was a striking feature of this exhibit.

INDUCTION MOTOR CONTROLLER.

· type of reversing controller for induction motors
· has been hitherto mostly favored for colliery and
si·ilar work is the one in which use is made of a revolv-
i· drum on which are carried various contacts. The cost
o·maintenance of the drum controller is considerable, and
· must be added the fact that small replacements,
·er trivial in cost, cause a large amount of incon-
·ce and attendant expense.

·would appear that a type of controller which would
· any excessive wear on contacts and give at the same

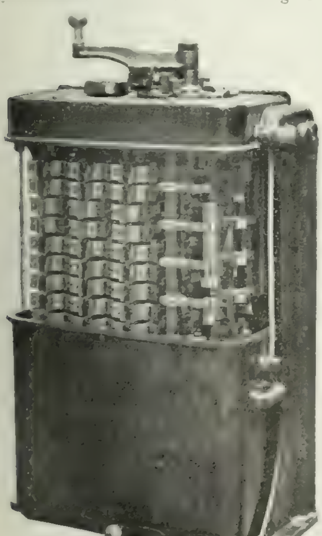


Fig. 1—View of Controller with Cover Lowered.

·e a positive action would appeal to motor users. In
t· controller illustrated herewith use is made of a con-
·tor system which gives a quick break-and-make action
a· maintains the surfaces smooth and clean and at the
s·e time causes a minimum of wear on the contacts.

Referring more particularly to the most important improvement in the controller, namely, the method of making contact, it will be seen from Fig. 3 that there is a fixed frame on which are carried the spindles A_1, which extend almost the entire height of the controller. Pivoted on each of these spindles are movable arms A_2, to which are

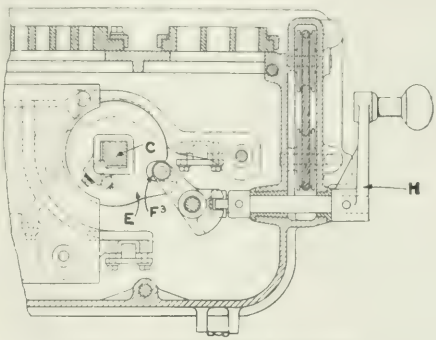


Fig. 2—Details of Reversing Mechanism.

fixed contacts A_3, each spindle carrying the number of arms with contacts corresponding with the steps of the rotor resistor, of which there are usually nine. These arms have a rotating movement on the spindle and also a small lateral movement, the combination of these movements insuring that the contact pieces shall approach one another (when making circuit) at such an angle as to insure a good wiping action contact. Corresponding with, and registering horizontally to, these contacts A_3 are the same number of fixed contact pieces B_1. These contact pieces are mounted on vertical standards B, but are insulated therefrom by mica.

Each of the movable contact pieces A_3 is held extended to the left by means of a spring, the spring movement being limited by blocks A_5. This addition insures that in each case when contact is made between the two contact pieces A_3 and B_1 any wear or unevenness of alignment relative to one another will not cause sparking as in the closed position, perfect contact being made against the full compression of this spring. It will be seen from Fig. 3 that a main operating pillar C, actuated by means of the controller handle, carries a number of cams, each cam being

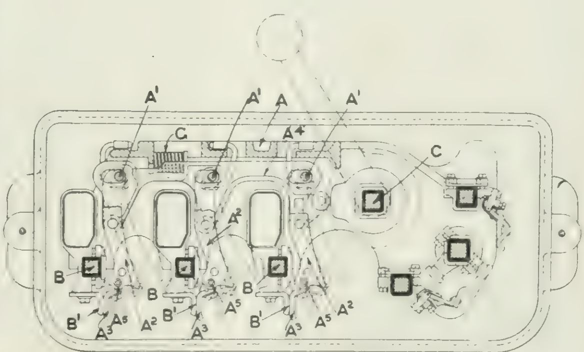


Fig. 3—Details of Accelerating Mechanism.

appropriated by one of the movable cradles A_4, on which are pivoted the movable contact arms A_2.

At the top of the operating pillar, just below the handle, is a cam E, Fig. 2, in which there is a recess into which projects a roller F_3. The first operation of the main con-

troller handle moves the cam E in a clockwise direction, carrying the arm F_3 with it through an angle of about 50 deg. in a counter-clockwise direction, at which point the roller leaves the recess in the cam and the primary circuits are closed, as may be seen by referring to Fig. 3, and the motor is connected to the line with all resistances in circuit. An extension of arm F_3 at the same time enters a slot formed in the end of the spindle of the reversing handle H (Fig. 2), thereby locking it in position. When bringing the controller arm back to the "off" position the tooth shown on the cam E engages with the roller on arm F and brings it back into the position shown in Fig. 2, thereby opening the primary circuits and unlocking the reversing handle.

The next and following notches actuate the movable contacts in turn, moving them forward through the necessary path to make contact with the fixed contact pieces. An automatic notching device, also attached to the handle, prevents the operator from moving forward more than one notch at a time. The time automatically allowed between the notches permits the motor to accelerate the requisite amount before it is possible to pass to the notch next in order.

For starting up the motor in the opposite direction use is made of the handle H, the movement of which raises or lowers the reversing drum so that the primary connections are reversed. The reversing handle is locked in position by the first movement of the controller handle. Moreover, the controller handle is locked by the reversing handle in any intermediate position of the latter.

In order to facilitate the examination of the contact drum the casing of the controller has been arranged to move vertically up and down in guides, as shown in Fig. 1, which illustrates the cover in the down position. The whole of the weight of the casing, including the oil, is balanced by a counterweight. All of the current-carrying parts are immersed in oil and the lowering of the controller case which contains the oil leaves the contacts exposed and at a convenient height for inspection or repair.

The above-described controllers have been developed for the market by Dick, Kerr & Company, Ltd., Abchurch Yard, Cannon Street, London, England.

EXHIBITS AT PENNSYLVANIA CONVENTION.

Manufacturers and supply men took advantage of the convention of the Pennsylvania Electric Association at Exposition Park, Pa., Sept. 5 to 9, to make an unofficial display of their wares or to send representatives to interest the central-station men present in their particular products. The General Electric Company and the Simplex Electric Heating Company made exhibits in the rear of the convention hall, the one displaying heating apparatus, motors, lamps, an ozonizer, etc., and the other making a display of irons and cooking devices. The former company was represented by the following: Messrs. J. M. Hayes, J. Hamilton, W. H. Cogswell, C. A. Raymond, W. H. Rue, W. L. Mason, E. W. Howard, J. J. Lills, J. E. Hill and C. C. Supplee. The Simplex Electric Heating Company was represented by Mr. E. B. Stebbins. Outside of the convention hall and under the dancing pavilion were a number of electric signs displayed by the Federal Sign System (Electric). The representatives of this company were Messrs. W. A. Williamson, W. H. Fry and R. W. Sullivan.

The Westinghouse Electric & Manufacturing Company chartered the steamer *Helena*, upon which it placed its exhibit. The boat, which was also placed at the disposal of the association for sails on Conneaut Lake, was decorated with incandescent lamps, the decorations including a keystone outlined in lamps. The exhibit included a complete line of electric cooking and heating apparatus, instruments, transformers, motors, lightning arresters, etc. The con pany was represented by the following: Messrs. J. (McQuiston, T. F. Foster, W. Barnes, Jr., L. L. Warfiel C. E. Stephens, S. A. Fletcher, W. B. Underwood, T. Pace, T. A. McDowell, A. M. Dudley, W. F. Fowler, Andrews, G. H. Criss, W. B. Wilkinson, M. M. Barr, L. Starrett, W. G. Miles, J. M. Ireland, H. M. Gansman, M C. Morrow, V. E. Cohen and L. T. Peck. Mr. B. F. Fishe Jr., was the representative of the Westinghouse Lamp Con pany.

On the veranda of the hotel a number of houses ma exhibits. The Philadelphia Electrical & Manufacturi Company displayed absolute cut-outs and arc cut-outs, tun sten lamps and street-lighting fixtures, conduit sealing plu and malleable pole and line hardware. Messrs. W. H. Ward and W. O. Dale were in attendance. W. N. Matthe & Brother, St. Louis, exhibited sample lamp guards, clam lamp changer and fuse switch. Mr. V. L. Crawford repr sented the firm. The Crouse-Hinds Company, Syracus displayed a sample meter panel and distributed printed ma ter on condulets. Mr. M. J. Kiefer represented the co pany. The H. W. Johns-Manville Company made a di play of "noark" service and subway boxes, friction ta splicing compound, "solderall" and fiber conduit. Mess P. C. McCutcheon and H. N. Voorhis were the represent tives in attendance.

The Pittsburgh Transformer Company had on display number of bell-ringing transformers, a large transform and parts of its series street-lighting system. Mr. H. Steele represented the company. Hubbard & Company e hibited photographs of the Mueller system of seconda distribution, hinged arms for tungsten street lamps, se ondary racks, spreader brackets, clamp pins, Pierce brac ets, hammer drill, expansion bolts, etc. Mr. C. L. Pier Jr., represented the company. National Metal Mouldi Company showed samples of its "sherarduct," "flexste conduit and armored conductor and "flexduct." Mr. C. Cushing was in attendance. The H. T. Paiste Compa placed on exhibition samples of its standardized and int changeable porcelain and iron conduit fittings in charge Mr. W. M. Winship.

Among the various other companies having exhibits the hotel veranda were the Duplex Metals Company, sa ple case of its products; Sangamo Electric Company, n ters; Pittsburgh High-Voltage Insulator Company, por lain insulators and cut-outs. Companies represented at convention but not making exhibits were as follows: Al Chalmers Company, Messrs. J. B. Nicholson and S. Payne; Art Brass & Fixture Company, Mr. L. R. Jeffor American Conduit Manufacturing Company, Mr. R. Jaynes; American District Steam Company, Messrs. C. Bishop and W. J. Kline; Buckeye Electric Compa Messrs. F. C. Foster, J. M. Smith, C. I. Barry and H. Porter; Bryan-Marsh Company, Mr. D. E. Eyman; Cro er-Wheeler Company, Messrs. R. H. Smith, J. O. Stan and W. F. Ficklen; Cleveland Electric Supply Compa Mr. M. L. Baher; Doubleday-Hill Electric Compa Messrs. W. D. Shaler, C. P. Hill, E. Reynolds and J. Atwell; Excess Indicator Company, Mr. W. L. Lo Elliott Lewis Company, Mr. T. E. Roger; Eureka Vacu Cleaner Company, Mr. C. H. Johnson; Frick & Lind Company, Mr. J. W. Smyth; General Vehicle Compa Mr. W. White; Ludwig Hommel & Company, Messrs. Hommel and F. R. Jennings; Holophane Company, Mr. E. Mansfield; Iron City Electric Company, Messrs. C. Corbin, R. C. Murdock and J. R. Boher; Miller-Owen E tric Company, Mr. F. C. Owen; Novelty Electric Comp Mr. K. C. Sadler, Jr.; Ohio Brass Company, Mr. N. Sh Pittsburgh Pole Reinforcing Company, Mr. W. A. Combs; Robertson Cataract Company, T. E. Devine; J. Roebling's Sons Company, Mr. R. J. Smith; Rumsey E tric Company, Messrs. J. H. Burroughs and D. C. An son; Raphael Electric Company, Mr. H. M. Raphael; St

a Underground Cable Company, Mr. E. Kerschner; F. H. S..art Electric Company, Messrs. J. S. Connell and W. T. Walker; Safety Armorite Conduit Company, Mr. R. M. Morris; Union Electric Company, Messrs. J. W. Disbrow and P. H. Schaum; Wall-Winn Company, Mr. B. Wall; Wagner Electric Manufacturing Company, Messrs. J. Mstard and C. F. Succop; Western Electric Company, Messrs. F. C. Jaeger, J. Sigg, E. E. Hedler, C. B. Price, W. C. Robinson, N. C. Owen, J. R. Stuard, J. S. Rogers and C. R. Lepper.

A REFRIGERATED SIGN.

.. the recent Manufacturers' Exposition in Milwaukee .. .f the conspicuous exhibits was that of the Vilter Manufacturing Company, which showed in operation, for the purpose of educating visitors, an electrically operated ice-making machine and refrigerating equipment. A strik.. ..ture of this exhibit was a "refrigerated sign," which .. ..rly shown in the accompanying illustration. This .. was made up of about 100 ft. of ½-in. iron tubing ..ng the words, "Vilter ice machine, made in Milwau.. ..nd arranged on a black background. This line of .. formed a part of the working refrigerating exhibit, ...ecoming frosted on the outside, stood out in white .. the black background in a very effective manner, .. the refrigerating machine for sign work in a unique .. ..fective way.

..e exhibit included a vertical single-acting ammonia ..pressor of the inclosed type belted to an 8-hp electric ... The compressor is rated at 5 tons refrigerating ..ty, or 3 tons ice-making capacity, a day. Ice was manufactured by this equipment every day, and fish, fruit, flowers and other objects were frozen in solid blocks of i. for the admiration of visitors, who bestowed a great .. .f attention on this interesting exhibit. The machine, ..hibited, was operated to produce about 1 ton of ice .. the remainder of its capacity being utilized for refrig... The installation also included a double-pipe brine cooler, the pipe being used to form the dividing line or fence for the exhibit, and it also was frosted like the piping

Refrigerated Sign in Exhibit at Milwaukee Manufacturers' Exposition.

of the sign. The brine pump was driven by a 1-hp motor. In the rear of the exhibit of the Vilter Manufacturing Company was the collective exhibit of the Milwaukee brewing industry, and the Vilter Company also displayed a number of its appliances in connection with the large brew.. exhibit.

ELECTRIC CEILING FIXTURE.

The Tungstolier Company, of Conneaut, Ohio, has brought out a new fixture known by the trade name T. T. C. fixture, which is made on the sectional principle and consists of a number of interchangeable parts—a wireless body, wireless arms, bottom shell and canopy.

The wireless body has a number of holes around its circumference, so arranged that arms may be inserted to make

Fig. 1—Two-Lamp Fixture.

a two-arm, three-arm, four-arm or six-arm fixture. The holes not occupied by the arms are covered with a neat cap that screws on. The arms are ready wired and have a patented spring clip that engages the contacts in the wireless body, so that to attach an arm it is simply pushed into one of the holes and locked fast with a baffle nut which screws up with the finger and thumb.

Any one of six different types or designs of bottom shell may be used, ranging in depth from 2 in. to 10 in., and instead of being attached to piping they fasten with two screws to the side of the body and may be changed in less than a minute. The canopies are of the standard type, but are supplied in styles to harmonize with the designs of the arms and body shells.

Among the advantages to central stations and contractors claimed for the new tungstolier are that with two fixture

Fig. 2—Four-Lamp Fixture.

bodies, eighteen styles of arm (four of each style), six styles of body shell and six canopies one may build up no less than 1944 different and individual fixtures; that any style of fixture can be assembled in two minutes, and that the customer can be shown a practically unlimited assortment with a stock consisting of only eighty-six parts.

Industrial and Commercial News

The Week in Trade.

MODERATE expansion continues to be shown in the volume of business throughout the country, and the attitude toward future commitments is less conservative than has been the case for some time past. There have been a number of favorable developments in the past week, and these have assisted in promoting confidence. Among them is resumption of work at many textile mills in New England, indicating growth of trade, and affording employment to thousands of operatives; there is a better outlook for adjustment of labor differences in many of the industries, and particularly the disputes on the Western railroads, and the season of the year is opportune for advancement in trade. In nearly every line some improvement has been made since the end of summer. A decided expansion has taken place in retail trade, due to the change of season. The monthly statement of the Steel Corporation showed unfilled orders as of Aug. 31 of 3,695,985 tons, representing an increase of 111,900 tons over the July report. A temporary decrease has taken place, however, in the volume of new orders in the iron and steel trades, and owing to the mild response to the recent cut in wire products shading is becoming more general. Tonnages on several of the railroads, particularly those in the West, are slightly heavier than at this time last year, and further decrease is reported in the number of idle cars. Earnings, however, are not satisfactory, operating expenses being large, and not in proportion to the freight handled. Movement of crops, foodstuffs and live stock is becoming more pronounced, and prospects appear good for early increase in the volume of business now handled by many of the roads. Business failures for the week ended Sept. 7, as reported by *Bradstreet's*, were 194, as compared with 164 last week, 173 for the corresponding week in 1910, 191 in 1909, 191 in 1908 and 172 in 1907.

The Copper Market.

DECREASE of 4,297,397 lb. in copper stocks in this country was shown in the August report of the Copper Producers' Association. Stocks on hand as of Sept. 1 were 133,441,501 lb., as compared with 137,738,858 lb. as of Aug. 1. Production increased from 112,167,934 lb. in July to 125,493,667 lb. in August. Domestic consumption was 59,935,364 lb. in August, as compared with 56,982,582 lb. in July, and was slightly larger than had been expected. Export deliveries were 69,855,660 lb., as against 74,880,658 lb. in

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.95	12.05	....
September	11.95	12.05	12.00
October	11.95	12.05	12.00
November	11.95	12.05	12.00
December	11.95	12.05	12.00

The London market, Sept. 12, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	55 5 0	55 3 9
Standard copper, futures	55 18 9	55 17 6

Extreme fluctuations for this year:

	Highest.	Lowest.
[illegible]	12.35c	11.57½c
[illegible]	£57 10 0	£53 7 6
[illegible]	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

the previous month. There is nothing in the report to indicate improvement in the situation. The excess of consumption over production in July caused substantial reduction in the stocks that were on hand at the beginning of that month, but this encouraging feature was absent in August. Total deliveries last month were 2,072,216 lb. less than in July and production was 13,325,733 lb. larger, so it is evident that the small reduction in surplus stocks in August does not signify marked progress in adjusting the relation between supply and demand. There is no likelihood of an increase in domestic consumption of copper until a decided expansion takes place in general business. In view of the outlook for further dullness in the copper industry in this country, the present decrease in foreign demand shown by the August report is a matter of grave importance. There is a probability that electrolytic wil go as low as 12¼ cents cash before consumers will begin t purchase in large amounts. Exports for the present montl including Sept. 12, were 9969 tons. The daily call on th Metal Exchange Sept. 12 quoted copper as per the accompany ing table.

Industrial and Commercial Notes

Westinghouse Government Contracts.—A contract ha been awarded the Westinghouse Electric & Manufacturin Company by the Bureau of Yards and Docks, Navy Depart ment, for furnishing and installing a complete equipment cor sisting of motors and control apparatus for two large elec trically operated pumps for Dry Dock No. 2 at the Unite States Navy Yard, Norfolk, Va. There will be two centrifug pumps, each having a discharge opening of 42 in. in diamete and each driven by a Westinghouse 300-hp induction moto There will also be one smaller pump having a 15-in. discharg and driven by a 65-hp induction motor, and in addition a sma bilge pump with a 3-hp motor. The United States Reclamatio Service has recently ordered from the Westinghouse compan for installation on the Boise project, Idaho, three 625-k 22,000-volt, three-phase, air-blast-type transformers. Anoth contract is from the United States Quartermaster's Depar ment, for furnishing the necessary transformers, wattmete and switchboards for the army post located at Ft. Blis Tex., and at the Angel Island Recruit Depot near San Francisc The post is to have an electric-lighting system installed, energ being purchased from the local electric company. The app ratus is for the purpose of distributing, controlling and mea uring the current consumed in the various buildings of the army posts. Recently the company furnished two 75-k direct-current, engine-type generators for installation in tl McKinley Manual Training School at Washington, D. (which school is under the direction of the commissioners the District of Columbia. This order represents an additi to the plant already installed in the school, which consis of a Westinghouse direct-current generator. The Bureau Insular Affairs has recently awarded a large contract to t same company for electrical equipment to be used by the Por Rico Irrigation Service at Guayama, P. R. This contra includes a three-phase, 2300-volt, 60-cycle, 700-kw alternat which will be driven by a 1000-hp Pelton water-whe and nine transformers with an aggregate capacity of 1500 k together with the necessary switchboard and protective a paratus for the 2200-volt transmission line and substatic The present plans include a duplication of this order later c thus doubling the capacity of the irrigation plant, in the eve that the irrigation project proves satisfactory.

German Locomobile Engines.—A large electrical oper ing company is considering the importation of several Germ locomobile units, which consist of a boiler and engine combin in one structure. It is stated that the price, with delive in this country, approaches the cost here of an ordinary boi and engine of the same capacity. Tests of this type of pri mover have shown an economy as low as 0.783 lb. of coal p brake horse-power, and the makers guarantee a consumpti of 1.25 lb. Negotiations are also now pending for the Ame can rights for the manufacture of one of the German types locomobiles. An output to date of 27,000 locomobiles claimed by one of the German companies.

Hydroelectric Equipment Wanted for Panama Canal. The Isthmian Canal Commission invites sealed proposals befo Oct. 9 for plant and material for a hydroelectric station Gatun. Three water turbines of 2250 kw each; three governo three headgates, three penstocks, three compressed-air regu tors, three 2500-kva, three-phase, 220-volt, 25-cycle alternato two 100-kw motor-driven exciters, three 50-kw exciters, a lub cating system and a 20-ton traveling crane are required. T switchboard, cable control and electric fixtures will be adv tised for later. Address inquiries to the commission at Wa ington for Circular No. 648.

St. Louis Terminal Electric Sign.—The Illinois Traction stem, of which H. E. Chubbuck, Peoria, Ill., is general anager, is planning to install a large electric flashing sign ove its new St. Louis terminal passenger station. The sign 'l be about 25 ft. wide by 60 ft. high, with lettering large ough to be read from a distance of six or eight blocks on Twelfth Street, an important St. Louis thoroughfare. The sign will be illuminated by about 2000 5-watt tungsten lamps. is planned to reproduce on the sign a large interurban passenger car and a block-signal post and blade showing the gnal in operation and conveying the impression of a moving ar. The sequence of the flash features will be such that the gnal blade, approximately 10 ft. long, will "clear"; then a ong or whistle will sound, a large electric head-lamp will flash om the front of the car, the wheels apparently will revolve nd the track pass under them to the rear. The sign will st about $2,500 and will be a permanent advertising feature. will be operated from dusk until midnight. The sign will constructed with an angle-iron framework, including by 3-in uprights and 1 5-in by 1-in cross-braces. The er will be inclosed in a metal house on the roof of the rminal passenger station. The sign, when completed, will the largest flashing sign in St. Louis.

German Electrical Men Active in China.—Before the ys and means committee of the Chicago Association of ommerce, Hon. William J. Calhoun, American Minister to hina, delivered an interesting address on Sept. 6. The llowing quotation from his speech is of especial interest to trical men: "The trouble with Americans is that if they send a bill of goods and draw a draft for it and have id, that satisfies them, but they make no effort to cultivate oreign market. All the other national interests have their ple on the ground. Take the Germans, for instance; they practically monopolizing the electric business and doing a y large business in electrical apparatus, because that is one e things that the Chinese are taking to. Even cities away mote districts have electric light plants, and the Germans n the ground ready to supply all the demands in that line."

Escher-Woiss Turbines.—The Swiss firm of Escher-Woiss Company has received from the Rio de Janeiro Light & wer Company orders for two 19,000-hp tangential wheels to k under a head of 950 ft. Another recent order received is company has been from the Tata Hydroelectric Power any, of Bombay, for four turbines of 13,200 hp and two 100 hp, designed for a head of 1680 ft. The Fuji Cotton of Japan has ordered four turbines of 300 hp each, and of 100 hp for a head of 280 ft. The total capacity of er turbines ordered from the Swiss firm during the month August aggregated 130,000 hp.

Chinese Electrical Contractors.—A concern known as the uong On Lung Company has been formed in New York for g a general electrical contracting business, and has located fices in close proximity to the Chinese quarter of the city. resentatives of the firm have been working in both New and Brooklyn and have been instrumental in bringing al new customers to the Edison Electric Iluminating Com- of Brooklyn through sales of washing machines they have to their countrymen.

Allied Machinery Company of America.—Captain G. L. n, vice-president and general manager of the Allied inery Company of America, is still in Paris arranging ranch offices in a number of European cities. The home of the company, 55 Wall Street, New York City, has engaged with the preparation of price lists for use of e foreign agencies. C. N. Thorn, manager of the local , states that business prospects are encouraging.

Proposed Foreign Tramway and Lighting System.—The *Consular and Trade Reports* states that the representa of a foreign government now in this country has asked it be announced that a municipality in his country having a pulation of 100,000 proposes to build an electric-light and treet-railway plant. The address of the municipality may be btained from the Bureau of Manufactures, Washington, by eferring to file No. 7303.

Aluminum Notes and Prices.—There has been little hange in the aluminum market during the week. Ingots for emelting are quoted at 20 cents to 22 cents spot No. 1 the ase for large ingots. Rods and wire are held at 31 cents, nd sheets at 33 cents.

Financial.

The Week in Wall Street.

RESUMPTION of the irregular trading that was in evidence during the recent decline took place in the closing days of last week, and prices moved downward, accompanied by loss of the cheerful tone that prevailed in the first few days of the month. In the market on Monday of this week many stocks sold at new low levels for the year, but made sufficient recovery late in the day for slight gains to be registered. A feature of the heavy selling was the strength of Canadian Pacific, which led the declining market last week. Conditions on foreign exchanges have improved somewhat, and many issues have recovered from the weakness noted recently abroad. Sales for foreign account were in large volume on Monday, and broadened the scope at the market. Trading on Tuesday showed little improvement, small advances taking place after a day of irregularity. Opening prices were a little higher, on advances of international stocks, but fluctuated until near the close, and then advanced. Although news from abroad on the Moroccan trouble was unfavorable, closing prices on foreign exchanges were steady, and trading was not in accordance with the news. While relations between France and Germany are strained, negotiations are still in progress, and financial circles do not expect a serious outcome. Repetition of the foregoing markets was the case on Wednesday, with a break in early prices and partial recovery at the end of the day. There is a general impression that the declines have been the result of professional operation. Features of interest during the week have been the progress toward settlement of labor troubles on Western roads, reports of railroad earnings, and the possibility of a lower dividend rate on the New Haven road. Shipment of currency to Canada and movement of money abroad have also been incidents of the week. The local money market has been quiet. Rates Sept. 12 were: Call, 2¼@2½ per cent; ninety days, 3¼@3½ per cent. The quotations in the tables are those at the close, Sept. 12.

NEW YORK.

	Sept. 5.	Sept. 12	Shares Sold		Sept. 5.	Sept. 12.	Shares Sold.
Al. Ch., pf..	18	18*	700	Int. Met., pf.	44⅜	42	7,675
All. Ch......	6½	6⅜*	—	Mackay Cos..	83⅜	84*	100
Amal. Cop...	57¼	57	37,675	Mackay C., pf.	72	72	150
Am. D. T.	30*	[illegible]	—	Man. Elev...	135*	135	175
Am. Loco...	35⅜	34½	1,000	Met. St. Ry..	15*	15*	—
Am. Loco., pf.	105¾	105¼*	300	N.Y.&N.J.Tel.	139½*	139½	—
Am. Tel. & C.	80*	80½*	—	Steel, com...	71¼	63⅜	366,500
Am. T. & T..	135	134¼	6,385	Steel, pfd....	115¾	114¾	7,000
B. R. T.....	76½	73¼	13,000	W. U. T....	75	74	1,500
Gen. Elec...	150¼	150	2,100	West'h, com..	65	63⅜	1,400
Int. Met....	15⅛	14⅝	7,000	West'h, pf..	114*	111½*	200

PHILADELPHIA.

	Sept. 5.	Sept. 12.		Sept. 5.	Sept. 12.
Am. Rys...........	44½	44	Phila. R. T.......	22⅜	22¼
El. Co. of A........	11¼	11⅞	Phila. Elec........	16⅞	16½
Elec. St. Bt'y......	53	52	Phila. Trac.........	85	85⅛*
Elec. St. Bt'y, pf..	30⅞	30*	Union Trac.......	50¾	50

CHICAGO

	Sept. 5.	Sept. 12.		Sept. 5.	Sept. 12.
Chi. City Ry.....	186*	186*	Com. Edison.....	133½	135
Chi. Elev. Rys.....	25*	26*	Chi. Subways.......	2¾*	2¾
Chi. Elev. Rys., pf..	90*	89½*	Chi. Tel. Co.......	120½	122
Chi. Rys., Ser. 1....	95*	92*	Nat'l Car...........	100*	100
Chi. Rys., Ser. 2....	29⅞	29⅞*	Nat'l Car, pf.	118½*	118½

BOSTON.

	Sept. 5.	Sept. 12.		Sept. 5.	Sept. 12.
Am. T. & T........	135¼	134¾	Mex. Tel..........	4¼	6*
Cum. Tel..........	156*	156*	Mex. Tel., pf.......	6*	6*
Edison Ill..........	284½	280*	N. E. Tel.........	145	145½*
Gen. Elec..........	151	150½	W. T. & T.........	16	17*
Mass. E. Ry.......	18	18¼	W. T. & T., pf.	98	96½*
Mass. E. Ry., pf....	86½	87½			

*Last price quoted.
Shares sold for the week, Sept. 5 to Sept. 12.

Financial Notes.

Traction Merger on Pacific Coast.—The Pacific Electric Railway of Los Angeles has been incorporated at Sacramento with an authorized capital of $100,000,000 to take over a large number of interurban trolley lines controlled by the Southern Pacific Company in southern California. The incorporators of the new company are William F. Herrin and W. C. Martin, of San Francisco; R. C. Gillis and Paul Strong, of Los Angeles, and Epes Randolph, of Tucson, all of whom are Southern Pacific officials. Among the companies that will be included in the merger are the Pacific Electric Railway of

Los Angeles; the Los Angeles Interurban Railway, Riverside & Arlington Railway, of Riverside, Cal.; San Bernardino Valley Traction Company, Redlands Central Railway and the San Bernardino Interurban Railway Company. It is stated that the consolidation was effected in order to place the interurban lines of the Southern Pacific Company in more compact form, with a view to facilitating the present methods of operation. Improvements on a large scale are being planned, including numerous extensions to the lines of the various companies. An expenditure of approximately $30,000,000 will be made for building lines that will double the present mileage, bringing this up to a total of 2000 miles, extending as far north as Santa Barbara and south to San Diego. This expenditure will be made gradually, and no immediate financing is under consideration at present in this connection. It is understood that the stock of the new holding company will be placed in the treasury of the Southern Pacific Company.

American Power & Light Company.—Stockholders of the American Power & Light Company have subscribed to approximately 95 per cent of the $2,200,000 ten-year, 6 per cent gold notes which, as recently described in these columns, were offered to them for subscription on July 5 to the extent of 25 per cent of their stock holdings. The right to subscribe expired at the close of business on Sept. 1. An underwriting syndicate has taken up the amount not subscribed for by stockholders. Inasmuch as many of the stockholders live abroad the extent to which they have responded is unusually gratifying. A feature of the offering is the introduction of the option warrant idea. Each note is accompanied by an option warrant giving the holder the right to subscribe to the company's common stock at par at any time during the next ten years. As the option warrants are detached and transferable, those who subscribed to their allotment of notes have the privilege of holding both the notes and the option warrants or of selling either of these.

Interborough Rapid Transit Company.—The pamphlet report of the Interborough Rapid Transit Company for the year ended June 30, 1911, shows a gross operating revenue of $29,767,352, compared with $28,987,648 in 1910, representing a gain of $779,704. Operating expenses were $12,368,981, an increase of $1,355,839, due, according to President Shonts, to the operation of ten-car express and six-car local trains. Net operating revenue was $17,389,371, as compared with $17,974,505 last year, a decrease of $576,134. Gross income was $15,813,195, as compared with $16,635,107 last year. The surplus over dividends of 9 per cent on the capital stock, as stated by Mr. Shonts, was $1,990,036, a decrease of $942,110, or 32.13 per cent.

Sterling Insulated Wire Company in Receiver's Hands.—On petition of Eastern creditors the Sterling Insulated Wire Company, of 1910 West Kinzie Street, Chicago, was placed in the hands of a receiver on Sept. 8. The liabilities of the company are about $95,000 and the value of the assets available for commercial creditors is about $30,000. E. D. Buell, 53 West Jackson Boulevard, Chicago, was appointed receiver. Samuel Mankowitz was president of the bankrupt company and Jacob Geiserowich was secretary. Aside from a Chicago bank, whose claim is preferred under the present bankruptcy law, the other creditors are mainly manufacturing concerns with headquarters in Eastern States.

Consolidation of Frederick (Md.) Electric Properties.—The Frederick Railroad Company has secured complete control of the Frederick Gas & Electric Company. Announcement has been given that no change will be made in the management of the company. Some time ago the railroad company acquired a controlling interest in the electric company and now has complete ownership of it. The latter is capitalized at $200,000, divided into $100,000 preferred and $100,000 common stock. Both common and preferred stock are divided into shares valued at $25 each. The two companies are under control of home capital.

Kellogg Switchboard Sales.—Business of the Kellogg Switchboard Company in July and August has shown an increase of over 3 per cent as compared with the corresponding months last year. The plants of the company are now working at full capacity, and all departments are employing their full complement of men.

Cuyahoga Telephone Company.—Charles A. Otis, president of the Cuyahoga Telephone Company of Cleveland, Ohio, said in a recent interview that no steps have yet been taken toward the consolidation of the Cuyahoga and Cleveland Telephone companies, and that he thought this would not b undertaken for some time yet. It is the belief of some tha several different plans will be submitted to the Ohio Publ Service Commission for the consolidation when the time come in order that the handling of the matter may be facilitated.

Western Union Telegraph Company.—Present earning of the Western Union Telegraph Company are showing a increase over the returns for the corresponding period in 191 and it is believed that earnings for the quarter ending Sept. will be close to 15 per cent in excess of those for the san quarter last year. This would mean net returns of approx mately $2,220,000, as compared with $1,941,066 in the quart last year. Net earnings for the quarter ended June 30, 191 were $1,982,483.

North American Company.—The Union Electric Light Power Company, of St. Louis, the Detroit Edison Compa and the Milwaukee public utility companies, subsidiaries of t North American Company, are showing an increase of son 12 per cent in the volume of business done. Valuable d posits of gas and coking coal were found recently on co holdings of the North American Company, in Kentucky, a officials of the company are expecting a substantial increa in revenue from the sale of this product.

Seattle Traction Official Sentenced.—Having violated ruling of the Washington Public Service Commission pr hibiting more than a 5-cent fare without transfer privile within the corporate limits of Seattle, W. R. Crawford, ma ager of the Seattle, Renton & Southern Electric Railway Co pany, has been sentenced to thirty days' imprisonment. M Crawford made an appeal to the Superior Court, and w released on $500 bond.

Louisville Lighting Company.—The municipality of Lou ville, represented by Mayor W. O. Head, has indicated th it will not dispose of its stock in the Louisville Gas Compa which owns the Louisville Lighting Company, at 120, t price offered by H. M. Byllesby & Company, of Chicago. It stated, however, that negotiations for the purchase of t company have been begun by a Philadelphia company.

Bell Telephone Company of Pennsylvania.—A meeti of the stockholders of the Bell Telephone Company of Per sylvania has been called for Sept. 28 to act upon purchase the Emporium Telephone Company, a small independent co pany operating in McKean and Potter Counties, Pennsylva

DIVIDENDS.

Buffalo General Electric Company, quarterly, 1½ per ce payable Sept. 30.

Manila Electric & Lighting Corporation, quarterly, 1¼ cent, payable Oct. 2.

Northern Ohio Traction Company, quarterly, preferred, per cent, payable Oct. 1.

Philadelphia Traction Company, semi-anuual, $2 per sha payable Oct. 2.

Tri-City Railway & Light Company, quarterly, preferr 1½ per cent, payable Oct. 2.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Surj
BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.					
July, 1911	$83,738	$41,121	$42,617	$29,935	$12
July, 1910	76,059	39,431	36,628	29,913	6
COLUMBUS ELECTRIC COMPANY.					
July, 1911	$39,623	$17,888	$21,735	$14,362	$7
July, 1910	38,532	17,917	20,615	17,848	2
DALLAS ELECTRIC CORPORATION.					
July, 1911	$125,037	$81,610	$43,427	$25,993	$17
July, 1910	117,270	85,473	31,797	26,842	4
EL PASO ELECTRIC COMPANY.					
July, 1911	$51,834	$30,777	$21,057	$8,318	$1[illegible]
July, 1910	49,351	29,557	19,794	8,215	11
GALVESTON-HOUSTON ELECTRIC COMPANY.					
July, 1911	$136,113	$76,069	$60,044	$25,105	$3[illegible]
July, 1910	122,097	65,989	56,108	26,609	2[illegible]
MINNEAPOLIS GENERAL ELECTRIC COMPANY.					
July, 1911	$106,997	$42,469	$64,528	$39,143	$2[illegible]
July, 1910	88,965	35,854	53,111	30,724	2[illegible]
NORTHERN TEXAS ELECTRIC COMPANY.					
July, 1911	$131,383	$66,878	$64,505	$25,592	$3[illegible]
July, 1910	125,943	68,147	57,796	20,273	3[illegible]
PUGET SOUND ELECTRIC RAILWAY.					
July, 1911	$163,774	$92,833	$70,941	$50,818	$2[illegible]
July, 1910	182,986	102,104	80,782	51,292	2[illegible]90
SAVANNAH ELECTRIC COMPANY.					
July, 1911	$64,038	$45,487	$18,556	$18,358	98
July, 1910	59,140	40,942	18,198	18,193	5
SEATTLE ELECTRIC COMPANY.					
July, 1911	$467,869	$247,595	$220,274	$115,681	$10[illegible]93
July, 1910	459,059	261,510	197,549	110,374	8[illegible]75
TAMPA ELECTRIC COMPANY.					
July, 1911	$57,252	$29,450	$27,802	$6,929	$2[illegible]73
July, 1910	51,506	28,900	22,606	6,711	1[illegible]95

General News

Construction News.

[illegible]MINGHAM, ALA.—The [illegible] Railway, Light & Power [illegible] has recently placed contracts for [illegible] 625-kva Allis-Chalmers [illegible] steam turbine, which will [illegible] [illegible] power [illegible] condensing equipment [illegible] and also with two [illegible] General Electric turbines. [illegible] equipment is manufactured by the Westinghouse [illegible] Ma- [illegible] Company. Contract has also been awarded to Henry R. Worthing- [illegible] New York, N. Y., for [illegible] cooling towers, which will be [illegible] in connection with the condensing apparatus. The Westinghouse [illegible] & Manufacturing Company has been awarded contract to [illegible] rotary converter to be used for the railway service.

[illegible] ALA.—The installation of a [illegible] electric-light plant [illegible] to cost about $7,500, is reported to be under consideration.

[illegible]ON ISLAND, ALA.—The [illegible] Island Railway & Harbor [illegible] is reported to be contemplating the installation of an electric [illegible]. T. W. Nickel, Bank of Mobile Building, Mobile, is chief [illegible].

[illegible]ETTEVILLE, ARK.—The Fayetteville Electric Light & Power [illegible]ny is planning to install a 350-kva Westinghouse turbine Oct. 1 [illegible] is manager.

[illegible]VETTE, ARK.—The installation of electric-light and water-works [illegible] in Gravette is reported to be under consideration. It is ex- [illegible] that an election will soon be called to vote on the proposition.

[illegible]TLE ROCK, ARK.—The Bankers' Rice Growing Company is re- [illegible] to be in the market for equipment for an electric generating plant [illegible] of developing 800 hp and also for twelve 60-hp motors. S. C. [illegible], Southern Trust Building, Little Rock, Ark., is president of the [illegible].

[illegible]TON, CAL.—The city of Colton has entered into a contract [illegible] Southern California Edison Company whereby the latter will [illegible] energy to the city at $1\frac{1}{2}$ cents per kw-hour. The former price [illegible] cents per kw-hour.

[illegible]WNEY, CAL.—The Downey Light, Power & Water Company [illegible]mpleted its extension to the Norwalk district and is now supply- [illegible]ectrical service in that territory.

[illegible]ALON, CAL.—The Escalon Water & Light Company, recently [illegible]rated, is planning to install an electric-lighting system in Es- [illegible] J. W. Smith, S. T. Irwin and others are interested in the [illegible].

[illegible]ONDIDO, CAL.—The Escondido Mutual Telephone Company, [illegible]y organized, is planning to erect a telephone system between [illegible]lido and Oceanside, to connect with the long-distance lines of [illegible]ome Telephone Company. The cost of the system is estimated [illegible].

[illegible]LERTON, CAL.—An electric power plant will be installed in [illegible]tion with the group of polytechnic high school buildings to be [illegible] in Fullerton, plans for which are being prepared by Norman [illegible]rsh, of Los Angeles, Cal., architect.

[illegible]NDALE, CAL.—The city is planning to install an ornamental [illegible]ighting system. Cluster lamps will be used.

[illegible]LEWOOD, CAL.—The Southern California Edison Company is [illegible]ing the output of its substation in Inglewood. An arc-lamp street [illegible] system will be installed.

[illegible]IESTOWN, CAL.—Plans are being considered to equip the Rio [illegible] mine, located on Knight's Creek, with electric motors for auxili- [illegible].

[illegible]GSBURG, CAL.—The city of Kingsburg has awarded the con- [illegible] for the construction of a new power house to Johnson Brothers.

[illegible]S ANGELES, CAL.—The Board of Public Works has appropriated [illegible] to defray the expenses of Prof. Harris J. Ryan, consulting en- [illegible] for the Power Bureau, E. F. Scattergood, chief engineer, and his [illegible]nt, T. A. Panter, of the Power Bureau, on a trip of inspection [illegible] investigation of hydroelectric developments in the Northwest and [illegible] in connection with preparing plans for the generating equipment [illegible] aqueduct.

LOS ANGELES, CAL.—The Pacific Electric Railway Company, re- [illegible]ntly incorporated with a capital stock of $100,000,000, has taken over [illegible] various interurban electric railways controlled by the Southern [illegible]cific Company in southern California. Among the railways in the [illegible]rger are the Pacific Electric Railway Company, Los Angeles Pacific [illegible]mpany, Los Angeles & Redondo Railway Company, Los Angeles Inter- [illegible]ban Railway Company, Riverside & Arlington Railway Company, San [illegible]rnardino Interurban Railway Company. Plans have been approved, [illegible] is said, for an expenditure of about $30,000,000 for new construction, [illegible] purpose being to increase the total trackage from 1000 miles to 2000 [illegible] [illegible] in the near future. The incorporators are: William F. Herrin, R. C. Gillis, W. C. Martin, Epes Randolph and Paul Shoup.

MONTEREY, CAL.—The Monterey & Pacific Grove Railway Company is planning to extend its railway from Nineteenth Street in Pacific Grove to the Presidio of Monterey.

MOUNTAIN HOUSE, CAL.—Arrangements are being made to equip the machinery at the Omega Mihe, near Mountain House, for electrical operation. At present steam power is used.

NEVADA CITY, CAL.—The Pacific Telephone & Telegraph Company is planning to erect a telephone line from Camptonville to Loyalton, a distance of about 80 miles. James Dolan is superintendent of construction in this district.

NEVADA CITY, CAL.—Plans have been approved by the Pacific Gas & Electric Company for the construction of a large dam at Lake Spaulding, which will have a storage capacity of 2,500,000 cu. ft. From this reservoir the water will be conveyed through tunnels and ditches to Bear River. The power plant is to be erected on property formerly owned by the South Yuba Water Company's system, which was absorbed by the Pacific Gas & Electric Company the first of the year. The proposed plants will develop 71,000 hp and will include the erection of a high-tension transmission line from the power plants on Bear River to the Bay centers. The cost of the dam is estimated at $3,000,000 and the entire project will involve an expenditure of about $10,000,000. Rights of way are being obtained for a tower line to tie in with the present system of the company, which covers a large territory in Central California and aggregates in high-tension lines alone about 1100 miles.

OCEANSIDE, CAL.—The Pacific Light & Power Company has commenced work on construction of its dam at the headwaters of the San Luis River, near Oceanside. A hydroelectric plant will be installed later.

OCEANSIDE, CAL.—Plans are being considered by the Young Company for the installation of an ornamental lighting system on the property along the ocean front. J. W. Young, of Long Beach, is interested in the company.

ORO GRANDE, CAL.—The Oro Grande Portland Cement Company, it is reported, is planning to construct an electric railway from Oro Grande and Barstow up the Mojave River valley. Oro Grande has not a post office.

PASADENA, CAL.—The installation of an electrical incinerator at the city sewer farm is under consideration.

PASADENA, CAL.—The installation of an electric power plant, program clocks and intercommunicating telephone system is planned in connection with the new polytechnic high school buildings in Pasadena. About $423,000 is available for the work, plans for which have been completed by Norman F. Marsh, of Los Angeles, Cal., architect.

RIVERSIDE, CAL.—An agreement has been reached between the City Council and the officials of the Pacific Electric Railway Company whereby a franchise will be granted the company for the construction of an electric railway over the Magnolia extension. The company is completing a railway from Arlington to the county line, which will soon be extended from Locust Street to Fairmount Park. The line will eventually be extended from Riverside to Colton. Paul Shoup is vice-president of the company.

SACRAMENTO, CAL.—It is reported that the City Trustees have adopted a design for electroliers to be erected in the business district of the city under the direction of the Retail Merchants' Association. Specifications for installation of electroliers have been submitted to the City Trustees.

SACRAMENTO, CAL.—The Board of Supervisors has awarded the contract for lighting the streets of Oak Park, Curtis Oaks, Highland Park and East Sacramento districts to the Pacific Gas & Electric Company. Under the terms of the franchise the company is to supply arc lamps at the rate of $6 each per month.

SAN BERNARDINO, CAL.—Negotiations have been closed between Victor Smith, trustee for the Arrowhead Reservoir & Power Company and the Westwater Power & Water Company, of Los Angeles, whereby the Arrowhead Reservoir & Power Company has purchased several thousand acres of land and valuable water rights in the Mojave River from the Westwater Power & Water Company. The Arrowhead Reservoir company is building a large reservoir at the headwaters of the Mojave in Little Bear Valley in the San Bernardino Mountains for the development of a large tract of intermountain arid lands.

SAN DIEGO, CAL.—The Normal Heights Improvement Association is planning to form a lighting district and will apply to the Board of Supervisors to install an electric street-lighting system. The service will probably be supplied by the San Diego Gas & Electric Company, of San Diego, Cal.

SAN FERNANDO, CAL.—H. J. Whitley and O. I. Bent are interested in a project to build an electric railway to connect San Fernando with Los Angeles. The cost of the proposed railway is estimated at about $40,000.

SAN FRANCISCO, CAL.—The State Board of Harbor Commissioners has granted the American-Hawaiian Steamship Company permission to install an electric fire alarm system on its property.

SAN FRANCISCO, CAL.—The Board of Supervisors has voted to appropriate the sum of $7,500 to secure the services of Bion J. Arnold, of Chicago, Ill., to investigate the local street railway situation. There are [illegible] independent systems, one being owned by the [illegible] plant.

SAN FRANCISCO, CAL.—The properties of the San Francisco & Napa Valley Electric Railroad Company will be sold at public auction on Oct. 30 in San Francisco. The bond issues amount to $1,500,000. The railway is operating from Benicia to St. Helena, via Napa and Napa Valley, a distance of 30 miles.

SAN FRANCISCO, CAL.—The contract for electrical work in connection with the Masonic Temple, located at 101 Post Street, San Francisco, Cal., for the Masonic Temple Association, has been awarded to the General Electric Company, at $7,900. Bliss & Faville, Balboa Building, San Francisco, are architects.

SAN FRANCISCO, CAL.—Application has been made by the West Side Railroad Company for a charter to build an electric railway to connect Sacramento and Rio Vista. The capital stock of the company is placed at $1,000,000. The directors are: William Herlitz, treasurer; B. P. Lilienthal and H. W. Furlong. The headquarters of the company are located at 310 Sansome Street, San Francisco, Cal.

SAN FRANCISCO, CAL.—The large power ditch of the Northern California Company along Battle Creek on the southern border of Shasta County is nearing completion. The ditch is 16 ft. wide at the bottom and 6 ft. deep and 11½ miles long and carries water to the lower power house of the Northern California Company at Coleman, which is the fourth power plant on Battle Creek owned by the company, making a total development of 44,000 hp on Battle Creek. The water is used the first time at Volta, where 9,000 hp is developed, the second time at the South power house and the third time at Inskip.

SAN LUIS OBISPO, CAL.—A franchise has been granted to Walter G. Lincoln to build and operate an electric railway in San Luis Obispo.

SANTA ANA, CAL.—The Pacific Electric Railway Company has been granted permission to equip the tracks of the Southern Pacific Railroad on East Second Street for electrical operation.

SANTA ANA, CAL.—The Board of Trustees has rejected the offer of the Southern California Edison Company to sell its distributing system to the city for $165,000. A new lighting contract will be awarded the company at rates fixed by the board.

STOCKTON, CAL.—The City Council, it is understood, will soon ask for bids for the installation of a conduit street-lighting system, with electroliers, in the business district of the city.

WOODLAND, CAL.—The Vallejo & Northern Railway Company has begun work on the construction of its proposed electric railway from Woodland to Sacramento. The railway will be known as the Sacramento-Woodland Electric Railway.

CANON CITY, COL.—It is reported that H. M. Byllesby & Company, of Chicago, Ill., have secured an option on the entire holdings of the Colorado Light & Power Company, of Canon City. The consideration is said to be between $1,500,000 and $2,000,000. The Colorado Light & Power Company supplies electrical service in the Cripple Creek district and the towns of Canon City, Florence, Concrete, Williamsburg and other places in Fremont County.

BRIDGEPORT, CONN.—The Warner Brothers Company, of Bridgeport, Conn., has just completed a $250,000 power plant. The equipment consists of six boilers, arranged in pairs, four engines, two cross compound and two simple, and four generators.

WALLINGFORD, CONN.—The Board of Electric Commissioners has placed orders for a new 250-hp boiler to be installed in the steam plant of the borough electric system. The cost of the boiler is estimated at about $4,000 and extension to the power plant to make room for boiler will cost about $2,000 more.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has purchased the franchise granted by the Street and Sewer Department to the Commercial Heat, Light & Power Company in 1907, which gives the company a monopoly of city lighting privileges in this city.

WASHINGTON, D. C.—The Westinghouse Electric & Manufacturing Company has recently furnished two 75-kw direct-current engine-type generators for installation in the McKinley Manual Training School, at Washington, D. C.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Sept. 18 for furnishing underground signal and telephone cable. Specifications and form of proposals may be obtained from the purchasing officer of the District of Columbia.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 28, for furnishing and installing lighting fixtures in the United States buildings at Columbus, Ind.; Granite City, Ill.; Macon, Mo.; Palestine, Tex.; Santa Cruz, Cal., and Eagle Pass, Tex., in accordance with drawings and specification, copies of which may be obtained at this office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—The Westinghouse Electric & Manufacturing Company has recently received a contract from the United States Quartermaster's Department, Washington, D. C., for furnishing necessary transformers, wattmeters and switchboards for the army posts located at Ft. Bliss, Tex., and at the Angel Island Recruit Depot, near San Francisco. An electric-lighting system is being installed at Ft. Bliss, energy for which is secured from the local electric-light plant.

BRUNSWICK, GA.—Plans are being considered for the installation of an ornamental street-lighting system on Newcastle Street. The Mutual Light & Water Company, of Brunswick, furnishes the street-lighting service.

CARROLLTON, GA.—The City Council has granted the Georgia Power Company a franchise to supply electricity in Carrollton from its plant at Tallulah or from any other plant which it is developing in the north and western part of Georgia.

JACKSON, GA.—At an election held Sept. 7 the proposition to issue $12,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant and water works system, was carried. The city has decided not to take power from the Central of Georgia Power Company.

BOISE, IDAHO.—Orders have recently been placed by the United States Reclamation Service with the Westinghouse Electric & Manufacturing Company for equipment for the Boise (Idaho) irrigation project, including three 625-kva, 22,000-volt, three-phase, air-blast-type transformers.

WALLACE, IDAHO.—The Burlington Mines Company, it is reported, has commenced work on the erection of a power plant on its property, located near Wallace, Idaho.

EAST MOLINE, ILL.—The contract for the erection of a power house and office building in East Moline has been awarded to A. C. Stouffer. Work will begin as soon as possible on construction of the building, the cost of which is estimated at $7,000. Additional generators and transformers will be installed in the new building.

GREENVILLE, ILL.—The plant and holdings of the Greenville Electric, Gas & Power Company have been purchased by the Hillsboro Electric Light & Power Company, of Hillsboro, Ill. The consideration, i is understood, was $60,000. The Hillsboro company will take over the property Oct. 1. It is stated that the purchase of the property by the Hillsboro Electric Light & Power Company is part of the general plar to build an interurban railway connecting Greenville with Hillsbor and Collinsville. The Hillsboro company now owns and operate twelve electric plants located in Hillsboro, Coffeen, Irving, Witt, Ray mond, Harvel, Butler, Nokomis, Taylor Springs and Schram City Montgomery County; Collinsville and Marysville, Madison County. Ne gotiations are said to be under way for the purchase of the Troy plant

LA SALLE, ILL.—The question of installing a new lighting system i La Salle, extending from the Rock Island depot to the Illinois Centra station, is reported to be under consideration.

DECATUR, IND.—The Ft. Wayne & Springfield Traction Compan will soon place contracts for construction of an extension from Sprin field to Portland.

JASPER, IND.—The Board of Trustees has awarded the contract fc erection of addition to the power house to A. M. Hochgesang & Sor for $1,979.

MONTICELLO, IND.—Work has been resumed by the Indiana Northwestern Traction Company in grading and clearing the right-c way through Newton County for its proposed electric railway, which to connect Cedar Lake, Reynolds, Hammond, Crown Point, Rensselae Lafayette and Chicago.. Subsidies amounting to more than $50,000 ha been voted in aid of construction of the railway.

PERU, IND.—The City Council has appropriated $12,000 for ere ing ornamental electric lamps around the public square and other i provements.

ALGONA, IA.—It is reported that the City Council has authoriz a bond issue, the proceeds to be used for extensions and improvemen to the municipal light and water plant.

BOONE, IA.—The Boone Electric Company is installing a new pow plant and overhauling its transmission system. The new equipment w include two 1000-kva Allis-Chalmers turbo-generators and a 300-k motor-generator set to supply power for the railway. The switchboa is of the remote-control type furnished by the General Electric Co pany. F. W. Laas, of the Cedar Rapids & Iowa City Light & Railw Company, is chief engineer, and J. M. Drabelle, electrical engineer the same company, is in charge of the erection of the plant.

CLARINDA, IA.—The Lee Electric Light Company has completed 7-mile transmission line to the town of New Market, Ia., and the stre lamps were turned on for the first time Aug. 29. The company has al closed a contract with the Bedford Light, Heat & Power Compa whereby it will extend its transmission line from New Market to Be ford, a distance of 15 miles. It is expected to place contracts at on for material for the proposed line, including poles, wire and other m terial. The present plans call for completion of the line by Dec. Rufus E. Lee is manager of the Lee Electric Light Company.

CORYDON, IA.—Plans are being prepared for the reconstruction of a municipal electric-light system. New equipment will be installed, including engines, generators, boilers, etc. The Iowa Engineering Company, of Clinton, Ia., has charge of the engineering work.

DES MOINES, IA.—The Des Moines River Power Company, it is reported, is contemplating a water-power development on the Des Moines River about 20 miles below Des Moines. Electricity generated at the plant will be distributed in this city. A. C. Miller, of Des Moines, Ia., is interested in the project.

DES MOINES, IA.—An extension is being built to the power house of the Des Moines City Railway Company to accommodate new equipment purchased recently, consisting of one 300-kw Westinghouse rotary converter, one 500-kw General Electric rotary converter and three 750-kw General Electric transformers. Bids have been asked for coal-handling apparatus and a traveling crane for power station and for a new intake with a well with concrete walls. The necessary switchboards are to be ordered.

ELLIOTT, IA.—The Griswold Electric Light & Power Company, of Griswold, Ia., has secured the contract for supplying electricity for lighting the town.

FT. DODGE, IA.—Preparations are being made by the Northern Iowa Power & Light Company, of Humboldt, Ia., for the construction of a large dam and power house across the Des Moines River, at Ft. Dodge, which will involve an expenditure of about $200,000.

HUMBOLDT, IA.—The Northern Iowa Power & Light Company, of Humboldt, Ia., is just completing its second dam across the Des Moines River at Humboldt. The dam and other improvements will represent an expenditure of about $100,000.

IOWA CITY, IA.—The Iowa City & Davenport Railway Company has awarded the contract for construction of an interurban railway, 70 miles in length, to connect Iowa City and Davenport, to C. E. Coon, of Omaha, Neb. The cost of the proposed railway is estimated at about $2,000,000.

IOWA FALLS, IA.—A special election will be held Sept. 25 to vote on the proposition to issue a franchise to construct and operate an electric-light and heating plant in Iowa Falls.

ROLAND, IA.—The contract for the erection of the transmission line from Roland to Story City in connection with the municipal electric-light system has been awarded to C. B. Nelson, of Ames, Ia., at $402.42 per mile, and for wiring the town to C. W. Rowland, of Des Moines, for $2,896. Electricity for operating the electric-light system will be secured from the municipal electric plant in Story City, Ia.

HILL CITY, KAN.—At an election held recently the proposition to issue $50,000 in bonds for municipal improvements was carried. Of the proceeds $15,000 will be used for the installation of an electric-light plant and $35,000 for water-works system. The J. S. Worley Company, Reliance Building, Kansas City, Mo., is reported to be preparing plans for same.

KANSAS CITY, KAN.—Plans and specifications prepared by the McLaughlin Engineering Company, it is reported, have been approved by the City Commissioners. The city clerk has been authorized to call for bids for construction of the proposed plant immediately. Through oversight this item appeared under Kansas City, Mo., in the issue of Sept. 2.

ALGIERS, LA.—Plans are being considered by Joseph E. Renecky and associates to build an electric railway on Morgan Street and Patterson Street in Algiers.

BALTIMORE, MD.—It is reported that plans have been prepared for lighting the boulevard and University Parkway.

RISING SUN, MD.—Plans are being considered for the installation of an electric-light plant and water-works system in Rising Sun. H. T. Young, of Wyoming, Del., is engineer in charge.

WILTON, MAINE.—The Board of Selectmen has granted the Wilton Electric Light, Gas & Power Company and the Livermore Falls Electric Light & Power Company permission to erect transmission lines in town. The Wilton Electric Light, Gas & Power Company has sold its charter rights and privileges to the Franklin Electric Light & Power Company, of Farmington, Maine, which gives the latter company the right to extend its transmission lines from Farmington to East Wilton and Wilton villages and furnish electricity for lighting the streets and residences in both villages. Work will begin on the installation of the system at once. The Livermore Falls Electric Light Company was granted permission to erect a system in Wilton.

BEVERLY, MASS.—The Massachusetts Gas and Electric Light Commission has given its approval of the consolidation of the Beverly Gas & Electric Company with the Danvers Gas Light Company. Authority has also been given to issue 1216 shares of additional stock of the Beverly Gas & Electric Company, par value $100, at $170 a share, the proceeds of sixty-nine shares to be used to cancel the 118 outstanding shares of the Danvers company and the remainder to pay for additions to the plant.

BOSTON, MASS.—The Boston Elevated Railway Company has begun work on the construction of six new substations in Brookline, Malden, Arlington, East Boston and Roslindale.

SALEM, MASS.—The Salem Electric Lighting Company is planning to install a 3500-kw turbo-generator set, of the Curtis type, in its power station on Peabody Street. S. Fred Smith is general manager.

SHELBURNE FALLS, MASS.—Plans calling for more extensive works than those previously filed in connection with the Deerfield River development have been recorded in the office of the clerk of courts by Chace & Harriman together with a petition for approval by the County Commissioners. The site of the proposed dam is stated to be about 1000 ft. east of Scott's Bridge on the Deerfield River, near East Charlemont. The dam is to be 45 ft. high and 285 ft. long, of cement construction. The plans also call for the construction of a tunnel 2800 ft. long for the purpose of conveying the waters to a power house to be located in Shelburne Falls.

SWANSEA, MASS.—The Fall River Electric Light Company has applied to the Selectmen for location of its poles in Swansea in connection with the erection of an electric distributing system here.

WILMINGTON, MASS.—A contract has been signed whereby the Reading municipal electric-light plant will supply electricity for street lighting in Wilmington. The contract calls for the installation of 200 lamps, to cost not more than $2,600 per year.

DETROIT, MICH.—The Detroit United Railway Company is reported to be considering the construction of a new crosstown line to extend from the southwestern section of Detroit to the northwestern district and then east to the automobile industry section in the northeastern end of the city.

FREMONT, MICH.—The Board of Trade is considering a proposition to build a municipal hydroelectric power plant on White River, about 12 miles from Fremont. The cost of erecting dam, power house and equipment is estimated at about $38,000; transmission line to Fremont, $12,000, and other expenses $10,000, making the total cost $60,000.

GRAND RAPIDS, MICH.—Chris De Jonge, of Zeeland, and others are reported to be interested in a project to build an electric railway between Grand Rapids and Grand Haven via Georgetown, Blendon and Robinson.

PORT HURON, MICH.—The property of the Port Huron Light & Power Company has been taken over by James T. Lynn and associates. Mr. Lynn already owns the Port Huron Gas Company. The officers of the new company are: James T. Lynn, of Detroit, Mich., president; P. H. Phillips, of Port Huron, Mich., vice-president; V. N. Gurney, of Detroit, Mich., secretary, and J. G. Sloan, of Port Huron, Mich., manager.

FRANKLIN, MINN.—Plans are being considered by the Wherland Electric Company, of Redwood Falls, Minn., to extend its transmission lines to Franklin to supply electricity for lighting this village.

ST. PAUL, MINN.—Bids for lighting the streets of the city for the two ensuing years beginning Jan. 1, 1912, have been submitted to the Assembly by the St. Paul Gas Light Company and the Patterson Street Lighting Company. The St. Paul Gas Light Company submitted a proposal providing for the use of its present arc-lamp equipment, although the specifications did not contemplate a bid on the equipment now in use. The company offered to furnish the service with the present equipmen at the rate of $66 per lamp per year and would represent a saving of about $9,000 as compared with the present contract. The present price is $75 each per year for arc lamps with overhead service and $90 per lamp with underground service. On the combination of the present arc lamps and the new flaming arc lamps for the year 1912 the company submitted the following proposals: Inclosed-arc lamps, $69 each; flaming-arc lamps with overhead and underground service, $90 each. For 1913, inclosed-arc lamps, $67.50; for flaming-arc lamps with overhead and underground service, $90 each. It is estimated that the first year of the contract 680 of the present arc lamps would be used and 250 of the flaming arc lamps would be in service. On the ornamental lamps the company submitted a proposal of $75 a standard per year, a reduction of $5 per year from the present price. The company submitted a bid for gas lamps offering to supply the service at the same price as last year, $13 a post; for bridge lamps $2 per lamp per month. The Patterson Street Lighting Comany offered to maintain the gas lamps at $10 per lamp per year, which is a reduction of 50 cents per lamp on the present contract. The Council will soon consider bids for furnishing lamp equipment such as is now used by the Patterson company. The city has appropriated $75,000 to purchase such equipment and may do so if the bids are satisfactory.

ST. PETER, MINN.—The Consumers' Power Company is reported to have submitted a proposition to the City Council offering to supply electricity in St. Peter.

THIEF RIVER FALLS, MINN.—Plans are being prepared for the construction of an auxiliary steam-power plant in Thief River, for which bonds to the amount of $40,000 were recently sold. Bids for construction of the proposed plant will be received until Sept. 19. Erick Wolf, of Minneapolis, Minn., is engineer in charge.

HOLDEN, MO.—The question of installing an electric-light system in Holden is under consideration.

LAMAR, MO.—It is reported that additions and improvements are contemplated to the electric-light plant and water-works system involving an expenditure of about $70,000, plans for which are being prepared by Rollins & Westover, Beals Building, Kansas City, Mo.

ST. LOUIS, MO.—The Board of Public Improvements is making arrangements to connect the new city hall power plant with other municipal buildings. Bids have already been asked for furnishing and installing conduit and cables. Maxime Reber is president of the board.

ST. LOUIS, MO.—Plans are being considered by the Illinois Trac-

[illegible] electric flashing sign to be erected above its new St. Louis terminal passenger station. The sign will be [illegible] and will be illuminated by 2000 5-watt tungsten lamps and will be operated from dusk until midnight. It is proposed to reproduce on the sign a large interurban passenger car and a block-signal post and blade showing the signal in operation and conveying the impression of a moving car. The cost of the sign is estimated at $2,500. H. E. Chubbuck, of Peoria, Ill., is general manager.

TWIN BRIDGES, MONT.—It is reported that surveys are being made by the Madison River Power Company for the erection of a transmission line from Ruby for the purpose of supplying electricity for lamps in [illegible] Laurin, Sheridan and Twin Bridges.

FAIRBURY, NEB.—The installation of an ornamental street-lighting system in Fairbury is reported to be under consideration.

PLATTSMOUTH, NEB.—The question of installing a municipal electric-light plant and water works plant in Plattsmouth is reported to be under consideration.

BLACKHORSE, NEV.—A hydroelectric plant is being built on Leahman's Creek by the Amalgamated Nevada Mining Company. A distributing system will be erected to serve the mining properties in the eastern part of White Pine County.

ELY, NEV.—The Telluride Power Company, of Telluride, Col., is planning to erect a hydroelectric near Ely and to erect a transmission line to Richfield, Utah, via Pioche, Nev., and from that point to Eureka, Utah, where it will connect with the company's system there.

JARBRIDGE, NEV.—Plans are being prepared by the Crater City Company for the construction of a power plant on Three Creeks, near Jarbridge.

GARFIELD, N. J.—The Council is considering the question of installing a municipal electric-light plant, plans for which have been prepared by Daniel R. Bacon, of New York, N. Y., to cost approximately $45,000.

MILLVILLE, N. J.—The installation of municipal electric-light and water plants in Millville is reported to be under consideration.

GALLUP, N. M.—An agreement has been made whereby the various suits between the town of Gallup and the county of McKinley and the Gallup Electric Light & Power Company have been settled. The town of Gallup agrees to drop its attack on the company's franchises and rights. Negotiations are under way between the town and the company for closing a new contract for street lighting.

BINGHAMTON, N. Y.—The contract for the construction of a general power house and installation of a heating plant at the Susquehanna Valley Home has been awarded to the C. W. Mitchell Company at $4,573.

CATSKILL, N. Y.—Owing to the village authorities and the officials of the Schoharie Light & Power Company being unable to reach an agreement the municipal authorities have petitioned the Public Service Commission, Second District, to fix a price to be paid for the street-lighting service in this village under a new contract.

EPHRATAH, N. Y.—The Mohawk Hydroelectric Company has applied to the Public Service Commission, Second District, for permission to erect transmission lines in Ephratah, Palatine and Nelliston, and also for authority to issue $56,000 in bonds.

FT. PLAIN, N. Y.—The Ft. Plain Gas & Electric Light, Heat & Power Company has applied to the Public Service Commission, Second District, for permission to lease its electrical distributing system in the village of Nelliston to the Mohawk Hydroelectric Company.

NEW YORK, N. Y.—The Long Acre Electric Light & Power Company has executed a general mortgage to the Empire Trust Company covering all its property in Manhattan and the Bronx for $50,000,000. The company has received authority to issue stock and bonds to the amount of $50,000,000.

ONEIDA, N. Y.—The installation of an ornamental lighting system in Oneida is under consideration. The lighting contract expires Jan. 1, and it is proposed to have provision made in the new contract for ornamental lamp standards.

RICHFIELD SPRINGS, N. Y.—The Richfield Springs Electric Light & Power Company has petitioned the Public Service Commission, Second District, for permission to assign its franchise in Richfield Springs to the Richfield Springs Utility Company. The latter company has applied to the commission for the right to acquire this franchise and for authority to issue $47,000 in bonds.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has submitted a scheme to the East Avenue residents' committee for ornamental street lighting on East Avenue. The designs call for ornamental concrete poles, equipped witth double arms, each carrying a high power Mazda lamp.

YAPHANK, N. Y.—Bids will be received by the Board of Supervisors, Court House, Riverhead, N. Y., until Sept. 20 for furnishing material and installing electric wiring and fixtures in County Almshouse and Children's Home, at Yaphank. Information and specifications may be obtained from Myron E. Overton, clerk of Board of Supervisors, Riverhead, N. Y.

RALEIGH, N. C.—The Board of Aldermen is considering the question of placing cluster lamps on West Martin Street and Fayettevillle Street.

FT. RANSOM, N. D.—The construction of an electric railway between Enderlin and Ft. Ransom is under consideration. E. S. Lovelace, G. Jacobson and O. A. Culbertson, of Ft. Ransom, are interested in the project.

GRAFTON, N. D.—Sealed bids will be received by the Village Board of Grafton, N. D., until Sept. 22 for constructing and installing an electric-light plant and water-works system in Grafton. Plans and specifications are on file at the office of the village clerk, and the office of Elmer L. Jensen, engineer, Harvard, N. D. The cost of the work is estimated at $12,500.

DEFIANCE, OHIO.—The Ohio Electric Railway Company, of Cincinnati, Ohio, is contemplating extending its Defiance & Lima branch into Defiance. The present terminus is in the suburbs and it is proposed to extend the line as far as the Auglaize River bridge.

HIRAM, OHIO.—E. H. Rankin, of Cleveland, Ohio, has purchased the local electric-light plant and is planning to remodel and rebuild the same.

MEDINA, OHIO.—The Council on Aug. 22 granted E. H. Rankin, of Cleveland, a franchise to install an electric-light system in Medina. Mr Rankin is planning to erect a plant here, using alternating current wit gas engine power.

COLLINSVILLE, OKLA.—At an election held recently the proposition to issue bonds to the amount of $45,000, the proceeds to be used for the construction of a municipal electric-light and power plant, wa carried.

PAWHUSKA, OKLA.—It is reported that plans are being prepared for extensions and improvements to the municipal electric-light plant t cost $10,000 and for additions to the water-works system to cost abo $50,000. Albert York is city clerk.

FT. STEVENS, ORE.—Sealed proposals will be received at th office of Post Quartermaster, Ft. Stevens, Ore., until Oct. 3 for i stallation of hot-water heating, including construction of basement an electric lighting in same, in Barracks Nos. 20 and 22 at Ft. Stevens plans and specifications for which may be seen at the above office.

LAKEVIEW, ORE.—The Nevada, California & Oregon Telephone Telegraph Company has awarded a contract to C. H. Lee for the e tension of its lines to Lakeview.

MYRTLE CREEK, ORE.—The Council is reported to have voted favor of establishing water and lighting systems in Myrtle Creek.

ONTARIO, ORE.—The contract for supplying electricity to opera the pumping plants for the Ontario-Nyssa irrigation project has be awarded to the Idaho-Oregon Light & Power Company. The contra calls for 25 hp for the season with a twenty-four service, the electr company to furnish the transformer. The company also agrees erect an electric transmission line along the ditch to accommoda owners of individual pumping plants who wish to raise the water abo main ditch for irrigation purposes and will build such a line, one m for every 10 hp contracted for.

VALE, ORE.—Investigations are being made by the Telluride Pow Association, of Salt Lake City, Utah, with a view of extending transmission lines in Eastern Oregon. The company purchased t local electric plant several months ago in order to secure a foothold this section. A transmission line is now being erected from the co pany's new plant near Bliss, Idaho, to this city, a distance of over 2 miles. L. L. Nunn, of Salt Lake City, Utah, is general manager the company.

PANAMA.—Sealed proposals will be received at the office of t general purchasing officer of the Isthmian Canal Commission, Wa ington, D. C., until Oct. 6, for reinforcing grids and vault lamps. Bla and general information in relation to this circular (No. 647-A) may obtained from the above office or at the offices of the assistant purch ing agents, 24 State Street, New York, N. Y.; 615 Whitney-Cent Building, New Orleans, La., and 1086 North Point Street, San Francis Cal. Major F. C. Boggs is general purchasing officer.

PANAMA.—Sealed proposals will be received at the office of the g eral purchasing officer of the Isthmian Canal Commission, Washingt D. C., until Oct. 9, for plant and materials for hydroelectric station Gatun, including water turbines, governors, head gates, penstocks, c pressed-air regulators, electric generators, exciters, exciter sets, lu cating system, traveling cranes, etc. Blanks and general informat relating to this circular (No. 648) may be obtained at the above of or at the offices of the assistant purchasing agents, 24 State Street, N York, N. Y.; Whitney-Central Building, New Orleans, La., and 1 Point Street, San Francisco, Cal.; also at the United States engin offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Ba more, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buff N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, M Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Ten Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Cl Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Cham of Commerce and Board of Trade, Tacoma, Wash. Major F. C. Bo is general purchasing officer.

BLOOMSBURG, PA.—The Bloomsburg & Millville Street Rail Company has been reorganized and plans have been made to comp the railway. The new company will be known as the Bloomsburg, M ville & Northern Railway Company.

HARRISBURG, PA.—Application will be filed with Governor Te for a charter for the Brecknock Township Electric Company by J. Mi Miller and Richmond L. Jones. The company proposes to supply

ty for light, heat and motors in Brecknock. Application will also made for a charter for the Adamstown Electric Company which oposes to supply electrical service in Adamstown. The companies ill be subsidiaries of the Metropolitan Electric Company.

LEBANON, PA.—The contract for the construction of the Lebanon Campbelltown Street Railway has been awarded to C. J. Barr and illiam S. Davis, of Lebanon, and M. E. Brightville, of Annville. The [illegible] railway will be about 9 miles in length. [illegible] esident.

MILLERSVILLE, PA.—The Lancaster & York Furnace Street Railay Company is planning to install a turbine or 500-kw, three-phase, 25-cle, direct-connected unit in its power plant at Millersville, orders r which will be placed in the near future. E. W. Goss is general [illegible]

NEQUEHONING, PA.—The citizens are considering the question of hting the streets of the town with electricity. It is understood that e Lehigh Coal & Navigation Company has submitted a proposition to rnish the service at a reasonable rate. B. Snyder, Jr., is manager of e Lehigh Coal & Navigation Company.

W BRIGHTON, PA.—The Beaver Valley Traction Company ex- to purchase a 150-cu. ft. air compressor and two turbines for its plant.

W CASTLE, PA.—The [illegible] Company has [illegible] for a charter for the [illegible] c plant on the banks of Slipperyrock creek, near McConnell's mills. corporators are: F. M. Butler, F. G. Ross and C. F. Young.

ILADELPHIA, PA.—The contract for the construction of the power house for the Philadelphia & Reading Railway Company, at aire, Pa., has been awarded to Irvin & Leighton, of Philadelphia, L. F. Shoemaker & Company, of Philadelphia, Pa., have been ed the contract to build an 85-ft. turntable at the new round of the company at St. Clair, which will be operated by an electric electricity for which will be supplied by the new power house.

OW SHOE, PA.—The Snow Shoe Electric & Street Railway Com- has applied for a charter to build an electric railway, 2 miles in h, to connect Snow Shoe and Bellefontaine. The capital stock of npany is placed at $15,000. The incorporators are: David Cham- John G. Uzzle, James Uzzle, George B. Uzzle and W. E. Brown.

AYAMA, P. R.—The Bureau of Insular Affairs has recently ed a contract to the Westinghouse Electric & Manufacturing Com- for electrical equipment to be used by the Porto Rico Irrigation Ser- at Guayama, P. R., consisting of one 700-kva, three-phase, 2300- 0-cycle alternator, which will be driven by a 1000-hp Pelton water- ; nine transformers with an aggregate capacity of 1500 kva and sary switchboard and protective apparatus for the 2200-volt trans- n line and substation. The present plans include a duplication of rder later on.

LON, S. C.—The city has voted to issue $70,000 in bonds, of the proceeds of $3,000 will be used for additions to the municipal c-light plant.

URENS, S. C.—The Reedy River Power Company is reported to purchased mill property and 73 acres of land at Tumbling Shoals, edy River, 13 miles west of Laurens. It is understoood that the iny will develop the water-power to supplement power generated present Reedy River plant, located 5 miles below this point on the River.

UX FALLS, S. D.—It is reported that H. M. Byllesby & Com- owners of the Sioux Falls Light & Power Company) will extend lectric transmission lines to the McKennan Hospital.

[illegible]RO, TENN.—At an election held recently in Jonesboro tizens voted to issue $25,000 in bonds to aid in building an elec- ailway from Jonesboro to Johnson City, a distance of about 8 The cost of the proposed railway is estimated at about $40,000.

STIN, TEX.—At an election held recently the citizens voted to the contract with William D. Johnson, of Hartford, Conn., to build m across the Colorado River in Austin. The cost of the dam includ- wer house is $1,600,000, to be paid in twenty-five instalments.

CATUR, TEX.—The electric-light plant and water works system e Decatur Light & Water Company, was destroyed by fire on 2.

USTON, TEX.—The Greater Houston Suburban Corporation is ted to have awarded a contract to the J. M. Winfrey Engineering any, of Houston, Tex., to install an electric-light plant.

TSBURG, TEX.—The City Council has granted F. E. Prince, r of the Pittsburg and Longview box factories, a fifty-year electric- ght franchise and a contract for lighting the streets of the city. Work ill begin at once on construction of the new electric-light plant.

SAN ANTONIO, TEX.—The San Antonio Traction Company is re- odeling and making improvements to its power plant in San Antonio.

STOCKDALE, TEX.—The Stockdale Cottonseed Oil Mill Company, it reported, is contemplating the installation of an electric-light plant.

TROUP, TEX.—The Troup Gin, Mill & Light Company, which has cently built a cotton mill in Troup, is reported to have taken over e local electric-light plant.

NORFOLK, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has recently awarded the Westinghouse Electric & Manufacturing Company a contract for furnishing and installing complete electric equipment consisting of motors and control apparatus for two large electrically operated pumps, for Dry Dock No. 2, at the United States Navy Yard, Norfolk, Va. There will be two centrifugal pumps, each having a discharge opening of 42 in. in diameter, and each driven by a Westinghouse 300-hp type HF induction motor. A smaller pump will also be installed, driven by a 65-hp type CCL induction motor and a small bilge pump with a 3-hp motor. The pumps are being built by R. D. Wood Company, of Philadelphia, Pa.

ELLENSBURG, WASH.—The city is reported to have voted to issue $110,000 in bonds for improvements to the municipal electric-light plant and bonds to the amount of $100,000 for construction of water works system.

LOON LAKE, WASH.—A proposition has been submitted to Gerhke & Sons, proprietors of the planing mill, to finance the installation of an electric light plant in connection with their mill.

TACOMA, WASH.—The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has secured the contract for entire switchboard and auxiliary apparatus for power house, substations and transmission line of the hydroelectric power plant on the Nisqually River being erected by the city of Tacoma. The amount involved in the contract is about $85,000.

WASHOUGAL, WASH.—Application, it is reported, has been made by Samuel Sampson for a franchise to erect a high tension transmission line through Washougal on to Vancouver, a distance of 60 miles.

MASONTOWN, W. VA.—H. C. Greer, president of the Preston County Coke Company, of Cascade, Va., is reported to have been granted a franchise to install a street-lighting system and to supply electricity generated at the company's plant at Cascade in Masontown.

SISTERVILLE, W. VA.—The Sisterville Electric Light & Power Company has placed an order with the Mesta Machine Company, of Pittsburgh, Pa., for one 20-in. by 24-in. twin-tandem, horizontal, double-acting, four-cycle gas engine. The engine will operate with natural gas and is rated at 1000 hp, being arranged for direct connection to a 650-kw, 60-cycle, 2300-volt generator.

APPLETON, WIS.—Plans are being considered by the Wisconsin Traction, Light, Heat & Power Company for the construction of a new plant at the Gardner dam, near Antigo. Electricity generated at the plant will be transmitted to Appleton.

EAU CLAIRE, WIS.—Changes are being made in the transmission line of the Chippewa Valley Railway, Light & Power Company connecting with Red Wing, which will increase the voltage from 33,000 to 66,000. The line is being extended from Red Wing to Lake City.

MAZOMANIE, WIS.—It is reported that the contract for the installation of an electric-light plant in Mazomanie has been awarded to the Ft. Wayne Electric Works, Ft. Wayne, Ind., for $4,715.

MELLEN, WIS.—Work has begun on the construction of a power plant in Mellen for the Ashland Light, Power & Street Railway Company, which is to supply power to the plants at White River, Ironwood, Ashland, Bessemer and Hurley.

PLYMOUTH, WIS.—The Water and Light Commission has decided to engage Thomas S. Watson, of Milwaukee, Wis., consulting engineer, to prepare plans and specifications for a new municipal electric-light plant in Plymouth.

PRINCE RUPERT, B. C., CAN.—At an election held Sept. 6 the by-law appropriating $550,000 for an electric-light plant and water-works system in Prince Rupert was carried.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company, Ltd., has awarded the contract for extension of its auxiliary steam-power plant to C. C. Moore & Company, of Seattle, Wash. The equipment will include four Babcock & Wilcox boilers, of 500 hp each, one 200-kw Allis-Chalmers turbo-generator, condensers, piping, etc. The output of the plant will be increased to 12,000 hp. The cost of the work is estimated at about $250,000.

TORONTO, ONT., CAN.—The city of Toronto has filed plans for the erection of steel towers to carry a 13,200-volt transmission line across the eastern, the old western and the new channels entering Toronto Harbor with the Department of Public Works at Ottawa, Ont.

SASKATOON, SASK., CAN.—By-laws appropriating $863,000 for various civic improvements, including a new electric-light and power plant, a large intercepting sewer and disposal plant, a water-filtration plant and several other projects, have been passed by the Council.

OAXACA, MEX.—Lic. Jose Vasconcelos, of Mexico City, is reported to have applied for a concession to erect an electric light and power system in this state. It is proposed to supply electricity for lamps and motors to towns and mining properties in this district.

New Industrial Companies.

THE CONSOLIDATED ENGINEERING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000. The incorporators are: Albert F. Polk, of Georgetown, Del.; F. Marion Hall, Edwin W. Wells and Charles A. Cummins, all of Baltimore, Md.

THE CRONK-SALTER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by H. Taylor Cronk, 25 West Eleventh Street; A. Plafford Cronk, 25 West Eleventh Street, and Jasper C. Salter, of 26 Broadway, all of New York, N. Y. The company proposes to acquire and develop patents.

THE ELECTRICAL SHOW ASSOCIATION OF UTAH, of Salt Lake City, Utah, has filed articles of incorporation with a capital stock of $5,000. The company proposes to engage in electrical shows, general entertainment business, general electrical business, to deal in electrical supplies and to engage in the handling of electrical signs, etc. The officers are: B. W. Mendenhall, president; C. B. Hawley, vice-president; R. J. Dinwoody, secretary, and William Kennedy, treasurer.

THE FURST CONCRETE SCOW CONSTRUCTION COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $100,000. The company proposes to carry on a reenforced construction business and to manufacture telegraph poles and other articles; also the construction of scows, barges and other vessels. The officers are: Frank A. Furst, president; Michael T. Homer, vice president, and Joseph J. Hock, secretary and manager.

THE MIDLAND ELECTRICAL & MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated by Andrew Engstrom, Arthur O. Carlson and Frederick Deiser. The company is capitalized at $50,000 and proposes to manufacture mechanical devices.

THE NEW PROCESS LIGHTING & HEATING COMPANY, of La Porte, Ind., has filed articles of incorporation with a capital stock of $50,000. The company proposes to manufacture a new heating and lighting device.

THE NORTHOLL ENGINEERING & CONSTRUCTION COMPANY, of Vancouver, B. C., Can., has filed articles of incorporation with a capital stock of $100,000.

THE OVERLAND ROCHESTER COMPANY, of Rochester, N. Y., has been granted a charter with a capital stock of $30,000 to manufacture motors, engines, etc. The incorporators are: Edward D. Creed, 121 East Avenue, Rochester, N. Y.; Royal R. Scott, of Canandaigua, N. Y., and Clifford F. Cribb, 228 Field Street, Rochester, N. Y.

THE PAIGE ELECTRIC SIGN COMPANY, of Worcester, Mass., has been incorporated with a capital stock of $15,000 by Lucius R. Paige, Michael J. Kane and George R. Stubb.

THE PETROLEO COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 by C. D. Morton, 50 Church Street; H. J. Brewer, 50 Church Street, and William H. Davis, 70 Broad Street, all of New York, N. Y. The company proposes to manufacture oil engines, machinery, etc.

THE PRECISION STEEL BALL COMPANY, of Syracuse, N. Y., has been incorporated by Alexander T. Brown, Willard C. Lipe and William C. Sharrer, all of Syracuse, N. Y. The company is capitalized at $100,000 and proposes to manufacture balls, bearings, etc.

THE RIDGEFIELD ENGINEERING WORKS, of Ridgefield Park, N. J., has filed articles of incorporation with a capital stock of $125,000 for the purpose of manufacturing engines, motors, machinery, etc. The incorporators are: Robert Burns, Jr., of Ridgefield Park, N. J.; Samuel J. Katzberg and Daniel W. Steele, Jr., both of 170 Broadway, New York, N. Y.

THE WESTINGHOUSE GEAR & DYNAMOMETER COMPANY, of Pittsburgh, Pa., has been granted a charter with a capital of $5,000. The directors are: Miles H. England, 249 Forty-third Street, Pittsburgh, Pa.; Alexander Black, and Walter E. Galbreath, of Pittsburgh, Pa.

New Incorporations.

LITTLE ROCK, ARK.—The Stuttgart & Southern Railway Company has been incorporated with a capital stock of $300,000 to build an electric railway from Stuttgart through Arkansas County to a point on Bayou Meto, a distance of 25 miles. The incorporators are: J. I. Porter, John L. Ingram, Phillip Reinsch, Elliott Tallman, J. W. Underwood, L. E. Morphew and George C. Lewis.

SAN FRANCISCO, CAL.—The Placer Electric Power Company has been incorporated with a capital stock of $2,000,000 by R. H. Borland, F. W. Nightingill, R. T. Harding, N. C. Butler and I. Lindemann.

SAN FRANCISCO, CAL.—The West Sacramento Electric Company has been granted a charter with a capital stock of $100,000. The incorporators are: B. P. Lilienthal, H. W. Furlong, W. Herlitz, T. T. C. Gregory and C. J. Goodell.

SAN JOSE, CAL.—The San Jose Terminal Railway Company has been incorporated with a capital stock of $2,500,000 by H. H. McCloskey, John A. Mehling and Hugh Center. The company proposes to construct an electric railway from San Jose to Alviso, a distance of about 8 miles.

BRIDGEPORT, CONN.—The Shelton & Bridgeport Traction Company has been incorporated by O. G. Beard, Jr., L. E. Moulthrop and B. N. Beard. The company proposes to build an electric railway to connect Shelton, Huntington Centre, Trumbull and Bridgeport.

WAYCROSS, GA.—The Waycross Street & Suburban Railway Company has been granted a charter with a capital stock of $150,000. The company proposes to build an electric railway, 30 miles in length, to connect Hebardville, Deenwood, Winona Park, Blackshear, Waresbor and Waycross. The incorporators are: L. J. Cooper, George W. Dean A. M. Knight and J. M. Cox, all of Waycross.

BEECHER, ILL.—The Beecher Electric Light & Power Compan has been granted a charter with a capital stock of $6,000. The office are: Herman Ruge, president; Thomas Clark, vice-president; Willian J. Henze, secretary and George Batterman, treasurer.

CHICAGO, ILL.—Articles of incorporation have been filed for th Chicago Suburban Traction Company with a capital stock of $25,000 b Louis J. Behin, H. Morton Taylor and Frank R. Utely. The compan proposes to build an interurban railway from Chicago.

CHICAGO, ILL.—Articles of incorporation have been filed for th Public Service Company of Northern Illinois with a capital stock o $1,000 by Harry J. Danbaugh, Cyrus H. Adams, Jr., and George C Madison. The company proposes to operate a heat, light and pow plant.

HENRY, ILL.—The Kewanee, Bradford & Henry Interurban Railwa Company has been incorporated with a capital stock of $5,000 to build a electric railway to connect Bradford, Henry and Kewanee. The inco porators are: John P. Code, of Bradford; John P. Brady, of Kewane Howard G. Stoner, of Henry; William H. Haines and Daniel J. Pheni of Peoria.

QUINCY, ILL.—The Quincy & Western Illinois Electric Railway Con pany has been incorporated with a capital stock of $5,000 by W. Duker, H. F. Dayton, J. P. Wall, William S. Govert and S. B. Mon gomery, all of Quincy. The company proposes to build an electric rai way from Niota to Quincy, a distance of 75 miles.

EVANSVILLE, IND.—The People's Telephone Company has bee incorporated with a capital stock of $10,000 to build and operate telephone system in the counties of Vanderburg, Pasey and Gibso The incorporators are J. M. Lewis, William R. Hoods, G. L. Pierce.

OFFERLE, KAN.—Articles of incorporation have been filed for tl Peoples Co-operative Telephone Company with a capital stock of $10,00

HICKMAN, KY.—The Southwestern Kentucky Electric Railwa Light & Power Company has filed articles of incorporation under tl laws of the State of Delaware to build an electric railway from Paduc to Hickman, Ky., via Mayfield, Fulton and Union City, Tenn., or fro Paducah through the north of Ballard County, following the Miss sippi River. The officers are: H. C. Rhodes, of Paducah, presiden John D. Smith, secretary and R. H. Scott, treasurer.

MELDER, LA.—The Melder-Forest Hill Telephone Company has be incorporated with a capital stock of $10,000.

PHILLIPS, MAINE.—The Phillips Electric Light & Power Compa has been incorporated with a capital stock of $10,000 by Herbert Berry, of Yarmouth, Maine; Newell P. Noble, of Phillips, Maine, a Elliott C. Dill, of Hallowell, Maine.

FORMAN, N D.—The Forman, Rutland & Havana Telephone Co pany has been chartered with a capital stock of $10,000 by John Powe of Havana; A. E. Land and H. O. Gardner, both of Forman, N. D.

Personal.

MR. J. C. LAWLER has been appointed manager of the Walsenb Light, Power & Ice Company, Walsenburg, Col.

MR. SETH H. DYER has been appointed electrical engineer of Hidalgo Cement Works, Matehuala, San Luis Potosi, Mexico.

MR. M. C. MILLER, assistant to President Call of the Allis-Chalm Company, has been given general oversight of the publicity work of t company.

MR. E. F. BAKER, general manager of the hydroelectric plant York Haven, has resigned his position and will be succeeded for present by Assistant Manager W. J. Hunker.

MR. CHARLES H. CLARE, formerly chief engineer of the Stor Battery Lighting Company, Chicago, has joined the staff of the Triun Electric Company and will be attached to its New York office in capacity of sales engineer.

MR. F. W. WEBSTER, manager of the Fresno and Stockton (C electric railways, of the Southern Pacific Railroad Company, has b appointed manager of the Visalia electric railway, Visalia, Cal., in a tion to his present duties.

MR. H. H. HIGBIE, until recently of the electrical engineering partment of the University of Michigan, has joined the faculty of W worth Institute, a new trade school in Boston, a part of the work which will be to give training in electrical work.

MR. J. W. GARDNER, manager of the power and electrical dep ment of the Allis-Chalmers Company at West Allis, Wis., was form district manager for that company in Chicago. Mr. Gardner's e neering training stands him in good stead in the management of important department in the home office.

MR. M. H. GREGG has been appointed manager of the Central Oakl Light & Power Company, of Oakland, Cal. Mr. Gregg is a graduate of engineering department of the University of Michigan, and for the five years has been connected with the power contract department of Southern California Edison Company, Los Angeles, Cal.

[illegible] *FREDERICK VON SCHLEGELL* [illegible] age for the Allis-Chalmers Company [illegible] Chi-go and St. Louis. Mr. von Schlegell has been connected with the [illegible] go office of the company for [illegible] in the railroad and [illegible] M[illegible] [illegible] any.

[illegible] *E. FLA[illegible]R*, who has been [illegible] Water & ht Company for more than ten years as resident engineer and has charge of several engineering propositions in the South while with [illegible] company, has resigned and will on Oct. 1 enter the service of the [illegible] Louis Smelting & Refining Company as engineer of the Collinsville [illegible]rks, at Collinsville, Ill.

MR. ALLAN B. FIELD, prominently connected with the engineering [illegible]artment of the Westinghouse Electric & Manufacturing Company, [illegible] New York Sept. 9 on the [illegible] for an extended [illegible]iness and pleasure trip to Europe, accompanied by his bride. His [illegible]rriage to Miss Virginia W. Pearne of Cincinnati, took place at [illegible], N. J., on Sept. [illegible].

[illegible] *HARRY B. KIRKLAND*, vice-president of the American Con-[illegible] Manufacturing Company, Pittsburgh, Pa., was married Sept. 14 [illegible] Emily Roberts Houghton, daughter of Dr. and Mrs. Owen E. [illegible]n, Brooklyn, N. Y. The ceremony took place at the home of the [illegible] sister, Mrs. Girard B. Townsend, Montclair, N. J. After a [illegible] trip of several weeks, the happy couple will make their home in [illegible]ch.

[illegible] *WILLIAM [illegible] HAGEN III*, formerly chief statistician of the [illegible]sin Railroad Commission, has opened an office in the First [illegible] Bank Building, Chicago, as a public-utility statistician. Mr. [illegible]h was retained by the city of Chicago in recent investigations [illegible]phone rates and gas rates, and is now making a report on rates [illegible]vice for the Union Electric Light & Power Company, of St. [illegible]and is also investigating the gas situation in Des Moines for the [illegible]pany.

[illegible] *CHARLES H. JUMPER*, chemical engineer of Arthur D. Little, [illegible]emists and Engineers, Boston, Mass., will act as assistant to [illegible] T. Randall in the centralized testing department which has [illegible] been organized under Mr. Randall's direction by the above-[illegible]ed concern. Mr. Jumper has had several years' experience in [illegible] the chemical and engineering divisions in the company from which [illegible] detailed. This was preceded by service in the testing departments [illegible]the Pennsylvania and Union Pacific railroads.

[illegible] *H[illegible] BACKUS*, of Chicago, until recently sales engi-[illegible] the United States Electric Company, has been appointed super-[illegible]nt of telegraph for the El Paso & Southwestern Railroad Com-[illegible]ith headquarters at El Paso, Tex., succeeding Mr. H. W. Cut-[illegible]esigned. Mr. Backus will have direct charge of the operation [illegible]intenance of telegraph and telephone lines and block signals. [illegible] experienced in telegraph and telephone operation, having been [illegible]d with the Western Union, American Telephone & Telegraph [illegible] York & New Jersey Telephone companies.

[illegible] *JOHN I. BEGGS* is the subject of the following personal tribute [illegible] author in Mr. W. L. Waters' recent book on commercial [illegible] design: "For twenty-five years in active touch with the elec-[illegible]ngineering industry, as a manufacturer or as an organizer and [illegible]r of public-service corporations, obtaining his engineering and [illegible]ial knowledge through hard personal experience, Mr. Beggs was [illegible]nently fitted to guide and encourage the youthful engineer. [illegible]ally improving and rendering commercially practicable much of [illegible]ratus used in connection with electric lighting or railway inter-[illegible]nd doing this with the purpose of obtaining results, rather than [illegible]g accorded credit or public recognition, he was one of the first [illegible]e that the engineer was destined to become the dominant factor [illegible] engineering corporations. Giving his young engineers a free [illegible] all branches of commercial and engineering work, only guid-[illegible] checking them where necessary, he developed organizations and [illegible] a way which, while it made the men his grateful and enthusi-[illegible]dmirers, established his reputation as one of the foremost or-[illegible] in the engineering industry and left his mark on the methods [illegible]aratus of to-day."

Obituary.

LEMUEL R. HOPTON, of the firm of Enos & Company, New [illegible]k, died at Garrison-on-the-Hudson on Sept. 5, at the age of thirty-[illegible]n years. He was a graduate of the Sheffield Scientific School [illegible] Yale University and had served as manager of the New York Sec-[illegible] of the Illuminating Engineering Society, in which he took a deep [illegible]rest, having contributed much of value to the discussions relating to [illegible] electric-lighting fixtures.

[illegible]R. OLIN A. STRANAHAN, formerly general sales manager of the [illegible]s-Chalmers Company, died suddenly on Sept. 8 in New York while [illegible] a dentist's chair undergoing an operation for an abscessed tooth. T[illegible] burial took place at Litchfield, Ohio. Mr. Stanahan was connected f[illegible] five years with the British Westinghouse Company. He joined the [illegible] Company as manager of the [illegible] department and [illegible] general sales manager from January, 1905, to November, 1906.

[illegible]R. WILLIAM DICKENSON, an electrician employed at the General [illegible]tric Works, Lynn, Mass., died in that city, Sept. 11, aged seventy [illegible] He was electrician on the Great Eastern when the first Atlantic cable was laid in 1866. He was born in Hull, England, and has been employed in the pattern department at the Lynn shops for ten years. He is survived by three sons and two daughters. He was a member of the Masonic order in England.

MR. JACOB H. EVANS, secretary of the Edison Electric Illuminating Company of Brooklyn, died suddenly at his Brooklyn home on Sept. 2. The deceased was in the employ of the Brooklyn company for thirteen years, first as auditor and later as secretary. The loss of his wife, a cousin of Mr. A. N. Brady, two years ago was a severe blow to Mr. Evans from which he never recovered. Mr. Evans at the time of his death was also secretary of the Kings County Electric Light & Power Company and secretary and director of the Amsterdam Electric Light, Heat & Power Company. He is survived by three sisters. The interment was at Cincinnati, Ohio, Sept. 5.

Trade Publications.

ELECTRIC GLASSWARE.—The Phoenix Glass Company, New York and Pittsburgh, has issued a leaflet on its new laurel-leaf globes, stalactites, balls and bowls and another on its Sheffield ribbed ball globes. The latter are made with regular curved lip collar to fit any fixture having a standard 3¼ in. holder. The glassware gives a delightful mellow light of strong illuminating value, the manufacturer claiming that very little is absorbed.

MOTOR DRIVE FOR THE PRINTING AND ALLIED TRADES.—Bulletin No. 4869, just issued by the General Electric Company, is an attractive publication devoted to motor drive for the printing and allied trades. The publication illustrates motors and the necessary controllers, for both direct-current and alternating-current circuits, and applicable to job and cylinder presses of all sizes and kinds and to stitching, perforating cutting, numbering, folding and punching machines.

CLOTH PINIONS.—The General Electric Company has just issued Bulletin No. 4878, which is devoted to cloth pinions. This remarkable and somewhat radical form of machine element is offered for a wide variety of applications in mechanical transmission of power where, because of noise or for other reasons, the meshing of metallic pinions with metallic gears is impracticable or undesirable. The advantages claimed for these pinions are great tooth strength, noiseless operation, freedom from damage by exposure to dampness, dryness or temperature changes, elasticity of teeth, self-lubrication and long life. These pinions are made in various styles and sizes, which are illustrated in the publication.

BUSINESS NOTES.

THE WALPOLE RUBBER COMPANY, Walpole, Mass., has added to its present power plant equipment a 750-kw Westinghouse generator set and several boilers, necessitating the erection of a new brick stack 150 ft. high.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., has moved from its long-established location at 2115 Locust Street to the Equitable Building, Suite 507, thus bringing the company into the main business district of St. Louis.

MR. BENJAMIN T. DELAFIELD, who formerly represented the [illegible] Company for a number of years in the St. Louis and Kansas City territory, has become connected with the Best Manufacturing Company, of Pittsburgh, Pa., to handle its line of valves, fittings, flanges, pipe bends, fabricated pipe and other power-plant material in the same territory. He will make his headquarters in Kansas City.

THE GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., will open in November a new branch house at Ohio and Franklin Streets, Chicago, Ill., to handle its business in the Middle Western territory, including the States of Indiana, Illinois, Michigan, Wisconsin, Minnesota and Iowa. This house will take over the entire business of the present "Goulds Company," with the exception of its line of centrifugal pumps, and will exploit the new line of volute centrifugal pumps made in its Seneca Falls factory, together with the company's complete line, which includes hand lift pumps, force pumps, windmill pumps of all types, spray pumps, both hand and power, "Triplex" power pumps, rotary pumps, centrifugal pumps, air compressors, vacuum pumps, working heads, etc.—in fact all types of pumping equipment for every service.

INSULATING MATERIAL.—The following communication has been received from the Hemming Manufacturing Company, Garfield, N. J., referring to an item which appeared in this column in the issue of Sept. 2 relating to the use of the trade name "Gummon": "The material manufactured by the Hemming Manufacturing Company under the name of 'Gummon' is the invention of Emil Hemming, being an improvement based on the original invention of Robert Müller. United States Patent No. 869,321, originally granted to Robert Müller, and covering this invention, is now the property of this company, having been purchased from parties in Munich acting on behalf of the orginal owners, the majority of whom were directors of the Isolatoren Werke. The trade mark, 'Gummon,' No. 78,633, has been duly registered by the United States Patent Office and is the exclusive property of this company. The Hemming Manufacturing Company is, therefore, manufacturing only under processes covered by its own patents and exclusive contracts. We must ask that you accord this communication the same publicity as you have given the statement of the Isolatoren Werke."

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 5, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,002,222. TELEPHONE SYSTEM; H. F. Clausen, Chicago, Ill. App. filed July 18, 1903. Common battery; metallic circuit; omits relays in the cord circuits.

1,002,232. ALARM FOR CASH-BOXES; W. E. Dawson and R. McAlpine, Detroit, Mich. App. filed Sept. 11, 1908. For telephone pay stations. An alarm circuit wire is associated with the usual cord. Cutting the cord or tampering with the money box gives an alarm.

1,002,233. ELECTRODYNAMIC BRAKE FOR ALTERNATING-CURRENT MOTORS; W. N. Dickinson, Jr., Brooklyn, N. Y. App. filed Dec. 20, 1905. Elevator system. Alternating-current motor drives direct-current generator and thus supplies direct current to the stator windings of the induction motor.

1,002,238. TELEPHONE ATTACHMENT; G. A. Duryee, New York, N. Y. App. filed May 13, 1908. A yielding mouthpiece within a casing. To permit the use of the transmitter without the voice being audible to a person near by.

1,002,239. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed April 11, 1902. Trunking system with communicating centralized call exchanges.

1,002,240. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed April 11, 1902. The originating operator controls the operation and supervises the entire connection.

1,002,249. ELECTRICAL OXIDATION OF NITROGEN; C. Ellis, Montclair, N. J. App. filed June 6, 1911. A current of oxygen and nitrogen is passed concentrically in a plane at right angles to the normal axis of an elongated arc and the arc is deviated into the path of the gaseous current.

1,002,253. HOT-WATER-BAG HEATER; T. E. Fogalsang and B. McCutcheon, San Francisco, Cal. App. filed Oct. 12, 1910. The stopper carries a naked electrode inside the bag.

1,002,258. APPLIANCE FOR PRODUCING ARTICLES BY ELECTRODEPOSITION; F. I. Gibbs, Birmingham, Eng. App. filed Aug. 16, 1910. A model formed of vitreous material with a metallic deposit-receiving surface burned into the glaze.

1,002,267. MORSE TRANSMITTER; T. Habermann, Hemslingen, Germany. App. filed Jan. 14, 1911. A plurality of series of movable electric contacts representing dots and dashes.

1,002,277. TELEPHONE SYSTEM; A. R. Kahl, Rochester, N. Y. App. filed July 16, 1907. Manual-automatic exchange. Effects by a single operation the closure and subsequent opening of a circuit.

1,002,286. METHOD OF ELECTRIC PRODUCTION OF IRON AND STEEL AND OTHER METALS; A. R. Linblad, Ludvika, Sweden. App. filed March 6, 1909. The terminals of one pole of two phases are connected to one electrode, while the other terminals are connected with the furnace lining.

1,002,336. INDUCTION-MOTOR-CONTROLLING APPARATUS; A. Sundh, Yonkers, N. Y. App. filed Nov. 16, 1905. Elevator system; a mechanical brake connected with the motor.

1,002,348. RAIL-BOND; W. H. Wherry, East Cleveland, Ohio. App. filed June 14, 1905. A continuous strand of conducting material is wound into a coil having superimposed layers, each layer comprising a plurality of turns.

1,002,383. DYNAMO-ELECTRIC MACHINE; V. A. Flynn, London, Eng. App. filed Nov. 29, 1909. Continuous-current generator with magnitude of emf independent of speed and direction of rotation. For train lighting and windmill-operated plants.

1,002,388. METHOD OF AND MEANS FOR CONNECTING TELEPHONE APPARATUS; E. A. Gray, Boston, Mass. App. filed July 30, 1907. The conductors are arranged in groups of divisions in rotation with respect to successive contacts to furnish a maximum service with minimum apparatus.

1,002,390. ANODE FOR X-RAY TUBES; H. Green, Hartford, Conn. App. filed March 28, 1908. A target having a face plate of platinum and a back plate of copper of large mass and high heat conductivity is soldered onto a conducting body.

1,002,444. ELECTRIC-RESISTANCE FURNACE; A. Peterson, Odda, Norway. App. filed May 25, 1910. The charge is forced horizontally inward between the upper and lower electrodes.

1,002,462. SUSPENSION LOOP FOR INITIAL CATHODE SHEETS; E. L. Sibley, Bennington, Vt. App. filed July 29, 1910. The sheet is suspended from a rod by sheet-metal loops having lugs secured in holes in the sheet.

1,002,481. FLEXIBLE CONDUIT; U. S. Armstrong and J. H. Parker, New Kensington, Pa. App. filed June 20, 1910. Non-metallic; for electric wires. Has an intermediate helical layer consisting of alternating coils of flat and round fiber.

1,002,484. CONTROLLING DEVICE FOR ELECTRIC MOTORS; T. Barnard, Toronto, Canada. App filed March 3, 1910. For printing-press control. Solenoids operated by push buttons against gravity for starting.

1,002,527. OIL-COOLED TRANSFORMER; O. Kulka, Hamburg, Germany. App. filed Sept. 21, 1910. The casing has an overflow pipe forming a reservoir to contain an excess of oil and a settling chamber connecting with the pipe.

1,002,533. RESISTANCE BOX; L. A. DeMayo, New York, N. Y. App. filed March 20, 1909. For field and marine engineering, etc. Resistance bars are held by upper and lower plates in a box.

1,002,544. AUTOMATIC CUT-OUT FOR ELECTRIC CIRCUITS; E. S. Sears, Chicago, Ill. App. filed July 25, 1910. Two trolley wires of a double-track railroad are normally fed in series, but can be connected in parallel in case of a break.

1,002,574. CHAIN GUIDE FOR ELECTRICAL PULL-SOCKETS; E. H. Freeman, Trenton, N. J. App. filed June 2, 1911. The "bell" is in two parts, both slotted, and the inner rotatable within the ou to permit the chain to be inserted and removed through the when the socket cap is off.

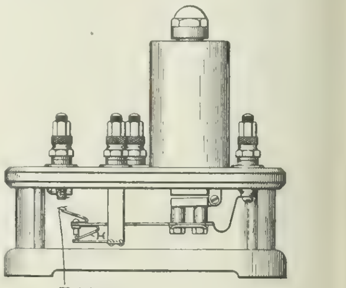
1,002,595. ELECTRIC SWITCH; J. F. McElroy, Albany, N. Y. A filed Nov. 17, 1910. Blow-out type for electric cars. The sw blades are doubly insulated.

1,002,608. METHOD OF TREATING EMERY ORE; F. T. T Niagara Falls, N. Y. App. filed Nov. 14, 1908. The pulverized with enough carbon is heated in an electric furnace to reduce silica only.

1,002,622. ARC LAMP; J. A. Zeigenfuss, Caney, Kan. App. filed N 18, 1909. Electrically operated mechanical device for holding guiding the upper carbon and feeding it.

1,002,637. WATER-HEATING APPARATUS; R. Von Brockdorff, lin, Germany. App. filed Jan. 5, 1911. An electrode is imme in the liquid and a non-conducting tube surrounds it and is above and below to permit circulation of the liquid.

1,002,645. ELECTRODE FOR ARC LAMPS; W. T. Conn, Lakew Ohio. App. filed April 1, 1909. Flaming arcs. The main port are coated with insulating material and a shell of carbon surro the insulating coating.



1,002,648.—Relay Contact.

1,002,648. RELAY CONTACT; F. B. Corey, Schenectady, N. Y. filed Sept. 3, 1909. The contact is made of malleable molybde

1,002,658. METHOD OF TREATING MOLDS USED IN THE OF ELECTROTYPING; G. E. Dunton, New York, N. Y. filed Nov. 11, 1910. A grease-converting substance is mixed black lead and applied to the mold and then the converted subs is washed off.

1,002,687. DYNAMIC-BRAKE CONTROLLER; C. T. Henderson, waukee, Wis. App. filed Sept. 6, 1907. The motor acts as a rator with a mechanical brake.

1,002,711. SYSTEM FOR THE TRANSMISSION OF ELECTR ENERGY; C. D. Lanning, Boston, Mass. App. filed Aug. 8, Relayed telephony. Automatically accomplishes the correct circ at a repeating point. Partial continuation of application filed 29, 1901.

1,002,712. ELECTROMAGNETIC DEVICE FOR ALTERNA CURRENTS; C. D. Lanning, Boston, Mass. App. filed Aug. 2, Two-way telephone relay.

1,002,713. SELECTIVE SIGNALING SYSTEM; O. M. Leich, Ch Ill. App. filed May 3, 1901. Party-line telephone; non-interf uses alternating currents of different frequencies.

1,002,718. INDUCTION MOTOR; E. Marelli, Milan, Italy. App Feb. 19, 1909. Single-phase. The field has pole pieces with partially concentric and partially eccentric to the armature so provide tapered air gaps.

1,002,721. ELECTRIC-ARC FURNACE HEATER; E. A. Mathers York, N. Y. App. filed Aug. 9, 1910. An arc and an air bla directed against material to be welded.

1,002,735. AUTOMATIC TELEGRAPH-KEY CLOSER; D. E. and F. B. Hatfield, La Jara, Col. App. filed Oct. 4, 1910. closing key with the switch arm above.

1,002,755. TROLLEY PLACER; W. D. Reist, Williamsville, App. filed Aug. 26, 1910. Detail combination of wheel, bearin diverging arms.

1,002,758. CONTACT FOR ELECTRIC-WELDING MACHINE F. Reitzel, Charlestown, R. I. App. filed Aug. 25, 1908. F taching spouts to kettles, etc. Contacts normally free fro electrodes engage the work around the place to be welded.

1,002,766. CONTROLLER FOR ELECTRIC MOTORS; A. W. Sc mm and E. B. Wilford, Riverton, N. J., and Merion, Pa. App iled July 10, 1911. Foot controller such as used by dentists for gov ning the operations of a dental engine, etc.

1,002,778. TAXIMETER CONTROL; J. D. Sulsona, New York, App. filed Dec. 29, 1909. An alarm sounds while a passer entering the cab and until the controlling flag is thrown cording.

1,002,803. COMPOSITE TELEGRAPH AND TELEPHONE SYSTEM C. L. Bopp, Meers, S. D. App. filed Oct. 17, 1907. Metall tel phone circuit and ground return for the telegraph with circuits.

Electrical World

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YORK, SATURDAY, SEPTEMBER 23, 1911.

CONTENTS.

ELECTRIFICATION OF THE HOOSAC TUNNEL.

The Hoosac Tunnel, on the line of the Fitchburg Railroad, was the first great railway tunnel in the world, and in spite of the mighty engineering feats in the construction of the transcontinental lines it still remains the longest railway tunnel in this country, although far surpassed now by several of the tremendous tunnels through the Alps. Its length is a trifle over 25,000 ft., and as it lies on the through line of the Boston & Maine system to the West the traffic is heavy, averaging nearly 100 trains per day. Its great length has always made it difficult of ventilation and, while its history has been marked by far fewer accidents than have fallen to the lot of some much shorter tunnels, passing through it has always been an unpleasant experience and a stalled train has been a pretty serious matter. The electrification of this tunnel has been proposed and urged for some years past, but nothing was done until the Boston & Maine system passed into the hands of the New York, New Haven & Hartford Railroad a little over a year ago. One of the first acts of the new management was to order the immediate electrification of the Hoosac Tunnel and its approaches. The work has now been carried out and trains have been regularly operated by the electrical equipment for the past four months. The electrification has been carried out, as will be seen in the account printed elsewhere, by the plan already well tried on the New York, New Haven & Hartford Railroad, using the single-phase, alternating-current system at 11,000 volts and 25 cycles, with the catenary construction of overhead work, which has been found necessary to the success of such installations.

The power station is at Zylonite, 2 miles south of North Adams. Designed for an ultimate capacity of 15,000 kw, there are at present installed two 3000-kw turbo-generators and their boiler equipment. This plant is a well-organized modern generating station of which the most interesting features are perhaps the use of forced draft under the boilers and a very ingenious condensing system made necessary by a somewhat limited water supply. The condensing water is obtained from artesian wells discharging into a pond containing about 2,250,000 gal. The discharge tunnel from the condensers is continued underground from the power-house walls to the pond and thence by sheet piling to its further end, so that the water before it can gain entrance to the intake tunnels has to traverse the entire length of the pond. In addition, two pumps with a conjoint capacity of 10,000 gal. per minute draw water from a point in the discharge tunnel near the pond and force it through a system of pipes and spray nozzles suspended above the surface of the water so that it may be thoroughly cooled by the air in case of the combination of hot weather and increase of capacity. Ordinarily the spray system is not

in use, but as the capacity of the plant is increased it may become a very important adjunct. The turbo-generators are three-phase machines worked so far as the railway part of the plant is concerned as single-phase generators and rated at 3000 kw, single-phase. The other two phases are used only for operating motors and auxiliary apparatus. The current is generated at 11,000 volts and carried from the Zylonite power station to the switch house at the tunnel over a double-circuit transmission line on steel towers.

The overhead trolley system is divided into twelve sections and is in the main of a much simpler construction than that familiar on the single-phase system near New York. In most instances the conductors are carried from cross-catenaries in the ordinary way, the earlier bridge construction being used at only a few points. Outside the tunnel there is a double catenary support for the working conductors, consisting of a messenger cable of stranded steel carrying, by supports at every 10 ft., a copper conductor wire leveled up by varying the length of the supports. Just below this is the contact wire attached to the conductor at the center of each space between the hangers of the former. In the tunnel, to secure better conductivity, the messenger cable is of 5/8-in. stranded copper and a complete double trolley wire is suspended over each track as security against interruption of service. The messenger cable in the tunnel is carried by suspension insulators from brackets which are themselves in turn carried on secondary insulators resting on hangers fastened into the roof of the tunnel, so that there are within the tunnel two insulators in series, each of them good for 150,000 volts to ground. Five locomotives are in use for the service, each of about 1600 hp, distributed in four motors, spring-supported on the truck frames and geared to the driving wheels. In the tunnel service the locomotives are not uncoupled from the trains, but pulled through with them, the fires being allowed to rest in proper condition to give the minimum smoke and steam during the twelve minutes or so required for transit. Two of the locomotives are high-geared for passenger trains, the other three being low-geared for the freight service. The plant has now been in operation long enough to be a demonstrated success in every respect, and the terrors of the Hoosac Tunnel are a thing of the past.

One of the most interesting minor features of the enterprise was the care taken to insure safety to the workmen in doing the very large amount of work required within the tunnel in the installation of the overhead conductors. Two work trains were equipped by the railway for the contractor, each hauled by an oil-burning locomotive and carrying a generator set, an air compressor, a blacksmith shop, platform cars on which material could be carried and from which work could be done, and a dining car. The generator furnished ample lighting facilities and the air compressor gave power for operating the pneumatic drills for cutting the bolt holes and air for the security of the workmen. On every third platform car an air lock was built, 1,002,544. ... MA S. Sears, Chicago, of a double-track connected in paral. tiny room supplied with air under slight ...hich the workmen could retreat while a 1,002,574. CHAIN G... H. Freeman, Trer... ...s filling the air with gases and could re- ...ir outside got tolerable again. The dining car was fitted up as a similar air lock, so that the air c...ld always be kept fresh within. With the aid of these ...e-cautions the work was carried on without any se...us accidents from bad air. Altogether the Hoosac T...el equipment has been very successfully worked out, a... is a matter of public congratulation that one more t... has been removed from the danger list by electric trac...

REGULATION OF PUBLIC UTILITIES.

An important feature of the conference of Gove... at Spring Lake, N. J., last week was the address of ...ernor McGovern of Wisconsin on "State Control of ... Utilities." The leading position occupied by the Sta... Wisconsin in the movement to regulate utilities, the ...tinued increase in the number of effective state law... this subject, and the undiminished approval of the ge... public, combine to make the discussion by Gov... McGovern of interest to officials of public-service cor...tions. We, therefore, publish it in full in this issue. ... the address not unnaturally is a vigorous presentati... the advantages of commission regulation, it is notew... that the speaker asserts that definite benefits have ac... to the utilities through the introduction of more sci... rate-making methods and better service, the eliminati... discriminatory rates, and knowledge of the value ... properties. The Wisconsin commission has undou... worked to make the companies more efficient public ser... and whether or not exception is taken to some of ...dividual decisions on rates and values it deserves ... spread credit for consistent efforts to improve service ... policy that has been followed in this respect, howe... perhaps due more to the personnel of the commissi... its staff than to the language of the law under whic... hold jurisdiction over the companies. In this opini... we may be differing from the conclusions in the address, ...hich says that the enforcement of the right to regulat... legislative function that cannot lawfully be delega... an administrative board, but adds that this fact d... militate against the practical utility of the comm... Governor McGovern goes on to say that the com...sion ascertains the facts of each case as it is presente... and applies thereto the law already laid down by the Legi... Ignoring the legal question involved, it may be ask... the carefully studied opinions of, for instance, the W...consin commission can be regarded as otherwise th... distinctly administrative or judicial in character. Reg...ating acts prescribe reasonable and undiscriminatory ...ates, adequate service and control of capitalization, bu... are very general and flexible terms. The fair interpr... of these typical provisions of such acts calls for const...ctive and administrative ability of a high order. Regul...on is certainly to be permanent in this country, and if it ... to be a success this result will arise from wise administra...n of the laws by able, fair-minded commissioners.

It is stated in the address that the fact of re...ation contains the implication that public utilities are ...irtual monopolies, and that the Wisconsin statute recogni...s this condition by providing for the indeterminate pe...it or franchise. Of course, the local conditions in Wisco...in are not the same as in other states, but an indeterminat... permit

[do]es not appear unreasonable even in cases where com[pe]tition prevails. In a number of cities in other states than [W]isconsin conditions of practical competition exist, and it [is] not clear that an indeterminate permit would not be [pr]oper in such situations. The policy which limits the life [of] franchises is a doubtful one unless it permits a company [to] charge rates high enough to provide not only for a fair [re]turn on the capital investment, but also for the amortiza[ti]on of the capitalization during the term of the grant. [H]owever, unless a company finds the conditions of an [ac]cepted franchise unduly burdensome as to service or [co]nfiscatory as to rates it does not appear to be the part of [wi]sdom to surrender such rights as may be held under an [ex]isting limited-term franchise in order to accept an inde[te]rminate permit under a new law. When the companies [ac]cepted limited franchises they did so, presumably, after a [thoro]ugh consideration of the good and bad points. It is [not] clear whether some companies in this position would [weak]en or strengthen their standing by retaining their [ri]ghts under old franchises until perhaps just before the [da]te of expiration. If the policy of the state remains un[cha]nged, they could then accept the indeterminate permit.

[On]e of the principal parts of the address is the discussion [of] the subject of rates. The old and crude phrase of "what [th]e traffic will bear" has indeed, as the speaker said, become [od]ious. It is, however, a concise method of expressing, in [on]e sense, what seems to be an essential element—the value [of th]e service—in any scheme of rate-making for a utility [that d]oes not charge flat rates for all service. Certainly [the co]st of electric service does not bear the same relation to [price] that the cost of production bears to the price of com[modi]ties. In order to stimulate a demand at varying hours [and i]n varying quantities the rates for electric service [shoul]d be based upon other conditions than the cost of [servi]ce alone. The value of the service, together with other [condi]tions, should be taken into careful consideration when [rates] are made for different classes of consumers. Where [condi]tions in one locality are the same it is just that rates [shoul]d be alike. Prices of commodities fluctuate with [chan]ging supply and demand and can be altered by manu[factu]rers as costs change; but public-utility rates are more [fixed] and companies find it exceedingly difficult to secure [th]e acceptance of any revision that is not downward.

[FIEL]D AND FLUX.

[Th]ree letters appearing in a recent issue of the *Elektro[techni]sche Zeitschrift,* as noted in the Digest, serve to call [attent]ion to the importance of employing the correct terms [wh]en referring to physical quantities if the proper idea [is] to be conveyed to a person unfamiliar with the relations [be]ing discussed. Opinions may differ as to the desirability [of] employing the word "flux" in connection with mag[ne]tism, which is considered not to flow, and as to the dis[ti]nction which should be made between the term "field," [as] representing the whole space subjected to magnetic in[flu]ence, and "flux," as measurable "lines of force" in certain [pa]ths within the field. One can, however, find little justifi[ca]tion for the prevalent use in American electrical litera[tu]re of the term "field" in such expressions as the "field [ha]s a resistance of 100 ohms," "the field is laminated" and "the field weighs 2000 lb." The fact that the person who employs such expressions is not ignorant of the relations involved and that the expressions will be properly interpreted by most people offers nothing in compensation for the further fact that the expressions are a source of needless confusion to the very persons who are expected to be most benefited by studying them. To an extent that many writers evidently fail to appreciate the average student reader places a logical interpretation on each technical term as brought to his attention, and when subsequently this term is used illogically he recognizes that confusion exists, but does not take time to unravel the tangle. For this condition the writers, who are much fewer in number than the readers, are to blame and not the readers themselves. American writers on engineering subjects can well be said to be the chief offenders in this respect.

THE INVESTIGATION OF ILLUMINATION.

We are glad to note that definite steps have been taken by the French Department of the Interior toward the formation of a commission charged with investigating and reporting on suitable material and methods of illumination with a view to prescribing conditions which shall tend to the general improvement of the situation and to the preservation of eyesight. The project was announced several months ago, and this note is not so much for the purpose of merely calling additional attention to it as to urge unity of action between the French commission and bodies working toward similar ends in other countries. We have already reaped some of the fruits of international effort in the establishment of the international candle. We now have in this country several organizations, notably the Illuminating Engineering Society and the American Association for the Conservation of Vision, actively working along the very lines proposed in France. Similar bodies are available for co-operation in England and Germany and some other countries, and it is greatly to be hoped that the formal action taken by the French government will lead to an international conference on this extremely important matter.

Of course, it may be too much to hope for any international action leading to anything as formal as standard specifications, since conditions vary widely from country to country, and so complete a consensus of opinion as is necessary to establish entire harmony is not reasonably to be expected at present. Yet an international recommendation for the lighting of industrial establishments and buildings used for public purposes is not beyond a reasonable expectation of establishment, and it would carry such weight as to exercise a powerful influence on the legal regulation of industrial conditions. In our own country such regulations are in the hands of the states, yet if there were any definite standard to which to refer there would be a strong tendency toward uniformity, as in the case of other protective legislation. The main thing in any event is to take steps toward a friendly conference upon which united effort might be based. This is certainly easily within reach of practicable action, and before the French commission gets far along with its work it would be desirable for the other bodies interested to get into communication with it.

Turin International Electrical Congress.

The Turin International Electrical Congress was inaugurated on Sunday morning, Sept. 10, at a formal session, which was followed in the afternoon by a meeting of the officers and the same evening by a banquet tendered to the official delegates of the congress. Among those present, aside from members of the congress, were official representatives of the Italian army and navy and of various administrative departments of the Italian government. Mr. Boselli, president of the Polytechnic Institute, who welcomed the congress on the part of the government, also paid a tribute to the late Prof. Galileo Ferraris and his work at the Polytechnic Institute. Professor Lombardi, as president of the committee on organization, in turn welcomed the delegates and gave a brief sketch of the origin of the congress and of the preliminary preparations for its work. He spoke of the great progress in electrical transmission of energy in Italy, a country poor in coal but rich in water-power, and invited the members to visit the more important Italian installations, or, at least, to gain an idea of them from a handsome illustrated volume which would be presented to each member of the congress by the Associazione Esercenti Imprese Elettriche in Italia, which corresponds somewhat to the American National Electric Light Association. He also spoke in high terms of the aid rendered to the congress by the Duca degli Abruzzi, its patron, and by the ministers of posts and telegraphs and other departments of the government; by Prof. Guido Grassi, president of the executive committee, and especially by Mr. Curti, general secretary, and Mr. Guido Semenza, the latter having rendered aid of the highest value in connection with the program of papers.

Minister Calissano, of the Italian Department of Posts and Telegraph, followed Professor Lombardi, and in the course of his remarks referred to an international conference that will presently convene at Rome to formulate a code for the regulation of wireless telegraphy. In the name of the Minister of Agriculture, Industry and Commerce, he offered to the members of the congress a volume of statistics of Italian electrical plants.

Professor Lombardi then introduced in turn representatives of several of the countries prominently identified with the congress, who made brief remarks. These gentlemen were: Mr. Gano Dunn, for the United States; Prof. Silvanus P. Thompson, for Great Britain; Prof. Paul Janet, for France; Dr. Georg Dettmar, for Germany; Professor de Chatelaine, for Russia; Mr. Carl A. Rosander, for Sweden, and Mr. Leon Gaster, representing the British Illuminating Engineering Society.

Upon motion of Professor Lombardi, Minister Calissano was elected honorary president, and upon motion of Mr. C. O. Mailloux, Professor Lombardi was elected active president of the body. Prof. Guido Grassi and Mr. Emanuel Jona were elected general vice-presidents, and Mr. Guido Semenza general secretary. The following honorary vice-presidents were then elected: Professor Pacinotti, the inventor of the modern dynamo, for Italy; Prof. S. P. Thompson and Mr. Alexander Siemens, for Great Britain; Mr. Gano Dunn, for the United States; Prof. Paul Janet, for France; Dr. Carl Strecker, for Germany; Dr. Alfred Graf, for Austria-Hungary; Prof. Pierre Ossactchy, for Russia; Mr. Gustav l'Hoest, for Belgium; Dr. Behn-Eschenburg, for Switzerland; Dr. de La Pena, for Spain, and Dr. Valdemar Poulsen, for Scandinavia.

The congress comprised eight technical sections, as follows: (1) Electrical machinery and transformers; (2) construction, central stations, switchboards, distribution; (3) instruments and methods of measurement; (4) electric light and heat; (5) electric traction; (6) telegraphy and telephony; (7) storage battery, electrochemistry and electrometallurgy; (8) rates, taxation and legislation. Each section was provided with a president and two vice-presidents, who were elected at the inaugural meeting. Dr. E. Kennelly was elected president of Section 3; Mr. C. Mailloux, president of Section 5, and Dr. C. H. Sharp, vic president of Section 4. At a session on Sunday afterno the various officers completed the routine organization the congress.

The final session of the congress was held on Saturd: Sept. 16, and the following Sunday was devoted to visits a number of large electrical installations. There we parallel meetings of sessions, from three to six sessic meeting simultaneously. Sessions met at nine o'clock the morning on Monday, Tuesday and Wednesday, a during three periods on Friday. Thursday was devoted an excursion to Genoa in order to visit the Giovi elect railway. On Monday afternoon the members of the co gress visited the exposition in a body and that evening tended a reception in their honor given by the Artists' Cl On Tuesday the city of Turin gave a banquet to the offic of and official delegates to the congress, and on Wednesc a luncheon was tendered to members. On Wednesc afternoon another official visit was made to the expositi The meeting closed with a formal general session Saturday afternoon.

A committee of ladies took charge during the congress the entertainment of ladies accompanying members. Monday morning, Sept. 11, there was an automobile r: with luncheon upon return. On Tuesday afternoon ladies in a body paid their respects to Professor Pacin at the Polytechnic Institute, after which tea was servec a restaurant in the exposition grounds, and in the even there was a theater party. On Wednesday morning vi were paid to the Turin picture gallery and to the Egypt Museum, and on Friday a visit was made to the parts the International Exposition most attractive to lad which was followed by a luncheon. All the ladies atten the reception given by the city of Turin on Tuesday and luncheon to members of the congress which was given Wednesday.

When the congress opened the total number of meml inscribed, including those not in attendance, was about hundred. American members of the congress presei papers in person as follows: Mr. Philip Torchio, of York, on *The Selection of the Transmission and tributing Voltage, and the Design of Switchboards and stations in Large Electrical Installations, Taking Into count Both Economy and First Cost, and Continuity Service;* Dr. Clayton H. Sharp, of New York, on *E tricity Meters, with Special Reference to Different K of Loads;* Mr. G. Faccioli, of the General Electric Comp on *Electrical Surges and Methods for Their Prevention* Italian); Dr. A. E. Kennelly, Harvard University, on *Rotating Electric Current Field;* Mr. C. O. Mailloux *Methods of Determining the Value of a Constant Cu Having the Same Heating Effect as a Variable Current* French), and also a paper (in English) on *The Electri tion of Railroads.* Papers were communicated to the gress by the following Americans not in attendance: S. Q. Hayes, of the Westinghouse Electric & Manufa ing Company, on *Commercial Electrical Apparatus 100,000-Volt Service;* Prof. Vladimir Karapetoff, of nell University, on *The Practical Calculation of Ele o-static Fields* (in French); Dr. C. P. Steinmetz, on *he Nature of Electric Transient Phenomena;* Prof. E. F. Creighton, of the General Electric Company, on *The ro-tection of Electric Systems,* and Dr. E. B. Rosa, of he Bureau of Standards, on *The International Candle.* he total number of papers on the program was eighty-t ee, divided into papers opening discussions, or setting rth the present status of the subject treated, and commu ca-tions on miscellaneous subjects. The various papers ere printed either in Italian, English, French or Ger an. Those in the English, Italian and German languages ere prefaced by a brief abstract in French.

Conference on Rubber-Covered Wire Inspection.

A conference was held on Aug. 9 in New York City between the Underwriters and the manufacturers of rubber-covered wire, at which the National Electric Light Association was represented by Mr. W. H. Blood, Jr., insurance expert for that body.

The conference was called at the request of the wire manufacturers, who desired that inspection of rubber-covered wire made under the new national electrical code specifications should be conducted on a uniform basis throughout the country. The wire manufacturers insisted ... as the matter was of so great importance to them they ... have a voice as to the carrying out of the tests on rubber-covered wires.

For the past three years the Underwriters have carried on their own laboratory and testing bureau, while most of the wire manufacturers have joined together and maintained a "Wire Inspection Bureau." These two bureaus have not always worked in harmony and one inspection has oftentimes supplemented the other.

As a result of the conference the inspection of wires will ... rtaken entirely under the supervision of the Under... laboratories. The sub-committee on wire of the electrical committee of the National Fire Protection Association is to be continued and is to include three representatives of the Underwriters and three representatives of ...e manufacturers subscribing to the Underwriters' ...ries inspection service. This committee is to be a committee on the laboratories inspection methods, and it is expected that there will be worked out a single and universally applicable method for factory and field inspection ...r-covered wires. This will carry with it the use of ...e form of label.

... 18 a meeting of the Rubber-Covered Wire Manufacturers' Association was held to consider the wire-inspection subject, but the result of the discussion has not yet been made public.

Distinguished English Visitors in the United States.

... S. Z. de Ferranti, president of the British Institution ...trical Engineers, accompanied by Mrs. de Ferranti, ...the United States on his first visit to this country. ... Ferranti's visit is in the nature of a vacation, although he is making a close inspection of electrical development in this country. He arrived in New York on the ... on Sept. 8 and after a few days spent in and near ...y, much in the company of Mr. John W. Lieb, Jr., ...roceeded to Chicago, where he remained for several days last week visiting electrical installations under the general guidance of Chicago friends, including Mr. Samuel ... Mr. Frederick Sargent and others. In Chicago Mr. ...anti met Mr. H. A. Couves, of Newcastle, England, and on Sept. 16, Mr. Charles H. Merz, of London and Newcastle, and Mr. Arthur Wright, of London, who are also in this country and who have made a visit to the Pacific Coast. Later the tourists were joined by Mr. Raven, chief engineer of the North Eastern Railway, of England, and the whole party plan to sail for home from New York on the *Olympic*, leaving Sept. 30. The party was entertained at Mr. Insull's country place at Libertyville, Ill., on Saturday and Sunday, Sept. 16 and 17. On Monday, Sept. 18, the visitors inspected the gas-engine and electrical equipment in the steel mills at Gary, Ind., and they left the same night for Pittsburgh. Here a stop was made and later the party attended the Edison convention at Spring Lake, N. J., planning to visit Niagara Falls, Schenectady and other points before sailing.

Mr. de Ferranti is one of the pioneers of electrical work in England. The generating station which he caused to be established at Deptford, near London, in 1888, was the first attempt to supply the wants of a great city from an outside source, using high-pressure generators, transmission by underground mains and transformation by substations within the area of supply. This general principle of centralizing production is now recognized as standard the world over. The alternating-current units put into service in Deptford in 1889 were rated at 1200 kw each and generated energy at 10,000 volts. They were the giant dynamo-electric machines of those days. The boldness and originality of this engineering received a just tribute of praise then and since.

In conversation with a representative of the *Electrical World* in Chicago Mr. de Ferranti commented on the high order of the electrical engineering work he had encountered in this country. There is nothing better anywhere, he said, and he expressed himself as pleased with the character of the electrical work he had seen. Mr. de Ferranti believes that somewhat higher economies from steam-turbine operation are obtained in England than in this country and he thinks that electricity is produced more cheaply from coal in England than anywhere else in the world. However, this economy is to some extent a question of the size of generating units, and with the extremely large units which are now in use and building in this country it may be that the record of the English engineers in economy of production may be soon equaled or possibly surpassed.

The distinguished visitor is much interested in the question of coal conservation, and he devoted his last inaugural address as president of the Institution of Electrical Engineers largely to this subject. He believes that the final solution of the question of coal conservation is to be obtained by the conversion of the whole of the coal used for heat and power into electricity and the recovery of the by-products at a comparatively small number of great electrical generating stations. All the wants of a country like Great Britain in the way of light, power, heat and chemical action would then be met by a supply of electricity distributed over the entire country. This can only be done, however, when the conversion is effected at such an efficiency as will cause the electrical energy delivered to represent a high percentage of the energy in the coal; and the president of the Institution thinks that in order to supply electricity for all purposes it will be necessary, among other things, to have a conversion efficiency of not less than 25 per cent, compared with the present coal-conversion efficiency in steam-generating stations of perhaps 12 per cent. To accomplish this result Mr. de Ferranti thinks it may be possible to convert the coal into gas, utilizing the by-products, and burn the gas as fuel for the operation of steam turbines having greatly increased efficiency by the use of highly superheated steam. By carrying out this proposal Mr. de Ferranti thinks that about half the coal now burned in England can be saved. The principal by-product of the coal will be used for fertilizer, maintaining the existing area of the country in a fertile state, so that the whole project is really one of far-reaching importance. Its author thinks that the greatest work of electrical engineers, particularly English electrical engineers, lies in the study of the subject of coal conversion, with the idea of using all the energy of the coal for electrical applications.

Mr. de Ferranti also spoke of the backwardness of commercial electrical development in England owing to oppressive legal restrictions and said that he thought that this condition was reflected in the electrical manufacturing industry of that country—a condition from which Germany and the United States are happily free. He also spoke of the fact that the Institution of Electrical Engineers in Great Britain is undergoing a broadening-out process to make it in a way more "popular," without losing its scientific and professional standing. An effort is being made to recognize in the Institution the commercial development of the industry in an adequate manner. Although this is his first visit to this country, the president of the Institution

expressed himself as feeling that he was among friends and entirely at home. He was very cordial in his references to the warmth of his reception by American electrical men and said that he and his party were enjoying their visit thoroughly.

Invalidation of Patent on Branch-Circuit Regulation.

The current issue of the *Patent Office Gazette* gives the opinion of the United States Circuit Court of Appeals, Seventh Circuit, in a case involving the validity of a patent issued Nov. 23, 1897 (No. 594,144), to Dr. Charles P. Steinmetz, on a means of regulating the voltage of alternating-current branch circuits. The case was an appeal from the Circuit Court of the District of Indiana, which dismissed a suit for infringement of the patent, and the Circuit Court decided that the patent was void for lack of patentable invention in view of prior art.

The invention comprises the combination of an "electro-dynamic phase modifier" and an "equalizer" in a branch circuit of an alternating-current system, the object being to secure in any sub-circuit any desired regulation of the voltage or current and to restrict the effects of such regulation to the circuit where it occurs, thus making working conditions in each of the sub-circuits independent of those in the main or transmission circuits. The regulable "phase modifier," which is more generally known as a synchronous condenser, causes the current in a branch circuit to lag or lead as desired, and in order to permit the condenser thus to vary the branch circuit emf without affecting the emf of the main system a "localizer," more generally known as a choke coil or series reactor, is used in the circuit in combination with the condenser. The court held that the "phase modifier" is found, just as it appears in the patent, in the prior art, performing the same function as in the patent; and that the "localizer" appears also in the prior art as a self-induction coil, being used, as in the patent, to produce synchronism between the current and emf. Moreover, the relation of these two agencies to each other, reciprocally acting upon each other to produce the given action, was known in the prior art.

The opinion states that the concept of bringing about synchronism in the sub-circuits does not seem, in view of what electrical inventors and engineers were then thinking and doing, to have been an invention. Not every advance, the court said, is an invention. Coming, as successive advances do, in the evolution of electrical uses, many such advances disclose nothing beyond good electrical engineering. To pronounce each adaptation of this kind patentable invention would, the court held, encumber the electrical field with monopoly, so that mere engineers would have no room to give to the art the benefit of their knowledge. The conclusion of the court was that the arrangement, in view of the prior art, was not patentable.

Convention of Iron and Steel Electrical Engineers.

The Association of Iron & Steel Electrical Engineers will hold its fifth annual convention in New York City from Sept. 25 to 30. The headquarters will be at the Hotel Imperial, Thirty-first Street and Broadway. There will be three sessions on Monday, Tuesday and Wednesday, and two on Thursday and Friday. Saturday will be devoted to visits to the Interborough and Edison generating stations light to the factories of the Cooper Hewitt Electric Com- telephor nd the Cutler-Hammer Company.

trometa following papers will be presented: *Dynamic Safety* sectior *for Electric Cranes,* by a representative of the Cutler-mer Manufacturing Company; *Recent Developments in Control,* by Mr. M. A. Whiting, of the General Electric Company; *Automatic Control of Direct-Current Mot* by Mr. A. C. Eastwood, of the Electric Controller & Ma facturing Company; *Direct Control Reversing Motor Dr for Planers,* by Mr. G. W. Richardson, of the Ameri Bridge Company; *Transformers for Steel-Mill Service,* Mr. H. C. Soule, of the Westinghouse Electric & Manufact ing Company; *Electric Furnaces,* by a representative of Swedish Chamber of Commerce; *Mechanical Design Cranes,* by Mr. C. A. Kafer, of the Bethlehem Steel Wor *Electric Cranes for Steel-Mill Service,* by Mr. E. Fri lander, of the Carnegie Steel Company; *Methods of Lu cation for Electric Cranes,* by Mr. T. E. Tymes, of Lackawanna Steel Company; *Track Wheels for Ele Cranes,* by Mr. W. T. Snyder, of the National Tube pany; *Alternating-Current Versus Direct-Current Cra* by Mr. K. A. Pauly, of the General Electric Compa *Recent Developments in Motors for Steel-Mill Service,* Mr. B. Wiley, of the Westinghouse Electric & Manu turing Company; *Alternating-Current Versus Direct-C rent Motors for Driving the Auxiliary Apparatus in S Mills,* by Mr. B. R. Shover, of the Carnegie Steel Comp and E. J. Cheney, of the General Electric Company; *De of an Electrically Driven Central Pumping Station,* by F. W. McKee, of the Jones & Laughlin Steel Comp *The Regulating Storage Battery in Steel-Works Ser* by Mr. F. W. Woodhull, of the Lukens Iron & S Company; *Prime Movers in Central Power Stations,* representative of the Westinghouse Machine Comp *The Light for Safety,* by Mr. Fortune, of the Co Hewitt Electric Company; *Illumination of Steel Work,* Mr. H. M. Gassman, of the Tennessee Coal, Iron & way Company; *Steel Works Illumination,* by Mr. Mundo, of the General Electric Company; *Some Feat of Good Steel-Mill Illumination,* by Mr. Ward Harriso the National Electric Lamp Association.

On Monday afternoon the safety committee will pr its report for general discussion. On Tuesday evening R. J. Young, of the Illinois Steel Company, will delive illustrated lecture on "Safety." On Wednesday eve will be held the annual informal dinner of the associ and its invited guests. On Thursday afternoon a visit be made to the works of the Crocker-Wheeler Com

The officers of the association are: Mr. L. R. Pa president; Mr. B. R. Shover, first vice-president; M W. Parkhurst, second vice-president; Mr. E. W. Yea treasurer; Mr. James Farrington, secretary.

Substation and Street-Lighting Equipment for Chicago.

On Sept. 14 the Sanitary District of Chicago awar number of contracts for electrical equipment to be us the new flaming-arc installation for street lighting the Sanitary District is under contract to build for th of Chicago. About 10,000 new 450-watt lamps w erected ultimately, and they will be operated by hydro tric energy obtained from the Drainage Canal plant Sanitary District. For this purpose several substatio be built, and the first of these will be at the corner of lin and Wabansia Avenues, known as the Wabansia A nue substation. The contract for the substation buildin has been awarded to Paschen Brothers for $15,720.

The electrical equipment for this substation will b supplied by the W. A. Jackson Company, whose bi was $21,585. Other bidders for the electrical equipment the substation were the Pierce Electric Company, $24,75 an Kohler Brothers, $26,948. The contractor for the electrical equipments is to furnish and install all conduits, pull oxes, junction boxes, cut-out cabinets, electrically operate and hand-operated oil switches and oil-switch compartments and disconnect switches, as well as compartmen for series and shunt transformers. The high-voltage in lated

cab will be furnished by the Sanitary District, and all low oltage wire and cable must be furnished by the contra or. The contractor must also build and install the swihboard, which will have twenty-three panels—one for ma control, two for transformer control and twenty for the ontrol of arc-lighting circuits. There will be five thr -pole, single-throw, electrically operated General Electric oil switches designed for operation on 12,000-volt, circuits. The operating solenoids shall be wound tential of 110 volts, energy to be obtained from a tor generator and a storage battery. The neces- ,000-volt series transformers for automatic opera- l be furnished with each switch, and the oil switch iall withstand a five-minute test at 50,000 volts. ee-pole, single-throw, hand-operated automatic oil will be required also. There will be six 250-kva nsformers, furnished by the district, but installed ntractor.

ntract for tubular wrought-iron lamp poles was to the Electric Railway Equipment Company, ill furnish a standard pole for $9.25 and an extra le for $12.75 each. These poles will be used for ig arc lamps for street-lighting purposes, and about l be required in the initial contract.

300 wrought-iron tubes will be required for in lamp-posts. These tubes, 4½ in. in diameter ft. long, will be supplied by the Western Electric for $10.40 each.

ble-iron cross-arms will also be supplied by the Electric Company at the following prices: Two- ss-arm, $1.25; four-pin cross-arm, $2.15; six-pin n, $3.10. Not less than 2000 cross-arms will be under the contract, and the right is reserved to additional number required during the year.

10,000 porcelain insulators, with pins, subjected of 20,000 volts, will be required for circuits having potential of 5000 volts. These insulators, each with a locust pin, will be supplied for 13½ cents the Western Electric Company.

ss than 500 bases will be required for Columbian ts, and these castings will be furnished by the ir Electric Company for $18.25 each.

fifty alternating-current indicating switchboard s will be needed, and these will be furnished by & Roller for $10.95 each. These meters will be onnection with series transformers of a ratio of one for indicating the current on 60-cycle 10-amp seri arc circuits. They will be mounted on the switchboa, and the dial range will be from zero to 15 amp.

Te contract for certain kinds of outside construction wor, including the setting of poles and the erection of bra ets, ladder supports and line wire, has been awarded W. F. Cummings Company. This work, at average is of construction and material, will cost about

Te hot-water heating system in the Wabansia Avenue subation will be constructed by the L. H. Prentice Com-

Rapid Erection of Minneapolis Generating Station.

Te new 12,000-kw steam generating station of the Minneapolis General Electric Company at Minneapolis, Minn., is nw in operation, having been turned over to the operatin company by the Stone & Webster Engineering Corporion.

As noted in these columns Jan. 12, 1911, the old Main Stret station, formerly the main steam generating station of the Minneapolis General Electric Company, was destroed by fire on Jan. 6. An engineering and construction offic was immediately opened by the Stone & Webster Engineering Corporation in Minneapolis to build a new generating station on the Mississippi River, north of the city, a large distributing station on the site of the old Main Street station and a substation on Sixth Street, with several miles of underground transmission line.

Ground was broken for the new power station on Feb.

Fig. 1—Site of Minneapolis Power Station Looking Northwest Toward the Mississippi River, March 4, 1911.

25 and electrical energy turned out Aug. 1, or in practically five months. The plant is of steel-frame and brick construction and is a typical modern turbine generating station. The distributing station and substation are of similar construction. The distributing station receives the output, not only of the new steam station, but also of the Taylor's Falls hydroelectric plant, which has a generating rating

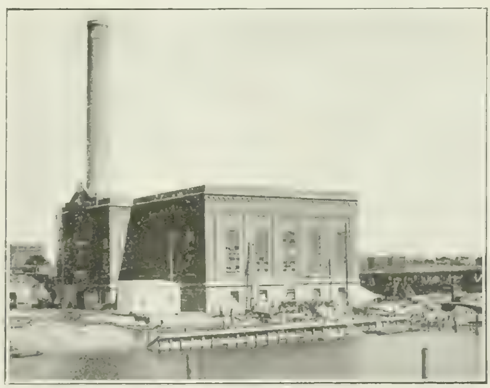

Fig. 2—12,000-kw Minneapolis Power Station Looking Southwest from Mississippi River, Aug. 14, 1911.

of 20,000 kw. In addition, the distributing station is a generating station on a small scale, the generators rated at 1200 kw being driven by wheels taking water from the Mississippi River.

Associated Gas and Electric Companies Meeting.

Messrs. W. S. Barstow & Company, managers of the Associated Gas & Electric Companies, held a meeting last week at their New York headquarters, at which the superintendents of the various plants in their organization were in attendance. The mornings were devoted to discussions intended to promote harmonious action, disseminate infor-

mation and interchange of ideas. The afternoons were largely devoted to visits to appliance and fixture rooms, public-utility plants, etc., while the evenings were given over to diversion. The meeting, which extended over the entire week, led to a more thorough understanding between management and superintendents and a closer knitting together of the plants.

The meeting was called to order by Vice-President Taylor, who welcomed the guests and explained the general intention and outline of proceedings. Mr. Barstow, president of the company, followed with a short address on the value of syndicate management, its results, relation to public welfare and the increasing knowledge the public is obtaining of corporate management through public-service channels. His view of the future was optimistic, while at the same time conservative in expression. Mr. Kilmer, of the Johns-Manville Company, spoke on indirect lighting, and the Dart Union was exhibited and explained by a representative of the manufacturers, following which there was a display of "Hot-Point" electric appliances. After luncheon the Stock Exchange and Singer Tower were visited, the New York-Chicago ball game was witnessed, and a trip after dinner to Chinatown completed the day.

Tuesday morning's session was opened by Mr. Atkinson, of Van Wert, Ohio, his subject being "Pipe Fittings." which gave rise to a lively discussion. Mr. W. J. Murdock, of Bethlehem, Pa., then took up the subjects of stock requirements, requisitions, domes, fixtures, glassware, uniformity of prices and adjustment of stock between plants, which points were discussed freely. After luncheon at the Lawyers' Club an interesting visit was made to the gas plant at Astoria, and a theater party concluded the day.

Wednesday's session was opened by Mr. Gauvey, of Greenville, Ohio, with a paper on water-heating appliances. Mr. W. J. Murdock, Cortland, N. Y., followed with a paper on house-piping, specifications for plumbers and inspection, which subjects were generally discussed. Mr. Flint, of West & Flint, public accountants, then gave an interesting talk on system and statistics; Mr. Morrison, of the Barstow Company, introduced the speaker and touched on financial topics. The party then adjourned to the offices of the Royal Art Glass Company and were conducted to the Café Boulevard, where luncheon was served under the hospitable direction of Mr. Bruenn. A demonstration of the new gas "arc" lamp at the offices of the General Gas Light Company was followed by a boat trip to Coney Island and a banquet in Luna Park.

Thursday's session opened with a discussion on "Economy in Gas Making," conducted by Mr. Stangland, operating engineer of the company. Mr. Shilling, of Salem, N. J., spoke on house wiring, and several other subjects came up. Adjournment was made to attend a luncheon at Kalil's, tendered by Messrs. Shapiro and Aronson. A view of the fixture rooms of the latter and a hasty inspection of the German high-pressure gas "arc," imported by Messrs. Fensterer and Ruhe, were followed by a visit to the Edison Waterside plant. A theater party ended the day.

On Friday morning Mr. Summers, of Ithaca, and Mr. Boyle, of Hornell, introduced topics pertaining to new business, card indexes and follow-up systems, and Mr. O'Neil, of Norwich, brought out some good ideas regarding main extensions. Luncheon was presided over by the executors of the Barstow Company, and an enthusiastic motion, thanking the officials for the unusual opportunity for instruction and diversion, was unanimously passed.

During the meeting it was remarked that the time is ripe for the formation of an appliance club or association in New York, with lunch facilities for resident members, a meeting room for monthly meetings for discussion, and with the entertainment features necessary for out-of-town members. It was suggested that a few large appliance manufacturers could easily create business by fostering the idea, even to the extent of permanent display rooms.

International Municipal Congress and Expositior

Under the auspices of the city of Chicago and a num r of civic organizations the International Municipal Cong and Exposition was opened at the Coliseum, Chicago, Sept. 18, to continue until Sept. 30. Greetings were tended at the opening exercises, Mayor Harrison of cago welcoming the visitors, and speeches being made Mayor Fitzgerald of Boston; Mr. John MacVicar, Mayor of Des Moines; Mr. Harry A. Wheeler, presi of the Chicago Association of Commerce; Mr. Francisc Rucavado of San José, Costa Rica (who spoke in Spani and others. Letters were read from the Lord Mayo London, Mayor Reyburn of Philadelphia, and others.

Sessions of the congress are held every afternoon, evening meetings of a more popular character, often sisting of moving-picture shows, one representing fireb operating at a fire and shown by the General Electric C pany. The subjects discussed at the daily meetings relat municipal advancement on such themes as city char municipal accounting and efficiency, municipal muse city planning, paving, taxation, police and fire service, supply, protection of water and disposal of sewage, waste, parks and playgrounds, hygiene and sanitation, the like. The subject of most direct interest to elect men, perhaps, is that of "Public Utilities," to be discu on the afternoon of Sept. 25 under the chairmanship of Bion J. Arnold and including addresses by Messrs. E Elliott, of New York; H. M. Byllesby, of Chicago, Edward W. Bemis, of New York.

Coincident with the congress there is shown a large play of exhibits pertaining to municipal activities, ma an exhibition of a very interesting nature; but only a of the exhibits are directly electrical in their nature. cities of New York and Chicago have the largest p municipal displays. One interesting feature of the York City exhibit is a series of pictures in one frame s ing the development of street lamp-posts in New York since the year 1850. A number of other pictures of illumination and modern lamp-posts are displayed. I Chicago municipal exhibit the Electrical Inspection B of the Department of Electricity has a booth fitted show the fire danger from hazardous electrical mate Here old-style wiring is contrasted with modern pra and examples of burn-outs show some things that are be avoided. Another contrast is afforded by an old-type a modern moving-picture machine, showing the improvement of apparatus now used in the booths used at moving-pi shows. The Bureau of Gas Inspection of Chicago dis a portable photometer outfit used for testing street lam all kinds, from gasoline to flaming arcs.

A large number of American and foreign cities are sented by exhibits, usually in the shape of photog books, pamphlets, drawings or diagrams. The Bure the Census of the United States government is also re sented by published reports of statistics and va ous schedules and forms. The Sanitary District of Ch shows a working model of a sewage-disposal plant.

Among the industrial exhibits, possibly that of gr te electrical interest is the one shown by the Commonwealth Edison Company and the North Shore Electric Com ny, of Chicago, in conjunction. The Commonwealth cor any displays a large map made of wood and provided with miniature incandescent lamps in colors correctly plac l as to location to show the generating stations and subst ions of the company in the city of Chicago. Four gene ting stations, twenty-four substations distributing direct cu ent, eleven substations distributing alternating current, ar one substation distributing alternating current with au iary steam reserve are shown, each distinguished by it own color. The North Shore map represents the large te tory served by this company surrounding Chicago, showin likewise by miniature lamps the cities and villages ser d at

he generating stations and substations. The exhibit also ontains fine interior views of the Fisk Street and Quarry Street generating stations and literature relating to the limination of the smoke nuisance by the use of central-tation energy, the sanitary conditions obtainable in fac-ories through the use of electricity, and the present status f existing and proposed electrifications of steam-railroad erminals.

The H. W. Johns-Manville Company, New York, has an xhibit, a prominent feature of which is an asbestos booth or moving-picture shows. This type of booth is now recog-ized by law in five or six states. Robert W. Hunt & Com-any, Chicago, demonstrate inspection tests, including the nvestigation of electrolytic corrosion of iron structures em-edded in concrete. The testing of rubber-covered wire is lso shown, as well as several other interesting processes. mong the large number of other exhibitors are the rnold Company, Chicago; H. M. Byllesby & Company, hicago; Dean Electric Company, Elyria, Ohio; Green ngineering Company, Chicago, and Western Gas Con-truction Company, Fort Wayne, Ind., the last-named show-g ornamental standards for street illumination. Vacuum eaners are exhibited by the McCrum-Howell Company, onarch Vacuum Cleaner Company and Palm Vacuum leaner Company.

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he 1911 Meeting of the British Association for the Advancement of Science.

From the engineering point of view generally the meeting the British Association for the Advancement of Science, hich has been held at Portsmouth from Aug. 30 to Sept. 7, s been considerably above the average. This applies rticularly to the papers of direct and indirect electrical terest, and in spite of the characteristic small attendance the meetings of the engineering section the discussions served to allay the criticism that the value of this n is deteriorating. The whole attendance at the meet- bout 1200, is somewhat below the average of recent s, but it should be remembered that the period chosen he meeting on this occasion overlapped more than with the holiday season. Next year the meeting will d from Sept. 4 to 11 in Dundee (Scotland), the presi- being Prof. E. A. Schäfer, of Edinburgh University. e following year, 1913, the association will meet in rmingham.

Proceedings commenced on the evening of Wednesday, 30, when Sir William Ramsay, president of the asso- n, delivered his address.

e president discussed the arrangement of the chemical nts in numerical order according to their atomic ts, including the twenty-six elements discovered in ely recent years, and pointed to the great desirability ermining the atomic weight of radium and the weight electron. Concerning the enormous quantity of en- tored up in radium and its descendants, the president hat if the energy in a ton of radium could be utilized in rty years, instead of being evolved at its invariable slow e of 1760 years for half-disintegration, it would suffice to pel a ship of 15,000 tons with engines of 15,000 hp at rate of 15 knots for thirty years—practically the life- e of the ship. To do this actually requires a million and alf tons of coal. The virtue of the energy of the radium sists in the small weight in which it is contained—in er words, the radium-energy is in an enormously con-trated form. This leads to the speculation whether, if nents are capable of disintegration, the world may not e at its disposal a hitherto unsuspected source of energy. whole progress of the human race has indeed been due ndividual members discovering means of concentrating rgy and of transforming one form into another. Great gress has been made during the past century in effecting the conversion of one form of energy into others, with as little useless expenditure as possible. For Great Britain as a nation it is of importance to make the best use possible of her coal fields. He advocates the conversion at the pit-mouth of the energy of the fuel into electrical energy, using as an intermediary turbines, or preferably gas engines, and transmitting the electrical energy to where it is wanted. The use of gas engines may, if desired, be accompanied by the production of half-distilled coal, a fuel which burns nearly without smoke, and one which is suitable for domestic fires, if it is found too difficult to displace them and to induce the English population to adopt the more efficient and economical systems of domestic heating which are used in America and on the Continent. The increasing use of gas for factory, metallurgical and chemical purposes points to the gradual concentration of generating stations near the coal mines, in order that the laying down of expensive piping may be avoided.

The meetings of the sections began on Thursday, Aug. 31, and continued daily until Sept. 7. Prof. J. H. Biles, president of Section G (engineering), devoted his address to this section entirely to stability in ships. The president's address was followed by a paper by Mr. W. Worby Beaumont on "The Origin and Production of Corrugation of Tramway Rails."

The author explained that the corrugations are a function of the elastic resistance of the material to compression, its elastic tensile strength and its hardness, the mechanical originating conditions being the weight on the wheels and the increase of that weight more especially on the outside curves by "car heeling" at the higher speeds. He claimed that the first and most effective remedy is the reduction of the great destructive weight on the wheels of the modern car, the second is the use of large wheels, the third is the maintenance of moderate speeds, and the fourth is the use of harder rails than the hardest at present employed.

The discussion was opened by Mr. Alexander Siemens, president of the Institution of Civil Engineers, who suggested that the author did not himself really believe the conclusions he had given in the paper. Reduction of speed and the use of larger wheels are impossible; all electrical engineers know that in the design of generators and motors the weight increases rapidly with decrease of speed, so that the remedy suggested is worse than the defect. He suggested that rail makers should turn attention to producing a rail having a hard resisting material on the sides and a soft metal for the head. This would "give" as the wheel passed over and regain its shape afterward.

Sir William Ramsay jocularly characterized this suggestion as "a dream" and asked what would be the effect on the average tractive force.

Prof. J. E. Petavel suggested as a remedy for rail corrugation the springing of the wheel tire by introducing a layer of some material all round between the outer tire and the wheel. This would give a larger area of contact and operate much in the same way as a pneumatic tire.

Mr. Beaumont in reply pointed out that Mr. Siemens could not have studied the properties of materials very closely if he thought he could get a sufficiently good tempered material which would stand the rolling pressures of small tramcar wheels, carrying 20-ton loads, and recover after every indentation. It would really be a reversion to the wrought-iron railway rails used many years ago, which used to spread gradually sideways until strips came off. He agreed that larger wheels could not be used with the present tramcar design, but a little modification would make this possible. Finally, after suggesting that this question of corrugation would be an important factor in determining whether tramways would eventually be superseded by some other form of traction, Mr. Beaumont said that the cost of repairs and maintenance on some lines in England due to this was rendering it impossible to run the undertakings without municipal aid.

The final paper presented before this section on Thursday morning was a description of the Anschutz gyrocompass by Mr. G. K. B. Elphinstone. The paper was not discussed. The instrument was demonstrated daily throughout the meeting. The apparatus is a rapidly rotating gyrostat compass in the true sense of the word in that its axle precesses to the true north and south automatically no matter in what position the compass is started.

Owing to lack of space the remaining portion of the report of the meeting is held over and will appear in the issue of next week.

Convention of the Colorado Electric Light, Power and Railway Association.

The Colorado Electric Light, Power and Railway Association held its ninth annual convention at the Hotel Colorado, Glenwood Springs, Col., Sept. 13-15. Sixty members were present at the first session, which began with a brief address by the retiring president, Mr. H. L. Corbett, of the United Hydroelectric Company, who rapidly sketched the growth in the use of electricity and the greater tendency to substitute electrical for other forms of energy, where costs could be shown to compare reasonably. He also commented on recent changes in the Colorado field through the resignation of three managers of large companies, namely, Messrs. George B. Tripp, of the Colorado Springs Light, Heat & Power Company; William T. Wallace, of the Colorado Light & Power Company, and J. F. Vaile, of the Pueblo Suburban Traction & Lighting Company.

Papers prepared by Messrs. G. E. Williamson and C. A. Sunderlin were then presented.

ELECTRICITY IN ADVERTISING.

Mr. Williamson, as illuminating engineer for the Denver Gas & Electric Light Company, has had unusual success with display lighting. His paper on "Electricity for Advertising Purposes," read by Mr. D. Evans, develops the importance of light from the beginning of time; the dissatisfaction which the natural night illumination has always given; early forms of artificial light, and, finally, modern electrical display applications. Window lighting, outlining and signs are separately discussed. Mr. Williamson suggested some unbalancing of window illumination so that some shadow will be evidenced and "flatness" avoided. All portions of the goods displayed should, however, be illuminated completely. He advocated the selling of large units as evidence of a good grade of salesmanship and stated that demonstration of comparative cheapness and effectiveness of electrical advertising, as compared with other forms, is readily made by approaching a merchant with the verified number of persons passing by his store and accentuating the fact that these persons are off duty evenings and susceptible to impression. With newspaper advertising, one particular advertisement must vie with many others on the printed page, and can only describe the goods, not show them. Emphasis was laid on service as against kw-hours, and the Denver company is stated to be advancing its display lighting solely on the flat-rate basis, so that efficient lamps make a direct energy saving to the company. The Denver flat rate consists of a readiness-to-serve charge of 5 cents per lamp per month, plus 5 cents per kw-hour on a 20-watt lamp basis, plus $1 a month, less a discount based on the total consumption. Over $70,000 worth of display lighting income has been taken on this year by proving the "circulation" and showing the merchant an illuminated model of his display lighting according to the proposed installation.

Discussion.

In the discussion Mr. S. E. Doane said the Denver company was the pioneer in selling service rather than energy, and that this method appears to be finding rapid favor, since fuel costs are the least involved in central-station service and the energy used is proportional only to the fuel consumed. Mr. Doane stated that the growing popularity of tungsten lamps was probably responsible for the falling off of carbon-filament lamp production for the first time in history.

INCREASING BUSINESS ON EXISTING CIRCUITS.

Mr. Sunderlin spoke on "Methods Used in Securing Business on Present Lines" and emphasized the need for complete data on all residences, whether wired or not, and as to what extent electricity was being employed. Where the consumption of energy is below the average, or where buildings are unwired, the filling out of such gaps shoul be cheaper than the extension of lines into new territories As aids to intensifying of service, a time-payment plan for wiring residences, wiring at cost and the definite presenta tion of wiring costs to the prospective consumer by the solicitor are recommended. The desire for convenient ap pliances if aroused will frequently bring in customers un interested in electric lighting. Over 90 per cent of the customers at Colorado Springs use electric irons.

Discussion.

The discussion centered largely on the character of wir ing necessary to induce adoption through its cheapness Mr. Doane commented on the disadvantages forced upo the electric-lighting industry of England by the well-organ ized gas interests. The necessity of placing all feeder underground and for moving feeders at any time on th request of the postal authorities makes very vital the ir tensifying of service uses in districts already served. A a cheap method of inducing the use of electricity Mr. Doar mentioned the concentric wire recently evolved abroad, cor sisting of an inner conductor, rubber insulation and double grounded copper outer sheath, the double conducto being clamped over surfaces as necessary. The constru tion is stated to be inconspicuous and cheap and under co sideration by certain manufacturers of this country.

Mr. W. J. Canada, of the Rocky Mountain Fire Unde writers' Association, suggested that frailer constructi than permissible in this country might be fairly satisfacto in foreign countries owing to the following reasons: T rare occurrence of frame structural material in Europe buildings as against its prevalence here; the governmen attitude which makes the owner, tenant or builder abs lutely responsible for any fire caused by defective co struction or operation in those countries as against ent irresponsibility here; the greater carefulness of workm of all classes in those countries. The much larger reven normally obtained per unit cost of original installation this country, he said, makes slight cost differences of mu less importance and the use of wiring exposed on the ce ing would be objectionable to the residence owner here

The general opinion of lighting-company operators pr ent was that conduit as now installed provides the o permanent form of wiring and is a small part of the ori nal cost as compared with fittings and especially with f tures in residence work. Conduit work was stated to e now averaging in cost from $1.75 to $4 per outlet, acco ing to the character of the installation.

OXYACETYLENE WELDING.

Thursday's sessions were opened with the paper n "Welding by the Oxyacetylene Process," by Mr. K. Brackett, of Denver. This was stated to give the hot st flame temperature known. The different systems were lined by the author and the necessity for pure gases sho .

The process has been coming into very general use, m h work being accomplished in large operations by use f portable sets with compressed oxygen and dissolved ac,y lene in small tanks. The heavy penstocks of the Cen al Colorado Power Company at Boulder, 4 ft. in diame r,

½ in. in thickness and supporting a static head of 1800 ft., ‹veloped numerous small leaks at the double-riveted butt-‹nged joints. Waste, wash and consequent danger to t‹ line made necessary the correction of this trouble, in ‹ich the oxyacetylene process was completely successful.

Discussion.

In discussion Mr. Tripp, retiring general manager of t‹ Colorado Springs Company, noted the success of its s‹p in using such portable apparatus. A cracked high-p‹ssure cylinder is now being so welded at a cost of $50 ‹ich would otherwise cost $2,000 to replace.

Mr. Dostal, of the Denver Gas & Electric Light Comp‹ny, suggested the value of oxygen generation by an elec-t‹ytic process as off-peak load. Mr. Brackett stated that o‹side of the difficulty in separating hydrogen perfectly o‹y a rate exceeding 4 cents per kw-hour could stand in t‹ way of replacing the present expensive chlorate of p‹ssium process.

ECONOMIC PRODUCTION OF LIGHT.

A paper by Mr. S. E. Doane, of the National Electric L‹mp Association, on the economic production of light w‹s then read. Mr. Doane prefaced his paper by stating t‹t on invitation he was expressing his own personal con-v‹tions rather than outlining any program in contempla-t‹n. The thought of the paper does not differ materially f‹m that presented by the same author before the St. L‹is convention of the National Electric Light Associa-t‹n. Mr. Doane stated that the temporary embarrassment o‹ ‹ghting companies by the introduction of high-efficiency la‹ps is far less serious in this country than abroad, where ‹ reduction of living expenses is a necessity. Although ‹g companies are promoting the use of such lamps m‹re than ever before, as yet only 5 per cent of the sockets a‹ filled with tungsten lamps. In the estimation of Mr. D‹ne lamp efficiency should be considered an important ‹f the total plant efficiency. Central stations are en-‹l with the problem of increasing the efficiency of ‹nd of transmission, whereas the incandescent lamp ‹cturers must study the problem particularly and in ‹n order to make the use of incandescent lamps most ‹le to the ultimate consumer; because, unless the ‹an compete in cost with other illuminants, its field ‹fulness will be greatly limited. Mr. Doane stated ‹a broad way the economic saving by the use of high-‹cy lamps is very great; but because most existing ‹systems are so designed as to give a great part of ‹ving to the consumer the electric-light company is ‹l to treat the use of the high-efficiency lamp as a ‹cidental in its routine business. He held that the ‹at electrical energy is metered and paid for by the ‹er when delivered at his premises did not remove ‹ral obligation of the company to assist the consumer ‹the energy in the best possible way. The efficiency ‹sformation of electrical energy into light, Mr. Doane cl‹ms, is not the only factor affecting the cost of the com-m‹ity to the consumer. The relatively low density of re‹dential service is responsible to a great extent for the ‹st of rendering such service, and the author stated ‹e high-efficiency lamp could form the basis of a cam-pa‹n for increasing the density of residential service. T‹ high-efficiency lamp properly used in a properly de-si‹ed system of charging offered great possibilities for ad‹ncing central-station interests and extending the field of ‹ghting service. The central stations and lamp manu-fa‹urers are mutually affected by the attitude of the public to‹rd electric illuminants in general, and Mr. Doane con-cl‹ed by stating that it is essential that both these interests un‹ in order to make the electric light the best, safest and ch‹pest illuminant that human effort can produce.

‹. Aller, illuminating engineer of the General Electric Co‹pany, contrasted the slogan in this country, "Increase yo‹ light," with that of Europe, "Decrease your bills." Mr. Dostal commented on the benefits by high-efficiency lamp sales to the lamp manufacturer and the consumer, with actually reduced revenue from lighting sales to practically all service companies using meters. Only by pushing other appliances have revenues been kept from falling off, where without the new lamps increases could be shown.

Mr. Tripp, of Colorado Springs, stated that delay in introducing such lamps might be of greater value in Colorado, where competition with gas is not so serious as in the East and where practically all houses are wired. Mr. G. L. Flower, of Montrose, emphasized the situation of companies in the small Western cities by stating that 70 per cent of all demand in Montrose is for lighting and that over 85 per cent of all buildings are wired. There is small chance of getting much new business by cheaper light, and it is impossible to avoid some loss in revenue where new and better lamps replace old lamps.

This was the general sentiment among the smaller companies, excepting the United Hydroelectric Company, of Georgetown, and the Leadville Light & Power Company, both of which still sell electricity on the old flat-rate basis. It appeared general practice in other cities to push the sale of large units, rather than to attempt changes in rates which would certainly entail litigation.

In commenting on the general hesitation of service companies to push the new lamps vigorously Mr. Corbett emphasized the fact that other interests introduce improved lamps if central stations do not, and the question now is, "What can central stations do to preserve their revenue intact?"

Mr. Doane stated that manufacturers have not wished to hasten the use of high-efficiency lamps. More floor space, equipment and help are necessary in their manufacture. Foreign competition, isolated plants and train-lighting service are forcing the issue. Co-operation is necessary with lighting companies, but the tendency is so strong toward low-watt units that the 25-watt lamp is even now the best seller and the sales are increasing. The first problem of central stations is a solution of the rate question, and this will probably take the form of a charge covering maximum demand plus a low metered charge to cover fuel and transmission charges.

ELECTRICITY IN MINING.

A paper entitled "Selling Electricity for Mining Operations" was next read by Mr. F. P. Wood, assistant manager of the Colorado Light & Power Company at Cripple Creek. Mr. Wood stated that the availability of accurate data is the greatest single advantage in attacking the electric-service problem in mining districts. His company keeps lists of applications in each mining property, with costs, character of load, etc., and ready reference to this list is the surest argument with prospective customers. Electric mine hoists, to which the greater part of the paper is devoted, are often avoided by lighting companies, because of the intermittent nature of the load and the large size of the units. Rates profitable to the service company have also been usually unattractive to users. The unbalanced hoists usually found are responsible for much of this trouble. Various methods of balancing, especially tail chains on double hoists, were explained, together with their benefits in reducing motor sizes and improving the character of the load. In continuous hoisting operations the use of flywheel motor-generator sets with a direct-current motor driving the hoist was recommended. The unusually good load-factor of mine, mill and pump loads was evidenced by actual figures. A load-factor exceeding 90 per cent was shown in many instances and for the entire Cripple Creek field the load-factor is 70 per cent. The use of motors appeals strongly to mill operators as clean and convenient and also removes the fire hazard of steam plants.

Discussion.

Mr. Woods stated that storage-battery installations for

keeping down hoist peaks had proved usually too costly. Mr. Robertson, manager of the Leadville Electric Light & Power Company, said that in five years his company had taken on 4000 hp in electric hoists, using an extra charge to cover the intermittent character of the load, based partly on maximum demand and partly on the total energy consumed.

Mr. Doolittle, of the Aspen company, stated that all steam hoists in the Aspen field had now been replaced by electric hoists.

Mr. Tripp, of Colorado Springs, pointed out that while a single hoist was a very undesirable load, 100 such installations made a good character load for a station and were so desirable as to warrant much lower rates.

Mr. Canada, of the Underwriters, said that electric-service companies too seldom appreciated that by making good motor installations in mill properties they were reducing fire risk and insurance rates from those of steam-operated stations and that in metal-mining buildings this saving might average 25 cents to 40 cents per $100 of insurance carried.

QUESTION BOX.

Under Question Box discussions the use of conduit installations and especially conduit services with main switch and cut-out outside the building received general support.

Mr. Canada and Mr. Dostal brought up the question of making 60-watt tungsten lamps with the same size of bulb as the 40-watt lamp, so that they may be utilized in ordinary shades and fixtures. Mr. Doane asked for a definite expression of the association on this matter, which was given in favor of making the small 60-watt lamp standard.

The custom of charging a meter deposit, while usual, had resulted in the case of the Denver company in such a large 6 per cent banking business that the practice has been largely abandoned in Denver.

ENTERTAINMENT FEATURES.

The remainder of the day was given over to entertainment. In the "pool" a number of swimming races, diving contests and women's ladder races were held, the baseball game being necessarily postponed on account of rain. In the evening prizes were distributed to winners in the "pool" contests. Some desperate boxing and wrestling matches were undertaken by the Sons of Jove, shadow pictures being employed to save the tender feelings of the women present. Mr. D. Evans, of the Denver Gas & Electric Light Company, sang "Killarney," and the evening concluded with informal dancing. On Friday morning the women of the party were taken in 'buses over the mountain drives, to the fish hatcheries and through the cañons.

At the Friday morning session papers were read by Mr. Edwin Yawger, of the Westinghouse Machine Company, and by Mr. B. S. Manuel for Stephen Q. Hayes, of the Westinghouse Electric & Manufacturing Company.

CONDENSERS AND COOLING TOWERS.

Mr. Yawger's paper on "Condensers and Cooling Towers" particularly covered the latest practice of the Westinghouse company and was illustrated by stereopticon. Emphasis was placed on the importance of such condenser design as would send very hot discharge water to cooling towers, so that the temperature of the water after being passed through a tower might be high enough to equal even hot summer atmospheric temperatures. The proportional expense to be incurred in condensing and cooling plants was stated to be determined rather by experience than theory, the efficiency of cooling towers as such being yet a matter of experimental design. Mr. Yawger developed designs of towers to handle various quantities of condensing water under varying operating conditions and outlined the essentials of such towers as follows:

(1) Speed is necessary at the surface of contact of air and water. (Still air against still water will cause only minute evaporation.) (2) Power is necessary to produ this speed of contact, either by forcing or elevating t water or by blowing the air into the tower, or by bo and much care must be exercised to reduce both these requirements to a minimum. (3) Time of exposu is an important element, hence excessive speed must avoided in order to give time for complete heat transf (4) The time element depends upon the ratio of volume water to superficial area of water, and hence complete su division of the water either in thin layers or in small drc will tend to reduce the time of exposure—which means lo elevation of water. (5) The subdivision of water and t speed of contact must not be carried to the point of pe mitting too much water becoming entrained and lost.

OUTDOOR TRANSFORMERS AND SWITCHING STATIONS.

A paper on this subject, prepared by Mr. Stephen Hayes, of the Westinghouse Electric & Manufacturi Company, Pittsburgh, was read by Mr. B. S. Manuel, that company. The subject is treated under the followi heads: Outdoor transformers; outdoor fuses; outdoor circuit-breakers; outdoor lightning arresters; designs power stations, and actual outdoor installations. T paper emphasizes the points brought out by Mr. K. C. Ra dall in an A. I. E. E. paper on high-voltage transform and protective and controlling apparatus for outdoor stallations at the April, 1909, meeting. The advantages outdoor apparatus lie in cheapening the installation, due saving in building; there is also less life and prope hazard. The author enumerated the disadvantages incid to exposed condition of the apparatus and described number of installations utilizing outside high-voltage c cuit-breakers. In order to give some idea of the arran ments adopted for outdoor stations of various voltages a ratings, illustrations were thrown on the canvas of desi for some typical stations and also for some particular p posed installations. Actual outdoor installations of 33,0 volt, 44,000-volt, 66,000-volt and 88000-volt circuits w also shown on the screen, indicating in a general man the tendency of design of such installations.

ELECTION OF OFFICERS.

The business meeting of the association followed w reports from the various committees, showing heal growth and greater co-operation between members.

The officers elected for the ensuing year are as follo President, Mr. W. E. Robertson, manager of the Leadv Electric Light Company; vice-president, Mr. W. N. Cla assistant manager of the Pueblo Suburban Traction Lighting Company at Victor.

Conference of Governors of States.

On Thursday morning. Sept. 14, Governor Hadley Missouri and Governor Aldrich of Nebraska delive before the Governors in conference at Spring L addresses on "The Right of the States to Control Int state Commerce." These papers with miscellaneous b ness, occupied all of the morning. At the afternoon sess Governor McGovern of Wisconsin spoke on "State C trol of Public Utilities." Intrastate commerce regulat and state control of public utilities were treated as a wh and after the delivery of Governor McGovern's addr the discussion was confined exclusively to the addresses Governors Hadley and Aldrich on intrastate comme the accompanying interjection of a matter of natio l politics having diverted attention from the subject of pu ic utility control.

This discussion centered around a proposal made y Governor O'Neal (Alabama) that a committee of go ernors be appointed to argue before the Supreme Cour of the United States the right of the states to regulate c merce within state borders. The Minnesota rate case in

ich Judge Sanborn, of the Federal Circuit Court of Minsota, held that the states had no right to regulate rates r freight or passenger railroad traffic, on the ground that ch intrastate regulation would seriously interfere with e regulation of interstate commerce, will shortly come bere the Supreme Court of the United States. The discuson showed that the Governors were practically unanimous their support of Governor O'Neal's motion. Under an endment offered by Governor Stubbs (Kansas) and cepted by Governor O'Neal, the motion was that the mmittee should consist of Governors Harmon (Ohio), as airman, Hadley of Missouri, and Aldrich of Nebraska. is motion was carried with only one dissenting vote. e meeting was united, however, in the belief that if the tes are denied the right to regulate commerce within ir respective borders they will be reduced to mere vinces, without one of the most important powers inrent in government, and that all powers not specifically anted by the Constitution to federal authority should be ained by the individual states.

STATE CONTROL OF PUBLIC UTILITIES.

Owing to its interesting nature and the full account luded of the routine administration of the Wisconsin blic utility law, the address of Governor McGovern is nted in full below:

As defined in the statutes of Wisconsin—and this paper written almost wholly from the viewpoint of my own ate—the term "public utility" has a somewhat restricted d technical meaning. It is there employed to embrace ly persons, corporations and municipalities that own or erate plants for the conveyance of telephone messages, for the production and sale to the public of heat, light power. These utilities, however, are regulated by the ilroad Commission, which, as its name implies, controls steam and electric railways, as well as express and ph companies. In ordinary speech even in Wiscon- erefore all these enterprises are public utilities and is in this more comprehensive sense that I shall use the

HISTORY OF PUBLIC UTILITY REGULATION.

ile the agitation for the regulation of public utilities a generation old, and the theories applicable to such tion rest on well-known and long-established comw principles, it is only within recent years that ntial progress has been made It is true that at times e attempted regulation of this sort by means of pros inserted in the original charters granted to public corporations; at times by authority granted to political subdivisions of the State, and more often ect legislative enactment. But all these laws, howwell suited to existing conditions when they were sed, in the rush and intensity of modern economic nge and development, speedily became obsolete. This east has been the experience of Wisconsin, and it has lieve been the experience also of many another State. our highest court has said:

gulation of railways by direct action of the legislaas been tried and found impracticable, and its attempt generally abandoned. The business of the carrier in these modern times so grown and expanded and become such a large factor in the complicated social and economic life of the country that the old modes of regulation by direct action of the legislative body are no longer adequate, and indeed no longer possible."

is only of late years that effective administrative control of public utilities through a board of commission has been attempted. Massachusetts in the year 1885 first pled the control of gas and electric utilities in the hands of such a commission. New York established a similar bd in 1905. In the same year Wisconsin placed comple regulation of railway service and rates and the control of express companies in the hands of three persons called the "Railroad Commission of Wisconsin." Two years later it added gas, electric heating, water, telephone and telegraph utilities, and street and interurban railways to the supervision of the same body. During the session of the Legislature this year the power of this commission was again enlarged so as to include the regulation and conservation of water powers. Thus all the public utilities of Wisconsin, using this term in its broadest sense, are now subject to the regulation and control of this single board, which, however, still retains its original designation.

A similar tendency toward commission control is observable elsewhere. During the last year Ohio, Kansas, Maryland, New Hampshire and New Jersey passed acts creating commissions similar in part at least to that of Wisconsin. California has submitted its commission act to a referendum vote of the people. During the past two years the legislature of practically every state in the Union has considered the question of establishing some sort of a public utility commission.

PRINCIPLES INVOLVED.

The basic legal principles underlying governmental regulation of public utilities, however novel may be their application to present industrial conditions, are as old as the common law. They are founded upon the very elementary distinction between a public and a private calling. One is clothed with a public use and interest, while the other is not; and this public interest has always in the eye of the law justified regulation in behalf of the people as a whole. The nature and character of the business of utilities is such that competition is inoperative in determining service or rates, and the only choice left to the public is between regulated and unregulated monopoly. It goes without saying that the right of the State to supervise monopolies is as ancient as it is obvious.

But it may be urged that the exercise of this power, the enforcement of this right, is a legislative function which cannot lawfully be delegated to an administrative board or commission. This is very true; it does not, however, militate against the practical utility of these commissions. Most assuredly it is the legislature and not the commission that has the power to regulate. It is the legislature that does regulate. It is the legislature that creates the commission, defines its powers, establishes rules for its guidance and determines the entire policy to be pursued. The commission merely ascertains the facts of each case as it is presented, and applies to these facts the law already laid down by the legislature. It is purely an administrative body with administrative functions only, although these functions have become so immensely difficult and important that we sometimes conceive them to be either legislative or judicial in nature, or both. Upon the other hand the rule laid down by the legislature is often a very simple and elementary one; in the case of Wisconsin utilities merely that the service and facilities furnished shall be reasonably adequate, and the rates charged shall be reasonable and just. Manifestly the difficulty here is not in formulating a rule of action, but in applying it.

This relation of the commission to the legislature and also to the courts is so well set forth in the recent case of the Minneapolis, St. Paul and Sault Ste. Marie Railway Company vs. the Railroad Commission of Wisconsin (136 Wisconsin, 146), that I feel justified in quoting from the decision. Answering the objection that the law creating the railroad commission is invalid because it involves an unlawful delegation of legislative power, the Supreme Court of Wisconsin, in a very comprehensive and illuminating opinion, stated the law upon this subject as follows:

"The division of governmental powers into executive, legislative and judicial, while of great importance in the creation or organization of a State, and from the viewpoint of institutional law and otherwise, is not an exact classification. No such exact delimitation of govern-

mental powers is possible. In the process of enacting a law there is frequently necessary the preliminary determination of a fact or group of facts by the legislature, and it is well settled that the legislature may declare the general rule of law to be in force and take effect upon the subsequent establishment of the facts necessary to make it operative or to call for its application. . . . The legislature may delegate any power, not legislative, which it may itself rightfully exercise. This power to ascertain facts is such a power as may be delegated. . . . This law establishes, and thenceforth assumes, the existence of rates, charges, classifications and services, discoverable by investigation but undisclosed, which are exactly reasonable and just. It commits to the Railroad Commission the duty to ascertain and disclose that particular rate, charge, classification or service. The law intends that there is only one rate charge or service that is reasonable and just. When the order of the commission is set aside by the court it is because this reasonable and just rate, charge, classification or service has not yet been correctly ascertained. When the order of the commission has been rescinded or changed by the commission because of changed conditions it is because there is a new reasonable rate to be ascertained and disclosed applicable to such new conditions and fixed by force of law immediately when the new conditions come into existence. But the theory and the mandate of the law is that this point always exists under any combination of conditions and is always discoverable although not always discovered. Until it is discovered and made known the former rates and service prevail. The order of the commission is *prima facie* evidence that the rate, charge or service found and fixed by it is the particular rate, charge or service declared by the legislature in general terms to be lawful and to be in force. If it were conceded that the commission had power or discretion to fix one of several rates, either of which would be just and reasonable, it would be hard to say that this was not a delegation of pure legislative power to the commission. But the theory of this law is to delegate to the commission the power to ascertain facts and to make mere administrative regulations."

An epoch-making decision, you will say; and in some respects it was. Contrasted with the holdings of some other courts the temper and attitude of the supreme bench of Wisconsin in this case was novel enough to be refreshing. As additional evidence of this, permit me to quote also the second last paragraph of this great opinion:

"The notion that commissions of this kind should be closely restricted by the courts, and that justice in our day can be had only in courts, is not conducive to the best results. Justice dwells with us as with the fathers; it is not exclusively the attribute of any office or class, it responds more rapidly to confidence than to criticism, and there is no reason why the members of the great Railroad Commission of this State should not develop and establish a system of rules and precedents as wise and beneficent within their sphere of action as those established by the early common-law judges. We find the statute well framed to bring this about."

THE COMMISSION.

The commission created by this act is appointive, not elective; its members hold for a term of six years, and receive annual salaries of $5,000 each and expenses; they are required by law to be experts in the business committed to them, and are strictly forbidden from engaging in any other work or becoming interested directly or indirectly in any utility it may be their duty to supervise. Employed under them are about one hundred clerks and engineers, some of whom receive salaries equal to those of the commissioners themselves. The engineering staff upon whom the members of the commission rely for all field and laboratory work, as well as for expert and technical examinations, is divided into groups, each worki along some special line under the direction of an expe enced chief. These men, wherever possible, co-oper with the members and employees of the tax commissi and when convenient do their laboratory work in conju tion with the scientists at the University of Wiscons Thus organized and supported this staff is considered many one of the most efficient ever organized for work this kind.

The Wisconsin law makes no distinction between vately and publicly owned utilities. Both are amenable the same regulations. Both report their financial con tions in the same manner, and according to the requi ments of a uniform system of accounting. This see reasonable, for the patrons of municipal plants are titled to the same protection against inefficient mana ment as those of private plants, and a comparison of sults obtained under these different systems of owners has been of real assistance in the regulation of both.

INDETERMINATE PERMIT.

The mere fact of regulation of public utilities conta the implication that they are virtual monopolies; otherw supervision of them might not be expedient or even just able. The Wisconsin statute goes farther and fran recognizes this condition by providing for the so-ca indeterminate permit. Considering that where effec regulation exists competition is neither necessary nor sirable, the Wisconsin law provides that the short-li franchises held by existing utility companies when it enacted may be surrendered for indeterminate pern This enabled the utility to secure a monopoly of the ritory it occupied during good behavior, or until the p should be acquired by the public at a fair valuation. this way unnecessary duplication of equipment, unne sary augmentation of fixed charges, and cut-throat c petition are prevented, and a more economic and satis tory service is secured. By doing away with short-t franchises, moreover, a speculative element is elimin from public utility investments, and the cost of finan enterprises of this sort is reduced.

Thus commission control is protective as well as re latory—protective of the utility, I mean. The requiren that every person desiring to start a new utility shall obtain from the commission a certificate of public venience and necessity further exemplifies this policy. order that each existing company, so long as it prop serves the public, may be free from fear of invasion o field by rivals possibly more powerful than itself it is vided that every utility having an indeterminate pe shall have an exclusive monopoly of the business in w it is engaged except in those rare cases where the mission, after hearing, may determine that public con ience and necessity require a second utility to divide field or to supplement inadequate or defective ser "Sandbagging" and "paralleling" are thus very pro and effectively outlawed.

The last report of the Railroad Commission shows seventy-two corporatons, representing 37 per cent of gross earnings from utility business in Wisco immediately upon this law going into effect, de to exchange their franchises for indeterminate per Many others came in afterward. Stability in investn was thus obtained, as appears from the fact that the se ties of utilities operating under a permit as a rule comi nd a higher price in the market than those that operate ler the old-time franchises. The period within which uti ies might thus exchange limited-time franchises for inder minate permits was at first definitely prescribed by the Legislature, then extended from time to time, and the ast session made the indeterminate permit universal and m pulsory. At present, therefore, there are no special an chises in Wisconsin.

STOCK AND BOND LAW.

Another important feature of the Wisconsin law is con-rol of stock and bond issues. The capitalization of utility mpanies is limited to the actual value of the property sed in the public service. The reason for this require-ent is obvious. Stock watering is always and every-here an evil of far-reaching and especially baneful sig-nificance; but nowhere is it more mischievous than in the ase of public service corporations. Wisconsin has abol-hed it, so far at least as public utilities are concerned. esides, experience teaches us that to be effective public gulation must be complete. It cannot be complete with-ut control of the issue of corporate securities. In deter-ining what is adequate service or a just rate, account ust be taken in every case of the value of the plant. The alue here spoken of is of course the actual, true value. here is no reason in the world why with complete con-ol this value should not correspond with the stock and nd value, taking these securities at par. If so, control ill be facilitated, the interests of inexperienced investors feguarded, and the utility placed on a stable and con-rvative basis.

PROCEDURE.

So much by way of outline of the history and principles public regulation and utilities. A word now as to how is regulation is made effective. The procedure is ex-emely informal and simple. A letter addressed to the cretary of the commission is usually sufficient to secure ompt investigation of the complaint and an adjustment the difficulty. Many of the most important rate sched-e disputes have been settled in this informal way. Ex-nsive reduction in railway rates for coal, potatoes, grain d merchandise, and in the utility cases, many improve-ents of service and reductions in rates, have been volun-rily made after an informal round-table conference. here no such agreement can be reached a formal hearing had, evidence received, and, if necessary, further inves-tation made, until the case has been determined upon all e facts and circumstances.

Every utility company must file with the commission all tes, rules and regulations. No changes can be made in isting rates or schedules unless such changes have been proved by the commission. Questions relating to ser-ce, rates and regulations may be investigated upon com-aint of a customer or shipper, or the commission may oceed to do so upon its own motion.

Should a court review of the order of the commission desired the statute provides for a speedy hearing. The grieved party must begin his action within ninety days, d all such actions are given precedence over any civil use of a different nature pending in court. Up to the esent time only seventeen orders of the Wisconsin com-ssion have been called in question in this way and in no se has any order been reversed.

Coming now more closely to the daily work of the com-ssion, it may be said, as has been pointed out by one of e commissioners, that the most important provisions of e public utilities law may be grouped under the four ding heads of rates, service, valuation and accounting.

RATES.

The ascertainment in any case of what constitutes a fair d just rate is a most difficult problem. With rate-mak-g indeed are associated most of the evils out of which e present insistent demand for public regulation has sen. Discrimination, extortion, secret rebates, draw-cks and similar abuses—familiar as they all are—illus-te what I mean. The ordinary citizen is entitled to otection against them. At any rate he has made up his nd to have such protection if the government can fur-h it.

What now is the basis of a just, equitable rate? Some lway managers and superintendents of public utility plants contend that it is the value of the service to the shipper and consumer. But this method of fixing rates at "what the traffic will bear" has become so odious and is so manifestly a cloak merely for extortion, discrimination and favoritism that extended discussion of it is no longer profitable. It involves so many elements, some subjective and some objective, and so varies with differences in person, time, place, commodities and other conditions as to afford really no scientific basis whatever for rate-making. Entirely aside from its whimsicality and the favoritism it invites, it is too indefinite and uncertain to be formulated into a workable basis for rate-making in even a majority of cases. Practically every commission, legislature and court which has seriously considered the subject has rejected this criterion for the more definite and scientific idea of the cost of service. The basis is definite, fair, ascertainable and economically justifiable. It bears the same relation to rates that the cost of production does to the price of commodities; and just as the cost of production of wares and merchandise determines their normal value, which market price constantly approximates but with which it seldom coincides, so the cost of service rendered by public utilities determines normal rates toward which actual schedules should steadily be made to approach.

VALUATION.

How now may the cost of service in a given case be ascertained? Many interesting and highly important data have been gleaned as to the relation under varying conditions of production of fixed investment or "overhead charges" to variable or current expenses and the ratio of each of these in turn to the value of the product. Without attempting to enter upon the discussion of the intricacies involved in this problem, let it be said that one of the major factors involved in this subject is manifestly the value of the plant. First of all, the owners of utilities are entitled to a fair return upon the reasonable value of the property devoted to public use. This calls at once for a valuation of the physical property of the plant. But this is not all. To it must be added something for the "going value" of an established concern and possibly something else for outlays and services expended in the past in upbuilding the plant.

The Wisconsin law requires the commission to value "all the physical property" and "all the property used and useful for the convenience of the public" belonging to every public utility in the State. As there are more than a thousand of these plants and the commission has appraised only about one hundred, it is evident that this is work that cannot be quickly dispatched. But it should be understood that among the one hundred valuations made are included all the steam railroads, the Milwaukee Electric Railway and Light Company, and many of the more important among the minor utilities of the State. Indicative of how well this work has been done is the fact that no appeal has ever been taken, either by a utility or a municipality, from any valuation made by the commission; and in some instances the utilities admitted that the inventories prepared by the commission were the best that had ever been taken.

UNIFORM ACCOUNTING.

But the value of the plant is not the only factor—though it may be the chief one—entering into the determination of equitable rates. Expense of operation, depreciation and other similar items must also be considered. And after there has been a determination of the gross charge necessary for the maintenance of the utility and the payment of reasonable profits to its owners there yet remains the apportionment of this amount among the various classes of consumers. Commissioner Ericson has well illustrated why this is necessary. In the case of electric lighting for example the flat rate per lamp rule which prevailed almost universally in Wisconsin before public regulation began

was soon found to be very unjust and unsatisfactory. Under it those who used their lamps for a short time each day were required to pay as much as those who used them constantly. To say nothing of the manifest unfairness of this arrangement, waste of electricity was of course the natural result with consequent loss to both producer and consumer. Similarly the straight meter or kilowatt hour rate normally imposes an unequal burden upon long and short hour consumers. The cost of 100 kw-hours per day delivered to each of two patrons may vary greatly with circumstances. The man who uses 10 kw ten hours a day should of course pay less than his neighbor who consumes 100 kw one hour a day, for the very plain reason that the latter requires ten times as great a proportion of the capacity of the plant. The proper adjustment of matters of this sort, though by no means simple, is nevertheless possible and highly desirable. It is of the very essence of scientific rate-making, for without it justice between different classes of consumers is impossible of attainment. Hence the necessity of proper accounting. As Mr. Ericson has said: "A correct method of rate-making is almost out of the question unless the financial and other records are properly kept."

But with accurate information as to the value of the plant and proper distribution of the cost of service according to modern systems of accounting it is possible to make rate schedules that are equitable to all classes of consumers, that yield a reasonable rate on the investment and that eliminate waste while promoting the maximum usefulness of the plant.

When this act went into effect, therefore, the commission called upon the utilities to submit a statement of their financial condition. The naïveté of the response has been so well described by Mr. F. L. Holmes, of Madison, that I take the liberty of quoting from his account of it. "The returns," he says, "were both amazing and amusing. Some companies kept books, the accounts of others were mere memoranda or check-book stubs which mean nothing. The bookkeeping affairs of one municipal plant were recorded in a vest-pocket account book, tied with a woolen string. Often the owner and manager carried the affairs of the corporation in his head. Few plants carried a depreciation account, and fewer managers understood the purpose of such a fund. Where several utilities had been merged one general account was maintained for credit and another for debit. Business system was unknown. A majority of municipal plants received no credit for the service rendered the city. The revenue went into the general fund and when there was any expense the city made an appropriation. Often city employees attended to the detail labor of the plant, but the salary for services was paid out of the general fund."

As required by law, the commission put an end to this rule-of-thumb work and prescribed a uniform system of cost accounting for all the utilities of the State. The result was most gratifying. By introducing system where chaos reigned and compelling uniformity both public and private plants were for the first time placed upon a basis of efficiency and economy and an enduring foundation was laid for intelligent future supervision. It should be some satisfaction to the commission after all this educational work has been done to know that its classification of accounts has since been voluntarily adopted by utilities in other states, in Canada and even in Mexico.

SERVICE.

The subject of service is closely related to that of rates. Like rates, just determination of what constitutes reasonably adequate service in any given case depends primarily upon a correct valuation of the utility and a satisfactory system of cost accounting. In addition, it requires an inspectional staff. Gas, electric, water and telephone service have received special attention at the hands of the Wisconsin commission and requirements as to them v been standardized. These standards so far as gas nd electric service are concerned were embodied in a se of rules adopted only after a most careful survey of aual conditions, both within the State and throughout the c try. They cover such matters as the heating value purity of gas, voltage, care of lamps, accuracy of mers, disturbance in electric circuits, and similar matters. he staff of field inspection charged with the administra of these rules are selected with particular referenc their previous technical training and experience in lighting business. Their visits to the various plants r unannounced and vary in frequency from once to or five times a year as the conditions may require. In diately after the promulgation of these rules there w marked improvement in the character of service.

RESULTS.

It is interesting to contrast the predictions of dis made by the opponents of railway and public utility r lation with the actual results of the operation of these l "Radical," "populistic," "revolutionary," were some of mildest terms used. It was pointed out that the e country and especially the State of Wisconsin had p pered under the *laissez faire* régime of earlier days, a was said that any such restriction of commercial lil as these laws proposed would result in a system of bu cratic control which must inevitably disorganize bus and destroy prosperity.

In striking contrast to these lugubrious forecasts s the actual results of commission control. Most emp cally has it been a good thing, not only for the publi for the utilities also. The public has made an imn financial gain; just how much it is difficult to state entire accuracy, for many orders of the commission cerning rates lowered some and raised others. But i been conservatively estimated that in the matter of fr rates alone there has been an average annual saving least $1,200,000; in passenger fares of not less than $ 000, and in other forms of public service a proportion large amount.

This, of course, is not all clear gain. The commi has done a great deal of work, most of it of an expe sort, and this cost has been borne in large part b public. In the regulation of railway rates it has necessary to separate state from interstate traffic, fr from passenger service, and to apportion the gross co transporting freight among the various commodities classes of merchandise submitted for shipment. Sub tially the same sort of analysis and discrimination has necessary in the case of the other utilities. It is work calls for a very high order of ability and expert trai In round figures, the cost of maintenance of the con sion, including the expense of hearings, of furni transcripts of the proceedings free of charge to al terested parties, of appraisals, of publications and of vice and accounting inspections, is about $100,000 a

A large outlay, an expensive commission you will but in view of the fact that the railroads and other ties are invariably represented at every important he by the very ablest engineers and experts, the State c afford to indulge in cheap or short-sighted economy after all when the saving effected runs into millio of dollars each year the people can afford to pay out en $100,000 for expenses.

But hereafter at the prescribed rate of one dolla for each one thousand dollars of the face value of corp ate securities thus issued the revenue derived from the o ration of the stock and bond provision alone will in all ob- ability be sufficient to defray the entire cost of the m- mission.

Hand in hand with reduction in rates has gone an eqally important improvement in service. Better service has

eve been placed first and reduction in rates made to wait ... Transportation facilities have been vastly improved; new stations have been built as ordered by the commission; cleanliness and sanitary precautions have ... served as never before; closer connections have ... made at junction points, and more and better trains ... een provided. And so also of express, lighting, tele... and telegraph service; they have all responded to ... nd for a higher standard of efficiency in numerous ... ore forcibly felt and plainly evident than it is ... for us briefly to describe.

...e genuinely constructive and enduring character of this method of control is best demonstrated, however, by ... t that while the people have thus gained enormous... ilities have not suffered. On the contrary, under ... em they have prospered as never before. Lower ... e not been followed by diminished income, but by ... arger patronage have resulted instead in an actual ... in revenues. To the utilities, therefore, the net ... has been a gain.

...lence of the prosperity under commission regulation ... annual report of the Wisconsin commission shows ... ng the year the operating revenues of electric ... ncreased 20 per cent, their net income 29 per cent, ... construction for the year 145 per cent. The oper... enues of water utilities meanwhile increased 7 ... their income 13 per cent, and new construc... per cent. Gas utilities increased their operating ... 3 per cent, their net income 15 per cent, and new ... ion 24 per cent. Telephone utilities increased ... rating revenue 11 per cent, their net income 9 per ... construction for the year 14 per cent. Railway ... on lines on the average increased their operating ... 13 per cent, their net income 8 per cent, and con... an equal amount. All utilities in Wisconsin are ... flourishing condition now than ever before and ... ing to extend their operations far into the future. ... andeis and Emerson have been doing for private ... ms and the railways of the country the Wis... commission has done for the public utilities of its ...

Taking a longer period, as we may in the case of rail... ... lation, which was begun earlier, the results are ... e striking. For the fiscal year ended June 30, ... total mileage of railroads in Wisconsin was 6,931 ... tal operating revenue $50,144,702.43. This was ... immediately before commission regulation of ... began. Five years later, or during the fiscal ... ed June 30, 1910, the total mileage had increased to ... an increase of 278 miles, and the total operating rev... ues amounted to $65,055,928.76, an increase of nearly $15,... Thus, notwithstanding the decrease in trans... rates and improvement in service enforced by ... ad Commission, the operating revenues of the railroads of Wisconsin increased approximately 30 per cent. As an indication of the general prosperity of the Sta... meanwhile it may be worth mentioning that under the... new policies the deposits in commercial and savings ban... in Wisconsin increased in round numbers during this ... ve years from $187,000,000 to $276,000,000, or 51 per ...

How these results are possible may be illustrated by the case of the Madison Gas and Electric Company, which in this respect may be considered fairly typical. In March, 191... this company's schedule of rates, based as it was entire... upon the energy consumed, was abolished and there was substituted a new schedule which took into considera... tion the elements of amount of installation, classes of consum...s, as well as the amount of energy used. In actual experience the form of rate schedule is as important as the ... te per unit; and it is the policy of the commission to devi... schedules which, while avoiding discrimination and unit... charges, will at the same time encourage extension of the service and thereby decrease the cost per unit. After one year's operation of the new schedule another investigation was made, and it was found that compared with 1909, the last current year in which the old rates were in effect, the output of the electric plant had increased over 16 per cent, the gross earnings nearly 13 per cent, the net earnings 24 per cent, while expenses increased less than 3 per cent. Compared with 1907 the number of consumers in the residence class had increased 34 per cent, the number of lamps connected 54 per cent, the kilowatt hours sold 70 per cent, and revenue 35 per cent. Here, however, is the important point; after a year's operation under the commission's schedule it was found that the business had so increased that it was possible to effect a further reduction in the primary rate of 2 cents per kw-hour and make a net cut in the revenue of the company of $24,000.

Thus it is seen that improvement in service, reduction in rates and fair treatment are all found to be perfectly consistent with increased net earnings for the utility. No more striking illustration of the harmonious interdependence of public and private interests, if utility managers had only the wit to see it, can be desired.

DISCRIMINATION ABOLISHED.

Not only have rates been lowered as a whole to the advantage of both the people and the utilities but discrimination among patrons has been abolished. Nothing could be more desirable. Speaking of the condition of affairs when these laws went into effect, Professor B. H. Meyer, formerly chairman of the Wisconsin commission, but recently appointed member of the Interstate Commerce Commission, has said: "The whole State of Wisconsin was streaked and plastered with discrimination in the rates of utilities"; and he mentions thirty-two telephone companies, every one of which gave at least eight subscribers out of every one hundred either free or reduced-rate service. It goes without saying that the cost of this service was not borne by the telephone companies, but by the subscribers who paid full rates. When the Wisconsin law went into effect it was estimated that discrimination and rebates to favored customers of telephone, water, heat and light companies amounted to as much as $2,000,000 annually. Even as late as August, 1909, 52 per cent of the telephone companies, 60 per cent of the water plants, 35 per cent of the gas companies and 58 per cent of the electric lines admitted they still maintained discriminatory rates. Since then there has been a change. All schedules and rates are now on file with the commission and these are the only rates that can be collected. Discrimination is absolutely forbidden and the law in this respect is well obeyed. The effect of this change upon industrial and commercial enterprise and the elevation in moral tone of the communities where these abuses formerly existed cannot easily be exaggerated. Peace, contentment and self-respect have taken the place of suspicion, injustice and guerrilla warfare.

WHOLESOME EFFECT UPON PUBLIC LIFE.

Times were in Wisconsin when the railroads ran or tried to run the government of the State and the minor utilities frequently sought to boss the cities, towns and even villages. They contributed liberally to campaign funds, urged their supporters and lobbyists to become candidates for public office and in close election districts colonized voters in the old conventional way. Now one and all they are in this sense absolutely out of politics. There is indeed no reason now why public service corporations in Wisconsin should wish to dabble in public affairs. Their relations to the people of the State have been definitely and finally determined. They no longer have anything to gain or lose by intermeddling in politics and apparently they have decided to retire for good. What the elimina-

tion of public service corporations from participation in political campaigns signifies in the purification of public life no one here needs to be reminded.

MAKES INVESTMENTS SECURE.

The operation of the stock and bond law, the indeterminate permit provision and other cognate requirements of the public utilities law have encouraged investment in the securities issued by these corporations. Most gratifying of all is the recent tendency toward local investment in these securities and consequent local support of the utilities. The natural result is the establishment of better and friendlier relations between the utilities and the public. That the operation of the Wisconsin law has brought additional stability to investments of this sort is shown by the fact that practically every trust company and dealer in stocks and bonds engaged in selling the securities of plants located in Wisconsin advertises regularly in the financial journals the fact that these securities are issued under State regulation. The whole tendency of commission control is to remove public utility securities from the field of speculation and place them upon the solid basis of conservative and stable investments.

CONCLUSION.

Such in brief are the principal features of the system of State control of public utilities as it is practised in Wisconsin. A product of constructive legislation somewhat novel in conception, it has nevertheless worked admirably. It is comprehensive, effective, prompt and progressive—a demonstrated practical success. It proceeds upon the theory that these corporations are the servants, not the masters, of the people. As servants it has protected, encouraged and instructed them in all matters of economy and efficiency just as it has summarily suppressed all assumption on their part to the rôle of masters. But in relentlessly enforcing fairness to the people it has not forgotten to be fair to the utilities. It has made the monopoly of each company within its appropriate field even more secure than it was before. It has systematized methods of accounting and so given to the most backward the advantages of the very latest improvements in management. By control of stock and bond issues it excludes opportunity for wild-cat speculation and the altogether too familiar methods of "frenzied finance." It compels the maintenance of each utility at the point of maximum efficiency and so safeguards legitimate investment. While protecting the citizen against extortionate rates and inadequate service, it insures to capital a reasonable return and to labor a fair wage. In a word, it has transformed what were formerly speculative ventures bent on exploiting the public into safe and conservative business establishments operated for the benefit and convenience of all.

New York Commission News.

The Mohawk Hydroelectric Company has applied for approval of the construction of transmission lines in the towns of Ephratah and Palatine and the village of Nelliston, and for consent and authority for that company to issue $56,000 in 6 per cent thirty-year first-mortgage bonds. The same company and the Ft. Plain Gas & Electric Light, Heat and Power Company have applied for consent to the leasing of the Ft. Plain company's electrical distribution system in the village of Nelliston to the Mohawk Hydroelectric Company.

The Richfield Springs Electric Light & Power Company has made application for permission to assign its franchise in Richfield Springs to the Richfield Springs Utility Company and the latter has applied for the right to acquire this franchise and for permission to issue $47,000 in mortgage bonds.

Massachusetts Commission News.

A continued hearing at which arguments were presen[d] before the Board of Gas and Electric Light Commission[s] of Massachusetts on the petition of Mayor James Log[an] of Worcester, for a reduction in the price of 4-amp m[ag]netite-arc lighting for streets in that city was held in [the] council chamber of the City Hall, Worcester, Sept. [.] The hearing lasted six and a half hours, the argument [of] the attorney for the company consuming about four ho[urs].

At the previous hearings, held several months ago, te[sti]mony was presented by the petitioner to show that [the] service of lighting the city streets in the above man[ner] could be performed at about $65 per lamp, whereas [the] present price for the all-night, every-night service char[ged] by the Worcester Electric Light Company is $91.25 [a] year. The city's expert, Prof. W. D. Marks, of New Y[ork] presented figures to show the value of wires, stating t[hat] they are worth about 4 cents per foot, or a depreciation [of] about 75 per cent from initial value, while the comp[any] contended that the present value is 12 cents per foot, [the] initial cost having been 18.5 cents per foot. The comp[any] at previous hearings also presented figures which showe[d in] detail the methods by which the cost of the service [was] determined. Its result showed a cost of $96.28 per la[mp] per year, including a 6 per cent interest charge. Th[e] tables showed the original cost of the ducts to June [] 1910, to be $666,538 and the total length of ducts to [be] 1,731,141 ft. Of these there were 372,141 ft. of vac[ant] ducts and 352,000 ft. of free city ducts.

At the last hearing the company was represented, as [for]merly, by its attorney, Everett W. Burdett, Esq., of Bos[ton]. He stated that the issue is a definite and narrow one—[that] of the price of 4-amp magnetite-arc street lighting [in] Worcester. The price of neither incandescent service [nor] commercial arc service nor motor service is an issue, no[r is] there any disparagement of the quality of the compa[ny's] service. He held that the readjustment of rates to pri[vate] consumers should precede any reduction in the rates [for] street lighting, and stated further that it was underst[ood] the company was planning soon to reduce the rates of [in]candescent service. Mr. Burdett held that the Mayor [had] been the victim of bad advice in seeking a reduction in [the] rate of arc lighting. The fact that the company had [re]sisted the temptation to sell to outside parties ought t[o be] a source of satisfaction to the Mayor and citizens [of] Worcester. He stated that the company had accumul[ated] its surplus of some $300,000 by virtue of careful man[age]ment, low salaries, etc. Its directors held small stock [in]terests in the company and were public-spirited men. A [list] of prices for arc lighting in twelve principal cities and [one] town of the State showed that in only three cases do lo[wer] prices prevail than in Worcester, two of which are on [the] seaboard, where cheap coal delivery is enjoyed. Nine c[ities] have higher rates than Worcester, while the price in [] River is the same as in Worcester.

Turning to the testimony of Professor Marks a[t the] previous hearing, Mr. Burdett characterized much of i[t as] "theoretical" and "guesswork." His testimony of cos[t of] material was regarded as "ridiculously low." "He un[der]valued the wire $80,000, or more than 50 per cent below [the] actual cost," counsel said.

On the question of what percentage of profit or re[turn] the company should receive, the attorney cited court [de]cisions and commission rulings which laid down the p[rin]ciple that a public-service corporation is entitled to a [fa]ir return on a fair valuation of its property. It is conte[nd]ed by some that a public-service corporation has no righ[t] to receive a profit on property acquired by surplus earni[ng]s. But, said Mr. Burdett, a company can put its surplus to stocks and bonds of other corporations and enjoy [th]e proceeds. The Massachusetts Gas and Electric Light C[om]-

ission have ruled that what a company has earned and ved is the property of the company. A Beverly company d $180,000 surplus in addition and extensions, and this as one-third of all the expenditures of the year, but it did ot influence the board to grant a petition for a reduction prices. The Interstate Commerce Commission was re- rred to as insisting upon a surplus fund. In the case of e Chicago, Burlington & Quincy Railroad more than half e property was created out of the surplus, and the Inter- ate Commerce Commission affirmed the right of a rail- ad company to enjoy a return upon its surplus. The ennsylvania Railroad Company reinvested two-thirds of e amount of the cost of its road east of Pittsburgh, a sum unting to $262,000,000, accumulated in twenty years. Public Service Commission of the First District of York in one case designated twenty years as the life electric-light plant. The Wisconsin Public Service ration allowed 25 per cent as the junk value of a plant. In the present case the company sets 3.92 per as the average annual rate of depreciation, equivalent 24 per cent of present value.

he matter of interest on investment the Wisconsin ad Commission, in the Menomonie case, 1909, held 7 per cent on cost of reproduction *new* was a fair re- In the Madison case, 1910, it was held that 8 per was fair. Here distinction was made between interest rofit. Six per cent was for interest, 2 per cent for Mayor Logan in previous testimony conceded that cent was a reasonable return.

Burdett said that large profits do not indicate high Here a conservative management had resulted in ssful operation. The company pays its president only per annum.

conclusion Mr. Burdett said that he hoped that the would enunciate principles that would be of guidance ating companies as a result of the hearings on this

rney Webster Thayer, counsel for Mayor Logan and ty, said the directors had been mistaken in assuming hey could create as large a surplus and declare as dividends as an interested party. He believed the ssion ought to have increased powers, with authority w counsel for a city to examine a public lighting com- s books.

Thayer held that the public had furnished a large of the money represented by the plant, and that the ny had been keeping up the plant under operating se account. He contended that the free city ducts be apportioned to the various departments of the ny's business—municipal arcs, commercial arcs, in- ent lighting and motors—equally, and that deprecia- hould be charged proportionately to each. He held n its franchise the company agrees to give the city cts. The case was taken under advisement. In the case about 400,000 words have been taken in ce

Maryland Commission News.

he Maryland Public Service Commission last week g nted the Consolidated Gas, Electric Light & Power Com- of Baltimore, an extension of time in the hearing guments for and against the reduction of its rates ectric energy and gas, which was set for Sept. 19 extension covers a period of thirty days and first hearing will take place on Oct. 19. A com- p nt against the Chesapeake & Potomac Telephone Com- p y was last week postponed to Oct. 16. The complaint is ased on the company's minimum charge to householders, a year, with thirty calls a month. The complainants this is an average of 8⅓ cents a call, while the com- p y makes a charge of only 5 cents for city calls.

vidence was heard by the commission in support of the petition of the Mayor and Common Council of Mount Rainier and others for a reduction in the rates of the Hyattsville Gas & Electric Company. The case has been on the docket of the commission for some time. At the time the petition was filed some of the parties interested made the assertion that, while anxious to secure a reduction in the price of gas, they did not want it unless the earnings of the company warranted such a reduction. They were anxious, however, to have the affairs of the company investigated for the purpose of determining whether or not the reduction might be made.

The commission has received from its chief engineer, Mr. Charles E. Phelps, a summary of the report made to the commission by Messrs. D. C. and William B. Jackson, of Boston, who had been engaged to report upon the proposition made some months ago by the Chesapeake & Potomac Telephone Company for permission to put into effect a new schedule of rates. The original report goes into the entire business of the telephone company with great thoroughness. It states that the company has approximately 29,000 main telephones with 14,000 extensions, main telephones being classified as all telephones in the system except extension apparatus and those connected with branch exchanges. There are 810 flat-rate business telephones and 6732 flat-rate residence telephones, with seven private branch exchanges on the flat rate with 341 telephones. The calls last year aggregated nearly 43,000,000, of which the flat-rate lines used 21,750,000; the message-rate lines, 15,952; the coin-box phones, 1,816,000; the public pay stations, 2,373,000, and attended pay stations, 717,000. The report recommends the adoption of a rate schedule proposed by the telephone company, with the following exceptions: First, that the part of the schedule which would abolish the party-line coin-box telephone, of which there are some 6200 served from Wolfe and Gilmor exchanges, be amended, and that these coin-box telephones be put on a straight-message basis with no additional rental charge, that the number of messages granted for a year be about 900 for a direct line and 600 for a two-party line, and that not more than four coin-box telephones be connected on any one line. Second, that the rate for party-line telephones for residence service be made on the basis of $2 a month and forty local messages a month instead of thirty, bringing this rate to that for a similar service in Boston, so that no local message on this class of telephone will be more than 5 cents. It is further recommended that the present flat rate for business service for both direct line, metallic circuit, at $125 a year, and direct line, grounded circuit, at $78 a year, be abolished. The figures given in the schedule to cover the moving of telephones at the subscribers' requests amount to $2.50 for changing the location of a telephone in the same building, $6 for moving a telephone from one building to another and $2.50 for moving an extension telephone from one building to another. A recommendation is included that not more than two message-rate telephones be connected on any one line, whether for residence or business. It is also recommended that the flat-rate service for residences be retained at $48 a year, on the ground that the use of the residence telephone is much less than that of a business telephone, and that the abuse in respect to "unnecessary and frivolous use" does not create a great burden on the system. The report states that the rate of $6 a year for extensions is considered a fair charge, and this conclusion is based upon taking an extension telephone as presenting an investment of $20, then charging against it 25 per cent for operation and maintenance, interest, depreciation, etc., together with its pro rata cost for the telephone directory, amounting to 30 cents, and also with one-half the cost of removals, which would amount to 50 cents; these figures bring the cost for each extension telephone to $5.80. The report states that Mr. Jackson's computations are based upon a return to the company of 8 per cent on the book values of the property.

Chief Counsel William Cabell Bruce last week handed down an opinion in which he holds that gas and electric companies, unlike railroads, have no right to serve their employees free of cost or at rates which are lower than those charged the general public. Mr. Bruce's opinion is the outcome of a request for information filed with the commission by the Hagerstown Light & Heat Company.

Ohio Commission News.

Mr. N. C. Kingsbury, vice-president of the American Telephone & Telegraph Company, appeared before the Ohio Public Service Commission last week and asked for information regarding the merger sections of the law under which the commission is acting. He indicated that the telephone companies will take up the small towns first, as they realize that they have a difficult problem to handle, and experience with the smaller companies will prepare them to handle those in Cleveland, Toledo, Columbus and other cities. He also made it plain that the commission will be asked for the approval of three kinds of combination, all of which were explained.

In municipalities where the Bell interests have no local exchanges, but merely toll stations, it was explained that it would be desirable to make contracts for the connection of the long-distance wires of the Bell Company with the local company's exchange, paying a percentage for the long-distance business originated by the local company. Representatives of companies at Van Wert and Mount Sterling were present to give their assent to contracts of this form.

In towns or cities where the Independent companies are particularly strong the Bell interests will sell their exchanges to these companies and enter into contracts covering the long-distance business. It is said that negotiations are nearing completion in Delaware and Ashtabula for such a consolidation as is mentioned.

The third form named by Mr. Kingsbury contemplates a straight consolidation of the business of the Bell and the Independent companies. Examples of this are found in Norwalk and Coshocton, where negotiations have been in progress for some time. Mr. Kingsbury said that in cases of this kind it might be necessary to advance the rates. The commission became interested when this fact was brought to notice and Commissioner O. H. Hughes asked for reasons for contemplated advances in the case of pure consolidations. Mr. Kingsbury stated that where this is necessary information will be furnished from the books of the companies to satisfy the commission on the matter. He said further that the rate question threatened to give the companies much trouble and that it would be worked out in the best way possible. The idea, he said, is to give Ohio one telephone system with the most reasonable charges that can be made.

In addition to Mr. Kingsbury the following Bell representatives were present: Messrs. L. N. Whitney, Chicago, general agent of public convenience; H. O. Seymour, Chicago, general agent of public relations, and R. R. Stevens, Columbus.

The Toledo Home Telephone Company has filed a petition with the commission asking that it be allowed to abrogate contracts with ministers, certain clubs and certain large business institutions which had been getting service at reduced rates. As the rate schedule was filed too late, the company must wait another month to do this, since every change in rates requires thirty days' notice.

The commission is having much trouble with the small mutual or community systems, of which there are many throughout the State. They were established as a convenience for the farmers and are not operated for profit. In most cases the officers and managers receive no salary and repairs are made by anyone able to make them. Most of the reports made by these companies or associations e[illegible] press the fear that the requirements of the commission w[illegible] force them to cease operations and thus take away a c[illegible] venience that has been worth much to the users and yiel[illegible] no profit to anyone.

Another source of trouble comes from the corporati[illegible] which seek to secure advance permission for an increase[illegible] capital stock or permission for a certain capitalization [illegible] fore incorporation papers are taken out. In most ca[illegible] where such information is sought the commission h[illegible] ascertained that the companies are already capitalized [illegible] yond their proper value or that proposed new corporatio[illegible] want to arrange matters so that "water" may be injec[illegible] without having to obtain the consent of the commissi[illegible] after they are organized. The law requires that incorp[illegible] tion papers must be secured and that increases must [illegible] granted by the Secretary of State before permission [illegible] the issue of the stock is sought from the commission. [illegible] commission insists that the law be complied with stri[illegible] in all cases and refuses absolutely to indicate what [illegible] course may be should certain things be asked of it. S[illegible] of those men who have appeared before the commission [illegible] errands of this kind have argued that "water" is an [illegible] to the small stockholder and that if the commission ref[illegible] to deal with corporations on suggestions from them cap[illegible] will be driven from the State. The commission has fa[illegible] to see any logic in either argument and insists that infor[illegible] tion will be given only when the applicants are in a p[illegible] tion to receive it and that decisions will be made only a[illegible] proper hearings.

CURRENT NEWS AND NOTE[illegible]

Marine Wireless Law to Be Tested.—The captai[illegible] the British vessel *Templemore* has been held for appear[illegible] before a federal grand jury in Baltimore for violatio[illegible] the federal law requiring ocean-going vessels carrying [illegible] sengers to be equipped with the wireless telegraph. [illegible] law went into effect on July 1 and the present action [illegible] the nature of a test case.

* * *

New York City Central-Station Service.—The [illegible] ceedings have been issued in printed form in the matt[illegible] the application of the Long Acre Electric Light & P[illegible] Company for authority to issue $10,000,000 of pref[illegible] stock and $50,000,000 of bonds for the construction o[illegible] electrical plant for the purpose of competing with the [illegible] companies now supplying New York City with elect[illegible] service. In former proceedings a similar application [illegible] denied, but the action of the commission was overrule[illegible] a Supreme Court decision. Upon reopening the case au[illegible] ity was granted by the commission, under restrictions [illegible] the issue of $4,000,000 in bonds, subject to the prior [illegible] at par of $2,000,000 in stock. Among interesting fi[illegible] contained in the printed proceedings in the case are [illegible] during 1910 the New York Edison Company sold 288,00[illegible] kw-hours of electrical energy, representing an oper[illegible] revenue of $18,000,000, or 6.27 cents per kw-hour; [illegible] added that if reductions are to continue in the futu[illegible] they have in the past, this latter figure will probably n[illegible] in excess of 5 cents to 5½ cents by the time the Long [illegible] company is ready to begin operations. The cost of pr[illegible] tion by the proposed plant is estimated at 3¾ cents [illegible] cents per kw-hour. An order requires that the $4,0[illegible] in bonds shall not be issued at less than 90, and th[illegible] proceeds shall be applied only to the following purp[illegible] Plant, $3,400,000; refunding of present indebtedness, [illegible] 000; expenses of sale of bonds, $400,000. The acti[illegible] the commission gave the case a status for final acti[illegible] the Court of Appeals.

[E]LECTRICAL SHOW FOR DES MOINES NEXT APRIL.—Coin[ci]dent with the convention of the Iowa State Electrical [As]sociation at Des Moines next April, it is planned to [ho]ld an electrical show to interest the public in electrical [s]ubjects. Des Moines' fine large coliseum will be used for [th]e 1912 show.

* * *

[F]T. WAYNE A. I. E. E. SECTION.—Ft. Wayne Section of [th]e American Institute of Electrical Engineers opened the [seas]on of 1911-12 Sept. 14 in the reception room of the [Ft.] Wayne Electric Works. An illustrated lecture was [giv]en by Mr. A. A. Serva, sales manager of the works, on "[E]lectrical Development in the West."

* * *

[P]RODUCTION OF ALUMINUM.—The United States Geologi[ca]l Survey gives the following figures for the production, [in] pounds, of aluminum for the years stated: 1883, 83 lb.; [18]85, 283 lb.; 1890, 61,281 lb.; 1895, 920,000 lb.; 1900, [7,]150,000 lb.; 1905, 11,374,000 lb.; 1910, 47,734,000 lb. The [fig]ures for 1905 and 1910 refer to the consumption in these [yea]rs.

* * *

[T]RIP OF AUTOMOBILE ENGINEERS TO EUROPE.—The So[ci]ety of Automobile Engineers has arranged for a trip to [En]gland about Nov. 1. The more important automobile [fa]ctories and garages there will be visited by the party and [se]veral days will be passed at the London Automobile Show. [Th]e Incorporated Institution of Automobile Engineers will [be] the host and one evening will be devoted to a joint [tec]hnical meeting with this body.

* * *

ILLINOIS STATE ELECTRIC ASSOCIATION.—While no official [an]nouncement has been made at this writing it is reported [th]at the next annual convention of the Illinois State [E]lectric Association may be held in Rockford, Ill., on [Oc]t. 24, 25 and 26. Mr. W. G. Austin, of Effingham, is [pr]esident of the association; Mr. H. E. Chubbuck, of [Pe]oria, is secretary, and Mr. C. A. Willoughby, Mayer [Bu]ilding, Peoria, is assistant secretary.

* * *

COMMERCIAL MOTOR VEHICLES IN GERMANY.—The num[be]r of motor trucks and wagons annually licensed in Ger[m]any has grown from 1211 in 1907 to 4327 in 1911. Of [th]e latter, 1695 are under 8 hp, 999 from 8 hp to 16 hp, [15]84 from 16 hp to 40 hp and 128 above 40 hp. In 1910 [G]ermany exported 2636 commercial vehicles and imported [..]1. In the same year 29,120 pleasure vehicles were ex[po]rted and 9512 imported. Automobile engines were ex[po]rted to the number of 16,455 and 475 imported.

* * *

SANITARY DISTRICT PAYROLLS.—After a long controversy [am]ong the trustees of the Sanitary District of Chicago a [pa]rtial compromise was reached by which President Smyth [si]gned the July and August payrolls on Sept. 13. This will [en]able the employees of the Sanitary District, including [th]ose of the electrical department, to draw their long-[ov]erdue salaries. The action of the president of the board [of] trustees followed closely a letter of protest from Mr. [E.] B. Ellicott, the electrical engineer of the district.

* * *

GROUND CONNECTIONS.—"B. L. T.," the "Line-o'-type [M]an" of the Chicago *Tribune*, calls attention to an alleged "[w]ant ad" in his own paper, wherein the advertiser seeks a [y]oung electrical man; good opportunity for bright, hard [w]orker who can keep both feet on the ground." This in[du]ces the paragrapher to ask if an electrical man with both [fe]et on the ground might be considered to be well grounded. [T]he query is repeated here to a constituency better able to [an]swer the question than the one to which it was addressed [or]iginally.

* * *

FARM ENGINEERING.—The management of the American [L]and and Irrigation Exposition, to be held at Madison Square Garden, Nov. 3 to 12, has appointed Mr. Putnam A. Bates, who has specialized in the subject of the application of electricity to farming, to direct the assembly of exhibits in this division of the exposition. Mr. Bates proposes to bring out the importance of close relationship between agriculture and engineering, and not only to demonstrate this to the farmer, but to awaken engineers to the opportunities open to them in agricultural lines.

* * *

WESTERN UNION MANAGERS IN CONFERENCE.—A managers' meeting of Western Union telegraph officials for the seventh district of the Western division of the Western Union Telegraph Company was held at Cincinnati on Sept. 8 and 9. Addresses on various subjects connected with the telegraph service were given by Messrs. I. N. Miller, district commercial superintendent at Cincinnati; A. A. Montgomery, district traffic superintendent at Cincinnati; F. H. Wolfe, manager at Shelbyville, Ohio; E. H. Cost; R. C. Bliss, of Cincinnati; W. W. Browne, of Dayton; E. D. Keyes, of Hamilton, Ohio; L. R. Scholl, of Cincinnati; S. M. Dunlap, of Columbus, and M. T. Cook, division commercial superintendent at Chicago. The district embraces parts of Ohio, Indiana and Illinois, and about forty managers attended the meeting, which included a dinner at the Gibson House and was a successful gathering.

* * *

UNITED STATES WIRELESS PLANS.—Experiments are being made by the navy to determine if the frame of a flying machine will act as a capacity "ground" for the type of wireless apparatus used by the navy. As a strategic measure the Navy Department is preparing to extend the wireless system of Alaska. On one of the Aleutian Islands will be erected next year a station to be superior to any in Alaska at present. It will have a radius of 1500 miles at night and about 800 during the day. The cruiser *Buffalo* is in Alaskan waters erecting wireless stations on Kadiak, Unalaska and St. Paul Islands. While plans are maturing for the extension of the wireless in Alaska, work has actually begun on the station at Ft. Myer, Va., just outside the national capital, which will be completed by May 1 and will enable the Navy Department to communicate with any naval vessel in the Atlantic as far as the coast line of the United States extends.

* * *

WATER RIGHTS AND EMINENT DOMAIN IN NEW ENGLAND.—The question of liability for damages in Concord, N. H., due to the putting of 2-ft. flashboards on the dam at Garvin's Falls by the Manchester Traction, Light & Power Company, and thereby flooding the city sewers, is under consideration by the Board of Aldermen of Concord. Last June the Manchester Traction, Light & Power Company, which owns and operates the falls, put on the flashboards to raise the height of the water during a dry period and as a result the water now stands from 12 in. to 15 in. on the outlets of two important sewers. It is claimed that the company has acquired land along the river by eminent domain, giving flowage rights to a height of 4 ft. The property of the falls was formerly owned by the Concord Manufacturing Company, which sold it to the Amoskeag Manufacturing Company. This latter company had the right to take land adjacent by eminent domain for flowage purposes, but its successor, the present company, is held by the city's attorney not to have that right. The point at issue is whether a corporation or an individual having right of eminent domain for certain purposes, under legislative act, can pass on that right without special enactment of the Legislature. In Massachusetts, counsel contends, the law is such that a corporation cannot pass on such a right by the mere sale of the property. He contends that the power company should get its charter amended by the New Hampshire Legislature if it wishes to floods the lands in question.

Seeding Wheat by Electric Light.—According to the Denver *Republican,* a party of fifty men left Denver on Sept. 7 for Cheyenne Wells to witness a very unusual spectacle. This was the seeding of a large acreage of land to winter wheat where the seeding was to be done at night by the light furnished by electric lamps supplied with energy by a dynamo driven by a traction engine.

* * *

Farmers' Use of Electricity.—As already described in the *Electrical World* (April 7, 1910, page 872), the Syracuse Power & Light Company, of Syracuse, Ind., has worked up quite an extensive business in supplying electrical energy to farmers in that region. The company is continuing its activity in this direction and also reports a considerable demand for gasoline-engine and storage-battery sets on various farms which cannot be reached by the central-station distribution without prohibitive expense.

* * *

Unfavorable Report on Municipal Ice Plant.—Mr. Benjamin S. Dean, corporation counsel for Jamestown, N. Y., has rendered an opinion to the Common Council of that city in which he holds that the city of Jamestown cannot erect or maintain a municipal ice plant. Jamestown has a municipal electric-service plant, and the question of operating a municipal ice plant in connection with it has been agitated. Mr. Dean concludes, however, that the making of ice is no more public in character than the making of cloth or wheels or furniture or any other article of manufacture, while the distribution of ice does not call for any public franchise or any other or different rights in the highways than belong of right to every individual or corporation engaged in the distribution of goods of its own manufacture.

* * *

Automatic Block Signals for Electric Railways.—Interurban railway companies are much interested in the subject of automatic signaling. At a recent meeting of the Illinois Electric Railways Association Mr. H. E. Chubbuck, of the Illinois Traction System, called attention to the remarkably few failures of the automatic block signals on that system. During August, with ninety-four signals installed, making 143,904 movements, there were but thirty-eight failures; signal operation was 99.97 per cent perfect. Of the thirty-eight failures twenty-four were caused by electrical storms, which burned out fuses and in two cases broke the line wires. Nine so-called failures were due to shutting off the supply of electrical energy in the transmission system; two were caused by grounded lightning arresters, and three were due to other causes.

* * *

Addition to Underwriters' Laboratories.—Work has been begun for an addition to the Underwriters' Laboratories at 207 East Ohio Street, Chicago. The new structure will be about 70 ft. x 70 ft. in ground dimensions, placed south and east of the present building. It will be a large open structure with fenestra windows, and will be used for fire-protection tests. As is well known, the building of the Underwriters' Laboratories approaches more nearly, probably, to absolute fireproof construction than any other building in the world. The object of the Laboratories is to provide impartial and expert opinion on the merits or demerits of appliances in respect to the fire hazard. Among other things, electrical apparatus is tested. Mr. W. H. Merrill is the manager and Mr. Dana Pierce is the electrical engineer of the Underwriters' Laboratories.

* * *

Pittsburgh Electric Boosters Meet.—The first fall business meeting of the Pittsburgh Electric Boosters' Club was held Sept. 11 at the Fort Pitt Hotel. The Board of Control reported completed arrangements for an energetic composite advertising campaign to be started in October for boosting electrical Pittsburgh through the daily pre This will be entirely new to Pittsburgh and good resu are anticipated. A motion to investigate the electric wiri and installation rules in Pittsburgh and their variance fr those of the National Board of Fire Underwriters provok an active discussion. The matter was laid over for furtl investigation and will be taken up with the electrical depa ment of the city of Pittsburgh. The club voted to inv the Sons of Jove to Pittsburgh for their annual conventi in 1912 and a committee was appointed to canvass t situation with full power. The business meeting was f lowed by a buffet lunch.

* * *

Chicago & Northwestern Railway Passenger Term nal in Chicago.—Mr. W. C. Armstrong, terminal en neer of the Chicago & Northwestern Railway Compa read an exhaustive paper on "The New Passenger Tern nal of the Chicago & Northwestern Railway" before t Western Society of Engineers in Chicago on Sept. 6. T paper contained many interesting statements, as, for i stance, that 455 buildings were wrecked or removed preparing the site of the terminal and that sixty-six these were four stories or more in height. As the termir tracks are themselves elevated it was necessary to eleva the structure of the Chicago & Oak Park Elevated Railro in Lake Street. This work involved some interesting pro lems, but was completed without mishap or without d laying traffic on the elevated road. Descriptions of t power plant and of the electrical and mechanical featur were given in articles recently published in the *Electric World.*

* * *

Illinois Electric Railways Association.—At a mee ing of the Illinois Electric Railways Association held Chicago on Sept. 15 electric-railway publicity and traf promotion were discussed. Mr. H. E. Chubbuck, of Peor president of the association, was in the chair and there w an attendance of about forty. Mr. L. E. Gould, of t *Electric Railway Journal,* was appointed statistician. M Fred G. Buffe, of the Illinois Traction System, read paper on "Electric Railway Advertising" and Mr. Richa Breckenridge, of the Aurora, Elgin & Chicago Railwa gave a paper on "Traffic Promotion." There was co siderable discussion. Mr. Beach, of the Edison-Beach Sto age Battery Company, described recent storage-battery ra way cars. In the afternoon the party took a trip to Micl gan City, Ind., over the line of the Chicago, Lake Shore South Bend Railway, returning to Chicago, where t gentlemen were entertained at dinner by Mr. F. E. Joh son, Chicago manager of the Ohio Brass Company. T next meeting will be held on Jan. 19, 1912.

* * *

Application for Water from Chicago Draina Canal Refused.—The Western United Gas & Electi Company, with headquarters at Aurora, Ill., asked t Sanitary District of Chicago recently for permission withdraw from 1600 to 2500 gal. of water per minute fro the main channel of the Chicago Drainage Canal, taking from the forebay above the power house at Lockport, I The matter was referred to Mr. E. B. Ellicott, electric engineer of the Sanitary District, and he reported that t proposed withdrawal would decrease the capacity of t power house about 18 hp. Further, it would introduce co plications in that the Sanitary District would be unable lower the water above the power house without interferi with the service of the Western United Gas & Electi Company. Frequently it is found necessary to drop t water 5 ft. or 6 ft. for inspection or repairs. Mr. Ellico therefore recommended that the application for water fro the forebay be refused, and the trustees of the Sanita District have taken action in accordance with this recor mendation.

SINGLE-PHASE GENERATING, TRANSMITTING AND DISTRIBUTING SYSTEMS FOR THE HOOSAC TUNNEL.

OUR readers are familiar with the initial single-phase railway system of the New York, New Haven & Hartford Railroad, which has been referred to frequently in our columns. The catenary-line construction was briefly described in our issue of March 30, 1907, the details of the overhead-line work were given in the issue for Aug. 1, 1907, and certain changes and improvements in the line work were noted in the issue dated Jan. 18, 1908. On Aug. 2, 1907, appeared an article describing the locomotives at some length, while the Cos Cob generating station was fully described.

On account of the successful operation of the single-phase system between Woodlawn, N. Y., and Stamford, Conn., President Mellen, of the New York, New Haven & Hartford Railroad, ordered the immediate electrification of the Hoosac Tunnel section of the Boston & Maine Railroad when the latter road passed into the control of the former, in the summer of 1910. On May 27, 1911, single-phase locomotives began to haul all freight and passenger trains through the tunnel, the work having been rushed to such an extent that in a little more than eight months from the time the electrification work was authorized by the directors both tracks in the tunnel and the yards and approaches on each side, a total of 21.31 miles of single track, were equipped with overhead trolley wires, a 6000-kw generating station was designed and constructed, a transmission line 2.42 miles long was erected and five electric locomotives were built. The general design of the locomotives is the same as that of the latest type built by the Westinghouse Electric & Manufacturing Company for the New York, New Haven & Hartford Railroad, as described on page 1552 of our issue for June 9, 1910. The overhead catenary construction, which differs from the type initially installed by the New York, New Haven & Hartford Railroad, was briefly described on page 901 of our issue dated April 13, 1911. The present article deals largely with the generating station at Zylonite, which supplies the energy for operating the trains.

generators were in operation within four months. The construction and equipment of the station were facilitated by the fact that the plans for a power station recently built by the Connecticut Company at Waterbury, Conn., were capable of being adapted with some changes to the conditions existing at Zylonite. The preliminary engineering

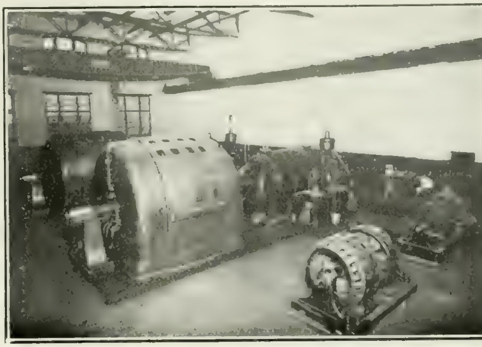


Fig. 2—Interior of Generating Station.

study and designing, therefore, were materially lessened. The mechanical equipment of the Zylonite station in the more important details is a duplication of that in the Waterbury station, but the electrical equipment and switching gear were designed especially for this station.

The station building was designed for an ultimate equipment of 15,000 kw in turbo-generators and 8000 hp of boilers, but only a part of the building was erected to house the initial equipment of two 3000-kw turbo-generators and four 500-hp boilers. The ultimate size of the building will be 149 ft. 8 in. x 152 ft. 6 in., with an addition 97 ft. 8 in. x 33 ft. 8 in. on the west end to be used as a switch house. The size of the building now in use is 83 ft. 1 in. x 152 ft. 6 in., with an addition for the switch house 33 ft. 8 in x 45 ft. 8 in. It is constructed with brick walls on concrete foundations, structural steel framework and roof trusses and reinforced concrete floors and roof. On

Fig. 1—View of Generating Station Showing Coal Conveyor and Outgoing Transmission Line.

The rapidity with which the work on the station was accomplished is very noteworthy. Every part of the construction work was rushed and the station building itself was completed in less than sixty days. Steam was raised in the boilers in a little over three months from the time of breaking ground for the foundations, and the turbo-

account of the gravity system of supplying condensing water from the pond adjoining the station, the building, including the basement floor, is entirely above the ground level. The turbine and boiler-room floors are 21 ft. 9 in. above the ground. The total height of the boiler-room section from the ground to the top of the roof parapets is

83 ft. 7 in. The turbine-room has clear headroom under the roof trusses of 28 ft. 11 in. The present building will accommodate without further enlargement three 3000-kw turbo-generators, ten 500-hp boilers and four exciter units with the necessary auxiliary apparatus.

BOILER EQUIPMENT.

The boiler-room is 97 ft. 2 in. wide and extends across the east end of the building. Four Bigelow & Hornsby water-tube boilers are installed in two batteries adjoining the partition wall next to the turbine-room. The boilers are equipped with Taylor automatic under-feed stokers and Foster superheaters. Green economizers have been installed in the smoke flues to heat the feed water. A combined forced-draft and induced-draft system is used in the boilers, and the smoke is exhausted through a steel stack 10 ft. in diameter. A single stack is used for the four boilers at present installed, and an opening has been left in the roof for another stack of the same size to be connected to future boilers to be installed on the west side of the firing aisle. The forced-draft apparatus is located in the basement under the firing aisle. Two 100-hp Kerr turbines, driving Sturtevant blowers, force air into the ash pits under the boiler grates. The induced-draft fans are placed in a fanroom on the floor above the boiler-room. Two American Blower Company's steel fans, driven by Harrisburg reciprocating engines, are installed for the four boilers now in use. An engine and blower are held in reserve. A duplicate equipment of two engines and blowers will be put in when additional boilers are connected to the second stack.

COAL AND ASH-HANDLING APPARATUS.

Coal is delivered in hopper-bottomed cars, which are dumped over a receiving hopper in the side track adjoining the power station. From this hopper it is fed to a bucket conveyor which elevates it to the top of a storage bin built along the north wall of the boiler-room. As the coal is delivered from this conveyor it passes through a crusher before dropping down to the storage bin. Suspended from the roof of the boiler-room above the center of the firing aisle is an I-beam trolley track, which carries an electrically driven traveling coal hopper, designed to weigh the coal as it is handled. This hopper is run under the storage bin and filled and then travels back and forth in front of the boilers delivering coal to the stokers through a spout. It is operated by an attendant who rides in a cage hung from the trolley carriage. The coal-handl apparatus was furnished by the Bergen Point Iron Wor

TURBO-GENERATOR EQUIPMENT.

The turbine-room contains two three-phase Westingho turbo-generators rated at 3000 kw single-phase. Th

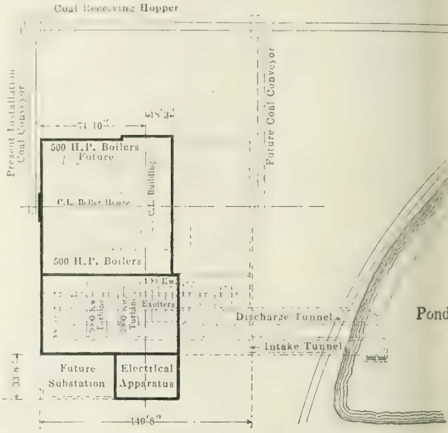


Fig. 4—Plan of Station.

machines deliver three-phase, 11,000-volt, 25-cycle al nating current, but only single-phase is used for the tro feeders. The other two phases provide for a supply three-phase energy for the operation of motors in power station and in the repair shops, and also a sin phase control circuit for the operation of the switch apparatus in the three switch houses along the track. the south side of the turbine-room are two 100-kw exc units, both of Westinghouse manufacture. One uni driven by a turbine and the other by an induction mo

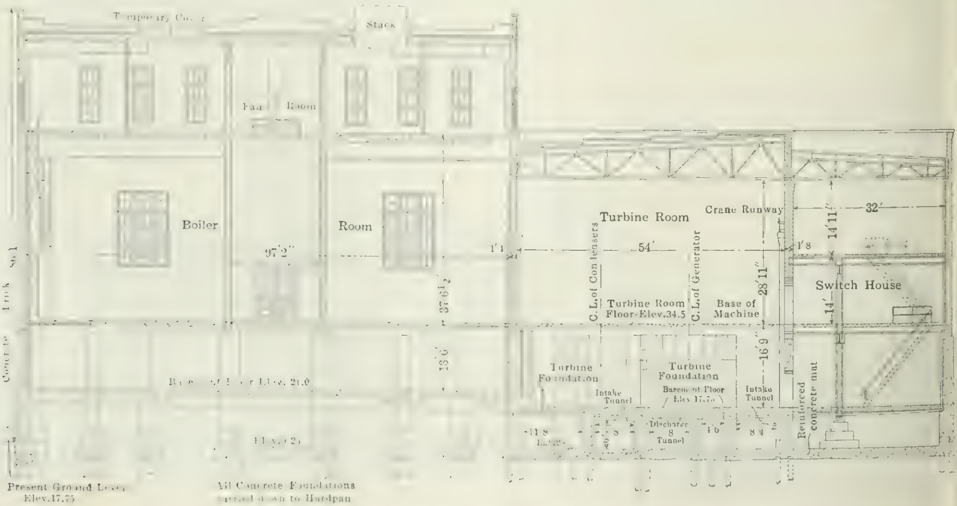


Fig. 3—Section Through Boiler-Room, Turbine-Room and Switch House.

The turbine-room is spanned by a 30-ton hand-operated traveling crane made by the Northern Engineering Works.

The turbines exhaust into Westinghouse-Le Blanc et condensers, which are mounted on the basement floor, immediately over the return leg of the intake tunnel. The discharge pump and air pump of each condenser are

mounted on the same shaft and are driven by a steam turbine. In order to provide means for re-establishing the vacuum in case it is lost while the turbine is in operation without shutting down the machine, a supply of priming water is provided by a 2000-gal. electrically driven pump. The pump draws water from the intake tunnel from the point to which condensing water is piped from the artesian wells and discharges it through a 6-in. pipe which enters the top of the condenser. The vacuum can be re-established by this means under full-load conditions. For starting up the condensers while the turbine is at rest the supply of priming water is furnished through a 2-in. pipe connected to the service pump. Under these conditions it is necessary completely to fill the condenser with steam before starting the circulating pump and then admitting the water from the service pump.

SWITCHING EQUIPMENT.

The switch house, which adjoins the turbine-room on sections of the three buses on the first floor, but these sections may be connected at the center by hand-operated switches. The auxiliary connections are made to each section of the buses by a loop from which the auxiliary transformer connections are taken off. The lighting transformers supply energy for station lighting at 110 volts, and the motor-service transformers supply energy at 440 volts for the auxiliary motors in the station.

The trolley bus on the first floor is connected at each end to a trolley bus in the basement, from which connections are made to the group of switches and resistors used for cushioning short-circuit surges. These switches and resistors are installed in duplicate, but only one set is used, the other set being held in reserve. The resistor is divided into three parts, and each part is successively connected in series with the trolley by the opening of an oil switch. Four current-limit relays are mounted on the control switchboard. These relays are operated by current supplied

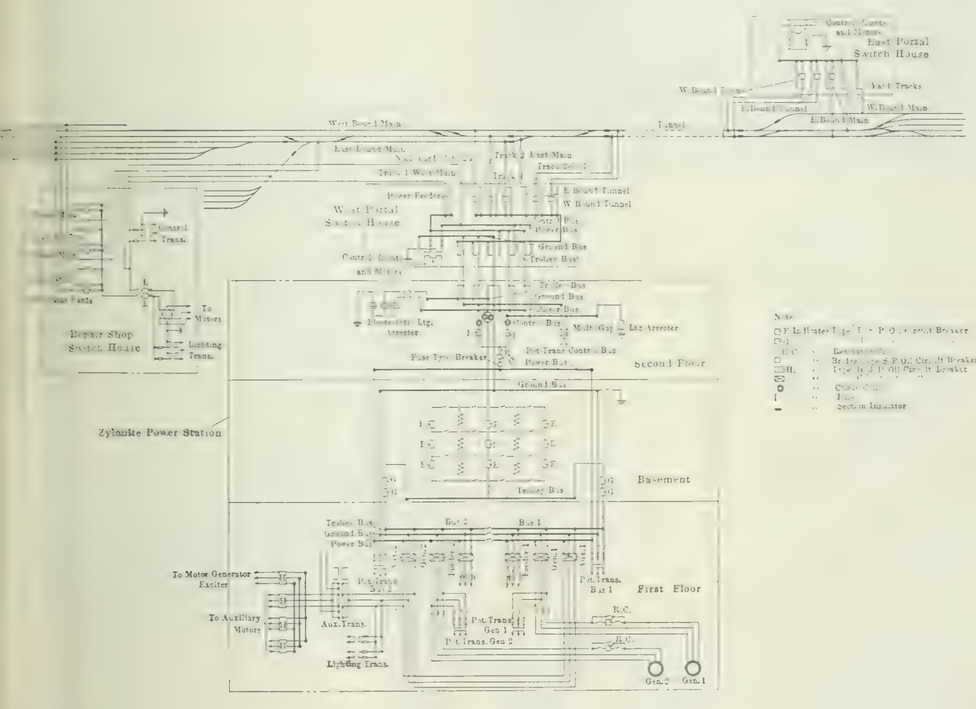


Fig. 5—Diagram of Electric Switching Apparatus.

the west side, has three floors. On the basement floor are located the main oil switches for the trolley phase of the generators and the resistors and oil switches used to cushion the effect of a short-circuit. The first floor is open through to the turbine-room and contains the control switchboard, main busbars, generator buses and disconnecting switches for the generators, auxiliary motor circuits and blank panels for future transmission-line circuits. The lightning arresters and disconnecting line switches are mounted on the second floor. The two generators are three-phase machines with one phase grounded after passing through the switching gear but before leaving the building. They are connected to a trolley bus, ground bus and power bus on the first floor through suitable oil switches. A reactance coil is inserted in the trolley phase of the generators to reduce the effect of short-circuit on the generators. Each of the generators is connected to separate from a series transformer in the trolley circuit. When a short-circuit occurs of sufficient magnitude to cause an excessive rise of current in the circuit the first relay acts and opens one of the three oil switches, which in turn cuts into the trolley circuit the first section of the resistor. At the same time connections are made on the first relay whereby the operating current from the series transformer is passed through the second relay. When the second relay operates it cuts in the second section of the resistor and also transfers the operating current to the third relay. The third relay cuts in the last section of the resistor and transfers the operating current to the fourth relay, which controls the main circuit-breaker. The effect of this arrangement is greatly to reduce the amount of current at the instant that the main circuit-breaker opens. An interval of about four seconds is required to cut in all the resistors and open the main circuit-breaker. Entire dependence is not

placed upon the operation of the relays and cutting in of the resistor, as the main circuit-breakers have a time-limit device which is set for five seconds, and if the short-circuit continues for that length of time they will open re-

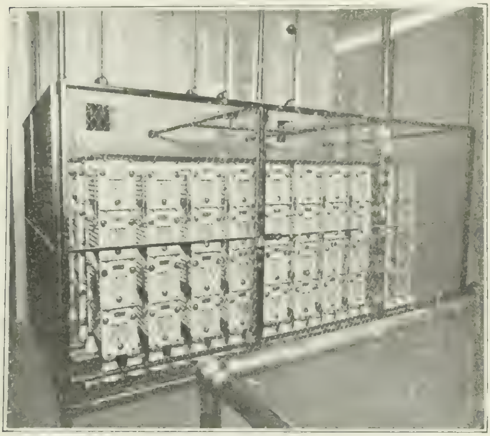


Fig. 6—Resistors for Limiting the Short-Circuit Current.

gardless of the operation of the relays and resistor switches. This plan is substantially the same method which has been developed as a result of experience and is now being successfully used for limiting the effects of short-circuits at the Cos Cob power station of the New York, New Haven & Hartford Railroad.

On the second floor of the switch house are four buses from which the transmission-line wires are taken off. The trolley bus and the ground bus are connected to the corresponding buses in the basement, while the motor-service bus and control-circuit buses are connected to the main motor-service bus on the first floor. The motor-service and trolley buses are connected to three sets of electrolytic lightning arresters arranged so that each circuit has two sets of arresters and horn gaps in series. The control bus is connected to a multigap lightning arrester. Hand-operated disconnecting switches are provided so that any one of the transmission wires can be connected to any desired busbar.

TRANSMISSION LINES.

The transmission-line wires are carried out through the west wall of the switch house just under the roof. A terminal strain tower is built near the corner of the generating station building, and from this point the transmission line extends to a switching house near the west portal of the tunnel, a distance of 2.42 miles. Four angles are turned by this line, which runs across country over the foothills of the Hoosac Mountains. The corner strain towers and terminal towers have four legs formed of heavy steel angles braced with diagonal rods and horizontal angle braces on all four sides. The legs of the towers are anchored to concrete foundations. The intermediate towers used for supporting the transmission line are of the A-frame flexible type. The average span between towers is 400 ft. The transmission line consists of five wires; two of these are No. 0000 cables for the trolley circuits, and a third, No. 0000 wire, is placed on top of the poles for the ground return circuit. The motor-service and control circuits consist of two No. 2 wires. The insulators on the corner and terminal towers are supported on steel angle cross-arms by pins, but on the intermediate towers they are suspended from twin cross-arms. The insulators are of the same size and type as those used for supporting the catenary cables from the trolley bridges over the tracks. The transmission-line towers were built by the Arcl ...-Brady Company, Syracuse, N. Y.

SWITCH HOUSES.

The transmission line terminates at a switch house, ... 8 in. x 23 ft., near the west portal of the tunnel. ... this point the trolley sections are fed with energy di... through six feeders taken off the trolley bus. The n... service and control circuit are continued through ... switch house and along the railroad right-of-way t... switch house adjoining the repair shop in North A... In the repair shop switch house a 60-kw transforn... connected to the trolley phase, the control circuit an... motor-service circuit in such a way as to supply three-... energy at 440 volts for the shop motors. A third s... house has been built near the east portal of the tunn... the purpose of installing suitable sectionalizing sw... for controlling the track sections east of the tunnel. ... these switch houses are one-story brick buildings. Tl... coming transmission lines and feeder connections ar... ported on insulators carried on a framework of light... angles, and the wires enter through the roof by mea... insulated waterproof bushings.

The overhead trolley system is sectionalized into ... units consisting of two tracks in the east portal yards ... bound main track and west-bound main track east ... east portal; east-bound and west-bound tracks in the t... west-bound main track from the west portal to the we... of the North Adams yard; a section of the east-bound ... track and a crossover opposite the west portal switch ... two sections of the long siding between the North ... yard and the west portal switch house; the shopyard ... tracks in the North Adams yard, and the east-bound ... track from the west end of the North Adams yard ... west portal switch house.

The trolley bus in the west portal switch house fee... two tunnel sections, the east-bound and west-bound ... tracks west of the portal, the easterly section of th...

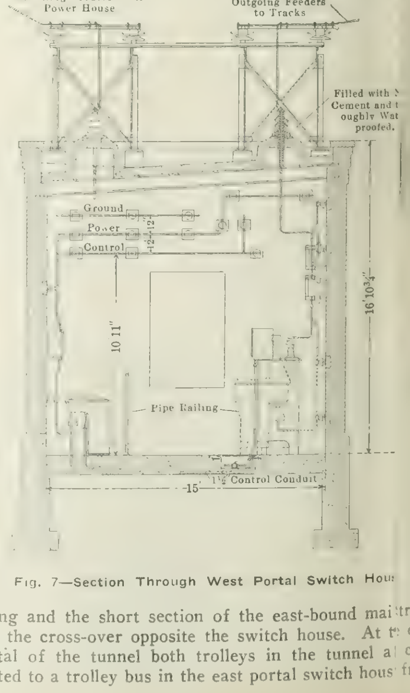


Fig. 7—Section Through West Portal Switch Hou...

siding and the short section of the east-bound mai... track and the cross-over opposite the switch house. At t... east portal of the tunnel both trolleys in the tunnel a... connected to a trolley bus in the east portal switch hous... from

wh h energy is fed to three sections beyond the tunnel. Th arrangement is such that so long as energy is available at ther one of the main-track trolley wires the remainder of ie system can be operated.

CATENARY CONSTRUCTION.

ie supporting bridges and cross-catenaries in the yards ar paced 150 ft. apart on tangents and curves of moderate ... The messenger cable over each track is of stranded ... in. in diameter. Below it is a No. 0000 grooved ... conductor wire suspended by rigid hangers of vary... is at intervals of 10 ft. A No. 0000 Phono-electric ... wire is carried 1¾ in. below the copper conductor ... double clips attached in the center of the 10-ft. ... tween hangers. On curves the conductor and con... es are suspended from the messenger by inclined ... having double clamps which hold the two wires in ... al plane. These hangers offset the contact wire towrd the inside of the curve a sufficient distance to comperte for the deflection of the pantograph shoe due to

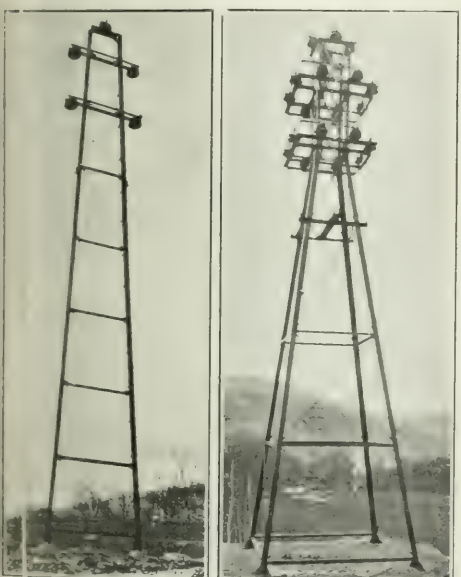


Fig. ntermediate and Corner Towers of Transmission Line.

the perelevation of the outer rail. Outside of the tunnel the ormal height of the contact wire above the rails is ...

In he tunnel the catenary span is reduced to 100 ft. and two o. 0000 Phono-electric contact wires are carried in the sam horizontal plane by twin hangers. In order to provide naximum conductivity a ⅝-in. stranded copper cable is u d for the messenger. Owing to the limited clearance under the roof of the tunnel the two Phono-electric cont t wires over each track, which are mounted in the sam horizontal plane 5 in. apart, are lowered to 15 ft. 6 in. abo the rails and the messenger cables are suspended 14 in. i ide the center line of each track. This plan gives a min um clearance of 12 in. between the messenger and the oof of the tunnel. The brackets which support the messenger insulators are in turn carried on secondary insulators resting on hangers dropped from the roof. The posi n of the hangers is adjustable vertically by varying e length of the hanger bolts, and the primary insu...ors can be adjusted horizontally on the lateral brackets to p vide for slight changes in alignment.

The twin contact wire hangers used in the tunnel are of special design to allow some vertical movement of the trolley wires. They consist of a yoke carrying the two trolley-wire clips and a suspension rod ½ in. in diameter on the top of which is screwed the messenger cable clamp. The suspension rod passes through a tapered hole in the center of the yoke and a spherical-faced nut is screwed on the bottom of the rod. The yoke is slotted and the nut on the end of the suspension rod is free to move in this slot through a vertical distance of about 1½ in. All parts of the tunnel hangers are made of bronze.

In the tunnel the primary and secondary insulators are of brown porcelain of the triple-petticoat pin type. Each insulator is capable of resisting 150,000 volts to ground, and as the primary and secondary insulators are in series the combined dielectric strength is 300,000 volts. The outside insulators are of the suspended type. They consist of an upper petticoat with the concave side turned up in the shape of the brim of a hat and a lower semi-spherical petticoat 15 in. in diameter with the concave side down. A hollow malleable iron pin is cemented into the lower petticoat and the malleable iron cap by which the insulator is suspended is cemented on the outside of the upper petticoat. These insulators were required to withstand a dry test of 110,000 volts, or ten times the normal working voltage. The strain insulators used for dead-ending the messenger cables and contact wires are of porcelain of the spool type and each one was tested to 110,000 volts under 35,000 lb. mechanical strain before erection. They have an ultimate tensile strength of 50,000 lb. For cross-catenary steady strain wire attachments two disk insulators in tandem were used at each anchorage. Impregnated hickory wooden strain insulators are inserted in the steady strain cables between each pair of tracks where required to preserve the sectionalization of the trolley wires.

The supporting bridges for the two and three-track sections outside of the tunnel are built-up trusses formed of 7-in. and 8-in. channel top and bottom chords with light angle posts and double diagonal rod braces in each panel. In the yards where more than three tracks are equipped with overhead wires use is made of cross-catenary span wires suspended from A-frame steel towers built of 8-in. channels. The anchor bridges are box trusses supported on heavy A-frame towers with latticed legs stiffened with double diagonal braces.

The electrification project was assigned to the engineering department of the New York, New Haven & Hartford Railroad, all plans involving policy of electrical operation and details of construction being there developed. The Zylonite power house was designed and built under the direction of Mr. E. H. McHenry, vice-president in charge of engineering, and the general scheme of the electrical equipment was developed in the office of Mr. W. S. Murray, electrical engineer. Messrs. L. B. Stilwell and H. S. Putnam, of New York, were the consulting and supervising engineers for the work. The general contractors for the installation of the overhead trolley and transmission lines and the erection of the power-house building and switch-house buildings were F. T. Ley & Company, Inc., Springfield, Mass.

SHORT CUTS IN TRANSMISSION LINE ECONOMICS.

By Alfred Still.

When considering a scheme involving the electric transmission of energy over an appreciable distance it is important that the most economic size of conductors be determined within a reasonable degree of accuracy before the commercial aspects of the complete undertaking can properly be discussed.

The following formulas have been evolved with a view to facilitating the calculation of conductor sizes to give

the most economical results on overhead transmissions. In every case the lesser factors which may, to a small extent, influence the results of the problem will be disregarded, but they may be taken into account when the final details of the transmission line are being considered. On the other hand, it will generally be found that the application of Kelvin's law in its simplicity, without regard to such influences as the possible variations in cost of supports, insulators, etc., depending upon the size of the conductors, will give results sufficiently accurate for practical purposes, and this for two important reasons:

1. A small variation in the diameter of the conductor either on the large or the small side is usually of very little consequence from the economic point of view.

2. As the standard size of conductor nearest in diameter to the theoretically correct size is generally selected, refinements or increased accuracy in the calculations will rarely affect the size of wire which is ultimately decided upon.

ECONOMICAL RESISTANCE VOLTAGE DROP.

It is not generally realized that when the size of a conductor is determined by the application of Kelvin's law the ohmic drop of pressure per unit length of conductor is independent of the actual voltage or the current to be carried, and therefore bears no reference to the total amount of power to be transmitted. The economic data and assumptions alone determine the ohmic drop in volts per unit length of conductor, and this will be a constant quantity whatever the number of conductors or system of electric transmission adopted, the total amount of power to be transmitted, or the voltage ultimately decided upon. This fact very considerably simplifies the problem in its earlier stages.

The formula for the economic voltage drop may be arrived at as follows, bearing in mind that the annual charges to be considered are (1) an annual charge for interest and depreciation on the cost of the line wire; (2) the annual cost of the energy wasted in the conductor in the form of I^2R losses[1], and that the equality of these two items of cost determines the size of the most economical conductor.

Annual Charges Depending Upon Cost of Conductor.—Let p be the price to be paid for 100 lb. weight of conductor and a the percentage to be taken to cover the annual interest and depreciation, then, if r be the resistance in ohms per mile of the conductor, one may write the expression:

$$\text{Annual charge} = \frac{a}{100} \times p \times \frac{1}{r} \times K \qquad (1)$$

where K is a constant depending upon the material of the conductor.

Annual Cost of Energy Lost.—Let p_1 be the cost per hp-year of the wasted energy; then,

annual cost per mile of conductor = $p_1 \times$ hp lost per mile

$$= p_1 \times \frac{I^2 r}{746}$$

$$= p_1 \times \frac{e_r^2}{746 \times r} \qquad (2)$$

where e_r stands for ohmic drop in volts per mile of conductor.

In order to fulfil the condition of equality between the values (1) and (2) one must put

$$\frac{a \times p \times K}{100 \times r} = \frac{p_1 \times e_r^2}{746 \times r}$$

which gives us

$$e_r = \sqrt{\frac{746 \times K \times a \times p}{100 \times p_1}}$$

If the material of the line is copper, the constant K may be taken as 8.76, while for aluminum it works out at 4.32.

[1]Other losses due to leakage over insulators and [illegible] be taken into account when considering the choice of emf, especially if this should exceed 60,000 volts.

Inserting these values in the last formula there is obtained for the economic resistance volts per mile of copper conductor:

$$e_r = \sqrt{65.5 \times \frac{a \times p}{p_1}} \qquad (3)$$

and for aluminum:

$$e_r = \sqrt{32 \times \frac{a \times p}{p_1}} \qquad (4)$$

ECONOMICAL VOLTAGE, AND CALCULATION OF CONDUCTOR SIZES.

Having ascertained what will be the most econon ohmic drop of pressure per mile of conductor without erence to the total amount of power to be transmitted size of the conductor cannot be determined unless value of the current is known, and this will depend the pressure at which the power will be transmitted

If the cost of the conductors forming the transmi line and the I^2R losses therein were the only considerat a high voltage would in all cases be desirable on accou the corresponding reduction of current for a given am of power to be transmitted. But, apart from the extra of the line due to the better insulation and wider sp of wires required by the higher pressures, the cost of eration and transformation of high-pressure energy be taken into account, and as the extra cost per kil of equipment for generating at high pressures will de largely upon the total output required, it follows tha most economical pressure will bear some relation to total power to be transmitted. This is apart from the tance of transmission, which is the most important f governing the choice of voltage. If the distance is it is obvious that the reduction of material cost and p losses in the line due to the employment of higher sures will be relatively of far greater importance tha increased cost of plant in generating and transforming tions. On the other hand, the employment of very pressures even on a comparatively long line might n justified if the total amount of power to be transn were very small.

In the early days of electric transmission Mr. C Scott suggested as a rough-and-ready rule that the total distance of transmission in miles divided by three would give a figure approximating to the required pressure expressed in kilovolts. This rule does not take into ac the amount of power to be transmitted; but an em formula which the writer has used for preliminary mates and which agrees generally with modern practi

$$\text{Pressure in kilovolts} = 5.5\sqrt{L + \frac{\text{horse-power transr}}{200}}$$

where L = length of transmission (in miles)

Given the amount of power to be transmitted an length of line, one can with the aid of formula (5) decide upon a standard voltage and proceed with the calculations for current and size of conductor, but it is necessary always to bear in mind that a transmission line cannot be considered by itself; it must be treated as a part of a complete scheme of transmission and distribution, and the best voltage to use on any given system can generally be arrived at only by a system of trial and error, taking into account the costs of the various parts of the complete system as influenced by alterations in the transmission voltage. No accurate formula can be evolved which would be applicable to all the varied conditions encountered in practical work.

EXAMPLE ILLUSTRATING QUICK METHOD OF DETERMINING ECONOMIC SIZE OF CONDUCTORS.

For the purpose of working out a practical exam the following assumptions have been made:

Total horse-power to be transmitted, P = 16,000.

System, three-phase.

ower-factor = 0.8.

istance of transmission = 120 miles.

opper conductors to be used, the cost p being \$15 per lb.

ercentage to be taken to cover depreciation and annual interest on cost of copper, $a = 12.5$.

stimated cost of wasted power per hp-year, p_1 = \$10.

he economic voltage drop per mile of single conductor will be, by formula (3),

$$e_r = \sqrt{65.5 \times \frac{12.5 \times 15}{10}}$$

$$= 27.7 \text{ volts}$$

The transmission voltage as given by formula (5) is:

$$\text{Kilovolts} = 5.5\sqrt{120 + \frac{16{,}000}{200}}$$

$$= 77.7$$

o say, 80,000 volts at the receiving end.

he current per conductor will be:

$$I = \frac{E.H.P. \times 746}{\sqrt{3} \times E \times \cos\theta}$$

$$= \frac{16{,}000 \times 746}{\sqrt{3} \times 80{,}000 \times 0.8}$$

$$= 107.5 \text{ amp.}$$

ance of conductor per mile $= \frac{e_r}{I} = \frac{27.7}{107.5} = 0.257$ ohm,

ice No. 4-0 B. & S. wire has a resistance of 0.259 per mile, that is the standard size which should be l unless a more careful study of the complete scheme lead to a different decision in regard to the pressure of transmission.

ce for a given amount of power to be transmitted the current will vary inversely as the pressure, it follows that the resistance per mile of conductor to give the economic e drop per mile (27.7 volts in this particular ex- will be directly proportional to the pressure at the power is transmitted. Thus if 100,000 volts were to be a more economical pressure than 80,000, the ons per mile of conductor would be $\frac{0.257 \times 100}{80} = 0.321$, the nearest standard size being No. 3-0 (ohms per mile 0.326).

Power lost in Line.—If w stands for the total I^2R watts lost in the three conductors, based on the calculated value of the resistance, then

$$w = 3 \times \text{length of line} \times I \times e_r$$

$$= 3 \times 120 \times 107.5 \times 27.7$$

$$= 1{,}070{,}000 \text{ watts}$$

on the assumption that a transmission pressure of 80,000 volts is adopted; and since the total horse-power transmitted is 16,000, the *percentage* power loss is:

$$\frac{1070 \times 100}{16{,}000 \times 0.746} = 9 \text{ per cent.}$$

Voltage Regulation.—The drop in pressure per conductor, due to ohmic resistance only, will be:

$$e_r \times \text{length of line} = 27.7 \times 120 = 3330 \text{ volts}$$

or $3330 \times \sqrt{3} = 5750$ volts between wires, since the system is three-phase and the volts e_r refer to a single conductor only. The *percentage* ohmic drop is, therefore:

$$\frac{5750 \times 100}{80{,}000} = 7.2 \text{ per cent}$$

This figure alone does not, however, give much indication as to what will be the actual regulation of the line, as the effects of inductance and electrostatic capacity must be taken into account and the resultant difference of pressure between the transmitting and receiving ends of the line calculated by any one of the usual methods. The resultant pressure drop may be found to be excessive; it may be such as cannot readily be dealt with in a practical scheme, and in such a case the economy of the line may have to be sacrificed by putting in larger conductors.

It is obvious that other conditions may render it inexpedient or impossible to adopt the most economical size of conductor, as calculated by the application of Kelvin's law, but in such cases experience and common sense will usually indicate the right course to follow. If the economic size of wire is small there may be trouble due to excessive heating, want of mechanical strength, or loss of power through corona discharges if high pressures are used. If, on the other hand, the conductor diameter is very large, there may be difficulties in handling and in taking the strain on the individual insulators. The remedy in this case is obviously to subdivide the single circuit into two or more parallel circuits, and, in fact, there are many advantages in doing so rather than running very heavy single conductors. One particular aspect of the question of subdivision of transmission lines has previously been dealt with in these pages by the present writer.[2]

Again, even from the economic point of view, the case might arise of a temporary installation intended to give a quick return on capital invested, and an exceptionally small size of wire giving a large I^2R loss might produce the best results. This, however, leads to the consideration of the most important factor in the whole problem, namely, the correctness of the estimates of costs, depreciation allowances and power transmitted, upon which the value of the calculated results will mainly depend. It is here that the experience, foresight and sound judgment of the engineer must necessarily play an important part, and it is not possible in this article to do more than indicate a few considerations which must not be overlooked.

Estimation of Amount and Cost of Energy Wasted in Conductors.—The correct value of the power (P) from which the value of the current (I) is determined is frequently very difficult to estimate. This is a point which is best considered when determining the cost of the wasted energy. It is, however, clear that the annual amount of energy wasted will depend not only on the average value of I^2, but also on the *time* during which the average amount of power may be considered as being transmitted by the wires. If, therefore, it is desired to estimate accurately the amount of energy wasted annually in the lines, a probable load curve for the year should be drawn and the average I^2 calculated therefrom. This will give a value for I which, if considered as flowing in the wires continuously throughout the year, will lead to a certain watt-hour or yearly horse-power loss, the cost of which it is desired to know.

Now, the annual cost of production of an additional electrical horse-power, considered apart from the total cost of production, is always difficult, if not impossible, to estimate accurately, but where coal is the source of energy there is at least the extra cost of coal consumed to be taken into account when estimating the production cost of the lost energy. The case is different in a water-power generating station, where the cost of running the station at full output is very little in excess of the cost of running at one-quarter or one-tenth of maximum output, and it is even more difficult to decide upon a figure which shall represent the cost of wasted energy (p_1 in the calculations) with sufficient accuracy to make the calculations of the economic conductor of real practical value.

There are two points in connection with water-power propositions which must never be lost sight of:

If the amount of water-power available is limited, while the demand for power is unlimited, the cost (p_1) of the wasted power may be taken at the price which the user would be actually prepared to pay for this power were it available for useful purposes.

If the water-power is unlimited as compared with the demand for power, the cost of wasted power is practically *nil*, except for the fact that a generating plant has to be

[2] "Transmission Line Calculations," *Electrical World*, Sept. 15, 1910.

installed of a somewhat larger capacity than would otherwise be necessary; and the works cost of the wasted power must, of course, include a reasonable percentage to cover interest and depreciation on this extra plant.

Estimation of Percentage to Cover Annual Interest and Depreciation on Conductors.—So far as interest is concerned, if cash is to be paid for the conductors, the figure to be taken for interest on capital should be on a par with the expected percentage profit on the complete undertaking; but if the conductors are mortgaged, it is the annual amount of the mortgage which should be taken.

In regard to depreciation, the probable life of the conductor must be estimated, and this, to a certain extent, may depend upon the life of the transmission line considered as a whole.

In conclusion, it should be clearly understood that this article deals only with the determination of the correct size of the conductors, based on certain assumptions as regards voltage and power to be transmitted; and since the transmission line is a part only of a complete power scheme, the economic problem is a wider one than might appear from the foregoing notes. The cost of generating and transforming plant and buildings, as influenced by the voltage, must be carefully considered, together with the type and cost of pole line, so far as these are influenced by the size of the conductors. The character of the country, too, will have some bearing on the design of the transmission line, and the final choice of voltage may depend to some extent upon whether a wood pole line with comparatively short spans and (preferably) small spacing between wires is likely to be more economical than a line with steel towers which will permit of longer spans with wider spacing between wires. In other words, the total cost of the whole undertaking and the total annual losses of energy from all sources, as influenced by any change of voltage, must be considered before the line pressure as given by formula (5) can be definitely adopted as being the most economical for the undertaking considered as a whole.

RELATIVE TRANSMISSION LOSSES.

By B. B. Brackett.

A SOMEWHAT unusual but convenient way to compare the power losses on transmission lines of different systems consists in adding the currents in the separate wires, without regard to their phases or directions, and then assuming that this total current is transmitted one way only over one wire composed of all the copper used in all the wires of the system. In other words, the currents are added arithmetically and one current equal to this sum is supposed to be transmitted one way over all the wires of the complete line in parallel.

As applied to a two-wire transmission, either direct current or alternating current, single-phase, let I' represent the current in each wire and R' the resistance of each of the two wires. By the usual method $(I')^2R'$ equals the power losses in each wire and $2\,(I')^2R'$ the losses for both wires, or for the whole line. On the other hand, $2\,I'$ is the sum of the currents in the two wires, $R'/2$ is the resistance of the two wires in parallel and $(2\,I')^2R'/2$ equals $2\,(I')^2R'$, or the true heat losses.

If we apply a similar method to a balanced three-phase, three-wire system the total current will be $3\,I'''$ and the resistance of all the wires in parallel $R'''/3$, giving $(3\,I''')^2R'''/3$, or $3\,(I''')^2R'''$ as the true heat losses.

Now to compare the amounts of copper that must be used in the above cases to transmit equal amounts of power at the same voltage between lines when the power-factor is unity or otherwise, if only the same for each system, we may note that $I' = \sqrt{3}\,I'''$, in which we represent the current per line by I' for the single-phase sys[te]m and likewise use I''' for the current in each wire of [th]e three-phase system. The total current for the single-p[hase] system will therefore be $2\,I'$ and that for the three-p[hase] system $3\,I'''$, or $\sqrt{3}\,I'$. Hence the total heat losses wi[ll be] $(2\,I')^2R'_{total}$ and $(\sqrt{3}\,I')^2R'''_{total}$, and since from [the] assumed conditions the losses are to be equal, R'[$_{total}$ =] $\frac{3}{4}\,R'''_{total}$.

The resistances designated R_{total}, as stated above, [a]re the resistances of all the wires of each complete lin[e] in parallel and are therefore inversely proportional to [th]e amounts of copper required. Hence the three-phase [sys]tem under the stated conditions will require only th[ree] quarters, or 75 per cent, as much copper as the correspo[nd]ing single-phase system.

Similar comparisons may be made between the sin[gle-] phase and the two-phase systems. If we use two i[nde]pendent return circuits for a two-phase system we sir[ply] divide the current into two equal portions without in [any] way modifying its total value, and this would involve [no] change in the "total" or parallel resistance of the wires [em]ployed. Hence there would be no change in the amoun[t of] copper needed.

But if we unite two of the four wires, one from [each] phase, into a common wire, an increased voltage will [re]sult between the two other wires, which we shall call [the] outside wires. When we are restricted in the voltage [that] can be used between any two wires on the line and [must] bring this largest voltage down to what would be [used] between the two wires of a corresponding single-p[hase] line, all of the two-phase voltages must be reduced a[nd a] proportional increase in the currents must occur. [This] will increase the current in the two outside wires from [...] to $\sqrt{2}\,I'/2$, and the current in the third wire, commo[n to] both phases, will be $\sqrt{2}\,\sqrt{2}\,I'/2$, for reasons given i[n] books treating polyphase currents. The total curren[t in] this system will therefore be $\sqrt{2}\,I' + I'$, and for e[qual] heat losses on the single-phase and the two-phase l[ines] $(2\,I')^2R'_{total} = (\sqrt{2}\,I' + I')\,R''_{total}$.

Hence,

$$R'_{total} = \frac{3 + 2\sqrt{2}}{4}\,R''_{total}$$

and

$$R'_{total} = 1.457\,R''_{total}$$

Thus the total or parallel resistance of all the three w[ires] of this two-phase line must be smaller than that of the [wires] for the single-phase line, and the ratio is such as to re[quire] just 1.457 times as much copper.

Similar comparisons may be made for practically [any] variety of phases or other conditions of transmission.

COPPER LOSSES IN ROTARY CONVERTERS

By John R. Carson.

WHILE the subject of the copper losses in rotary [con]verters has been very thoroughly investigated, t[here] is not, so far as the writer is aware, any ge[neral] formula which expresses the copper loss for any po[wer-] factor as well as any number of phases.

The problem of determining the I^2R losses in a ro[ta]ry converter is simply an extension of the problem of the h[eat]ing effect of current consisting of a direct component [wi]th an alternating current superposed. That this is the [ca]se follows at once from a consideration of the current in [t]he coils of the rotary in which both direct current and a[lte]rnating current co-exist. Obviously, the general form of the armature current is given by $A - B\sin\Theta$, wher[e] A is the direct component and $B\sin\Theta$ the alternating [com]ponent. It must be borne in mind that this statement an

[illegible]nsidered as holding only for half a cycle, since the [illegible] component is discontinuous—that is, reverses every [illegible]cle. Hence the above mathematical expression of [illegible]rrent value cannot be extended through the instant [illegible]rsal, and care must be exercised to limit properly [illegible]rations.

[illegible]e the heating is proportional to the square of the ar[illegible]ture current, squaring the expression for the current gi[illegible] a quantity proportional to the instantaneous heating eff[illegible]t as follows:

$$A^2 - 2AB\sin\theta + B^2\sin^2\theta.$$

[illegible] mean heating effect of this current during the interval [illegible]e, expressed by the limits θ_0 and θ_1, is obviously

$$\left(\frac{1}{\theta_1 - \theta_0}\right)\int_{\theta_0}^{\theta_1}\left[A^2 - 2AB\sin\theta + B^2\sin^2\theta\right]d\theta$$

[illegible] the superior and inferior limits of this integration [illegible]incide with the instants of reversal of the direct [illegible]. The total interval is π electrical degrees. At [illegible] θ is arbitrarily taken, and, therefore, assume

$$\theta_1 = \pi + a \text{ and } \theta_0 = a.$$

[illegible]stituting, integrating and simplifying the expression fo[illegible] the mean rate of heating becomes

$$A^2 + \frac{B^2}{2} - \frac{4AB}{\pi}\cos a$$

[illegible] the above it is quite obvious that the heating effect [illegible] upon the value of the alternating-current compo[illegible] the instant of direct-current reversal—that is, upon [illegible]e of $\cos a$. In a rotary the heating is least in that co[illegible] which the alternating current is undergoing reversal at [illegible] instant of passing under the brush. At unity power-fa[illegible]r this coil lies midway between the alternating-current [illegible]

[illegible] necessary to identify A, B and a with the physi-ca[illegible] quantities involved. It can be shown very readily that, ne[illegible]cting losses,

$$B = A\left[\frac{4}{n\sin\frac{\pi}{n}}\right]\left(\frac{1}{\cos\beta}\right)$$

[illegible] is the number of alternating-current taps or rings a[illegible] $\cos\beta$ is the power-factor. Moreover, since the taps are di[illegible]laced $\frac{2\pi}{n}$ electrical degrees the maximum value possible to [illegible] is $\beta + \frac{\pi}{n}$. In the coils between consecutive taps the [illegible] of a varies continuously from $-\frac{\pi}{n} \pm \beta$ to $+\frac{\pi}{n} \pm \beta$. The double sign before β is introduced to take ca[illegible] of both leading and lagging power-factors. The mean he[illegible]ing in the coils between two consecutive taps is, there-[illegible]

$$\frac{n}{2\pi}\int_{-\frac{\pi}{n}\pm\beta}^{\frac{\pi}{n}\pm\beta}\left[A^2 + \frac{B^2}{2} - \frac{4AB}{\pi}\cos a\right]da$$

$$= A^2 + \frac{B^2}{2} - \frac{4AB}{\pi^2}(n)\sin\frac{\pi}{n}\cos(\pm\beta).$$

[illegible]ince the taps are symmetrical the above is proportional to the mean heating in the rotary. Operating as direct-c[illegible]rent generator the heating is simply proportional to A^2. B[illegible]ring this in mind, and substituting the value of B in te[illegible]s of A, the ratio of the alternating-current to the d[illegible]ect-current generator copper loss becomes

$$\frac{\text{Rotary copper loss}}{\text{Direct-current copper loss}} = 1 + \frac{1}{2}\left(\frac{4}{n\sin\frac{\pi}{n}}\right)^2\left(\frac{1}{\cos\beta}\right)^2 - \frac{16}{\pi^2}$$

The above formula is immediately available for readily calculating the relative I^2R for the same direct-current output.

[illegible]	[illegible] 100 PER CENT POWER FACTOR.		[illegible] 90 PER CENT POWER FACTOR.	
	I^2R Ratio.	Relative Ampere Rating for Equal I^2R.	I^2R Ratio.	Relative Ampere Rating for Equal I^2R.
2	1.379	.852	1.848	.736
[illegible]	.564	1.332	.842	1.090
4	[illegible]	1.624	.614	1.276
6	.268	1.932	.476	1.449
8	[illegible]	2.072	[illegible]	1.250

Power-Factor.	I^2R Ratio.	Relative Ampere Rating.
100	.268	1.932
95	.364	1.658
90	.476	1.449
[illegible]	.509	1.281
[illegible]	[illegible]	1.141

The results which the formula gives are embodied in the first of the above tables. In the second table are tabulated the I^2R ratio and the relative ampere rating at different power-factors for a six-ring converter.

AN ELECTRIC CREDIT SYSTEM FOR DEPARTMENT STORES.

By A. Lawrence.

THE usages to which electricity is being put in commercial fields increase daily and inventors are constantly bringing out new devices, many of which do not become immediately public. It has been recently the good fortune of the writer to have an opportunity to see one of the latest additions to the list in actual operation in a large department store, and a description of it will undoubtedly prove of general interest to both electrical

Fig. 1—Cabinet for Fifty-Line Equipment.

and business men. The system is the product of a cash register company's interests and has for its object the expeditious handling of credit transactions in large department stores. It comprises a desk type of cordless telephone switchboard, located in the credit department of the store,

a number of standard-type telephones, each equipped with a solenoid-operated stamping attachment and located in the various departments of the store, and suitable connections between these and the switchboard.

Before describing in detail the apparatus a brief outline of the requirements of the system may not be amiss. In

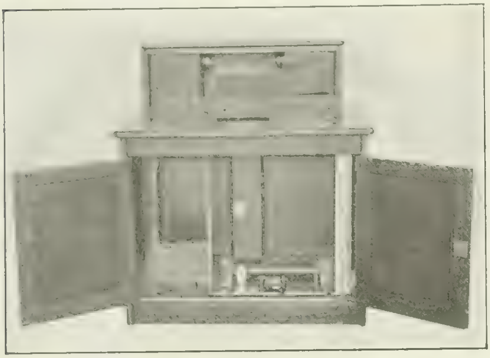


Fig. 2—Cabinet for Ten-Line Equipment.

handling credit sales in department stores rapidity of operation, secrecy and accuracy are essential to the success of any system. With most of the old methods the customer has to wait fifteen or twenty minutes for the package while a sales slip is sent up to the credit office. Where the pneumatic tube system is used the carriers often get mislaid en route, and the writer has seen customers wait nearly an hour for their goods. The electric system under consideration overcomes these difficulties by having the sales slip stamped at the very department counter where the sale is made, and the entire transaction seldom consumes more than one or two minutes.

In service the operation is as follows: A customer enters the store and makes a credit purchase, the clerk filling out a sales record slip in the usual way and in addition writing upon it the customer's name and address. This slip is then placed in the stamping attachment of the telephone and the receiver hook is lifted and released, but without removing the receiver.

This operation sends in a call to the switchboard at the credit office by lighting a visual signal lamp on the board after the usual manner in telephone work, with the exception that the light remains glowing. This is accomplished by means of a "lock-in" relay circuit and enables the clerk in the store to continue his or her regular duties while awaiting the convenience of the credit clerk to attend the call.

When the credit clerk is ready to take up the call a line key directly below the signal lamp glowing is depressed, which operation places the credit clerk on that particular line. The stamping and ringing key at the lower central portion of the panel is then depressed, which rings a call bell on the telephone in the store, thus showing the clerk that the credit department is ready to attend to the call. The clerk then removes the receiver from the hook, which lights a supervisory lamp on the switchboard, showing the credit clerk that the store clerk has answered. The former says "credit department" and the store clerk then reads in a low voice the station number of the department, the customer's name and address and the amount of the sale. The credit clerk usually knows the condition of the account from memory, or, if necessary, looks it up in the card index, and if it is in good condition he merely lifts the stamp key, which causes the stamping attachment on the telephone to operate and stamp the sales slip and also records the date and station number.

There is a sharp click to the stamping device, which indicates to the store clerk that the slip is stamped, but in addition a single-stroke bell rings as a signal for this purpose.

Should the account not be in condition to warrant passing the sale the credit man tells the store clerk what disposition to make of it, or to send the customer up to the office for an interview. As a safeguard against burnt-out signal lamps on the switchboard a pilot lamp on the lower right of the panel glows in conjunction with each line lamp.

A paper flash lamp in the lower central part of the panel, directly above the stamp key, serves to show the credit clerk that the sales slip is properly placed in the stamping attachment by glowing when the paper is not inserted correctly. This is brought about by having the paper flash lamp on a relay circuit which is broken by the insertion of the sales slip between contact springs. An audible signal at the switchboard is provided so that it can be switched on when the credit man leaves the immediate vicinity of the switchboard. This is usually a standard type of buzzer shunted across the pilot lamp relay so as to operate on all the lines.

The type of switchboard is shown at Fig. 1, this particular board belonging to the system in use at the department

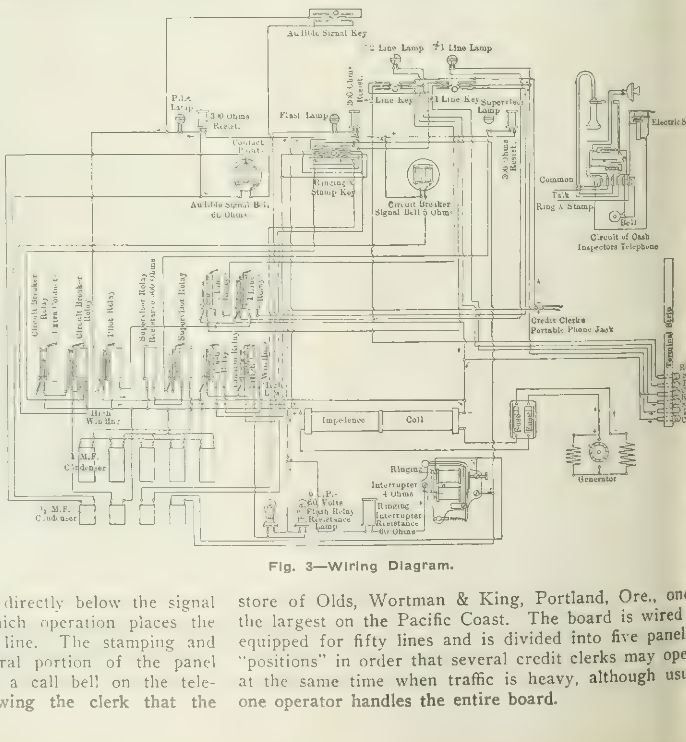


Fig. 3—Wiring Diagram.

store of Olds, Wortman & King, Portland, Ore., one of the largest on the Pacific Coast. The board is wired and equipped for fifty lines and is divided into five panels or "positions" in order that several credit clerks may operate at the same time when traffic is heavy, although usually one operator handles the entire board.

A better idea of the interior arrangement of one of these vitchboards may be gained from inspection of Fig. 2, hich shows a ten-line equipment at closer range and ·ings out the neatness of disposition of the various relays, ondensers, interrupters and wiring. Energy is supplied to ie system at from 40 volts to 50 volts from a small motor-enerator set, which may be conveniently located in the ore. The wiring from the board to the stamping tele-iones is of standard triplex telephone cable, the stamping id ringing circuits being over two of the wires, while lking is carried on between one of these and the third ire.

The various connections of the system are clearly shown the wiring diagram, Fig. 3, in which the different devices are arranged diagrammatically, yet in their proper relative positions, when looking at the switchboard from the rear. The small diagram at the right hand shows the stamping telephone connections, and the circuit for the paper flash lamp is also plainly shown.

The writer has been informed that there are nearly fifty of these equipments in service at present in the United States and that others are now being installed in various sections of the country.

It will be seen that the printed "O. K." on the sales slip, the original of which is retained by the store clerk, proves that the latter was authorized to pass the transaction. At the same time the desired results of speed and secrecy are accomplished.

Central Station

Management, Policies and Commercial Methods

LECTRIC TOASTERS FOR CURLING FEATHERS.

The Edison Electric Illuminating Company of Brooklyn received a request recently from a millinery establishment for an appliance that might be used to curl feathers. The Edison Shop was equal to the occasion and experimented with an electric toaster. After inclosing the toaster in a wire screen for preventing injury to the plumes by contact with the coils, the method proved satisfactory, and several toasters so equipped are now in use by the applicants.

SHOE STORE ELECTRIC DISPLAY.

he Regal Shoe Company has an effective window attraction at its store on Tremont Street, Boston. It consists of a exact model of a Curtiss biplane and of a Bleriot monoplane, made of canvas and wire in the former case and of sheet zinc in the other. The propeller of each plane is turned by a miniature electric motor attached to the electric lighting circuit. In the biplane there are four small incandescent lamps which add further attraction. The store manager says this is the most effective drawing card he has ever used.

EXTENDING CENTRAL-STATION SERVICE IN WORCESTER, MASS.

ince July 1 of this year, when Mr. Fred H. Smith took charge of the Worcester Electric Light Company as general manager, the company has made large advance in the volume of business. Up-to-date business methods have resulted in about 600 new contracts for lighting houses, stores and other buildings, and a large number of contracts for small powers have been closed. The company, which has just finished its fine new station, is in the market for a 5000-kw turbine and three more 600-hp boilers. The company has an equipment of 6000 kw now, and it is about all taken. The company deems it necessary to provide an adequate reserve in view of the expansion of the business.

BOSTON'S ELECTRICAL PAGE.

The *Boston Sunday Post* of Sept. 3 contains a "People's Electrical Page" similar to that printed in Cleveland for the past few years. The headpiece is designed to illustrate the convenience, utility and efficiency of electricity and across the bottom of the page is a statement on co-operation by the Edison Electric Illuminating Company of Boston. In the center of the page are two articles and a number of electrical notes, the leader being entitled "What Is Electricity?" and the other article captioned "The House Without a Broom or a Match." Surrounding the reading matter are advertisements of electric manufacturing companies and supply houses. About 50 per cent of the advertising is devoted to the electric vehicle, reflecting in a measure the energetic campaign launched some months ago in Boston by the Edison company for the more general adoption of this type of vehicle for social and business purposes.

CENTRAL-STATION SERVICE FOR PAPER MILLS.

The Tidewater Paper Mills, which will occupy over 100,000 sq. ft. of floor space in the Bush Terminal, Brooklyn, N. Y., have entered into a contract with the Edison Electric Illuminating Company of Brooklyn for energy to operate their entire paper-making plant. This will be a strictly modern plant in every particular, and above 1000 hp in motors will be used. The contract is for a long term and will bring a revenue of approximately $75,000 per year to the Brooklyn Edison Company. Owing to the nature of the work certainty of operation is a prime factor in connection with the power supply, and for this reason the Brooklyn Edison company will furnish connections from both of its stations, in order to insure uninterrupted service. In case a private plant had been installed in this instance it would have been necessary to have this practically in duplicate, and the cost of this offered one of the strongest arguments leading to the adoption of central-station service by this customer, owing to the saving in fixed charges thus effected.

THE METER READER AS ELECTRIC-IRON SALESMAN.

The Union Electric Company of Dubuque, Ia., offers irons for thirty days' free trial, following which, if the customer is satisfied, he may purchase the iron for $4. Free repairs are made at any time upon all such irons, this offer being also extended to any iron in use on the company's circuits on which repairs can be made without ordering special parts. For such parts, of course, the actual cost is charged.

The larger part of the company's residence customers are now equipped with irons, and the most successful solicitor

in placing these devices has been one of the company's meter readers, who gives special attention to the iron campaign. Having access once a month to the houses of consumers without irons, this representative has found little difficulty in interesting the housewife in his accounts of the experience of her neighbors and friends having electric irons, and soon departs with her own application for a trial iron. When not engaged in meter reading the same employee handles the repairs on customers' irons, as above noted, so that he becomes familiar with the practical construction of the devices, and on his meter-reading visits can often make slight repairs to restore service to customers' irons without its being necessary to remove them from the house.

SOLICITORS' BONUS OFFER GETS OLD HOUSES WIRED IN OMAHA, NEB.

Fifteen thousand houses are now wired in Omaha, Neb., and the Omaha Electric Light & Power Company is taking on additional old houses at the rate of 1200 a year. Within the last few years the lowest number connected, according to Mr. I. B. Zimman, contract agent, has been 938, and last year 1257 old houses were wired. Results already obtained indicate that the present year will exceed 1300 houses connected.

The Omaha company does no wiring, leaving all such work in the hands of local contractors who are called in for competitive bids. To each solicitor obtaining a house-wiring contract, however, a bonus of $1.50 is awarded, and this stimulus is believed to cause the unusual house-wiring interest noted in Omaha. The solicitors are already well paid by salaries, but the bonus is in the nature of an extra perquisite which they work energetically to earn.

The Omaha company also has a very large motor load, a great part of which is made up of grain elevators. Prior to the recent burning of an elevator having 1100 hp connected load and consuming 60,000 kw-hours to 75,000 kw-hours monthly, the Omaha system had probably the largest motor-driven elevator business in the country, the load aggregating 5000 hp.

SAFETY OF THE ELECTRIC DRIVE.

A correspondent points out that a strong talking point which seems to have been overlooked by most central-station operators in developing additional power business is that the installation of motors and provision of a direct drive instead of belt transmission largely reduces the opportunity for accidents in a plant. The theme of accident prevention is one, he says, that is interesting every employer of labor, as well as the liability insurance companies, and the argument can be strongly developed that the efficiency of a plant should be visibly increased by reducing the accident hazard through eliminating belts, hangers and other transmission equipment. Insurance company inspectors agree that the number of accidents resulting from employees being caught in belting, falling from ladders while oiling working parts of the transmission, and from deficient lighting caused by the interposition of transmission equipment between the windows and the machines, is so great as to form a large fraction of the total. Were every factory equipped with motor-driven machinery the sum total of casualties to workmen would be greatly lessened. While the first thing that the owner of an industrial plant wants to know about electric drive is, "What will it cost compared to present expenditures?" the accident-prevention feature is a secondary consideration well worth developing to its fullest strength.

NATIONAL ELECTRICAL CODE FOR 1911.

The 1911 edition of the National Electrical Code has bee printed and will soon be available for general distributio The code appears now as recommended by the Nation Fire Protection Association, which has taken over the wo formerly conducted under the direction of the Unde writers' National Electric Association. The latter had bee the sponsor of the code since the first edition in the ear nineties and the change marks a subordination of the wo on electricity to the work in general of the Underwrite on fire-protection devices of all sorts. A change in the bo which will be welcomed is a return to a single volume i stead of two volumes, one dealing with installation rul and the other with construction of devices, as in the 19 Code.

The new Code is a book of 190 pages in the usual for but is printed on thinner paper. The most obvious chan is a renumbering of all the rules to include the later ad tions. While this may cause some confusion for a sh time, the change will, in general, be welcomed, no doubt.

There is a revision, with some important changes, the rules on theater wiring. The treatment of transfor ers is somewhat amended, but, in general, there are very radical changes in the rules of installation of el trical work. In the construction of fittings and materi the recently adopted specifications for rubber-covered wi and cables occupy some ten pages and set forth the m more definite and exacting requirements for this import material. Other important changes treat of fixture wi and the construction of fixtures and the construction a testing of auto starters, while there is an entirely n classification of knife switches, with many minor chan in details of construction.

The index is elaborated so as to be a better guide the subject matter. Inquiries for copies should be addres to the National Board of Fire Underwriters, 135 Will Street, New York, or to local insurance boards and age

It is said that no one body of engineering rules is ado by so wide a constituency as the National Electrical C There are over 200 municipalities in the United St where the Code is explicitly or practically a part of city statute law.

OLD-RESIDENCE WIRING AND RURAL SERVI IN VERMONT.

The Brattleboro (Vt.) division of the Twin State G Electric Company, which in 1906 bought out the Bra boro Gas Company, has made a large development i electric department, particularly during the past months. The company's policy has been to push its ele business for lighting and motor service, while wor for gas business in the line of cooking and heating. M of the merchants have changed from gas to electrici their store lighting. The company has undertaken a paign of wiring houses at practically cost, the charg owner being about $30 for a seven-room house. In this it has added since May of this year forty new custo some twenty of whom have been taken on since Au In July of last year the company reduced its rate t cents for the first 25 kw-hours monthly, 9 cents for 25 kw-hours, 8 cents for next 50 kw-hours and 6 cent amounts in excess. The management finds that the reduction in price is already nearly compensated for by the growth in the business.

Another feature of the company's operations is it extension of service into the surrounding farming country. It has run a line about 3 miles west of the town to connect twelve prosperous farms. The consumers paid for the extensions from the company's wires to their own places, in several instances 1 mile to 1½ miles in length. One

rmer paid an installation bill of about $900. The farm-s connected have installed several small motors each, hich are used for pumping water, cutting wood and en-age, etc. The company has a hydroelectric plant on est River, but this does not supply sufficient energy for e present demand, and an almost equal amount is bought the Connecticut River Power Company, whose plant is at ernon, some 12 miles south of Brattleboro.

The officers of the Twin State Gas & Electric Company re: Messrs. I. L. Mellon, New York, general manager; M. Addis, assistant manager, in charge of the Brattle-ro division; L. C. White, in charge of the electric light nd power department at Brattleboro. The company has e present time about 640 customers, of whom about are motor customers. The company's motor rate nges from 6 cents down to 2 cents per kw-hour.

SOME DENVER NOTES.

By John Craig Hammond.

Perhaps it was the late Charles Hoyt—no matter who, he was an observing writer—who had two characters s: "Texas is a great state. All it needs is plenty of ter and good society."

And the second man observed that that was all hell ...

n I visited Denver a few days ago for the first time er six years the idea came to me that all the Denver s & Electric Company required of Denver was some re stores and buildings and it might, perhaps, sell me more electric-light signs. There may be some busi-ss man in Denver who has not an electric sign of some kd or another—in fact, if I was a Denver business man, k I would cut out my electric light for a month or t for the novelty of the thing—just to be different.

story is told of an Indiana girl who, on first seeing ra Falls, wanted to know if the falls worked at ust as they did in the day time. I felt a bit like the I wondered before I reached the city whether the r Gas & Electric Company was still selling electric ...

Overland Limited of the Union Pacific landed me ver at night. To a train acquaintance I explained wanted to take an open cab at the depot and drive streets just to see the electric lights.

rly ten years ago, I explained, I was advertising er for the Denver Gas & Electric Company. Mr. L. Doherty, the president, had what was then called ideas over "new business" and the selling of gas and electric signs. I had certain theories about advertising and publicity, and it is related that when I first met Mr. Doherty and gave vent to my feelings he later remarked that he had at last found a man who was just as foolish as he was over advertising.

This as it may be, the Denver Gas & Electric Company was one of the pioneers in the new-business methods. The foolish ideas of years ago have proved dividend-paying ideas to-day. Many were the wonderous advertising stunts planned, and executed, to awake the business man to the advantage of electric signs. One day I suggested the slogan, "The City of Lights," and that is what Denver is called to-day wherever you go.

On a tour of the principal cities of the West I talked to many business men and local "boosters." They all had their story to tell of why Salt Lake City, Los Angeles, Portland, Seattle or Tacoma was *the* city of the West.

"How about Denver?" I would ask.

"Well, Denver is a good town. She certainly is a well-lighted city. Guess they have it on us in that line, but"—and then would follow the story of the respective merits of their own city.

You see the idea; Denver has gained fame by her well-lighted streets and buildings. I mingled with tourists on my tour. Four men were talking—two of them from San Antonio, Tex.—as we went from Salt Lake City to Los Angeles.

"Did you stop at Denver?" one of the San Antonio men wanted to know. And he was told the other two men had not. "Well, don't make a mistake—stop at Denver on your way back. It will pay you to see the electrical display, if nothing else." That is just one incident that I happened to be in on. It proves, to my mind, that the business men of Denver have done more than pay money to the electric-light company. They have advertised their city and have directed new dollars into their own pockets.

To me the Western trip was worth while just to see what had been done in lighting Denver, to look upon the wonderful, yes, marvelous, strides that have been made in the past half-dozen years. Over in the Gas & Electric Building I found new-business men, or solicitors, hustling out after business with just as much vim and go as they displayed years ago.

Denver has been famous for its warring newspapers—that is, the differences of opinions that existed between the owners. But I do not think Denver business men realize what the newspapers have done to boost Denver. No city in the country, to my mind, has newspapers that do more to spread the fame of Denver.

I happened to be in the office of Mr. Joshia M. Ward, managing editor of the Denver *Post*, when an employee of the electric-light company brought in a new view of Denver's streets at night. Now, most newspapers want a "scoop" and exclusive story. Mr. Ward looked at the picture.

"Like to have this exclusive," he said, "but, as it will boost Denver, let all the papers have it and we will use it our way."

That is a pretty broad principle—certainly a boosting spirit for Denver.

I was as enthusiastic as a boy over the new Denver. And the new buildings, the clean streets—they all go along with the civic pride to make Denver a real city of lights.

My idea is that Denver business men have a good investment in their lavish display of lights. Some other cities are backward—perhaps due to the local companies. I may have more to say on this question in future papers, as well as a few suggestions to the various central stations on why they are not getting more new business.

In the meantime, Denver is certainly getting new business, or, rather, has got it, and that it has paid is told by the stock quotations—the market value was away under par over six years ago. To-day it is just as far above par. It would seem that the "foolish" new-business methods do pay.

CENTRAL-STATION DISTRICT HEATING.

The subject of heating in connection with central-station work was discussed by Mr. John C. Hornung, of the W. H. Schott Company, Chicago, in a paper read before the Indiana Electric Light Association at South Bend, Aug. 23. After pointing out that where the earlier failures have occurred in heating plants these, real or apparent, can be traced to unfitness of situation or plant or to improper accounting, omitting to credit the heating plant with its share of the earnings, the author declared that the practical and profitable possibilities of heating are best illustrated by the increasing interest in heating work by central stations, particularly among the syndicates operating groups of plants.

The destination of the heat units liberated during the consumption of a pound of average Indiana coal containing 11,500 lb.-Fahr. units Mr. Hornung illustrated by the

accompanying diagram. Here 37 per cent, or 4255 units, are irreclaimably lost in the stack gases, radiation, cinders, etc.; 5 per cent, or 575 units, are lost in the steam piping and cylinder losses, auxiliaries, friction, excitation, etc.; 6 per cent, or 690 units, are delivered to the switchboard as useful kw-hours, while 52 per cent, or 5980 units, are rejected in the steam passing the exhaust ports. These proportions, declared Mr. Hornung, are typical of the conditions in the average electric-lighting plant running non-condensing.

The gage pressures most economical for general plant practice range about 150 lb. and are being adopted in nearly all new installations. The terminal pressures may vary all the way from 28 in. of vacuum to 20 lb. per square inch back pressure. The author then exhibited a table representing the quantity of steam in pounds per kw-hour passing through the exhaust ports under initial pressures varying from 100 lb. per square inch to 200 lb. per square inch, and terminal pressures varying from 28 in. of vacuum to 20 lb. back pressure. The table applied to the Corliss type of compound engine running at its rated capacity and its most economical point of cut-off. The latter is usually an important point in considering the design of an engine for an electric-light plant on account of the varying load. However, if the exhaust steam can be put to commercial use, the lesser efficiencies due to the engine not being loaded to its most economic capacity no longer enter into the question so strongly. In fact, the engine may during the heating season be looked upon as a reducing valve which converts the sensible heat units in the steam into kw-hours, and if a proper balance can be maintained between the electrical load and the heating load the highest economies can be secured, the losses then being only those of radiation and conduction.

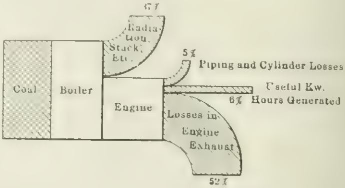
The efficiencies of the steam engine, however, require attention on account of that part of the year when no heat can be sold. This calls for an engine which can be operated most economically during the summer months. Several schemes have been brought into practice, and so far the most flexible is what may be called the "bleeder" type of engine. This scheme employs the receiver between the high-pressure and low-pressure cylinders as the source of supply to the heating mains, the low-pressure cylinder doing its work normally with the aid of a condenser. This method permits of the desired flexibility which has long been sought for, in that the varying loads, both electrical and heating, can be nicely handled without the loss of heat units, for at least the range is greatly extended and only the sharp evening lighting peaks will possibly cause heat to be rejected.

The performance of a 1000-kw, cross-compound condens-

Load Kilowatt	Pounds Steam, Bled.	Pounds Steam, Total.	Steam, Total per Kw-hour.	Total Steam Non-Condensing 10-lb. Back-Pressure.	Total Steam Condensing 24 in. Vacuum.
	0	13,500	22.6		
	5,000	15,700	26.2		
[illegible]	10,000	17,900	29.9	46.0	22.6
	15,000	20,000	33.5		
	0	17,000	21.1		
	5,000	19,200	24.0		
800	10,000	21,600	27.0	38.3	21.1
	20,000	26,300	33.0		
	0	21,000	21.0		
	5,000	24,000	23.7		
1,000	10,000	26,500	26.5	36.0	21.0
	20,000	31,800	31.9		
	30,000	37,300	37.4		

ing engine of modern type and capacity, using 150 lb. steam and exhausting into a 24-in. vacuum, when operating with the receiver bleeding steam at 10 lb. pressure to the heating mains will be about as shown in the table.

Turbines show considerable irregularity in steam consumption per kw-hour under varying initial and termi pressures, hence no attempt is made to tabulate the sultant economies. The last few years have, howev seen considerable development in the turbine to make more adaptable for the economical disposition of the



Distribution of the Heat Units Obtained from the Coal.

jected steam. We now have as the result a bleeder type turbine which promises that its annual economies, both heating service and operating condensing during the su mer season, will be brought up to those of the Cor engine.

Under proper conditions non-condensing units may be installed to give the required pressure to the heat mains, while in multiple with the main a low-pressure c densing turbine may be added to utilize the excess st and in this way preserve the desired balance between electrical and heating loads without rejecting any heat

Modern practice ever leads into higher gage press and consequent greater number of expansions in cylinders, for it has been clearly demonstrated that work done in the engine is due entirely to the sensible in the steam and this sensible heat can be put into steam for delivery to the engine only by raising the p sure and by superheating.

Furthermore, as pressures increase some of the la heat becomes sensible or convertible into energy; that say, the higher the pressure the larger the percentag the total heat becoming available and capable of b transformed into useful energy. For instance, the heat of steam at atmosphere, 14.7 lb. absolute, is 1 units, while at 150 lb. gage, or 164.7 lb. absolute, the heat is 1196.5 units, an increase of 46.9 units. The la heat values of steam at the same pressure are 966.6 and 855 units respectively, showing a decrease of units in the latent heat. It may thus be seen that an tion of 46.9 heat units to the steam has converted latent units into available heat for transformation into ful energy.

Again a heat unit added to high-pressure steam wi crease the pressure more than when added to low-pre steam. For instance, steam at atmosphere, or 14. absolute, has a temperature of 212 deg., while steam a 150 lb., or 164.7 lb. absolute, is at 356.6 deg. By adding, ay 15 deg. of heat to each of the above we have 227 deg and 377.6 deg., but the resultant pressures are 5 lb. gage and 176 lb. gage, an increase in the first case of 5 lb and i the second case of 26 lb. These comparisons show the e mies of the higher pressure, and incidentally they may a clew to the solution of the much-mooted question as t economy of boiler-pressure steam versus exhaust stea heating.

Superheat is hard to handle carrying it as superhea requires the best of insulation, so that it might be co ered poor practice to put high-pressure steam into low-pressure lines, except in proper percentages of the low-pressure or exhaust steam. But where there is a high-pressure line designed to carry steam in such quantitie that a considerable part of the drop in pressure must take place in the line itself instead of at one point, namely, the reducing valve, the superheat thus liberated will re-evaporate any condensation taking place and as a result the consumer will get about all the steam at a low economic distributing pressure.

In fact, during the past season actual meter measurements have shown that 95 per cent of the total steam was delivered to the consumer from a plant which is about 50 per cent loaded. Thus, at 50 per cent of the lines' rated capacity 95 per cent of the steam was paid for by the consumer.

In general, the same discussion of the design and operation of heating plants will apply to both steam and hot-water heating systems. Each, said Mr. Hornung, has its merits and the nature of the territory and the business served should determine which to employ.

When all of the exhaust steam in the plant, outside of that required to heat the feed water, is used for heating the only part left to charge to the electrical system is the difference in heat units due to the difference in pressure between gage and exhaust plus the condensation in the cylinders, pipes, etc., and any reduction in the cost of electrical generation should be credited to heating.

Wiring and Illumination

STREET LIGHTING IN LOUISVILLE.

The installation of ornamental standards, with opalescent globes, for lighting purposes on Jefferson Street, between Second and Fourth, in Louisville, Ky., has been so successful and has attracted such generally favorable comment that efforts are being made by the Commercial Club, the leading business body of that city, whereby Main Street, the wholesale thoroughfare, may be similarly illuminated. The Federal Sign System, the Louisville Lighting Company and the Kentucky Electric Company are working together on the project and it is more than likely that contracts will be closed very shortly.

DES MOINES NEW ELECTRICAL INSPECTION ORDINANCE.

The new electrical inspection ordinance passed by the Des Moines City Council Sept. 13 requires that permits to do electrical work shall be granted only to registered contractors who have filed a bond of $1,000. No wiring of any kind is allowed without such a permit. The newly appointed inspector, Mr. J. B. Dempster, is officially a member of the fire department, and is given authority to enter all premises where electric wiring is installed. A complete schedule of inspection rates is included in the ordinance, the Underwriters' Code being adopted as official. It had been the desire of local electrical interests to hold the contractors' bond at $5,000 or $3,000 to insure exclusion of curbstone wiremen, but when the ordinance was passed the amount was reduced to $1,000 by the Council.

THE CONTRACTOR AS A MERCHANT.

By Charles L. Johnston.

Under the above title an address was recently delivered before the National Electrical Contractors' Association in which contractors were urged to pay more attention to the retail sales of electrical appliances. The writer, however, is firmly convinced that storekeeping and contracting are two entirely separate businesses, and that any attempt to run them as one business is to court disaster. There is no more reason for an electrical contractor running a retail electrical store than there is for a building contractor to retail hardware, paints and window glass. The fact that there are so few hardware-contracting combinations should warn the electrical contractor to be very careful where he ventures. The small job seems to be neither contracting nor retailing, and while it carries a large percentage of gross profit it rarely pays anyone a net profit, except the man who does his own work, who has very low overhead expenses, who does not loaf on the job and for whom red tape and bookkeeping are non-existent. The large contractor, if he is to maintain his reputation, has to oversee and inspect every job, no matter how small. The material and time have to run through the books, and a small job often causes more bookkeeping and more labor for the head of the firm than does a large job. The overhead expenses are thus out of all proportion to the work performed, or to what it can be done for profitably by the so-called vest-pocket electrician.

Large contracting, or even contracting on a modest scale, is essentially different—almost antagonistic to retailing. Consider how different is the bookkeeping. In contracting it is essential to note the cost and profit on each sale or contract. In retailing this is unnecessary and unpractical. In contracting each job should be billed out as soon as finished, while collections are made in accord with the terms of the particular contract in question. Spot cash is in the nature of things unknown. In retailing spot cash is the road to success, while charged accounts are billed at the end of the month and upon the same terms. These are but a few of the differences in bookkeeping. Moreover, the employees are all of a different class; a mechanic is seldom a salesman, and *vice versa*, so the men cannot be transferred from one department to another as trade may be dull or active in their regular department. In fact, you cannot permit the mechanics even to come into the retail department. They look dirty, make dirt and leave things lying around. They misplace and sometimes steal the stock. Our firm had to discontinue a side line of small tools on this account.

A retail electrical store requires only a small space but a good location on the principal retail street. The contractor must carry bulky material and heavy tools, must have a shop and lockers and wash-room for the men, all of which requires space out of the question in a good retail location. The retail man comes to his store early in the morning and stays there all day—things go wrong the minute he leaves. But with a contractor things go wrong if he stays in his office. He must get out and solicit work, inspect it and look after his men. He must even collect his accounts, which are large and often have to be adjusted and explained.

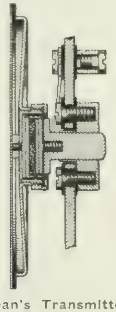
It is, of course, possible to employ some one to run the retail business, but the same is true of the contracting business, and the fact remains that contracting and retailing are two distinct businesses and should be run as such. If a town is large enough to support a purely electrical retail business it might pay the contractor to enter this field on its merits; or he may combine electrical with some other retail lines. If he finds his contracting business too small let him cover a wider territory, put forth more enthusiasm or add some other line of contracting, such as plumbing, the construction of steam and hydraulic plants and their repairs, elevator work, etc., but stay out of the retail business if he has to run it himself.

RECENT TELEPHONE PATENTS.

IMPROVED TRANSMITTERS.

The telephone transmitter as usually constructed is not airtight and therefore it is subject to gradual corrosion, especially if it is in an atmosphere charged with corroding gases. For such conditions the transmitter should be sealed. To accomplish this result Mr. F. Gottshalk, of

New York City, has invented a transmitter in which the diaphragm is flanged, a clamping ring being used to engage the flanged part to draw the diaphragm down to a perfect seat. The casing is then sealed at the point of entrance of the electric circuit by providing a stuffing box about the



Dean's Transmitter.

terminal entrance. Thus, when the terminal is seated, a packing is put in and clamped by tightening down the cover.

Another improved transmitter has been brought out by Mr. W. W. Dean, of Elyria, Ohio, his patent being assigned to the Dean Electric Company. A section of the working parts is illustrated herewith. It will be noted that a sheet-metal box-like structure is mounted behind the diaphragm. This forms a guide for the movable granule box. Any heat given off by the granule box is absorbed by the sheet-metal piece, and because this is dished inward any expansion resulting will be forward and tend to pull the electrodes apart. Thus, heating will not tend to packing or initial compression of the granules. Another effort in the same direction prompts the use of a virtually incompressible insulator behind the diaphragm, rather than the usual soft-rubber ring.

METHOD OF CABLING AUTOMATIC EXCHANGES.

The cabling of automatic exchanges has always been a matter requiring considerable attention, as the diminutive and closely spaced parts are not well adapted to receive the necessary wires without considerable crowding. In a method of wiring patented by Mr. F. R. McBerty connecting racks are provided at the top of each vertical set of multiple banks. Flat cables connect the various vertical rows of terminals of the multiple banks with each other and with the connecting rack above. The sets of multiple banks, with their connecting racks above, are arranged side by side, and to complete the wiring the connecting racks must be connected together, terminal for terminal. In order to reduce the required space to a minimum, use is made of flat ribbon-like cables having straightaway conductors. The talking wires must, however, be transposed at intervals to prevent cross talk. To accomplish this and at the same time not confuse the wiring or circuits the wiring of alternate selectors is reversed in their wiper mechanism. Thus, while before transposition the top terminal of a multiple bank may meet a negatively connected wiper and the second terminal a positive wiper, in the bank following the transposition the top will meet the positive and the second the negative battery terminal. Mr. McBerty's patent has been assigned to the Western Electric Company.

PARTY LINE SYSTEMS.

A step-by-step party-line system is the subject of a patent granted to Mr. N. E. Norstrom, of Chicago. This system contemplates a stepping mechanism at each station, controlled by a central operator. When a call is sent in by the removal of the receiver the operator merely responds in the usual way. All save the calling station are locked out. When any station on the line is, on the other hand, desired, the operator plugs in and sets a corresponding key. When the desired station is selected and responds all step device except those of that station return to the normal locatio[n]. When the conversation is complete the clearing of th[e] line restores the called-station apparatus. Another suc[h] system has been patented by Mr. W. M. Bruce, Jr., c[of] Springfield, Ohio, his patent having been assigned to th[e] American Automatic Telephone Company. This syste[m] also provides for selection, lockout and clearance.

Letters to the Editor.

Analysis of Power Costs.

To the Editor of Electrical World:

Sir:—It may be of interest to your readers to point o[ut] that the article by Mr. F. B. Fletcher, in your issue [of] Sept. 9, on "Steam vs. Central-Station Energy in a Mattre[ss] Factory," does not take account of all of the conditio[ns] that apply in a case such as he treats.

In the test described he has taken into account the stea[m] used for operating the plant by the engine as 48.44 l[b.] per hp-hour, but he does not state whether the exhau[st] steam from this engine is used, or can be used, for oth[er] purposes than operating the engine. In the latter case t[he] engine might well be considered a reducing valve, and t[he] steam used thereby not considered as having any val[ue] other than for heating purposes, since practically the sa[me] amount of steam would have to be supplied by the boile[r] for heating purposes if the engine was not used. In oth[er] words, he has not indicated whether or not there would [be] any actual reduction in the coal bill through the introdu[c]tion of electric power.

In the second place, he states that the average actual co[n]sumption of power at the machines is 40.5 minus 24.6, [or] 15.9 hp; and since all friction losses would be excluded [in] an individual motor drive, the number of hp-hours [per] month would be $16 \times 10 \times 26$, or 4160 hp-hours, or 31[20] kw-hours per month. It will be noted, however, that t[his] statement absolutely neglects the efficiency of the moto[rs] and also all losses from the meter to the motors, wh[ich] would certainly represent at least 15 per cent more pow[er]. Table B shows that the motors are not direct-connected, a[nd] therefore there would be an additional loss of friction [be]tween the motors and the machines, which, with the s[izes] of pulleys indicated in this table, would certainly not be l[ess] than 5 per cent and probably would be more. These ad[di]tions make a total power required at least 20 per c[ent] greater than that given, thereby making the kw-hours [per] month 3792 instead of 3120.

Still further, so far as I can see, no allowance is m[ade] for the fixed charges on the difference between cost of [the] original installation and what it could be sold for, wh[ich] naturally would have to be added to the cost in case elec[tric] drives were installed.

In other words, the writer of the article neglects a nu[m]ber of items of very considerable importance which sho[uld] enter into the analysis of a case such as he considers.

Boston, Mass. Henry D. Jackso[n]

Regulation of Transformers and Transmission Lin[es.]

To the Editor of Electrical World:

Sir:—I have read with interest the article of Mr. H. Bewlay in the Sept. 9 issue entitled "A Semi-graphical Method for Determining the Regulation of Transformers and Transmission Lines."

The problem as applied to transmission lines has been solved in a manner very similar to that described in an article with chart on "Chart for the Calculation of the ze

of Copper Conductors in Transmission Lines" by the writer, and can be found in the *Electrical World* of Jan. 2, 1909. The method outlined in Mr. Bewlay's paper is semi-graphical, while the one in the article referred to is entirely a graphical one and does not involve the use of wire constant tables.

McGill University, Montreal. L. A. Herdt.

Values and Depreciation.

To the Editor of Electrical World.

SIR:—Referring to Mr. Nutting's reply to my criticism of his article in your issue of Aug. 5, it is refreshing to observe the cosmic comprehensiveness which the gentleman from Wisconsin gives to the word *value*. He says that "those who have had occasion to think broadly upon the meaning of this word will agree with me that it may mean almost anything reasonable, depending upon the circumstances." . . . . It is gratifying to have the language enriched by such a useful word! Unfortunately, the great political economists are not so generous as Mr. Nutting, as they seem to have agreed to restrict the use of the word "value" to one specific meaning. Thus, John Stuart Mill said: "The word 'value,' when used without adjunct, always means, in political economy, value in exchange." He added: "The value of a thing is what it will exchange for." Bastiat said: "Value is the relation of two services exchanged." C. H. Chase said: "The value of an object or service is its power in exchange for other services or objects of desire. . . . . While utility, as the objective side of a relation, is fixed invariably in the properties of an object, which make it capable of satisfying wants, value attaches to the object because of satisfying wants which the object bears to other objects and because of the relations which it bears to man individually and collectively."

Alexander Del Mar, whom C. H. Chase refers to as "the most exhaustive and painstaking of all modern writers on monetary subjects," said: "Value may, for the present, be regarded as a numerical relation which involves the unknown ratio between the demand and supply of a service or commodity at a given time and place, as opposed to the known ratio between the demand and supply of another service or commodity at the same place and time, and by comparison and analogy it extends to and between all services and commodities." Further, he says: "Worth (or utility) comprises a number of attributes, value comprises none. Worth appears in the isolated state, value only in the social. Worth cannot be measured by money—value can."

C. H. Chase, whose definition of value was given above, said: "Money is an instrument, created by custom or law, which serves as a medium of exchange, a measure of value and a standard of value." J. S. Mill uses similar language. In fact, the same idea was familiar to Aristotle, who said: "The function of money is to measure value."

Mr. Nutting and Mr. Floy do not believe all this, for they both try to measure utility in money, and Mr. Nutting very plainly avows that he does not believe that a measure has to have the same physical dimensions as the quantity it measures. He measures weight with a yardstick, and it is hard to see what restrains him from measuring temperature with a pint pot. Comment on this would seem unnecessary, were it not for the fact that it is too common to find engineers falling into this unscientific procedure, thereby exposing the profession to ridicule. To those who do not see the absurdity of measuring a quantity of many dimensions, like utility, by means of a unit, like money, which has the dimensions of a number, the following questions may make a stronger appeal:

How do you estimate the utility "in dollars" of any object? Do you not have to forget the utility and consider an exchange before you can make the estimate, thereby making your estimate, not of utility, but of value? Thus, can anyone say how many dollars useful is a ton of coal?

Is there any direct relation between "utility in dollars" and value in dollars? If so, how is it that coal is more useful in New York than in Los Angeles, but costs more in the latter city? If not, why do Mr. Nutting and Mr. Floy assume that there is a direct relation between utility and value?

The fact is that Mr. Nutting's curve has nothing whatever to do with depreciation. Depreciation is a lessening of value—that is, a lessening of power in exchange. A curve of utility is of not the slightest use in estimating depreciation.

New York. William A. Del Mar.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Generators for Lighting Automobiles.—An illustrated description of the "Magician" generator for car lighting. The machine consists of a shunt-wound generator whose armature can be driven by the car engine by any convenient method. The special feature of the machine is that its field magnets are capable of rotation through a fraction of a single revolution. Moreover, the brushes are attached to the field magnets so that they also rotate at the same time. The commutator is L-shaped in section, the brushes being in contact with the horizontal portion. Pressing against the vertical portion is a third brush which is connected to one end of the shunt winding, the other end being connected to one of the first-mentioned brushes. It is obvious that the emf generated by the dynamo will now depend not only on the speed, but also on the position of what may be called the third brush with relation to the others, since the magnitude of the exciting current depends on this position. Attached to the fixed framework is a *C* spring of ribbon steel (*a* in Fig. 1). This carries a copper contact piece of delta section about 1 in. long (*b*). Attached to the framework of the field magnets is a grooved roller *c* whose halves are, however, insulated from each other in a direction perpendicular to their axes. Hence, when the field magnets move so as to bring the roller into contact with the delta-shaped copper the two halves are connected electrically and the device, therefore, acts as an automatic switch. This switch is in series with the main circuit. If the machine is at rest the lamps are supplied by the accumulators alone, because normally the automatic switch is open. Directly it is started the fields are excited and there exists a tendency for them to be dragged round with the armature owing to the magnetic torque. They are, however, prevented from moving at once by a spring. Ultimately, the torque exceeds the tension of the spring and the magnets move round through a small angle, closing the automatic switch. It will be observed that the instant when this occurs depends upon the value of the torque; this latter depends upon the strength of the magnetic field, and consequently upon the position of the third brush. Hence by adjusting the position of this brush the speed and emf at which the generator shall be cut in or out of circuit can be nicely determined. The third brush is carried on a clamping sheave. If, now, the speed increases, the tendency is

for the emf to rise; this increases the field current and thereby raises the torque. The result is that the field magnets move a little further round, thus altering the relative positions of the two field brushes, thereby decreasing the difference of potential across the field circuit, reducing the

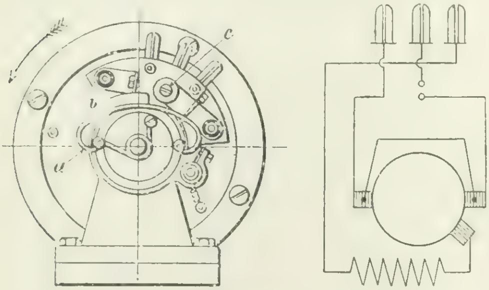


Fig. 1—General Arrangement of Dynamo.

excitation and bringing the emf back again to its original value. In this way the emf can be kept constant over a very large speed range. In an actual demonstration the generator cut in at 800 r.p.m. and from that speed to 2100 r.p.m. there was not more than a 5-per-cent variation, as indicated by the voltmeter, the lamps and accumulators being in parallel. Directly the speed fell to 800 r.p.m. again the generator was cut out of circuit automatically, thus avoiding any discharge from the cells through the armature coils. The diagram of the connections is given in Fig. 2. When short-circuited the field cores are rocked back by the spring and the automatic cut-out opened; this allows the field magnetism to build up again, the magnets are once more dragged round and the generator is cut in circuit. If the short-circuit still exists this operation is repeated. This indicates to the operator that something is wrong. If the generator is connected wrongly to the cells the magnets rock back and thereby cut the generator out of circuit. Almost im-

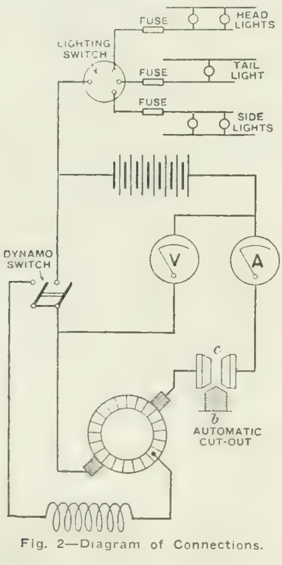


Fig. 2—Diagram of Connections.

mediately, however, the direction of the emf in the armature is reversed the field magnetism builds up and the machine is cut in circuit again, this time, of course, with opposite polarity.—Lond. *Electrician,* Sept. 1.

Nickel Steel.—E. Colver-Glauert and S. Hilpert.—A paper presented before the Iron and Steel Institute. The authors give an account of a number of tests they have made on various alloys of nickel steel. The magnetic investigations were carried out with a Du Bois magnetic precision balance, the material being heated in an electric furnace, while alcohol or petrol ether cooled with liquid air was used for the lower temperatures. The following conclusions are drawn from these experiments: A 5-per-cent nickel steel is hardest (magnetically) when quenched in the neighborhood of 900 deg. C. Quenching from higher temperatures results in a softer material. The changes which occur during the thermal treatment of a 25-per-cent nickel-iron alloy are of a far more complicated nature than has previously been thought. At high temperatures there probably exists a product which may be preserved by rapid quenching and is then strongly magnetic and persists to the temperature of liquid air. This product does not exist in the region between about 600 deg. C. and 900 deg. C., bu another which is also magnetic can possibly occur at abou 300 deg. C. There is very little connection between th magnetic properties and metallographic structures. Ther is no sharp, magnetic change point for this alloy below zero but the permeability gradually increases as the temperatur decreases from about — 50 deg. C. to — 180 deg. C. Th magnetic properties of a 33-per-cent nickel-iron alloy ar only very slightly affected by thermal treatment. Despit the gamma-iron structures produced on this steel by th more general etching media it is strongly magnetic an soft. There is no connection between magnetic propertie and micro-structure. There is no evidence that if gamma iron exists it is non-magnetic. The micro-structures o commercial nickel steels are practically the same as thos of meteoric iron.—Lond. *Electrician,* Aug. 25.

Synchronous Reactance.—J. Rezelman.—In the opera tion of alternators in parallel when driven by variabl torque engines the movement is not uniform and resonanc phenomena are produced, causing more or less importa oscillations. The author investigates the part which played in these phenomena by synchronous reactance. Th subject is discussed with special reference to various co structions of poles and the influence of saturation analyzed.—*La Lumière Elec.,* July 22.

Generation, Transmission and Distribution.

Voltage Drop of Three-Phase Lines.—G. Markovitch.- A paper on the inductance and voltage drop of three-pha overhead lines, with special reference to non-balance sy tems. Special chapters are devoted to two three-phase lin placed side by side and to the voltage drop in three-pha traction conductors.—*La Lumière Elec.,* Aug. 5.

Transmission Systems in Austria.—Miethammer.—A article on the prospects of transmission systems supplyi energy to industrial districts in Austria and especially Moravia. The prospects for plants in the two large co deposit districts in Moravia are thought to be good. O generating plant in the Rossitz coal field is in course erection. It is to be equipped with turbo-alternators a energy is to be sold to the surrounding mines and tow as well as to the city of Brünn. Data are also given on t Thayatal water-power development.—*Elek. Zeit.,* Aug. 2

Gas Producer.—E. A. Allcut.—A paper read before t (British) Institution of Mechanical Engineers. The autho investigations, which were made on a small gas produc were mainly with the object of determining the effect its efficiency of varying proportions of steam. His resu are compared with those of Bone and Wheeler. T efficiency was found to be proportional to the ratio oxygen in steam to oxygen in air, up to a ratio of 0.65, af which it bends sharply and becomes inversely proportio to that ratio. The down grade of the curve is almost exa ly parallel to the results obtained by Bone and Wheeler. It appears from this that the increased supply of steam beyd the point of maximum efficiency causes a decrease in e-

ciency proportional to the ratio of oxygen in steam to oxygen in air. This decrease, in the case of these two producers, is the same for equal rises in the value of the ratio. Whether this also holds for other producers can only be determined by further investigation, but the fact that it is the same for two producers that are so different as these are appears to be significant.—Lond. *Electrician*, Aug. 18.

Traction.

Electric Traction on Main Railroads.—GLEICHMANN.—The first part of his long illustrated lecture presented before the German Association of Electrical Engineers on electric traction on main railroads, with special reference to developments in Germany.—*Elek. Zeit.*, Aug. 31.

Installations, Systems and Appliances.

Glasgow.—An abstract of last year's financial results of the municipal electricity station of Glasgow. While the revenue increased by $72,830, the working expenses increased by only $20,545. The total number of kw-hours sold was 40,823,000, representing an increase of 5,827,000 kw-hours. The total cost per kw-hour sold (including capital charges) was 2.46 cents, as against 2.66 cents last year, which is a reduction of 0.2 cent. The following classification is given of the number of private consumers and their consumption, the figures in parentheses being the numbers of consumers last year:

	Number		Consumption, Kw-hours.
[illegible] under 1 hour of maximum demand..	3,716	(3,537)	778,538
[illegible] under 2 hours of maximum demand	2,962	(2,919)	2,504,041
[illegible] under 3 hours of maximum demand	1,661	(1,545)	2,187,929
[illegible] under 4 hours of maximum demand	791	(695)	1,476,868
[illegible] under 5 hours of maximum demand	348	(305)	1,203,799
[illegible] over 5 hours of maximum demand...	396	(375)	2,484,040
Theaters, halls and schools..........	308	(289)	1,246,228
Special..................................	124	(102)	1,714,695
Domestic consumers and churches...........	6,895	(6,417)	1,657,463
[illegible]................................	2,936	(2,630)	23,523,863
[illegible]............................	583	(340)	286,076
	20,720	(19,154)	39,063,540

The increase of heating customers is pointed out. This is probably due to the scheme, which came into operation in October last, whereby domestic consumers can obtain a supply of energy for cooking, heating, etc., at 2 cents per kw-hour without separate wiring. The electricity committee states that this scheme has been adopted with favorable results. The number of consumers already benefiting by this scheme is 300.—Lond. *Electrician*, Sept. 10.

Central-Station Operation.—J. REYVAL.—An illustrated review of several recent papers referring to central-station operation. The first is a paper by Barbillion on the different methods of regulation of hydraulic-turbine-driven generators. In the next instalment is reviewed a paper by de Bousquet, emphasizing strongly the great advantages of the Diesel oil engine for central stations. In the last instalment a paper by Howard on the Diesel engine is abstracted, as well as a paper by Norberg Schulz on the influence of the rates for energy on the financial results of central stations. These papers have already been abstracted in the Digest.—*La Lumière Elec.*, July 22, 29 and Aug. 5.

Electrophysics and Magnetism.

Energy Losses in Dielectrics.—In last year's report of the Reichsanstalt it is mentioned that a series of tests was carried out on plates of insulating material to determine the energy losses in dielectrics. About ten such plates were interspersed with copper foil, the whole making up a condenser, C_1, with a capacity of from 0.004 to 0.07 mfd. (Fig. 3). This was connected in a Wheatstone bridge, as shown in the accompanying diagram, C_2 being a variable-capacity air condenser which was connected in series with a resistor of adjustable resistance. From the capacity of the condenser C_2, the resistance of the resistor ρ, and the frequency, the angle by which the voltage and current in the condenser C_1 differed from 90 deg. could be determined.

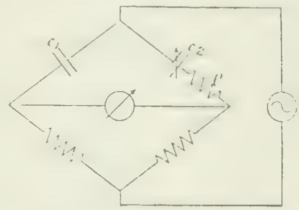


Fig. 3—Connections for Testing Dielectrics.

Tests were carried out on this arrangement for frequencies between 9 and 2000 cycles per second, and it was found that the variation in capacity in the case of some substances was dependent to only a slight extent on the frequency, while in other cases the variation was considerable. Sometimes the phase difference also depended on the voltage used, but not always. These researches are being continued.—Lond. *Electrician*, Sept. 1.

Electrochemistry and Batteries.

Sulphated Storage Cells.—G. A. PERLEY.—If a lead accumulator is neglected sufficiently the final outcome is the formation of white-lead sulphate over the surface of the plates, while the capacity of the cell drops toward or to zero. The author discusses the best method of treating such cells, and reaches the following conclusions, which appear to be of practical value. A badly sulphated cell can be restored by charging at the normal rate in a sodium-sulphate solution. It is desirable, but not necessary, to use lead dummies outside the end plates. A concentration of about 200 grams $Na_2SO_4 10H_2O$ per liter is recommended, but the concentration can be varied within very wide limits. It is essential to the life of the cell that the sodium sulphate should meet the requirements as to purity which are laid down for battery acid. A very badly sulphated cell can be restored by about sixty hours' charge at normal rate. The cost of electrical energy to restore a 40-amp-hour cell should not exceed ten cents. Since sodium sulphate is not deleterious to the cell, it is not necessary that the sulphate solution should be washed completely out of the pores of the plates. It has been stated by others that a cell can be restored by charging half of the normal rate for a long time in the regular battery acid, but it seems probable that the time and electrical energy required would be excessive in the case of very badly sulphated cells.—*Jour. Phys. Chem.*, Vol. 15, No. 5, May.

Units, Measurements and Instruments.

Resistor of Variable High Resistance.—F. A. AUST.—A description of a resistor of variable high resistance of India

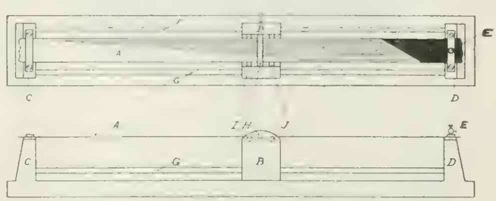


Fig. 4—Resistor of Variable Resistance.

ink on paper. The arrangement is shown in Fig. 4. A strip of strong drawing paper *A* of 3 by 45 cm size is stretched between two insulated holders *C* and *D*. The India ink is put on the paper in the form of longitudinal

strips of different length, the paper being saturated with ink at its low-resistance end, while the resistance toward the other end increases rapidly more and more. The ends of the paper are held between brass plates. *B* is a sliding contact which moves on the two rods *F* and *G*. The paper passes over two glass rods *I* and *J* and below the brass rod *H*. With this arrangement the resistance can be varied from 0.01 megohm to 20,000 megohms. But it is easy to push the higher limit further up. The author uses Higgins' waterproof ink. This may also be used for making auxiliary standards of large resistance. Heavy drawing paper, several times impregnated with India ink, when dried, represents a resistor of rather constant resistance. A strip of paper of 2 by 10 cm size with five layers of India ink, provided, while still wet, with two terminals of tinfoil, has a resistance of about 1 megohm.—*Phys. Zeit.*, Sept. 1.

Miscellaneous.

Insulating Material.—A note on a recent British patent (5167, Aug. 24, 1911) of the British Thomson-Houston Company (General Electric Company of this country). A hard and tough material with a high insulating power is obtained by treating paper or other material with a liquid condensation product. This is formed by the reaction between phenolic bodies and aldehydes. Sheets of a soft absorbent paper are soaked in the liquid, and when they are thoroughly impregnated they are withdrawn, drained and dried in air. A number of these sheets are then subjected to a heat treatment under a pressure of from 1000 to 1500 lb. per square inch. Asbestos fiber and Portland cement or plaster of Paris can be treated in the same way.—Lond. *Elec. Engineering*, Aug. 31.

Book Review.

THE THEORY OF ELECTRONS. By H. A. Lorentz. Leipzig: B. G. Teubner. 332 pages, illus.

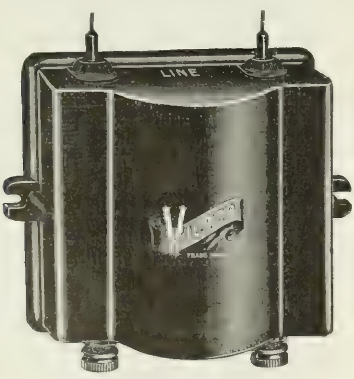
This volume contains and sets forth a course of lectures delivered by Professor Lorentz at Columbia University, New York, in 1906. It is an advanced mathematical treatise on the theory of electrons and on the application of that theory to the phenomena of light and radiant heat, including the Zeeman effect, Boltzmann's law, Fresnel's coefficient and Michelson's experiment. As a pioneer treatise in a very superficially explored and recondite region of mathematical physics the book has no equal at present.

New Apparatus and Appliances

BELL-RINGING TRANSFORMER.

Taking the place of batteries for operating doorbells, bell-ringing transformers furnish uninterrupted and inexpensive service, avoiding the annoyances of bells being out of order, as is so frequently the case in household installations.

The accompanying illustration shows a new bell-ringing transformer recently brought out by the Victor Electric Company, Jackson Boulevard and Robey Street, Chicago. This device, connected across the 110-volt alternating-current lighting circuit, supplies low-voltage energy for ringing bells, operating annunciators, buzzers, burglar alarms and small toys. The type A transformer illustrated furnishes 6 volts at its secondaries. The Victor type B device has three tops, so that 6 volts, 10 volts and 16 volts can be obtained if desired for operating a larger number of bells or buzzers. The transformers are well finished and durable and present such extremely low core losses that the slight exciting current taken will not actuate the ordinary meter.



Bell-Ringing Transformer.

ELECTRICALLY SELF-CRANKING GASOLINE AUTOMOBILE.

The electrical generator with which the 1912 Cadillac gasoline automobile is equipped serves not only to supply energy for the lamps and for igniting the engine, but can also be pressed into use as a motor, taking energy from the battery to start the engine in lieu of the usual laborious cranking operation, thus permitting a saving of time and effort that will appeal to owners and drivers of cars.

As is customary with automobile lighting systems, the generator when in operation charges a storage battery, which is automatically cut in to energize the lamps when the generator speed falls below 300 r.p.m. required to produce the lamp pressure. The 80 amp-hour battery is thus kept charged at all times and supplies the lamps when the car is standing still. Its energy is also available to operate the generator as a motor for turning over the engine preliminary to starting it.

To start the engine, the operator after taking his seat in the car, simply retards the spark lever and pushes forward on the clutch pedal. This automatically engages a gear of the electric motor with gear teeth in the flywheel of the engine, causing the latter to "turn over," thereby producing the same effect as by the old method of cranking. As soon as the engine takes in charges of gas from the carburetor and commences to run on its own power the operator releases the pressure on the clutch pedal, the electric motor gear disengages its connection with the flywheel, and the car is ready to be driven. The electric motor then again becomes a dynamo or generator, and its energy is devoted to the purposes of ignition and of charging the storage battery.

Practical tests have shown that the storage battery is of sufficient capacity to operate the starting device and "turn over" the engine in about twenty minutes, although it has been found in practice that it seldom requires more than a second or two.

To guard against accident to the generator system the car is equipped with an auxiliary ignition outfit energized from dry batteries.

NEW TYPES OF METAL-FILAMENT LAMPS.

For some months past the development laboratories of the National Electric Lamp Association, as well as the laboratories and factories of numerous American lamp companies, have been working on the new types of drawn-wire filament lamp, investigating the effects of various bulb shapes and filament mountings on the performance of experimental lamps, and finally the designs have been brought to such a satisfactory point, as shown by test, that the manufacturers feel sure of the quality of the commercial product.

Two of the new lamps are extensions of the present 100-volt to 125-volt multiple group, while the remainder comprise a separate group intended primarily for electric-vehicle service.

For show-window lighting, where trough-shaped reflectors are used behind the sashes; for the lighting of showcase interiors, and also for outdoor sign and billboard illumination by a single horizontal row of units placed high, with reflectors to direct the rays downward obliquely, a 25-watt lamp in a tubular bulb has been developed, being the first metal-filament lamp with a cylindrical bulb to be placed upon the American market for operation in multiple on circuits of from 100 volts to 125 volts. The 25-watt, 100-volt to 125-volt tubular lamp, which is fitted with the standard Edison base, has an outside diameter of 1¼ in. and a length of 5¾ in. A bulb of this same diameter and length has been used for several years in the manufacture of carbon tubular (sometimes called "bighole") lamps, and is still used for carbon tubulars in the 30-watt and 60-watt ratings. The bulb of the new lamp has 16 per cent less radiation impinging on its inner surface than the 30-watt carbon and hence does not get as hot as the latter, although it gives 117 per cent more lumens of light owing to its greater efficiency (7.48 lumens per watt as against 2.86 for the 30-watt carbon).

Another new type is the 25-watt, 100-125-volt lamp in a round bulb only 2 5/16 in. in diameter. A demand has long existed, particularly in the lighting of hotels, first-class residences and theaters, and wherever decorative lighting is in vogue, for a high-efficiency lamp in a smaller round bulb than has heretofore been obtainable in standard voltages. Where a large metal-filament lamp is used as the main source of illumination and surrounded by a number of small round-bulb carbon lamps burning at a much lower efficiency, the joint effect of the yellow and the white light is not pleasing and tends to neutralize the artistic appearance which the smaller lamps were intended to create. The new lamp renders it possible to use the 2 5/16-in. round 25-watt metal-filament lamps and to have all the filaments burning at practically the same color.

As in the case of the tubular, the small round-bulb lamp has been made commercially possible by the greater flexibility of mount design permissible with drawn-wire construction.

Prior to the introduction of the two new 25-watt types

25-Watt Tubular Metal-Filament Lamp.

above discussed there were already two distinct bulb shapes in which 25-watt high-efficiency metal-filament lamps could be obtained. There are now, therefore, four such standard bulbs—one pear-shaped, one tubular, one large round and

Prior to the introduction of the two new 25-watt types

TABLE I.—25-WATT, 100-125-VOLT LAMPS.

[illegible]	Efficiency. Rating	Efficiency. Watts per Mean Horizontal Candle-Power	Actual Total Watts.	Mean Horizontal Candle-Power.	Ratio of Horizontal to Spherical Candle Power	Total Lumens.	Lumens per Watt.	Bulb Diameter, Inches.	Length Over All, Inches.
[illegible]	High	1.31	25.0	19.1	.78	187	7.48	2 3/8	5 1/8
	Medium	1.37	24.2	17.7		173	7.16		
	Low	1.43	23.4	16.4		160	6.85		
[illegible]	High	1.31	25.0	19.1	.78	187	7.48	1 1/4	5 3/4
	Medium	1.37	24.2	17.7		173	7.16		
	Low	1.43	23.4	16.4		160	6.85		
[illegible]	High	1.31	25.0	19.1	.79	190	7.58	2 [illegible]/16	3 1/2
	Medium	1.37	24.2	17.7		176	7.25		
	Low	1.43	23.4	16.4		162	6.94		
[illegible]	High	1.31	25.0	19.1	.78	187	7.48	3 1/8	4 1/2
	Medium	1.37	24.2	17.7		173	7.16		
	Low	1.43	23.4	16.4		160	6.85		

in time, because of its compactness, supersede the large to a considerable extent. The total life of the tubular and small round types is about 50 per cent of that of the other two types. Data on all four types are given in Table I.

An entirely new schedule of high-efficiency lamps has been drawn up for electric-vehicle service. At first the only

TABLE II.—LAMPS FOR ELECTRIC-VEHICLE SERVICE.

Voltage Range.	Bulb Diameter. Inches	Length Over All, Inches, Edison Base.	Total Watts.	Watts per Mean Horiz. Candle-Power.	Ratio of Horizontal to Spherical Candle-Power.	Total Lumens.	Lumens per Watt.
21 to 65	2 1/16	3 1/4	15	1.23	.81	124	8.28
			25	1.23	.81	207	8.28
21 to 90	2 1/16	3 1/2	15	1.23	.81	124	8.28
			25	1.23	.81	207	8.28

lamps available for this service had carbon filaments and were of very low efficiency, from 3.6 watts to 6.5 watts per candle. Later several of the leading manufacturers of electric automobiles experimented with tantalum lamps and some of these made that lamp an optional form of equipment, while one well-known company made the tantalum

lamp a regular feature of its high-grade cars. No sooner had drawn tungsten wire become a commercial fact than the electric automobile manufacturers experimented with incandescent lamps having filaments of this wire in place of tantalum. The present line of electric-vehicle lamps is really an outcome of these preliminary service tests, which gave remarkably successful results.

Lamps of the same type are also suitable and are being used for storage-battery street cars, as on the cross-town lines in New York. They are made in round bulbs either 2 1/16 in. or 2 5/16 in. in diameter and come in voltages ranging all the way from 21 to 90. The wattage ratings are 15 and 25, corresponding roughly to candle-powers (at full impressed voltage) of 12 and 20 respectively. In view of the fact that they are not only efficient, but in every way strong enough to withstand the peculiar electrical and mechanical conditions of electric-vehicle service, these lamps promise largely to supersede both the tantalum and the carbon, except for meter-lights and tail-lights, which are generally of lower candle-power than is at present obtainable in the usual battery voltages with other than carbon filaments. Technical data on the electric-vehicle line are given in Table II.

ELECTRICALLY DRIVEN CENTRIFUGAL PUMPS.

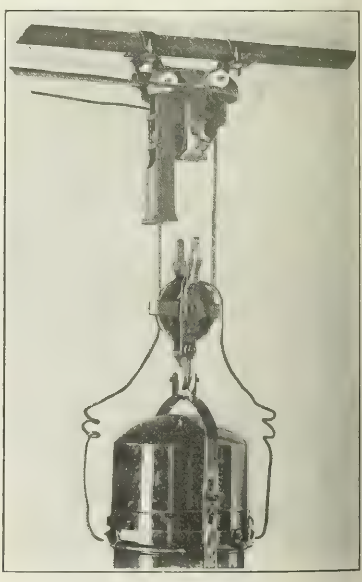
The Goulds Manufacturing Company, Seneca Falls, N. Y., has placed on the market a new line of centrifugal pumps which are furnished in single-stage, single-suction, and single-stage, double-suction types. Either type may be arranged for belt drive or direct connection to an electric motor. The single-suction as well as the double-suction pumps contain many features which are important from an operating and economical standpoint. The impeller in the single-suction pump is of the open type. The vanes are carefully designed so that the maximum efficiency is obtained under normal conditions. The impeller is accurately machined to minimize the clearances between the impeller and the side covers. Although of the single-suction type, which in most cases means a considerable amount of end thrust, the impeller in the Goulds pump is designed in such a manner that this feature is eliminated. The stuffing box, through which the shaft passes, has a

Single-Stage, Double-Suction Centrifugal Pump.

brass water-sealing ring which prevents air being drawn into the pump at this point. The single-stage, double-suction centrifugal pumps are designed with a view of combining all mechanical details necessary to produce a centrifugal pump of the very highest grade. The casing proper consists of two castings bolted together on a horizontal joint. The purpose of dividing the casing is to permit quick and ready access to the interior parts of the pump for inspection without disturbing the pipe connections. The impeller is of the inclosed type and develops the highest efficiency under the conditions for which the pump is sold. The bearings are of the ring-oiling type, independent of the stuffing boxes, and they are provided with removable shells lined with anti-friction metal. The stuffing boxes are provided with brass water-sealing rings. The double-suction pumps are sold for heads up 150 ft., while the single-suction pumps operate against maximum heads of 100 ft. The illustration shows a view the double-suction pump with the upper half of the sing partially removed.

AUTOMATIC CUT-OUT HANGER FOR ARC LA

In the automatic cut-out hanger built by the Tho Hanger Works, Cleveland, Ohio, the lamp cord is ended in the upper member of the hanger and afte ing around two 4-in. pulleys and a pulley attached pole or wall on a plane with the hanger is brou ground and fastened. The feed wires are faste binding posts in the upper member of the hanger an leads extend from the lamp to binding posts in the member of the hanger. When the lamp is in its position the two members of the hanger are elec and mechanically in contact, the weight of the lam ing the electrical connection secure. A short, lig on the lamp cord with an instant release suffices connect the two members, and the lamp and the member descend. As the cord passes around two and the two portions of the cord between the pulley of necessity be parallel and in the same plane wh lamp is suspended freely, the two members are b



Arc-Lamp Hanger.

together with a snap without possibility of reversi polarity of the lamp circuit. When the lamp is in position all weight is taken from the cord by the hanger its when the lamp is released in lowering the weight is taken up by the cord and all electrical connection is broke The working parts of the hanger are inclosed in a metal casing so as to protect them from the weather. The lower member is attached to the lamp by a universal joint, permitting the lamp to swing freely, and the hanger is provided with a top bale suitable for attachment to any horizontal support. The hanger possesses the advantage common to all automatic devices of this type of permitting the lamp to be trimmed from the street without danger of shock

CRUDE-OIL ENGINE.

…cent test of an Atlas crude-oil engine, made by the …as Engine Works, Indianapolis, Ind., which was carried …b Mr. C. E. Sargent, of Chicago, gave the low con…ption of less than 10 gal. of crude oil per 100 kw-hours …r wide range of loads. The variation in speed between …lightest load and 25 per cent load did not exceed 2 per …t, and the speed during the test was uniform for any …stant load. Mr. Sargent reported that the governor …ve a regulation not surpassed by the best Corliss en… …e engine was tested direct-coupled to a 175-kw …rent generator, the speed being 175 r.p.m.

…is engine is of the Diesel type. There is no …lose mixture, the crude oil being sprayed into air com…ssed in the cylinder, its combustion being gradual. … no ignition system, the temperature due to the …n of the air in the cylinder being sufficient to …su… the crude oil. The pressure and temperature in …cylinder do not rise appreciably above those due to …compression of the air on the compression stroke. The …ul… is consequently taken on and relieved gradually, …engine thus operating without shock. As crude oil …be purchased as low as 2 cents per gallon, the economy …the results found by Mr. Sargent is evident.

NEW WATT-HOUR METERS.

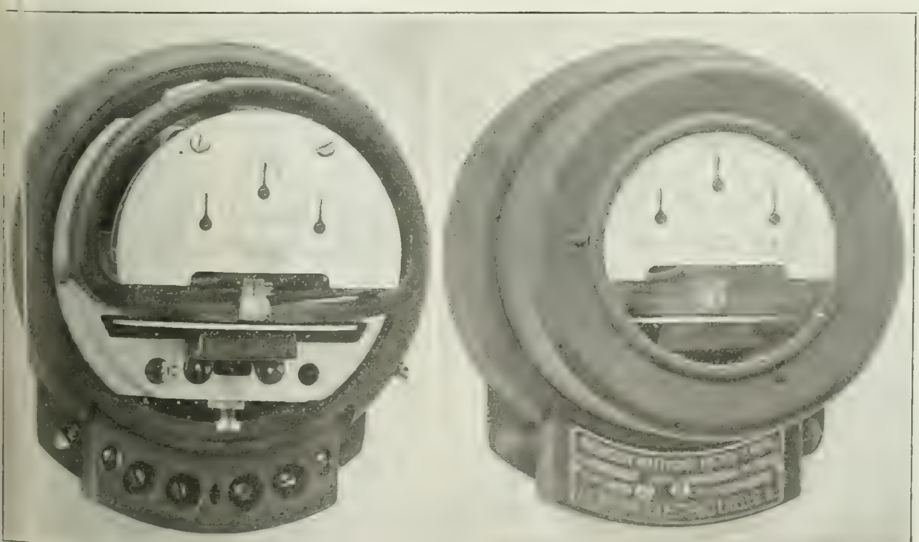
The Thomson watt-hour meters having the trade designa… "…pe I-10," which have recently been developed by …General Electric Company, are designed for 5-amp and …amp 100-120-volt, two-wire, and 200-240-volt, two-wire …three-wire, 40-cycle, 50-cycle, 60-cycle, 125-cycle and …-cycle circuits.

Their mechanical and electrical design represents the …st advanced stage of the meter art, the former insuring …t weight and compact and rugged construction, the …er affording great accuracy of measurement under the …tage, frequency, wave-form and temperature variations …linarily occurring on lighting circuits, and also shielding the meter element from any stray fields liable to be encountered in ordinary practice.

The rotating element consists of a small aluminum disk mounted on a bronze shaft. The lower end of the shaft carries a removable steel pivot, while the upper end has a worm for transmitting the motion of the disk to the registering mechanism. The upper and lower bearings are carried on an aluminum frame casting, which also supports the magnet and registering mechanism, thereby insuring permanent alignment. The upper bearing consists of a steel pin fastened to a removable brass plug and extending down into the rotor shaft, which is drilled to receive the same. The lower bearing is a selected Oriental sapphire mounted in the top of a threaded brass screw and resting on a spring. A brass collar at the top of the jewel screw prevents the pivot from jumping off the jewel surface and riding on the top edge of the jewel screw, in case of extreme short-circuits or other violent disturbance. The pivot, which is made of highest-grade piano steel, hardened and polished, is screwed into the lower end of the shaft so as to permit of its being readily replaced if necessary.

The register is of the three-dial type, reading directly in kw-hours, no multiplying constant being necessary. One complete revolution of the most rapidly moving pointer registers 10 kw-hours; therefore, 1000 kw-hours must be registered before the dials repeat. The dial face **is of** white porcelain having a dull finish. The registering mechanism is of such construction that it may be removed for resetting the dials, repairing the meter, etc., and be replaced without disturbing the mesh of the train of gears.

The permanent magnet controlling the full-load speed of the rotating element is of semi-circular form and completely surrounds the register. The magnet is made of the very best magnet steel properly aged and hardened to insure permanency. It is so assembled on the frame that the opening between the poles is brought close to the upper surface of the aluminum disk. The arrangements provided for regulating the full-load and light-load speeds afford great refinement in adjustment. Creeping on potential alone is entirely prevented. The meters are lagged by means of a copper punching, which acts as a short-circuited secondary for the flux of the potential coils, and therefore



Watt-Hour Meters.

the meters will give satisfactory results in the measurement of inductive as well as non-inductive loads.

The terminals comprise four brass binding posts located in a separate compartment made of molded insulating compound and fastened to a projecting part of the meter base. The terminals can be separately sealed and the method employed for fastening the meter to the wall effectually prevents it being removed for the purpose of tampering.

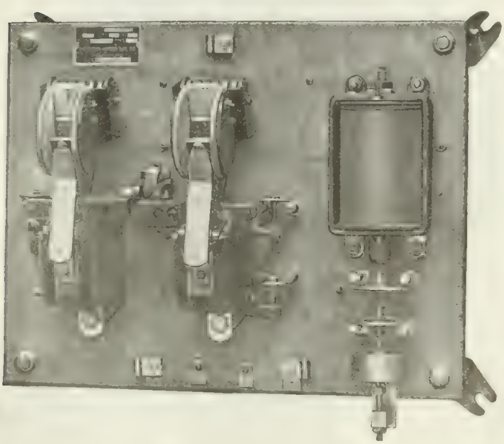
For convenience in testing prior to installation, a testing loop is brought out through the frame just below the magnet. Any number of meters may be tested in series, without recording the losses in the potential circuits, by connecting the potential coil of each meter to the source of potential at some point before the line wires enter the meters.

The cover is drawn from zinc alloy, the bottom being threaded to fit in a groove in the meter base, and when screwed firmly into place makes a perfectly dustproof joint. Suitable means are provided for sealing the cover as well as terminal box.

CONTROLLING DEVICE FOR ELECTRIC RAILWAY STATION.

The automatic exciter circuit transfer switch (62-amp capacity) shown in the accompanying illustration performs an interesting and important duty for the Philadelphia Rapid Transit Company. It is very important that the large turbo-generator recently installed by that company shall be provided with excitation current at all times and also that this supply shall have a voltage above a certain minimum—about 500 volts. The switch shown transfers the current supplied for the excitation of the turbo-generator from the power-house supply to a battery circuit, which transfer is automatic and does not interrupt the operation of the generator for an instant. Two "clapper"-type switches are used, one in the power-house circuit (550 volts) and one in the battery circuit. These switches are in the positive side of the circuits, as the excitation circuit has the negative grounded.

The action of transferring is secured by means of the



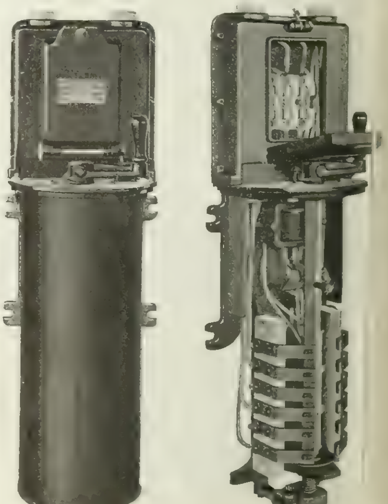
Automatic Transfer Switch.

voltage relay at the right. The silver-plated copper disks mounted on the extension of the solenoid plunger make contacts with two pairs of copper posts. When the power-house supply voltage is normal, or 550, the voltage relay solenoid is energized and the upper copper disk bridges the upper posts. This closes the "clapper" switch in the power-house supply circuit, exciting the turbo-generator directly from this circuit. If because of a heavy load outs… or for some other reason this voltage should drop to a predetermined low value, or the circuit be opened, the v… relay will drop, causing the lower disk to comple… circuit to the second "clapper" switch. This throws batteries in the generator excitation circuit and i… continuous operation. When the voltage of the power-house circuit returns to normal the solenoid will be ga… energized so as to raise the plunger, drop out the ba… and close the "clapper" switch in the power-house circuit. The batteries are therefore in use usually f… short periods. This transfer switch was designe… manufactured by the Cutler-Hammer Manufacturing … pany, of Milwaukee.

INDUCTION MOTOR-STARTING SWITCH

The Allen-Bradley Company, of Milwaukee, W… placed upon the market a new switch for starting s… cage induction motors, shown in the accompanying i… tions. It is a drum-type oil-immersed switch, provid… a no-voltage release, which returns it to the off … when the current in the supply circuit is shut off. … switches are particularly adapted for use in infla… places, such as planing mills, textile mills and gr… vators, and also where inexperienced help is used a… be protected from coming in contact with live part…

The motor is started by bringing the handle to th… ing position and holding it there until the motor i… speed and then throwing it around to the running … Both the "starting" and "running" positions are … marked on the cast-iron top of the drum. It is im… to throw the starting handle into the running … without passing through the starting point and, furt… it is impossible to leave the handle in the starting … as a powerful coil spring will return it to the off …



Figs. 1 and 2—Starting Switch for Induction M…rs.

as soon as it is released by the operator's hand. …he running fuses are not in circuit when the switch is in …e starting position and therefore they are not called upo… to carry the excessive starting current and may be of suc… capacity that they will offer real protection to the motor …ler run-

ning conditions. The switch is held in the running position by a catch, which is released when the current in the supply circuit is shut off. It may also be released from the running position by hand. A roller and star wheel are provided to insure a quick, positive "make and break."

For motors of 5 hp and below this switch is used alone,

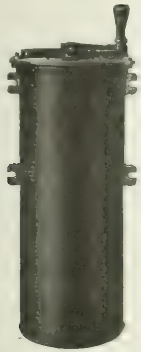


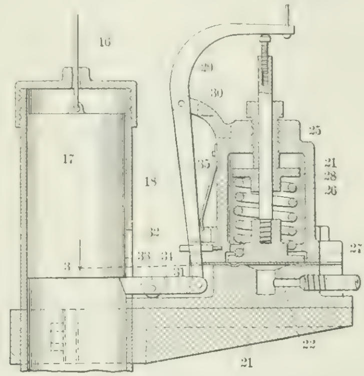
Fig. 3—Starting Switch for Induction Motor.

l for motors above 5 hp it is used in connection with a ·istance which is of the carbon-compression type and is lesigned that when the switch is thrown into the starting ·tion the elongation of the resistor columns, due to heat ·pansion, is retarded in such a manner as gradually to ·press them, which results in reducing automatically ·r resistance until the motor starts. After the motor has ·ched its normal speed the switch is thrown into the run-·g position.

l hese rheostatic starters require in their operation about · per cent more power from the line than is demanded by · auto starter, but the actual current supply to the motor ·o greater and sometimes less, because the starter auto·tically prevents more current from flowing than is abso·y necessary to start the load, even though the load may ·ry at different starting periods. As the wattless com·ent of the line current is less with the rheostatic starter ·e disturbance to the line voltage is no greater than with he auto starter. It will be noted also that the running fuses are protected during the acceleration of the motor, so the greater line current is seldom an objection.

AUTOMATIC PRESSURE CUT-OFF FOR ENGINES AND MOTORS.

· weight-operated, valve-closing device, designed to be ·ped by undue rise of pressure, is shown in the accom·ying sectional sketch of the safety stop made by the American Safety Equipment Company, 1002 Marquette Building, Chicago. The device illustrated is for application to a steam-driven compressor or pump. A tap from he compressor line is brought to the small piston chamber, notion of the piston being resisted by an adjustable spring. When the pressure reaches the critical point for which the spring is set the piston trips the trigger, releasing the weight, the force of which in falling is transmitted through a cord to a pulley wheel on the valve admitting steam to the prime mover. At the same time as the weight falls in ts closed tube air is compressed ahead of it, the escape of which through a whistle gives a sharp, audible alarm of the operation of the safety stop. As will be evident to any engineer, the device shown is susceptible of a number of applications for closing steam, water and other pressure alves to guard against critical rise in pressure. The stop s also made in the form of a centrifugal device designed to prevent overspeeding of flywheels, the trip being so arranged that an excess of only a few revolutions per minute will release the weight, closing the engine throttle. A similar safety stop for electric motor-driven pumps is also made by the same company, the pressure-piston ele-



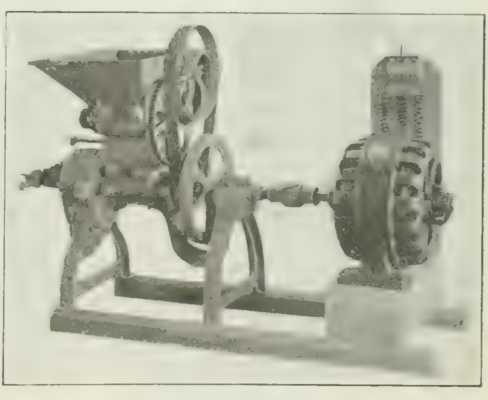
Automatic Pressure Cut-off for Steam-Driven Pump.

ment releasing a spring-actuated double-pole switch, opening the motor circuit in case the pressure on the pump it is driving goes above a predetermined value.

MOTOR-DRIVEN GRAIN MILL.

The accompanying illustration of an electrically driven Kelly duplex mill is an example of the advantages of electric drive and of another factor in building up the day load. The mill, which is the product of the Duplex Mill & Manufacturing Company, of Springfield, Ohio, will grind any kind of grain, cottonseed, corn cobs and shucks and produce a grist of any desired quality, coarse, medium or fine. The grinding surface is just double that of the ordinary mill, owing to a double set of grinders or burrs, for which reason it is called the "Duplex."

A device is provided to permit regulating the feeding of small grain from the base hopper into the crushers. The application of electric drive insures a maximum capacity

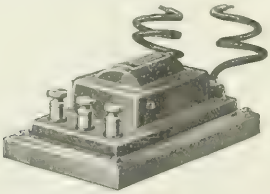


Motor-Driven Grain Mill.

for grinding with the least operating expense. This mill is driven by a 7½-hp alternating-current induction motor manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

NEW BELL-RINGER.

Rule 30-C of the National Electrical Code requires that air-cooled transformers used inside of building shall be mounted 1 ft. from combustible material or on a slab of non-combustible, non-absorptive insulating material. To



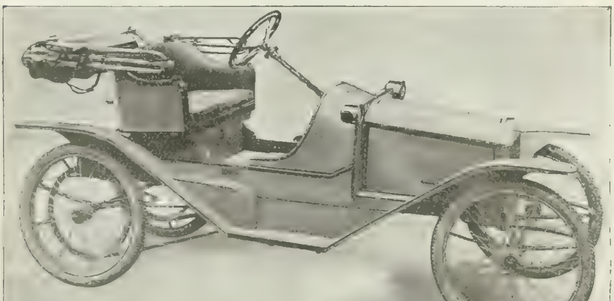
Bell-Ringer Mounted on Enameled Slate Slab.

meet the above requirement the Packard Electric Company, of Warren, Ohio, has brought out a new bell-ringer mounted on a neat enameled slate slab all ready to install. The core loss of this instrument is about ½ watt and it will stand a continuous short-circuit without damage to either the transformer or the bell wiring. Two secondary voltages of 6 and 8 are furnished. Primary leads are of heavily insulated cable and the core and coils are vacuum-treated with a waterproof insulating compound. The case is of cast iron neatly finished in black baked enamel.

ELECTRIC RUNABOUT.

A small electric automobile of a new type is made by the Storage Battery Power Company, of 301 North Peoria Street, Chicago, and is illustrated herewith. It is called the "Electra" automobile and is the invention of Mr. J. E. Haschke, who has had many years' experience in storage-battery work. Only twelve cells of battery are used and they are mounted in specially made glass jars resting on sealed rubber hose, creating a pneumatic cushion. The jars are divided into two trays and are set into the front bonnet of the car.

Each battery has a storage rating of 125 amp-hours and is capable of a discharge of 25 amp for five hours, or 15 amp for eight hours. At the former rate the vehicle is said to be capable of attaining a speed of 20 miles an hour for the five hours, while in the latter case it can run at the rate of 12 miles an hour for over eight hours. Where little use is required the vehicle can be employed for traveling 6 miles a day for eighteen days on a single charge of the battery.



Electric Runabout.

The weight of the storage battery is but 275 lb. and the total weight of the car is but 475 lb. The wheels are of the motorcycle type, with 28-in. x 2¼-in. pneumatic tires, and as each wheel carries so little weight tire troubles are not apprehended.

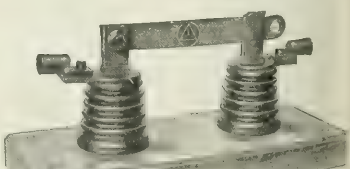
The electric motor is of a special design and is set into the seat of the car, connecting with a countershaft by a Morse silent chain. The controller is operated by a small lever placed under the steering wheel, and the car is reversed by using the same lever. The frame of the motor is of steel with laminated poles attached thereto. The commutator is extra large and affords contact surface for imported French carbon brushes. The motor is sectionally series wound, permitting of the use of a non-resistance three-speed controller of simple type. The motor bearings are of the ring self-oiling type. The body of the car is of rigid construction, with a low center of gravity, and the whole vehicle requires little power to operate it. As shown by the illustration, the car bears a strong resemblance to a gasoline machine.

It may be of interest to add that the machine is very moderate in cost, the selling price being but $350.

NEW HIGH-TENSION DISCONNECTING SWITCH.

Engineers and central-station managers are beginning to realize the desirability of so arranging their high-tension circuits and feeders that any particular district or group can readily be sectionalized. The early designs of disconnecting switches were as a rule laid out along the lines of low-tension knife switches, and to meet specifically the actual conditions applying the Delta-Star Electric Company, Chicago, has designed a special type of disconnecting switch, in which the mechanical weaknesses of the older types have been eliminated, an example of this new switch being shown in the accompanying illustration.

In addition to the use of lock washers and nuts at the contact surfaces, the porcelain insulators are also provided with locking points, which in connection with the supporting base form a locking seat or key, which absolutely prevents loosening up or turning of the insulators in the base. The current-conducting parts are also supported by a locking key or stud, which is then cemented into the porcelain pillars, the interior of which has deep recesses, into which the cement freely flows and hardens. The net result is robust construction which can be subjected to the roughest handling without loosening of any part. The design is made in sizes intended for carrying currents up to 2000 amp and in all standard potentials up to and including 44,000 volts.



High-Tension Switch.

Industrial and Commercial News

The Week in Trade.

THERE has been no pronounced change in business conditions during the week, and advancement continues on the conservative scale of the past few weeks. Operatis at the majority of steel mills are as extensive as in A ust, and September tonnages are expected to be as large the preceding month. At the same time, a fair percentage utput of the various mills has been contracted for at prices. There are indications of cuts in steel products, with rumors of wage reductions at the mills unless expansion takes place before the end of the year. Some ement was made this week in the pig-iron market. A ner of contracts for fair tonnages have been let, and inqi ies are reported in increasing volume. Equipment orders, er, are still scarce, and there are few new specifications road equipment. Crop news is very encouraging ut the country. Warm weather has prevailed in the wing states, and conditions have been very favorable tton belt, while heavy rains in some sections have d the prospects for winter grains. Favorable news of in the French and German negotiations on the situation has been offset by general strikes and n of martial law in Spain, accompanied by labor dis- in Austria. President Taft's address on trust ques- Detroit, on Monday, indicates further activity against ge corporations unless they voluntarily reorganize in nce with the rulings of the Sherman law. On this together with the disturbing influence of the next itial election, it is more than likely that progress will e but slowly during the rest of the year. Business fares for the week ended Sept. 14, as reported by *Bradst's*, were 219, as compared with 194 last week, 210 in the coponding week in 1910, 198 in 1909, 266 in 1908 and 179 in .

The Copper Market.

U SETTLED conditions abroad have narrowed the operations in the copper market, and buying at present is on a very limited scale. With the slackening in foreign deand, prices have also declined, and while the leading pro- and agencies continue to quote electrolytic at 12½ few sales of small lots have been reported as low as nts. Standard copper in New York has been quiet, r changes, but there has been a mild activity in London, leclines of 8s 9d on spot and 11s 3d on futures were uring the week. Prices of electrolytic abroad have

rd Copper.	Bid.	Asked.	Settling Price.
[illegible]	11.95	12.05	....
r	11.95	12.05	12.00
[illegible]	11.95	12.05	12.00
r	11.95	12.00	12.00
[illegible]	11.95	12.05	12.00

ndon market, Sept. 19, was as follows:

	£	s	d	£	s	d
[illegible], spot	55	2	6	55	1	3
copper, futures	55	16	3	55	16	3

[illegible] for this year:

	Highest.			Lowest.		
[illegible]	12.35c			11.57 .c		
[illegible]	£57	10	0	£53	7	6
	£	s	d	£	s	d
[illegible]	58	2	6	54	0	[illegible]
[illegible]	61	10	0	57	5	[illegible]

be shaded slightly, and such sales as have been made have be on a basis of £57 to £57 5s delivered on the other side. A had been expected, the fortnightly statistics of the visible su ly of copper abroad showed an increase in stocks, which in e first two weeks of September amounted to 2,854,000 lb. In view of the decreasing volume of inquiries from both estic and foreign consumers and continuation of the high ra of production, it is likely that the September report of the Coer Producers' Association will show increased stocks. a revival takes place in general business there will be no nessity for consumers to purchase in large amounts, and as h regard lower prices as inevitable in view of the increasing accumulations in producing hands, they feel justified in buying on a hand to mouth policy rather than commit themselves at prevailing prices for future needs. There is no question as to the inability of copper users to absorb the large amounts of copper now produced in this country, and it is evident, from present indications, that there will be a considerable surplus of the metal on hand at the end of the year. Export business has been light in the present week, and, including Sept. 19, exports for the month aggregate 14,906 tons. The daily call on the Metal Exchange, Sept. 19, quoted copper as per the accompanying table.

Industrial and Commercial Notes.

Georgia Railway & Power Company.—An application for the incorporation of the Georgia Railway & Power Company, of Atlanta, Ga., with an authorized capital stock of $27,000,000 has been received by the Secretary of State. This capital is to be divided into $15,000,000 common stock, $2,000,000 6 per cent cumulative first preferred, without voting power, and $10,000,000 of 4 per cent non-cumulative second preferred stock. The incorporators are residents of Atlanta, Ga. The company proposes to construct and build, purchase, lease and acquire the lines of street and suburban railroads and their franchises in a number of cities and towns in the neighborhood of Atlanta, Ga., and to purchase, construct or lease steam, hydroelectric and electric plants. From these provisions a number of rumors have arisen regarding the possible connection of this company with the Georgia Power Company, but no confirmation of this was obtained at the New York office of interests allied with the Georgia Power Company.

Westinghouse Railway Orders.—Among recent orders for electric railway equipments received by the Westinghouse Electric & Manufacturing Company are the following: From the Pensacola (Fla.) Electric Company, four double-motor railway equipments, with control; from the Muskegon Traction Company, one quadruple-motor equipment, with control; from the Lehigh Valley Traction Company, twenty double-motor equipments, with control; from the Reading (Pa.) Traction Company, for six double-motor equipments, with control; from the Columbia (S. C.) Gas & Electric Company, six double-motor equipments, with control; from the Warren (Pa.) Street Railway Company, an order for five double equipments of motors, with control. Among other recent orders received by the Westinghouse company is one from Walter Brothers, Rio de Janeiro, Brazil, for two double-motor railway equipments, with control.

H. L. Doherty & Company Acquire Southern Traction.—The Hattiesburg Traction Company, of Hattiesburg, Miss., has been acquired by H. L. Doherty & Company, who plan to spend about $100,000 in improving the property. Of this amount, $50,000 will be utilized for new cars, extensions to the traction system, etc.; $25,000 will be spent upon the electrical distribution system, and the remaining $25,000 will be spent for new gas mains and other additions to the gas-distribution system. A. V. Patterson, manager of the Meridian Light & Railway Company, of Meridian, Miss., will be the representative of H. L. Doherty & Company at Hattiesburg and will be supervising manager of the Hattiesburg Traction Company.

Electric Bread Crumber.—Among motor-driven appliances recently added to the Broadway showrooms of the New York Edison Company is a "Lee bread crumber," which is designed and especially adapted for the use of hotels and restaurants. The machine has a double set of knives which cut the broken loaves of bread into small pieces for passing through the crumbing fingers. These cut the bread still further and force it against a sieve, through which it passes in small flakes. The capacity of the machine is 75 to 100 loaves per hour. It is made by the Goodell Company, of Antrim, N. H.

Line-Pole Cross-Arms and Pins.—The Bureau of Manufacturers, Washington, has the names and addresses of five English firms which desire to obtain from American dealers prices of line-pole cross-arms, brackets and pins.

Niagara Falls Plant of National Carbon Company.—A new carbon plant which the National Carbon Company, of Cleveland, Ohio, is building at Niagara Falls will be ready for occupancy some time in October. This is the second plant which the National Carbon Company has built during the past year, the other being at Toronto. In nearly every one of its nine factories considerable improvement and expansion has been made during this year. The main plant and general offices of the National Carbon Company are located at Cleveland. This plant alone covers about thirty acres of ground, and is engaged in the manufacture of a miscellaneous line of carbon products. The eight outside plants manufacture a special line of products for which the locality, equipment, and organization are best adapted. The Cleveland plant is stated to be by far the largest industrial carbon factory in the world, while the total facilities of the nine branches make a tremendous organization for the development and manufacture of a complete line of high-class carbon products.

United Wireless Telegraph Company.—At a meeting of creditors called at Portland, Me., Sept. 15, Lewis Pierce, referee in bankruptcy, appointed, with the consent of the creditors, Selden Bacon, of New York; Philip G. Clifford and Ex-Judge John H. Hill, of Portland, trustees of the United Wireless Telegraph Company. The United Wireless company has passed through a year of extraordinary vicissitudes due to malfeasance of its officers now in prison and bankruptcy proceedings instituted in numerous States. In spite of these unfavorable conditions the commercial department of the company has not abated its activities, and now is operating under contract four hundred and fifty-three steamship stations. It is stated that under the trusteeship the company will be thoroughly reorganized along business lines and established on a firm basis for continuing the manufacture of wireless apparatus and the equipment and operation of wireless stations.

Changes in Directorate of Michigan Companies.—In keeping with a provision of an agreement between the bondholders' committee of the Michigan-Lake Superior Power Company and the Lawe Superior Corporation, members in the boards of the Michigan-Lake Superior Power Company and the St. Mary's Falls Power Company, representing the Lake Superior Corporation, resigned at the recent meeting, and the following were elected to replace them: John Pitcairn, Percy M. Chandler, S. F. Houston, A. J. Hemphill, Clarence M. Brown, J. Newlin Brown and Thomas L. Gibson. These officers were elected for the two companies: President, C. M. Brown; vice-president, S. F. Houston; secretary and treasurer, P. M. Chandler.

New Lynn G. E. Factory.—The General Electric Company has added another factory, No. 41, to its plant at Lynn, Mass. The new building is a long brick structure of the company's standard type, the frame being of steel and the outer walls of brick, paneled between buttresses. The dimensions of the new shop are 360 ft. in length by 110 ft. in width on the first floor, with a second floor 360 ft. long and but 80 ft. wide, the first floor winging out below. The new building adds over 1½ acres to the floor space of the plant.

Will Improve Traction System.—About $3,000,000 will be spent next year by the Pittsburgh Railways Company, a subsidiary of the Philadelphia Company, on improvements and extensions of its traction properties in Pittsburgh. Of this amount, $1,500,000 will be expended upon some 20 miles of new track, $676,000 will be spent for bridges and betterments and $425,000 for machinery. About $600,000 will be used in connection with grading in one of the sections of the city, the total cost of the work being borne in part by the city.

Sale of Hudson Power Companies Confirmed.—In the United States Court at Norwich, N. Y., on Tuesday of this week, Judge Ray confirmed the sale of the Hudson River Electric Power Company, including the Madison County Gas & Electric Company, recently mentioned in these columns, and directed the filing of the order on Sept. 21. Objection to the sale was made by the National Contracting Company, but the court stated that the claims of the company would be protected under the sale in case its lien is sustained.

Los Angeles Aqueduct Electric Plant.—The Board of Public Works of Los Angeles, Cal., has asked for bids for machinery for the municipal aqueduct power plant, which will be received to Oct. 23. The machinery includes water-wheel and electrical generating equipment, the total cost being estimated at $1,000,000.

Financial.

The Week in Wall Street.

SHARP selling at the opening on Monday resulted in pressing the stock market to the level at the close of the preceding week, followed by general recovery in the l trading. Throughout the greater part of the day the Street disturbed by conditions on foreign exchanges due to the stra relations between France and Germany, and in the aftern interest centered in the remarks the President might mak his Detroit address concerning trusts. International Harve declined 3½ points as a result of fresh interest in possible lations of the Sherman law. Selling orders from abroad duced prices at the opening on Tuesday, and declines were istered in many active issues. The tone of the market bec somewhat firmer later in the day, but trading was in lim volume, and many of the active stocks were not traded. Un States Steel figured prominently, and transactions in this i

NEW YORK.

	Sept. 12.	Sept. 19.	Shares Sold.		Sept. 12.	Sept. 19.	S
All. Ch.......	6⅜*	6½*	400	Int. Met., pf.	42	40	
All. Ch., pf..	18	18*	200	Mackay Cos..	84*	82*	
Amal. Cop...	57	54	93,390	Mackay, C.,pf.	72	73½	
Am. D. T....	20½*	20½*	———	Man. Elev...	135	134½*	
Am. Loco...	34½	34½	2,400	Met. St. Ry..	15*	15*	
Am. Loco.,pf.	105¾*	106½*	200	N.Y.&N.J.Tel.	139½*	139½*	
Am. Tel. & C.	80½*	80½*	———	Steel com....	68⅛	65	8
Am. T. & T..	134¾	135½	13,700	Steel, pfd....	114¾	113⅞	1
B. R. T.....	73¼	73¼	12,400	W. U. T.....	74	76⅛	
Gen. Elec....	150½	149	4,050	West'h, com..	63⅛	61	
Int. Met.....	14⅜	14⅛	3,500	West'h, pf...	111½*	111½	

PHILADELPHIA.

	Sept. 12.	Sept. 19.		Sept. 12.	Se
Am. Rys..........	44	44	Phila. R. T.........	22¼	
El. Co. of A........	77⅞	11⅝	Phila. Elec.........	16½	
Elec. St. Bt'y.......	52	51⅞	Phila. Trac.........	85⅜*	
Elec. St. Bt'y, pf...	30*	30*	Union Trac.........	50	

CHICAGO.

	Sept. 12.	Sept. 19.		Sept. 12.	Se
Chi. City Ry.........	186*	186*	Com. Edison.........	135	1
Chi. Elev. Rys......	26*	24*	Chi. Subways.......	2¼	
Chi. Elev. Rys., pf..	89½*	89½	Chi. Tel. Co.......	122*	1
Chi. Rs., Ser. 1.....	92*	92*	Nat'l Car..........	100	1
Chi. Rs., Ser. 2.....	29⅞*	28½*	Nat'l Car, pf.......	118½*	1

BOSTON.

	Sept. 12.	Sept. 19.		Sept. 12.	Se
Am. T. & T.........	134¾	135½	Mex. Tel...........	6*	
Cum. Tel...........	156*	152½*	Mex. Tel., pf.......	6*	
Edison	280*	286	N. E. Tel..........	145½*	1
Gen. Elec..........	150½	149⅝	W. T. & T........	17*	
Mass. E. Ry........	18¼	17	W. T. & T., pf.....	96½*	
Mass. E. Ry., pf....	87½	88			

*Last price quoted.
Shares sold for the week, Sept. 11 to Sept. 16.

were in large volume, resulting in reduction of its price t lowest in over a year. The statement of the President pressing his belief in a strict interpretation of the restric imposed by the Sherman law was regarded as a warning ag unlimited competition, and led to discussion of the likeli of a federal suit against the Steel Corporation. Indu conditions abroad and increase in the discount rate of the perial Bank of Germany from 4 per cent to 5 per cent bearish influences during the day. Further declines took in the early trading on Wednesday, with numerous loss from 1 to 2 points, followed by irregular recovery. The s centered on Steel shares again, based upon a rumor of cutting at its mills. Decline of the cotton market to the l level since 1909 was an incident of the day. Large adv to German borrowers, at rates about 1½ per cent a those prevailing for local accommodation, were made by York banks on Wednesday. Local demand upon the n market was light, and rates September 20 were as fol Call, 2⅛@2½ per cent; ninety days, 3½@3¾ per cent. quotations in the table are those at the close Sept. 19.

Financial Notes.

Central Maine Power Company.—New York and Boston banking houses are offering $500,000 first mortgage 5 per cent gold bonds of the Central Maine Power Company, which operates and controls the commercial electric lighting and power business without competition in practically all of the important cities and towns in the Kennebec Valley. The bonds are dated Nov. 1, 1909, and are due Nov. 1, 1939, being callable after 1910 for the sinking fund only at 105 and interest. The Central Maine Power Company, which was formerly the Messalonskee Electric Company, incorporated unler the laws of the State of

Maine, is a consolidation of the various water-power and electric-lighting companies on the Kennebec, Sebasticook and Messalonskee rivers, and in addition to its acquisition of the entire property, rights and franchises of some nine companies in this section, it owns all of the stock of the Waterville & Oakland Street Railway Company and the Union Gas & Electric Company, of Waterville, and practically the entire capital stock of the Solon Electric Company and Clinton Electric Company, of Clinton, Me. The authorized common stock of the company is $2,500,000, all of which is issued, in addition to which there is authorized $750,000 preferred 6 per cent cumulative stock, of which $721,500 has been issued. The total funded debt of the company is $2,451,500, made up of $1,714,000 first mortgage 5 per cent bonds of an authorized issue of $5,000,000, and $737,500 in bonds of subsidiary companies. The greater part of its electrical energy is generated from hydroelectric developments on the rivers mentioned above, the present hydroelectric development permitting the production of 9000 hp. Additional capacity is provided by reserve steam stations of 5000 hp, including the new steam station of 4000 hp located at Farmingdale, which will shortly be placed in operation. This station is designed to permit of an ultimate capacity of 14,000 hp. In addition to its electric properties, the company also does a gas business in several towns in the State of Maine. Its franchises are liberal in their terms, are free from burdensome restrictions and are without time limit. It is estimated from the figures of the several properties for the year ended June 30, 1911, that the earnings of the consolidated company for the calendar year of 1912 will be approximately as follows: Gross earnings, $510,000; operating expenses and taxes, $250,000, leaving net earnings of $260,000. Bond interest is placed at $129,600, leaving a balance of $1[illegible],400.

Edison Electric Illuminating Company of Boston.—The annual report of the Edison Electric Illuminating Company of Boston for the year ended June 30, 1911, has just been issued and shows gross earnings of $5,257,913, as compared with $4,709,456 in 1910. Expenses were $2,796,803, as against $2,688,720 the previous year, and the net income was $2,461,110, as compared with $2,020,736 for the fiscal year ended June 30, 1910. Fixed charges were $189,993, as compared with $253,288 the previous year, leaving a balance of $2,271,117, as against $1,848,650 for 1910. Dividends amounted to $1,867,035, as compared with $1,555,596 the previous year, leaving a surplus of $404,082, a substantial increase as compared with $293,054 in the year preceding. During the past fiscal year the company sold 88,402,126 kw-hours of energy, of which 66,933,508 kw-hours were for light and power purposes, 11,636,669 kw-hours were for street lighting, 7,177,552 kw-hours for street railways and 2,654,987 kw-hours sold to other companies. During the year the company used 124,724 tons of soft coal, as compared with 111,136 tons in 1910, and the average number of employees for the year was 1188. The plant account of the company as of June 30 totaled $27,226,003, made up as follows: Land, $1,560,965; buildings, $4,278,148; steam plant, $4,144,470; electric plant, $4,713,504; overhead lines, $3,767,389; underground lines, $6,904,616; transformers, $483,259; meters, $985,041; arc lamps, $388,612. It is stated in the report that on June 30 last there were 3630 stockholders in the company, of whom 3070, or 84 per cent, are residents of Massachusetts. The business of the company for the month of August has shown improvement over the corresponding month last year.

Chicago & Milwaukee Electric Reorganization.—Full details of the plan for reorganization of the Chicago & Milwaukee Electric Railroad Company have been arranged, and have been agreed to by all of the important interests. According to a statement issued recently, a new corporation will be organized under the laws of Illinois to acquire the properties of the old Illinois and Wisconsin companies. Securities will be issued by the new corporation as follows: $4,000,000 first mortgage 5 per cent bonds; $4,000,000 4 per cent first income bonds; $5,000,000 4 per cent second income bonds, and $6,000,000 stock, all of one class. These new first mortgage bonds are to be used for retiring the $1,000,000 receivers' certificates, for retiring the $1,080,000 underlying bonds of the Chicago & Milwaukee Electric Railroad Company, and for providing new capital. The underlying first mortgage bonds are callable on any interest date at 105 and interest. It is further stated that the new first income bonds will be given in exchange, dollar for dollar, for the $4,000,000 first mortgage 5 per cent bonds of the Illinois Division (Chicago & Milwaukee Electric Railroad Company). The new second income bonds are to be given in exchange for $10,000,000 Wisconsin Division bonds. As holders of the latter will also receive the entire new stock issue, they will consequently manage the property.

United Service Company Preferred Stock.—Scranton (Pa.) bankers are offering $35,000 preferred stock of the United Service Company, with a bonus of 20 per cent of common at 49½ (par value $50). In a circular issued by the bankers, it is stated that the United Service Company owns and controls several operating companies in Tuscarawas County, Ohio, with a central station at New Philadelphia, Ohio. These companies are the Tuscarawas County Electric Light & Power Company, which serves New Philadelphia and Canal Dover, Ohio; the New Philadelphia Heating Company, which supplies steam heat; the Twin City Traction Company, which serves Dennison and Urichsville, Ohio, and the Warren Light & Power Company, serving Warren, Pa., and vicinity. Franchises of the company are liberal and satisfactory and the net earnings of the company are now at a rate of over 4 per cent on the common stock. The active management of the company is directed by L. H. Conklin, formerly general superintendent of the West Penn Railways Company, of Pittsburgh, and later with J. G. White & Company, of New York.

Commonwealth Edison Stock Outstanding to Be Increased to $37,950,000.—At a meeting of the directors of the Commonwealth Edison Company, of Chicago, on September 18 it was voted to increase the capital stock outstanding by 15 per cent. As the amount outstanding is approximately $33,000,000, the amount of new stock to be issued is $4,950,000, bringing the total issue up to $37,950,000. The total authorized capital stock is $40,000,000. The proceeds will be used for the general expansion of the company's business, including the work on the new Northwest generating station, the initial equipment of which will be ready for service in a few weeks. Stockholders of record of Oct. 14 will have the privilege of subscribing for the new stock at par to the extent of 15 per cent of their holdings. They may pay for the additional stock in four quarterly instalments, beginning Nov. 1, 1911. The stock pays a 7 per cent dividend.

New York City Borrows from Interborough.—Arrangements have been made by Comptroller Prendergast of New York City for a loan of $2,225,000 from the Interborough Rapid Transit Company and allied interests, for meeting various municipal obligations before tax collections are made in October. This is the first occasion upon which the city has borrowed money through any source other than banks or trust companies. The Interborough company had some $32,000,000 on hand which it had borrowed for financing improvements to its system, and was in a position to offer the funds at lower rates than obtainable elsewhere. The loans will be as follows: From the Interborough Rapid Transit Company, $1,500,000, at 3 3/16 per cent, maturing Oct. 30, 1911; from the Rapid Transit Subway Construction Company, $500,000, at 3¼ per cent, maturing Nov. 28, 1911, and $225,000, at 3⅜ per cent, from the Subway Realty Company, maturing Jan. 2, 1912.

Consolidated Gas, Electric Light & Power Company.—The report of the Consolidated Gas, Electric Light & Power Company of Baltimore for the year ended June 30, 1911, shows gross income of $4,867,776, as compared with $4,699,098 in 1910. Expenses and taxes were $2,455,440, as compared with $2,265,534, and net income was $2,412,336, as compared against $2,433,564 in the previous year. Fixed charges amounted to $1,377,403, as compared with $1,374,362, and the surplus available for dividends was $1,034,932 as compared with $1,059,202 in 1910. Preferred dividends were $423,603 and common dividends were $283,001, the latter being $157,000 larger than in the preceding year. These deductions left a balance of $328,827, as against $509,598 in 1910. Of this amount $219,049 was reserved this year for renewals, as compared with $275,596 last year, leaving a surplus of $109,278 for the year ended June 30, 1911, as compared with $252,002 in 1910.

Bronx Gas & Electric Company.—The Bronx Gas & Electric Company has applied to the Public Service Commission for the First District of New York for permission to issue $80,000 in bonds, the proceeds of which are to be used for extensions and improvements to its plant. The bonds are to be issued under its first refunding mortgage of $1,500,000. The company has bonds outstanding at present to the amount of $797,000.

Washington, Baltimore & Annapolis Electric Railway Company.—The report of the Washington, Baltimore & Annapolis Electric Railway Company for August was issued last week and showed an earning record for the month which is highly satisfactory to the officials. The gross income of the property for August was $65,152, as against $64,548 for the same month of 1910, the increase for the year being $604. Operating expenses for the month were $29,537, as compared with $29,332 for last year, or a gain of $205 for this year. The net operating income for the month was $37,614, as against $35,212 for last year, the increase for this August being $2,401. From this amount were deducted fixed charges, taxes, etc., leaving net income or surplus for the month of $15,536, an increase of $11,540 over the corresponding month of the preceding fiscal year. The percentage of operating expenses to gross operating revenue for the month was 43.99 per cent, as compared with 45.44 per cent for August, 1910. The gross operating revenue of the company for the five months of the fiscal year which began April 1, 1911, was $309,886, as compared with $300,794 for 1910, or a gain of $9,072. Operating expenses were $144,638 as against $147,349 for last year, which represents a decrease of $2,711. It will be noticed that a saving of over $2,000 occurred in operating expenses for the five months as compared with the corresponding five months of 1910, and this reduction in expenses was brought about also without in any way impairing the operating efficiency of the property. The percentage of operating expenses to gross operating revenue for the five months was 46.66 per cent as against 48.97 per cent for 1910.

Kings County Electric Light & Power Company.—The report of the Kings County Electric Light & Power Company, including that of the Edison Electric Illuminating Company of Brooklyn, for the month of August shows an increase in gross earnings of $20,208 and a decrease in profit and loss surplus of $7,405, as compared with August, 1910. The gross earnings for the month were $365,171, and operating expenses were $186,711, which includes general, technical, production and distribution expenses. The net income was $178,459, which was an increase of $3,493 over the corresponding month of the previous year. The bond discount written off was $1,689 and depreciation charges were $49,576. Fixed charges were $66,980, leaving a profit and loss surplus for the month of $60,213. In the eight months ended Aug. 30 gross earnings were $3,065,716, an increase of $272,102 over this item in the corresponding period in 1910. Operating expenses were $1,537,592, leaving net earnings of $1,528,124, representing an increase of $72,383 over the net income for the same period the previous year. The bond discount written off was $13,512, depreciation charges were $371,327, and the fixed charges were $522,582, leaving a profit and loss surplus for the eight months of $620,701, a decrease of $10,530 as compared with the profit and loss surplus for the corresponding eight months in 1910.

Northwestern Elevated Railroad Company.—The annual report of the Northwestern Elevated Railroad Company has been issued and shows a surplus for the year of $237,509, an increase of $11,410 over the surplus in the previous year. Gross earnings were $2,731,375, as compared with $2,632,039 in 1910, and expenses were $1,084,804, as compared with $1,055,686. Net earnings were $1,646,571, as against $1,576,353. Charges, taxes, etc., were $1,209,062, showing a slight increase over the $1,200,254 in charges in 1910. Preferred dividends amounted to $200,000, as against $150,000 in 1910, leaving a surplus of $237,509, as mentioned above. Earnings amounted to 8.7 per cent on the $5,000,000 preferred stock, as compared with 7.5 per cent in the preceding year. The report states that since the close of the fiscal year ended June 30, 1911, the company has made a new mortgage, covering all of its property, to secure $25,000,000 in bonds, all of which has been issued and sold.

Otis Elevator Company.—During the first eight months of its present fiscal year, including Aug. 31, gross sales of the Otis Elevator Company were nearly 5 per cent larger than in the corresponding period of the previous year. This means that the business of the company in this time was the best in its history. From the present scale of orders and inquiries, the outlook for the balance of the year is very encouraging, and there is likelihood of decided increase in both gross and net returns over the figures in 1910. It is expected that the company will earn over 11 per cent on its $6,375,300 common stock, which would be practically four times the 3 per cent now paid.

Consummation of Power Merger Expected.—It is stated that between 95 and 98 per cent of the stock of the North Shore Electric Company, the Economy Light & Power Company and the Illinois Valley Gas & Electric Company has been deposited with the Illinois Trust & Savings Bank, in accordance with the plan of the Commonwealth Edison interests, for consolidating the suburban electric light and power companies near the city.

Receiver's Compensation.—W. O. Johnson, who was appointed receiver for the Chicago & Milwaukee Electric Railroad Company on Feb. 21, 1911, has been allowed $9,375 salary for his services from that day to Sept. 1. The order of the court also provides that Mr. Johnson shall be paid $1,500 a month for his future services as receiver for the company.

DIVIDENDS.

American Telephone & Telegraph Company, quarterly, $2 per share, payable Oct. 16.

*Bell Telephone Company of Canada, quarterly, 2 per cent, payable Oct. 14.

Canadian General Electric Company, semi-annual, preferred, 3½ per cent; quarterly, common, 1¾ per cent, both payable Oct. 2.

Carolina Power & Light Company, quarterly, preferred, 1¾ per cent, payable Oct. 2.

Chicago City Railways, quarterly, 2½ per cent, payable Sept. 30.

Chicago Telephone Company, quarterly, 2 per cent, payable Sept. 30.

Commonwealth Edison Company, quarterly, 1¾ per cent, payable Nov. 1.

Cumberland Telephone & Telegraph Company, quarterly, 2 per cent, payable Oct. 2.

Duluth Edison Company, quarterly, preferred, 1½ per cent, payable Oct. 2.

Minnesota & Ontario Power Company, quarterly, preferred, 1¾ per cent, payable Oct. 2.

National Carbon Company, quarterly, common, 1½ per cent, payable Oct. 14.

Niagara Falls Power Company, quarterly, $2 per share, payable Oct. 16.

Toronto Railway Company, quarterly, 2 per cent, payable Oct. 15.

Union Traction Company, of Indiana, semi-annual, preferred, 2½ per cent, payable Oct. 1.

Western Electric Company, quarterly, $2 per share, payable Sept. 30.

Western Union Telegraph Company, quarterly, three-fourths of 1 per cent, payable Oct. 16.

West India Electric Company, Ltd., quarterly, preferred, $2 per share, payable Sept. 30.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
AMERICAN LIGHT & TRACTION COMPANY.					
August, 1911	$284,127	$9,194	$274,933	......	......
August, 1910	267,302	11,516	255,786	......	......
8m., Aug. '11	2,597,331	74,777	2,504,554	......	......
8m., Aug. '10	2,318,057	79,862	2,238,195	......	......
BROOKLYN RAPID TRANSIT COMPANY.					
Yr., June, '11	$21,986,543	$12,166,367	$10,117,700	$6,969,221	$3,148,479
Yr., June, '10	20,979,514	11,737,110	9,521,218	6,909,622	2,611,595
CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY.					
Yr., June, '11	$4,867,776	$2,455,440	$2,412,336	$1,377,403	$1,034,932
Yr., June, '10	4,699,098	2,265,534	2,433,564	1,374,362	1,059,202
EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON.					
Yr., June, '11	$5,257,913	$2,796,803	$2,461,110	$189,993	$2,271,117
Yr., June, '10	4,709,456	2,688,720	2,020,736	253,288	1,848,650
KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.					
August, 1911	$365,171	$186,711	$178,460	$118,247	$60,213
August, 1910	344,963	169,997	174,967	107,349	67,618
8m., Aug., 11	3,065,717	1,537,592	1,528,124	907,422	620,702
8m., Aug., '10	2,793,614	1,337,874	1,455,740	824,499	631,241
NORTHWESTERN ELEVATED RAILROAD COMPANY.					
Yr., June, '11	$2,731,375	$1,084,804	$1,646,571	$1,209,062	$437,509
Yr., June, '10	2,632,039	1,055,686	1,576,353	1,200,254	376,098

General News

Construction News.

ALABAMA CITY, ALA.—The City Council is contemplating submitting the proposition to issue from $40,000 to $50,000 in bonds for the construction of an electric-light plant and water works system to a vote of the people.

BIRMINGHAM, ALA.—The Chamber of Commerce has indorsed the plan to install an ornamental street-lighting system in the business district of the city. The cost of the ornamental lamps is estimated at $35,000, of which $23,000 has already been subscribed. It is proposed to erect 200 ornamental lamp standards, each carrying five 100-watt tungsten lamps. The merchants and property owners will pay for the installation of the system provided the city will maintain the lamps.

GLOBE, ARIZ.—Preparations are being made by the Globe Water & Irrigation Company for the installation of new air compressor machinery in connection with its irrigation system near San Simon, Ariz.

GRAVETTE, ARK.—A petition has been presented to the City Council by a majority of property holders asking the Council to pass necessary ordinances to install an electric-light plant and water-works system in Gravette. It is proposed to issue bonds to the amount of $25,- [illegible] provide funds for same.

OSCEOLA, ARK.—The City Council has received notice from the Abner Driver Light & Ice Company that its plant will be closed down Jan. 1, 1912. The primary reason for this action is the refusal of the Council to grant a franchise extension. It is expected that the city will [illegible] to build a municipal plant.

CALISTOGA, CAL.—The local electric-light plant, owned by William Spiers, is reported to have been purchased by the Napa Valley Electric Company, of St. Helena, Cal.

CHICO, CAL.—A franchise has been granted to George E. Springer to construct and operate an electric railway on certain streets in Chico.

COLTON, CAL.—The Southern California Edison Company has awarded the contract for the erection of a large distribution station in Colton to E. Engstrum, to cost $16,597.

CORONA, CAL.—The Pacific Electric Railway Company has authorized the construction of a railway, about 5 miles in length, to connect the Corona and Colton systems.

DAVIS, CAL.—The Pacific Gas & Electric Company is planning to rebuild its substation in Davis.

EL CAJON, CAL.—The question of installing a street arc-lamp system on Main Street in El Cajon is under consideration. A committee has been appointed to consult with the officials of the San Diego Consolidated Gas & Electric Company in regard to the cost of installing the system.

ESCONDIDO, CAL.—The City Council has awarded the Escondido Utilities Company a contract for street lighting for a period of five years. The contract calls for nearly twice the number of lamps now in use.

FOLSOM, CAL.—The Pacific Gas & Electric Company is planning to erect a transmission line from Folsom to Roseville in the near future. The company will also supply electricity to the farmers along the line for pumps, motors and other purposes.

LERDO, CAL.—The San Joaquin Light & Power Company, of Fresno, Cal., will soon begin work on the installation of electric-pumping equipment for pumping water on its property in this section.

LOS ANGELES, CAL.—The Los Angeles-Hollywood Homes Company has acquired property in the Hollywood district and is planning to construct and operate a trackless trolley system.

LOS ANGELES, CAL.—The Board of Supervisors will receive bids until Oct. 16 for an electric-light and power franchise, covering certain parts of the county, for a period of forty years.

LOS ANGELES, CAL.—Bids will be received until Oct. 8 for furnishing electric-lighting fixtures for the Los Angeles Detention Home. Hudson & Munsell are the architects, and M. J. Delande is county clerk.

LOS ANGELES, CAL.—The Board of Public Works has signed a contract for right of way across the property of the Alta Vista Hydraulic Power Company for telephone and temporary transmission lines of the municipal power project.

LOS ANGELES, CAL.—The Alta Planing Mill Company has secured the general contract for the erection of a hotel at Beverly Hills, near Los Angeles, for the Rodeo Land & Water Company, for about $200,000. A power plant will be installed in a separate building.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has awarded the contract for grading and other work in connection with its proposed railway from Watts to Homeward to Robert Sherer, of Los Angeles, Cal. The proposed road will connect the Pacific Electric and Los Angeles-Redondo systems.

LOS ANGELES, CAL.—To test the feasibility of physical connection between the two telephone systems, the Pacific Telephone & Telegraph Company (Bell) and Home Telephone Company (automatic), the Board of Public Utilities is planning to install five trunk lines of each system, with an exchange plant, in the city hall building, allowing subscribers using only one telephone system to subscribe to the intercommunicating system through this exchange, at a small cost. The cost of operating the plant for one year is estimated at $5,000. The telephone companies have been asked if they will permit the use of the trunk lines for this purpose.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Works, Los Angeles, Cal., until Oct. 23, for furnishing electrical machinery and equipment consisting of main generators, exciter generators, step-up transformers, step-down transformers, tools, spare parts and supplies for the proposed power plant to be known as the San Francisquito No. 1 aqueduct, plans and specifications for which are on file in the office of the Board of Public Works, City Hall, Los Angeles. Bids will also be received at the same time and place for hydraulic machinery, including water wheels for main generating units, water wheels and appurtenances for exciter units, central oil pressure system for governors, tools and appliances for the San Francisquito canyon power plant.

OAKLAND, CAL.—The Oakland Traction Company, a subsidiary of the United Properties Company, is contemplating increasing the output of its generating plants to provide power to operate the proposed extensions of the Key Route and the Oakland Traction systems.

ORANGE, CAL.—The Board of Trustees has announced its intention of enforcing the city ordinance requiring the placing of electric wires underground in the business district of the city.

PASADENA, CAL.—Plans are being considered by the city for the erection of a new buildingg in connection with the municipal electric-light plant. C. W. Koiner is manager.

PASADENA, CAL.—The City Council has awarded the contract for erection of ornamental lamp standards including wiring and connections for the ornamental street-lighting system on South Orange Grove Avenue to N. A. McNally, for $34,400.

POMONA, CAL.—The residents of Kenoak tract are planning to install an ornamental street-lighting system. The wires will be placed underground. Charles Carrette has been appointed to make investigations in regard to the cost of the work.

RED BLUFF, CAL.—It is reported that E. D. Baker, of San Francisco, Cal., will install pumping machinery to be operated by electric motors on his Proberta tract, located near Red Bluff.

RIVERBANK, CAL.—The Santa Fe Railway is planning to install electric pumping machinery in connection with its new water-works system at Riverhead.

SACRAMENTO, CAL.—The Corporation Counsel has rendered an opinion that the Great Western Power Company must provide underground conduits for its transmission lines in certain districts of the city, to comply with the city ordinances.

WHITLOCK, CAL.—It is reported that A. H. Ward, of San Francisco, Cal., is contemplating the construction of a hydroelectric power plant on Saxon Creek in this district.

DENVER, COL.—The new light contract ordinance passed by the City Council has been approved by Mayor Speer, under which the Denver Gas & Electric Light Company agrees to furnish 75-watt series tungsten incandescent lamps for parks and boulevards at $20 each per year and to place the wires underground. The new contract runs for a period of ten years, dating from Jan. 1, 1911, and is supplemental to one entered into by the city five years ago, under which the city paid $28 each per year for the lamps now in use. Should the price of electricity be reduced in the meantime there is a provision for arbitrating the price to be paid for the service by the city.

EAGLE, COL.—The installation of an electric-light plant in Eagle is reported to be under consideration. It is proposed to utilize water from the Eagle River to operate the plant.

NAUGATUCK, CONN.—The Housatonic Power Company has announced a reduction in the price of electricity for lamps to take effect immediately. The rate for the first 50 kw has been reduced from 12 to 11 cents per kw-hour and the minimum charge has been reduced from $1 to 50 cents. The company has also reduced its rates for power service. The reduction was voluntary on part of the company.

WATERBURY, CONN.—The resolution passed by the Board of Aldermen authorizing a referendum vote to be taken at the coming election on the question of establishing a municipal lighting plant in Waterbury has been approved by Mayor Hotchkiss.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Oct. 2 for furnishing one 16-in. heavy back-geared, motor-driven crank shaper. Specifications and form of proposal may be obtained from the purchasing officer of the District of Columbia.

WASHINGTON, D. C.—Proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Sept. 28 for furnishing and installing one steam engine and electric generator in the Armstrong Manual Training School, Washington, D. C. Specifications and form of proposal may be obtained from the purchasing officer of the District of Columbia.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Oct. 14 for furnishing and installing lighting fixtures in the United States buildings at Brazil, Ind.; Fairbury, Neb.; Hillsdale, Mich.; Mount Clemens, Mich.; Murphysboro, Ill.; Rock Island, Ill.; Wabash, Ind.; Watertown, Wis.; Willmar, Minn., and Ottumwa, Ia., in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is Supervising Architect.

PENSACOLA, FLA.—Proposals will be received at the office of the clerk of the Board of County Commissioners of Escambia County, Pensacola, Fla., until Sept. 26 for furnishing and installing combination electric and gas fixtures for the new county jail and court house building. Plans and specifications may be obtained from the clerk of the circuit court, court house, Pensacola, Fla. James MacGibbon is clerk of board.

ST. AUGUSTINE, FLA.—The property of the St. Johns Light & Power Company, of St. Augustine, Fla., recently placed in the hands of a receiver, will be sold at a special master's sale on Oct. 2. The system includes the street-railway system and electric-light and power plant.

TALLAHASSEE, FLA.—Bids will be received until Sept. 25 by the Board of Managers of the municipal electric-light and water plant for a 300-kw direct-connected unit with switchboard panel, specifications for which may be obtained at the office of the board. C. H. Ellis is superintendent of the plant.

ATLANTA, GA.—Application has been made for a charter for the Georgia Railway & Light Company by Charles Magee, John M. McWhinney, George A. Kingston and Robert Mathison, of Toronto, Can.; J. J. Spalding, Forrest Adair, Alexander C. King, E. Marvin Underwood. Hughes Spalding and George W. Adair, of Atlanta, Ga. The company will be capitalized at $27,000,000, and proposes to build, purchase, lease and acquire street and interurban railways with their franchises in the cities and towns of Atlanta, East Point, College Park and Haneville, in Fulton County, and in Stone Mountain, Clarkston, Decatur, East Lake, Lakeview, Oakhurst, Kirkwood and Atlanta, in DeKalb County. It is reported that the company will operate about 200 miles of road. It is also rumored that the company may acquire control of the Georgia Railway & Electric Company and the Georgia Power Company.

MULLAN, IDAHO.—Arrangements have been completed by the Mullan Electric Light & Power Company for the construction of a brick building at Second and Pine Streets.

ALTON, ILL.—The Alton, Jacksonville & Peoria Electric Railway Company is reported to have entered into a contract with the Alton, Granite & St. Louis Traction Company to supply electricity to operate its system until electrical energy generated at the Keokuk dam is obtainable. It is understood that the Alton, Jacksonville & Peoria Electric Railway Company has decided not to install a power plant.

BLOOMINGTON, ILL.—Preparations are being made for the installation of 125 additional ornamental street lamps.

CHICAGO, ILL.—The capital stock of the Commonwealth Edison Company has been increased by $4,950,000, the proceeds to be used in connection with the development of power to be used in the operation of elevated railways and surface traction lines.

GALESBURG, ILL.—Plans are being considered for the installation of a new street-lighting system in the business district. It is proposed to install magnetite lamps.

PAXTON, ILL.—At an election held Sept. 12 the proposition to issue $17,000 in bonds, the proceeds to be used to install a municipal electric-light and water-works system in Paxton, was carried. Electrical service is now supplied by the Paxton Electric Company.

PRAIRIE CITY, ILL.—The local electric-light plant was destroyed by fire on Sept. 5, causing a loss of about $10,000. The town is at present without street-lighting service.

QUINCY, ILL.—The Quincy Gas, Electric & Heating Company has awarded the contract for placing its wires underground to the J. W. Turner Construction Company, of Des Moines, Ia.

ST. JOSEPH, ILL.—The Central Illinois Electric Company has been granted a thirty-year franchise to operate an electric-light plant in St. Joseph. The company has also been awarded a contract to light the streets of the city for a period of ten years. Under the terms of the contract the company is to supply forty lamps of 80 cp at $900 per year.

ANDERSON, IND.—Improvements and extensions are contemplated to the municipal electric-light plant, involving an expenditure of about $30,000. The installation of a turbo-generator is being considered.

AUBURN, IND.—The County Council has voted to appropriate $30,000 for the installation of the proposed power plant, recently asked for by the County Commissioners. As $8,000 will be needed at once, it is said, arrangements will be made so that the amount will be available immediately.

ELKHART, IND.—Work has commenced on the construction of a large [illegible] and power house on the St. Joseph River in Elkhart by the Indiana & Michigan Electric Company. The new dam, it is said, will create a lake 7 miles long.

FT. WAYNE, IND.—A composite design has been adopted for the ornamental lamp standards for the cluster lamp system, which will be manufactured by the Murray Manufacturing Company. Each standard will carry four lamps with 12-in. globes. Ten posts to the square will be used.

GREENFIELD, IND.—The City Council has given its approval for erecting ornamental lamp standards on the public square and has appropriated $900 for that purpose. Efforts are being made by the business men to raise $1,800, which is their share of the cost of the project. After the system is installed the city agrees to furnish electricity and maintain the lamps. Thirty-three lamp standards will be erected.

HUNTINGTON, IND.—The installation of an ornamental street-lighting system in the business section of the city is under way. John W. Hier is superintendent of the municipal electric-light plant.

INDIANAPOLIS, IND.—The Commissioners of Marion County have granted the Indianapolis & Delphi Traction Company a franchise to construct and operate an electric railway from the State Fair grounds north on the range line to the Hamilton County line.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has filed a notice with the Secretary of State showing an increase in its capital stock from $500,000 to $3,000,000, the proceeds to be used to care for future developments. Edward L. McKee is president.

KENTLAND, IND.—The Town Council has granted Robert W. Howard a franchise to install and operate an electric-light plant in Kentland. The franchise provides for a twenty-four-hour service.

MISHAWAKA, IND.—Plans are being considered by the Chapin Park Improvement Association for the installation of a new lighting system in Chapin Park. It is proposed to install cluster lamps similar to those used in the business district of the city. Albert Leisure is president.

COLUMBUS JUNCTION, IA.—Steps have been taken to organize a company to install an electric-light plant in Columbus Junction. R. D. Parker, of Lake Crystal, Ia., is said to be interested in the project.

DEEP RIVER, IA.—At an election held recently the proposition to issue bonds for the installation of a municipal electric-lighting system was carried. The plans call for a twenty-four-hour service.

DEFIANCE, IA.—Arrangements are being made by the Defiance Press Steel Company, manufacturer of steel beer and milk cases and steel bottle cases, for improvements to its plant in East Defiance this fall, to cost approximately $25,000. It is proposed to erect three additions to the plant and install a large amount of electric galvanizing equipment. About 750 kw will be required to operate the galvanizing plant.

DES MOINES, IA.—Contracts have been awarded by the Des Moines City Railway Company to the J. W. Turner Construction Company for the construction of an addition to its power house, 30 ft. by 60 ft., and a con crete coal bin with a capacity of 2500 tons, and for the construction of a new water intake system from the river, at a total cost of $43,000. The Des Moines Bridge & Iron Company was awarded contract for the erec tion of steel cranes to be used for handling coal, at $11,000. The cranes were furnished by the Whiting Foundry Company, of Harvey, Ill., fo $11,000.

DENISON, IA.—The Council has passed an ordinance requiring al electric wires to be placed underground in Denison.

FT. DODGE, IA.—The contract for construction of the propose dam across the Des Moines River at Ft. Dodge by the Northern Iow Power & Light Company is reported to have been awarded to Butle Brothers, of St. Paul, Minn.

OSKALOOSA, IA.—It is reported that plans are being considered fo the construction of a hydroelectric power plant to supply the city wit electricity for lamps and motors. J. J. Henry, of Chicago, Ill., and C. A Miller, of Des Moines, Ia., are said to be interested in the project.

ROCKFORD, IA.—The local electric-light plant, which was recentl purchased by Charles Walker, is being thoroughly overhauled and in provements made to the service.

SILVER CITY, IA.—At an election held recently the citizens vote in favor of the proposition to grant the Silver City Light & Power Cor pany a franchise to erect and operate an electric-light plant in Silv City.

WEBSTER CITY, IA.—The total lines of the Martin Telephone Co pany in this part of Iowa are reported to have been purchased by the Iov Telephone Company.

BLUE RAPIDS, KAN.—Plans have been completed by the Allen En neering Company, of Chicago, Ill., for the construction of a combin hydroelectric and steam power plant for Jason Yurann at Blue Rapic Kan. The proposed dam will be 900 ft. long with a fall of 25 ft. a will impound water for three generating units. The proposed plant w cost about $500,000 and will have an output of 3600 kw.

STAFFORD, KAN.—The formal transfer of the Larabee electric-li plant to the city was made Sept. 6. The plant is now operated by municipality. The plant was purchased by the city last June for $14,0 but owing to delays in completion of the new power house the forr transfer was delayed. The new street-lighting system will be turned on a short time.

LEXINGTON, KY.—The Kentucky Traction & Terminal Company

…rded a contract for the construction of its power house to the … Lumber Company, of Lexington, Ky. The Pittsburgh Bridge … Company has the contract for the structural ironwork. Contracts … equipment have already been placed.

…ISVILLE, KY.—The Commercial Club is considering the question … ring an ornamental lighting system for the business district of the …

…WENSBORO, KY.—The contract for the installation of a steam turbo- … set in the municipal electric-light plant has been awarded to … Westinghouse Electric & Manufacturing Company. The George F. …cker Company, of St. Louis, Mo., was awarded the contract for a new …itchboard. The cost of the new equipment will be about $14,500.

…HREVEPORT, LA.—The City Commissioners have decided to call an … on Oct. 17 to vote on the proposition to issue $310,000 in bonds, … ceeds to be used for the installation of a municipal electric-light … Shreveport, La. The commissioners have entered into a tentative … contract with the Shreveport Gas, Electric Light & Power Com- … street lighting under the terms of which the company has agreed … the price of arc lamps from $75 to $62.50 each per year and … ce the price of electricity to private consumers from 9.22 cents … hour to 8½ cents per kw-hour.

…GOR, MAINE.—The Bangor Power Company has filed amend- … its charter increasing its capital stock from $1,250,000 to $1,- …

…ERVILLE, MAINE.—The capital stock of the Central Maine … Company has been increased by $100,000.

…TIMORE, MD.—The Board of Awards on Sept. 14 awarded con- … r an electric generator and switchboard for the sewage pumping … to the Thomas C. Basshor Company, for $5,712.

…ERLY, MASS.—The Beverly Gas & Electric Company has an- … a reduction in the price of electricity for commercial purposes … 13 to 11 cents per kw-hour, to take effect Jan. 1, 1912, and for … $1.15 to $1.10 per 1000 cu. ft., to take effect from Oct. 1. The … expects to have its new River Street station completed by the …

…BARDSTON, MASS.—The Selectmen of Hubbardston have … locations for lamps in connection with the proposed street- … system, consisting of fifty lamps, for which wiring will begin at … A transformer station will be erected on the Worcester Road in …

…NNIS, MASS.—The Buzzards Bay Electric Company, of Fal- … Mass., has secured control of the Hyannis Acetylene Gas Com- … A temporary electric-lighting plant will be installed by the com- … once to supply electrical service in this vicinity. The gas plant … operated as at present.

…LETON, MASS.—At an election held Sept. 5 the town voted to … an electric-light plant and water-works system, to cost about $65,- … which bonds were authorized at the last session of the Legislature. … the town has not decided whether to install a municipal plant to … electricity and for pumping water or to erect a distributing sys- … purchase energy for both the lighting and pumping systems. … orted that propositions have been submitted by the Lowell Elec- … ght Corporation, the Edison Electric Illuminating Company and … necticut River Transmission Company to furnish electricity in case … decides to purchase its energy.

…H BROOKFIELD, MASS.—Extensive improvements are contem- … the Oxford line mills in North Brookfield. Contract has been … for the construction of a new power house at School and Grove … W. W. Fullam, to cost $2,500. The equipment of the power … include a 240-kw generator and a compound engine, for which … been placed at a cost of $7,500. Orders will soon be … r 250 looms. Benjamin C. Mudge is treasurer of the company.

…NGE, MASS.—An agreement has been entered into between … committee and the Athol Gas & Electric Company whereby the … now in use will be replaced by incandescent lamps and an … light service established.

…ABODY, MASS.—The contract for building an addition to the …nicipal power station has been awarded to the E. H. Porter Com- … of Peabody, for $3,179. The building will be 25 ft. x 50 ft., and … provide space for three new boilers.

…EYMOUTH, MASS.—The Weymouth Light & Power Company has …plied to the Massachusetts Gas & Electric Light Commissioners for …rmission to issue 500 shares of additional capital stock of par value of …, the proceeds to be used for payment of floating indebtedness and … enlarging plant.

…ORCESTER, MASS.—The Worcester Electric Light Company has … completed its new power station and is in the market for a 5000-kw …ine and three boilers of 600 hp each.

…ORCESTER, MASS.—The Worcester Suburban Electric Company has … granted relocations on West Main Street in Millbury, Mass., and lo-…ons for a new pole line from West Millbury to the Auburn line.

…AY CITY, MICH.—The electric-light committee has awarded a con-… to the Westinghouse Electric & Manufacturing Company for 145 … flame arc lamps for $3,605 to replace the open-arc lamps now in … on the west side. William H. Fitzhugh, superintendent of the mu-…nicipal electric plant, has notified the committee that no more lamps can be placed on the east side until the output of the plant is increased.

HASTINGS, MICH.—The Interurban Construction Company is reported to have been granted a franchise to construct an electric railway through the principal streets of Hastings. W. L. Sontag is manager of the company.

AITKIN, MINN.—A proposition has been submitted to the Council by M. D. Stoner, head of the Cuyanna Range Light & Power Company, of Deerwood, Minn., offering to lease the municipal electric-light plant for a term of fifteen years and to supply electricity to the city from 2 cents to 6 cents per kw-hour and for lighting purposes at 10 cents per kw-hour, subject to discounts for prompt payment. A committee has been appointed to consider the proposition and if favorable the proposition will be submitted to a vote of the people.

CHISHOLM, MINN.—Arrangements are being made by the Range Power Company to commence work on a water-power development on Sturgeon Lake, about 25 miles north of Chisholm. The company proposes to extend its transmission lines to the towns in the vicinity to supply electrical service. It is reported that the Water, Light, Power and Building Commission is contemplating an expenditure of $12,000 for street lamps during the coming year.

FERGUS FALLS, MINN.—The Otter Tail Power Company is reported to be contemplating the construction of two new dams and the installation of a steam pumping plant.

MINNEAPOLIS, MINN.—Contracts have been awarded by the City Council for the installation of an electric light plant at the city crematory as follows. To the Northwest Electrical Company, of Minneapolis, Minn., for station equipment, at $5,720; for pole lines and 150 magnetite arc lamps to R. B. Whitacre & Company, of St. Paul, Minn., for $13,979 and $4,890, respectively, and to the Electric Machinery Company, of Minneapolis, Minn., for generator, etc., at $8,279; steam engine equipment at $8,781.

ST. PAUL, MINN.—The City Council has awarded the St. Paul Gas Light Company a contract for lighting the streets of the city with electricity for a term of two years. The company is also to supply gas for the incandescent gas lamps for two years. The Patterson Street Lighting Company was awarded a two-year contract for maintaining gas and gasoline lamps.

ST. PETER, MINN.—The Tri-State Telephone Company is reported to be negotiating for the purchase of the properties of the Nicollet County Telephone Company, which owns exchanges at St. Peters, Cleveland, Casota, New Sweden, Nicollet, La Fayette, Gibbon and Gaylord, with pole lines in Nicollet, Le Sueur, Sibley and Kenville counties. The franchise of the company in St. Peter expired two years ago and permission to increase rates has been sought in exchange for promised improvements.

VIRGINIA, MINN.—A petition has been presented to the City Council asking for the appointment of a special water and light commission to make investigations with a view of purchasing the local light and water plants to be owned and operated by the municipality. The proposed ordinance provides for an appropriation of $2,500 to carry on the investigation.

COLUMBUS, MISS.—Louis Shull, care of The Subway, Columbus, Miss., it is reported, is contemplating the installation of an electric plant, to be operated by gasoline power, of sufficient output to provide for 400 incandescent lamps of 16 cp and three small passenger elevators and would like to secure information pertaining to such a plant and cost of same.

HATTIESBURG, MISS.—The management of the Hattiesburg Traction Company has been taken over by Doherty & Company, of New York, N. Y. The new management contemplates extensive improvements and extensions to the system involving an expenditure of about $100,000, of which about $25,000 will be expended on the electric system, $25,000 for the installation of new gas mains and other improvements to the gas system and $50,000 for the street railway system, including the purchase of new cars, extensions to car lines, etc. A. B. Patterson will be local manager.

BEVIER, MO.—The Bevier Commercial Club has entered into a contract with Fairbanks, Morse & Company, of St. Louis, Mo., for the construction, maintenance and operation of an electric-light plant in Bevier.

PARMA, MO.—The National Motor & Supply Company, of Cairo, Mo., has secured the contract for the installation of an electric-light plant in Parma. The equipment will include one 35-hp Olds gasoline engine and one 25-kw direct-current generator and accessories, to cost about $5,000. The plant is being installed by Messrs. Malcomb & Hull, of Parama, who have been granted a twenty-five-year franchise by the town and also a contract for street lighting for a period of five years.

BUTTE, MONT.—Bids will be received until Oct. 12 by the Board of County Commissioners for furnishing lighting fixtures for the new county court house. Link & Haire, State Savings Bank Building, Butte, Mont., are the architects.

LIBBY, MONT.—It is reported that a Massachusetts syndicate is contemplating a hydroelectric development at Kootenai Falls, Mont., involving an expenditure of $6,000,000. It is proposed to develop about 80,000 hp for distribution in western Montana, northern Idaho and northeastern Washington. The plant will be located at a point about 7 miles east of Troy, Idaho, and 11 miles west of Libby, Mont. The principal transmission lines will be as follows: To Kalispell, Mont., 100 miles

in length, Spokane, Wash., 90 miles; Wallace, Idaho, 60 miles, Sandpoint, Idaho, 38 miles, and Republic, Wash., the new gold camp, 110 miles. J. A. Coram, of Boston, Mass., and Chandler M. Wood are interested in the project.

LIVINGSTON, MONT.—The Madison River Power Company is planning to extend its transmission lines from Livingston to Lewiston through the Shields River Valley. The company will supply electricity in Clyde Park, Wilsail and other towns in the valley.

WIBAUX, MONT.—The Council is reported to be considering the question of installing a street-lighting system in Wibaux.

CURTIS, NEB.—We are informed that the installation of a municipal electric-light plant in Curtis, to cost about $7,500, is under consideration. F. E. Dillman is City Clerk.

KEENE, N. H.—The Keene Gas & Electric Company is contemplating extending its transmission lines to Winchester and Swanzey. Steps have been taken by the company to secure right-of-way for same.

MANCHESTER, N. H.—The Amoskeag Manufacturing Company is planning to connect and consolidate its two large power plants, one in the northern division and the other in the southern division, both located on the east bank of the river. A pipe line will be laid in the bed of the canal to connect the two systems.

EATONTOWN, N. J.—The proposition to appropriate $2,000 for extensions to the electric-lighting system in Eatontown village will be submitted to the voters at the coming election.

ROCKAWAY, N. J.—The Morris & Somerset Electric Company has applied to the Borough Council for a fifty-year franchise to supply electricity in Rockaway for lamps and motors.

TRENTON, N. J.—The Trenton Street Railway Company is contemplating the installation of a 750-kw turbine in its power station in Trenton.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company, it is reported, is contemplating the installation of new machinery and making other improvements to its plant, for which bonds to the amount of $75,000 have been issued.

BROOKLYN, N. Y.—An ordinance has been approved by the Mayor of New York providing for an issue of corporate stock to the amount of $15,000 to erect feeder lines to supply electricity for lamps and motors for the Kings County Hospital, under the jurisdiction of the Department of Public Charities.

INDUSTRY, N. Y.—The Board of Managers of the State Industrial and Agricultural School has awarded the contract for furnishing electricity for lighting the school to the Niagara Power Company. It is expected to have the installation of the system completed by Oct. 1. F. H. Briggs is superintendent of the school.

NEW YORK, N. Y.—The Union Railway Company has applied to the Public Service Commission, First District, for franchises for building two extensions to its railway lines in the Bronx. One is for a railway on Broadway to make a link between the Kingsbridge Railroad Company at 225th Street and the Yonkers Railroad Company at 230th Street. The other franchise asked for provides for a route by the way of the new Madison Avenue Bridge from 138th Street in the Bronx to 135th Street in Manhattan.

NEW YORK, N. Y.—Bids will be received at the office of the Mayor, chairman of the Armory Board, Hall of Records, Chambers and Centre Streets, New York, N. Y., until Sept. 26 for furnishing and installing a complete additional electric-lighting system and wiring and electric-light and gas fixtures in the Twelfth Infantry Armory, Sixty-second Street and Columbus Avenue, Borough of Manhattan, in accordance with specifications. Forms of proposals can be obtained and specifications may be seen at the office of the board, Room 6, Hall of Records, Chambers and Centre Streets, Borough of Manhattan.

SODUS, N. Y.—The directors of the Sodus Gas & Electric Company have filed notice at the office of the clerk of Wayne County of its intention to apply to the Public Service Commission, Second District, for permission to execute a blanket mortgage on its property to secure an issue of $100,000 in bonds.

THOUSAND ISLAND PARK, N. Y.—Plans are being considered by the trustees of Thousand Island Park for extensive improvements at the park before the opening of the season of 1912, including the construction of a new fireproof pumping and electric-light station and the installation of a 150-hp engine and 100-hp boiler.

OXFORD, N. C.—The Town Commissioners have granted the North State Hydro-Electric Company a franchise to erect and maintain its transmission lines in the town of Oxford. Charles Johnson is president and general manager of the company.

BLUFFTON, OHIO.—A twenty-four-hour service has recently been established by the municipal electric-light plant in Bluffton. Cyrus Schumacher is chief electrician.

CINCINNATI, OHIO.—The Union Gas & Electric Company has filed a petition with the Public Service Commission asking permission to establish a sliding scale of rates for electricity for lamps.

COLUMBUS, OHIO.—Bids will be received by H. S. Holton, Director of Public Service, until Sept. 27 for the design, construction and furnishing material and equipment for four 75-lamp rectifier equipment for magnetite lamps, 320 magnetite lamps and two synchronous condensers.

YOUNGSTOWN, OHIO.—Sealed proposals will be received at the office of F. A. Jones, consulting engineer, Youngstown, Ohio, until Sept. 28 for furnishing and installing power plant in the new high school building being erected at Lake and Walnut Streets. The equipment includes gas engine, generator and motor. Plans, specifications and blank forms of proposals may be obtained at the above office.

TULSA, OKLA.—Bids will be received by the Board of County Commissioners of Tulsa County until Oct. 3 for light fixtures for new county court house. Plans and specifications may be obtained from W... & Macdonald, architects. R. E. Curran is county clerk.

WAGONER, OKLA.—The City Council has engaged the Benham Engineering Company, of Oklahoma City, Okla., to prepare plans and specifications for a new electric-light plant and extensions to the waterworks system, for which bonds to the amount of $40,000 have been issued.

GRANTS PASS, ORE.—The Chicago & Rouge River Irrigation & Power Company is planning to install a number of electric pumping plants in connection with its power development and irrigation work in this section. George E. Sanders is manager.

MEDFORD, ORE.—Plans are being considered by the Pacific Telephone & Telegraph Company for the installation of additional cable in ... district, to cost about $15,000.

SPRINGFIELD, ORE.—The Portland, Eugene & Eastern Railway Company is planning to extend its local system to Tenth Street.

WESTON, ORE.—The Pacific Telephone & Telegraph Company has applied for a franchise in this district. The company proposes to r... and extend its system. A new switchboard will be installed.

ALLENTOWN, PA.—The Allentown Eqnipment Company, 311 Commonwealth Building, Allentown, Pa., is reported to be in the market for several generating units, direct connected, ranging from 40 ... 200-kw, 125 or 250 volts, with switchboard panel.

BATH, PA.—At a special election held Sept. 11 the proposition to issue $10,000 in bonds for the installation of a municipal electric ... plant was defeated.

CHARLEROI, PA.—It is reported that efforts are being made by the West Penn Electric Company to secure rights of way between Ch... and Washington for the erection of a high-tension transmission line with a view of making Charleroi the distributing point for Washington County. The company proposes to supply electricity throughout the ... from its Connellsville plant through the Charleroi plant. The W...ton, Canonsburg and McDonald plants were recently taken over ... company.

CONNELLSVILLE, PA.—The West Penn Company will soon ... application to the State Department for a charter for the New ...andria Electric Light Company for the purpose of supplying electri... the town of New Alexandria, Westmoreland County.

FAIRVIEW, PA.—Sealed proposals will be received by the ...sylvania Commission to Erect a State Hospital for the Criminal ... care of H. G. Ashmead, Secretary, Room 650 Real Estate Trust ...ing, Philadelphia, Pa., until Sept. 26, for construction of new bu... known as laundry building T, power building V, ice house W, sys... sewage disposal and equipments for kitchen, laundry and power ...ings pertaining to the State Hospital for the Criminal Insane the Commonwealth of Pennsylvania at Fairview, Pa. Drawings and specifications and form of proposal may be obtained on application to J. M. Shirk, architect, 518 Philadelphia Bank Building, Philadelphia, ... which a deposit of $200 and $185 will be required, which will ... funded on return of same. Henry F. Walton is chairman.

HARRISBURG, PA.—The city improvement committee, a sub-co... of the bureau of municipal affairs, is making investigations of light... tems in different cities with a vew of securing a better lighting ... for Harrisburg.

MAHAFFEY, PA.—The Penn Electric Company, which prop... supply electricity to a number of coal mines in Cambria County ... as other counties, it is understood, will investigate the feasibility ...veloping the Susquehanna River near Mahaffey.

MERCER, PA.—Application has been made to the Borough Council for a franchise to install and operate an electric-light plant in Merce...

PITTSBURGH, PA.—Plans are being considered by the Pittsburgh Railways Company, a subsidiary of the Philadelphia Electric C... for extensive improvements and extensions to its system, invol... expenditure of about $3,000,000. About 20 miles of new track ... laid, at a cost of about $1,500,000; about $425,000 will be exper... new machinery and $676,000 for bridges and other betterment... company will contribute about $600,000 toward removing a heav... in Grant Street, the city paying part of the cost.

SELLERSVILLE, PA.—Preparations are being made by ... Excelsior Light & Power Company for extensive improvement to ...s system, involving an expenditure of about $27,000. A new power house will be built, new boilers and generators installed. The entire system will be changed to two-phase throughout Sellersville, Souder... and Telford. It is also proposed to extend the system to Blooming ...n and Trumbauersville. The flat rate will be eliminated entirely and meters installed for all consumers. The company proposes to supply electricity for manufacturing plants.

SPRING CITY, PA.—Sealed proposals will be received by the Board of Trustees for the Eastern Pennsylvania State Institution for the Feeble-Minded and Epileptic, care of Philip H. Johnson, architect, 1824-25 Land Title Building, Philadelphia, Pa., until Sept. 25 for erect-

n and equipping power house and laundry for the Eastern Institution Feeble-Minded and Epileptic, Spring City, Pa. Plans and specifications and form of proposal may be obtained on application to Philip H. ...son, architect. A deposit of $100 will be required, which will be refunded upon return of plans and specifications. Samuel A. Whitaker secretary of board.

HARLESTON, S. C.—Plans have been prepared by Lamar Lyndon, of New York, consulting engineer, and submitted to the City Council for the construction of a municipal electric-light plant in Charleston. Four propositions were submitted as follows: 1. A plant to provide electricity for lighting the entire city, municipal buildings and departments and the sewage pumping stations. 2 A plant that will provide for an extended street lighting system, the illumination of municipal buildings, departments and sewage pumping stations. 3. A plant to be operated in connection with the water works if built. 4. A plant that provides for increased street-lighting system and pumping station ... commercial service.

...EA PATH, S. C.—Contracts have been awarded by the Board of ... Works for machinery and equipment for electric-light plant as ... Boilers and accessories and engine with equipment to the ... Iron Works Company, of Meadville, Pa., for $2,100; generator, ... and switchboard, arc lamps, series lamps, regulators, switchboards, cut-out blocks, fuse wire, electric watt-hour meters and motor, to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, P. for $2,700; wire and line hardware to the Southern Electric Company, of Baltimore, Md., at $3,300; poles and electric control valves to J. F. Blount, of Atlanta, Ga., for $860 and $150, respectively; contracts have not yet been awarded for triplex pump, air-compressor, tank and tower, water meters, deep-well pump, boiler house and engine room. J. F. Monroe is chairman of Board of Public Works.

HITMIRE, S. C.—Arrangements are being made by the Glenn-Lowry Manufacturing Company for enlarging its plant. The company proposes to increase its capital stock by $500,000 and to add about 30,000 spindles with accompanying looms, cards, etc. At present the company operates 36,000 spindles, 125 narrow looms, 775 broad looms, 48 cards, etc. The plant is operated by electricity. William Coleman is president.

APID CITY, S. D.—The Dakota Power Company has awarded the contract for the concrete foundation for its proposed power house to the South Dakota Construction Company, estimated cost, $6,000. The building will be 80 ft. x 35 ft., one story high, with a two-story annex 2. ft. x 26 ft., to cost about $12,000. The cost of the equipment is estimated at about $40,000.

ACKSONVILLE, TENN.—The Jacksonville Railway & Light Company is contemplating the purchase of one second-hand 500-kw, 2200-volt, 60-cycle, three-phase, 3600 r.p.m. turbo-generator for its power house in J...

KNOXVILLE, TENN.—The City Council has passed over the veto of the Mayor the ordinance granting the Eastern Tennessee Power Company a thirty-five-year franchise to operate in Knoxville. The Mayor claimed that the city should have received a bonus of $5,000 in addition to other concessions by the company, the details of which are given in the issue of Sept. 9.

ORPUS CHRISTI, TEX.—The People's Light Company has engaged F. H. Lancashire, of Dallas and Corpus Christi, to make investigations and prepare plans for improvements and extensions to its plant. It is proposed to double the output of the plant.

ALLAS, TEX.—Work has begun on the erection of the ornamental lamp standards in the business district of the city. The system will include 110 standards, each carrying a 1000-cp arc lamp.

ECATUR, TEX.—It is reported that the Decatur Water & Light Company is planning to rebuild its electric-light and power plant, recently destroyed by fire.

ORNEY, TEX.—The Forney Water Works Company has filed an amendment to its charter increasing its capital stock from $10,000 to $..000 and changing its name to the Forney Water, Light & Ice Company. It is understood that improvements to the system have been com...

ARLIN, TEX.—Preparations are being made by the Marlin Electric Light Company for extensions to the street-lighting system. About 100 street lamps will be erected in the residence portion of the town. It is understood that material has already been purchased.

ENIEL, TEX.—The City Council has granted the Greenville Railway & Light Company a charter for the extension of its street railway system from Forest Park in Greenville to Peniel.

UNGE, TEX.—Steps have been taken toward the establishment of an electric-light plant in Runge.

...AN, UTAH.—The City Council has decided to install a new street-lighting system, to cost about $2,200. Tungsten incandescent lamps will be used.

...DEN, UTAH.—The Merchants' Light & Power Company has entered into a twenty-five-year contract with the Davis & Weber Counties Canal Company for water power for its plants.

OGDEN, UTAH.—The Davis & Weber Counties Canal Company has awarded the contract for the construction of its proposed hydroelectric power plant at Riverdale to the Lynch Cannon Engineering Company, Salt Lake City, Utah, for $215,000. The company has also awarded a contract to William Doyle, of Ogden, Utah, for the construction of a new concrete headgate in Weber Canyon.

SALT LAKE CITY, UTAH.—Bids will be received by the County Clerk of Salt Lake County, Salt Lake City, Utah., until Oct. 2 for furnishing material and erecting power-house building for Salt Lake County, to be located at the corner of Twelfth, South and State Streets, Salt Lake City, plans and specifications for which are on file at the office of J. A. Headlund, architect, 523 Dooly Building, Salt Lake City, Utah.

ENOSBURG FALLS, VT.—The village of Enosburg Falls has awarded the contract for the construction of a concrete dam to the Twitchel Lumber Company, to cost about $15,000. F. O. Sinclair, of Burlington, Vt., is engineer.

HARDWICK, VT.—Contracts have been awarded by the village of Hardwick for construction of concrete dam and machinery in connection with municipal electric-light plant as follows: To the Woodberry Granite Company for construction of dam; electrical equipment to the Westinghouse Electric & Manufacturing Company and for water-wheels to the S. Morgan Smith Company. An appropriation of $50,000 has been made for improvements to plant. Frank O. Sinclair, of Burlington, Vt., is engineer.

HYDE PARK, VT.—An appropriation of $10,000 has been made by the village of Hyde Park for improvements to the municipal electric-light plant, including the construction of a concrete dam, electrical machinery and water-wheels. The electrical machinery will be furnished by the Westinghouse Electric & Manufacturing Company and water-wheels by S. Morgan Smith Company. Contract for dam has not yet been awarded. F. O. Sinclair of Burlington, Vt., is engineer.

RUTLAND, VT.—Plans have been prepared by Henry F. Bryant, of Brookline, Mass., for the dam to be built by the Rutland Railway, Light & Power Company at Clarendon Gorge. The plans call for a reinforced concrete dam with an ultimate height of 96 ft., but which will probably be finished for the present at a height of 51 ft.. The radius of the circle upon which the dam is to be built is 150 ft. The power station will be located a short distance below the dam and will be 40 ft. x 20 ft. and equipped with one 500-kw generator direct-connected to water wheel of 1000 hp.

HANFORD, WASH.—The Black River transmission line of the Pacific Power & Light Company's system has been completed. This line completes the Columbia River system and will connect the Priest Rapids power plant with North Yakima, running over the Rattlesnake Mountains and through the Moxee Valley, and connect White Bluffs, Beverly, Hanford, Richland, Pasco, Kennwick and Walla Walla with the Priest Rapids plant.

PASCO, WASH.—Bids will be received by the city of Pasco until Sept. 26 for furnishing 84 ornamental lamp standards with cluster lamps for Improvement District No. 35. L. H. Kintz is city clerk.

PORT ANGELES, WASH.—The Olympic Peninsular Electric Railway Company, capitalized at $2,500,000, is planning to build an electric railway from Lake Crescent to Port Ludlow. Thomas T. Aldwell is president.

SPOKANE, WASH.—The Washington Water Power Company is planning to install an electric distributing system in the Coeur d'Alene mining district, Idaho.

TENINO, WASH.—Preparations are being made by the Tenino Light & Power Company to extend its system from Tenino to Chehalis, via Centralia. The company has applied for a franchise to erect a transmission line in Centralia. The Tenino Light & Power Company is owned and controlled by the Washington-Oregon Corporation.

TOPPENISH, WASH.—The City Council has granted the Reservation Electric Company a fifty-year franchise and a contract for street lighting for a period of ten years. Under the terms of the contract the city has the option of renewing the contract at its expiration without an increase in rates. The company has made a reduction in the price of electricity for street lamps and for operating the pumps at the water works. It is stated that the company will make extensive improvements to its system. C. D. Fullen is president of the company.

WENATCHEE, WASH.—The Wenatchee Traction Company has been granted a franchise to construct an electric railway in Wenatchee. The company proposes to build a system, 100 miles in length, operating with branches from Cashmere to Beverly, Wash. Louis W. Pratt, of Tacoma, Wash., is president.

WINLOCK, WASH.—The new lumber mill of the O'Connell Lumber Company, which is to replace the one recently destroyed by fire, will be equipped for electrical operation.

ELKINS, W. VA.—The Elkins Electric Railway Company is planning to build a new power house in Elkins this fall. The company will not let any contracts for the work.

BARABOO, WIS.—At a special election held Sept. 5 the proposition to issue bonds to the amount of $65,000 for the installation of a municipal light plant was defeated.

NEW LISBON, WIS.—The Central Construction Company, of Oshkosh, Wis., is reported to have been awarded the contract for the installation of proposed municipal electric-light plant and water-works system at New Lisbon, to cost $18,000.

ALIX, ALTA., CAN.—It is reported that the town of Alix has placed a contract for the complete installation of an electric-light plant, to cost $15,000. The town, it is understood, expects to supply electricity to light

[illegible] Trunk Power Railroad is building at Buffalo Lake, located a short distance from the town.

PRINCE RUPERT, B. C., CAN.—Plans are being considered for the erection of a hydroelectric power plant on Goose Bay for the Hidden Creek Mine. The plant will have an output of 3500 kw. Jay P. Graves, of Spokane, Wash., is general manager of the mine.

PORTAGE LA PRAIRIE, MAN., CAN.—The by-law authorizing an issue of debentures to the amount of $110,000 to purchase the electric plant of the Central Electric Company, to be owned and operated by the municipality, has been approved by the ratepayers. The city has taken over the plant.

SELKIRK, MAN., CAN.—The Town Council has decided to install an electric distributing system at a cost of about $10,000. The Council recently entered into a contract with the Winnipeg, Selkirk & Lake Winnipeg Railway Company to supply electricity to operate the system. Under the terms of the contract the company will supply 100-hp at $30 per horse-power per year.

GALT, ONT., CAN.—The ratepayers on Sept. 10 voted in favor of the by-law appropriating $5,000 for extensions to the water-works system and $5,000 for the installation of hydroelectric power at the station.

WALKERVILLE, ONT., CAN.—The Town Council is reported to have decided to discard the use of natural gas for street lighting and has entered into a contract with the Walkerville Light & Power Company to light the streets of the town with electricity for a period of ten years at the rate of $154 per month, which includes maintenance and care of lamps.

MOOSE JAW, SASK., CAN.—The city is reported to have made a revision in its rates for electricity for motors, allowing a discount of 40 per cent on monthly bills exceeding $80 and 50 per cent on bills over [illegible].

PRINCE ALBERT, SASK., CAN.—C. H. and P. H. Mitchell, engineers, Traders' Bank Building, Toronto, Ont., Can., will have charge of the construction of the proposed hydroelectric plant to be erected by the city of Prince Albert at LaColle Falls on the Saskatchewan River. The cost of the proposed plant is estimated at about $800,000. A. Holmes is Mayor.

PARRAL, CHIHUAHUA, MEX.—The installation of a new power plant is under consideration by the Sierra Plata Mining Company. R. H. Allen is manager of this property.

MAZAPIL, ZACATECAS, MEX.—The Santa Rosa Mining Company, it is reported, is planning to install a power plant. The equipment will include gas producers, gas engines and electric generators.

New Industrial Companies.

THE AMBOY ELECTRIC COMPANY, of Perth Amboy, N. J., has filed articles of incorporation with a capital stock of $20,000 for the purpose of doing a general electrical and mechanical engineering business. The incorporators are Bruce W. Jones, William H. Gerow and Neils Christian Nielson, all of 176 New Brunswick Avenue, Perth Amboy, N. J.

THE BRIGGS MAGNETO COMPANY, of Augusta, Maine, has filed articles of incorporation under the laws of the State of Maine with a capital stock of $600,000. L. J. Coleman is president; M. M. Farrar, treasurer, and Charles L. Andrews, clerk.

THE DETROIT ELECTRIC CAR COMPANY OF PHILADELPHIA, of Camden, N. J., has been incorporated by A. M. Garrison, J. M. Russell and A. S. Flowers, all of Camden, N. J. The company is capitalized at $25,000 and proposes to manufacture electric cars and do an electrical and mechanical engineering business.

New Incorporations.

WILMINGTON, DEL.—Articles of incorporation have been filed for the United States Telephone Company under the laws of the State of Delaware with a capital stock of $5,000,000 by John W. Long, Lester S. [illegible] and William M. Pyle, of Wilmington, Del.

WILMINGTON, DEL.—The American Traction & Light Company has been chartered with a capital stock of $50,000 to build electric railways and power plants in the Southern States. The officers of the company are H. C. Brubaker, of Indianapolis, Ind., president; G. E. Bruse, of Indianapolis, Ind., secretary; P. P. Dew, of Blacksburg, S. C., treasurer, and W. A. Calhoun, of Buffalo, N. Y., chief engineer.

Personal.

MR. [illegible] has been placed in charge of the newly [illegible] electrical inspection department of the city of Des Moines, Ia.

MR. CHARLES D. KAEDING has been appointed superintendent of the mechanical and electrical department of the Goldfield Consolidated Mining Company, Goldfield, Nev.

MR. FRANKLYN D. WITWER, until recently connected with the Brilliant Electric Company, of Cleveland, is now assistant manager of the Bryan-Marsh Company, Chicago.

MR. M. R. LASH has succeeded Mr. W. N. Keiser as electrical [illegible] neer for the Union Electric Company of Dubuque, Ia. Mr. Lash [illegible] to Dubuque from Des Moines and was formerly with the Western [illegible] tric Company.

MR. F. C. BARRINGTON, formerly president of the Columbia [illegible] trical Company, supply dealer, of St. Joseph, Mo., has been app[illegible] sales manager of the St. Joseph Railway, Light, Heat and Power [illegible] pany's lighting department.

MR. G. WURFEL, formerly with the Intermountain Electric Com[illegible] of Salt Lake City, has entered into partnership with Mr. H. L. D[illegible] son, of the Electric Manufacturers' Sales Company, with offices in [illegible] Gas & Electric Building, Denver, Col.

MR. H. A. COWGILL has been appointed electrical engineer fo[illegible] St. Joseph Railway, Light, Heat and Power Company, of St. Joseph, [illegible] Mr. Cowgill was formerly located at Columbus, Ohio, with the Colu[illegible] Railway and Light Company, another of the Clark syndicate properti[illegible]

MR. OLY H. ALLEN, assistant superintendent of the Housatonic [illegible] Company and the Connecticut Company, Suffield, Conn., has bee[illegible] pointed superintendent to succeed Mr. J. P. H. de Windt, who has [illegible] appointed manager and superintendent of the Springfield-Alberta Com[illegible] Alberta, Canada.

MR. THOMAS FOULKES, Los Angeles, Cal., a retired electrical [illegible] neer and contractor, has been appointed by Mayor Alexander a me[illegible] of the Board of Public Utilities of that city. This completes the full [illegible] bership of the board, the two other members being Lewis R. V[illegible] and Martin Bekins.

MR. ARTHUR C. HOBBLE, formerly connected with the hydroel[illegible] undertaking at Cauvery Falls, Sivasamudrum, Mysore, India, has [illegible] employed by the Mexican Northern Power Company as electrical [illegible] struction engineer for the 500-hp, 110,000-volt Conchos project near [illegible] Rosalia, Chihuahua, Mexico.

MR. A. M. WORTHINGTON, general manager of the Louisville [illegible] ing Company, has resigned that position on account of ill healt[illegible] resignation to take effect Oct. 15. Mr. P. T. Glidden, vice-presiden[illegible] general manager of the Eastern Pennsylvania Power Company, E[illegible] Pa., will succeed Mr. Worthington.

MR. A. L. HARDING has been appointed superintendent of ope[illegible] of the Colorado Department of the Telluride Power Company, su[illegible] ing Mr. J. C. Damon. Mr. Harding, who joined the staff of the co[illegible] in the fall of 1910, is a graduate of the electrical engineering depa[illegible] of the Massachusetts Institute of Technology.

MR. PETER J. MORRISEY, formerly assistant to the chief en[illegible] of the Detroit Edison Company, is now general manager of the Ci[illegible] Light, Heat & Power Company, Johnstown, Pa. Mr. Morissey ha[illegible] connected with the Detroit Edison Company continuously since his [illegible] uation from the Pennsylvania State College in 1904.

MR. J. G. HENNINGER, illuminating engineer, with the N[illegible] Electric Lamp Association, will deliver a lecture before the Ele[illegible] Vehicle Association of America at its annual convention in New [illegible] City Oct. 10, which will cover the illumination of public and [illegible] garages and also touch on the lighting of automobile salesroom[illegible]

MR. THOMAS A. EDISON was the guest in Budapest of Mr. [illegible] de Fodor, general manager of the Budapest General Electric Co[illegible] who was one of the assistants of the great inventor in 1881 a[illegible] pioneer work in Europe in establishing there the Edison system. Fodor met Mr. Edison in Vienna and induced him to take an aut[illegible] trip to Budapest.

MR. WILLIAM EDWIN FREEMAN, who has been associated w[illegible] Western Electric Company, Chicago, for the past seven years, ha[illegible] elected professor of electrical engineering at the Kentucky State [illegible] sity, from which he graduated in 1904. Mr. Freeman will succee[illegible] A. M. Wilson, who resigned to become professor of electrical engi[illegible] at the University of Cincinnati.

MR. ARTHUR WILLIAMS, of the New York Edison Compa[illegible] returned from Europe after a ten weeks' trip through England, [illegible] France, Germany and Switzerland. While his trip was primar[illegible] recreation, Mr. Williams spent part of the time in studying [illegible] conditions abroad, with particular reference to welfare work and [illegible] progress of the electrical industry.

MR. R. P. VIVIAN has been appointed chief engineer for [illegible] buque (Iowa) Union Electric Company, succeeding Mr. C. J. [illegible] whose death, due to pneumonia, occurred last April. Mr. Vivi[illegible] formerly with the steam-turbine department of the General Electr[illegible] Company, following several years' service as superintendent of motive [illegible]ower for the Havana (Cuba) Central Electric Railway.

MR. WIRT S. SCOTT, chief engineer of the McKeever Electric Construction Company, has been appointed superintendent of the m[illegible]icipal electric light plant, Columbus, Ohio, to take effect Oct. 1. Alth[illegible]gh he was graduated from the Ohio State University only a few months [illegible], Mr. Scott has had much experience in electrical work, having been [illegible] the employment of the government at the Norfolk navy yard from 94 to 1907.

MR. WILLIAM A. DONKIN, general contract agent of the A[illegible]gheny County Light Company, has been selected as manager of the Pi[illegible]burgh Industrial Development Commission, a body organized to "bo[illegible]" the [illegible] City. Mr. Donkin, who will assume his new duties on Oct. 1, [illegible]

been associated with the Allegheny County Light Company for the past ... years, during the last five of which he has been the ... operating agent of the company. His new work will ... the ... of what he has been accustomed to, and his experience with the ... organization he is leaving is regarded as a valuable asset to the industrial ... session.

MR. JOHN BURLAND INGERSOLL, formerly electrical engineer of the Spokane & Inland Empire Railroad Company, has been appointed ... electrical engineer of the British Columbia Electric Railway Company, with headquarters at Vancouver, B. C. In his new position Mr. Ingersoll will have charge of all new electrical construction, the rebuilding of the existing lines of the company in Vancouver and the electrical installation in two generating stations soon to be erected. Mr. Ingersoll went to Spokane from Pittsburgh as representative of the Westinghouse Electric & Manufacturing Company in charge of the installation of apparatus for the Coeur d'Alene & Spokane Railway Company. Mr. Ingersoll became an associate of the A. I. E. E. in 1903 and was transferred to full membership in 1910.

DR. J. M. BROWN, formerly professor of physics and electrical engineering at the Agricultural and Mechanical College of Texas, has been appointed professor of electrical engineering at the University of Texas, succeeding Dr. A. C. Scott. Dr. Brown received the degree of mechanical engineer from Ohio State University in 1893, the degree of master of arts from Cornell University in 1898, and the degree of doctor of philosophy from Illinois Wesleyan University in 1900. His experience in his profession has consisted of a student assistantship in physics and electrical engineering during his senior year in Ohio State University; an instructorship in physics and electrical engineering for five years in the same institution, afterward an assistant professorship for two years in Delaware College and for five years a professorship of physics and electrical engineering at the Agricultural and Mechanical College of Texas. For the past ... years he has been educational director of the Young Men's Christian Association at Wilmerding, Pa. Besides his educational work Dr. Brown has had practical experience in his profession as general manager of the Rapid Transit Railway at Chattanooga, Tenn., for two years, and was in charge of the government test on incandescent lamps at the World's Fair in Chicago. He is the author of a book of problems in elementary electrical engineering, and also of a book of special logarithmic ratios to facilitate the selection of gears for use in trains and ... machines and lathes for cutting thread-gears to incommensurate ...

Obituary.

MR. OTIS CARTER POST, of the switchboard sales department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, died suddenly of heart failure after retiring on the night of Wednesday, Sept. ..., on which date he had been placed in charge of this department, succeeding Mr. K. E. Van Kuhan, who had been transferred to the ... office of the company. Mr. Post was a graduate of the Michigan Agricultural College. He was about thirty-two years of age.

MR. C. RASMUSSEN, a young electrical engineer, was killed by electric shock at the hydroelectric plant of the city of Sturgis, Mich., at Sand Dam, on the St. Joseph River, sixteen miles from Sturgis, on Sept. 15. According to the newspapers, Mr. Rasmussen came in contact with ... wires carrying 23,000 volts, at which potential the output of the plant is transmitted. It is said that death was instantaneous. Mr. Rasmussen was employed by the Allis-Chalmers Company and was engaged on ... work for that company when he met his death. The body was taken to Milwaukee for burial.

Trade Publications.

TAILORS' IRONS.—The three principal types of tailors' irons manufactured by the Westinghouse Electric & Manufacturing Company are illustrated and described in Folder 4190, just issued. Complete information on the entire line, including sizes, styles, weights, watts input, etc., is also given.

CRUDE-OIL ENGINE.—The Atlas Engine Company, Indianapolis, Ind., has issued in printed form a report made by Mr. C. E. Sargent, of Chicago, on the Atlas crude-oil engine and also a catalogue describing and illustrating the engine. The tests by Mr. Sargent gave a consumption of crude oil of less than 10 gal. per 100 kw through a wide range of load.

POLYPHASE INDUCTION MOTORS.—The Mechanical Appliance Company, Milwaukee, Wis., has issued a neat booklet on its Type K induction motor. These have squirrel-cage rotors and attain their best efficiency between three-quarter and full load. The machines are built in the horizontal, vertical and back geared types and are also combined with buffers, grinders and ventilating fans. The various details of construction are outlined in the booklet.

METERS.—The Westinghouse Electric & Manufacturing Company has issued four folders, 4217, 4210, 4216 and 4215, devoted respectively to ... meters, watt-hour meters for small residences, direct-current switchboard meters and alternating-current switchboard meters. Both types of watt-hour meter work on the induction principle as do also the alternating-current switchboard instruments. The direct-current switchboard instruments operate on the D'Arsonval principle.

WIRING SPECIALTIES.—Catalogue No. 15 issued by the Arrow Electric Company, Hartford, shows important additions to the company's line of sockets, receptacles and rosettes. The complete interchangeable line of Arrow-Ide sockets is illustrated as well as a complete line of twenty-point adjustable sockets. The same interiors—key, keyless or pull—are used in both lines of sockets. The company has made some minor improvements in its line of switches and has also brought out several new porcelain sockets, receptacles and a line of midget and K-W rosettes.

SELLING FIXTURES.—The Tungstolier Company, Conneaut, Ohio, has issued a handsome pamphlet giving full details of a method whereby electrical dealers can, with a small stock of parts, give a customer a choice of no less than 1944 different fixtures. The pamphlet, which was written by Mr. E. J. Kulas, president of the Tungstolier Company, illustrates the various interchangeable fixture parts, and shows numbers of fixtures assembled. An outfit and arrangement are also described by means of which a dealer can assemble and advantageously display to a customer any style of the 1944 different fixtures.

SERIES STREET-LIGHTING SYSTEM.—The Pittsburgh Transformer Company, Pittsburgh, Pa., has issued Bulletin No. 1154, describing its series street-lighting system. There are no moving parts to the system, the tungsten lamp being regulated by a silico-vanadium steel core regulating coil from a simple step-down transformer mounted on a pole. The latter is built for 1100-2200-volt circuits and is provided with various taps to yield a number of voltages. The regulating coil is mounted in the dome of each lamp fixture and operates by maintaining the continuity of the circuit when one or more lamps fail. The fixtures comprise mast arms or hanger arms with reflector, center span suspension with reflector, or ornamental bracket with reflector.

BUSINESS NOTES.

THE DONGAN ELECTRIC MANUFACTURING COMPANY, of Detroit, Mich., manufacturer of the Dongan line of electrical measuring instruments, has established a New York agency at 150-152 Chambers Street, under the management of Mr. W. F. Curtis.

NEW OFFICE BUILDING OF THE NEW YORK & OHIO COMPANY.—A commodious brick building has been erected on Dana Avenue, Warren, Ohio, in which the sales department of the New York & Ohio Company will be located on or before Oct. 1. The company manufactures the Packard incandescent lamp, which for more than twenty years has been well and favorably known to the electrical trade.

THE SANBORN ELECTRIC COMPANY, of Indianapolis, Ind., has purchased a site on North Illinois Street, Indianapolis, Ind., on which it proposes to erect a six-story business building. The first floor will be used as display rooms of the Sanborn Electric Company and the second floor will be used for drafting rooms and office. The company is planning to engage extensively in electrical supplies as well as the contracting business.

THE FALKENAU ELECTRICAL CONSTRUCTION COMPANY, of Chicago, acting as general contractor for the Merchants' Light & Power Company, of Ogden, Utah, has, during the past week, placed in operation the arc lighting system for the city of Ogden. This is an installation of 200 Westnighouse luminous arcs and involves the erection of about 3000 poles, 50 miles of wire and the building of a substation equipped with Westinghouse transformers and rectifier outfits. This entire work was completed in ninety working days under heavy municipal penalties for delays. The work was finished thirty days ahead of contract time and has been formally accepted by the Merchants' Light & Power Company.

THE STAVE ELECTRICAL COMPANY, 131 Hudson Street, New York, reports that its Western business has increased by leaps and bounds, due to the introduction of the Long-Burning Stave Flaming Arc Lamp, and this has necessitated the opening of a Western office at 452 Monadnock Block, Chicago. Mr. J. Gustaf V. Lang, who is well known in electrical circles, both in this country and abroad, and who has been associated with Mr. Theo. Stave, president of the Stave Electrical Company for a number of years, has been appointed manager of the office, and he will look after the interests of the company in the West. It will be recalled that the Stave Company recently secured an initial order of 250 lamps for the illumination of the "Loop District" of the city of Chicago.

SIGN PROJECTORS.—The advertising sign projectors made by the Pittsburgh Electric Specialties Company, Pittsburgh, Pa., described on page 128 of the issue of July 8, are now made in three different models. Model A is equipped with a specially designed 132-watt Westinghouse-Nernst glower, guaranteed to have an average burning life of 200 hours at rated voltage. The cost for energy at 10 cents per kw-hour will be 1.3 cents per hour; or if burned five hours per day, 30 days per month, the cost per month for energy will therefore be \$1.95. The cost of renewals per month, under the guarantee, would amount to 50 cents; this makes a total monthly operating cost of \$2.45 Model B is provided with a 260-watt Edison stereopticon lamp, which has a useful life of 50 hours at rated voltage, consuming energy at the rate of 2.6 cents per hour, or \$3.90 per month. This model requires three renewals per month at a

cost of $2.25; so that its total monthly cost is $6.15. Model C is the same as Model A, except that it is equipped with a specially designed 66-watt Westinghouse-Nernst glower, with a burning life of 200 hours. This burner cuts in half the cost of energy used, but the renewals cost 35 cents per month, making a total monthly operating cost of $ 3. With these guaranteed figures before him, the prospective user will be able to figure out in advance exactly what this form of display advertising is going to cost him.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 12, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,002,820. ELECTRIC ALARM; P. A. Brown, Denver, Col. App. filed Feb. 5, 1909. An intermittently operated solenoid controls a whistle.

1,002,831. SPEED-LIMITING DEVICE; H. F. Elshoff, Norwood, Ohio. App. filed April 20, 1908. A centrifugal device trips a dog which holds the switch. For dynamo-electric machines.

1,002,832. SOUND-CONDUCTING ATTACHMENT FOR TELEPHONE RECEIVERS; C. H. Gatchell, Boston, Mass. App. filed June 24, 1909. A clip having one ear-piece is adapted to engage a receiver and has an extension ear-piece for the other ear.

1,002,837. INDUCTION MOTOR; A. M. Gray, Milwaukee, Wis. App. filed Nov. 13, 1908. Squirrel-cage rotor with bars normally connected through a high resistance and a low resistance, which is cut in to interconnect the bars after starting.

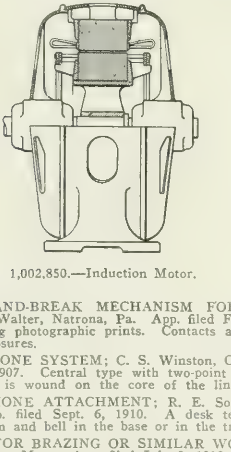
1,002,843. ELECTRIC FURNACE; A. Helfenstein, Vienna, Austria-Hungary. App. filed Nov. 16, 1909. A single-bottom electrode is common to a series of separate shafts.

1,002,850. INDUCTION MOTOR; J. L. Johnson, Milwaukee, Wis. App. filed Feb. 14, 1910. A short-circuiting ring engages the ends of the conducting bars in a squirrel-cage rotor.

1,002,855. CIRCUIT-BREAKER; W. J. Lietzenmayer, Webster, N. Y. App. filed April 15, 1907. A reciprocal arm produces unidirectional rotation of the movable contacts.

1,002,878. PARTY-LINE TELEPHONE SYSTEM; S. A. Souther, Chicago, Ill. App. filed Oct. 22, 1908. A branch-line-controlling relay for serial selection.

1,002,882. ELECTROLYTIC APPARATUS; W. B. Thorpe, Balham, London, Eng. App. filed Aug. 18, 1909. For use as or in the construction of meters, switches, etc. Bent tube with a spark-gap for igniting the evolved gases.



1,002,850.—Induction Motor.

1,002,886. MAKE-AND-BREAK MECHANISM FOR ELECTRICAL CIRCUITS; J. Walter, Natrona, Pa. App. filed Feb. 19, 1910. Machine for making photographic prints. Contacts adjustable for different time exposures.

1,002,891. TELEPHONE SYSTEM; C. S. Winston, Chicago, Ill. App. filed Nov. 22, 1907. Central type with two-point jacks. A second neutralizing coil is wound on the core of the line relay.

1,002,936. TELEPHONE ATTACHMENT; R. E. Southwick, Los Angeles, Cal. App. filed Sept. 6, 1910. A desk telephone with the ringer mechanism and bell in the base or in the transmitter body.

1,002,941. CLAMP FOR BRAZING OR SIMILAR WORK; C. R. Sturdevant, Worcester, Mass. App. filed July 9, 1910. For brazing rail bonds. A holder with copper-covered carbon electrode.

1,002,977. ELECTRIC WATER HEATER; C. O. Parrington and H. M. Hill, Dallas, Tex. App. filed Nov. 8, 1910. A protecting casing with a removable heating unit.

1,002,983. TROLLEY CATCHER; F. W. Geoghegan, Vancouver, B. C., Canada. App. filed June 27, 1910. The trolley pole is automatically retracted when the wheel jumps the wire.

1,002,988. METHOD OF UTILIZING THE GASES RESULTING FROM REDUCTION OPERATIONS CARRIED OUT IN ELECTRIC FURNACES AND ELECTRIC FURNACES FOR CARRYING OUT THE SAME; A. Helfenstein, Vienna, Austria-Hungary. App. filed Nov. 16, 1909. The electrode is always surrounded by the charge.

1,002,989. ELECTROLYTIC CELL; W. S. Heltzen, Davis, W. Va. App. filed May 25, 1910. For decomposing salt products.

1,002,996. ELECTRIC CUT-OUT; G. A. Jordan, New York, N. Y. App. filed Feb. 15, 1910. An inclosed switch with a protruding operating rod.

1,003,009. FIRE ALARM; E. Reimann, Goldfield, Nev. App. filed March 13, 1911. A fusible device.

1,003,041. ELECTROLYTIC PROCESS OF TREATING ALKALINE COMPOUNDS; E. G. Ekstrom, Los Angeles, Cal. App. filed Dec. 7, 1910. An aqueous solution of sodium fluo-silicate is electrolized between a carbon anode and a mercury cathode, so as to prevent escape of chlorine gas.

1,003,044. CIRCUIT INTERRUPTER; F. W. Harris, Wilkinsburg, Pa. App. filed May 9, 1908. For high-voltage outdoor or manhole service.

1,003,067. SIGNALING; D. Robertson, Oakland, Cal. App. filed 9, 1907. Combined electric light and whistle signal for vessels.

1,003,083. CABLEWAY; H. O. Adam, Dresden, Germany. App. Jan. 14, 1911. For automatically maintaining uniform tension conveyor system for transferring from one ship to another at s

1,003,092. METHOD OF ELECTROLYTIZING NICKEL-SULPH SOLUTIONS; H. H. Dow, W. S. Gates and A. E. Schaefer, tario, Canada. App. filed April 11, 1907. The sulphate solution a basic nickel precipitate is passed successively through agitating separating means.

1,003,111. ELECTRIC SWITCH; J. P. Jakobsen and H. F. Je Copenhagen, Denmark. App. filed Aug. 1, 1910. A switch co is rotated by an oscillating handle.

1,003,120. TURBO-ROTOR CONSTRUCTION; S. H. Mortensen, waukee, Wis. App. filed Dec. 21, 1908. A collector lead is ported by annular members, one of which consists of grooved

1,003,143. ELECTRIC SIGNALING APPARATUS; L. P. Locke, tor, N. Y. App. filed Aug. 30, 1910. For railroads, to in breakage of a rail or joint.

1,003,145. ELECTRIC CONTACTS UNDER CARPETS AND LIKE FOR ALARM SIGNALS AND OTHER PURPOSES Marmion, Paris, France. App. filed June 24, 1910. One of se contacts is adapted to be operated by an extended plate.

1,003,173. ELECTRIC FIRE ALARM; J. Cass, Manchester, Eng App. filed Aug. 28, 1909. A gelatine sheet effects the closing c circuit on a rise in temperature.

1,003,185. SIGNAL APPARATUS; A. J. Kercher, Los Angeles, App. filed Oct. 6, 1909. A pneumatic relay and alarm system.

1,003,187. ELECTROLYTIC PRODUCTION OF PRINTING PL AND THE LIKE; A. Leuchter, Brooklyn, N. Y. App. filed 23, 1909. An alloy of nickel and iron with a backing of copp

1,003,196. AUTOMATIC FIRE ALARM; L. Myers, Newark, App. filed Aug. 4, 1910. A pivoted elastic contact arm with a pot and guard.

1,003,199. RAILWAY SIGNALING SYSTEM; T. H. Patenall an W. Talbert, Wilkinsburg, Pa. App. filed Dec. 8, 1910. Bloc cut sections for single track with common wire and battery.

1,003,201. ELECTRIC AUTOMATICAL INSTRUMENT; T. Phillips, Liverpool, England. App. filed Aug. 8, 1908. Piano keys are actuated by electric magnets controlled by a perf sheet.

1,003,210. WAVE DETECTOR FOR WIRELESS TELEGRAPHY W. Schloemilch and P. F. Pichon, Berlin, Germany. App. filed Ap 17, 1909. A galena contact and a contact of material which ox with difficulty, as, for instance, graphite rod.

1,003,222. INTERRUPTER; R. H. Wappler, New York, N. Y. App. filed Oct. 6, 1909. Mechanical improvements on Patent No. 9 for alternating current.

1,003,234. BURGLAR ALARM; A. Cline, Indianapolis, Ind. App. filed Nov. 5, 1909. Wires arranged in a window frame to close a circuit.

1,003,242. GAS LIGHTER FOR AUTOMOBILES; C. Elliott, Baltimore, Md. App. filed Nov. 1, 1910. The hand grip for turning the gas on or off also serves to close an ignition circuit.

1,003,250. SELECTIVE SIGNALING SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed Sept. 4, 1908. For telephone or telegraph and dispatching. Has an answer-back device and the party called can interrupt the signal.

1,003,269. MOTOR-CONTROLLING APPARATUS; S. H. Plainfield, N. J. App. filed Feb. 21, 1910. Ironclad solenoid with blowouts. For various speeds and both directions, as in machine-tool drive.

1,003,271. MANUFACTURE AND PRODUCTION OF SILICA GLASS; H. A. Kent, Bounds Green, Eng. App. filed Aug. 13, 1910. Particles of silica fall separately through a heated zone onto a movable body.

1,003,285. LIGHTNING-ROD BRACE; G. A. and L. E. Mill St. Louis, Mo. App. filed Nov. 16, 1910. Details of construction and a holder for the rod.

1,003,299. PROCESS AND APPARATUS FOR PRODUCING LONG STABLE ELECTRIC ARCS; O. Schönherr and J. Hessberger, Christiansand, Norway. App. filed Aug. 6, 1910. A hollow cooled electrode at the entrance of the furnace. The starting point of arc moves slightly.

1,003,325. X-RAY SYSTEM; E. Blum, Union Hill, N. J. App. filed Sept. 27, 1910. A high potential transformer, a direct-current ampere meter and current-rectifying means.

1,003,338. CIRCUIT CONTROLLER; J. P. Coleman, New York, N. Y. App. filed Dec. 20, 1910. An oscillatory drum at the center of a plurality of contacts for compactness.

1,003,354. ELECTRODE FOR ELECTRODE FURNACES; W. T. Gibbs and R. A. Witherspoon, Buckingham and Quebec, Canada. App. filed April 28, 1910. A pencil of distinct sections of different hardness and a conductive substance of higher electrical conductivity.

1,003,374. WAVE DETECTOR FOR WIRELESS TELEGRAPHY; W. Schloemilch and P. F. Pichon, Berlin, Germany. App. filed April 14, 1906. Contacts of copper pyrites and platinum.

1,003,375. WAVE DETECTOR FOR WIRELESS TELEGRAPHY; W. Schloemilch and P. F. Pichon, Berlin, Germany. App. filed April 14, 1906. Contacts of iron pyrites and platinum.

1,003,391. ELECTRIC SNAP SWITCH; R. J. Barber and V. Turbin, Brookline, Mass. App. filed Nov. 18, 1909. Small, as for use on an ear-phone cord or a surgical lamp. Two parts which lock on each other.

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CONTENTS.

ELECTRICITY IN AGRICULTURE.

It is a singular thing that, in spite of the fact that the first recorded uses of the electric motor on a practical scale were agricultural, so little has been done toward making electric power a regular and important adjunct in farming operations. If we remember aright, water was electrically pumped so long ago as the Vienna Exposition. The first practical demonstration of the electric motor was in electrical plowing and its earliest regular commercial use was in hoisting beets at sugar works. As time has gone on, however, something material has been accomplished, and an article by Mr. Williams elsewhere gives a vivid idea of the practical utility of electric power in the operation of great farms in the semi-arid territory of the United States. The great Western plateau, as our readers know, is a district of slight rainfall, yet the land is enormously fertile if properly irrigated, and in the States of Colorado and Wyoming agricultural prosperity depends mainly upon irrigation. The necessary conditions of water supply, as Mr. Williams states them, are certainly startling to the Eastern farmer. The natural rainfall of the northern Colorado district is, roughly, scarcely more than one-third of that which falls on the Atlantic slope, ranging in general from 12 in. to 18 in. It is, therefore, found that the rainfall must be reinforced by 1 in. to 24 in. in average depth of water supplied artificially.

Irrigation, however, possesses the great advantage that the water can be applied when it is needed and not when the clouds provide it. Irrigation work in Colorado is particularly difficult owing to the fact that the evaporation from open reservoirs is great, as much as 5 ft. to 8 ft. per year, and most of the distribution is through open ditches, seldom properly lined, so that the losses from seepage are great. The lands unirrigated have merely value for grazing purposes, but when properly supplied with water their value rises at least a hundredfold. As the farming and irrigation have increased the difficulties of supply have increased also, and at the present time water rights are of somewhat uncertain value. All through this arid belt, in which the rainfall is light and surface water somewhat uncertain, there is a large amount of underflow, which includes probably the greater amount of the water derived from the melting snows of the mountains and which can be tapped usually at 20 ft. to 25 ft. below the surface. Pumping water from the underflow has now become a very valuable method of irrigation, and of late the Northern Colorado Power Company has been making a well-directed and systematic effort toward the exploitation of electric power for the purpose of operating irrigating pumps. The work of obtaining water is now carried out with deliberate and scientific care. A series of drill holes are run down and

the cores carefully examined and tested to show the conditions in the strata which carry the underflow. The porosity of the ground in the nature of a flow is tested by drilling a group of holes and making an actual quantitative examination for the amount of water available from the flow, so that when the final well hole is put down the amount of water for pumping can be pretty well ascertained. In fact it has been found that the water supply in the underflow can be determined more precisely than the surface flow, since the conditions remain more uniform.

The Northern Colorado Power Company was formed for the special purpose of generating cheap energy in the lignite coal field and distributing it for irrigation, lighting and other power uses over a territory extending from Denver on the south to Cheyenne on the north and over a distance east and west of some 50 miles. The main power plant is about 15 miles from Denver, on the Colorado & Southern Railroad, in the center of the northern lignite field. The power is produced by turbo-generators in a plant taking its fuel practically directly from the mines and equipped with all modern appliances for its efficient utilization. The generating plant is 13,200 volts, three-phase, 60 cycles. For the main transmission 44,000 volts is used on the line with branches at 13,200 volts, 6600 volts or 2300 volts, as occasion may require. The system already built reaches thirty-two towns in the center of the richest agricultural district in northern Colorado. The lines are run on wooden poles, forty to the mile, with substations and switching stations about 20 miles apart on the main line, so arranged that any substation can be cut out without interrupting the service. All the territory covered has a copious underflow which can be tapped for pumping. The wells dug for irrigation are peculiar. They are either circular or rectangular in form with concrete curbings lowered down to the water-bearing strata. The pump is submerged and the vertical shaft carried up to a framing which either carries a motor with vertical shaft directly coupled or a pulley belted to a motor placed in a housing at the side of the well. The lift being but moderate, centrifugal pumps are used, driven by 2300-volt motors.

During the pumping season of 1910 careful tests were made on fifty-seven pumping plants with approximately the following results. With an irrigation plant arranged to supply a quarter-section of 160 acres lifting through a 25-ft. head the average investment required is \$7.45 per acre. The cost of operation varies from \$1.75 to \$2.25 per acre-foot—that is, a foot of artificial rainfall can be obtained for this modest sum. Over much of the territory this additional foot is all that is required, although in other places 2 ft. might be necessary. Allowing 10 per cent as fixed charge on the pumping investment the ultimate cost to the farmer for an acre-foot amounts to only about \$2.75. This is much lower than the ordinary cost of water rights and their maintenance, with the additional advantage that the water is always available just when it is needed. It is an interesting fact that the gain by this ability to regulate the time of flow to the condition of the crops has led to not a little pumping by farmers who already have water rights. Besides the use of electricity for pumping a considerable amount of auxiliary farm machinery is operated from these convenient power circ.. so that on nearly every farm that has a pump elec c lamps will be found, motors for driving tools, for hoist, for cutting feed and other incidental purposes. Still other and more interesting feature of the system is fact that at last, after more than twenty years since first experiments of Chretien and Félix, electrical plow by the same method of cable haulage which they trie now being experimented with. Altogether this power tem is a most interesting and important development. day of the old-time careless and reckless farming passed and the era of intensive farming in our own cou is approaching. The work of the Northern Colorado P Company will prove to be only the beginning of the app tion of electricity to agriculture.

TURIN MEETING OF INTERNATIONAL ELECTROTECHNICAL COMMIS

The Turin meeting of the International Electrotech Commission will mark an epoch in the history of i national electrical engineering, owing to the import of the decisions it has rendered, the unanimity of its lutions and the magnitude of the work it has undert In regard to its composition, it brought together more fifty delegates from nineteen different countries, spe eleven different languages, not reckoning dialects. two languages, however, French and English, were offi recognized and each delegate expressed himself in o these. All the notices, records and resolutions had posted and maintained in these two languages. the decisions of the commission, the first great ste been the definite adoption of the $I = E/R$ as the alg international expression of Ohm's law. This has long the approved expression in France, Italy, the United and in other countries; but England and Germany hav exceptions to the rule, England having adhered symbol C for current and Germany to W for resis Now our British and German confrères have court given way for the sake of international uniformity, there is now only one authoritatively recognized of writing Ohm's law all over the electrotechnical All other ways are either antiquated or irregular. important agreement could not probably have been r for many years without the aid of the Internationa trotechnical Commission.

Next on the list are various other rules and s which have been adopted provisionally. That is have been definitely adopted, but subject to possible amendments in detail, on the suggestion of a specia national committee, which is charged with carry the work of symbol standardization and with re its findings and recommendations to the next com meeting, at Berlin in 1913. Since, however, these rules and symbols have been under consideration, change, for more than a year already, it is not lik that they will be materially changed in the near future. other very important decision is that in relation to alternating-current diagrams, or vector diagrams as they a monly called. It will be remembered by those such diagrams that ever since 1887 there have b two

ferent schools of graphics on the subject; namely, those vo, taking the hour hand of a clock at 3 p. m. as representing an impressed emf in an alternating-current circuit, and the minute hand at, say, 3:20 p. m. to indicate, with Fleming, a lagging current; and those who, on the contrary, used the minute hand at 3:10 p. m. to indicate, with Kapp, the same lagging current. For more than twenty years our electrotechnical literature has been as needlessly divided into opposed schools of graphical representation and taught as were the big-endians and little-endians, who, in Swift's memorable story, brought their country to the verge of civil war over the question as to whether boiled eggs on the breakfast table should be opened at the big or at the little end. Nor has the controversy been limited to electrotechnical literature in the English language. Nearly all of the languages of the civilized world have suffered in this dissension. At Turin, without a single dissenting voice, the resolution was speedily voted on the motion of the British committee to adopt the 3:20 p. m. method, which was originally imported into the literature of the science by Fleming, whereby also the impedance of a choking coil becomes expressed by $R + jx$, as distinguished from $R - jx$. If the commission had accomplished nothing else than this decision, we think that the trouble and expense of its organization would have been amply justified, so important is a unanimous, authoritative international decision on this vector question to electrotechnics.

... I. E. C. also undertook to call and assign all future international electrotechnical congresses, and, in particular, accepted with thanks the invitation received through its ... an committee from the American Institute of Elec... ngineers to have an international electrotechnical congress held at San Francisco in 1915, in connection with the Panama Exhibition at that time. This action was taken ... request of the Turin Congress of Electrical Appli... and will result not only in greater uniformity of ...sses, but also in their better organization. Here... in one and the same year a commission meeting ... be held in one country and a congress in another. ...rmanent organization of the I. E. C. and its authori... character, under the auspices of various govern... and national electrotechnical societies, will aid in ...g such unfortunate conditions in the future. Presi... Dunn, of the American Institute of Electrical En... and ex officio member of the United States na... ommittee of the commission, extended the invitation on behalf of the board of directors of the American Institute for 1915. Meanwhile, a commission meeting is scheduled to be held at Berlin in 1913 and an invitation extended through the German national committee. In conformity with the suggestions offered in the retiring address of the ...ssion president, Prof. Elihu Thomson, the important questions of international rating of machinery and international electrotechnical nomenclature are left in the charge of international sub-committees, which are to report at the Berlin meeting. A fairly full account of the proceedings of the Turin meeting will be found on another page. For its success much credit is due to the permanent officers of the commission, as well as to their Italian hosts and to the members of the American committee.

STUDIES IN LUMINOUS EFFICIENCY.

A recent paper by Buisson and Fabry, dealing in an interesting way with the amount of energy necessary to produce the unit of luminous intensity, gave results which bring up some rather curious considerations. Buisson and Fabry worked with a quartz mercury arc and determined the number of watts radiated per mean spherical candlepower in the case of each of the brilliant lines of the spectrum. The values which they found were as follows: For the green light 546 $\mu\mu$, 0.018 watt per candle; for the yellowish pair 578 $\mu\mu$, an average of 0.031 watt per candle, and for the bright blue violet line 454 $\mu\mu$, 0.31 watt per candle. Dr. Ives in a recent paper in these columns (June 15, 1911) computed for the highest luminous efficiency possible in monochromatic radiation 0.0154 watt per candle at the wave length of this green mercury line, a most satisfactory agreement with the figures just given, considering the difficulty of the investigation from every standpoint. In the rough, Dr. Ives' figures indicate a possible efficiency of 65 spherical candles per watt, while Buisson and Fabry obtained 55.5 spherical candles per watt for the green mercury light. If one could obtain anything like this figure in practice he could cheerfully forgive the unwonted color. Approximately two-thirds of the light of the mercury arc comes from this brilliant green line. The value obtained for the efficiency of the yellowish radiation by the French investigators seems rather lower than it should be, considering the position of this radiation on the normal luminosity curve, and suggests possible corrections due to the particular intensity of the light under investigation with a corresponding position of the maximum sensibility. At high intensity there should be no such difference between the green radiation and the yellowish as is here shown. The efficiency of the blue violet line, on the other hand, is quite nearly what would be anticipated. This line, however, contributes so little to the total illumination that the loss of efficiency ascribable to it is very small.

So far as the efficiency of the luminous radiation is concerned, therefore, the results reached by the quartz mercury arc would be something altogether startling in the way of luminous efficiency. In point of fact, however, while the light is among those of the very highest efficiency, it actually returns only some four or five candles per watt, instead of forty or fifty. The rest of the energy seems to be frittered away in various incidental losses—losses at the electrodes, losses due to heating the tube and still other losses in infra-red and ultra-violet radiations of the metallic spectrum. As the tube runs red hot in the commercial quartz mercury arc, probably by far the largest part of the loss is in long-wave heat radiation from the tube quite separate from any radiation due to the mercury spectrum by itself. It is only another example of the difficulty of utilizing substances which give discontinuous spectra as practical illuminants. They promise fair, and the visible spectra may give prodigiously encouraging results, and yet through specific infra-red radiation, as in the case of the helium tube, or through the incidental losses here mentioned in connection with the mercury tube, the net result falls far short of the theoretical mark.

Meeting of the International Electrotechnical Commission at Turin.

The meeting of the International Electrotechnical Commission, which was held at Turin, has been notable for the number of countries and national committees represented, the unanimity of its decisions and the technical importance of its resolutions.

The following is a list of the delegates who attended the meetings, government delegates being distinguished by an asterisk: President of the commission, Dr. Elihu Thomson. Belgium: MM. A. Halleux, G. A. L'Hoest, E. Gevaert and O. De Bast. British Indian government: Mr. F. H. Mears.* Canada: Prof. L. W. Gill. Denmark: Mr. S. A. Faber and Prof. Absalon Larsen. Ecuador: Sr. Richard Muller. France: MM. R. V. Picou, H. Armagnet, P. Boucherot, E. Brunswick, M. J. Blondin, Ch. David, P. Janet, F. Laporte, R. Legouez and G. Roux. Germany: Prof. Dr. E. Budde, president and secretary of the Verband Deutscher Elektrotechniker; Dr. Georg Dettmar, Geh. Ober Postrat and Prof. Dr. K. Strecker. Great Britain: Messrs. Alex. Siemens,* W. Duddell, Major W. A. J. O'Meara,* R. K. Gray, Dr. Silvanus P. Thompson* and P. F. Rowell. Holland: Prof. Clarence Feldmann, president of the Electrical Section of the Dutch Society of Engineers, and Mr. L. M. Barnet Lyon. Hungary: Prof. Dr. Moritz de Hoor-Tempes. Italy: MM. Prof. Luigi Lombardi, president of the Associazione Elettrotecnica Italiana; C. Clevici, Prof. G. Grassi, E. Jona, C. Montù and P. Verole. Japan: Prof. Dr. A. Oya. Mexico: Sr. Alfonso Costello. Panama: The consul at Turin. Portugal: The consul at Turin, Il Barone Nasi. Spain: Sr. Don Luis de la Peña. Sweden: MM. C. A. Rossander and E. C. Ericson. Switzerland: MM. C. Prof. J. Landry and K. Täuber. United States: Messrs. C. O. Mailloux,* Gano Dunn,* president of the American Institute of Electrical Engineers; A. E. Kennelly, C. H. Sharp. General officers of the commission: Col. R. E. Crompton, honorary secretary; Mr. C. le Maistre, general secretary, and Mr. E. Litton, assistant. Personally invited: Mr. Leon Gaster, honorary secretary of the British Illuminating Engineering Society and representative of the London Chamber of Commerce.

The total number of countries represented was nineteen, the number of delegates in attendance being fifty-one.

The first session on Sept. 7 was opened with an address by His Excellency Signor Calassano, Italian Minister of Posts and Telegraphs. This was followed by an address from the retiring president, Prof. Elihu Thomson.

Professor Thomson called attention to the large recent development of the commission as an international organization and to the rapid progress of its work. He pointed out that the settlement of the questions now pending before the commission was of very great importance to electrical engineers all over the world and that other questions of similar importance would no doubt soon call for consideration. He suggested the desirability of appointing small international sub-committees to carry on the work of the commission during the periods between the official meetings of different years.

Dr. E. Budde, the president of the Verband Deutscher Electrotechniker, was elected as president of the commission to succeed Dr. Elihu Thomson. The proposal emanated from M. Picou, the president of the French committee, and was unanimously adopted.

Four subjects were dealt with by the commission in the sessions of Sept. 8, 9 and 11. The sessions of the eighth and ninth lasted about five hours each day and were sessions for the unofficial discussion of the subjects. The official meeting on the eleventh was devoted to a formal ratification of the written decisions as reached at the previous sessions. The four subjects related to (1) international nomenclature; (2) international symbols; (3) international diagrams for alternating-current quantities; (4) international rating of electrical machinery and apparatus. The place and ti of future meetings and the organization of future electric congresses were also subjects of discussion.

These subjects had all been discussed to some extent the preceding reunion of the commission at Brussels August, 1910, and the questions under consideration h been placed before the various national committees printed form about a year ago.

In brief, the action taken at the Turin meeting w definite on all four subjects. In relation to nomenclatu a list of international terms was adopted provisionally, t further pursuance of the subject being left to a small su committee. An international list of symbols was adopt provisionally, and the three symbols entering into t algebraical expression of Ohm's law were adopted defini ly. Definite action was taken on the direction of pha rotation in alternating-current diagrams and the report the Brussels conference in relation to international rati of machinery was adopted, a sub-committee being appoin to continue work upon the subject. In particular it w recommended that both the electrical power of generat and the mechanical power of motors should be expressed international watts.

The following resolutions were provisionally adopted regard to international symbols:

(1) Instantaneous values of electrical quantities wh vary with the time are to be represented by small letter

(2) Virtual or constant values of electrical quantitie be represented by capital letters.

(3) Maximum values of periodic electrical quantitie be represented by capital letters followed by the s script "m."

(4) Magnetic quantities, constant or variable, to be r resented either by capital script, gothic, heavy-faced any special type.

(5) Maximum values of magnetic quantities to be re sented either by capital script, gothic, heavy-faced or special type, followed by the subscript "m."

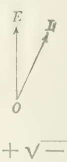
(6) The following quantities to be represented by following letters:

Electromotive force....................	E, e
Electric quantity......................	Q,
Self-inductance (coefficient of self-induction)............................	L
Magnetic force..........................	$\mathcal{H}$
Magnetic flux-density..................	$\mathfrak{B}$
Length..................................	L,
Mass....................................	M,
Time....................................	T,

The following letters were definitely adopted for international representation of the quantities entering the algebraical expression of Ohm's law:

Current	I
Electromotive force	E
Resistance	R

The name "reactive power" was adopted for the qua $UI \sin \varphi$ in relation to alternating-current circuits, U t the virtual potential difference, I the virtual current a the difference of phase.



In regard to alternating-current diagram t following resolutions were adopted unanimo In the graphical representation of altern electric and magnetic quantities advance in as shall be represented in the counter-clockwis direction. In consequence, the impedance of a ac tive coil of resistance R, and inductance L, is $R + \sqrt{-1}\, L\,\omega$, and that of a condenser of capacity is

$$\frac{1}{\sqrt{-1}\, C\,\omega},$$

where ω is equal to $2\pi \times$ frequency.

t follows also that the diagram herewith represents the pase relations in a simple alternating-current circuit containing an impressed emf OE and a lagging current OI.

t was decided that the next official meeting of the commission should be held at Berlin in 1913, an unofficial meeting, if needed, to be held at some intermediate date.

Mr. Gano Dunn, as president of the American Institute of Electrical Engineers, invited the commission to hold an official meeting at San Francisco in 1915, on the occasion of the Panama Pacific Exposition, to be held in celebration of the opening of the Panama Canal. He announced that the American Institute of Electrical Engineers was desirous of holding at the same time an international electrical congress, that the board of directors of the Institute had already passed resolutions authorizing the congress and had instructed him to appoint a committee of organization, provided that an expression of opinion favorable to the holding of such a congress was obtained from the commission at its meeting in Turin. The meeting thanked Mr. Dunn for the very cordial invitation of the American Institute of Electrical Engineers and adopted the following resolution:

"The International Electrotechnical Commission expresses its willingness to hold an official meeting at San Francisco ...5, and instructs the central office, on the request of ... American Institute of Electrical Engineers, to co-... with it in the organization of an International Elec-... Congress at San Francisco at the same time."

... unofficial meetings of the commission were ably pre-... over by Prof. Luigi Lombardi, the president of the ...zione Elettrotecnica Italiana. Mr. C. O. Mailloux, ...sident of the American committee, rendered valuable ...s at all of the sessions of the commission by acting ... interpreter, not only between the official languages of the commission—English and French—but also between these and the German, Spanish and Italian languages.

... social events of the commission's visit to Turin were ...l with great care by the Italian committee. At one ... dinners a souvenir in the form of a picture was ...ed by a number of the delegates to Prof. Elihu ...on in recognition of his valuable and highly recog-... services to the commission as its president. The ...ry secretary, Colonel Crompton, acted as master of ceremonies on this occasion.

... plenary meeting of the International Electrical Con-... on Sept. 13 it was unanimously voted that the Inter-...al Electrotechnical Commission should be requested ...anize in the future all international electrotechnical congresses, so far as concerned their dates and places of meeting, the details of the organization being referred to the national committee of the country in which the con-... to be held, and through such committee to the local ...l electrotechnical bodies.

... council meeting of the commission, held later in the ...e council declared its readiness to undertake the task of organizing future international electrotechnical congresses. The council also accepted the invitation transmitted through the American committee in regard to holding a congress at San Francisco in 1915. This invitation emanated from the board of directors of the American Institute of Electrical Engineers.

The success of the official work of the commission was largely due to the ability of its executive staff, headed by the general secretary, Mr. C. le Maistre.

The meeting of the committee was held in the handsome assembly hall at the Prefettura in Turin, which was placed at the disposition of the commission by the Provincial Council. The success of the arrangements for the meetings was largely due to the able and cordial services of the Italian national committee, its president, Signor Luigi Lombardi, professor at the University of Naples, and its secretary, Signor Guido Semenza, of Milan.

International Electrical Congress of Turin.

Among the pleasant features of the International Congress of Turin not noted in our issue of last week were the presentation to Prof. Antonio Pacinotti of a memorial album and a formal visit to the monument of the late Prof. Galileo Ferraris in Piazza Castello. The album was offered by the Italian Electrotechnical Association, which invited members of the congress to be present on the occasion. The presentation was made by President Lombardi, and other addresses were made by Professor Mengarine, of Rome, and Prof. S. P. Thompson, of London. Upon the visit to the statue of Professor Ferraris three crowns were placed on the pedestal; one, of bronze, offered by the French members of the congress; another, also of bronze, by the American members of the congress, and a third, of laurel, by the city of Frankfort-on-Main. M. Ferdinand Meyer, in the name of French electricians, and Mr. Philip Torchio, in the name of American electricians, made short addresses; Mr. Hartmann, of Frankfort, offered the wreath from the city of Frankfort as a recognition of the leading part which Professor Ferraris had taken in the work of the International Exposition held in that city in 1898. The Mayor of Turin, in the name of the city, thanked those taking part in the tribute to the memory of the great savant who had honored Italy.

PROF. LUIGI LOMBARDI,
President Turin International Electrical Congress.

At the reception given to the congress by the municipality on Tuesday, Sept. 12, President Lombardi, Mr. C. O. Mailloux and several others delivered addresses in response to the address of welcome by the Mayor. At the banquet on Wednesday, Sept. 13, at which ladies were present, President Lombardi and officials of the city and province greeted the guests, and thanks for the reception were tendered by representatives of the various countries taking part in the congress. The total of registrations at the congress up to its close was about 450.

At the general session of the congress on Sept. 13 but one subject was discussed, namely, the manner of providing for future congresses. Prof. Clarence Feldman, of Holland, made a motion on the subject which was seconded by Prof. S. P. Thompson, for Great Britain, Mr. C. O. Mailloux, for the United States, and by members representing other countries. The motion, which was carried unanimously, requested the International Electrotechnical Commission to accept the task of the organization of future electrotechnical congresses, both as to dates and places where they were to be held, the charge of details of each congress being confided to the international electrotechnical committee of the country in which the congress will be held,

which committee will invite the assistance of the electrical societies in that country.

At the final general session, held on Saturday, Sept. 16, a number of important resolutions were adopted, which resolutions had been submitted for action at the general session by various sections of the congress.

METRIC SYSTEM.

A resolution proposed by Section 3 of the congress and unanimously approved was as follows: The International Congress of Electrical Application of Turin congratulates the American Institute of Electrical Engineers on its practice of giving in its publications, within parentheses, the equivalent in the metric system of values expressed in English measures. Since this practice facilitates greatly the reading of electrical literature in all countries employing the metric system and at the same time constitutes an excellent precedent toward a complete unification of international weights and measures, the congress recommends that all countries not having adopted officially the metric system shall follow the example of the American Institute of Electrical Engineers.

ILLUMINATING ENGINEERING.

Proposed by Section 4 and unanimously approved: The congress believes it to be desirable that an international committee be named for the study of various systems of lighting and of technical questions relating to lighting; and having been informed that the Illuminating Engineering Society of London intends to constitute such a committee, which will maintain relations with all existing national and international photometric bodies, the congress approves this initiative.

TRAIN ACCELERATION.

Proposed by Section 5 and unanimously approved: The committee of the fifth section of the congress, to which was referred a proposition by Mr. C. O. Mailloux concerning the definition and the practical measurement of acceleration of trains, reported the following conclusions: In view of the fact that in practical traction work the speed of trains is always expressed in kilometers per hour (or in miles or in versts per hour) and that this usage is absolutely universal; that it is logical, following this definition of speed of trains, to express acceleration per second; that this definition of acceleration of trains is solely employed in America and is also used in other countries; that this proposition was received favorably at the Marseilles International Congress of 1908; therefore, the congress recommends that the acceleration of trains be expressed in kilometers per hour per second (or in miles or versts per hour per second).

LEGAL UNITS AND ELECTRICAL REGULATION.

Proposed by Section 8 and approved unanimously: In view of the fact that electrical legislation is being enacted in various countries and that each country will establish statutory units and regulations governing public works and other electrical installations, it is recommended: 1. That in any legislation scientific matters shall be sharply separated from matters relating to regulation. 2. That scientific matters shall be revised and fixed by a permanent electrical commission in each country. 3. That in each country there be established regulations which, without affecting local rights, will permit the easy and prompt execution of installations.

TAX ON ELECTRICAL APPLICATIONS.

Proposed by Section 8 and unanimously approved: In view of the fact that the extension of the applications of electricity has been of great economic benefit to the world; that it is to the interest of every country to encourage the development of the industries engaged in the production, distribution and application of electrical energy; therefore, fiscal action of governments in relation to the electrical industry should be within reasonable limits, in order not to trammel its development; that of all the applications electricity electric lighting is the only one upon which fiscal burden can be placed, provided that this bears proper relation to other systems of lighting and is not su ject to arbitrary action upon the part of local governi bodies; that, finally, any tax on electric heating woı absolutely prohibit its industrial application has been de onstrated in countries where such a tax exists; therefo it is recommended:

1. That countries shall not place a tax on the producti or sale of electrical energy, with the single exception private electric lighting. 2. Such a tax should be so fi l and applied as not to put electric lighting at a disadvant with respect to other methods of lighting. 3. That ad tional municipal taxes should not be left to the discret of municipalities, but regulated by the state and k within limits fixed in advance. 4. That financial statis should be compiled to accord with statistics of operat and should include all the information necessary to m them useful for reference.

ELECTRICAL EDUCATION.

A number of members of the congress, including Mr O. Mailloux, submitted a resolution asking that the international electrical congress shall include a section education. The resolution was accepted by the congres a recommendation and the president was requested to r it to the committee on organization of the next congres

Abstracts of the various papers presented before congress, and of their discussion, will appear in the i of next week and in following issues.

Wireless Telegraph Patent Decision.

Judge Hale, of the United States Circuit Court for District of Maine, handed down at Portland, Me., Sept a decision sustaining the fundamental claims in a p (No. 706,736) issued to Prof. R. A. Fessenden on Aug 1902, on an application filed Dec. 15, 1899. The paten thirty-five claims, of which sixteen were sustained an he bill dismissed as to the other nineteen claims, some of ich were not in issue.

One of the objects of the Fessenden invention, as s in the patent, was to replace the coherer by a receiver ich is constantly receptive. The coherer is normally non ductive and does not respond to other than max activity on the wireless circuit, and after being ren conductive must be restored to its normal or non-cond condition. The inventor proposed to substitute for thi tem one in which the wave-responsive device is self-r ing and always capable of being affected by the wave not, as in the case of the coherer, incapable of respo waves for a portion of the time.

Two of the claims of the patent are on a transmitte tem, including a closed tuned circuit adjusted to r trains of electromagnetic waves in which a single freq is predominant, together with a receiver system, incl first, a closed circuit, tuned to said predominant freq and second, a current-actuated, wave-responsive c Another claim is for a system of wireless transmissi electromotive waves; apparatus for utilizing the ene o said waves, including in combination a conductor con structed and arranged to cause the energy of each w e to develop electric current flow; means for rendering th current flow persistent and for co-ordinating the curre developed by successive waves to cause them to act c ulatively upon each other to produce an increased o reinforced resultant-current flow; a means operated b said resultant-current flow to produce a sensible effect in dication.

The opinion states that at the time of the applicati for the present patent in 1899 there were only four nited States patents on wireless telegraphy, three of whi had

[...]len issued to Marconi and the other to Lodge. One of t[...] experts in the suit is quoted to the effect that the present i[...]ention is the first disclosure of wireless telegraphy in [...]ich the sending and receiving apparatus is adjusted to i mutual maximum effect, not merely with the adjustment [...] mast-wire to mast-wire, as in the prior art, but with the [...]nforcement due to the additional effect of a tuned local [...]cuit, including the spark-gap at the sending station, and [...]uned local circuit, including the detector, at the receiving [...]tion; and that this is the first disclosure in the art of [...]reless telegraphy of the above conditions in conjunction [...]h a current-operated wave detector, it being added that t[...] presence of the coherer is inconsistent with the complete t[...]ng which is obtained under a current-operated, wave-[...]ponsive device. Imperfect electrical contact, the court [...] was at the basis of electric-space telegraphy, and until [...]len made his invention there had never been a wire-l[...]-telegraph system except such as employed the voltage-[...]rated coherer. In such a system no tuning whatever [...]ld be had beyond getting the two antennas into reson-a[...]e with each other, and in order to do this the coherer [...]t be taken out of the circuit on which the current had [...]

[...] the defense that the patent does not disclose inven-[...]e court states that the idea of Fessenden was to dis-[...]e method of operation by the imperfect contact and [...] current-operated, wave-responsive device operated [...] a good circuit contact, its purpose being not to [...] big waves to "knock down" the detector, but to [...]n open door through which every wave could flow, [...] which he could have a constantly receptive receiver [...]l by all the waves all the time. Marconi, he said, [...] a system of definite signals without wires, and while [...]ention of Fessenden is not entitled to be pronounced [...]portant an invention as that of Marconi, the [...]onsidered it to be a pioneer invention which gave [...] direction to the progress of the art. The imperfect [...]al contact was at the basis of space telegraphy until [...]len made his invention. No tuning could be ob-[...] with the use of the coherer except to get the two [...]s into resonance with each other. What was [...]l with the coherer was to have all the energy of the [...]f waves bunched into one wave, so as to knock down [...]truction of the detector—to weld it into good con-[...]d let the current through it. Marconi's idea was to [...]r the purpose of getting a big wave, while that of [...]len was to make a current out of all the waves. [...]he latter system the current-operated, wave-respon-[...]vice is always in a circuit that is to be tuned, while [...]e presence of the coherer all the tuning that could [...]e was from mast to mast. The court concluded that [...]te tuning, therefore, was possible only in such a sys-[...] that of Fessenden, and that the tuning of the prior [...]s essentially and typically different from the tuning [...]d in Fessenden's invention.

[...]o anticipation, the defendant cited the prior patents o[...] Marconi and Lodge, and also an article by Messrs. North-r[...] Pierce and Reichmann, which appeared in the *Electrical World* of Dec. 18, 1897. The court states that after careful [...]f the record it is persuaded that the defendant has [...]wn that the patent is void by reason of anticipation. A[...] infringement, the court held that as the receiver of th[...] defendant is susceptible to the action of every current, la[...]e or small, and is not dependent for action upon high v[...]ages, it is current-operated and not voltage-operated; th[...] it responds to action of all the waves of the train in-st[...]d of only to some of them, and enables the effect of all th[...] waves to be added together. The testimony of an ex-pe[...] is quoted as establishing that the so-called crystal de[...]ctors are current-operated detectors, and therefore be-lo[...] to the same class as that disclosed in the patent in the su[...] since they do not change their electric conducting pr[...]erties from wave to wave, but behave to one wave in a group as impartially as they behave to another, having good contacts instead of poor, shaky or powder contacts. The court also held that the tuning of the defendants is not merely the crude tuning of Marconi and other predecessors, but is substantially the tuning of the Fessenden patent. In conclusion the court held that it cannot be said that the invention of Fessenden presents a solution of all the great problems in electric telegraphy without wires, but it can be claimed that it opens a little wider the door of invention in the art of wireless telegraphy. The decision will be appealed to the United States District Court.

Los Angeles Municipal Hydroelectric Plant.

In accordance with instructions from the Public Service Commission of Los Angeles, Cal., Mr. E. F. Scattergood, chief engineer of the city power bureau, has presented to the commissioners a report of recommendations for the commercial distribution of electric energy to be generated by the proposed municipal power plants along the route of the aqueduct.

According to estimates made in May, 1910, the cost of a complete distributing system for supplying all street lights and all commercial light and power within the city limits, an area of approximately 100 sq. miles, excluding railways, was $4,250,000. This included all underground conduits and overhead poles, with cables and wires sufficient for an excess of 50 per cent greater business than that realized in such year. It also allowed for all connections, transformers and meters, together with the necessary substations and shops. According to a similar estimate just now completed, the cost of such additions as would be essential to provide for the probable business of the year 1913 gives a total of $5,500,000.

An estimate has also been made of the total yearly cost of operating and maintaining the necessary hydroelectric system and distributing system to care for the business mentioned, assumption being made that the city enjoyed all such business. An allowance of $50 an arc lamp for street lighting was made, as against the present rate of $75.60 a lamp per annum, and a base rate of 6 cents assumed for commercial light and power. The results of these calculations show that with this total consumption a net profit to the city of $700,000 per annum would be derived after deducting from the earnings all operating and repair expenses, interest on the entire investment, depreciation of the total property and a sinking fund allowance for canceling the bonds. During the year 1913 the business will probably be 60 per cent greater than in 1910.

With reference to the matter of auxiliary steam plants the report states that the expense connected with providing for and maintaining these must necessarily be met by corresponding increase in rates to consumers and should be incurred only so far as the added reliability of service would justify such rate advancement, viewed from the consumer's standpoint. The preliminary report of the consulting board of engineers for the power project states that an auxiliary plant is not deemed necessary, as the probability of serious interruptions of service would be too remote.

The proposed hydroelectric power plant, including penstocks, power houses and transmission lines, would be more reliable than a steam plant properly located to furnish service to the city. The installation as planned will not require more than 200 sec.-ft. average flow, and the capacity of the Fairmont reservoir would be sufficient to operate the plant for a period of eighteen days, allowing time for any necessary repairs above such point.

The street-lighting contract for the coming year must necessarily be determined independently of the question of providing for a complete municipal distributing system, because of the time requirements. Assuming that the companies furnishing the lights were not required to make ex-

tensions to the existing system, $60 per arc lamp per year, the report states, would conform to the present rates for commercial light and power. The present number of arc lights is 3200, with a contemplated addition of 360 during the coming year; the total cost to the companies providing such additional lights should not exceed an average of $150 per lamp, including the cost of pole-line extension and complete erection. The difference between the present contract price of $75.60 per arc lamp per year and $60, as above, applied to the total of 3560 lamps would more than defray the entire expense of installation. The report adds that the installing at the city's expense of such additional lamps as will be necessary, the same to be the property of the city, with a reasonable rate for street lighting for the entire system, would be the most economical.

In connection with this report the Public Service Commission has instructed its attorney, Mr. V. B. Mathews, to draft a resolution requesting the City Council to call a special election at once for the purpose of voting on a bond issue of $5,500,000, the figures mentioned by Mr. Scattergood for a municipally owned distributing system. This is to be ready for service on or before Jan. 1, 1913.

The commission announces its intention of disregarding any suggestions for a leasing of the systems of any of the private companies or for the selling of power in blocks to these for distribution, favoring a municipal service to consumers direct.

Public Utilities from the Civic Standpoint.

On Monday afternoon, Sept. 25, the International Municipal Congress, which has been holding a two-week convention and exposition in the Coliseum, Chicago, Sept. 18 to 30, gave over its session to the discussion of public utilities, with Mr. Bion J. Arnold, of Chicago, acting as chairman.

Mr. Arnold opened the meeting with a brief review of the conditions leading up to the establishment of public-utility commissions, which are now found in many states. The last thirty years, he said, was a period of rapid advance, during which inventors and engineers were producing many new ideas which the capitalists were busy financing and promoting. As a result franchises were granted easily and on liberal terms, often being awarded to competing undertakings. Later, these competing corporations, compelled to combine and absorb by economic conditions, produced monopolies, the privileges of which, as well as the financial management, were sometimes abused. Allowances were not made for depreciation, and in some cases even maintenance was not provided for, so that as the original franchises lapsed the corporations found themselves without the means of rehabilitating their badly run-down plants, and so heavily capitalized as to preclude their raising further funds. About this point the commissions were developed, and the problems of regulating have since been undergoing solution in many cities and states. In conclusion Mr. Arnold declared he believes that where a company has been judiciously managed the differences between property value and invested capital, represented by promoter's profit, fees, etc., should also be allowed to earn a fair rate of return for the investors, all over such a fair rate being turned back into an amortization fund to retire the burden of these early costs, so that finally the physical value shall equal the capitalized value of the plant.

In discussing "Public Lighting" Mr. E. L. Elliott, editor of the *Illuminating Engineer*, next referred to the close interrelation between the development of municipal methods and public lighting. Modern street illumination, he said, is not alone a matter of putting up as many lamp-posts as there are funds for in the city treasury, but the character of the illuminants and their location should be carefully considered. After mentioning the shortcomings of the early open and inclosed-carbon arcs the speaker enumerated the yellow-flaming arc, the white-flaming arc, the magnetite a and the tungsten incandescent lamp as the present practi l street-lighting units. The custom of using magnetite a with clear globes he declared to be highly objectionable a a return to the primitive conditions of glare surroundg the old open arcs. The reason for this clear glass, Elliott explained, is one of economy, for white-opal gl ware cuts down the light greatly from the bluish-magn arc, although having small effect on that from the ru flaming arcs and tungstens.

While post-tungsten lighting is more expensive t n the crude and simple arc fixtures, the handsomer e t secured by both night and day is greatly to be des Even the coarsest elements of humanity have an instinc regard for beauty, said the speaker. As an incident il trating this fact he cited the great reduction in mischie breakage of glassware when the former ugly square lamps in New York were replaced by the present circ globes. Mr. Elliott also showed how the type of fixt should be made appropriate to the proportions of the st they light, and spoke of the efforts to project more of flux from street lamps in the useful directions along roadway by means of prismatic glassware and reflec The speaker also made a strong plea for better and a park lighting, arguing that as the evening is the only of leisure for the masses the parks should be either t oughly lighted or closed to remove opportunities for vic ness and immorality.

A paper by Mr. H. M. Byllesby, Chicago, was next in Mr. Byllesby's absence by Mr. Arnold. After revie the events of the last quarter-century, the accomplishn of engineers and inventors and the undertakings of moters and capitalists in carrying out these developn Mr. Byllesby called attention to the decrease in price v the commodities made and sold by public-utility cor tions have undergone in late years. In many case said, the companies have even extended their services unproductive fields at a loss.

The public and the corporations are fast approach common meeting ground, wrote Mr. Byllesby, and th of fair dealing between corporations and the public corporations and the government is at hand. In the p utility commissions the demand of the companies is onl able, experienced men, familiar with utility manag and themselves men of some accomplishment. The will then better realize that the utility corporations s be encouraged rather than strangled, and their bene monopoly will be protected.

Mr. Arnold then called upon Mr. W. D. Norton, for assistant secretary for the New York Public Service mission of the First District. Refuting the claim that mission regulation is expensive, Mr. Norton explaine the body under which he served and which has jurisc within the limits of New York City has besides its numerous duties succeeded to the functions of the f rapid-transit commission, an organization with an $8 yearly budget and employing an engineering staff o The present budget of the Public Service Commissio more than a million dollars, is even less than the ex rate of growth of that of the old transit commission Mr. Norton also spoke of the advantages of unifo counts and reports.

In answer to questions from the audience Mr. brought out the point that while a street railway have "going value," like a gas or electric-light plant has expended funds to develop its business, the r lway company should be given an opportunity to retrieve it early losses, as he before outlined.

Mr. W. H. Buist, of Dundee, Scotland, said that in Great Britain it is a notable fact that the municipal plan are the best managed, most stable and furnish the best service The Edinburgh railways, he said, under private management with municipal division of profits have giver much

rouble, while the municipally owned Glasgow roads are in flourishing condition and last year paid $500,000 net profit. Municipally owned utilities in Great Britain, said Mr. Buist, are by their charters required to pay off their capital debts in a limited time.

Mr. Arnold said that thus far in America it is believed better results can be obtained with private management under regulation. The talent required for efficient management, he said, requires something more than merely the usual rate of interest or salary returns.

Library of the United Gas Improvement Company.

An address on the subject "Technical Literature Abstracts and Information Bureau Work in the Library of the United Gas Improvement Company" was made at the annual meeting of the Special Libraries Association, Engineering Societies Building, New York, on Sept. 27 by Mr. F. N. Morton. The address explains the origin and broad scope of the extensive library of the United Gas Improvement Company.

Mr. Morton, the librarian, is a graduate of a technical college, and has spent seventeen years serving in all departments of the gas and electric business, both technical and commercial. It was intended at first that the principal work would consist of keeping the various officials and heads of departments informed of the current progress and development in subjects in which the company is interested. This is done by a system of abstracts. The work has broadened, however. The forty periodicals taken by the company are read, and abstracts are made of all articles of interest. The abstracts are arranged and classified for filing. They are issued at intervals of about ten days. Many requests for general information are received, and in such cases special reports are prepared. For the responses to many important questions asked of the librarian technical knowledge is essential.

Chicago Convention of Illuminating Engineering Society.

About 135 members and visitors, including several ladies, attended the opening session of the fifth annual convention of the Illuminating Engineering Society in the Congress Hotel, Chicago, on Monday morning, Sept. 25. Mr. V. R. Lansingh, of New York, vice-president, presided and introduced Mr. John F. Gilchrist, of Chicago, chairman of the convention committee, who welcomed the visitors. The response was made by Mr. Joseph D. Israel, chairman of the Philadelphia Section.

PRESIDENTIAL ADDRESS.

In the absence of Dr. A. E. Kennelly, of Harvard University, president of the society, who was in Europe as American delegate to the meetings in Turin of the International Electrotechnical Commission and the International Electrical Congress, his presidential address was read by Vice-president Lansingh. Dr. Kennelly chose as his subject "The Relations of Physico-Physiological Research to Illuminating Engineering," and in a brief paper he considered the closeness of the connection between apprehension and accomplishment in the measurement of light. The writer showed that every science is developed from the complex and manifold to the simple and unique. The number and degree of precision of the measurements in a branch of science gage the extent to which that branch has become exact. In illuminating engineering it would be useful to possess a knowledge of certain physico-physiological constants for the human eye. "We ought to know," says the president of the society, "the lumens per area-watt produced in the normal eye for each color and its frequency, as well as for all working intensities." In short, the address was a plea for "the accumulation of observations on the photometric properties of our eyes by all who may have the opportunity to make them."

Dr. E. P. Hyde, of Cleveland, moved that the address be referred to a committee and that at the same time the society express its regret at the absence of its honored president. Messrs. J. R. Cravath, of Chicago; E. P. Hyde, of Cleveland, and W. H. Gartley, of Philadelphia, were appointed as this committee.

NOMENCLATURE AND STANDARDS.

In the absence of Dr. Alex C. Humphreys, of Hoboken, N. J., the report of the committee on "Nomenclature and Standards" was read by Mr. Joseph Langan, of New York, assistant secretary of the society. The report consisted of a progress report from the subcommittee on photometric units, signed by the chairman, Dr. Clayton H. Sharp, of New York. The sub-committee reported some progress and concluded with two recommendations. One was that the term "lighting" be used to designate the product of luminous flux by the time, the symbol therefore being L. The L then would displace the Q used as a symbol for this quantity in the 1910 report.

The other recommendation relates to symbols to represent candle-power and flux. These cannot be represented here for the reason that their reproduction would involve the making of engravings for that purpose. It may here be remarked that this consideration will also render it difficult to secure the adoption of the symbols, which would involve the casting of special types or the addition of special matrices to the magazine of linotype machines. Even should special type or matrices be available, few printing offices would carry them in stock, and in cases where this was done the characters would, owing to infrequent use, be apt to become mislaid. These conditions applied to the special characters (French script) adopted to represent magnetic quantities at the Chicago International Electrical Congress of 1893. An American type founder was induced to make matrices from which to cast these special characters and a number of printing offices were induced to purchase the corresponding type. The experience was, however, that in time the special type could not be found when needed and finally the type founder ceased to make it owing to the small sale.

The recommendation is that the symbol for mean spherical candle-power shall be $I\,\Theta$, with the horizontal bar of the Greek letter projecting on each side; for mean upper hemispherical candle-power the letter I followed by a symbol representing the upper half of the special character; for the mean lower hemispherical candle-power the letter I followed by the lower half of the character; for total flux, $F\,\Theta$; for the upper or lower hemispherical flux the letter F followed by the upper or lower half of the special character. The report states that these symbols were proposed by Professor Blondel and differ but slightly from those used in Germany, the difference being that the bar is carried a little beyond the circle on each side. The committee further recommends that negotiations with individuals and societies in other countries be carried on with a view to an international conference on the adoption of the symbols proposed.

Dr. A. S. McAllister, of New York, presented a written discussion on this report which was read by Mr. P. S. Millar, of New York, general secretary. Dr. McAllister pointed out that confusion would very likely arise by the use of the same letters of the English alphabet for symbols for both electrical and photometric units, citing the well-known E, I and R of Ohm's law as already widely in use. The writer recommended the use of the Greek letters ψ (psi) for light flux and β (beta, lower case) for light flux density, on account of their similarity to the symbols for magnetic flux. It was also pointed out as a practical objec-

tion that the symbols recommended by the sub-committee could not be set in type in the ordinary printing office.

REPORT ON PROGRESS.

The report of the committee on progress, submitted by Dr. Louis Bell, of Boston, chairman, was read by Dr. P. W. Cobb, of Cleveland, in the absence of the author. The committee reviewed the progress of the year in relation to luminous and flaming-arc lamps, small intensive-arc lamps, the quartz-mercury arc and the Moore tube filled with neon. In electric incandescent lamps some reference was made to the wire-drawn tungsten. The improvement in mantles for gas lamps was commented upon and there was some reference to high-pressure gas lighting and to the pressure-wave system for the lighting of gas street lamps. In methods of illumination the most notable tendency has been toward the use of indirect and more especially semi-indirect lighting. Reflectors have been undergoing steady improvement. During the year the American Association for the Conservation of Vision was founded, and the report concluded with the recommendation that the society co-operate with foreign commissions to report on methods of illumination in their practical bearing on vision and on industrial processes.

Mr. George S. Barrows, of Philadelphia, a member of the committee, elucidated some references in the report to high-pressure gas lighting and to the pressure-wave system of lighting gas street lamps. Mr. J. G. Henninger, of Cleveland, spoke of the great improvement in metallic reflectors and said that reflectors are now available that are four or five times as good as those on the market a year ago. It is quite practicable to get 65 per cent of the total flux in the lower hemisphere and in some few cases a figure as high as 90 per cent has been reached. Mr. Rose, of Schenectady, spoke of the inclosing of the arc of flaming-arc lamps as a method of increasing the life of the lamp. This method increases the life of a lamp to a considerably greater extent than the figure mentioned in the committee's report. Mr. E. L. Elliott, of New York, said that it was not advisable to use simply clear glass globes with a magnetite arc. He advocates inner globes. The light should be diffused even at the loss of efficiency. The speaker deprecated glare in illumination.

Mr. L. B. Marks, of New York, pointed out the advancement that had been made during the year in systems of lighting. Particular progress has been made in the use of systems of general illumination, supplemented by local illumination where necessary. Under the old plan in factories and industrial establishments it has been the practice to use a drop lamp with an opaque reflector over the special object to be illuminated. The tendency of to-day is to get away from that strictly localized system of illumination and modern factories are illuminated in an entirely different way, placing greater stress on general illumination even at greater cost. Mr. J. R. Cravath, of Chicago, also pointed out the importance of more general lighting and less localized lighting. Not only the quantity but also the quality of light should be considered. Mr. Cravath also expressed some surprise at the high figures of efficiency of reflectors reported by Mr. Henninger. Mr. W. M. Skiff, of Cleveland, spoke of the use of low-voltage miniature lamps on machines in factories to direct light at the exact point where especially good illumination is desired over a small area.

PAPERS RELATING TO GLASSWARE.

Monday afternoon's session was devoted to the reading of papers on glassware. Three of these were contained in a "Symposium on Illuminating Glassware." The introduction to this symposium was prepared by Mr. Bassett Jones, Jr., of the papers committee, and was read in his absence by Prof. W. E. Barrows, Jr., of Chicago. The three papers following were written by representatives of manufacturers of glassware for illumination. The first, by Mr. George H. McCormack, of New York, was read in the absence of the author by Mr. Godinez. Mr. McCormack said in his paper that the evidence of monotony in design is one of the most difficult problems to be solved by the manufacturer of shades. Intrinsic brilliancy demands serious consideration also. The modern reflector must be of a type which may be scrutinized from below with perfect eye comfort. Depolished inner surfaces give excellent results and produce no glare. With reference to opal glass (opalux) the transmission of light through it is accompanied by perfect diffusion from the minute particles of opal suspended within the glass, and it is this effect which lends the sparkle, color and life characteristic of opal in reflector or inclosing-bowl form.

Mr. A. J. Marshall, of New York, the author of the second paper in the symposium, described the Holophane system of illumination as it now stands. In this system are included (1) prismatic semi-inclosing and totally inclosed globes and (2) prismatic reflectors. These two classes are combined in one-piece and two-piece units and also with other glassware, as satin-finish, opal and tinted glassware. The principles governing the designing of prismatic-glass globes were traversed, as well as the construction of prismatic reflectors. Various combinations and fixtures were described and illustrated.

The third paper of the symposium, written by Mr. L. W Young, of New York, related to Alba glassware and was read by Mr. S. G. Hibben, of Pittsburgh. The glass described is of a clear or crystal base, holding in itself by a species of colloidal suspension a very great number o infinitesimal flakes. These flakes act to give color to the glass, to break up the rays of light and to aid in the reflection of light. Lantern slides were given to show the characteristics of Alba shades, globes and special shapes As to the efficiency of transmission of this glass compared with other glasses, these figures were given: Standard crystal roughed inside globe, when new and clean, 16.7 per cent; thin opalescent, 15 per cent; regular Alba, 13. per cent. Artistic effects in this glass are now being obtained in a large and increasing number of special shapes

The paper by Mr. E. H. Bostock, of New York, on "Th Manufacture of Glass for Illuminating Purposes" wa abstracted by Secretary Millar. Glasses are described b this author as structureless solids. Manufacturing processes and methods of coloring were described, and reflecting glassware is taken up in the second part of the pape Prisms of glass may be arranged with reference to strengt of light flux to make almost a perfect distribution. The au thor says, however, that for diffusive lighting, the newes and the best development is that of the already well-know phosphate glasses. One great objection to the use of prisı glass has been that its sharp-drawn straight lines do n conform to any decorative scheme. Recently, however, wave-line prism glass has been placed on the market. Th glass, at any section, shows the true definite-angled prisr but its wavy line fits it for use in decorative schemes.

"Modern Requirements of Reflector Design" was th title of a paper read by Mr. F. L. Godinez, of Jersey Cit N. J. The author goes into the technical requiremen of reflector design and pays considerable attention to tl ultra-microscope as affording a means of rendering visib the most minute particles within the structure of glas Mr. Godinez thinks that glassware embodying a proper r lation between transmission phenomena and selective a sorption will "assist in supplying a long-felt want, attai able with modern illumination at a consumption of 1 watts per candle, instead of 4 watts for the same quanti of light." As a result of considerable research, the auth has developed a new glass that is manufactured in a de icate amber tint and also in a most subtle tone of old ro The author suggested that when a value in foot-candles given as typical of any special condition attention shou be directed to the fact that a factor of depreciation mig

prove a sensible adjunct, since the calculated values represent initial performance of lamps and reflectors. In concluding his paper, he expresses the hope that there may be instituted an impartial standardization test with which the merchant, for instance, might demand compliance by any manufacturer when perplexed by differing contentions of salesmen in relation to proper illuminating units and methods.

The papers relating to glassware were discussed at some length at Tuesday morning's session when Dr. H. E. Ives, of Cleveland, vice-president, was in the chair. Mr. V. R. Lansingh, who spoke first, made a number of comments on points brought up in all five of the papers. He explained how pressed glassware was made in such a way as to have as high a polish as by the off-hand process. He discussed the reflecting properties of opal glass and explained that with the milk opals the glass must have considerable density. Another point made by the speaker was that uniformity of illumination is desirable from the engineering point of view; what is to be avoided is monotony of installation. On the question of specular reflection it was declared that it made no difference on the plane to be illuminated whether light came from specular reflection or diffuse reflection. As to the prismatic system, perhaps its worst enemy is itself. Acting by specular reflection it must be used correctly. As to the absorption of Alba glass, Mr. Lansingh pointed out that the percentage is much greater for pressed globes than for blown globes. Glare and specular reflection are synonymous only when one looks directly into the reflector, and this is not done often. Commercial glassware can be used in ordinary residences in more or less modified forms. The speaker also said that the conditions under which photometric curves are made should always be stated and studied to make the curves really valuable.

Mr. W. J. Cady, of Newark, Ohio, differed with some of the conclusions expressed by Mr. Godinez. One point made was that the intrinsic brilliancy of any reflector cannot be as great as that of the lamp itself.

Mr. J. R. Cravath, of Chicago, mentioned the need for glass to be perfectly smooth, and so easily cleaned, having about the diffusing qualities of ground glass without the latter's roughness. Such a glass is needed for skylights and other purposes and if available in flat plates would be a valuable material.

Dr. P. W. Cobb, of Cleveland, discussed several points brought out in the papers—among others that of intrinsic brilliancy. The manufacturers of glassware are tending to bring out glassware with depolished surfaces or with diffusing mediums, and this tendency is a good one. In its physiological aspects, at least, the question of color is still to be settled. Dr. Cobb pointed out that shadows have much to do with the cheerful "mellow glow" of sunlight and the oil lamp in the home. Light can be produced by the use of artificial light sources and proper shades that will approximate daylight very closely.

Mr. Norman Macbeth, of New York, congratulated the society on the entrance of commercial discussions into its proceedings. He also, by various concrete illustrations, showed how essential it is to explain the conditions under which photometric curves are made.

Mr. G. H. Stickney, of Harrison, N. J., spoke briefly on the effect of specular reflection on polished surfaces.

Mr. A. J. Marshall, of New York, and Mr. S. G. Hibben, of Pittsburgh, had a brief colloquy referring indirectly to the merits of Holophane and Alba glassware. In answer to Mr. Marshall's questions, Mr. Hibben said that sometimes the flakes in Alba glass are visible but more often not; they are supposed to be invisible in the higher grades of the glass. Alba glass has some fluorescence; the speaker did not know just how much. A number of Alba one-piece blown-glass balls are in use in the Chicago & Northwestern passenger terminal in Chicago. Mr. Marshall said that he thought the larger flakes were imperfections or bubbles. He said that the claims made for Alba glass are to some extent contradictory. The glass is not in the true sense of the word reflecting; it is rather a transmitting medium. The speaker did not think it gives true color transmission. It does fairly well for several purposes, but answers no one purpose perfectly.

Mr. Godinez summed up for Mr. McCormack and himself. He discussed briefly the question of monotony of lighting installations and explained his ideas of store lighting. He thought departure from uniformity desirable for advertising purposes. In relation to the question of looking into a reflector he said that it is practically impossible to prevent the eye from straying to the source of light if the latter is not concealed. Mr. Godinez remarked that it is interesting to learn what the operating companies are doing in supplying their customers with illuminating engineering advice. In many cities the central-station companies send out with the bills the statement that illuminating engineering installations designed by the local company will be guaranteed or made satisfactory, while no responsibility is assumed for installations made by others. Where changes in lighting are desired attractive sketches are furnished. In this way the public is taught increased respect for illuminating engineering.

Mr. Marshall, in his closing, said that the glassware described in his paper has been improved as a general thing since its introduction, although changes in design may have increased the percentage of absorption in some cases. Some considerations of physical efficiency have been sacrificed in some plainly stated cases for decorative effects.

Mr. Hibben in his closing remarks said that the curves in Mr. Young's paper were made by the Electrical Testing Laboratories of New York and could be accepted as disinterested and authentic. The ribs shown on some of the samples of Alba glass illustrated are used entirely for decoration and the glass is not to be considered a copy of any former type.

PAPERS RELATING TO GAS.

Mr. George S. Barrows, of Philadelphia, gave a talk illustrated by a number of lantern-slide pictures on "Natural Gas; Its Production and Utilization." Among other things he said that natural gas is nearly pure methane and that the average pound-Fahrenheit thermal units per cubic foot in natural gas are about 1000, compared with a corresponding figure of about 600 for manufactured gas.

Mr. F. H. Gilpin, of Philadelphia, abstracted his paper on "Recent Small Gas-Lighting Units." The use of small units is comparatively new in the gas-lighting field, but during the last two years several small gas-lighting units have been tested in various ways. The speaker gave the results of some of these tests and showed that on the whole the efficiency of the new small units was about 25 per cent to 30 per cent higher than the older and larger units. The tendency of the smaller units seems to be to give considerably higher efficiency. Mr. Gilpin also remarked that all gas lamps collect dirt internally. If this is removed and a new mantle supplied, the lamp will be restored practically to its original efficiency. It will not be sufficient to renew the mantle alone.

Mr. T. J. Little, of Philadelphia, questioned whether in general smaller gas-lighting units are more efficient than large ones, provided the mantles are of exactly the same structure. However, there is a great possibility of increasing the efficiency of larger burners. The speaker thinks the stack lamp is the coming gas lamp.

INCANDESCENT ELECTRIC LAMPS.

An interesting paper entitled "Recent Developments in the Manufacture of Incandescent Electric Lamps" was read by Mr. J. E. Randall, of Cleveland. Speaking of carbon lamps, the speaker showed that the best lamps of ten years ago were as good as the best of the present year.

That the average has risen is due to the elimination of defectives. The Gem lamp shows a sufficient superiority in quality over the regular carbon-filament lamp to justify its more extensive use. The greater part of the paper, however, was devoted to metal-filament lamps. The mechanical weakening of the tantalum wire, due to offsetting when kept on alternating current, has prevented the general introduction of the tantalum lamp in this country. It was, however, the first production of a real drawn-wire lamp. But the tantalum lamp cannot continue to compete with the drawn-wire tungsten lamp in its present form. In relation to the pressed-filament type of tungsten lamp the author believes that the loose contact at the bend of the filament with a support that is rigid makes the hardiest lamp of that type. The drawn tungsten wire has served to make the tungsten-filament lamp a universal lamp. The wire may be considered to consist of pure tungsten. There is no offsetting either on direct current or alternating current and tests indicate that the wire is less brittle at every stage in the life of a lamp than is the pressed filament. Nevertheless, the lamp should be handled with reasonable care in order to prevent breakage. Mr. Randall made an interesting comparison, near the end of his paper, which may be quoted in his own words:

"Having traced recent developments up to the latest, it may not be amiss to consider the future. If the progress in lamp development may be gaged by the highest filament temperature at which each new lamp will show a given performance, one has a rational measure. For example, if 90 per cent of the theoretical candle-power hours are developed in 1000 hours' burning, candle maintenance and mortality both considered, the advance from the raw carbon-filament lamp to the tungsten-filament lamp will show something as follows:

Raw carbon filament lamp (cellulose carbon)	100
Treated carbon filament lamp	119
Metallized carbon filament lamp	149
Tantalum filament lamp	206
Osmium filament lamp	370
Tungsten filament lamp	35[illegible]

"This comparison excludes many items, such as process difficulties, lack of wattage range, lack of voltage range, lack of suitability for both alternating current and direct current, cost, etc., which affect commercial values. It is not a comparison of commercial values, although it is a comparison of the most important element in commercial values, namely, the energy wasted in doing equal work."

Mr. George H. Jones, of Chicago, said that the central-station company in Chicago has felt that the high-efficiency lamp is the one that its customers should have and the one that pays the best in the long run. In support of this assertion, he gave some interesting figures to show the average consumption of electrical energy from three classes of customers of the Commonwealth Edison Company in the month of October for the years 1908, 1909 and 1910. These figures may be tabulated as follows:

	October, 1908	October, 1909	October, 1910
[illegible]	16 kw-hours	17 kw-hours	1[illegible] kw-hours
[illegible]	[illegible] "	32 "	33 "
[illegible]	[illegible] "	[illegible] "	[illegible] "

The increased demand for electricity from small stores, comparing October, 1910, with October, 1909, is remarkable. These figures show that the central station need not be afraid of the tungsten lamp; apparently, as the lighting becomes more efficient, the demand for electrical energy increases.

Mr. J. W. Howell, Harrison, N. J., said that the figures given in the table at the close of Mr. Randall's paper might be misleading, as the various types of lamps are not compared at their maximum efficiencies. To compare lamps properly each should be exhibited under its own most favorable conditions, giving also the first cost and the operating cost. Mr. Howell declared that the pressed-filament tungsten lamp has passed away. The drawn-wire filament has many advantages. It is a one-piece filament and it is also stiffer than the pressed filament. Another advantage is that it has only two heat-conducting contacts—those at the leading-in wires—the other supports being poor heat contacts. This is not the case with a pressed filament, and where that is used much heat is carried away by the supports. The drawn-wire lamp makes possible great improvement in large-size lamps, which are much better in quality than the pressed-filament lamps of the same size. Mr. Howell sought to impress on the engineers the great value of large-size incandescent electric lamps in the art of illumination. These lamps are also being improved very rapidly. He remarked, too, that the Gem lamp deserves much greater attention than it has received. The elimination of early breaking lamps is a valuable characteristic of the Gem. The speaker thinks the Gem is about three times as good a lamp as the ordinary carbon lamp and wonders why people do not use it when it only costs 10 per cent more than the regular carbon lamp. Large carbon and Gem lamps are still made and sold, because they are ordered; that is, lamps of 32 cp and more. This should not be the case; these lamps are back numbers and their use should be discouraged by engineers.

Mr. G. C. Webster, of Cleveland, referred to price cutting by manufacturers of carbon-filament lamps in the period from 1904 to 1907 and showed how the quality o the lamp suffered in consequence. If the engineers wan quality and service, he said, they must give the manufac turer his price. Let the latter have at least ¼ cent pe lamp to put into development work.

Mr. W. F. Little, of New York, made an exceedingl interesting demonstration of a lamp built in the Electrica Testing Laboratories to test the ruggedness or resistanc to breakage of incandescent lamp filaments. The machin is so arranged that the lamp under test, while its filamer is traversed by a very slight current, is subjected to re peated shocks or vibrations that are gradually increased i length. A dial is arranged to show at what length of v bration or "bump" the filament breaks. Mr. Little teste carbon lamps and pressed-filament and drawn-wire tung ten lamps in this machine, and the much greater rugge ness and strength of the filament of the last-named ty were very clearly manifested. If, for instance, the presse filament would break as the result of a blow of 0.6 in., th drawn-wire filament would withstand successfully a blo of 4 in. The demonstration was received with applaus

Mr. Macbeth said it was a great step in advance to ha only one metallic filament in a lamp. The special adva tage is due to the continuous filament from end to end.

Mr. F. A. Vaughn, of Milwaukee, said that illuminatir engineers wish particularly to be imbued with confiden in relation to the various sizes of the drawn-wire lam The large sizes seem good, but how about the lamps small than the 25-watt size? How about the ruggedness ar durability of these smaller lamps? This is important b cause the consumer demands these small lamps.

Mr. P. S. Millar, of New York, pointed out that tl change in position of the light-giving source in the i candescent-lamp bulb due to the use of the drawn-wi filament has altered light-distribution curves. He al praised the progressive attitude of central-station cor panies like the Commonwealth Edison Company of Ch cago in placing the tungsten lamp before customers most advantageous terms.

Mr. T. H. Aldrich, of Chicago, spoke of the practical u of tungsten lamps in factories, where, as in the case of tl factories of the International Harvester Company, th have been tested under adverse conditions. However, tl engineers of this company have about concluded that tl tungsten lamp is the most satisfactory form of illum nant that it can employ, and there are now between 12,0 and 13,000 in use in its factories, some of them operati

itisfactorily in rooms where there is a good deal of vi-ration. The average life is found to be 1500 to 1800 urs.

Mr. Randall, in closing, reviewed briefly the art of manfacturing incandescent lamps and showed the slow progss of the carbon lamp. He said that the table given at te end of his paper pretends to be nothing but one way f comparing progress in lamp development. The manuicturers are struggling, he said, to reduce the price of ungsten lamps. The table referred to ignores many varbles. The incandescent lamp as an energy transformer s exceedingly wasteful. In relation to small-wattage mps, Mr. Randall said it was largely a question of the ize of the holes in the die through which the wire is rawn. If the die-maker can make a hole of 0.0001 in. the diamond, the speaker believes that tungsten ire can be drawn through it. The 25-watt lamp is not hardy as the 40-watt lamp, but in candle maintenance will compare favorably with any other size. The speaker es not think it advisable to go to lower wattages than ose now available for ordinary commercial illumination. e spoke of the new automobile lamp as demonstrating me of the special uses of the drawn-wire tungsten fila-

This concluded the Tuesday morning session, which sted until 1:35 p. m. The remaining sessions will be ported in the *Electrical World* of next week. On Tuesy noon it was announced that the total attendance was Of this number 130 were members of the society, t equally divided between local members and out-of-members.

oronto Meeting of the American Electrochemical Society.

e twentieth general meeting of the American Electroical Society was held in Toronto, Ontario, Canada, on sday, Friday and Saturday, Sept. 21 to 23. On Thurs- there were professional sessions in the morning and ternoon in the Chemistry and Mining Building of the niversity of Toronto and on Friday morning another prossional session at the Lambton Golf and Country Club. neteen papers were presented at the convention and st of these elicited an animated discussion. The policy rinting practically all papers in advance is producing l results.

The social features were greatly enjoyed, as is always e case with the meetings of the American Electrochemical ociety. On Thursday afternoon there was a reception the house of Lieutenant-Colonel and Mrs. J. B. Miller. here was a smoker in the West Hall of the university on rsday night, when Prof. J. B. Kenrick gave a remark- exhibition in glass blowing, followed by an entertain- by "Section Q" in the form of a very amusing elec- furnace farce, "The Electrocomical Lab." The occa- was very enjoyable. While the evening was in ogress the returns of the anti-reciprocity election were ming in and the election crowd in the streets of Toronto as certainly interesting.

After the Friday morning session and lunch those who anted to play golf did so on the beautiful grounds of the ambton Golf and Country Club. During the whole meetg the weather was ideal. On the evening of Friday there as a subscription dinner at McConkey's.

The whole of Saturday was devoted to an excursion. At Hamilton the works of the Canadian Westinghouse Comany and those of the Steel Company of Canada and at undas the transformer station of the Canadian Hydroectric Commission were visited.

The number of members and guests registered was 120. hile the number is smaller than at some recent meetings f the society, the Toronto meeting will be remembered by all who attended it as an exceedingly enjoyable and successful affair.

The first session was called to order on Thursday morning by the president, Dr. W. R. Whitney. In the temporary absence during the first session of the secretary, Dr. J. W. Richards, Mr. Carl Hering was made acting secretary.

Following are abstracts of the papers presented.

RECENT PROGRESS IN ELECTRIC IRON SMELTING IN SWEDEN.

The first paper of the meeting was presented by Mr. T. D. Robertson, who gave a very concise yet full account of the results obtained at the 2500-hp electric iron-ore reduction furnace of the Jerkontoret at Trollhättan, Sweden. The chief results are summed up as follows:

(1) Electric smelting of iron is no longer in the experimental stage, but in Sweden it is thoroughly established on a commercial scale. (2) The smooth and regular working of the furnace at Trollhättan has been a marked feature, probably less trouble being experienced than would have been the case with a blast furnace doing similar work. (3) The quality of iron produced for steel-making purposes has been shown to be equal and in some cases superior to that of Swedish blast-furnace pig iron. (4) The comparative costs of electric and blast-furnace smelting depend in general on the cost of suitable fuel and electrical energy, as the electric furnace simply substitutes one electrical hp-year for 2 metric tons of blast-furnace fuel. In Sweden there is no doubt that the electric furnace has come to stay on account of cheaper production. (5) The electric furnace is specially adapted to the smelting of finely divided ores or concentrates. (6) Electric smelting in Sweden has a national value, as its adoption will result in the development of water-powers which could not in many cases be profitably utilized for any other purpose.

The paper was discussed at some length by Messrs. Brady, Whitney, Simpson, Kohn, Hering and Lidbury.

AN UNSUCCESSFUL FURNACE EXPERIMENT.

In a paper by Mr. Francis A. J. FitzGerald were compared the heat losses in different electric-furnace designs, all of the same general type, the heat being produced by downward radiation from an electrically heated resistor at the top. The latest design gave disappointing results, since the heat losses were unexpectedly large. This is partly explained by the fact that in it the ratio between hearth area and total area receiving heat from the resistor was relatively small and that the ratio between the area of the surface, other than the hearth, receiving heat from the resistor and the rate of generation of heat in the resistor was relatively large.

The main point is to provide good heat insulation of the walls. If the heat insulation is good, then, while there may be a great difference in temperature between the charge on the hearth of the furnace and the resistor, there will be very little difference between the rest of the surface receiving radiation and the resistor, and hence the losses will be small. It was in this point that the chief weakness of the furnace showing high losses was found.

A communicated discussion by Mr. John Thomson, who had been the co-designer of the furnace, was read by Mr. Lidbury, while the president, Dr. Whitney, emphasized the importance of publishing an account of unsuccessful experiments for the lessons they teach.

TITANIUM IN IRON AND STEEL.

A paper by Mr. Charles V. Slocum emphasized the large extent to which titanium is now used in the iron and steel industry since Rossi succeeded in devising an electric-furnace process for making ferrotitanium. The methods of applying ferrotitanium in steel making and refining are described. The effectiveness of titanium is due to its deoxidizing powers, to its elimination of nitrogen and to the fact that it gives the slag greater fluidity so as to separate it completely from the metal.

There was a long discussion, in which Mr. FitzGerald,

Dr. Waterhouse, Dr. Whitney and Mr. Slocum participated, besides two communicated discussions by Dr. R. Moldenke on the use of titanium in foundry practice and by Dr. Hans Goldschmidt on his reasons for using a carbon-free ferrotitanium containing some aluminum.

NIAGARA TRANSFORMING STATIONS.

A paper by Mr. A. J. Jones on the "Transforming Stations of Niagara Electrochemical and Electrometallurgical Industries" gave an illustrated catalog of the electric equipment of the transformer stations at the different electrochemical plants on the United States and Canadian sides of Niagara Falls.

In the discussion Dr. E. F. Northrup referred to the successful use at the Massena plant of the Aluminum Company of America of a mercury ammeter (based on the pinch effect) measuring 14,000 amp regularly. Its rating is 16,500 amp, and no failure has occurred in continual service.

MOLYBDENUM STEEL DIRECT FROM IRON ORE.

A paper by Messrs. E. T. Dittus and R. G. Bowman gave an account of laboratory experiments carried out in the Colorado School of Mines on the production of molybdenum steel direct from iron ore in an electric furnace.

The furnace used could be operated either as a Héroult or a Girod furnace, the latter being found more advantageous in this case. The reduction of the iron ore to metallic iron is done in the usual way with coke as reducing agent. Just before tapping the steel a mixture of ferrosilicon and powdered molybdenite is added to the steel, producing the reaction $MoS_2 + Si = Mo + SiS_2$. In this way molybdenum is alloyed with the steel. Ferrosilicon is also effective as a desulphurizer of the steel. In the different experiments considerable difficulty was experienced in tapping the steel, and it is thought preferable to use a tilting furnace.

The paper was briefly discussed by Messrs. FitzGerald and Hansen.

ELECTRIC INDUCTION FURNACE.

The last paper of the morning session was one by Mr. Albert Hiorth, of Christiania, Norway, describing the design of a 30-ton induction furnace, based upon the data and results obtained with his original 5-ton induction furnace. The author deals at length with the calculation of the power-factor. In order not to get too low a power-factor two remedies are used in the 30-ton design: First, a three-phase induction furnace with three iron cores (instead of the single-phase system of the 5-ton furnace) is used and, second, the frequency is reduced from 13 cycles per second to 8 cycles per second.

Data are given on the power required to keep the charge molfen at constant temperature. The dimensions of the furnace are worked out and details of the designs of the two furnaces are given in a numerical table and diagrams.

In a communicated discussion Mr. Unger pointed out that the power-plant installation would be costly on account of such a low frequency as 8 cycles per second. He thought it would be cheaper to combine a number of smaller units in one furnace. Mr. Hering pointed out the possibilities of reducing the heat losses by careful designs.

MINERAL RESOURCES OF ONTARIO.

The first paper of the afternoon session of Thursday was presented by Director T. G. Gibson, of the Bureau of Mines of Ontario. He gave an outline of the mineral deposits in the different portions of Ontario, with special reference to nickel, silver and gold, and suggested some important problems which might be solved by electrochemistry.

ELECTROLYTIC-COPPER DEPOSITION FROM SOLUTIONS CONTAINING ARSENIC.

A paper by Dr. Ching Yu Wen and Dr. E. F. Kern, of Columbia University, gives an account of an extended investigation of "the effect of organic and inorganic addition agents upon the electrodeposition of copper from electr lytes containing arsenic." The troubles due to arsenic co tained in a copper-salt solution subjected to electrolysis a well known, and the object of the investigation was to pr vent the deposition of arsenic on the cathode and to preve the formation of dendritic trees. This problem was work out, having in mind the production of solid and smooth d posits, from copper electrolytes containing a high percen age of arsenic by means of organic and inorganic "additi agents."

The best addition agents were found to be combin gelatine and sodium chloride (about 0.01 per cent to 0. per cent gelatine and 0.01 per cent Cl as NaCl), as the co per deposits thus obtained are smooth and of great ductili and high purity.

CONDUCTIVITY OF MIXTURES OF COPPER SULPHATE AND SULPHURIC ACID.

A paper by Prof. H. K. Richardson and Mr. F. D. Tayl of Pennsylvania State College, gave the results of measur ments of the conductivity of different-percentage mixtur of sulphuric acid and copper sulphate at 25 deg. C. and deg. C. and of the temperature coefficient of conductivit

Addition of copper sulphate to solutions of sulphuric ac increases the conductivity of the mixture if the sulphur acid is less than 3 grams per 100 cu. cm, while it decreas the conductivity if the sulphuric acid is more than 3 gra per 100 cu. cm.

Owing to lack of space the remainder of the conventi report is held over for the following issue.

Convention of Iron and Steel Electrical Enginee

The Association of Iron and Steel Electrical Enginee met in annual convention at the Hotel Imperial, New Yo City, Sept. 25-30. The sessions were held in the recepti room on the second floor of the hotel, and the officers e pressed gratification at the attendance, which exceeded t comfortable seating capacity of the room, the registrati being as we go to press about 160. As is probably w known by our readers, the object of the association is further continuously the improvement of apparatus a machinery used in the iron and steel industry, and to bri together once a year the manufacturer and the consum so as to enable an interchange of ideas and the combinati of the experience of the latter with the skill of the form Unfortunately, the by-laws of the association will not p mit of the publication of abstracts and discussions pr to the issuance of the proceedings, so that only gene characterizations of the papers will be permitted at t time. The complete program of papers and events w published in last week's issue, and was carried out with exception of a paper on "Electric Furnaces" by a rep sentative of the Swedish Chamber of Commerce; one the "Mechanical Design of Cranes," by Mr. C. A. Kafer, the Bethlehem Steel Works, and one on "Alternating-C rent Versus Direct-Current Cranes," by Mr. K. A. Pauly, the General Electric Company, all of which were withdra

Monday's session was given over to a consideration the report of the safety committee, which contained formation regarding rules, signs and appliances relative safety such as have been installed and adopted at vari s works, together with suggestions relative to safety wh might be worthy of adoption. Nothing definite was s gested by the committee, the report being a forerunner another to follow next year.

At Tuesday morning's session Mr. F. W. Woodhull, the Luken Iron & Steel Company, showed a number lantern slides and described safety devices used in the i and steel industry. Following this lecture, Mr. C. T. He erson, of the Cutler-Hammer Manufacturing Compa, read a paper on "Dynamic Safety Stops for Elec

cranes." The author pointed out that dynamic braking has been almost universally used in ore and coal handling machinery, and that it could also be and has been applied to the steel industry. He described the principles involved, and pointed out the merits of the drum type of controller as opposed to the face-plate type of controller for this service.

CONTROL APPARATUS FOR STEEL MILLS.

At the afternoon session Mr. M. A. Whiting, of the General Electric Company, presented a paper on "New Developments in Control Apparatus for Steel Mills." The company had already described its direct-current and alternating-current contactors, and the current limit system used with these two lines of contactors, at a previous convention of the association. The developments have been chiefly in the direction of improved forms of auxiliary devices, and in the design of a normally closed contactor in which the contacts are held closed by spring pressure and opened by the application of voltage to the operating coil. These contactors are used to provide emergency dynamic braking in case of failure of the circuit, under which condition the controlling contactors as a rule will drop out. The greater portion of the paper was devoted to a description and applications of the series contactor for reversing and non-reversing equipments.

AUTOMATIC CONTROL FOR DIRECT-CURRENT MOTORS.

The second paper at Tuesday afternoon's session was presented by Mr. A. C. Eastwood, of the Electric Controller & Manufacturing Company, on "Automatic Control for Direct-Current Motors." The paper described in detail a form of magnetically operated series switch brought out by the company, which is combined in various ways in the construction of automatic starters and controllers for different purposes. The valuable features of the combined series switch and relay were brought out in connection with numerous applications already in extended use, and the author felt that the series-wound switch will, to a very great extent, revolutionize the art of automatic motor control.

DIRECT-CONNECTED REVERSING MOTOR FOR ROLLING MILLS.

Mr. G. W. Richardson, of the American Bridge Company, read a paper on "Direct-Connected Reversing Motor Planer Drive," in which he pointed out that to drive a planer reversing with every stroke, from the shortest to the full stroke of the planer, it is necessary to employ a very low-speed motor, an automatic controller and to use dynamic braking to stop the table so that there will not be counter-electromotive force at the time the applied electromotive force is applied to the armature of the motor at the moment of reversal. This must be so arranged that the dynamic braking relay is off at the moment the applied electromotive force is connected, and that dynamic braking will take effect at the moment the applied electromotive force is withdrawn. He described an application of a double-armature, 50-hp, 220-volt motor on a 120-in. planer, which was very satisfactory and showed a saving of approximately $700 a year, not counting delays to work, over the former belt drive.

TRANSFORMERS FOR STEEL MILL SERVICE.

The final paper at the afternoon session was read by Mr. H. C. Soule, of the Westinghouse Electric & Manufacturing Company, and was entitled "Transformers for Steel Mill Service." The author gave a very general treatment on standard transformers, for, of course, those intended for steel-mill service are not different from standard. He championed the shell-type transformer as possessing the most solid construction, but this statement was challenged by representatives of manufacturers building the butt-jointed and lap-jointed core-type transformers.

ELECTRIC CRANES FOR STEEL MILLS.

There was to have been a lecture on Tuesday evening by Mr. R. J. Young, of the Illinois Steel Company, on "Safety," but this lecture was postponed until the Wednesday morning session. Although there were four papers scheduled for Wednesday morning, only one was presented owing to the time taken up by the lecture by Mr. Young. This paper was entitled "Electric Cranes for Steel Mill Service," and was prepared by Mr E. Friedlaender, of the Carnegie Steel Company. The author did not take up the questions of design of girders, gears, motors, controllers, etc., but confined himself to a few points relative to electric crane construction and operation, so as to bring out discussion on many important features. He showed that the total mechanical efficiency of electric cranes hardly exceeds from 65 to 70 per cent, and together with electrical losses in motors, controllers and conductors, the over-all efficiency is brought down to from 50 to 60 per cent. He advocated taking the speed control of crane motors out of the hands of operators, and to predetermine acceleration, speed, torque and current through magnetic switches. Mr. Friedlaender stated that, inasmuch as normal load hardly ever exceeds one-quarter maximum load, the speed should be made to suit the normal load, and the work in foot-pounds should then be made the same for the maximum load. For this service series direct-current motors are better adapted than alternating-current motors and possess a better working efficiency. The author drew attention to the fact that cranes are generally handled more roughly than any stationary machinery, and said that the use of energy at potentials over 275 volts could not be recommended because the accidental touching of conductors would probably prove fatal. Ordinary commercial motors have been found unsatisfactory for the trying conditions met with in crane work, and special mill-type motors have been developed and the characteristics of these were pointed out. Poor commutation of high-peak currents has always been a defect of crane motors, which has been more or less mitigated by the introduction of interpoles. The author claimed that the usual practice of rating railway motors after one hour's full load run, with a maximum temperature not to exceed 75 deg. C. above that of the surrounding air, should be adhered to in most instances for crane work, especially upon bridge and trolley motion. The alternating-current motor has encroached more and more into the field of the direct-current motor, and successfully replaced the latter where speed and direction of rotation is constant, but the introduction of alternating-current motors for crane work has been slow for reasons which the author enumerated at length.

The first topic taken up at Wednesday afternoon's session was a paper on "Track Wheels for Electric Cranes," by Mr. W. D. Snyder, of the National Tube Company. This was followed by a paper by Mr. T. E. Tynes, of the Lackawanna Steel Company, on "Methods of Lubrication for Electric Cranes." These two papers were scheduled for presentation at the morning's session, and dealt with matters of no electrical interest.

MOTORS FOR STEEL MILL SERVICE.

At the afternoon session Mr. B. Wiley, of the Westinghouse Electric & Manufacturing Company, presented a paper on "Recent Development of Motors for Steel Mill Service." During the past year his company has completed the development of three new lines of motors for industrial work, which are particularly suitable for various classes of steel-mill applications. These include a direct-current, commutating-pole motor for continuous service, a direct-current, commutating-pole motor for heavy intermittent service and an alternating-current, high-torque, wound-rotor type of motor designed to withstand the severe service conditions in iron and steel mills. The principal features and applications of the motors were pointed out.

ALTERNATING-CURRENT VERSUS DIRECT-CURRENT MOTORS.

One of the most interesting papers presented at the convention was prepared by Messrs. B. R. Shover, of the Carnegie Steel Company, and Edward J. Cheney, of the

General Electric Company, and was entitled "Cost and Efficiency of Alternating Versus Direct-Current Motors for Steel-Mill Auxiliaries." The authors stated that there was no question but that induction motors should be used for driving the main rolls and that induction or synchronous motors should be used for pumps and other apparatus about the plant where large motors are necessary. There is, however, a diversity of opinion as to whether the so-called auxiliaries should be driven by alternating-current or direct-current motors. A comparison is made between a straight alternating-current system and a mixed system of alternating-current and direct-current motors, and from a study of sixteen cases the authors arrived at the following conclusions:

(1) The all alternating-current system costs slightly more than the mixed system. (a) Excess first cost higher for 22,000 volts transmission than for 6600 volts. (b) Excess first cost higher for gas engines than for turbines. From which it appears that the higher the first cost of power supply the less favorable is the use of the all alternating-current system. (2) The lower the power-factor the greater is the excess cost of the all alternating-current system for both percentages of auxiliary load. (3) The less the percentage of auxiliary load the less the excess cost of the all alternating-current system for both power-factors. (4) The annual costs of the all alternating-current system considered are lower than those of the mixed system. (5) The actual operating costs—that is, excluding interest, depreciation, taxes and insurance of the all alternating-current system—are considerably less than those of the mixed system. (6) The excess cost of maintenance of the mixed system is based on an estimate and not on actual records. Should this item be entirely neglected the results in nine out of sixteen cases would show an excess of annual costs for the all alternating-current system, but the amount is so small that accurate calculations for any individual case would be necessary to determine the relative advantages. (7) When the saving in output due to the fewer delays in the all alternating-current system is taken into consideration the saving in annual costs will be largely increased, and even should the difference in motor maintenance be neglected there would still be a considerable saving in annual costs for the all alternating-current system.

For a rolling mill properly motored, where there are no problems of electric drive which have not been successfully solved by the use of alternating-current motors, where the percentage of power required for auxiliary apparatus (exclusive of pumps, etc.) is 25 per cent or less of the total power delivered to that mill and where the power-factor of the entire mill, including both main and auxiliary apparatus, is 70 per cent or over, the authors feel amply justified in saying that the all alternating-current system will show a saving in annual cost, to say nothing of its greater simplicity and more satisfactory operation.

ELECTION OF OFFICERS.

On Wednesday evening a banquet was held in the large reception room on the main floor of the Imperial Hotel, covers being laid for 125. Letters of regret were read from Mr .Charles Nagel, Secretary of the Department of Commerce and Labor; Mr. Charles P. Neill, United States Labor Commissioner; Dr. W. Wilson, Governor of New Jersey; Mr. A. C. Dinkey, president of the Carnegie Steel Company, and Mr. E. A. S. Clark, president of the Lackawanna Steel Company . The speakers at the banquet included the following: Mr. R. C. Bolling, assistant solicitor of the United States Steel Corporation; Dr. S. S. Wheeler, Crocker-Wheeler Company; Rev. J. McDowell, Newark, N. J.; Mr. C. T. Henderson, Cutler-Hammer Manufacturing Company; Colonel Andrews, General Electric Company; Mr. F. R. Hutton, American Museum of Safety; Mr. F. P. Townsend, past-president of the Association of Iron and Steel Electrical Engineers, and Mr. McConnahey, of the Pittsburgh Central Y. M. C. A.

The result of the election was announced at the banque as follows: President, Mr. B. R. Shover, Carnegie Stee Company; vice-president, Mr. E. W. Yearsley, Midval Steel Company; second vice-president, Mr. E. Friedlaender Carnegie Steel Company, and secretary-treasurer, Mr James Farrington, LaBelle Iron Works. The conventio was still in session when we went to press.

Convention of Association of Edison Illuminating Companies.

The twenty-seventh annual meeting of the Association o Edison Illuminating Companies was held at the new Mon mouth Hotel, Spring Lake Beach, N. J., Sept. 19, 20 an 21. The decorations prepared for the conference of Gov ernors of states held the week before at the same plac and hostelry were still in evidence, and the 350 attendant at the convention, under the inspiration of delightf autumnal weather, helped to kindle anew the life of th resort, whose season had already ended. In many respect the meeting was noteworthy. Not only was the attendanc the largest ever recorded, but for the first time in the his tory of the association engineers of the Westinghouse Elec tric & Manufacturing Company were present during pa of the sessions. The association also acted as host to th president of the Institution of Electrical Engineers, M S. Z. de Ferranti, of Sheffield, England, who was accon panied by Mrs. de Ferranti, Mr. Charles H. Merz, of Lor don; Mr. Arthur Wright, of the same city, and Mr. H. A Couves, of Newcastle.

As has been the custom in past years, none but the elec were permitted to take part in the deliberations of the ass ciation. The sessions were held in the ballroom of the hot behind closed doors and the press committee passed on a matter issued for publication. Needless to state none of th discussion was included in this matter, the idea of the ass ciation being that only in this way can a free and fran discussion be conserved. The delegates were provided wit printed papers, but some of the most important ones we read from manuscript. Included among the latter we the following: "Thermal Application of Electricity," b Dr. William Stanley, of Schenectady; "Report of the Con mittee on Incandescent Lamps," by Mr. J. W. Lieb, Jr., o New York; "Improvements in Incandescent Lamps," b Mr. J. Howell, of Harrison, N. J.; "Test of Large Boil Units at the Detroit Edison Plant," by Dr. D. S. Jacobu Hoboken, N. J. In addition there were two addresses ma on Thursday evening, one by Mr. Arthur Williams, o New York, on industrial movements abroad, and the oth by Dr. C. P. Steinmetz on the nature of electrical energ Dr. Stanley's remarks dealt with investigations in electr heating apparatus which are at present being made by t General Electric Company. Dr. Jacobus gave advance i formation on tests made on the huge boilers with which t Delray plant of the Detroit Edison Company is equippe full details of which will be given in a paper to be pr sented before the American Society of Mechanical E gineers. From what could be gathered the association satisfied with the present situation in the lamp industry.

ENTERTAINMENT FEATURES.

Entertainment was not lacking throughout the wee The association monopolizing the entire hotel, social li was almost homelike, and when the hotel did not suffi a large tent outlined within and without with incandesce lamps and situated in front of the hotel was pressed ir service. There a splendid vaudeville entertainment w given on Tuesday night and in it on Thursday night clambake was served. On Friday a fishing excursion w provided for those who remained after the closing sessi and what with tennis, golf, automobile trips, teas, danc etc., just enough time was allowed for eating and sleep.

ELECTION OF OFFICERS.

At the closing session the following officers were elected: resident, Gen. George H. Harries, of Washington, D. C.; ce-president, Mr. Arthur Williams, of New York; secretary, Mr. T. T. Edgar, of Seattle, Wash.; treasurer, Mr. ouis Ferguson, of Chicago. The executive committee comprises the following: Messrs. G. H. Harries, S. Insull, C. . Edgar, J. W. Lieb., Jr., J. B. McCall, W. W. Freeman, . Williams, L. A. Ferguson and H. W. Edgar.

Gen. George H. Harries is a national figure in the electric light and traction industries. Although a Welshman birth and education, he has served his adopted country ell and long. While yet a lad he toured the Canadian orthwest and spent many active years on the plains and

PRESIDENT-ELECT GEN. GEORGE H. HARRIES.

mining regions. His Western life brought him into ite contact with the Indians and made him so familiar the traits of the redman that President Harrison ap- d him a member of the Sioux Commission in 1891. e the late Spanish war he was commissioned by Presi- McKinley to the command of the brigade of the nal Guard at Washington and during the war he was nmand of a regiment of infantry from the District of ıbia. General Harries' first connection of note with ilway industry was as president of the Metropolitan ad Company, Washington, to which office he was ted in 1896. Returning from the Spanish war, he re- ted his attention to lighting and traction work and in nuary, 1900, became a member of the board of directors the newly organized Washington Traction Company, a ntative aggregation of railway and electric light corporations. Six months later he became vice-president of the ganization now known as the Washington Railway & ectric Company, which controls the Potomac Electric ower Company, the Great Falls Power Company and the eet railway systems of Washington. General Harries treasurer of the National Electric Light Association and is for two years vice-president of the Association of Edin Illuminating Companies. He is also second vice-president of the American Electric Railway Association, chairn of its federal relations committee and a member of its blic relations committee. In addition General Harries a member of the Washington Society of Engineers and e Illuminating Engineering Society and an associate memr of the American Institute of Electrical Engineers. He also widely interested in affairs other than engineering Washington. General Harries is fifty-one years old.

PRESIDENT'S ADDRESS.

The address of the president, Mr. Thomas E. Murray, of the New York Edison Company, was replete with information on modern practice in the design and construction of steam-driven electric-power plants. The author has brought together valuable power-station data of a comparative nature which are included in the address, and altogether the entire subject of design is treated in a manner which makes the address a valuable contribution to technical literature.

Mr. Murray, after some general remarks, took up in detail the power-station structure, the generating apparatus, prime movers, auxiliary apparatus, electrical equipment and operating costs. The treatment was devoted entirely to large stations representing the very highest type from the standpoint of reliability of service, operating economy and structural excellence. Larger boilers are coming into vogue and the evolution of boiler furnaces is such that fuels heretofore considered worthless can now be burned to advantage. Stokers are less automatic but more efficient than formerly, and the growing scarcity of steam sizes of anthracite, rendering a greater use of bituminous coal necessary, carries with it a wider adoption of the mechanical stoker. The steam-piping systems now in use are designed on the unit system with interconnecting mains and steam speeds of 12,000 ft. a minute. Steam pressures still remain between 175 lb. and 200 lb. and the use of superheated steam is becoming more general. A great improvement in boiler feeding has followed the use of the centrifugal pump and accurate water meters, and open heaters and forced draft are most widely employed in later stations. The steam turbine has supplanted the reciprocating engine in large stations and the author doubts if any more large reciprocating units will be installed for power-station purposes. Coming to the electrical equipment, the author shows that the design is largely influenced by the character of the load and the distance to which energy is to be transmitted. The conditions governing the size of the units and the voltage are also discussed. In busbar arrangements standard practice favors the group method of generator and feeder connections having two sets of busbars sectionalized at one or more points by switches. For bus and switch compartment work concrete is coming largely into use, but brick makes a more finished construction, while for high-tension switches and for flooring high-tension compartments soapstone is still the best available material. The improvements made in protective devices and instruments for switchboards are noted by the author, as well as methods of control which have worked well in practice, especially in stations having system operators or load dispatchers. Under the caption of operating costs Mr. Murray states that at the present time attention to station economics with large units and careful design has resulted in a station cost which is gradually approaching a minimum. He divides the cost of a fair-size station per kilowatt as follows:

	Per Cent.
Building structure	30
Boilers, furnaces and boiler room auxiliaries	20
Turbines, generators and condensers with auxiliaries	25
Piping systems	10
Switchboard and other electrical work	[illegible]
Miscellaneous small items not otherwise included	8
Total	100

The importance of striving after a low cost of construction per kilowatt of station capacity will be appreciated when it is considered that the effect of a saving in the station investment cost of $5 per kilowatt is equivalent to an annual saving in the coal bill of 12 cents with coal at $3 a ton, where a fixed annual charge on the investment of 14 per cent is allowed to cover interest, depreciation and taxes. It would appear according to the author that further improvements must come from advances in the direction of reduction in cost, increase of output and an improvement in the load-factor under which the stations operate, rather than in the efficiency of the individual units.

Abstracts of the papers presented at the meeting will appear next week.

Convention of Northwest Electric Association.

The 1911 convention of the Northwest Electric Light & Power Association assembled in the "Hall of Doges," at Spokane, Wash., Thursday, Sept. 21, at 10 a. m., with an attendance of approximately 200 members. President Douglas Allmond introduced the Hon. W. J. Hindley, Mayor of Spokane, who delivered the address of welcome.

Mayor Hindley dwelt on the important part the electrical industry plays in the world's work and the consideration it is entitled to for the labor, brains and capital put into the various electrical enterprises. He took up the question of public-service corporations and the municipalities, stating that, inasmuch as they had prepared the soil, planted the trees and taken care of them until they bore fruit, they were certainly entitled to a just return for the fruit. He stated that the endeavor should be to strike a happy medium, so that the public-service corporation and the public itself would each receive what it is justly entitled to—the company a fair return on its investment and the people proper service at reasonable rates.

The Mayor's speech was followed by a short address by the president, who complimented Mayor Hindley on the fairness of his address, stating that it was the broadest speech he had yet heard on the subject, and coming from the representative of Spokane's commission form of government made it decidedly more important. A vote of thanks was tendered Mr. Hindley by the convention. The president then discussed briefly the disposing of unjust legislation and urged that all members show more interest in this matter, giving to the secretary of the association every assistance possible to cope with it successfully.

The report of the treasurer showed total receipts of $3,915 and disbursements of $2,513 to Aug. 31, 1911, leaving a balance of $1,402. Treasurer N. W. Brockett stated that the association had lost only six members during the past fiscal year, these members being lost by reason of consolidation with other companies, and that eight new members had been taken in to offset the six lost.

RATES.

The chairman of the committee on rates, Mr. N. C. Osborn, of the Washington Water Power Company, Spokane, delivered a short talk on rates. He mentioned the fact that different states are now represented by public-service utility commissions, which regulate the rates, etc., of public-service corporations, and exhibited the published rates, charts, etc., of the Washington Water Power Company, giving blackboard illustrations of the rates. Mr. A. A. Lewis, assistant to Mr. Osborn, gave examples and explained the rates in detail.

LEGISLATION.

At the opening of the afternoon session on Sept. 21 the president asked for the report of the legislative committee appointed at the last convention of the association, consisting of a representative each from the States of Oregon, Washington and Idaho. The representative from Oregon stated there was nothing of particular interest to report from that State. The representative from Idaho not being present, Mr. M. C. Osborn stated that the State of Idaho had passed at the last session of the Legislature a law that would create public-service commissions in communities and municipalities with rate-fixing power. This action was killed by the committee in the beginning and again taken up at the last moment just before adjournment and passed. It was, however, vetoed by Governor Hawley, who stated as his reason for such veto "that a commission appointed in communities in such a manner could not be a fair commission; that one could not secure five men from any community who would not be in some way personally interested."

Mr. N. W. Brockett, chairman of the legislative committee, then delivered an address on the work accomplished in the State of Washington. He stated that two important measures were passed, the public-utilities bill and the employees' compensation act. From the first of these measures were stricken most of the redeeming features which were introduced into the original draft, on account of the activity of the committee. In the latter measure were included all of the provisions contained in resolutions adopted at the last convention of the association.

DISTRIBUTION PROBLEMS.

In a paper by Mr. John B. Fisken certain problems encountered in the transmission and distribution of energy throughout the northwestern part of the United States were treated in detail. The subjects discussed related t the methods of transmission from outside points, metho of generation, methods of operating generating station and city substations, methods of distribution in cities, loa dispatching and the education of employees. Much in formation was given concerning the constructive feature and operating experiences of the Washington Power Com pany, Seattle-Tacoma Power Company, Portland Railway Light & Power Company, the city of Seattle and the Seattl Electric Company. Both aluminum and copper are used fo conductors, but the mileage of aluminum is much in exces of that of copper. The general practice is to erect the tele phone lines on the same poles as the transmission con ductors, and in normal operation this method is perfectl satisfactory. All of the companies lay down rigid rule for the guidance and protection of their patrolmen, and i all cases high-tension lines are short-circuited and grounde before anyone is allowed to work on them. A great de of trouble has been experienced on account of the burnin of pole tops. The only explanation which seems to cove the facts is that the heat due to the charging current start a smoldering fire in the poles. In order to overcome th trouble all of the pins are now being grounded. For ligh ning protection the tendency is to discard the multi-ga type and replace them with aluminum cells. The city o Seattle is using two spark-gaps in series with a 2-in. colum of running water as a resistance to ground. The Washin ton Water Power Company is the only one employing ground wire strung above the conductor. The standa frequency employed is 60 cycles per second. With the e ception of the Portland Railway, Light & Power Compan which has four steam turbines and seventeen steam engine the Washington Power Company, which has two steam tu bines, and the Seattle-Tacoma Power Company, which h one steam turbine and one steam engine, the energy is fu nished by hydraulic turbines, of which twelve of the vertic type and thirty-one of the horizontal type are in use. In of the recently equipped plants use is made of the indire type of waterwheel governor, in which oil acting und pressure is employed to operate the gates.

A written discussion of Mr. Fisken's paper was submitt by Mr. S. C. Lindsay, who described the system and pra tice of the Seattle Electric Company, which operates a mile, 50,000-volt line for transmitting energy from the El tron plant to Seattle and Tacoma. The conductors for t Electron line are 4-0 stranded copper, with the excepti of 11 miles of one line, which is of No. 1-0 solid copp The company operates 39 miles of 13,800-volt, three-ph line in the city of Seattle, 13 miles of which is aluminu It has also 5 miles of aluminum railway feeders. The o objections against the use of aluminum for line conduct are that it has no scrap value and that linemen experie difficulty in making good joints between it and cop Although lightning is almost unknown in the Puget So region, the company makes use of lightning arresters taking care of disturbances due to switching, short-circu etc. Grounded wires are not used along the transmiss line, because it is not considered necessary to protect line against lightning. The alternating-current generat are equipped with non-automatic breakers, the opera being depended upon to open the switch on the unit in c

trouble arises. All of the transmission lines are equipped with automatic oil switches in the stations where the lines originate. Mr. Lindsay expressed the opinion that it is best to make practically all transmission-line breakers, as well as generator breakers, non-automatic, and to confine the use of automatic switches to the distribution circuits. In connection with its steam station in Seattle the company operates a steam-heating system for about eight and a half months of the year. A load dispatcher is employed for regulating the load on the engines, so that the exhaust steam will equal the amount of steam necessary to meet the requirements of steam-heating. There are over 300 steam-heating customers, with a total connected radiation of approximately 248,000 sq. ft. The rates charged vary from 77 cents per 1000 lb. to 55 cents per 1000 lb., according to the amount used.

At the conclusion of the reading of the papers by Messrs. Fisken and Lindsay an open discussion took place concerning them. The principal points taken up were the use of leased telephone service on transmission lines, in addition to company telephone service, to avoid discontinuance of communication between generating points and central station, etc.; the grounding of wires to avoid loss and damage by lightning disturbances; the life of poles, cross-arms, etc., and the preserving of native timber to take the place of that now imported; cost of construction of lines; the forming of clubs by members of a company, for the betterment of service and the bringing of officials in closer touch with employees; the improving of central stations and other properties to obtain better work and results from employees.

PUBLICITY.

"Central Station Publicity and Commercial Policy" was the title of a paper by Mr. W. J. Grambs. The author claimed that it is to the financial advantage of the public-service corporations to cultivate the good will of the public. The right of the public-service corporation to do business comes from the people, its income from service comes from the people, and its prosperity rests upon the good will of the people. Public-service commissions, when created along the right lines, can do much to create a fair understanding on the part of the public concerning the problems that central stations have to solve, and can thereby assist the corporations in improving and lowering the cost of service. Such commissions are created for the purpose of regulating the public-service corporations, but it must be borne in mind that it is no less their duty to protect the public-service corporations against unjust imposition of burdensome regulations and taxes. Control regulation is here to stay, and the time will come when commissions will make the same effort to be fair with corporations that the corporations are now striving for in dealing with the public. Commissions should stop at control and regulation; they should not manage, operate or dictate what the management or operation should be beyond efficiency and economy. Commissions should pass judgment upon matters of justice and fairness, but not upon matters of technical detail. There is a possibility that part of the general prejudice against utilities corporations might be removed if the central station published an annual financial statement with a reservation for maintenance and possible extensions, in this way taking the public into its confidence.

In its dealings with the contractor the central station should meet him more than half way. The contractor or engineer is the person who advises the owner concerning the installation of a private plant or obtaining service from the central station. It is necessary, therefore, to cultivate the friendship of electrical contractors and engineers. If the central station treats the contractor fairly and generously the contractor will in most cases give to the public the impression that it may also expect the same kind of treatment from the central station.

Owing to lack of space, the remainder of the report of the convention is held over for the following issue.

Convention of Kansas Electric Association.

The fourteenth annual meeting of the Kansas Gas, Water, Electric Light and Street Railway Association was held at Independence, Kan., Thursday and Friday, Sept. 21 and 22, with President W. R. Murrow, of Independence, in the chair and a total registration reaching nearly ninety. Mayor Frank Moses welcomed the convention to the city in a happy speech, the response to which was made by Prof. B. F. Eyer, of Manhattan, Kan.

The technical program was opened with a paper on "The Use of Potential Feeder Regulators on Distributing Systems," by Mr. A. D. Fishel, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Mr. Fishel outlined the advantages of maintaining voltage regulation, mentioning the increased sale of energy, improved illumination with satisfied customers, decrease in lamp renewals and increased economy of operation. The increased sale of energy, he declared, will well repay the cost of automatic regulation. Automatic regulating apparatus of the induction type was then described in detail, the paper closing with an account of the very large high-voltage, three-phase, oil-insulated, self-cooling regulators recently brought out by the Westinghouse company.

Secretary-Treasurer James D. Nicholson, of Newton, followed with his official report, enumerating the association membership, which is made up of ten honorary, 114 active and fifty-four associate members. His report on the organization's treasury also showed the association to be in equally comfortable circumstances financially.

COMBINATION ICE-MAKING.

Mr. W. E. Sweezey, of Junction City, Kan., gave an interesting talk on ice-making for central stations gained from his own experience of nine years' operation. The combined operation of the two plants makes use of practically uniform requirements of coal and labor, he said, decreasing the kw-hour cost during the light-load summer period to a point equal to the fully loaded winter-output unit cost. These facts he illustrated by figures and offered practical advice on the selection of motive power for compressors. The subject was also discussed by Prof. B. F. Eyer, of Manhattan.

Mr. Sweezey then read a paper prepared by his wife, who was unable to be present, on the subject of electric cooking. Recounting her own experiences, Mrs. Sweezey told of the appetizing preparation of less expensive foods possible with electric heat and gave the cost of operating her own electric range in every-day use.

KANSAS UTILITY COMMISSION.

Mr. Carl C. Witt, chief engineer of the new Kansas public-utility commission, followed with a discussion on the relation of that body to the companies. Regulation of public utilities, he declared, will result in an increase of the public's confidence in these corporations in the same way as in the case of the banks which undergo inspection and now find it immensely to their business advantage, although the first efforts at banking regulation were resented by them. The new corporation commission will be the means of saving much costly litigation, said the speaker, and will avoid the evils of the lobby system. The commission as constituted in Kansas becomes a kind of court from which prompt decisions, based on expert knowledge, may be expected. Where necessary, as shown by the cost of the service rendered, the utility commission expects to raise rates, proving its position so that no criticism or objections will follow from the public. A system of uniform accounting is regarded as important to enable the commission to carry on its investigations. Another function of the commission will be the prevention of needless duplication of plant equipment by competing companies, which will not be permitted to enter into competition in a field already satisfactorily filled. Mr. Witt recounted instances of economically expensive water and telephone plant duplications which would

have been impossible under proper supervision of a commission.

Prof. B. F. Eyer, who is vice-president of the Manhattan (Kan.) company, said that under proper administration state regulation will be welcomed by the Kansas plants, eliminating as it will dead losses and useless competition. Mr. C. E. Marsh, of Garden City, told of the recent campaign in his own town, which resulted in the voting of a competitive municipal plant, in spite of the good service rendered by the existing company. Mr. C. L. Brown, of Abilene, said that the public must be educated to the facts of public-utility businesses and added that the interests of the companies are better guarded in the hands of the well-qualified and expert commissioners than when resting with the stove-box politicians, as formerly. While, declared Mr. Brown, the desire of a community to operate its own electric plant may be thoroughly proper and admissible, it should, instead of erecting a plant to compete with the one already in service, be required to purchase the latter at a fair appraisal of its value. Mr. W. E. Sweezey, of Junction City, pointed out that even where the commission does not regularly have authority it may be appealed to from the decisions of local officials. Mr. J. H. Rathert, of Junction City, said it is often impossible to educate the public to the community's best interests.

ACCOUNTING AND COLLECTIONS.

Mr. Ivor Thomas, of Wichita, opened the afternoon session with his paper on "Accounting." Mr. Thomas is by birth an Englishman, having recently served as an accountant in the British colonies of South Africa, and several interesting points in his paper compared central-station business methods in America and abroad. In England, he said, the responsibility for an unpaid lighting bill lies with the owner of the house, which cannot be rented again until the account is settled. American companies, declared Mr. Thomas, write off too much as uncollectible bad debts, a source of loss which, he said, he believed could be decreased. He also deplored the American precedent by which a combination company will continue to furnish gas to a defaulting customer who has failed or refused to pay his electric bills. Tactful collectors, he asserted, can retrieve many losses which companies now suffer. Persons otherwise highly moral often consider it not dishonest to defraud corporations. To apprehend those who make a practice of moving from one town to another leaving unpaid bills behind, Mr. Thomas proposed the organization of a national collection agency to which all central stations and utility companies might subscribe.

Mr. Thomas's reference to defaulting customers provoked a discussion on the subject of meter deposits, customer connection charges, etc. Mr. Slayton, of Wichita, said that the loss of so many meters has caused his company to require a deposit or the signed guarantee of some property-holder, although, he added, he suspected the latter guarantor could not legally be held responsible. Mr. M. T. Flynn, of Kansas City, said he had also used the guarantee-slip plan, and Mr. C. D. Braden, of Kansas City, Mo., said that while operating a plant he found the best plan that of cutting off customers promptly when their bills lapsed beyond a certain date. Under these conditions the meter would be left in for a few days and the customer soon appeared to pay his bill and to apply for restored service. For reconnection no charge was made, the application being treated as from a new customer. Mr. Braden reported that no customers were ever lost as a result of thus promptly cutting off service and he protested against allowing bills to run on as being productive only of future trouble on a larger scale. In Kansas City, Mo., $5 deposit is required, and all bills must be paid within ten days on penalty of discontinuance of service, the cost of reconnecting which is $1.50. Mr. A. C. Brown said he made a practice of charging a fee of $5 for running each service, these fees being permanently retained by the company. Mr. Clyde Crummel, of Independence, said that the local gas company requires a deposit of $5, on which it pays 5 per cent interest.

Mr. W. E. Sweezey, of Junction City, said he finds the system of deposits of chief service in notifying the company when customers are preparing to move, as they then never fail to call and collect their deposit money. Otherwise the office may remain ignorant of the change in occupants of the house and be put to some difficulty in apportioning the cost of service used between the former and later occupants. In St. Louis, said Mr. Gordon Weaver, of Kansas City, a regular deposit is required of all customers not property owners, the amount of the deposit being based on an estimated one-month bill. Fifteen days after the bill remains unpaid the company disconnects its service, the charge for restoring which is $5.

Secretary Nicholson, of Newton, said that recently when a former customer left his town with an unpaid electric bill he wrote to the company in the city to which the defaulting consumer had gone and when the later applied for electric service he was met with a statement of his debt in Newton. As a result the Newton debt was paid before the local application was made, but the speaker added that, in strict legality, he believed a public utility might not refuse service to an applicant who owed bills to another company Referring to the practice of the Commonwealth Edisoı Company, of Chicago, another speaker said that while this company requires deposits only from those who are un known to it such deposits earn 6 per cent interest for theiı owners while in the company's hands.

ILLUMINANTS AND LIGHTNING ARRESTERS.

Under the title of "The Choosing of Lamps for Electri Lighting" Mr. Evan J. Edwards, of the National Electri Lamp Association, Cleveland, Ohio, next presented a pape of unusual practical and academic interest describing th manufacture and uses of modern types of tungsten lamp and their operation at the various pressures of the three voltage rating, and closing with an account of some interest ing considerations of lamp efficiency, color quality, dis tribution and diffusion, etc.

Besides discussing the grounding of transformers, use c ground wires on transmission lines, etc., Mr. Gordo Weaver's paper, which followed, gave an account of th classical series of lightning-arrester experiments carrie out by Mr. E. E. F. Creighton and others on a 25,000-vo system at San Juan, Col., several years ago. Mr. Weav took part in these experiments, which included tests (liquid-electrolyte, aluminum-cell and multi-gap lightning a resters. In discussing the effect of transformers to absoı surges in distribution lines Mr. A. D. Fishel, of Pittsburg Pa., said that while such transformers may decrease tl protection required lightning arresters will neverthele still be needed.

THE KANSAS WORKMEN'S COMPENSATION ACT.

At the invitation of President Murrow, Mr. Charles Keı representing the Independence district in the Kansas Legi lature, presented a review of the provisions of the ne Kansas workmen's compensation act, which, as chairm of the House committee, he introduced and advocated to final passage.

In the compensation of injured workmen the purpose this law is to substitute for the present system of expensi suits and litigation, in which the injured party receiv actually only about one-sixth of the amount paid by the e ployer in settlement of the claim, a simple method of a riving at and paying to the injured workman a fair co pensation for his loss of earning power. The lawyers a courts, with their expensive fees, retainers and costs, a thus eliminated from the equation, which recognizes ac dents as simply a result of carrying on the business a assumes that the workman should be repaid for the loss earning power he has suffered. The new Kansas law, in ca of a workman's death, grants three years' wages—amou ing to not more than $3,600 or less than $1,200—to his

pendents, the payment being limited, however, to $750 if the dependents live outside this country. If the injured man is without dependents the employer is liable only for burial and medical expenses, not exceeding $100. Where total incapacity for work results the injured employee receives 50 per cent of his former earnings, and in case of partial disability from 35 per cent to 50 per cent of his former wages, this compensation award continuing during disability, but not exceeding ten years. As written, an employer may express his desire to come under the compensation law or not as he elects, but in the event he does so fail to elect, and he is sued by an injured employee, he is denied the usual common-law pleas of fellow-servant act, contributory negligence or assumed risk. The law applies only, of course, to injuries received in the employee's regular line of work and is effective only in employments using fifteen men or more, but smaller employers may come under the law upon making application.

Owing to lack of space, the remainder of the report of the convention is held over for the following issue.

The 1911 Meeting of the British Association for the Advancement of Science.

Following are abstracts of papers presented at the Portsmouth meeting of the British Association for the Advancement of Science, a general account of which meeting was printed last week. Further abstracts will appear in the following issue.

In Section G the first paper was by Mr. H. A. Mavor upon "Electrical Drives for Screw Propellers."

On account of the great difference in the economical speeds of propeller shafts and prime movers it is desirable to place speed-reducing mechanisms between the shafts and the engines. For this purpose there are available mechanical gearing by toothed wheels, hydraulic transmission and electric transmission. In cost, weight and efficiency the electric transmission compares favorably with either of the two competing methods; in other important qualifications it is unrivaled. For example, it provides a ready means of reversing the direction of rotation of the propeller without changing the direction of rotation of the main generator; it provides means for changing the speed ratio so as to permit economical operation at all speeds; it provides means for operating at each instant only the exact number of engines required by the load.

Mr. Mavor described the equipments of the steam-turbine ship *Freida*, designed to carry 5000 tons; a United States Navy steam-turbine collier designed to carry 12,500 tons at 14 knots; a 245-ft. oil-engine canal barge and the experimental ship *Electric Arc*, equipped with a 45-hp gas engine. In all cases three-phase motors are used.

Prof. W. E. Dalby opened the discussion by asking for figures of mechanical efficiency of Mr. Mavor's system at half and quarter load. He also asked for some dimensions of the motors attached to the propeller shaft, as he anticipated considerable flywheel action, which would give rise to some interesting problems with regard to the strength and oscillation of the shaft. Prof. J. E. Petavel pointed out that the system practically involves three sets of propelling machinery, namely, the turbine or engine, the generator and the motor. Each of these is liable to individual defects and introduces greater liability to breakdown.

Prof. G. W. O. Howe asked for a few particulars of the windings of the motor and for an explanation of the method of shutting down one of the generators without touching any of the switches and without bad effects. He said that ordinarily when one generator is shut down while the other two are running energy is pumped back from the motor and tends to drive the engine. He disagreed with Professor Petavel's view that the three links in Mr. Mavor's system of transmission are a disadvantage, as squirrel-cage motors and alternating-current generators can be made so reliable that they will not introduce any weakening in the chain.

Dr. J. M. Morrow asked for what type of vessel the author would suggest his system to be most suitable. There are the low-speed cargo boat, the high-speed liner and the warship. In the former the electric drive has to compete with mechanical drive; in the high-speed liner electricity has yet to make out a case, while in the case of warships the question of economy at low speeds is the determining factor. The United States Navy has discarded the turbine for the reciprocating engine and this type of vessel may be the more suitable field for electric drive.

Mr. C. T. Dyer asked, in reference to the vessel in which three oil engines are used for driving the dynamo, if the efficiency is as good as with one engine. Mr. C. E. Handy also asked for information on this point. He expressed the belief that three small engines would not have as high an over-all efficiency as one large engine.

Sir William White said he must correct Dr. Morrow as to the action of the United States Navy in preferring reciprocating engines. The navy had merely installed this type in one vessel built by a particular firm owing to the very satisfactory results obtained in a previous vessel built in the same yard.

President Biles asked as to the effect upon the motors if they were "drowned out" in any way.

Mr. B. P. Haigh said he knew of a case in which motors of the type mentioned by the author had been flooded with salt water and continued in operation perfectly well. The voltage was not so high as that used by Mr. Mavor, but the effect of flooding was not such as to cause any great anxiety provided the motor was not allowed to remain in that condition too long.

Mr. Mavor in his reply said he was able to use voltage varying from 600 to 2000, the latter value being used with the object of keeping down the size of the cables in the newer designs. Where there is any essential reason for keeping the voltage down it can easily be done. The estimated mechanical efficiency of the boats mentioned as about to be built is 90 per cent. It is possible to increase it to 96 per cent, but in adopting a motor which would give this value its properties would not be quite so favorable for the purpose in view; in order to push up the efficiency the clearance between the moving and stationary parts must be reduced to very small limits. The question is whether one can afford to undergo the loss of 6 per cent. The answer is that in the case of the *Freida* the coal consumption would be reduced from 40 tons to 30 tons per day. The diameter of the motor is about 15 ft., which has been found to be large enough to deal with most cases. Concerning strains, he said that in the *Electric Arc* the motor weighs about 1000 lb. in the rotating part and there is no indication of strain or disturbance to the propeller shaft or bearings. In the sea the motor runs much more steadily than the engine. The electric system does not involve three sets of machinery, but one, with two rotating parts. The rotor of the turbine and the generator are rigidly coupled together and form one rotating part. The motor is rigidly fixed to the propeller shaft and it is simpler in construction than a cartwheel. All the other parts are stationary and correspond with the stationary parts of a reciprocating plant. The moving parts in both systems are precisely the same in number. To the electrical engineer the system is not a complicated one. All change in the connections is made when no current is flowing and there is no danger.

The author said that he had had an opportunity of making a precise comparison with a mechanically geared ship and there is no doubt that mechanical driving is a very serious competitor, indeed, in respect of mere transmission, but he was much pleased to be able to say that the weight, price and efficiency of the electric system are about the same, and in the *Freida* the steam consumption with the

electric drive will be 25 per cent less. There is no more danger of breakdown with the electric driving of ships than there is with other forms of applying electric power. In the design of the motor the whole question is to make the windings mutually non-inductive. The use of three engines instead of one has the advantage that one can be shut down when high speeds are not required. The boat of bulk freight already mentioned has to go at slow speed in the locks and canals, but is to be run at full speed in the lakes. Another point is that three low-power Diesel engines are lighter than one high-power engine. With regard to short-circuiting, he said that he had astonished the representatives of the Admiralty by being able to throw the motor right over from full speed ahead to full speed astern without anything happening except that the boat went astern as desired. In this respect the squirrel-cage motor is a distinct advantage. As to other possibilities of short-circuit, he had put a similar motor in a tank of water for a whole day and run it without trouble, although there was danger of damage to the insulation if the test were maintained for too long a period. Again, even if the cable on the boat were to be connected to the body of the ship the generator would give out two and one-quarter times its normal power at low voltage and the turbine would continue to run, but there would be no danger to anyone in the boat. Mr. Mavor also mentioned that an order for one of the colliers described had been placed by the United States Navy and that Admiral Cohn, of the United States Navy, has expressed his intention of placing an order for a second one. He remarked upon the greater interest which is being taken in this matter by the United States Navy compared with the British Admiralty.

Mr. B. P. Haigh then read a paper on electrical steering in which he stated that electrical steering offers considerable advantages for steamers as well as for vessels propelled by internal-combustion engines, for the improved economy corresponds to a saving of weight in boilers and fuel. Difficulty has been experienced in obtaining a reliable system of control, capable of dealing with the power necessary to put the helm hard over in emergency in the shortest possible time and possessing sufficient sensitiveness to enable an accurate course to be kept by moving the rudder promptly in small angles. The steering motor may be started and stopped for every motion of the rudder, but it is preferably kept running continuously, mechanical control being introduced either in the form of hydraulic transmission or in the form of magnetic clutches as developed by the writer of this paper. In the latter type of gear two magnetic clutches are employed, these being fitted at opposite ends of the motor; and, as no gearing is kept continuously in motion, the wear and tear, as well as the current required, are reduced to a minimum. The clutches prevent the shock of the sea being transmitted to the electrical system and, as they have considerable flywheel effect, the current taken by the motor does not fluctuate widely under normal conditions and the steering gear may therefore be supplied with energy from the ship's lighting generator.

Sir William White opened the discussion, expressing a strong prejudice in favor of electrical steering. A difficulty with regard to it, he said is the human element. On one yacht with such a gear, which he himself had designed, there was nearly a collision due to the nervousness of the operator, because he kept moving the gear without giving the hunting gear time to do its work. With all electrical systems it is essential to install a helm indicator quite independently of the gear, so that the man in the steering position can see where the helm is. Prof. W. E. Dalby, referring to the author's system in which magnetic clutches are made use of, asked as to the coefficient of friction between the fiber and the steel and what would be the safe limiting pressure to work at in order to make sure of durability of the fiber—that is, the pressure per square inch between the fiber and the armature under normal conditions.

The author replied that at first the fiber gave a little trouble, being very hygroscopic. It is now boiled in linseed oil, which fills up all the pores, and no water gets in. He usually relies upon a coefficient of one-sixth.

A long mathematical paper was given by Mr. T. F. Wall upon the single-phase repulsion motor. The author developed the circular current diagram of the machine and reported the results of tests made upon a 6-hp unit.

Prof. Ernest Wilson, in a paper entitled "The Electrical Conductivity of Light Aluminum Alloys," described tests recently completed showing that alloying commercial aluminum alone with copper to the extent of 2.6 per cent is not to be recommended. An alloy known as "duralumin" has been tested and a report is made thereon. Its specific resistance is 5.35×10^{-6} ohms at 15 deg. C. as against 2.76×10^{-6} for pure commercial aluminum.

On Monday Section G was mainly concerned with a discussion on mechanical flight, but subsequently found time for a lucid exposition of wireless telegraphy, with special reference to recent developments by Prof. G. W. O. Howe. The author had installed an equipment in the lecture-room and received time signals and weather reports from the large station on the Eiffel Tower in Paris, and also from Norddeich, in North Germany. These signals, however, were not received without interference from other stations.

Professor Howe stated that the total number of ships of the mercantile marine fitted with Marconi apparatus at the end of 1907—that is, after seven years of development—was 140; at the end of 1908 the number was 220; at the end of 1909 it was 330; while at the close of last year it had risen to 510. In addition to the mercantile marine practically every ship in the British navy has been fitted with the Marconi apparatus. The Telefunken Company, o Berlin, carried out 106 installations last year, bringing th total number of stations using its apparatus up to nearl 1000. About 500 of these are warships, principally Germa and Russian, while 100 are portable military sets. Exclud ing German boats, only thirteen ships of the mercantil marine are fitted with Telefunken apparatus. Attentio was called to the troubles from interference between sta tions working simultaneously, which promise to become o the gravest importance in the immediate future. Inter ference is being minimized by sending out well-sustaine trains of waves of one definite frequency and by using high musical pitch easily distinguished from the cracklin noises caused by atmospheric disturbances, and also fro other stations having notes of different pitch. The de tectors now employed in conjunction with the telephor receiver are not only more sensitive than the filings coher operating a Morse inker, but they enable the operator discriminate between signals being sent to him and th various disturbances picked up by the aerial. To produ a musical note of high pitch it is necessary to make th sparks follow one another with great regularity and rapi ity, say, 1000 per second. The simplest plan is to use 500-cycle alternator and adjust the voltage until the ga breaks down once every half cycle. Practically all th radiotelegraphic apparatus working commercially or bei installed at the present time is based on the principles ou lined; with the exception of the spark-gap and the detect employed the differences are non-essential.

This paper was followed by a series of lantern slid which were exhibited by Capt. H. Riall Sankey and wh depicted Marconi's portable field sets for cavalry and i fantry use. These showed in a very interesting mann the way in which the frame of the saddle in the cavalry is used as a stand, the generator and oil engine resting brackets, one on either side, the necessary connection bei made by a flexible shaft. In the cavalry sets four pa horses are used. These sets, which are of 0.4-kw rati have a range of 20 miles over mountainous country, 50 miles over normal country. The aerial pole is 60 ft.

light, and the whole station, it is said, can be unpacked and erected in nine minutes and dismantled and packed again in six minutes. The infantry sets are of 1.5-kw rating, and these have a range of 200 miles. In all of these portable sets a valve receiver is used. During a conversational discussion upon Professor Howe's paper and Captain Sankey's slides it was stated that both at Clifden and Glace Bay a valve receiver is used, with an air blast to quench the spark. It was also mentioned that the Marconi transatlantic station is working with a wave-length of 20,000 ft. The cavalry set illustrated works with a wave-length of 300 m (990 ft.).

Owing to lack of space the remainder of the report of the meeting is held over for the following issue.

Public Service Commission News.

WISCONSIN COMMISSION.

The Wisconsin Commission recently held a hearing on the question of physical connection between telephone lines, this being the first hearing since the law providing for such connection was passed by the Legislature last winter. A petition was presented by the Linzy Brook Telephone Company asking for connection with the Cecil-Green Valley Telephone Company. A similar case involving the La Crosse Telephone Company and the toll lines of the Wisconsin Telephone Company was postponed to the November calendar.

A number of hearings involving the refusal of certain utilities to comply with the orders of the commission have been postponed a month upon request of the utilities involved and with the sanction of the engineering staff. This was done for the purpose of allowing the utilities a little extra time in which to complete the alterations and improvements ordered by the commission.

The Oshkosh Gas Company has filed with the commission a revised and reduced schedule of rates for gas. The old rates were $1 net for gas used as fuel, and ranged from $1.50 net per 1000 cu. ft. for the first 10,000 cu. ft. to $1.20 net for all gas used in excess of 50,000 cu. ft. per month for gas used for illuminating purposes. Under the revised schedule all gas is to be registered by one meter and paid for at the following rates: For the first 15,000 cu. ft. per month, $1 net; for the next 35,000 cu. ft., 90 cents; for all over 50,000 cu. ft., 75 cents net. The minimum bill is to range from 50 cents per month for a three-light meter to $4 per month for a 200-light meter.

The case of C. R. Martin vs. the Southern Wisconsin Railway Company was argued before the commission on Monday. The petition related to the rule recently put into effect by the traction company prohibiting the carrying of certain designated articles on the company's cars. The immediate matter in controversy was a section of the rule prohibiting the carrying of baby carriages unless inclosed in a paper or cloth bag. The testimony tended to show that this section was prohibitive in its nature; that it was unreasonable and unnecessary. The company defended the rule on the ground that it was necessary in order to maintain the car schedule and that the presence of baby carriages on cars, especially in rainy weather, worked an inconvenience to the traveling public. Under the same rule the company prohibits a working man carrying his tools with him. On account of the peculiar shape of the city of Madison this rule works considerable hardship. The commission has taken the case under advisement.

NEW JERSEY COMMISSION.

At a hearing before the Board of Public Utility Commissioners of New Jersey in Newark on Sept. 27 in connection with an inquiry into the electric and gas rates of the Public Service Corporation of New Jersey, Thomas N. McCarter, president of the corporation, made an extended address. He described the organization of the corporation and the capitalization of the underlying gas and electric companies. He argued that the decision of the United States Supreme Court in the Consolidated Gas Company case settled the legal validity of underlying securities of the Public Service Corporation because conditions in the two instances were alike. Mr. McCarter contended that no less than 8 per cent should be allowed on a fair valuation of the property devoted to the public use. The state of turmoil involving a long investigation would be disastrous to the business of the company and its efforts to raise the additional new capital required. He proposed that a schedule of rates should be fixed by the board effective for a period of five years from Jan. 1, 1912, on a basis that would recognize the obligations of the Public Service gas and electric companies as to their respective underlying securities, and enable these companies to pay annually a dividend of 8 per cent on their actual capital as it will exist from year to year after the deduction of proper reserves for maintenance and the provision of a moderate fund for such capital expenditures as business prudence demands should not be capitalized, but must be made as an inducement to new capital. The proposed schedule of rates for the Public Service Electric Company is the same schedule of discounts from the base rate which was placed in effect recently by the New York Edison Company. The present Public Service rate steps down one cent for every 500 kw-hour of monthly consumption for the first five steps; the New York rate steps down 1 cent for every 250 kw-hour of monthly consumption for the first four steps. In the fourth year of the period, or on Jan. 1, 1915, the base rate is further reduced from 10 cents to 9 cents, thus combining the first two steps of the theretofore existing schedule.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has authorized the Empire Gas & Electric Company to issue $51,000 in 5 per cent joint first and refunding thirty-year gold bonds. The bonds are to be sold at not less than 85 and the proceeds used in extension and improvements to the company's property in Auburn and other proper capital expenses of the company.

The commission has received a preamble and resolution from the Common Council of the city of Watervliet reciting that that city, with a population of 15,000, has no telegraph office; that the Western Union Telegraph Company has received a valuable franchise from the community permitting the erection of poles and wires for the conduct of its business and for many years did maintain and conduct an office in that community, but for some reason discontinued the maintenance of such office. The commission is asked to compel the Western Union Telegraph Company to establish and maintain a centrally located office for the sending and receiving of messages in the city of Watervliet. The complaint has been served upon the company and an answer required within twenty days.

The commission has received a complaint from residents of Ulster Park, Ulster County, and members of Ulster Grange No. 969, requesting the issuance of an order directing the New York Telephone Company to render direct service from Ulster Park with the Kingston exchange without toll charge. At the present time the telephone company has established a boundary between Kingston and Esopus with the exchange centering at Esopus and including Ulster Park and vicinity. The subscribers from this exchange have to pay a toll rate for Kingston calls or are charged for mileage for direct communication with the Kingston exchange. The complainants state that even after paying this mileage charge they are still required to pay toll to talk with subscribers on the Esopus exchange. It is claimed that the boundary as determined

by the telephone company is arbitrary and made without due respect to the needs and convenience of residents of this section. This complaint has been served upon the company and an answer will be filed within twenty days.

CURRENT NEWS AND NOTES.

The "Tungsten" Cigar.—In their search for striking names for their products the cigar manufacturers have now fastened upon the name "Tungsten." The Tungsten cigar is already advertised for sale in the West as the "bright white light of cigardom."

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Vacuum Cleaners in Schools.—The Russell Sage Foundation, a philanthropic institution, in an investigation of the subject found that dust in schools is a prolific source of contagious diseases and as a result has recommended that vacuum cleaners be used in school buildings.

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A Correction.—In the letter to the editor from Mr. W. A. Del Mar on "Values and Depreciation," which apeared on page 757 of the issue of Sept. 23, the words "satisfying wants" in the quotations from Mr. C. H. Chase, at the end of the twenty-second line of the letter, should read "the relations."

* * *

Bureau of Standards Vacancies.—The United States Civil Service Commission will hold examinations Oct. 25-26 to secure eligibles to fill places in the Bureau of Standards as they occur. Details of the examination are given in Circular 803 of the commission, of which a copy may be obtained by addressing the United States Civil Service Commission, Washington, D. C.

* * *

Electrical Turnstiles.—A system of electric turnstiles has been installed at the Indiana State Fair Grounds, Indianapolis, which includes a tabulating device in the office of the superintendent of admissions, whereby each admission is recorded as the person enters any of several gates some distance apart. The electric tabulating machine contains a separate tabulating section for each turnstile and enables the management to ascertain the exact attendance any time during the day. Each visitor deposits a half-dollar in a coin slot, which unlocks the turnstile to admit him and at the same time indicates his admission on the tabulating apparatus in the superintendent's office.

* * *

Electrical Moth Exterminator.—Electric light and emf are the two agents employed in a coddling moth exterminator which is said to have been employed successfully by Messrs. W. M. Frost and J. C. Lawrence in an apple orchard at Opportunity, Wash. The apparatus consists of a storage battery to furnish energy to 6-cp incandescent lamps, which are netted with fine steel wires maintained at a difference of potential between adjacent wires. Attracted by the bright light in the tree, to which the globe is strung by a covered wire, the moth flies against the net work, completes the circuit and is instantly killed. It is claimed that the electrical device is much cheaper to install and operate than spraying apparatus.

* * *

Denver Electric Show.—At the midweek luncheon of the Colorado Electric Club on Sept. 21 reports were made by the various committees having in charge the Electric Show to be held Oct. 14-21 in the Denver Auditorium. Among new features arrangements have been compiled for an illuminated parade of electrically decorated elect vehicles. Over 500 pleasure and 100 commercial machi will be in line and the parade will extend over sixty bloc All traffic will be suspended along the line of march no gasoline machines will be allowed on those streets within the parking limits at the Auditorium. This is pected to prove not only a successful feature, but one of benefit in advancing the interests of the electric veh in Denver and neighboring cities.

* * *

Bathing-Beach Alarm System.—The beach city Venice, Cal., has completed and placed in service an al system for life-saving, fire and police service. Operat from posts along the beach, fifteen alarm boxes con with the Ocean Front Bath-house for summoning the l saving crew. The annunciator at this station has n bered buttons which become lighted when the correspc ing alarm box is operated; in addition a bell rings u the button is pressed in response. For police service telephones and red lights are provided, while the u equipment is employed for the fire department. To in protection against moisture and other damage the w are carried in cable, a total of about 76 miles of condu being necessary for the installation. All metal fixt exposed to the salt air are galvanized to prevent co sion. The system, with its three arms of report, cost proximately $3,000, and, based upon the cost of repairs the former service, it is expected to pay for itself wi a short period.

* * *

Hydroelectric Power.—Bulletin No. 3, just issue the Mississippi River Power Company, which is buil the great water-power development opposite Keokuk, declares that as the result of the completion of the liminary work and the rapid attack on permanent struction already made during the past six months, deli of hydroelectric energy from the Mississippi is now t oughly assured by the date originally set, July 1, 1913 round million dollars has been expended in the constru plant alone, and on account of the heavy expenses volved between the beginning of construction and the livery of energy, all possible speed is being made in b ing the dam and power house. Most of the wheel-pi cavation is now finished, and concrete has been place some of the huge draft tubes. The rate of placing crete on the dam has increased with experience, and than one-fourth of the arches and piers are alread place. The new navigation lock, a part of the dam pr will be 110 ft. wide and 400 ft. long, with a 40-ft. lift

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Rewards of Literature.—A technical writer in Ch who has contributed to a number of American papers magazines determined to endeavor to find an outlet for a of his literary output abroad. Accordingly, he se an article, written in the language of the country and ac panied by a photograph, to a technical journal quite known and published in a Continental capital. In ue course he received a courteous letter from the editor s ing that the article had been received and accepted and uld be paid for on publication. Judging from his exper nce with American publications the author felt reasonably ure that he would receive a respectable remittance for his rk. He was rather surprised, therefore, when he came t ind that it consisted of foreign postage stamps of the val of 72 cents in the land of issue. As the author had pa 15 cents in postage and had no market for the foreign s nps he did not consider the transaction a very profitabl ne. The sequel to this true story is that the author, wh saw the humorous aspect of the situation, wrote an acco of it for an American literary periodical and received f the second "story" many times as much as the original ompensation, even if the latter had been in real money.

St. Louis League of Electrical Interests.—The noonday luncheon of the St. Louis League of Electrical Interests, held at the City Club, St. Louis, Tuesday, Sept. 26, was addressed by Mr. Ell. C. Bennett on the subject of "Electrical Publicity."

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Union Electric N. E. L. A. Branch, St. Louis.—The next meeting of the Union Electric Light & Power Company (St. Louis) Section of the National Electric Light Association will be held Friday evening, Oct. 27, when Mr. S. N. Clarkson, of the company's commercial engineering department, will talk on "A Trip Through Some European Power Stations."

* * *

Individual Efficiency.—Mr. H. N. Tolles, of the Sheldon School of Salesmanship, gave an address on "Individual Efficiency" before the Electric Club of Chicago at the midday meeting of Sept. 20. Mr. Tolles discussed the psychology of salesmanship and told of the "success formula." He said that according to the science of salesmanship the success of every man depends on his "area." This word "area" is made up of the initials of the words "ability," "reliability," "endurance" and "action," and all these qualities should be developed in about equal degree to make a successful four-square man.

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Telephone Service on the Isthmus of Panama.—A contract has been entered into between the Panama Railroad Company and the Isthmian Telephone Company, a local corporation organized for the purpose of conducting a general telephone business on the Isthmus of Panama, by which the railroad company transfers its commercial toll-line business originating at Colon or Panama to the telephone company. The telephone company will at once establish its toll-line service, using the railroad company's circuits out of Panama and Colon. It has an exchange in operation in Colon and has also obtained the concession for the establishment of a local exchange in the city of Panama. The contract does not include the whole Canal Zone in its scope, and the present arrangement of charging $7.50 a month for commercial service will be continued at all intermediate points.

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Electric Towage for Panama Canal.—The Isthmian Canal Commission, Washington, D. C., has advertised for proposals for furnishing one electric towing locomotive, complete, for the Gatun Locks, and thirty-nine electric towing locomotives for towing ships through the locks of the Panama Canal. Four locomotives will be required to tow a vessel of moderate size—two ahead, one on either wall, towing, and two behind, trailing, to keep the vessel in the middle of the lock. The towing speed is 2 miles per hour. The electrical equipment of each locomotive is to consist of two traction motors and control. There are also to be a motor and controllers for operating a windlass for hauling in or paying out the tow-line under load, and a high-speed, motor-driven attachment for coiling the tow-line when out of service. The motors are to be three-phase, 25-cycle, 220-volt induction motors of the railway or mill type, totally inclosed and moisture-proof.

* * *

Science Defined.—Mr. R. T. Crane, the Chicago multimillionaire who at intervals breaks loose in denunciation of higher education—apparently considering it a presumption for schools to teach men more than he himself has been able to acquire in his "self-made" career—has recently returned to his attacks on technical education. Just previously he fired a volley at higher institutions of learning in general, charging, as the result of reports of detectives engaged by him for the espionage of students, that our larger universities are seats of gross immorality and debauchery. A ludicrous incident in this connection was a public overhauling of the author of the attack by a grandson, a student at Harvard—for it appears that opposition to higher education does not extend to prohibition of its acquirement by members of the critic's own family. In fact, this opposition appears to be largely that of an employer who resents the entry of the schools as a factor in the industrial field. In the diatribe against technical education, after stating that all departments of "higher schooling" are founded on "error, deception and ignorance," a definition of science is given, in connection with the remark that the masses "imagine that since science in the past has played an important part in the progress of civilization, the same must be true to-day," which assumption is flatly denied. "Let me," he says, "state just what I mean by science. The dictionary definition is very long and unsatisfactory, and, in my opinion, inconsistent with the general understanding of the word. Science means the doing of things in a more or less highly intellectual way by taking advantage of natural laws and principles. The wheel in a wheelbarrow; the lever; the block and tackle; braces and trussing; the hammer, the axe; the building of cofferdams; the building and making of caissons, etc., I consider to be scientific, and I believe the general public will accept this definition. While scientific principles are very numerous, yet many of them are also exceedingly simple; in fact, most of them are so considered by good mechanics."

* * *

Unusual Electrical Accident.—According to the Los Angeles newspapers, Martha Elizabeth Bloom, a four-year-old child, was the victim of an unusual electrical accident in Pasadena, Cal., a short time ago. Martha was playing on South Fair Oaks Avenue near her home and while she was seated on a fire plug it is said that a guy wire of the Pacific Light & Power Corporation broke and fell on the hydrant. Current escaping over this broken wire caused a short-circuit at the fire plug resulting in a burst of flame. The child's clothes caught fire and she was badly burned about the legs before the flames were extinguished. The company, it is said, volunteered to compromise any claim on behalf of the child for $1,500, and as the matter had been brought into court the judge allowed the child's guardian to accept this compensation.

* * *

Conditions in the Orient.—The regular weekly meetings of the Electric Club of Chicago were resumed Wednesday noon, Sept. 13, at the usual place. Mr. A. D. Curtis, president of the National X-Ray Reflector Company, who recently made a trip to Japan, China and the Philippines, gave an interesting and entertaining account of his trip and some of the conclusions which he reached as to the probable futures of those countries. The talk covered political, social and economic conditions in those countries, as well as electrical development, but he seemed especially impressed with evidences of American activity in Manila. He complimented the street-railway service in that city and observed that the native Filipinos are excellent mechanics when properly trained and well suited to operation of electric plants. Except in some of the foreign centers China is practically without electrical development. Japan, he said, is actively preparing to get the trade of China which is sure to come with the foreign innovations in that country. In the securing of this trade Japan would be America's most active competitor and by reason of its proximity would have a decided advantage. It is not a question of America securing Japanese trade, but of whether Japan or America will get the Chinese trade. The speaker described China's political conditions as very unsettled, primarily due to the fact that the rulers are not of the genuine Chinese nationality and that the masses feel that they are being oppressed and imposed upon by foreign rulers.

Lightning Damages Plant Chimney.—The municipal water and electric-light plant at Winfield, Kan., suffered a lightning stroke to its tall chimney Sept. 18, the engineer and two firemen in the boiler-room being knocked down by the shock. Mr. Harry V. Forest is plant manager for the Winfield Municipal Commission.

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Annual Meeting of Sons of Jove.—The ninth annual meeting of the Order of Rejuvenated Sons of Jove will be held at the Denver Auditorium in Denver, Col., on Oct. 16, 17 and 18, during the Denver Electrical Show. A number of important subjects will be discussed, including the matter of publishing advertising in the *Jovian Bulletin.*

* * *

Wired-House Ratio in Manhattan, Kan.—The town of Manhattan, Kan., probably stands near the head of the list in its ratio of central-station customers to population. With barely 6000 people in town, the Manhattan Ice, Light & Power Company has 1200 electric-lighting and power meters in service, according to Mr. B. F. Eyer, vice-president of the company.

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Tests of Meters.—Tests of customers' wattmeters reported by companies to the New York Public Service Commission, Second District, show that of 6506 tests in July, 1911, 465, or 7.15 per cent, were fast; 4926, or 75.71 per cent, were accurate, and 1115, or 17.14 per cent, were slow. Of a total of 238 companies thirty-six did not report, and of those which made reports 115 made no tests.

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Advertising an Investment or an Expense?—An article by Elijah W. Sells, published in the September issue of the *Journal of Accountancy,* discusses the subject, "Should Advertising Expenditures Be Charged as an Investment or as an Expense?" The article was presented originally as an address before the Associated Advertising Clubs of America. It discusses the advantages of publicity regarding financial affairs and also the extent to which advertising for the purpose of developing good-will may be held properly to be an investment.

* * *

New York Y. M. C. A. Lectures on Electricity.—Illustrated evening lectures on electricity will be given under the auspices of the Department of Education of New York City during October, November and December in a number of public schools and branch public libraries, six in all. Prof. W. Wallace Ker, of the Hebrew Technical Institute, will give a course both in Manhattan and Brooklyn on the principles and practice of electrical engineering. The other lectures will be on elementary electrical science, by Messrs. J. Newton Gray, Frederick W. Huntington and Charles L. Harrington and Prof. John S McKay.

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Electricity in Farming.—An experiment with electric power for agricultural purposes was made on Sept. 18 at the farm of John Prouse, near Ingersoll, in the county of Oxford, Ontario, service being taken from a line of the Canadian Hydroelectric Commission. The demonstration consisted of filling a silo, for which work Mr. Prouse had installed a special equipment. The test was pronounced eminently satisfactory in every particular and emphasized the value of Niagara power to the farmer. Hon. Adam Beck, chairman of the Hydroelectric Commission, the Ingersoll light and power commissioners and many representative farmers were present.

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Central Station Renders Medical Service.—Lewis, Ia., is lighted by a 25-kw gasoline-engine-driven central station, which was described in the *Electrical World* o April 20, 1911. A few days ago one of the members of th little community which gets its electrical supply fro this tiny power plant was badly injured, and when take to the doctor's office the physician declared he must ha electric power immediately to operate one of his in struments. Lewis has at present no twenty-four-hour serv ice, but the electric-light man was quickly reached on th telephone and the situation explained to him. In a minut he had run to the plant and in two more cranked up th little engine. In four minutes the doctor had his electricit and the man's life was saved.

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Electricity in the Transvaal of Boer War Times.- Some incidents of former electrical conditions in th Transvaal country of South Africa were recounted b Mr. Ivor Thomas, formerly with the Barnato company central station at Johannesburg, and now of the Kans Gas & Electric Company, Wichita, Kan., in a talk o "Accounting" before the Kansas electrical conventio Sept. 21. Residence customers in Johannesburg paid cents per kw-hour for their electricity and in some of t suburbs service was interrupted after 12 midnight. N accounts were rendered customers, but bills were known be due on the tenth of the month, and if not paid by t fifteenth at the company's office service was discontinu without warning. New customers were required to p $10 deposit and those who objected were told they cou do without light if they wished. In reply to a member the Raadzaal who proposed converting the local horse-c line to electric trolley, President Kruger retorted: "This an agricultural country and grows oats to feed horses. we have an electric line we shall have no horses to fee so the farmers will lose the sale of forage. We w go on with the same street cars as before and if the Englishmen who want electric cars are not careful I w get a law passed to take away their 'verdommt' telephones

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Changes in Purdue Electrical Faculty.—Prof. L. Rowell, formerly assistant professor of electrical engine ing at the Case School of Applied Science, has been secu to take charge of the electrical laboratory of Pur University, Lafayette, Ind. Professor Rowell is a 1 graduate of the University of Wisconsin, where he hel graduate scholarship the following year. During the th succeeding years he was chief engineer of the Arn Magnetic Clutch Company and for four years follow was in charge of experimental work with the Cutl Hammer Manufacturing Company. During the last years he has held the above-mentioned position at C School of Applied Science. Aside from the direction the electrical laboratory, Professor Rowell will have cha of the first semester course in electrical engineering, wh embraces the theory of electrical transmission and dis bution systems. Prof. A. D. DuBois, who was gradua from the University of Illinois in 1899 and for the three years has been instructor at Cornell University, have immediate charge of the junior electrical laborat under the general direction of Professor Rowell and also give the electric course in electric-railway enginee for seniors in the electrical school. Prof. DuBois si graduation from the University of Illinois has been ployed with the Electric Storage Battery Company, e Wabash Railroad and the Western Electric Company, d for the year previous to his instructional work at Cor ll was in charge of important electric-railway developm ts of the Illinois Traction Company at Decatur, Ill. Mr. E Curtner, who graduated from the Purdue school of ele cal engineering last June and who has been engage in transformer design for some years with the Hornbe er Transformer Company, of Lafayette, will assist in e design department and in the electrical laboratory.

ELECTRIC ENERGY FROM COAL FOR IRRIGATION FARMING IN COLORADO.

By C. H. Williams.

COLORADO is ordinarily looked upon as a mining State by those unacquainted with its real resources. A few years ago the mining industry was the most important factor, but this condition has been changed and agricultural interests have placed the mining industries in the background. To-day the value of the agricultural products is many times that of mining, not because of the falling off of the mining industry, but because of the rapid advancement made in agriculture; and still this work is in its infancy. The States of Colorado and Wyoming lie in an arid and semi-arid zone, the rainfall being insufficient to mature the crops, and hence irrigation must be carried on to make crop-raising pay.

WATER REQUIRED FOR CROPS.

To grow a crop and bring it to maturity, 22 in. average depth of water seems to be the minimum which will produce results, and this must be supplied at such time as the growing plants require. Each crop requires water at a time peculiar to its needs. Winter and spring wheat, barley, oats and other grains require as a maximum 12 in. of water during the months of June and July, during the period of the filling of the heads of grain. Potatoes and sugar beets require a maximum of 12 in. during the months of August and September, during which time these crops are filling most rapidly below the surface of the ground. Alfalfa requires a large amount of water immediately following the cutting of each crop. All of these crops require irrigation at other periods, but these constitute the maximum conditions.

LOSSES IN IRRIGATION WORK.

A large amount of the water run upon the land is lost through seepage and evaporation. The evaporation from an open reservoir in this territory varies from 5 to 8 ft. of vertical depth per year, when water is available for evaporation all the time, and this amount is much increased where moisture is available for evaporation in an open field, because on newly cultivated land the exposed surface from which evaporation can take place is very large in comparison to the plain surface of a lake or reservoir.

For many reasons the efficiency of irrigation work is less in Colorado than in some older districts, particularly California. In California the losses are reduced to as small amount as possible. The waters are largely carried in closed pipes or conduits, and where open ditches are made use of these ditches have been lined or puddled so that seepage is at a minimum. The losses from evaporation are less in California than in the arid countries because of lesser altitude, lesser differential temperature and higher barometrical pressure. The value of the water in the old irrigated countries is more thoroughly established and greater care is exercised in applying water to the ground.

As an example: Colorado irrigators largely carry on their work of irrigation in the day time and under conditions of brightest sun and heavy winds. With these conditions, double the amount of water must be supplied to furnish the actual water taken by the plants as would be required if application were made at night time when winds are low and when the differential temperature of the water and ground and the overhanging air is least.

With some crops irrigation in the heat of the day is actually injurious to the growth of the plants. The water coming in direct contact with more delicate plants gives them a shock from chilling and frequently retards their growth. This is not true, however, with any of the crops as grown in northern Colorado.

RAINFALL.

Accurate records of the rainfall kept by the government for seventeen years past show that in northern Colorado east of the Rocky Mountains the precipitation varies in localities from 12.27 in. at the Greeley observation station, which is 4639 ft. in elevation, to 17.66 in. in Larimer County at an elevation of 7750 ft.

The distribution of the rainfall throughout the year is a factor as important as the amount which falls, and Nature has provided so that the rainfall goes as far as possible to help the plants in supplying 60 per cent of all the rainfall of the year during the growing period, which consists of the five months from April 30 to Oct. 1.

LAND VALUES.

If rainfall alone has been depended on, the only value which could be attached to the vast areas of fertile soil would be the value as a grazing range and lands would have remained in value at a price of from one to three dollars an acre, instead of from $100 to $500, as is now the case with irrigation.

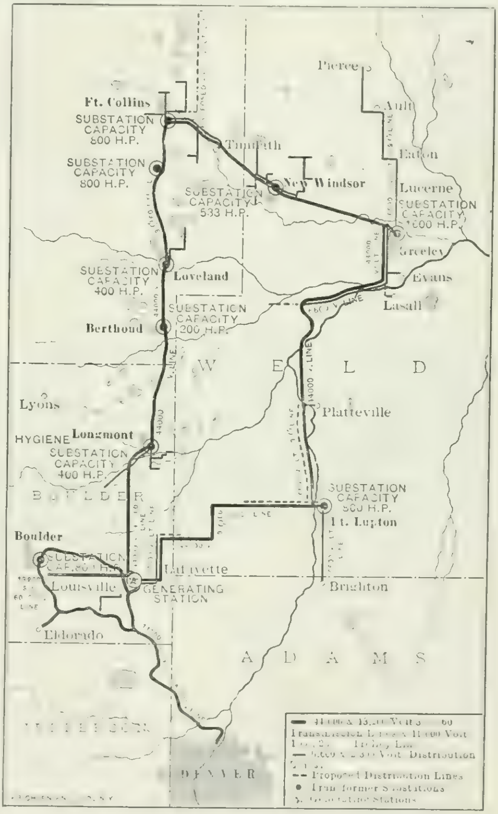


Fig. 1—Territory of Northern Colorado Power Company.

The lands which lie above the ditch, or which have no rights for water from a ditch or reservoir, are sold within this territory at from $15 to $40 per acre, anticipating the application of water at some future day. Under this entire territory underflow water is found, and the installation of the pumping plants immediately increases the value of the lands. These values range from $100 to $500 per acre, the variation in price being regulated by the proximity of the land to market and to shipping point.

EARLY IRRIGATION WATER RIGHTS.

The original work of irrigation as carried on in the arid West consisted, first, of leading off a certain part of the

flow of streams and rivers by means of open ditches to carry water to the lands bordering on these waterways. This was successful and led to carrying the ditches farther from the streams and running branches from the mains to cover territory lying farther back and then damming up the streams to take off greater volume. Soon stream flows were depleted during irrigation time and means were taken to conserve the run-off waters at the time of greatest flow, when water was not needed for immediate use.

Large reservoirs were built so that flood water could be stored up near the source and made available on the lands below months after storage, when plant life needs the water in its growing period. As long as water was available more land was taken on to be supplied from every ditch, and contracts were entered into by the men owning the reservoirs to furnish water sometimes in excess of capacities.

The way that rights to water were secured was, first, the farmer took the water and put the same to beneficial use, and "beneficial use" is looked upon by all the courts as one of the strongest points in determining the relative rights of two or more contesting parties. The party who has made use of water files with the State authorities a claim, in which he states the amount of water he intends to use, the purpose for which water will be taken, and the means whereby diversion will be made. This application makes a record of the filing and is resorted to by courts when several disputing claimants ask adjudication of their rights.

The water rights of farmers ordinarily consist of a decree for a certain amount of water issued by the State to applicants, and usually these decrees have been passed on and adjudicated by the courts.

At the early stage of irrigation work abundant water was available and little thought was given to legality of rights or certainty of supplies. During later years tracts of land have suffered from continued drought, either from lack of water in the reservoirs and ditches or from the rulings of the men who are intrusted with the refereeing of the water distribution, and this has oftentimes resulted in crop failures, when farmers were compelled to watch their crops burn up, while water under question was allowed to pass their farms through streams or ditches to territory further down.

The water rights in all the arid States are subjects of continued and expensive strife. A man who thoroughly believes that his water rights on one day are beyond a question finds court decisions taking them away from him the next. The matter of appropriations in the several Western States has been most loosely handled in the early days, and filings have been made on streams which cover many times the total flow recorded, or even probable, when the drainage area is considered.

WATER-RIGHT DECREES ON UNDERFLOW.

As yet the legislators have enacted no specific laws to govern the decrees for underflow, but this is bound to come, and when it does the plants already built will have established prior rights of no small value by the beneficial use of water so obtained.

The farmers are beginning to appreciate the value and importance of making proper record of the dates and means by which this underflow is being put to use upon their lands, and now are filling out the forms furnished by the transmission company, and they are filing the records with the State engineer and in so doing are establishing rights which will become of much value in the future.

Although the underflow and surface waters have a common origin in the mountains, they are quite distinct when once they leave their source. The greatest snowfall comes at highest altitudes, as the moisture-laden winds in contact with the lower temperatures precipitate their moisture in the form of rain or snow. These rains and snows are held as storage in the mountains in the form of snow and ice, and in the reservoirs constructed for impounding waters at the time of greatest run off. A certain portion of the waters finds its way to streams and rivers, and from these the water is led to ditches and to reservoirs to facilitate its handling at the proper time.

EXTENT OF UNDERFLOW.

Another very large amount of mountain water finds its way into a loose and gravelly stratum lying between two sheets of strata impervious to water. This stratum exte[nds] out from the mountains to the plains at a fairly unif[orm] distance below the surface of the land, and the waters [re]tained are carried out toward the Mississippi Valley, w[he]re they appear upon the surface in the form of springs.

In this territory the average distance at which this w[ater] can be reached is from 20 to 25 ft. below the surface, [and] it is on this tremendous body of water or underflow [that] the greatest developments in the future will depend. [This] subsurface water can be considered as being held bet[ween] two monstrous, tough, elastic sheets, which stretch out [from] the foothills to the plains and retain the water thus [re]tained unless the sheets are punctured. In digging [wells] it is generally found that on a stretch of land irregul[ar in] contour water can be found at lesser depths upon the [higher] lands than in the draws or valley. An explanation for [this] is apparent. Originally the water was held at a uni[form] depth below the surface. When upheavals came the [dis]turbances which made the hills and valleys carried [the] water-bearing strata with them, but by the action o[f the] elements erosion gradually took place and this in par[t re]moved the covering of the water on the higher lands [and] deposited it below, which left the distance from the su[rface] of the ground to water much less upon the hills than i[n the] valleys.

The action of the water in the ground is similar to [that] upon the surface, and a definite direction of the flow [can] be determined, although the flow is much less rapid, d[ue to] the obstructions of the soil.

PREDETERMINING UNDERFLOW.

Considerable work must be done to predetermin[e the] quantity and location of the underflow before the [actual] work of digging wells is undertaken. One method [which] promises to produce results is carried on as follow[s:] special apparatus is built for drilling small, deep hole[s and] provision is made for taking out the core without di[sturb]ing the relative positions of the strata or the mat[erials] which make up the core. A hole is drilled and th[e] core taken out and analyzed, from which are foun[d the] depth of water-bearing strata below the surface c[of the] ground, the thickness and the porosity of the strata. [The] water content of the strata is then determined from [these] measurements. After these determinations have been [made] the operation is repeated on a number of holes put [down] upon a 5-ft. radius, the first hole being taken as a c[enter.] All of the determinations made upon the first are re[peated] in the later holes to check the accuracy of the first [deter]minations.

At this point in the test a standard chemical solu[tion is] introduced in the first hole and by means of galvano[meter] measurements the rate of flow from one hole to the [other] is determined, and from these tests are found not o[nly the] approximate rate of flow but the direction of the [under]flow as well. Holes are then put down at such a di[stance] from the first hole that an hour's time will be con[sumed] for the water to flow from the first hole to th[e] last one. Several holes are drilled upon the radius o[f the] larger circle and determinations checked upon each [one] as before. When the amount of water present and th[e] rate at which it passes through the ground is found, the [q]uantity of water which can be removed by pumping i[s] fixed within the limits of a very small amount.

Where these conditions can be measured accurate[ly], the amount of water that can be secured can be dete[rmi]ned with much greater accuracy than can that of [su]rface streams, because the waters found below the surf[ac]e in

the underflow are subject to fewer factors of uncertainty, since seepage in and out and evaporation in its several forms are factors which amount to practically nothing in the underflow.

Where wells have been installed at frequent intervals and the topography and geology are quite thoroughly understood, the underflow can be determined with precision.

When irrigators realized the limits of the surface flow and experienced the losses from uncertainties of supply, the question of making use of the vast storehouse of the water underneath their lands was brought to them most forcefully. Every step of investigation pointed more clearly to the fact that surface waters were limited in proportion to the demands, and extensive use of underflow must be adopted to supply demands for irrigation needs.

ELECTRIC PUMPING OF UNDERFLOW.

Realizing the situation on this water question, and recognizing the demands to come, the Northern Colorado Power Company was formed to generate cheap energy in the coal fields and to distribute this for irrigation pumping network throughout the richest agricultural part of Colorado and Wyoming, and to supply the needs for lighting, motor and railway service of the 120,000 people in the territory contiguous to the lines.

The territory supplied with energy by this concern extends from Denver, Col., on the south, to Cheyenne, Wyo., on the north, and from the foothills of the Rocky Mountains on the west to a line some 50 miles eastward on the plains.

MAIN POWER PLANT

The main power house is located in Colorado between the towns of Louisville and Lafayette, on the Colorado & Southern Railway, 15 miles northwest of Denver, and at the company's coal mines, in the center of the northern lignite fields, and at a place where a 26,000,000-cu. ft. reservoir is available for condensing water. Energy at 13,200 volts is generated by Parsons turbines running condensing which receive their steam from high-pressure boilers, fed with automatic stokers equipped with economizers, superheaters and induced draft, and take their coal from the mines below the plant, consume it and discharge the refuse mechanically throughout.

TRANSMISSION LINES.

From the power house a main transmission line carrying 60-cycle, three-phase, 44,000-volt energy is built due north, then east, and a second line extending east and north connects with the first-named line at Greeley, Col., forming a closed loop of transmission line, inclosing an area of 940 sq. miles, and from these lines are branches running out in all directions carrying leads of 13,200, 6600 and 2300 volts.

The system supplies the local towns with commercial lighting and motor service, lights the streets and furnishes all the intervening and surrounding territory with service from low-tension mains, and also supplies energy for urban and interurban railroads.

The Colorado towns to which the lines extend are Boulder, Louisville, Lafayette, Superior, Longmont, Niwot, Berthoud, Loveland, Fort Collins, Wellington, Tinmath,

Fig. 2—Fields in Colorado Agricultural District.

Fig. 3—Electrically Driven Pumping Stations.

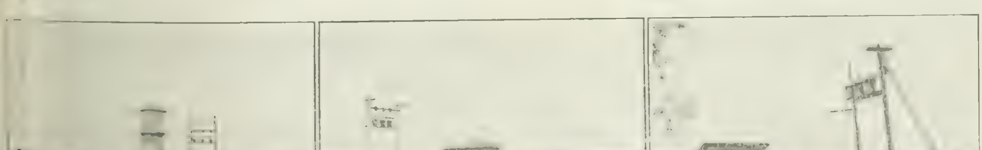


Fig. 4—Electrically Driven Pumping Stations.

Windsor, Severance, Greeley, Lucerne, Eaton, Ault, Pierce, Evans, LaSalle, Milliken, Johnstown, Platteville, Fort Lupton, Brighton, Henderson, Traceyville, Frederick, Firestone, Dacona, Erie and Canfield, all encircled in the richest agricultural district of northern Colorado.

Substations and switching stations are located about 20 miles apart along the high-tension line, and switches are so arranged that any substation on any section of line between the towns can be cut out without disturbing the remaining lines or interrupting service. Wooden-pole construction is used throughout with forty poles to the mile; on the poles which carry the high-tension transmission line low-voltage three-phase lines are carried from one substation to the next, from which the lateral pumping leads crisscross the country and furnish service to the pumping plants.

WELLS FOR PUMPING PLANTS.

The territory covered by these lines is underlaid with water-bearing strata. This water can be cheaply raised by pumps from wells and used for irrigation work.

There are two means commonly employed in Colorado for the building of wells for irrigation pumps. One consists in the digging of a well usually circular in form, but preferably rectangular, by excavating to the level of the water-bearing strata and by placing concrete curbings upon steel shoes which, after being weighted down, are lowered to the proper level by pumping the loose sand and gravel from beneath. The entire curbing is lowered in this way a sufficient distance to insure a free inflow of the water to the well.

Another means employed is that of excavating to the water-bearing strata and installing curbing, after which slotted casings are sunk down through the water-bearing strata to insure a ready flow of water to the well. Use is made of from 10-in. to 12-in. casings and the number necessary ranges from four to twelve to the well.

When a stratum of quicksand is encountered one casing is placed inside another so that no open slots are presented to the surface of the shifting sand, and clogging of the well is thus prevented. The circular wells are built from 10 ft. to 20 ft. across, and the rectangular ones 4 ft. to 5 ft. in one dimension by 10 ft .to 20 ft. across the direction of the underflowing water.

A structural-steel framework built up of I-beams, latticed across for strength, carries a vertical shaft which transmits the torque from a vertical-type motor located at the top of the well directly over the pump or belted to a motor in a housing at one side. The pump is fastened securely to the rigid frame at the bottom of the well and is submerged where a sufficient amount of water is available.

The placing of the motor at one side and belting to the shaft posssesses one advantage in that the framework can be more readily withdrawn and the pump inspected or repaired without the handling of the motor.

PUMPING-PLANT EQUIPMENT.

The pumping-plant equipment consists of a centrifugal pump, single or multiple stage, driven by a 2300-volt, three-phase, 60-cycle induction motor. The discharge from the pump is carried through long and easy bends of light steel pipe in order to reduce the friction head to minimum.

A standard type of panel, carrying a meter, fuses and no-voltage and overload release, is used. A housing for the motor and controlling apparatus is built of concrete blocks with patent roof and cement floor, and the consumer is encouraged to go to this expense to protect his motor and equipment.

PUMPING COSTS.

An endeavor has been made to secure accurate figures on the cost and operation of the average electrically driven pumping plant, and careful observations and tests were made on fifty-seven of these plants installed and operated during the pumping season of 1910.

In compiling data the following information was det. mined for each plant:

The number of acres under irrigation of each c grown, such as beets, alfalfa, potatoes, truck or grain. source of the supply of water, such as well, ditch, reserv or drainage sump. The total static head, as measu from the surface of supply to the discharge of the line at the highest point. The length and size of line from the pump. The type, make, size, rating and ciency of pump. The make, size, speed and characteris of the motor drive. The individual costs of motor, wir pump, transformer, if the same are used. The cost of pipe line and the trenching. The housing for the well motor and the miscellaneous costs attendant. All of th were figured up in detail and the total cost summed up shown in total for each plant.

From these figures it is shown that under average co tions where pumping plants are used to cover 160- tracts (the average now in use) and lift the water thro a 25-ft. head, the farmer makes an investment of $7.45 acre to install a good efficient plant, complete in every ready to furnish water to the crops.

OPERATING COSTS.

The actual cost of operation was more difficult to as tain, and tests of water have been made repeatedly plants. At first the operating costs would vary widely, to lack of proper installation and use of pumps unsuite the work.

The average efficiency of a well-built motor-driven p including both the motor and the pump, is fairly take 50 per cent on actual working duty. It is an easy m to fall below this mark if careful attention is not g to the selection of the apparatus, and a centrifugal operating under a different head or speed from that signed can give most disappointing results.

With constant tests and changes fairly uniform re have been obtained, and with a plant as noted, pun from a well covering 160 acres through a 25-ft. lift farmers' cost will vary from $1.75 to $2.25 per acre- that is, the expense per season totals this amount to each acre with water 1 ft. deep, and 1 ft. of water i amount used in excess of the rainfall in this section the amount pumped.

COST OF PUMPING VERSUS. DITCH RIGHTS.

In comparison with these figures of supplying through a pumping plant, it is interesting to note the age cost to a user when water is taken from a dit reservoir, the usual method of supplying water.

Water rights in northern Colorado to-day are worth $60 per acre on the average, and this is subjec minimum cost for maintenance of $1 per acre per This applies to rights for water taken directly fro streams, as well as storage rights, whether individu operated by communities, and this cost is taken low. the older water rights the actual cost of the wate probably average about one-quarter of the market of the water rights to-day, and the price is rapid creasing.

On the other hand, there is an investment charge of per acre for the pumping plant against $60 per ac ditch and water rights, and an average of $2 per operating cost for the pumping plant against $1 f maintenance cost on ditch and water rights.

SAVING BY PUMPING.

With the fixed charge of interest at 6 per cent and preciation at 4 per cent, or 10 per cent in all, and 6 pe cent interest only on the water-right investment, the ulnate cost to the farmer for his water amounts to $2.75 f the pumping plant per acre-foot against $4.60 with dit and water rights, with the tremendous advantage of bei as- sured of water at just the time the water is required.

ADVANTAGE OF PUMPING.

The greatest advantage, according to the statement of the farmers who use pumps, is that the water is available at all times; that the work of irrigation can be carried on and water placed upon the growing crop at just the time and in the exact quantity which the crop demands. The importance of this factor cannot be overstated, and the very fact that water can be depended on when pumped has caused a large use of motors for this purpose by men who already had most excellent rights in water supply and ditches, but who have had experience in being unable to secure the water at the time and in the quantity desired, and who have found that failure to get water as required resulted in at least a partial loss of crops.

USE OF WATER.

From every ditch a large amount of land is served, and where water is available in the ditch it is necessary for those in charge so to portion out the water that one consumer cannot take water from the ditch more often than once in several weeks, between which times it is probable that the day will come and go when water would have proved the greatest value to his crop.

With pumping, the irrigator is not in any way dependent on the rulings of the officers of the company from which he has his rights, nor upon the dictates of the State authorities who control the distribution of the waters of the streams. This is conceded by every man who operates a pumping plant.

The investment for a pumping plant is used for other purposes. A large number of pumping motors are so installed that these can be removed and used for other purposes.

STOCK FEEDING.

In northern Colorado tremendous herds of cattle are fed for market every fall. These animals are bought in poor condition in the south and from the range; they are shipped or driven in and put in feeding yards, and given all that they can eat for a period covering two or three months' time and then they are quickly rushed to market.

Much knowledge has been gained along the line of scientific feeding in the last few years, and farmers claim that they can realize an increase of some 30 per cent in chopping and grinding the products of their farms and making feed for stock and feeding and marketing their products in the form of beef, instead of produce on the open market as before. It has been clearly shown that cattle fattened on this kind of food are ready for the market from thirty to sixty days earlier than cattle which feed themselves from stacks. This work requires the installation of a motor varying in rating from 15 to 30 hp.

FEED GRINDING.

When grains are ground for feed the value of the food is doubled, and the cost of grinding is small compared with the benefits derived. The cost of energy used upon the farm is estimated upon the basis of the pumping energy and with these rates the cost per ton for grinding feed is: Corn, 24 cents; barley, 36 cents; alfalfa, chopped, 30 cents; alfalfa meal, 52 cents.

All kinds of cellulose matter are worked up in this way, and this, sometimes enriched with just the right amount of sugar (usualy the refuse of the factory), is found to yield most excellent returns when fed to cattle which have grazed upon the range. The stock will eat this food when chopped and fed in troughs, although they would trample under foot the same material in the stack and sometimes lose in weight, instead of fatten, as they do upon the food when ground. The beef produced is not of the highest grade and goes upon the market as "pulp-fed."

ELECTRICITY ON THE FARM.

The farmers find a varied use for electricity. The dairy farmers use electric drive on suction milkers and to operate the separators which extract the cream, to operate the deep-well pumps for service at the house and watering of stock, which gives the cattle clean water of a constant temperature instead of from the ditch—frozen in winter and warm and contaminated in the summertime. The dairy farmer finds it pays to put up ventilating fans in cow barns, which, besides adding to the comfort of his stock by driving away flies, produce sanitary products from his herd.

The poultry farmer uses incubators operated with electricity and finds the constant temperature of great service in producing good results.

The pumping motor has displaced the traction engine for use in threshing grains at harvest time, and the uniformity of the drive is readily appreciated by the farmer in securing better yields per acre, in that the screens can be adjusted so that loss of grain into the straw stack is reduced to almost nothing and fire hazards are entirely removed.

On nearly every farm where pumping is installed the house and barns are lighted with electric lamps, a small repair shop with a forge and blacksmith's drill is fitted with

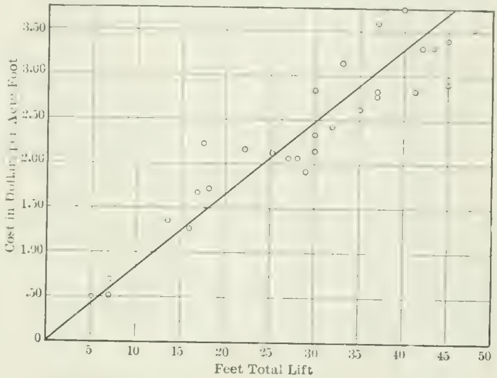


Fig. 5—Relation of Cost of Irrigation Pumping to Total Lift.

electric drive, and motors are fitted with back gears and drums for hoisting hay into the barn.

The housewife on the farm is a better prospective customer for the sale of small appliances than is the average city housewife, and buys the more practical ones, such as irons, fans and heating devices.

An attempt is now being made to introduce the German method of cable plowing, which can be undertaken with only a small additional expense when motors have been purchased for the other work.

ALKALI LANDS

In much of the older irrigated lands it has been found that continued irrigation has raised the water table so that waters have been brought up to the surface.

Where continued rapid evaporation has gone on the waters percolating through the soil have taken up large quantities of salts which are always present in the soil, and with evaporation at the surface the salts are left behind. These salts are very largely sodium sulphate and sodium carbonate, and are helpful to the growth of plants when present in normal quantities. When these become excessive the effect is most pronounced and any form of plant life fails to thrive. In arid countries, where evaporation is excessive, the deposit at the surface is pronounced where quantities of water percolate the soil. The lands where this takes place are considered salty, or are known as alkaline, and serve no useful purpose when in this condition.

The reclamation of these lands is easy and the cost is small. A system of drainage pipes is introduced below the

surface and the soil is washed with water, until the water is surcharged with alkali. This water is then carried to the surface and pumped away. The installation of the drainage pipes below the surface when the salting first begins allows filtration to take place, and then, by pumping to main- [illegible] the water table, it keeps the deposits below the danger point, and oftentimes allows of the irrigation of large tracts of land which lie above those reclaimed.

The importance of this work of prevention and the work of reclamation of the soil is not thoroughly appreciated as yet, although in every irrigated district can be seen marked evidence of this difficulty coming on. Although this work of washing out is just beginning, it is evident that a tremendous field is being opened for the use of electricity in reclamation of this kind, even when the irrigation work is from the ditch and reservoir.

DEVELOPING MOTOR-SERVICE BUSINESS ON THE FARM.

The introduction of the use of electricity on the farm is a work of education. The work of securing the pumping business is undertaken first and this is followed by securing other business after the pumping plant is in. The method of securing pumping business has been as follows: A personal canvass has been made on territory covered by the electric lines and active solicitation has been carried on for two years' time.

An educational campaign has been carried on through the local newspapers and periodicals which find their way into the hands of the farmers and a series of "follow-up letters" is sent to prospective customers to assist the solicitation. Where lands are found adaptable to pumping, the representative first makes a survey of the conditions to be met in the installing of a pumping plant, and an endeavor is made to determine upon the best location for the well on the land to be irrigated, first cost of construction and cost of delivery of water both being given due consideration. An estimate is made to show the cost of installation to the owner of the land, including the cost of well, pump, motor, pipe, housing and transformers—if a motor designed for less than 2300 volts is used. An estimate is also made of cost of operation, including cost of energy, maintenance and repairs, and the final figures in cost of water per acre-foot is given.

The prospective consumer is given the names and addresses of all pumping consumers within a reasonable distance from his lands, and the detailed costs of each are shown to him so that he can communicate with those who are already users and verify the figures given him.

Frequent trips are made with motor cars, on which a group of prospective consumers are taken to operating plants to see them work and to go over questions of adaptability with the owners of the plants, and also get at first hand comparisons on costs of pumping with electric energy, steam and gasoline, and it is found that this method of promoting installations convinces a prospective user more readily than any other.

When gasoline is found already in use, small difficulty is experienced in displacing the service, as the plants are necessarily located at a distance from supplies and expert help.

CONTRACT.

A contract is entered into with the owner of the land for a period of either five or ten years. The basis on which the pumping energy is sold is that of a "readiness to serve" charge of $1 per horse-power installed per month, for the irrigation months as specified, and usually covers the months of May, June, July, August and September, to which is added a consumption charge of 3 cents per kw-hour as measured with the 2300-volt, three-phase meter.

In case the pumping plant requires the construction of considerable pole line, provision is made in the contract to protect the company by having the minimum proportioned to cover one-half the construction costs each year. This minimum amount is payable each year for the five year or ten-year period, as the case may be.

It frequently occurs that a prospective consumer desire a pumping plant installed, requiring the building of a con siderable stretch of line, and in each case the agreement o the annual construction minimum provides that on secur ing other pumping contracts which can be fed from th line on which the first consumer pays a minimum, the mini mum charge will be reduced to the first consumer an charged to the second one, in direct proportion to the siz of the plants.

This arrangement has worked out well for both the farm er and the company, in that the farmer has been able t secure his plant, and by his efforts has procured an installa tion on the farm adjoining, thus cutting down the minimu for himself and securing added business for the company.

In some instances extensions have been made wherei the consumer has advanced construction costs, and these i turn are paid back to him in rebates, taking a percentag of the bill, after he consumes a certain minimum amou per year. These amounts apply upon the line extensio title to which is vested in the transmission company aft a certain period is covered.

FLAT RATES.

No contracts have been made wherein flat rates are use as these work to the detriment of both the owner of t land and of the transmission company. The tenden exists to use more energy than is needed, and this resu not only in a low rate to the company but in a loss of cro to the irrigator from use of too much water. The chemi of the sugar companies claim that where unlimited water available the per cent of saccharine in beets has been duced by 20 per cent by over-irrigation.

All pumping contracts are so drawn that the consum agree to use no energy at the peak-load hours whene the transmission company so demands. In starting up t class of business, the company aimed to have installed plant which operated satisfactorily in the immediate vicin of each town served. In this it was successful the fi year, and the greatest care was given every plant to that operations were successful.

THE FARMER AS A CONSUMER.

The farmer, as a class, is a consumer hard to reach, time is necessary for the closing of each contract. W first approached, the farmer has in mind that electric se ice is not suited for his needs, that it has a field in to for lighting and in the shops for motor service, but never has considered it as a substitute for the ani power he has always used.

When once secured, the farmer makes a splendid tomer. He knows his wants and can pay for his eq ment. When once he becomes a customer he seldom connects his installation, and he offers a splendid pros for use of energy in other lines. He depends upon marketing of his crops to pay his bills, but pays then that time, and he is able to secure large credit when quired from the country banks in his vicinity.

DESIRABLE BUSINESS.

The business which this pumping load brings on is desirable and permanent, and is as certain as agricultur self. The desirability of the pumping load, when adde the average load secured in serving towns of small siz best shown by means of load curves, which give the conditions as they exist during the winter period and conditions found with the addition of the summer pum load. The power demands in the winter time are 160 cent of that of summer, but the summer energy outp equal to that of the winter time, with 25,000 acres cove

Development work along this line has just begun an effect so far produced makes clear the fact that a c tion will arise—and that within a three years' period a

resent rate of change—wherein the peak demands upon the ant and lines will come upon a summer afternoon instead c in the winter evenings. With this condition the annual ld factor will exceed any that can be found in public-service plants.

The towns within this territory are all dependent on the ricultural work, and each additional acre irrigated means ded industries to the towns and added requirements for ergy. The one builds up the other and each supplies the rket that the other needs.

ESISTOR MATERIAL WITH VARIABLE TEMPERATURE-RESISTANCE COEFFICIENT.

By L. Körber.

METAL is employed almost exclusively to-day for electric resistor material, use being made of iron, platinum, manganin, nickelin, kruppin and other alloys. ese materials, save the manganin, which has a very sall negative temperature-resistance coefficient, have positi temperature-resistance coefficients. Resistors with negati temperature-resistance coefficients and capable of withsnding temperatures up to 500 deg. C. without alteration o their character have been unknown hitherto. The disa antages of the materials enumerated above when used a resistor materials consist on the one hand in their reqring much space and on the other hand in the chemical a ration they undergo in consequence of the passage of tl electric current. After being in use for some time the nterial gets brittle. This feature is conspicuous in all stems where electric resistors are used as heaters. From a the resistors nowadays in use for heating purposes, sh as naked wire furnaces, heating bodies with insulated cductors, luminous heating bodies, the metalloceramic ristors made by Parvillié Brothers at Paris thoroughly der. in consisting of combinations of non-conductors in ctain proportions with conductors. The process used by Pvillié Brothers is about as follows: Nickel with quartz a kaolin, and with fluxes which prevent oxidation of the nal, is melted at a high temperature and the mass thus oained is molded under hydraulic pressure into slabs or rs. The ends of the rods are provided with brass socket Heating bodies made of such resistors primarily adn of rapid heating to high temperatures, but after a

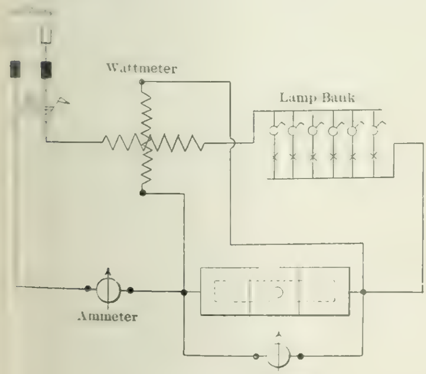


Fig. 1—Test Connections.

st time the emission of heat diminishes in consequence of he resistors being internally melted.

here are two causes of the short life of this material, naely, the employment of a base metal and the existence of ad contacts. In fact, in consequence of the passage of the electric current, the nickel employed becomes oxidized after a short time and at the points where oxidation goes on most rapidly melting sets in and the resistors are destroyed. In order to avoid the formation of sparks at the contact points the makers enrich the ends of the re-

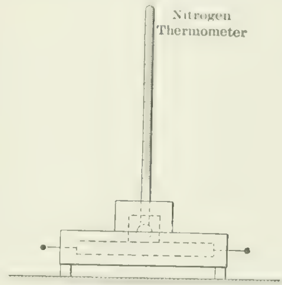


Fig. 2—Arrangement of Thermometer.

sistors with the powder of nickel. In consequence of the jamming of the resistors in metal clamps a high intermediate resistance is created between the clamps and the resistor body, the resistance manifesting itself by rise in temperature locally. The enriching with a base metal—nickel—does not afford any advantage, because in this case also oxidation and melting through at the contact points take place.

A long series of experiments has shown that the main conditions for the creation of a resistor material able to maintain a constant resistance at high temperatures, up to 600 deg. C., are the employment of a precious metal and of suitable contacts. Recently resistors have been built with variable temperature-resistance coefficient which contain the precious metal silver as the main conductor material. The difficulty to be overcome consisted in binding the necessary quantity of this metal to the oxides of the metals to be added in order to give the resistor material its desired resistance characteristic.

For this purpose use was made of metallic aluminum or magnesium. The process of making the resistor material is as follows: A precious metal, such as silver, gold or

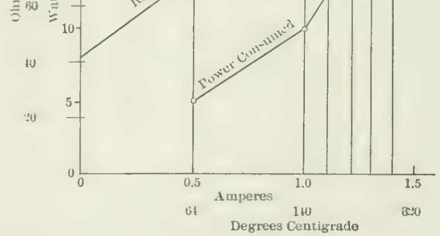


Fig. 3—Resistance of and Power Consumed by the Resistor.

platinum, in powdered state, is mixed with a liquid silicate, for instance, potassium or sodium waterglass, a manganese compound and aluminum being also added, and the mass thus obtained is calcined in a crucible at a temperature of about 1000 deg. C. The resulting product is freed from

all unburnt particles of aluminum, kneaded with a suitable cement into a plastic mass and pressed into molds.

A suitable composition of a resistor having a negative temperature-resistance coefficient is as follows: From seven to eight parts of silver, from eight to ten parts of

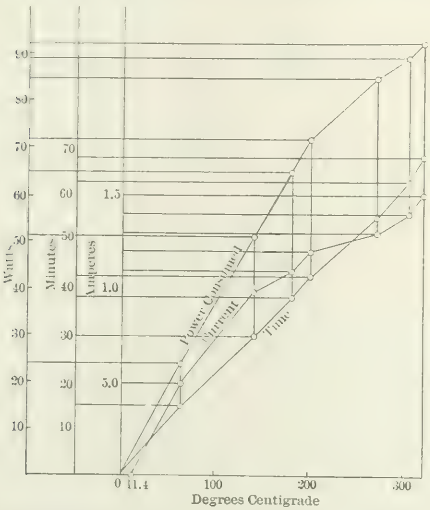


Fig. 4—Variation of Current and Power with Temperature.

potassium or sodium waterglass, four parts of peroxide of manganese and one-half part of aluminum.

A resistor having a positive temperature-resistance coefficient may to advantage be composed as follows: Ten parts of silver, from one-fifth to one-half part of peroxide of manganese, ten parts of potassium or sodium waterglass and from one to two parts of aluminum.

As already stated the employment of precious metals is a necessary condition by reason of their little affinity for oxygen and the necessity for high temperatures in the resistor. On the quantity of the manganese compound entering the mixture depends the character of the prepared resistor. When larger quantities of this compound are employed the resistor shows a negative temperature-resistance coefficient, and when smaller quantities are employed a positive coefficient. This special quality is peculiar to the compounds of manganese. The passing from the positive to the negative through the zero temperature-resistance coefficient takes place when about 5 per cent of the manganese compound is present. The aluminum or magnesium is necessary for binding the requisite quantity of the precious metal, for if it be dispensed with a portion of the silver employed would separate in the metallic state during the calcining process. Such a resistor would be unfit for use, as it contains too little precious metal and would therefore soon be melted by the passage of the electric current.

The reaction process, which is of an exothermic nature, shows that aluminum is necessary for binding the silver. Moreover, the aluminum converted into aluminium oxide by the burning also constitutes a resistor material. This is seen from the fact that as the percentage of aluminum contained in the resistor material increases the resistance rises.

It has already been mentioned that faultless contacts play a prominent part in the resistors. For this purpose the contacts are made as follows: The resistor material is placed in a mold and at the points where the contacts are to be formed use is made of material composed of the main resistor mass and a powder of precious metal. Into this layer, richer in precious metal, the conductors of preci[ous] metal, advantageously made of silver wire, are embedded [in] such a manner that the end of the silver wire project[ing] into the mass is wholly surrounded by the layer richer [in] precious metal. Subsequently, the contact mass richer [in] precious metal is covered with the resistor mass, be[ing] completely inclosed thereby. By using precious metals [for] the outer layer and the conductor oxidation and heat[ing] at this point, which would cause deformation, are avoi[ded], and by embedding the contacts, instead of jamming [or] soldering them, alterations of the temperature-resista[nce] coefficient are prevented.

It has been ascertained by experiments that when a [re]sistor body with a negative temperature-resistance [co]efficient, the contacts of which were formed by solder[ing] and subsequent galvanizing, was heated from 20 deg. to 300 deg. C. its resistance increased from 2.65 ohms [to] 3.7 ohms, thus indicating a positive temperature-resista[nce] coefficient. This result shows the importance of the m[an]ner of forming the contacts.

The chemical nature of the product obtained by [the] burning process is such that it may be termed a kin[d of] metal glass. Contrary to other processes no melting t[akes] place during the chemical reaction. The mass, consis[ting] of silver, a liquid silicate and aluminum, reacts at a[bout] 1000 deg. C. in the crucible, and after cooling it beco[mes] a light-brown, grossly granulous power.

The resistors with variable temperature-resistance [co]efficient serve mainly for replacing the wire resistors n[ow]days used in motor controllers and for heating purp[oses]. By reason of their compactness and convenience they [are] well suited for electrical purposes. For example, a res[istor] 100 mm in length and having a square cross-sectio[n] from 9 sq. mm to 16 sq. mm carries 2 amp. They [can] easily be replaced and they excel wire resistors in [with]standing concussions.

THERMOELECTRIC CHARACTERISTICS.

A trial resistor with a positive temperature-resistanc[e co]efficient having the dimensions of 100 mm, 6 mm and 6 [mm] and made of the material referred to above, was teste[d to] determine its behavior on the passage of currents. [The] resistance of this experimental body in the cold state [was] 8.4 ohms. The temperature of the room, as indicate[d by] a thermometer, was 11.4 deg. C. The trials were ca[rried]

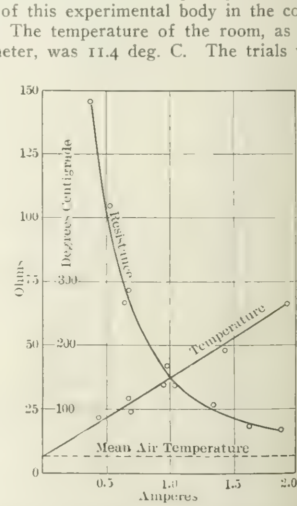


Fig. 5—Variation of Resistance and Temperature with C[ur]rent.

through with the aid of alternating current, the e[lec]tric connections of the installations being made accord[in]g to the diagram of Fig. 1. From the simultaneous readi[ng]s of current and voltage the resistance of the resistor [b]ody, heated by the current, was calculated. The powe[r] con-

sned was ascertained by means of a precision wattmeter iterposed into the circuit. The temperature on the surf·e of the resistor was observed by means of a nitrogen trmometer capable of indicating up to 400 deg. C. For t purpose of obtaining the most exact possible readings t' trial resistor was inclosed in an eternite body provided wh a cover and the thermometer could be lowered into tl cover until the mercury bulb was placed just above the ristor, as shown in Fig. 2. In Fig. 3 the resistance of

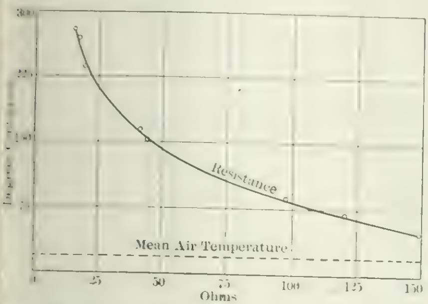


Fig 6—Variation of Resistance with Temperature.

ar the power consumed by the resistor are shown as fu:tions of the strength of current. Fig. 4 shows the de:ndence of the strength of current, the power consumed ar the necessary time in minutes on the temperature re:hed by the trial resistor. Up to a temperature of 320 de C. the resistance increased quite gradually. The characristic features of a resistor of negative temperaturere:stance coefficient are indicated in Figs. 5 and 6. At a ri: of temperature from 0 deg. C. to 260 deg. C. the resisnce decreased from 150 to 20 ohms.

TE CALCULATION OF WIRE SIZES FOR COILS.

By G. E. Marsh.

I the construction of apparatus involving ordinary wire-wound coils it is generally desirable to be able to ascertain by calculation, rather than by any experimental cu:nd-try method, the size of wire that will enable the wi:ling to fulfil certain prescribed conditions. It may be th: the depth of the winding area is limited, or, at the mc. must not exceed a fixed value, or that the winding sp:e dimensions are stated and that the coil is to produce a aximum field strength with a given resistance or a spe fied heat production, or both.

: the first of several possible cases, suppose that it is de:ed to ascertain the size of wire that will give to a sol:oid of specified length, inside radius and resistance the grtest field strength at the center of the core of the wi:ing. It is hardly necessary to remark that the windng hat is the best for one current is the best for any other, bai ng the heating effect, as the efficacy of the winding fro the standpoint of magnetic field production is only de:ndent on the size, length and manner of winding of the onductor.

:e symbols used have the following meanings: R, t:e esistance of the coil; n, the total number of turns in the oil; Φ, the field strength in gausses at the center of the coi l the length of the coil in centimeters; r, the inside rads of coil; r_m, the mean radius; t, the number of layers of ire; s, the specific resistance of the wire used, ohms per entimeter cube; p, the resistance per centimeter length of :re; d, the diameter of insulated wire; d_1, the diameter o: e bare wire; $k_1 = d/d_1$, the ratio of the insulated to the are wire; $k = R/4lsk_1^2$. All linear dimensions are expressed in centimeters. No bedding of the wire in winding is assumed. This characteristic of circular-sectioned conductors is in the ordinary case of no importance even though its action is favorable rather than otherwise.

In the case of a cylindrical solenoid of circular section the strength of the magnetic field at the center of the core is given by

$$\Phi = 4\pi ni \div 10\sqrt{l^2 + 4r_m^2} \qquad (1)$$

and the values obtained by the use of this formula are, in general, sufficiently close for all constructional needs, the accuracy, in any case, increasing as the ratio of the length to the mean radius of the coil becomes large.

A little inspection will show that the following relations may be written. The mean radius, the length of the mean turn, the number of turns per layer, the total number of turns and the total length of wire in the coil are given respectively by $(r + td/2)$, $2\pi r_m$, l/d, tl/d and $2\pi lt(r/d + t/2)$.

The resistance of the winding is $2\pi plt(r/d + t/2)$, and from this the number of layers is easily found to be

$$t = -\frac{r}{d} \pm \sqrt{\frac{r^2}{d^2} + \frac{R}{\pi lp}} \qquad (2)$$

In order that the significance of the double sign before the radical may be seen, consider equation (2) in words. This expression enables the number of layers of wire of diameter d and occupying a winding space of mean radius r_m and length l, and with a total resistance R, to be calculated. The value of r_m is greater than r if the latter be the inside radius, as is supposed here, and the corresponding value of t is given by using the plus sign before the radical. The use of the minus sign, on the other hand, refers to the case when r_m is less than r (r becoming the outside radius) and the wire is wound inwardly with decreasing radius and consequent reduction of diameter of core. This case is of no particular importance here.

The resistance per centimeter of wire is expressible as $4s/\pi d_1^2$ or $4sk_1^2/4d^2$. Introducing the values of p and k into equation (2) there is obtained

$$t = -\frac{r}{d} + \sqrt{\frac{r^2}{d^2} + kd^2}. \qquad (3)$$

Equation (1) may now be written in the form

$$\Phi = at \div d\sqrt{b + cdt + d^2t^2}, \qquad (4)$$

where $a = 4\pi i/10$, $b = l^2 + 4r^2$, and $c = 4r$.

The introduction of the value of t, the number of layers, from equation (3) into equation (4) and the solution of the resulting one for a maximum, d being the independent variable, results in the very interesting and simple expression:

$$d = \sqrt[4]{l^2/k}. \qquad (5)$$

The value of the diameter of the wire as given by the last equation is only approximate, and the degree of approximation is dependent on the values of the constants involved. In some cases the value is given more precisely than can be actually realized on, owing to the differences between consecutive wire-gage sizes. In others the best size of wire can be easily ascertained by a trial calculation or two, using the value as given by equation (5) as a guide in selecting a size once or twice removed from the one in hand. The simple form of the last expression is surprising in view of the complexity of the operation of reducing it, as any one with a fondness for lengthy calculus reductions can ascertain to his own satisfaction.

In order that the full significance of the last expression may be seen, let the problem be restated: If a cylindrical winding area of inside radius r, length l, is to be wound to a resistance R with wire of conductivity p, insulation thickness $(d - d_1)/2$, and to provide a field of maximum strength, then the wire of insulated diameter d, as given by equation (5), satisfies the conditions. A little examination of the values of the field strengths corresponding to respective values of arbitrarily chosen wire diameters will

reveal in any particular instance how much the magnetic intensity will be reduced by the use of a wire more or less different from the best size. As several factors enter the problem, it is impossible to say whether the maximum field strength will be one of sharply defined character or not, and an examination will be advisable before using a wire several sizes removed from the calculated value as the reduction in field strength may be too considerable to be sacrificed.

If equation (5) be rewritten in the form

$$d = \sqrt{sd^2l^2/d_1^2R},$$

it is seen that the better the conductivity, the thinner the insulation of the wire, or both, the smaller is the wire size satisfying the conditions, which is in accordance with our knowledge of the case. Other things remaining the same, the diameter of the wire is halved by a sixteen-fold increase in the specified resistance and the diameter of the wire is increased 68 per cent when the length of the coil is doubled.

In the precise determination of any wire size it becomes necessary to use in the initial calculation an approximate value for the thickness of the insulation as that quantity is itself a variable and not known until the wire size is ascertained more or less closely. Accordingly two or more applications of the equation are generally necessary in order to determine the most nearly correct value of the wire diameter, using in the first calculation a value for the insulation selected by estimation alone and then correcting this from the resulting value of d. That a table of thicknesses of insulation of the kind of wire to be used is required hardly need be stated.

Coming now to the case in which the length, inside and outside radii of the winding space are specified, there are the relations

$$t = 2(r_m - r)/d, \quad n = 2l(r_m - r)/d^2$$

The field intensity is given by

$$\Phi = Pi/d^2,$$

where P is the expression

$$8\pi l(r_m - r)/(10\, d\sqrt{l^2 + 4r_m^2}).$$

The resistance is

$$16\, lsr_m k_1^2 (r_m - r)/d^4, \text{ or } k_2^2/d^4, \text{ say}.$$

The equation $R = k_2^2/d^4$ enables the wire size for coils of fixed dimensions and given resistance to be found at once.

As $i = \dfrac{e}{R + r_e}$, where e and r_e are respectively the emf and the resistance of the circuit not included in the coil, there is obtained at once

$$\Phi = Pe/(R + r_e)d^2. \qquad (6)$$

Proceeding in the usual manner and ignoring the thickness of the insulation, it can be shown that the field is a maximum when R equals r_e; that is, when the coil resistance equals that of the rest of the circuit, a relation that is well known. The value of the wire size in this case is given by

$$d_1 = \sqrt[4]{16\, lsr_m (r_m - r)/r_e}. \qquad (7)$$

And in those cases in which the insulation thickness is not negligible the maximum field strength of a coil of given winding space is secured by making its resistance R bear the same relation to the rest of the circuit r as the diameter of the bare wire d_1 bears to the insulated diameter d. This fixes R and the size of wire is clearly given by

$$d = \sqrt[4]{16\,[illegible]\,(r_m - r)/R}.$$

When the value of the wire size is found, the number of turns, layers, length of wire, field strength, etc., can be readily calculated.

If the I^2R loss and the current are specified, then R is known from the relation $R = w/i^2$, where w is the power consumed in heating the coil. This value of the resistance can be used and the corresponding condition of a given heat production introduced.

If the I^2R loss and the drop over the coil are given, the value of the resistance is h^2/w, where h is the drop and w has the same meaning as before. The use of this last named resistance enables the corresponding conditions to be introduced into the problem.

A SERIES-PARALLEL TRANSFORMER SWITCHBOARD.

By LOUIS DERR.

For work with the electric furnace, especially in research, it is necessary to have at command large currents with a wide range of voltage at the furnace. If the supply voltage is fixed, bulky and wasteful resistors are necessary or for the alternating current a scarcely less cumbersome reactance coil, and it is very desirable to have a supply whose emf can be varied at pleasure. For work requiring heat alone apart from electrolysis the alternating current has many advantages, and the readers of this journal may be interested in a description of the method by which it is utilized in the electrochemical laboratory of the Massachusetts Institute of Technology. As the units are alike except in size, a description of one will serve as typical.

Power at 2300 volts is led to the primary of a 66-kw Pittsburgh transformer, which differs from the usual type in having twenty-two independent secondary coils, each capable of giving 300 amp at 10 volts. Each coil terminal is connected to the blade of a single-pole, double-throw switch, as indicated in Fig. 1, where terminals of the same polarity are marked with corresponding signs. The left-hand studs are connected to two busbars, as shown by dotted lines, and the right-hand ones are linked in pairs also as indicated. From the illustration it is clear that if all the switches are thrown to the left the three coils connected to the switches will be thrown in parallel on the busbars. If the first and last switches are thrown to the left and the rest to the right, the three coils will be in series on the busbars, and this arrangement may obviously be extended to include any number of switches.

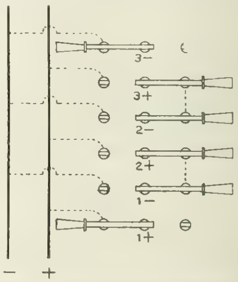


Fig. 1—Arrangement of Switches.

PERMISSIBLE OUTPUTS.

Volts.	Amperes.	Kilovolt-Amp
10	6,600	66
20	3,300	66
30	2,100	63
40	1,500	60
50	1,200	60
60	900	54
70	900	63
80 to 110	600	48 to 66
120 to 220	300	36 to 66

On the actual board alternate studs are made longer than the others, and one of the busbars is bolted directly upon the long studs while the other is connected by short, offset pieces to the short studs. This gives the simple construction shown in Fig. 2, which is a view of the back of the board before connection with the transformer. The forty-

f[o]ur switches are mounted in double column for conven[ien]ce in handling and economy of copper, and this arrange[me]nt has the incidental advantage of allowing the halves t[o] be used separately if desired and at different voltages as w[e]ll, as may be convenient.

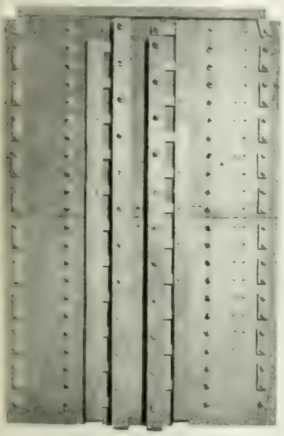


Fig. 2—Rear of Switchboard.

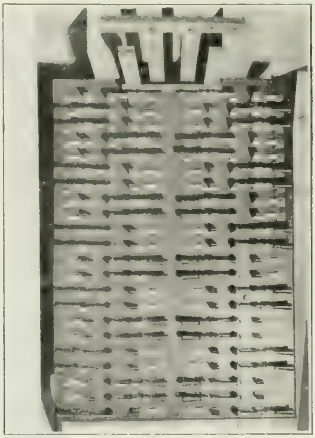


Fig. 3—Front of Switchboard.

[I]n this way any emf up to 220 volts can be obtained in [10]-volt steps by throwing in the needed number of coils, b[ut] the advantage of the arrangement does not stop here. T[he] connections shown in Fig. 1 will give 300 amp at 30 v[ol]ts since three coils are in series on the busbars. If more than 300 amp is needed it is merely necessary to treat the next group of three coils in precisely the same way, thus putting it in parallel with the first group. Other groups may be added in like manner, so that with this transformer seven groups of three coils each can be used, giving 2100 amp at 30 volts. Other combinations are, of course, possible. Fig. 3 is a view of the face of the board with the switches set for eleven groups in parallel, each having two coils in series and thus giving 3300 amp at 20 volts.

With any such series-parallel arrangement it is not always possible to utilize the full output of the transformer, but for most cases nearly all of it is available, as the table printed on the preceding page shows.

With this wide range of emf, covering practically all of the work of the laboratory, the question of ballast resistors is a simple one. In most cases a few strips of sheet iron or 2 ft. or 3 ft. of thick iron rod suffice, held in screw clamps and supported on two firebricks to give free circulation of air. Since the terminal emf is controllable, the power spent in the ballast resistors is small and it has not been found necessary to adopt the more troubesome iron pipe carrying a stream of water. For the not unusual requirement of an emf which must rise or fall rapidly it has been found by trial that the switch combinations can be changed to follow the furnace variations with all necessary speed.

Central Station
Management, Policies and Commercial Methods

A REMINDER TO NEW TENANTS.

[S]everal central-station companies have printed post cards o[r] tags which their representatives, when temporarily re[mov]ing meters from vacated houses, hang to the chandeliers o[r] place in a prominent location to inform future new ten[an]ts that the house is wired.

[I]n Kansas City the new tenant moving into a house wired f[or] service finds an envelope on which is printed, "Notice: H[ow] to Turn on Electric Light." Suspecting that the o[wn]er or former occupant has left a reminder (the en[vel]ope bears no trace of the electric company's name), the p[ro]spective customer finds inside a card beginning "Don't s[i]t in the dark. Call 50 Main and arrange to have the el[ec]tric service connected immediately." Below is a postc[ar]d form addressed to the company, which can be filled out a[nd] mailed without delay if desired.

A [C]OMMERCIAL-VEHICLE GARAGE FOR KANSAS CITY.

[T]o meet the need for a commercial-vehicle garage for el[ec]tric-truck users in Kansas City, Mo., several officials of th[e] Kansas City Electric Light Company have organized th[e] Electric Truck Company, which is closely allied to the lo[ca]l central-station interests. The members of the garage c[or]poration are Messrs. John M. Egan, Louis H. Egan and J. .. Harder, president, general manager and secretary, re[s]p[ec]tively, of the electric-light company. Mr. L. E. M[ar]shall, formerly with the Commonwealth Edison Company, Chicago, is manager of the truck company, which will do a general sales and garage business at its garage, Thirteenth and Charlotte Streets.

In spite of the general hilly contour of Kansas City, about 350 electric pleasure cars are already in use there. An off-peak rate of 5 cents per kw-hour is granted for private garage users, the average income per car being $6.50 to $7 a month.

SOME ECONOMICS OF ELECTRIC COOKING.

A cheaper grade of coffee can be so prepared in an electric percolator as to be really quite superior to the more expensive coffees made ready in the usual way. Mrs. W. E. Sweezey, wife of the manager of the Junction City (Kan.) Electric Light Company, in telling of her own experience with electric cooking in a paper read before the Kansas State electrical convention, Sept. 21, declares that she finds 30-cent percolator coffee all that can be desired and has given up the use of the 40-cent grade, thus saving the difference between $15.60 and $11.70, or $3.90, a year in her coffee bills.

Recently Mrs. Sweezey determined to make a test of the energy consumed by her electric cooking range in preparing a day's provender. The range used was of the General Electric type retailing at $75. On the day in question, after a breakfast of bacon and eggs, toast and coffee, a dinner of fried chicken with gravy, hot biscuits, baked sweet potatoes, mashed potatoes, peach pie and coffee, and a warmed-over supper, the total consumption shown by the meter was but 3 kw-hours. The Sweezey home is a completely motor-

equipped household and Mrs. Sweezey's example is rapidly educating her townswomen to the conveniences and comforts of electrical service.

A CUT-RATE HOUSE-WIRING CAMPAIGN AT JOPLIN, MO.

Taking a step beyond the usual "wiring-at-cost" offer, the Empire District Electric Company, operating in Joplin, Webb City, Mo., and Galena, Kan., stands ready to wire old houses at a price about 35 per cent below the usual local cost of such work.

Thus, for $17.75 the company will furnish and install, complete, wiring, fixtures and tungsten lamps for a house of five rooms as follows: Living-room, one two-lamp fixture; dining-room, one two-lamp fixture; bedroom, kitchen, bathroom and porch, one lamp each. The price, $17.75, may be paid $2.75 down, followed by twelve monthly payments of $1.25 each. The company's rates for residence service are 8 cents per kw-hour for the first 25 kw-hours and 5 cents thereafter.

The present house-wiring campaign began June 1 and was planned to close Oct. 1. Out of the total population affected by the offer, 35,000 people, an average of seventy-five old houses per month have been contracted for wiring. For the final month of September it is expected that this number will be doubled. With each house wired an electric iron has been placed for thirty days' free trial, most of these iron installations becoming *bona fide* purchases at the expiration of the month. A number of electric toasters have also been installed. The fixtures furnished with the $17.75 wiring offer are of simple but good design and the customer is furnished with 40-watt or 60-watt lamps, as he chooses, but may have larger lamps by paying a small excess. None of the tungsten lamps are, of course, exchangeable after the first filling.

The house-wiring campaign in the towns of the Empire District, which is a famous lead and zinc-mining country, has been carried on under the direction of Mr. J. E. Harsh, contract agent for the Empire District Electric Company.

AN EFFECTIVE METER EXHIBIT.

The mounting of a meter with a glass case and adjacent switches connected with various sizes of incandescent lamps at a conspicuous point in a central-station office for the instruction of the public in the operation and reading of dials is a common practice which has accomplished much good. When such an exhibit is located near the receiving window, where the public pays the periodical lighting bills, there is no question that it often does a great deal toward eliminating the inherent hostility of the public toward the meter as a complicated registering device. An interesting modification of the foregoing plan is in use in the Salt Lake City office of the Utah Light & Railway Company. In place of the usual single meter the company has installed two outfits, each consisting of a glass-incased watt-hour recorder connected with an incandescent lamp of 32-cp rating. One of the lamps is an ordinary carbon bulb and the other is a tungsten unit. The company is making a continuous demonstration of the relative economy of the two types of lamps, having started the two metered circuits in service with the dials at zero on July 21. The lamps are burned continuously and each day an employee of the commercial department reads the two meters and files the corresponding bill at the company's regular rates on the bulletin board above the lamps, calling attention in a printed notice to the fact that the amount of light given out is the same, while the energy consumption of the carbon lamp is approximately three times that of the tungsten. Thus, on Sept. 11 the carbon lamp had consumed 141 kw-hours, at a cost of $15.51, and the tungsten unit had consumed only 51 kw-hours, at a cost of $5.61, the rate being 11 cents per kw-hour. The relative speed of the two meters and the

Double-Meter Exhibit.

posting of the bills each day have aroused considerab interest on the part of persons visiting the office, and tl demonstration has done not a little to allay the dislike t meters which so often is manifested by consumers who fa to realize the precision with which registration occurs.

ARGUMENTS FOR CURB LIGHTING.

To point out the advantages to merchants of individu curb-lighting installations the Commonwealth Edison Com pany, of Chicago, has issued a pamphlet entitled "We Lighted Streets Mean More Business." It is pointed c that lamps on ornamental posts spaced uniformly along a business street will increase materially the amount business transacted there. In many cases well-light streets form the only safeguard against failure for t small merchant. The people residing in outlying neighbo hoods would prefer to do their shopping in the evenin near home, provided the streets are well lighted and attra tive and the merchants carry the goods which are need Plenty of light is always inviting, and many times t nearby residents would welcome the opportunity of stro ing along the street and looking in the store windows they were well lighted and attractive. Nearly everyo hesitates to frequent dark and poorly lighted stree whereas a brilliantly lighted street is an irresisti attraction.

When the merchant can induce people to frequent s street and view his show windows he has a good chance f securing their trade. Another fact noted is that when pr erly illuminated middle-of-the-block locations are as va able as corner stores. "When the people of your neight hood," says the company to the merchant, "see these p s being installed in front of your store they are immedia y convinced that you are desirous of making shopping a pleasure to them. It marks you in their minds as a progs sive, up-to-date merchant, who has a liberal amount of c ic

ide for the district in which he resides and does business." Where there are local organizations of business men the ganization is urged to take the matter up and to telehone to the electric-light company, which will be glad to nd a representative to a meeting. If there is no organizaon the merchants are urged to organize for the good of e street. "Get the movement started and you will be rprised to find the number of merchants who will give eir moral and financial aid to make it a success."

The only light that is wholly satisfactory and almost niversally adopted for street-lighting purposes is electric ght—clean, bright, steady, economical and unaffected by ind and weather. The prices offered by the Commonealth Edison Company for curb lighting are for street osts supporting four 60-watt tungsten lamps each or one o-watt lamp, and are as follows:

One post with lamps burning from dusk to 10 p. m. for x nights and from dusk to midnight for one night a week, .50 a week.

One post with lamps burning from dusk to 11 p. m. six ghts a week and from dusk to midnight one night a week, 60 a week.

One post with lamps burning from dusk to midnight seven ghts a week, $1.70 a week.

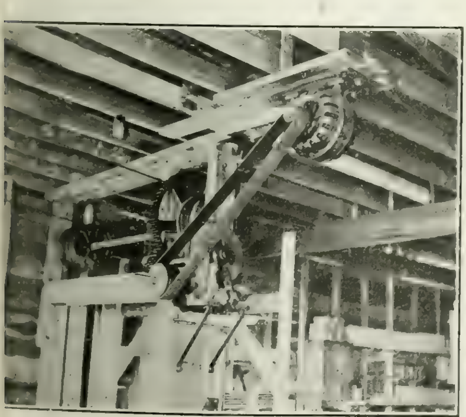
One post with lamps burning from dusk to 1 a. m. seven ghts a week, $1.85 a week.

This proposition is made with the understanding that ders are received to install fifty or more posts. The lights e turned on and off by the company at the specified time, d the prices given include wiring, lamp renewals and the intenance of posts, fixtures and lamps.

MARYVILLE, MO., A SMALL TOWN WITH A LARGE MOTOR LOAD.

Maryville, Mo., is an example of the small community in hich an energetic manager has found applications for otors in almost every local industry. Two years ago there as practically no motor service in Maryville. To-day this tle town of 6000 population has 275 hp connected.

Not long ago Mr. C. C. Hellmers, manager of the Mary-



Two-hp, Three-Phase Motor Driving Elevator.

le Electric Light & Power Company, undertook to have otor drive installed in the local laundry. On account of e need of hot water he met the usual discouraging argunt that they might as well have the steam anyhow. nally he succeeded in getting motors installed under the reement that they should be paid for out of the savings effected. The motors are rapidly paying off their indebtedness and the laundry owner, won over to the better way, is now delighted.

A large local industry is the manufacture of lightning rods, which have a lively sale in farming communities near by. Something as a fire engine is used to fight fire, the lightning-rod factory is equipped with electric drive throughout, motors being used to twist the metallic ribbons into rods, convey material, etc. The accompanying illustration shows a 2-hp, three-phase Westinghouse squirrel-cage motor belted to a worm gear for driving a freight elevator, which is used to lift loads of 3000 lb. through three stories. The application, though crude and rather unusual, is simple and effective. The motor is without a starting device of any kind except a double-throw switch attached to the elevator control rope. The car can be run in either direction by pulling upward or downward on this rope and the motor is often used as a brake by pulling on the reverse rope to stop the elevator suddenly. The severe service which the small motor thus undergoes can be imagined.

Mr. Hellmers has not confined his "power" service campaign to his town limits. Lines from his plant extend to farms 4 or 5 miles in opposite directions, where besides lighting their places the farmers use electric energy for chopping feed, sawing wood, cutting ensilage, pumping, churning, etc.

CENTRAL-STATION METER TESTING IN CHICAGO.

In a paper bearing the significant title "Converting the Company's Product Into Cash" and read by Mr. O. J. Bushnell, superintendent of the meter department, before the Commonwealth Edison Section of the National Electric Light Association in Chicago on Sept. 5, some interesting information was given about the work of the meter department of the Commonwealth Edison Company.

The meter department of this company goes back to 1888. Mr. W. L. Church was the first superintendent, and both Mr. L. A. Ferguson and Mr. John F. Gilchrist were connected with the department in former years. To-day the department has on its payroll 260 employees and its various lines of work are conducted at an annual expense of nearly $200,000. The number of customers' watt-hour meters on the company's circuits has increased rapidly of late years. Ten years ago the number was about 16,000, while now it has reached nearly 160,000, about 27,000 being added annually.

The work of the department is divided along two lines—the maintenance or operating work, which consists of the repair, testing and calibration of meters, and the commercial work, which consists of reading the meters in service and rendering to the auditing department the amounts of electricity to be billed.

All meters when received from the factory are tested on both light and heavy loads, and calibrated if necessary. Alternating-current meters are also tested on an inductive load. The dial ratios and constants of all meters are checked and a thorough inspection made of the mechanical construction. As soon as possible after the meter has been installed an initial inspection is made by a meter-department inspector. Among other things, the inspector checks the accuracy of the meter. In the case of all meters of 15-amp rating or more this check consists of a full instrument test known as the installation test; in the case of meters of 5 amp and 10 amp, a careful examination of the meter is made and the test is by means of a standard 50-watt lamp. If this light-load check on small meters shows any material change in the calibration the meter is reported for a regular instrument test. All meters in service are given periodic tests, the frequency of tests varying according to type, size and use of the meter. In accordance with the established schedule, tests are made as follows:

Direct-current meters of 100 amp and above, every three months; of 25 amp to 75 amp, every six months; of 5 amp to 15 amp, every 12 months. In the last-named class there is a modification of the rule by which meters which exceed a fixed number of revolutions between tests or are in locations affecting their accuracy are tested more frequently than once a year.

Meters of the alternating-current type are tested somewhat less frequently than direct-current meters. Single-phase meters of from 5-amp to 25-amp rating are tested every two years; single-phase meters of 50 amp and above, every six months, and polyphase meters of all ratings, every six months.

Only instruments of a high grade are used in testing customers' meters, and the accuracy of these portable instruments is checked every week by comparison with standard instruments kept in the instrument checking room of the meter department. The stop watches used in testing are also checked daily with a Howard clock, with a seconds pendulum, located in the instrument checking-room. The standard instruments in this room are in turn checked monthly with primary standards in the standard and railway meter-testing laboratory. The equipment of this laboratory includes Weston standard cells with which comparison is made by means of a Leeds & Northrup potentiometer and standard resistances and current shunts. The value of these standards has been certified by the National Bureau of Standards at Washington, and they are rechecked periodically by this government authority. The equipment also includes a full set of Westinghouse precision instruments, a Wolff Wheatstone bridge and other necessary apparatus. A 5-kw motor-generator operated from a sixty-cell storage battery furnishes steady current of any desired frequency or power-factor.

Testing of primary-side or high-voltage meters is carried on in connection with this laboratory, as, on account of the large amounts of energy which are measured by these meters, great accuracy is required. Meters of this class are checked while in service at intervals of from one to three months. If an error exceeding 0.5 of 1 per cent is found the meter is readjusted and must be brought within 0.3 of 1 per cent to be considered correct. The average error found on the monthly tests in the railway power metering during last year was only 0.13 of 1 per cent.

Scarcely any alternating-current meters made previous to the year 1900 are now in use by the Commonwealth Edison Company. The earlier types of direct-current meters have also been discarded; the last of the Edison chemical meters went out of service in September, 1904. Mr. Bushnell believes that the accuracy now obtainable from electric meters compares favorably with that of any other system of mensuration applied to the sale of any kind of commodity. The troubles which may arise in any mechanical device are more likely to cause meters to run slow than fast, so that if an error arises the company rather than the customer is likely to be the loser.

AN ALL-HOUSE SURVEY AND HOUSE-WIRING CAMPAIGN AT DES MOINES, IA.

Des Moines, Ia., with a population of 86,000, is estimated to have 30,000 houses scattered over its unusual area of 56 square miles, a territory larger than that of Boston, Mass. While not all these houses are reached by the lines of the Des Moines Electric Company, the company is carrying on a detailed survey of the entire city, investigating whether each resident uses gas or electricity and the reasons why his house is not connected or wired, if reached by its lines. These records are entered on cards of the form reproduced herewith, filled in by a solicitor who makes a house-to-house canvass of the city by districts. This man first hands the housewife a copy of the Des Moines company's attractive booklet, "The Servant in the House," describing domestic applications of electricity, and then through inquiries secures the data required. This information, he reports, has in every case been very cheer

Street Center No. 2430

Occupant John Doe ~~Business~~-Residence

~~Agent or~~ Owner Address

HOUSE WIRED	HOUSE PIPED	FIXTURES	REQUIRES	USING GAS FOR	PROBABLE INSTALLATIO
OLD Yes ~~NEW~~	Yes	Cont.	~~EXTENSION~~ ~~OR~~ SERVICE	C. + L. USING ELECTRICITY FOR —	12 - 16 cp

Remarks: Wiring needs repairing before using.

Date 10/12/10 Solicitor

Fig. 1—Record Card in Des Moines House-to-House Survey.

fully given. One card relates to each householder, the one reproduced herewith being self-explanatory. The class "old" and "new" under the "house wired" heading we found necessary on account of some installations failing pass the present wiring requirements. In the fourth ite information is given as to whether the prospect will requi an extension of pole line or simply a service drop. O man has been assigned to this work of the house-to-hou survey for the last year and has already collected seve thousand cards. He can turn in about seventy-five car

HOUSE WIRING ORDER

Des Moines, Ia., ____________ 191__

DES MOINES ELECTRIC CO.

Dear Sirs: Please install in the premises at ____________ Des Moines, Iowa, of which I am the ____________, the following list of wiring, switches, fixtures, etc., necessary for the use of electric light therein, for which I agree to pay $______ upon completion, or as follows: $______ upon completion and $______ upon the ______ day of each month thereafter, until fully paid. All payments to be made at the office of the Des Moines Electric Co., 5th and Mulberry Sts.

LOCATION OF ROOM	CEILING OUTLET	SNAP SW	SIDE WALL OUTLET	3 WAY SW	LAMPS	CEILING HEIGHT: 1st, 2nd — FIXTURES	STORIES — PRICE
Porch	1	1					3.50
Vestibule							
Hall	1	1					3.00
Living rm	1	1					3.00
Parlor	1	1	2				6.00
Dining rm	1	1					3.00
Bedroom							
Pantry							
Kitchen	1	1					3 75
						Laundry Iron Outlet	1 50
Basement							
2d Floor Hall	1			1			6.25
Bath rm	1	1					3.00
Bedroom			B				3.00
Attic	1	1					3.50
Barn							
							3 00

Total for wiring, fixtures and holophane reflectors ______

Six pound laundry iron ______

Mazda lamps ______ 40w ______ 60w

Carbon lamps (loaned) ______ 4cp ______ 8cp ______ 16cp

Entrance on ______ side. Meter in ______ TOTAL

It is expressly understood and agreed that the title to the material listed above shall not pass from the Des Moines Electric Co. to the undersigned, until the amount agreed above is paid in full, and in default of the payment of said sum when due, the Des Moines Electric Co. is hereby authorized and empowered to remove the above listed material without legal process.

Accepted
Des Moines Electric Co.

By ____________ Signed ____________ Owner

____________ Solicitor

Fig. 2—House-Wiring Estimate and Order Filled Out In Customer's Presence.

per day, making the cost of the survey about 4 cents per card for the solicitor's salary. When received at the office the cards are filed in order in cabinets for reference.

Using this information, a map has been prepared showing in colors the premises of each householder and whether he

is a consumer, has his house wired or is not reached by service. Premises not on the lines are tinted blue with water-color paint. Those wired but not using electricity are colored yellow, while customers are colored green. Should a resident who has had his house wired, but without service, later make application for service it is an easy matter to add a little blue to the yellow already on his plot, converting him to the green shade of the company's customers. This map has been found useful in showing at a glance the company's service in any portion of the city.

While data are not yet available on the entire number of wired and unwired houses in Des Moines, the investigation thus far has shown that in a typical residence section where central-station service reaches 4000 houses 1700 are wired and 1500 are using electricity.

Along with its survey the Des Moines company has been carrying on a campaign to get its old houses wired. The time of three solicitors has been given to this subject. The work is all done by one contractor, who has agreed with the company on a fixed cost of wiring, the elements of which are represented in the accompanying house-wiring order. This rate is equivalent to about $1.50 per outlet, including switches. When flush switches are used 75 cents additional is charged, and 50 cents is added for the longer runs, such as a porch or an attic. The wiring order shown is filled in by the solicitor in the customer's presence and the total cost quoted to him at the first visit. To the items listed $3 plus approximately 5 per cent of the bill is added to cover cost of soliciting, handling, etc. By the wording of the last paragraph on the order sheet failure to pay for the work gives the company a lien on the house.

When the customer has signed the house-wiring contract the items enumerated are copied in triplicate on pink order sheets similarly tabulated. Two of these pink sheets go to the contractor, while a third is filed with the customer's order in the company's office. When the work is completed one of his pink copies is returned by the contractor. This copy is then passed to the bookkeeping department which has charge of accounts, leaving a record of the work in each department interested.

During the five months the campaign has been in progress [illegible] old houses have been wired, 1136 16-cp equivalents being installed. Forty-two new houses have been wired and ninety-five additions have been made to existing wiring. Mr. J. L. Bradfield is contract agent for the Des Moines Electric Company.

Wiring and Illumination

GROUNDING SECONDARY NEUTRALS TO WATER-PIPES ON CUSTOMERS' PREMISES.

As a means of securing positive grounds for the neutrals of its secondary three-wire circuits, the Kansas City Electric Company has resorted to the connection of such neutrals, from a point directly where they enter the customers' houses, through No. 4 copper wires soldered to the house water-pipes. At least two neutrals in each block are thus grounded, the intention being that four or more of each secondary circuit will later be thus protected. This grounding assures against any dangerous rise in pressure should the primary voltage become crossed and also prevents troublesome leaks and losses which sometimes occur through a partial secondary ground, to the annoyance of both customer and company. With the dead ground provided the fuses are blown at once, giving notice that the circuit is in trouble.

The work of making these grounds is being done by a special gang, which averages six grounds a day, according to Mr. A. N. Richardson, general superintendent of the company. These men have already installed 1100 grounds, covering at least one-half of the section to be protected. The work is done in the best possible fashion and is made to correspond closely with the existing wiring in the house. Whenever feasible outside construction is used, the No. 4 ground wire being run down and soldered to the sprinkling hose faucet. A good job of soldering can usually be made by emptying the pipe of water, and the use of pipe clamps has been avoided. The average cost of installing the grounds has been $2.05 each .

Grounds to the water pipe are practically perfect electrically and are quite reliable, as the water company does not remove its meters when houses are vacated. Even if piping changes should be made and a given ground disconnected, the other three or four intact connections on the same secondary will protect the house service. In the country surrounding Kansas City the bed rock rises to within a few feet of the surface in places and any driven or buried ground device is, of course, out of the question. The local water company has given its tentative permission for the use of its pipes for this purpose, as such grounding of secondaries to water-pipes has the approval of the American Waterworks Association. A quantity of junked pressure wire which is being taken down in Kansas City will also be used to tie the various secondary neutrals together, thus extending even further the assurance of good grounds for all circuits.

A HOUSE OF ELECTRICAL CONVENIENCES.

The new house being erected for Mrs. Charles K. Towt, of Lindsay, Cal., is to be arranged for lighting, cooking, heating and cooling by electricity. Besides luminous radiators in the fireplaces of several of the apartments, all rooms will be equipped with outlets for heating appliances. In the kitchen both an electric range and a fireless cooker will be provided. The lighting control of this twelve-room house will be notably convenient, the lamps of each room being controlled from three-way and four-way switches at the side of any of the entrances to the room. Similar cross-connections are provided for the stairways, and the porch lighting can be turned on or off from concealed switches operable before starting up the steps. In the basement space is arranged for a motor-driven refrigerating machine for cooling the air in the twelve-room dwelling.

LINE POLE CENSUS STATISTICS.

Preliminary Comparative Report for 1910 Issued by the Census Bureau.

A preliminary statement has been issued by the United States Census Office showing the number of poles purchased by the telephone and telegraph, steam and electric railroad, and electric-light and power companies in the United States during the years 1910, 1909, 1908 and 1907.

Of the 3,870,694 poles purchased during 1910, 2,831,810, or 73.2 per cent, were reported by telephone and telegraph companies; 733,092, or 18.9 per cent, by electric-railway, light and power companies, and 305,792, or 7.9 per cent, by steam railroad companies.

The total number of poles purchased in 1910 by all users of these materials, while greater than the number in 1909 by only 3.5 per cent, exceeded that of 1908 by 19.1 per cent and of 1907 by 17.9 per cent. The steam railroads reported 110,471 more poles purchased in 1910 than in 1909, and the electric railway, light and power companies increased their purchases by 105,678. The number reported by the tele-

phone and telegraph companies, however, was slightly less than in the preceding year, the decrease amounting to 84,195.

In 1910, as in each of the three preceding years, more poles were cut from cedar than from all other woods combined. The proportion contributed by this species, however, has been steadily growing smaller, the percentage of cedar poles in the total of 1910 being 62.8, as against 65.3 in 1909, 67.7 in 1908 and 64.2 in 1907. Undoubtedly cedar leads all other woods in the possession of those qualities most sought after in pole material; hence the increasing proportion of other woods reported during recent years is clearly a logical result of the growing scarcity of cedar timber, together with the consequent advance in its cost. While twenty-eight different woods were reported as drawn upon for pole material during 1910, four species—cedar, chestnut, oak and pine, ranking in the order given—contributed more than 90 per cent of the total during each of the four years covered by the report.

Among the woods used in relatively smaller quantities as pole material a marked decrease is noted in the case of cypress, the number reported from this species in 1910 being only about 75 per cent of that shown for 1907. Principal among the causes of this decrease is, of course, the high and increasing value of this wood as lumber and shingle material. On the other hand, the number of Douglas fir poles has increased rapidly during the four years, the total reported for 1910 being nearly four times

Kind of Wood	Number of Poles Purchased.			
	1910	1909	1908.	1907
Cedar	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut.	677,517	608,066	516,049	630,282
Oak......	265,290	236,842	160,702	76,450
Pine	184,677	179,586	116,749	155,960
Cypress...	75,459	77,677	90,579	100,368
Douglas fir....	56,732	24,877	19,542	15,919
Tamarack	30,964	29,889	24,123	13,884
Redwood.....	30,421	23,145	13,061	31,469
Osage Orange.	23,221	21,491	18,109	5,962
Spruce........	22,929	11,423	8,088	10,646
Juniper...	20,042	43,581	42,367	38,925
Hemlock	12,773	6,222	1,998	3,301
Locust....	9,030	10,463	10,224	4,672
All other	30,072	25,653	27,424	85,953
Total	3,870,694	3,738,694	3,249,154	3,283,268

as great as that for 1907, while a substantial gain was also made for each of the intervening years.

An interesting fact disclosed by the figures is the rapid growth of the practice of treating poles in order to prolong their period of use. In 1910 824,673 poles, or more than 21 per cent of the total reported purchases for that year, were given some preservative treatment. This number was an increase of 248,042 poles, or 43 per cent, over that of 1909; 480,285, or 139.5 per cent, over that of 1908, and 428,474, or 108.1 per cent, over that of 1907. In 1910 the class of pole users which applied preservatives most extensively was the electric-railway, light and power companies, 29.4 per cent of the reported purchases having been given some treatment of this character, as against 19.9 per cent by steam railroads and 19.4 per cent by telephone and telegraph companies.

MOTOR GROUPING IN ARRANGEMENT OF LEAD-SMELTER DRIVE.

The lead smelter of the Galena Smelting & Refining Company, at Galena, Kan., is one of two smelters in the surrounding Empire lead and zinc zone district driven by electrical energy from the Empire District Electric Company's lines, which operate a number of mines in the vicinity. In this smelter, which produces about 2,000,000 lb of lead per year, all of the motors driving the variou blowers, fans, exhausters, etc., are inclosed in a specia motor-room to exclude dust from the machine bearings an parts. As shown in the accompanying illustration, all o these motors are substantially mounted on concrete founda tions and each is wired in conduit to its starter on the wal opposite. As is characteristic in the instalations of th Empire District company, all motors of more than 30-h rating are 2300-volt machines, operated off the primar distribution lines.

The process of smelting lead ore consists in melting th ore in cupola furnaces, the molten lead running off int pigs, while the slag refuse is melted over again in "jumbo

Motor-Room of Lead Smelter, Galena, Kan.

furnaces for further recovery. The smoke from the fu naces, containing considerable lead oxide, is led throu "bag rooms," where in passing out the solid material is d posited in the form of fine dust on the fabric of the num ous bags, 4 ft. wide and 30 ft. long, hung from the ceili These bags are then tapped, causing the dust to fall to t floor, where it is gathered up again and subjected to treatment.

The lead produced by this smelter is of very good qual and finds uses in the electrical arts in the manufacture storage-battery plates, cables, etc.

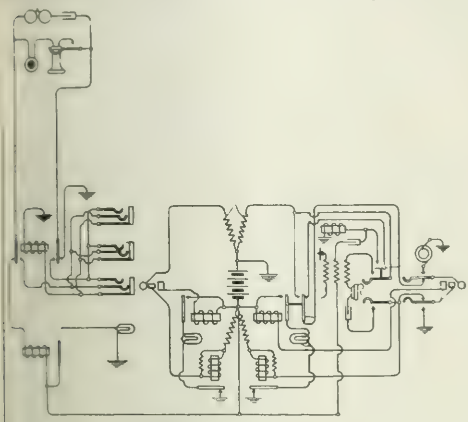
RECENT TELEPHONE PATENTS.

DESK SET.

Mr. A. G. Remhilt, of Philadelphia, is the patentee o a desk set which includes a novel receiver, receiver supp t and switch device. The receiver polarizing magnet has s axis in a plane parallel to the diaphragm. It theref is like the old spoon-type receiver, save that it is bipo This receiver is hung in a yoke which spans its body, ear-piece, permitting the receiver to swing slightly ab a vertical axis. The other end of the yoke-piece hinge a short arm, which in turn is secured to the transmit r The yoke and arm are of such relative length that w n swung together the receiver will register with and c e the transmitter mouthpiece. At the same time the ler h is such that when arm and yoke are at right angles e receiver and transmitter are in the relative positions f ear and mouth of a user. Furthermore, the arm may s- sume a position either to the right or left from the tr s- mitter or may be returned to normal position with e folded arm turned down parallel to the stem of the sk stand. The switch springs are within the arm at the h ge and are driven by cams turning with the yoke-piece.

THREE-WIRE CIRCUIT SYSTEM.

Common-battery switchboard circuits may be classed in two main groups—the three-wire and the two-wire. In the former the multiple-jack circuits carry three conductors each, while in the latter the test conductor is merged with one side of the line and a two-conductor circuit results. There are, however, also other features which may be considered characteristic of the type. Such is the connecting-cord supervisory circuit. In the three-wire system this is



Winston's Telephone System.

generally led through the plug-sleeve and jack-sleeve cut-off relay to ground. On the other hand, in the two-wire system the supervisory-lamp circuit is usually local to the relays of the cord circuit, not being led into the coils at all. Again, in the three-wire system the multiple jacks are usually directly connected to the line circuit, while in the two-wire system this connection is only maintained when the cut-off relay is actuated.

These distinctions are all broken down in a circuit system recently patented by Mr. C. S. Winston, of Chicago. His system is fundamentally three-wire. The cut-off relay controls the jack connection and the supervisory-lamp circuit is not connected through the cords. The accompanying illustration is a diagram of this circuit. The patent is held by the Kellogg Switchboard & Supply Company.

LETTER TO THE EDITOR.

State Control of Public Utilities.

To the Editor of Electrical World:

SIR:—Referring to the editorial comment in the issue of Sept. 23 on the address of Governor McGovern of Wisconsin, delivered at the recent conference of Governors, on the subject "State Control of Public Utilities," and with particular reference to that portion commenting on the limited franchise, it may be of interest to you to know that your statement as to this phase of the public-utility question practically reiterates my own views on this topic, which were, among other features, set forth in a discussion which I recently gave on the increasing cost of operating and the many other obstacles which make difficult the profitable operation of our public-service industries to-day. My discussion, which appeared in the July issue of the New York *Editorial Review*, related specifically to modern systems of urban rapid transit, and I quote below from that portion of my paper in question respecting limited franchises as follows:

"A short-term franchise is another factor adversely affecting the return on the investment, as the expenditure of the large amount of capital necessary for the creation of a high-class city railway system is wholly unjustified if the term of franchise be so brief as not to permit of amortizing the greater part of the investment by provision, from revenue, of suitable sinking funds before the expiration of the franchise. Experience has also demonstrated that for years approaching the expiration of franchise rights the property and service are allowed to deteriorate, much to the inconvenience of the traveling public. Thus it is seen that these disquieting conditions surrounding the operation of public-service properties at present react upon the public itself through the poorer service possible with meager receipts, and this poorer service is also due, in part, to the somewhat reduced efficiency of officers of public utilities, who find it necessary to devote not a small portion of their time to watching and combating adverse legislation, which could otherwise be taken up in the more efficient management of their properties by bettering the service and keeping more in touch with public needs."

Brooklyn, N. Y. CLARENCE P. FOWLER.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Equalizing Connections in Direct-Current Machines.—W. EILER.—A mathematical discussion of the effect of equalizing connections in direct-current machines. Lack of symmetry in the distribution of the magnetic flux would produce non-uniform load on the brushes and unequal armature reaction on the auxiliary poles. By means of equalizing connections these troubles may be greatly diminished. Rules are given on the number of equalizing connections required.—*Elek. u. Masch.* (Vienna), Aug. 6.

Compound Single-Phase Commutator Motor and Generator.—F. NIETHAMMER, K. SACHS AND E. SIEGEL.—A highly mathematical paper illustrated by numerous diagrams in which they first explain the origin of the compound single-phase commutator motor of the Allgemeine Elecricitäts Gesellschaft. It is shown that it may be considered a combination of the principle of the well-known series motor with cross brushes and of the compensated shunt motor. The theory of both types is given, as well as that of the compound commutator motor and generator, together with results of tests.—*Elek. u. Masch.* (Vienna), Aug. 13 and 20.

Two-Phase to Three-Phase Transformer.—VIDMAR.—An English translation of his German paper recently abstracted in the Digest. The system of transformation described is employed at Weiz, near Graz, for interlinking the old two-phase supply system with a modern three-phase system. The author compares it with the Scott system and thinks that it is an improvement on the latter, both as regards weight and cost and also from the fact that the leakage, and, therefore, the voltage drop, is smaller.—Lond. *Electrician*, Sept. 8.

Belt Leakage.—F. NIETHAMMER AND E. SIEGEL.—A mathematical paper on belt leakage in two-phase and three-phase induction motors.—*Elek. u. Masch.* (Vienna), July 30.

Alternating-Current Machines.—J. LISSNER.—A highly mathematical paper on the theory of alternating-current machines without commutator. The author shows how

certain fundamental differential calculations which he formerly developed can be integrated.—*Elek. u. Masch.* (Vienna), July 30 and Aug. 6.

Commutation and Rotary Converters.—H. S. Hallo.—The author gives the theory of the commutation of single-armature converters with and without interpoles on the basis of Arnold's theory and gives a comparison with that of the direct-current generator and the cascade converter. It is pointed out that interpoles are not especially suitable for single-armature converters, and this is important for the design of machines for high speed, high frequency and high voltage.—*Elek. Zeit.*, Aug. 31.

Heating and Ventilation.—C. Caminati.—The author endeavors to calculate the minimum quantity of air which is necessary for the good ventilation of an electrical machine and applies the method to a numerical instance of a 10,000-kw turbo-alternator.—*La Lumière Elec.*, Aug. 25.

Lamps and Lighting.

Osram Lamps.—H. Remane.—A lecture before the Swiss Electrical Society on the application of the osram lamp in practice. The manufacturers sent inquiries to about 1600 European electricity supply authorities in towns and villages asking whether osram lamps were used for street lighting and what were their candle-powers. One thousand two hundred and ninety replies were received, showing that osrams are employed in 484 localities. The total number in use is 33,643, with a total of 1,640,000 hefner-candles, about 50 per cent of the lamps working on 220 volts. The majority of osram lamps (61.5 per cent) are 50-cp units and very few, actually only 2 per cent of the osrams used in street lighting, are of 16 cp. These are evidently lamps in unimportant streets or emergency lamps. It might have been expected that a large number of 100-cp lamps would be used for street lighting. That this is not the case may be due to several causes, the first and principal one undoubtedly being that the former 16-cp carbon lamps were simply replaced by osrams of the same power consumption so that the lighting system should not be any further loaded up. Secondly, incandescent gas lighting is still predominant in the larger towns. It is well known that in Germany at least many of the smaller towns have for years owned their own gas works and that with the advent of the gas mantle many other gas works were started in very small towns. It is shown that on account of their low specific power consumption osram lamps can be operated at a saving even when carbon-filament lamps are replaced by osrams of double the candle-power. For lighting large squares and streets the osram does not, of course, enter into competition with the carbon-filament lamp, but osrams from 100 cp to 1000 cp compete with small and medium-sized arc lamps. Some data are given on the replacing of arc lamps by large osram lamps in several German railway stations.—Lond. *Electrician*, Sept. 1.

Fluctuations of Temperature and Candle-Power of Alternating-Current Incandescent Lamps.—F. Kesselring.—The author first develops some formulas for calculating the fluctuations of temperature of an alternating-current incandescent lamp during one cycle and especially for calculating the difference between maximum and minimum temperature. These formulas are then applied to four different incandescent lamps, the results being given in Fig. 1. Curve *a* relates to a 230-volt, 32-cp carbon lamp consuming 3.5 watts per candle-power (maximum temperature, 2000 deg. C.). Curve *b* relates to a 230-volt, 32-cp metallic-filament lamp consuming 1.2 watts per candle-power (maximum temperature, 2300 deg. C.). Curve *c* relates to a 145-volt, 25-cp metallic-filament lamp consuming 1.2 watts per candle-power (maximum temperature, 2300 deg. C.). Curve *d* relates to a 25-volt, 25-cp metallic-filament lamp consuming 1.1 watts per candle-power (maximum temperature, 2300 deg. C.). The abscissas represent the frequency in cycles per second, the ordinates the difference between maximum and minimum temperature of the filament. The temperature fluctuations, and, therefore, also the fluctuations in candle-power, are about of the same intensity for low-voltage metallic-filament lamps and for carbon lamps, while they are much larger for high-voltage or standard-

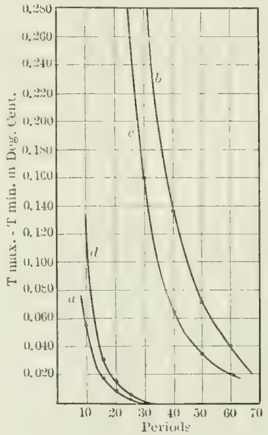


Fig. 1—Fluctuation of Temperature of Alternating-Current Lamps.

voltage metallic-filament lamps. If the current in a low-frequency network (traction current) is used for lighting, it is therefore recommended to use low-voltage metallic-filament lamps.—*Elek. u. Masch.* (Vienna), Aug. 27.

Light Production.—R. A. Houstoun.—The first part of a serial in which the author proposes to deal with the theory of light production, the scope being indicated by the following contents: (1) The distribution of the energy in the spectrum and the measurement of efficiency. (2) The importance of "black-body" radiation and the experimental realization of the black body. Comparison of the energy curves of a black body and of platinum and the variation of the position of maximum energy with temperature. (3) Mechanism of flame, and the temperature, energy and efficiency of flames. (4) The Welsbach mantle and selective radiation. (5) Radiation and efficiency of the carbon incandescent lamp. (6) Physical properties and temperature of the arc. (7) Temperature and energy curves of the Nernst glower. (8) Efficiency of the metallic filament. (9) The mercury arc and its difficulties. (10) The light of the future and the possibility of obtaining "cold light." In the present instalment the spectral energy distribution and the definition of efficiency are discussed.—Lond. *Electrician*, Sept. 8.

Metallic-Filament Lamp.—A note on a recent British patent (23,639, Aug. 31, 1911) of Mr. J. Schilling. Finely divided metal, such as tungsten, is mixed with a quantity of ammonia solution and then kneaded and worked up at the ordinary temperature; or the metal can be exposed to the action of ammonia gas in closed vessels at the ordinary temperature. The product is a plastic mass which can be readily squirted into filaments when the ammonia evaporates on passing a current through, leaving a filament of pure metal.—Lond. *Elec. Eng'ing*, Sept. 7.

Drawn Tungsten Filaments.—A note on a recent British patent (8004, Aug. 31, 1911) of Mr. K. Schwab. The filament is drawn from a tungsten alloy containing non-metallic substances in quantities insufficient to affect the resistance of the wire. Good results are obtained with an alloy of tungsten and a little phosphorus, and nickel can also be added if desired.—Lond. *Elec. Eng'ing*, Sept. 7.

Starting of Mercury Arc.—O. Kruh.—An illustrated paper read before the Vienna Electrical Society giving

review of the different methods for starting an alternating-current arc.—*Elek. u. Masch.* (Vienna), July 23.

Generation, Transmission and Distribution.

Rural Electrical Supply in Germany.—Notes, with a map, on the rural transmission and distribution system of the Elbtal (Elbe River Valley) power station. The power plant is near Pirna in Saxony and will be equipped with three 4250-volt turbo-alternators. The voltage is 6000 and this is the voltage of transmission by cable through the industrial district between Pirna and Dresden. For distribution of energy to adjoining valleys overhead lines at 20,000 volts are used. The plant is interconnected by a 40,000-volt line with the Hirschfelde power station near Zittan, which contains three steam-turbo sets, two of 2500 hp each and one of 5000 hp.—*Elek. Zeit.*, Sept. 7.

The First 110,000-Volt Transmission System in Europe.—E. G. Fischinger.—The conclusion of his long and profusely illustrated article on the 110,000-volt Lauchhammer transmission system. Further details are given of the insulators and poles and other parts of the transmission line, as well as of the equipment of the substations. The plant will be opened in November, 1911.—*Elek. Zeit.*, Aug. 24 and 31.

Installations, Systems and Appliances.

Central-Station Statistics of Austria.—Statistical data on central stations in Austria, the figures referring to the status on July 1, 1911. Statistics are given for only those stations that sell electric energy for public purposes or to private consumers. Isolated plants and traction plants are not included. Stations which buy electricity in bulk from other power plants and sell it to their customers are, however, included. There were 740 stations with an aggregate rating of 378,736 kw (against 675 stations with 318,614 kw in the preceding year). Two hundred and eighty-seven stations were municipal; 453 were owned by private persons or corporations. According to the system used the stations may be subdivided into classes as shown in the first table. Of these stations 332 were operated by water-power, 129 by steam-power, seventy-seven by gas, ninety-two by water and steam, fifty-four by water and gas, nineteen by steam and gas, eleven by steam, water and gas, and twenty-six buy electricity in bulk; 425 stations use overhead wires, twenty-one cables, 216 cables and overhead lines, while no information about this point is available from seventy-eight stations. Of 451 direct-current stations 203 use a two-wire system, 246 a three-wire system and two a five-wire system. The second table gives information on the rate systems in use. Among the stations using a meter rate with discount there are seven stations with a double-rate system.—*Elek. u. Masch.* (Vienna), July 23.

	Number of Stations.	Rating in Kilowatts Normal Generators.	Rating in Kilowatts Storage Batteries.	Total Kilowatts
Direct current with batteries	283	50,518	11,128	61,646
Direct current without batteries..	170	5,718		5,718
Single-phase Two-phase	13 4	47,212		47,212
Three-phase	216	135,968		135,968
Combined alternating and direct current	54	111,375	16,754	128,129
Total	740	350,854	27,882	378,736

	Number of Stations. For Lighting	Number of Stations. For Power
Meter rate without discount	150	138
Meter rate with discount	142	135
Flat rate	206	128
Mixed rate (meter and flat rate)	134	94
No information available	108	245
Total	740	740

Prepayment Meters.—Gruber.—An article advocating strongly the use of prepayment meters for the sake of making electric lighting more popular with the less well-to-do classes of the population. It is recommended that the owner of a at house or tenement house should pay for the electric installation and should get his money back by charging for every room with electric lamps an extra rent of $1 a year. A review is given of the principal prepayment meter designs on the market in Germany. In Lüdenscheid in Germany there was originally a strong opposition to the introduction of prepayment meters, but after the first 200 had been in use for a few months the people changed their mind completely and within two years the number of prepayment meters increased to 700. For all installations of at least two and not more than ten lamps a prepayment meter must be used, while for more than ten lamps a double-rate meter is used, for which a monthly rate is charged. No rent is charged for the prepayment meter, but the price of the kw-hour is 10 cents, while the double-rate consumers pay 10 cents and 5 cents respectively per kw-hour. The system has given satisfactory results for the central station. —*Elek. Zeit.*, Sept. 7.

Italy.—J. Reyval.—A brief sketch of the development of the electrical industry in Italy since the first central station was opened in Milan in 1883. The dates of the opening of the most important other Italian stations, together with brief notes on their equipment, are given.—*La Lumière Elec.*, Aug. 12.

Charging of Ignition Batteries.—W. E. Rogers.—An article giving data on the best equipment of central stations for the charging of ignition batteries of gas engines for automobiles.—Lond. *Elec. Rev.*, Sept. 8.

Wires, Wiring and Conduits.

Earth Plate.—An illustrated description of an earth plate (Fig. 2) designed by Mr. J. Bentham for an English colliery installation. The whole of the earth plate and cable terminals is one solid casting weighing 1100 lb. and made of iron 4 ft. 6 in. square to point of teeth and 1¼ in. in thickness. The cable connections are above ground, so that there is no danger of the cable becoming detached from the earth plate through corrosion and, as inspection is easy, constant testing is unnecessary. The cast-iron terminals to

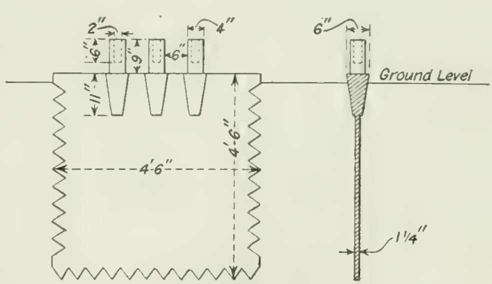


Fig. 2—Earth Plate.

take the cables are 9 in. in height from top of plate and 4 in. in diameter, having a hole bored in the center of each terminal 2 in. in diameter and 6 in. deep. The earth plate is fitted with three terminals, one for the 220-kw generator, one for the 550-kw generator and one for the earth cable

of the mine; it is fixed in a vertical position in the ground in the usual manner, just outside of the power house. The full length of cast-iron terminals remains above ground. It is so arranged that the water from the exhaust pipe of the engine flows constantly to the earth plate, the whole being protected by a small brick cabin with door. The earth plate is also bonded to the water main by means of copper tape ¾ in. wide and ⅛ in. thick, two pieces of this being used. Their ends are put into the cast-iron terminals of the earth plate. In fixing the cables to the earth plate the insulation is taken off for about 8 in. or 9 in. and after the terminals have been made hot by means of blow lamps, etc., the copper cable is pushed down to the bottom of the terminal and then run in solid with white metal. When the terminals are cooled off the bare part of the cables may be finished off with insulation and black varnish.—Lond. *Elec. Eng'ing*, Sept. 7.

Units, Measurements and Instruments.

Reichsanstalt.—Grünbaum.—An account of the work of the German Reichsanstalt in 1910. First an account is given of the co-operation of the Reichsanstalt in the work of the international committee on electric units. The different investigations in the first department relating to mechanics and heat are then briefly sketched. In the electrical division the influence of humidity on the manganine resistors of 1 ohm resistance was investigated, as was also the influence of the silk and of the filter paper on the silver deposit in the silver voltameter. Extended investigations were carried out concerning the radiation loss. In the electrical division of the second department the best arrangement of tests of transformer oils for the determination of the break-down voltage was investigated. Spheres, as well as conical points and needle points, were used as electrodes. With very dry and pure oils the break-down voltage between points is somewhat lower than between spheres. The difference, however, becomes appreciable only for greater distances between the electrodes. With moist oils the break-down voltage was sometimes higher between points than between spheres. In general the values found with points were often irregular. Further preliminary work was done on the absolute determination of the ohm. Other work referred to the reduction of the capacity of large resistors, to energy losses in dielectrics, to energy losses with rapid oscillations. Ammeters for stronger high-frequency currents up to 40 amp were tested for the first time. The experiments on the aging of fuses were supplemented. In the magnetic laboratory improvements of the methods for testing magnetic materials were tried. The influence of the direction of rolling on the saturation value of dynamo sheets seems to be much smaller than the influence on the induction with low field intensities. At Bismarckhütte it was found that the permeability of sheet strips cut at an angle of 45 deg. with the direction of rolling may be sometimes greater than the permeability in the direction parallel to the rolling direction, while heretofore it was assumed that the permeability always decreases if one passed from the direction of rolling over to a direction perpendicular to the direction of rolling. Tests of magnetic circuits with materials of very different properties have given interesting results. In the thermometer department quartz-glass resistance thermometers, platinum thermometers for low temperatures and optical pyrometers were investigated.—*Elek. Zeit.*, Aug. 17.

Reichsanstalt.—A review in abstract of the principal work done by the Reichsanstalt in 1910.—Lond. *Electrician*, Sept. 1.

The Self-Induction of Incandescent Lamps.—M. Höchstädter.—While incandescent lamps are generally assumed to represent non-inductive resistors and are used as such, the author describes some experiments in which carbon-lamps showed a distinct coefficient of self-induction. Carbon lamps for 110-volt normal operation, when used as resistors with 75 volts at their terminals, showed a phase difference of five minutes. With a decrease of the voltage at the terminals the phase difference also decreased and was practically zero at 45 volts. The phenomenon is due to the fact that when a carbon-filament lamp is operated by alternating current its conductance fluctuates with the temperature during a complete cycle, the conductance variations lagging behind the current variations. This results in a distortion of the current wave which, in its effect on the wattmeter, is equivalent to a self-inductance. If this argument is correct it has to be expected that the fluctuations of the conductance would more strongly manifest themselves the lower the frequency. Tests were made with constant voltage (80 volts), while the frequency was varied from 50 periods to 10 periods per second. The results are given in Fig. 3, showing that the apparent self-induction increases rapidly with decreasing frequency. A mathematical theory is given, together with some interesting oscillograph curves. The author shows that metallic-filament lamps should be expected to represent a small negative reactance (a capacity), but this has not yet been tested.—*Elek. u. Masch.* (Vienna), Aug. 20.

Induction Meters.—An official statement of the Reichsanstalt, by which induction meters for polyphase currents and single-phase currents of the Isaria Meter Company are admitted for calibration. Detailed drawings are given of the designs, and the construction, operation and method of calibration of the meters are described.—*Elek. Zeit.*, Aug. 10.

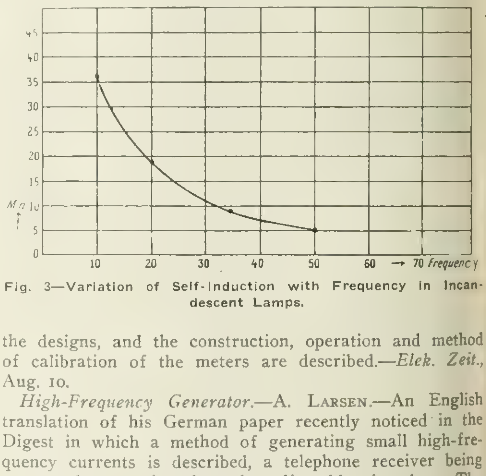


Fig. 3—Variation of Self-Induction with Frequency in Incandescent Lamps.

High-Frequency Generator.—A. Larsen.—An English translation of his German paper recently noticed in the Digest in which a method of generating small high-frequency currents is described, a telephone receiver being connected to a microphone by adjustable air tubes. The frequency can be varied from 600 cycles to 1100 cycles per second.—Lond. *Electrician*, Sept. 1.

Harmonic Analysis.—R. Beattie.—The author describes an extension of Fischer-Hinnen's method of resolving a periodic wave into a Fourier series. Besides the ordinary Fischer-Hinnen 2 *n*-ordinate method he discusses a 4 *n*-ordinate and a combined or 6 *n*-ordinate method. The article is well illustrated.—Lond. *Electrician*, Sept. 8.

Gyroscope Compass.—O. Martienssen.—A paper read before the Berlin Electrical Society on the latest design of the gyroscope compass and its use on board ship and the electrical transmission of the indications of the compass to other parts of the ship.—*Elek. Zeit.*, Aug. 24 and 31.

Electrophysics and Magnetism.

Emission of Electrons from Metals.—J. R. Wright.—The emission of electrons from a metal plate in a vacuum when illuminated by ultra-violet light has been the subject of various investigations. If the electrons emitted under the influence of the light are constituent parts of the atom which owe their escape to resonance, then the velocities of emission can be determined by measuring the maximum positive charge acquired by a metal when illuminated in

perfect vacuum. Recently Millikan found that by prolonged illumination with very intense ultra-violet light the positive potentials were increased from ten to thirty times the values previously obtained. The present author has determined the relation between these new positive potentials and the wave-length of the incident light. The positive potential of aluminum was found to increase from 0.25 volt to 14.1 volts as the result of long exposure to very intense ultra-violet light. The relation between this comparatively high positive potential and the wave-length of the incident light has been determined, and it has been found that, contrary to the results obtained by Ladenburg and by Hull, the positive potential reaches a definite maximum for a wave-length of 2166 $\mu\mu$. Using light from different sources is without effect either on the value or the position in the spectrum of the maximum point.—*Phys. Review,* July.

Radiation Pressure.—D. Owen.—A review of our present knowledge of radiation pressure. The prediction of its existence on theoretical grounds is described and interpretation of radiation pressure is given, showing how the pressure arises in wave propagation, dealing first with light, heat and electrical waves, second with sound waves, and third with transverse waves in an elastic solid. An interpretation from the energy point of view is also given. Finally the most important experimental work on the subject is summed up.—Lond. *Electrician,* Sept. 1.

Conductivity of Copper.—In last year's report of the German Reichsanstalt an account is given of tests of the electric conductivity of various samples of copper. It was found that with a good approximation there exists proproportionality between the temperature coefficient and the electric conductivity, so that the product of the temperature coefficient and of the specific resistance in ohms at 15 deg. C. (meaning undoubtedly per centimeter cube) is constant. The mean value of this product for all kinds of copper tested in the Reichsanstalt since 1905 is 0.0000678. The same relation, with other numerical constants, seems to hold good for aluminum and iron. Quite a similar relation has been found by the Bureau of Standards in Washington.—*Elek. Zeit.,* Aug. 17.

Magnetization Curves of Iron.—J. T. Morris and T. H. Langford.—A paper presented before the Physical Society of London, giving an account of an investigation of the differences between the magnetization curves for a given sample of iron when determined by the following methods: (1) Constant rate of change of flux; (2) step-by-step method; (3) method of reversals, and (4) alternating current. The first, or "uniformly varying flux," method appears to possess advantages over the older methods and is recommended by the authors. In Fig. 4 is given a diagram of connections. The voltage induced in the secondary winding S is balanced by the fall of potential over a known resistance r_1, in series with a known resistance r_2, across a cell B, of known emf, equality being indicated by a zero reading on a galvanometer G. The battery B is closed on to the circuit r_1r_2 and simultaneously the primary current is caused to begin to change by means of the rheostat A, and the experimenter has continuously to adjust the rheostat at such a pace as will maintain the galvanometer reading at zero. This adjustment requires some skill, but an average experimenter easily acquires this with a little practice. In making a hysteresis test the primary current is continuously varied from a maximum positive value to an equal negative value by a specially designed resistance in which two sliders a, b, connected to the primary winding P, are moved in opposite directions across the edges of the zigzag resistance A. The primary current is measured on a potentiometer by the voltage drop across a known resistance, r_3, the exact times at which the current has certain convenient values being recorded by a chronographic arrangement. Magnetization curves, permeability curves, reluctivity curves and hysteresis loops determined by all the different methods are given and compared with each other. The authors reach the following conclusions. The method of "uniformly varying flux" appears to possess advantages, both scientific and practical, over the older methods in use for the testing of ring samples of magnetic materials. It avoids difficulties due to eddy currents and magnetic viscosity, which effects are themselves due primarily to rapid or irregular changes of flux. It also has

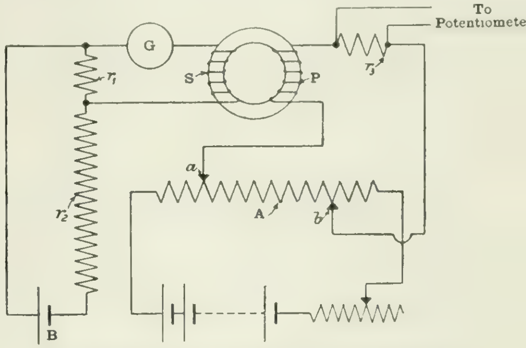


Fig. 4—Connections for Method of Uniformly Varying Flux.

the practical advantage that experiments may be carried out with rapidity, accuracy of repetition and under standard or predetermined conditions of magnetic change. The authors, therefore, commend this method to the careful consideration of those interested in the carrying out of magnetic tests, especially where great accuracy under definitely known conditions of experiment is essential.—Lond. *Electrician,* Aug. 25.

Telegraphy, Telephony and Signals.

Manual and Automatic Telephone Systems.—W. Stiel.—For a number of manual, semi-automatic, and automatic telephone systems the periods of time required for the different steps in making a telephone connection are given from practice, and therefrom different "coefficients of value" are derived for the different systems. The results are summed up in a table which is believed to show the great superiority of the automatic systems over manual systems, but also to emphasize the great difference between different automatic systems.—*Elek. Zeit.,* Aug. 31.

Book Reviews.

Über den Kraftlinienverlauf im Luftraum und in den Zähnen von Dynamoankern. By Dr. Karl Hoerner. Berlin: Julius Springer. 37 pages, 4 illus., 3 plates. Price, 1.20 marks.

A thesis on a research directed to determine the magnetic flux density in and around the teeth of armature when excited. Of interest to dynamo designers.

Les Enroulements Industrie. By Eugène Marec. Paris: Gauthier-Villars. 240 pages, 212 illus. Price, 9 francs.

A very practical and well-illustrated treatise on armature windings for both direct-current and alternating-current machines. Very little attention is given to the theory of the subject, which is taken for granted; but much detail is given concerning the different types of windings, direct current, single-phase, two-phase and three-phase, etc., for armatures. The armature-winding diagrams are remarkably simple. The details of structure and of connection are carefully described.

Anlasser und Regler für Elektrische Motoren und Generatoren. Second edition. By Rudolf Krause. Berlin: Julius Springer. 149 pages, 133 illus. Price, 5 marks.

The second and enlarged edition of a very practical treatise on the theory, construction and mode of operating starters and regulators for generators and motors of various kinds, written by an engineer for engineering students and constructors. The various switching, controlling and protecting devices of dynamo-electric machines in general use are described and illustrated with considerable structural and connectional detail. The book will be appreciated by designers and operators of direct-current and alternating-current machinery.

Electrochimie. By Henri Vigneron. Paris: L. Geisler. 160 pages, 49 illus

This work forms one section (No. 44) of the Encyclopédie Électrotechnique, now in course of publication, and is mainly descriptive of the various electrochemical processes in practical use at the present day. The first section of the volume is theoretical, dealing with electrolytic dissociation, concentration changes, electrolytic conductivities, emfs and electrolytic theories. The second section describes and details the chlorine and alkali industries, the manufacture of hypochlorites, electrometallurgy and miscellaneous products of electrolysis. The third section discusses the industrial production of ozone. The work will be of particular interest to electrochemical engineers.

New Apparatus and Appliances

SIGN PROJECTOR.

The Electric Advertising Company, 32 Union Square, New York, has recently placed on the market a simple device for projecting sign advertisements and trademarks in colors on the sidewalk at night, or the device can also be used for the same purpose indoors during the day, projecting the sign on the floor or wall.

The projector complete weighs 5 lb. and is equipped with a flasher, to make this method of advertising as attractive as possible, and is so arranged that the flashing period can be regulated or set permanently if so desired. The projector body is entirely of brass, neatly finished in gun metal. The device will operate in any position and can be fastened to a bracket wall or suspended from the ceiling. The illuminant is a special wire-drawn tungsten of 100 cp. The projector has three lenses, and when placed in focus projects a powerful spot of light about 4 ft. in diameter, which increases in size to accord with the distance between the front lens and the background upon which the sign is projected.

Sign Projector.

The slides are 2½ in. in diameter and are made of sheet brass for plain letters, glass being used for trademarks or color effects. The slides are dropped into a slot arranged in one of the tubes. Slides are furnished at a nominal cost, and thus can be changed frequently.

A POLE-PRESERVING MACHINE.

The steadily increasing cost of pole timbers, due to the gradually diminishing supply, has caused all companies using wooden poles for overhead electric circuits to consider methods for increasing the life of these poles. Many preservative treatments have been proposed and tried out to some extent. One method, effective but rather expensive, contemplates the impregnation of the outer layer of the entire pole, or of that portion of it embedded in the ground. Another, using brush or non-pressure treatment, is not so effective but more economical. A new method, using a pole-preserving machine, may be said to occupy a position midway between the other two, and is described herewith.

Careful observation has shown that poles decay almost exclusively at the ground line, where the zone of prolonged exposure to both moisture and air forms a fertile breeding place for germs and insects that destroy the wood cells. It seems logical, therefore, that the portion of the pole near the ground line needs the chief protection. The problem of providing a simple and inexpensive method of applying such a treatment engaged the attention of George P. Benton and I. B. Eberhardt, of Chicago, experienced cedar-pole men, who, after several years of investigation and experimental work, conceived what is known as the "B. & E. pole-preserving machine."

A demonstration of this machine was made on Sept. 20 in the pole yard of one of the largest public-utility corporations of Chicago. Fig. 1 is a view of the machine under test, with a pole in position. About a dozen representatives were present from the United States Forest Service and from several of the leading electric-utility companies of Chicago and other cities. Three 35-ft. Michigan cedar poles cut last winter were treated seven, ten and fifteen minutes respectively with heated creosote oil, which was injected by an air pressure of about 5 lb. per square inch into a 3-ft. band corresponding to the ground belt of the pole. With the ten-minute treatment an initial penetration of 3/16 in. was obtained and this extended in a few days to a depth of over ½ in. The pole in the ten-minute treatment absorbed a full gallon of oil in the 3-ft. band that was subjected to the treatment. The tests showed the simplicity and value of the process.

A fair idea of the machine may be obtained from the accompanying illustrations, and more particularly from Fig. 2, which is a good general view. The machine is about 19 ft. long and 6 ft. wide and is mounted on iron wheels so that it may be easily hauled about by a team of horses to various positions in the pole yard or taken from yard to yard. The main parts of the machine are: A steam boiler, an air compresser and storage tank, a closed oil tank con-

taining steam coils for heating the preserving oil, an air-tight canvas band, 3 ft. wide, which incases the pole at the zone to be treated, and the necessary gearing and mechanism to pass this band about the pole and tighten it. If a large number of poles are to be treated a platform is built

Fig. 1—Pole-Preserving Machine During Tests.

on either side of the machine or the latter is placed in a trench so as to have the iron skids level with the ground; a simpler plan is to place inclined skids on each side of the machine.

The operation of the machine is quite simple. The pole is rolled onto the iron skids. The two segmental rings, which open at the top and are known as track rings, are closed about the pole by turning a hand wheel. The spool carrying the canvas band is then revolved about the pole by an opposite movement of the handle. A clamping bar is wedged against the band so that the latter forms a closed bag or cylinder around the pole. Air pressure is applied to the edges of the band to tighten it and the compressed air is allowed to enter above the oil in the tank, thus forcing the heated oil through a pipe connection into the bag and entirely around the pole for any desired length of time. Any oil oozing out of the bag, as for instance through checks in the pole, drops into a basin on top of the tank,

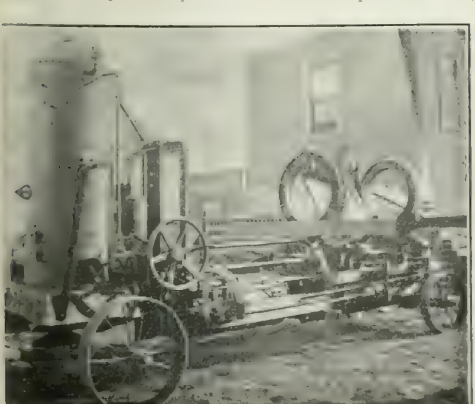


Fig. 2—Pole-Preserving Machine.

into which it is later drained by opening a drip valve. Thus no oil is wasted by spilling on the ground or by treating more than that part of the pole that is subject to decay while in service. By means of the reverse operation the pole is released and then rolled off the other side of the machine, the entire operation taking only a few minutes beyond that required for actually subjecting the pole to the oil. Any kind of coal-tar oil may be used. The capacity of the machine is about fifty poles a day. Poles from 7 in. to 24 in. in diameter may be handled. The cost of treating each pole, which includes labor, oil, fuel and fixed charges on the machine, is said to be only a fraction of a dollar for a 7-in.-top, 35-ft. pole.

This process of pole preservation and the machine for carrying it out are protected by basic patents. The machine is manufactured by the B. & E. Pole-Preserving Machine Company, Fisher Building, Chicago. The company undertakes also to furnish treated poles from Chicago.

ELECTRIC GLUE-HEATING APPLIANCES.

It has been estimated that more than $4,000,000 is paid every year by manufacturers in this country for glue. It has also been asserted by those in position to know that approximately one-half of the glue purchased, or $2,000,000 worth, is wasted yearly. Some of this waste is unavoidable, but much of it can be prevented. A great deal of glue is

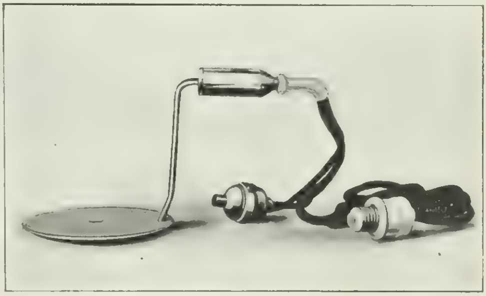


Fig. 1—Disk-Type Immersion Heater for Glue-Pots.

spoiled through overheating. It is well recognized that the proper temperature for melting glue lies somewhere in the neighborhood of 140 deg. Fahr. It is also thoroughly appreciated that, if the temperature of glue is allowed much to exceed 160 deg. Fahr., if it is not rendered wholly unfit for use, its strength will be greatly impaired. An expensive

Fig. 2—Exploded View of Portable Glue-Pot.

glue thus abused will be no more effective than a cheap quality. On the other hand, either live or exhaust steam has a temperature (at atmospheric pressure) of at least 212 deg. Fahr.

Electrical methods of glue heating are, when properly

applied, ideal. The ease with which the heat can be controlled, the evenness of the temperature afforded, the readiness with which electricity for glue-pot or heater operation can be conducted to any part of a factory and its economy

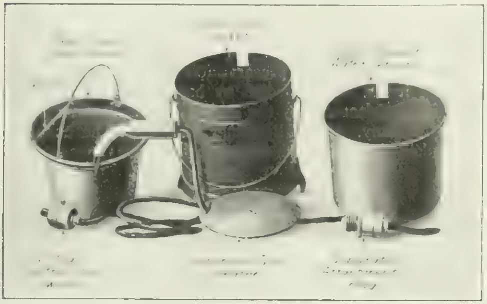


Fig. 3—Flush-Type Bench Glue-Pot Installed.

are all convincing recommendations for the electrically heated appliances.

The Westinghouse Electric & Manufacturing Company is manufacturing a line of glue-heating appliances that have

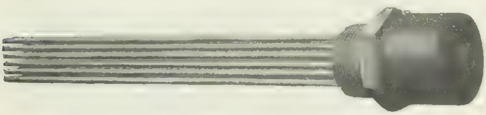


Fig. 4—Bayonet-Type Heater for Glue Cooker.

been designed to incorporate all desirable features and are intended to appeal to practical men through their simple and common-sense design and the fact that they are very ruggedly built to withstand the abuse of industrial-plant service. This line includes portable glue-pots in capacities of ½ pt. to 4 qt.; flush bench-type glue-pots in capacities of 1 pt. to 4 qt., and glue cookers in capacities of 3 gal. to 25 gal. The electrical heaters used in the devices are also

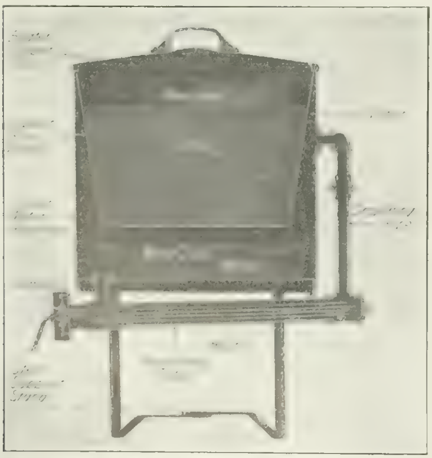


Fig. 5—Sectional View of Electrically Heated Glue Cooker.

supplied separately, so that any manufacturer can fit his present line of glue-heating devices for electrical operation.

All the Westinghouse glue-heating devices are equipped with immersion-type heaters—those which are submerged in the liquid to be heated. Obviously this is the most efficient type of heater for liquids, as no heat can be lost by direct radiation from the heater. Disk-immersion-type heaters, like that shown in Fig. 1, are used in the glue-pots, while bayonet-type immersion heaters, Fig. 4, are used in the glue cookers.

The construction of the portable glue-pots is evident from Figs. 1 and 2. Glue-pots of cast iron, with tinned-iron glue vessels, are made in capacities of ½ pt. and 1 pt., but the regular line has spun-copper glue vessels, it having been found that this is the most satisfactory material for glue receptacles. Substantial bails are provided both on the casings and on the glue vessels. The portable pot is designed for use in any part of a shop where it can be connected to an electric socket.

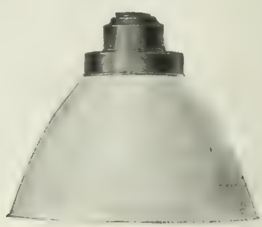
Flush-bench-type glue-pots are designed for mounting in bench tops or slides, as shown in Fig. 3. A sectional view of a bench-type pot is given in Fig. 4, which shows its construction. Glue vessels and electric heaters are interchangeable for portable and flush-type glue-pots of equal size.

The glue cooker is entirely of heavy copper and will last indefinitely. It will be noted from the sectional view of the glue cooker shown in Fig. 5 that the bayonet-type heater is located in a vaporizing chamber located under the water vessel. Almost immediately after current is turned on water is evaporated and the vapor rising through the circulating pipe enters the space surrounding the glue vessel. Because of this arrangement of the vaporizing equipment the space is filled with vapor in a very short time—long before the entire body of water is heated to the vaporizing temperature. Heating of the glue in minimum time is thus assured. A controller is provided whereby the temperature of the glue can be adjusted to a nicety.

STEEL REFLECTORS.

There are certain conditions in which steel reflectors wit aluminum finish are unsuitable on account of deterioratio due to acid fumes or excessive dirt or exposure. In orde to meet these adverse conditions the Holophane Compan has designed a new line of steel reflectors having a toug enamel finish and with the holders and connections of co per. These new reflectors are finished both inside and o with a white enamel, which is stated to have a reflectin value about 18 per cent higher than any other at prese available and which is not affected by chemical fumes by weather conditions and is very easily cleaned. They a made for the extensive type of light distribution only.

Three holding devices are now available for use wi Holophane-D'Olier reflectors. The clip spring holder well known, being the type that has hitherto been suppli exclusively. A new 2¼-in. heel which admits using t steel reflectors with standard holders, and a porcelain sock



Steel Reflector.

holder which allows the use of steel reflectors in ma installations where brass sockets are not permissible, a now available also. These holders, as before stated, a copper finished and are of a sturdier construction than th heretofore used.

Industrial and Commercial News

THE WEEK IN TRADE.

INDUSTRIAL conditions are showing gradual improvement, but the absence of steadying influences is still apparent. Gains are being made in many lines of industry, but a stimulus to hasten advancement is needed. Competition and price-cutting have expanded operations this week in the steel trade, and from present indications, September tonnages will equal those of August. Demand for foundry iron is broader, and several sales of fair amounts have been made. Equipment orders from the railroads are still in narrow volume, but inquiries are on an increasing scale, and there is a fair outlook for better business. Dry goods and clothing lines are enlarging, and export demand for cotton goods is showing substantial increase. Sentiment has been improved by news of good weather conditions in the harvesting sections throughout the country, and the forward movement is reflected by better collections at the important centres. Western traffic conditions are improving. Public interest has centered this week upon developments in the affairs of large corporations and the question of their legality under the last rulings of the Sherman law. Attorney-General Wickersham, after approving the reorganization plan of the American Tobacco Company on Monday, issued a carefully phrased statement the same day to express the attitude of the government toward trusts, the substance of which indicated probability of suits against questionable companies in case voluntary dissolution was not made. Owing to the ambiguity of the remarks, business interests found little in them to settle rumors of investigation of the Steel Corporation, and in order to set such rumors at rest, a statement was given out on Tuesday by the United States Steel Corporation, stating that it is not violating the Sherman law and has no intention of voluntary dissolution. Business failures for the week ended September 21, as reported by *Bradstreet's*, were 236, as compared with 219 last week, 190 for the corresponding week in 1910, 171 in 1909, 267 in 1908 and 166 in 1907.

THE COPPER MARKET.

CONTINUATION of dullness in the copper industry has resulted in a decline of ⅛ cent per pound in the price of domestic copper and in a slightly larger reduction in prices abroad. The larger agencies are holding out for [illegible] cents, but electrolytic is now selling at 12.20 cents to 12¼ cents per pound, cash, for September and October delivery. Little response to the lower prices is being made, however, by either domestic or foreign consumers, for the majority are pending deliveries on standing contracts sufficient for immediate needs and are placing only very small orders for future requirements. Standard copper in New York is dull and shows signs of further weakness. The record of the month has been exceedingly poor and the September report is not

Standard Copper.	Bid.	Asked.	Price.
[illegible]	11.80	11.90	....
[illegible]	11.80	11.90	11.85
[illegible]	11.80	11.90	11.85
[illegible]ember	11.80	11.90	11.85
[illegible]	11.80	11.90	11.85

[illegible] market, Sept. 26, was as follows:

	Noon. £	s	d	Closing. £	s	d
[illegible] copper, spot	54	6	3	55	2	6
[illegible] copper, futures	54	8	[illegible]	55	5	0

Extreme fluctuations for this year.

	Highest.			Lowest.		
	12.25c			11.57½c		
[illegible], spot	£57	10	0	£53	7	6
[illegible] futures	58	2	6	54	0	0
[illegible]ted	61	10	0	57	5	0

expected to show progress in the industry. Development of industrial unrest abroad has checked the narrow buying movement that followed the last report of the Copper Producers' Association and consumers have not purchased in large amounts at any time during the month. In view of this lack of interest it is believed that total deliveries in September will not exceed 100,000,000 lb., and that after making allowance for slight curtailment at several of the refineries the forthcoming report of the association will show an increase of at least 10,000,000 lb. in surplus stocks. The knowledge that most of the copper now being shipped abroad is upon contracts placed before the slackening in foreign demand took place, and the prospects of large accumulations of stocks in producing hands continue to strengthen the position of consuming interests and lead to the belief that still lower prices may be expected. Amalgamated Copper shares declined 4⅛ points in the break in the stock market on Monday. Exports for the month, including Sept. 26, aggregate 20,531 tons. The daily call on the Metal Exchange Sept. 26 quoted copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES

Claims Rentals for New York Conduits.—Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity of New York City, has written to Mayor Gaynor stating that many telegraph, fire alarm and electric protective companies are apparently operating without franchises for privileges in city streets. Mr. Thompson finds that the Western Union Telegraph Company has made no payments to the city since 1885. He asks for immediate investigation of the rights of all the companies whose lines occupy space in the public streets, and recommends that those companies which are found not to possess the proper consent or authority to operate should be compelled to make application for franchises and to pay into the city treasury the amount due for the period of time in which they have unlawfully occupied space in the streets. The following nine companies are named specifically by Mr. Thompson: American District Telegraph Company, Holmes Electric Protective Company, Stock Quotation Telegraph Company, Bankers & Brokers' Messenger Company, Automatic Fire Alarm Company, Consolidated Fire Alarm Company, Manhattan Fire Alarm Company, National District Telegraph Company and Special Fire Alarm Electrical Signal Company.

Long Power Transmission.—Advices from San Bernardino, Cal., are to the effect that the Southern Sierra Power Company is preparing to invade the southern California field with its large amount of surplus electrical energy generated at the great power house at Bishop Creek, Imyo County, 300 miles north. It is said that surveyors are now in the field running lines for the high-voltage transmission line to be built across the San Bernardino Mountains and the desert beyond. The company has also secured a blanket franchise to construct pole lines over the highways of San Bernardino and Riverside Counties. A site has been purchased in the western part of San Bernardino for a plant, apparently to be used as a terminal station, although possibly a steam reserve may be also installed. C. M. Scrubby is mentioned as one of the officers of the Southern Sierra Power Company who are active in the work in and near San Bernardino.

Kansas City Railway & Light Company.—Full investigation of street railroad conditions in Kansas City will probably be a result of a petition which the city has filed in the United States Court requesting that either the railroad properties of the Kansas City Railway & Light Company be made suitable for the needs of the city, or the charter of the company be revoked at once. Further complication arises from the fact that the only source available at present by which the receivers of the company can provide finds for satisfying the city's requirements is by withholding bond interest, and if this plan is followed, bondholders can appeal to the courts for their property.

Association of Edison Purchasing Agents.—The regular annual meeting of the Association of Edison Purchasing Agents was held at the New Monmouth Hotel, Spring Lake, N. J., Sept. 21, at which the following officers were elected for the ensuing year: President, J. W. Brennan, Detroit Edison Company; first vice-president, W. H. Francis, Boston Edison Company; second vice-president, J. B. Eaton, Rochester Electric Light Company; treasurer, Andrew Banks, Jr., Consolidated Electric Light & Power Company of Baltimore; secretary, H. F. Frasse. Brooklyn Edison Company; stock controller, E. H. Shufro, Union Electric Light Company, St. Louis, Mo.

Western Electric Business.—Although a slight decrease in gross business has been shown in four of the past five months, Western Electric business in the eight months ended Aug. 30 is about 3 per cent larger than the showing made in the corresponding eight months last year. Gross sales in 1910 were $61,000,000, and from present indications the 1911 record will exceed this, approaching $66,000,000, which would be the largest gross in the history of the company with the exception of that in 1906, which totaled $69,000,000. Comparative figures show that August business was about 3 per cent under that of August, 1910; that July was about 3 per cent less than July of last year, while there was a slight gain in May, and a falling off of about 4 per cent in April, compared with the corresponding months of 1910. Foreign business of the company is running steadily and the present falling off in the domestic business of the company is chiefly from the eastern part of the country. About 26,000 employees are now on the pay rolls, which, with approaching completion of the new plants at Hawthorne, indicates satisfactory progress in the affairs of the company.

Western Union Rates.—President Vail of the Western Union Telegraph Company, discussing rumors of a possible rate controversy as an outcome of the lease of two English cable companies by the Western Union, said recently: "It is singular that the Postal Company should call attention to the danger of a war of cable rates. The Mackay company is a cable system with a land line adjunct for the collection and delivery of cables. Its cable profits are 80 per cent at least of its total net income upon which it depends to pay its dividends on $90,000,000 of stock. The Western Union is a land system with a cable adjunct. Without any cable earnings yet it can take care of the cable obligations out of its surplus and maintain dividends. To talk of a war of rates, however, is out of date. It is too primitive. In all the new services which the Western Union has introduced it will be seen that while the Western Union has been anticipating the needs of the public and developing new lines of business it has been careful not to interfere in any way with the established business or old services."

Public Service Corporation of New Jersey.—Thomas N. McCarter, president of the Public Service Corporation of New Jersey, stated on Wednesday at a hearing by the New Jersey Board of Utilities Commissioners that rates of the company for both gas and electric service will be reduced after Jan. 1, 1912. The rate schedule submitted by the electric company provides for the same schedule of discounts recently adopted by the New York Edison Company. Referring to statements that the company was active in politics, Mr. McCarter said that the company has been active in politics to the extent of self-preservation. "Just as long," he said, "as approximately 10 per cent of the bills introduced into the Legislature at Trenton affect the business of this corporation, just so long will the corporation not only be justified, but required, to defend itself from such attacks by any legitimate means within its power."

Electric Service Extended.—On Sept. 27 forty officials of the Pennsylvania Railroad Company and the Hudson & Manhattan Company made the initial run on the high speed road to be operated by these companies between New York and Manhattan Transfer, where the Pennsylvania road changes from steam to electric locomotives for its through trains. As soon as right-of-way can be obtained the service of the Hudson & Manhattan Company will be extended to Newark. Wilbur Fish, vice-president of the company, stated after the inspection trip that construction work for this extension will require about sixty days. After the line from Manhattan Transfer has been completed to Newark the only part of the system to be built will be an extension in New York City from Thirty-fourth Street to the Grand Central Station. Service will be put in operation Oct. 1 over the portion of the system now completed.

U. S. Lighting & Heating Company Expanding.—Owing to widespread adoption of axle-generating sets by railroads throughout this country, Canada and Mexico, for train-lighting purposes, business of the United States Lighting & Heating Company is showing continual improvement. Control of the Bliss axle lighting devices is held by the United States company, through ownership of the Bliss Electric Car Lighting Company, and the company also controls the National storage batteries by ownership of the National Battery Company. During the month of August these devices were installed in 500 cars, at a cost of $800 to $850 per car, making gross business for the month from this source of $400,000. Part of the expansion of the company's business has been due to increased demand for electric lighting of automobiles and large demand for batteries for electric vehicles.

Westinghouse Railway Orders.—Recent orders received by the Westinghouse Electric & Manufacturing Company include the following: From the Bluestone Traction Company, of Bluefield, W. Va., for one double equipment of No. 101-B-2 motors and type K-10-A control; from the Dayton & Troy Electric Railway Company, Dayton, Ohio, for two type HL control equipments; from the Oakland & Antioch Railway Company, San Francisco, Cal., for four quadruple equipments of No. 321 motors and control, one quadruple equipment of No. 332-E motors and control, and one locomotive equipped with four No. 308-B-6 motors and control; from the Lake Charles Railway, Light & Water Works Company, Lake Charles, La., for two double equipments of No. 92-A motors and K-10-A control.

Otis Elevator Company.—Nearly $30,000 has been distributed voluntarily by the Otis Elevator Company to the families of the victims of the explosion of molten iron at the Yonkers plant of the company last June. Payments in amounts from $3,000 upward have been made to the widows of the four men who lost their lives on this occasion, and their weekly wages will be paid for one year by the company. The doctors' bills and wages of the injured have been paid. As the company was held blameless for the accident, its policy is a noteworthy instance of the attitude now held by leading corporations toward employers' liability.

Canadian Company Buys Equipment. — The Sarnia Gas & Electric Light Company, of Sarnia, Ont., has purchased the following equipment: Boilers, receivers, piping, condensers and a mixed pressure turbine from Goldie, McCulloch Company, of Galt, Ont.; three-phase, 60-cycle generators from Kilmer, Pullen & Burnham, of the Swedish General Electric Company; three exciter sets from the Canadian Westinghouse Company; switchboard from the Canadian General Electric Company; and pumping equipment from the Deane Steam Pump Company, of Holyoke, Mass., and Henry R. Worthington, of New York.

Electric Automobiles for Export.—A report from an American consul in a Latin-American country states that an inquiry has been received from one of the largest importing firms in the city in which he is located, requesting names of the principal manufacturers of electric automobiles in the United States. In order to save time in ordering goods the consul suggests that manufacturers send their price lists and full particulars, as well as catalogs. Further information may be obtained from the Bureau of Manufactures, Washington. The inquiry has the file number 7363.

Proposed Sale of Winnipeg Electrical Properties to Municipality.—At a conference between Sir William MacKenzie and the special committee of the Winnipeg (Man.) City Council on Sept. 23 a basis of audit was agreed to in connection with the proposed purchase by the municipality of the Winnipeg electrical properties. The proposed purchase involves the payment of $24,000,000 to the MacKenzie and Mann interests for the street-railway, light, power and gas plants. The necessary by-law will be at once prepared and submitted to the ratepayers for ratification.

Morris & Somerset Electric Company.—In order to meet the requirements of increased business, the Morris & Somerset Electric Company, of Morristown, N. J., has purchased a 350-hp Babcock & Wilcox boiler; one 750-kw, 2300-volt turbo-generator, and a 25-kw exciter from the Allis-Chalmers Company; a surface condenser and pumps from the C. H. Wheeler Manufacturing Company, of Philadelphia, and a marble switchboard and transformers from the Westinghouse Electric & Manufacturing Company.

Telephone Train Dispatching.—The Toledo & Ohio Central Railroad, which about a month ago adopted the telephone for dispatching trains on its Eastern Division, has recently placed another order with the Western Electric Company for thirty-one telephone selectors for use on its Western Division. This new circuit will extend from Columbus, where the dispatcher will be located, through to the Union Station at Toledo, a distance of 132 miles.

Aluminum Notes and Prices.—The market for aluminum is steady, and quotations on ingots for remelting are 20@22 cents spot No. 1 the base for large ingots. Sheets are held at 33 cents, and rods and wire at 31 cents.

Financial.

The Week in Wall Street.

Demoralization has prevailed on the New York Stock Exchange since Friday last, when widespread rumors of a government suit for dissolution of the Steel Corporation resulted in a sudden break in its preferred and common shares. The latter dropped to 53¼ and the former to 103. Large selling orders in the forenoon of Monday, placed on an irregular market, brought declines of from 2 to 6 points in the prices of a majority of the leading stocks. Steel common fell to 51⅛ and many of the railroad issues made new low records. After a day of great activity partial recovery took place upon news of acceptance of the plan for reorganization of the American Tobacco Company. Total sales for the day amounted to 1,456,196 shares, the largest aggregate since June 30, 1910. A vague statement issued by Attorney-General Wickersham with reference to possibility of more suits under the Sherman law was the basis for still lower prices at the opening on Tuesday, accompanied by indications of further liquidation. While some advances were made, the market was uncertain and wavering throughout the day and the activity not as great as on Monday. Sales were over the million mark, however, amounting to 1,086,263 shares, of which 448,200 shares were Steel common. Tuesday was a large day in the bond market, total sales reaching $7,538,000, of which $5,553,000 were American Tobacco issues. As a result of a favorable statement by officials of the Steel Corporation discrediting rumors of government investigation or voluntary dissolution, a violent upward movement took place on Wednesday. The opening transaction was a sale of a block of 30,000 shares of Steel common, the high quotation being 62. Other issues advanced during the day, but declined toward the close, leaving net prices under those at the opening. The local money market remains unchanged, with no increases in quotations expected until approach of October disbursements. Rates Sept. 27 were: Call, 2⅛@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in the tables are those at the close Sept. 26.

NEW YORK.

	Sept. 19.	Sept. 26.	Shares Sold.		Sept. 19.	Sept. 26.	Shares Sold.
Al. Ch.	6½*	6	200	Int. Met., pf.	40	41	5,000
Al. C. pf.	18*	16½*	800	Mackay Cos.	82*	83*	125
Am. Cop.	54	47⅝	213,420	Mackay, C., pf.	73½	72	990
Am. D. T.	20½*	20 *	——	Man. Elev.	134½*	131¼*	850
Am. Loco.	34½	33⅛	1,500	Met. St. Ry.	15*	15*	——
Am. Loco. pf.	106½*	104½*	200	N.Y.&N.J.Tel.	139½*	139½*	——
Am. Tel. & C.	80½*	80½*	——	Steel com.	65	56⅞	1,973,900
Am. T. & T.	135½	134½	11,440	Steel, pfd.	113⅞	107¼	106,830
B. R. T.	73¼	73⅜	10,400	W. U. T.	76⅛	77¼	6,017
Gen. Elec.	149	144	9,125	West'h, com.	61	61	6,350
Int. Met.	14⅞	13¾	12,400	West'h, pf.	111½	110½*	240

PHILADELPHIA.

	Sept. 19.	Sept. 26.		Sept. 19.	Sept. 26.
Am. Rys.	44	44	Phila. R. T.	21⅞	21
El. Co. of A.	11⅝	11⅝*	Phila. Elec.	16¼	16¼
Elec. St. Bt'y.	51⅞	50	Phila. Trac.	82	82*
Elec. St. Bt'y, pf.	30*	30*	Union Trac.	50	48½

CHICAGO.

	Sept. 19.	Sept. 26.		Sept. 19.	Sept. 26.
Chi. City Ry.	186*	186*	Com. Edison.	134½	134
Chi. Elev. Rys.	24*	24*	Chi. Subways.	2½*	1⅝
Chi. Elev. Rys., pf.	89½	89½*	Chi. Tel. Co.	122*	122*
Chi. Rs., Ser. 1.	92*	92*	Nat'l Car.	101	101*
Chi. Rs., Ser. 2.	28½*	27*	Nat'l Car, pf.	118½*	118½*

BOSTON.

	Sept. 19.	Sept. 26.		Sept. 19.	Sept. 26.
Am. T. & T.	135½	134½	Mex. Tel.	6*	6*
Cum. Tel.	152½*	150½	Mex. Tel., pf.	6	6*
Edison	286	285	N. E. Tel.	147½	143¼
Gen. Elec.	149⅝	144	W. T. & T.	16¼*	15
Mass. E. Ry.	17	17*	W. T. & T., pf.	97*	95
Mass. E. Ry., pf.	88	87½*			

*Last price quoted.
Shares sold for the week, Sept. 18 to Sept. 23.

Financial Notes.

American Railways' Year.—The report of the American Railways Company for the year ended June 30, 1911, shows improvement in both gross and net earnings. The surplus after payment of dividends was $40,700, which compares with $11,200 in the previous year and makes the total surplus amount to $554,187. Gross income of the company was $810,413, which represents an increase of $116,735, as compared with the previous year. General expenses were $3,892, taxes were $12,000 and interest on the funded debt amounted to $370,400, making total deductions from income of $387,926. This was an increase of $47,541, and left a net income of $422,487, representing a gain of $69,194 for the year. Dividends were $381,786, leaving a surplus of $40,700 as stated above, an increase of $29,480 over the corresponding item in the previous year. President J. J. Sullivan in his annual report said in part that 18 per cent of the gross earnings were spent in keeping the properties up to the highest standard of maintenance. During the year the company acquired about 99 per cent of the capital stock of the Ohio Valley Electric Railway Company, which owns and operates the street railways in and in proximity to Huntington, W. Va., and Ashland, Ky. This purchase included control of the capital stock of the Consolidated Light & Railway Company, operating in West Virginia towns, the Ashland Electric Light & Power Company and the Ironton Electric Company, which does all the lighting business in the section from Coal Grove to Hanging Rock, Ohio. During the year the company also purchased the electric plant at Bellwood, Blair County, Pa., and consolidated it with the Home Electric Light & Steam Heating Company, of Tyrone, Pa.

San Francisco Gas & Electric Company.—A New York banking house is offering $4,951,000 general first mortgage 4½ per cent thirty-year gold bonds of the San Francisco Gas & Electric Company, which owns and operates gas and electric properties covering the entire city of San Francisco. These bonds are dated Nov. 1, 1903, and are due Nov. 1, 1933, and are part of an issue of $9,500,000 (closed mortgage), which in the opinion of counsel is a first lien on the entire property of the company, subject only to $1,661,000 underlying bonds which are secured by first liens on a comparatively small part of the property, and for the retirement of which an equal amount of the above bonds is reserved. In the company's report to the city its physical property is valued at over $24,000,000, against which there are outstanding only $9,500,000 bonds, the funded debt being less than 40 per cent of this appraised valuation. A strong sinking fund provision, which has already retired $500,000 of the issue, will retire $2,700,000 bonds prior to their maturity in 1933. The gross earnings of the company as officially reported for the year 1910 were $5,534,592, which is over 58 per cent of the bonded debt. There is an equity back of the bonds of more than $14,000,000 on the basis of the purchase price paid for 98½ per cent of the stock of the company by the Pacific Gas & Electric Company. The bonds are offered at 94 and interest.

Tri-City Railway & Light Company.—The August report of the Tri-City Railway & Light Company shows gross earnings of $215,477, which represents an increase of $10,615 as compared with August, 1910. Operating expenses and taxes were $122,793, an increase of $1,129, and net earnings were $92,684, or $9,486 larger than in August of the previous year. Interest and sinking fund charges were $47,661, an increase of $3,536, leaving a balance available for dividends of $45,023. This was $5,950 larger than in August, 1910. Preferred dividends amounted to $14,131 and the surplus for the month was $30,892. In the twelve months ended August, 1911, gross earnings were $2,650,569, an increase of $320,526 over last year's showing. Operating expenses and taxes were $1,546,840, an increase of $203,000, and net earnings were $1,103,729, or $117,526 larger than in the corresponding twelve months of 1910. Interest and sinking fund charges amounted to $559,499, an increase of $28,694, leaving a balance of $548,230 available for dividends, which was $88,832 over last year's figures. Preferred dividends were $169,572 and the surplus for the twelve months was $378,658.

Washington & Rockville Railway Company.—The Maryland Public Service Commission received a letter last week from W. H. Lamar of Rockville, Md., protesting against the approval of the application of the Washington & Rockville Railway Company for permission to give a mortgage deed of trust to secure $100,000 of bonds, and also to increase its capital stock from $50,000 to $300,000, the securities to be delivered to the Washington Railway & Electric Company. Mr. Lamar says the sums mentioned are far above the value of the property and the transaction would convert invalid obligations into valid obligations. He asks a postponement of the hearing in the case, owing to his enforced absence from the State for a couple of weeks.

Brooklyn Rapid Transit Company.—The record of the Brooklyn Rapid Transit Company in the fiscal year ended June 30 was the best in the history of the company. After deduction of all charges there was left a balance available for dividends of more than $3,000,000, which represents 6.82 per cent on the $44,853,772 outstanding stock, as against 5.73 per cent in 1910 and 4.16 per cent in 1909. Gross earnings were $21,986,543, an increase of $1,007,028, or 4.80 per cent, and total expenses were $12,166,367, an increase of $429,256, or 3.66 per cent. Net revenue from operation was $9,820,176, an increase of $577,772, or 6.25 per cent, and other income was $297,524, making a total net income from operation of $10,117,700, which was $596,482, or 6.26 per cent, larger than in the previous year. Deductions from this were $6,969,221, of which $1,465,535 was for taxes and $5,503,686 for interest and rentals. Net income was $3,148,479, an increase of $536,883, or 20.56 per cent, and after deducting from this $88,535 for special appropriations the surplus available for dividends was $3,059,944, representing an increase of 22.25 per cent over the record of the previous year. President Winters in his report stated that arrangements have been completed for providing the $75,000,000 required for the construction and operation of the new subway.

Trenton Street Railway Bonds.—An issue of $300,000 of its general mortgage 6 per cent gold bonds has been sold by the Trenton Street Railway Company to New York banking interests, which are offering them at 101 and interest. The company operates a system of some seventy miles in and about Trenton, N. J., and enjoys unlimited franchises. Net earnings of the company for the first half of the present year indicate substantial improvement over the returns in the corresponding period in the previous year, and it is estimated that earnings for the year will be large enough to leave a balance equal to approximately eight times interest requirements of this issue after all other charges are paid.

Marconi Wireless to Issue Bonds.—At the annual meeting of stockholders of the Marconi Wireless Telegraph Company, Ltd., of Canada, to be held in Montreal Oct. 5, approval of an issue of $2,500,000 thirty-year, first mortgage 6 per cent gold bonds will be asked of the stockholders. The plan provides for the immediate issuance of $1,000,000 of these bonds, the proceeds of which will be used for meeting present indebtedness and furnishing sufficient funds for developing and extending the system and for furnishing additional working capital. The $1,500,000 remaining will be held in the treasury until additional financing is required.

Shawinigan Water & Power Company.—Additional capital stock amounting to $1,000,000 will be issued by the Shawinigan Water & Power Company and will be offered to stockholders at $108, on the basis of one new share for each nine shares now owned. A portion of the proceeds of this issue will be used toward meeting the cost of recent additions to the capacity of the generating equipment of the company. These additions will furnish the capacity necessary for supplying the energy recently contracted for by the Montreal Light, Heat & Power Company.

Mexican Light & Power Company, Ltd.—The combined statement of the Mexican Light & Power Company, Ltd., and the Pachua Light & Power Company, for August, 1911, shows gross earnings (Mexican currency) of $682,494, as compared with $583,337 in 1910, and net earnings of $512,111, as compared with $439,810 in August of last year. Aggregate gross earnings from January 1 were $5,332,894, as compared with $4,392,083 for the corresponding period last year, and net earnings of the two companies amounted to $3,412,217, as against $3,047,032 in the corresponding months of 1910.

Option on American District Telegraph Company Expires.—The option secured in July by F. M. Delano, of Detroit, on the stock of the American District Telegraph Company of Brooklyn has expired, due to delay in taking it up caused by illness of the promoter. It is possible that the matter will be taken up again by the Detroit interests later in the year. The record of the company shows that it was organized in 1872, under the general law of 1844, which gave it the right to transact business and to string wires in any part of New York State.

Toronto Street Railway Company.—The report of the Toronto Street Railway Company for August of this year was the most favorable in the history of the company. Gross earnings for the month were $428,960, as compared with $386,805 in August, 1910. Gross revenues of the company have shown marked improvement in the past few years, as is shown by the fact that the percentage of August earnings paid to the city this year, amounting to $85,792, is almost double that paid in 1906. That the affairs of the company are regarded as in very satisfactory condition is shown by the recent increase in dividend rate from 7 per cent to 8 per cent.

Virginia Railway & Power Company.—It is expected that action will be taken shortly relative to a dividend on the common stock of the Virginia Railway & Power Company. During July and August the surplus of the company was $150,000, which is at the rate of $900,000 for the year. In case the scale of July and August earnings is maintained, after deducting $400,000 for the preferred dividend of 5 per cent, $500,000 would be left for dividends on the $12,000,000 common stock.

Canadian Bell Telephone Company.—An increase in capital stock from $12,000,000 to $15,000,000 will be made by the Canadian Bell Telephone Company, and the additional amount will be offered to stockholders of record at par at the rate of one share of the new stock to five owned. The company has just opened its line from Montreal to Fort William, Ont., a distance of 995 miles. This is the longest telephone line in Canada.

United Missouri River Power Company.—At a public auction to be held at 31 Nassau Street, New York City, on Nov. 8, the New York Trust Company as trustee will sell $2,781,500 first and refunding gold bonds of the United Missouri River Power Company, which represent collateral security for $1,850,000 6 per cent gold notes of the company. These matured July 1, 1911, and payment was defaulted.

Sao Paulo Tramway, Light & Power Company.—It is announced that the Sao Paulo Tramway, Light & Power Company has arranged to dispose of £150,000 additional perpetual consolidated debenture stock.

Wagner Electric Increases Capital Stock.—Advices from St. Louis state that the Wagner Electric Manufacturing Company, of St. Louis, has increased its capital stock from $1,200,000 to $1,500,000.

DIVIDENDS.

American Gas and Electric Company, quarterly, preferred, 1½ per cent, payable Nov. 1; common, 1½ per cent, payable Oct. 2.

American Power & Light Company, quarterly, preferred, 1½ per cent, payable Oct. 2.

Bell Telephone Company of Missouri, quarterly, 1 per cent, payable Oct. 2.

Electric Storage Battery Company, quarterly, preferred and common, 1 per cent, payable Oct. 2.

Electrical Utilities Corporation, quarterly, preferred, 1¼ per cent, payable Oct. 16.

Kansas Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 2.

Mexican Telegraph Company, quarterly, 2½ per cent, payable Oct. 14.

New England Telephone & Telegraph Company, quarterly, 1¾ per cent, payable Sept. 30.

Otis Elevator Company, quarterly, preferred, 1½ per cent; common, 1 per cent, both payable Oct. 16.

Philadelphia Company, quarterly, 1½ per cent, payable Oct. 2.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
KEYSTONE TELEPHONE COMPANY OF PHILADELPHIA.					
August, 1911........	$96,928	$49,247	$47,681	$25,073	$22,608
August, 1910........	93,966	47,206	46,790	24,267	22,523
MONTREAL STREET RAILWAY COMPANY.					
August, 1911........	$443,108	$232,529	$210,578	$73,633	$136,945
August, 1910........	398,828	216,314	182,514	65,743	116,771
NORTHERN OHIO TRACTION COMPANY.					
August, 1911........	$272,624	$143,666	$128,958	$44,321	$84,637
August, 1910........	263,149	135,833	127,316	43,496	83,820
RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY.					
August, 1911.......	$1,149,851	$530,173	$619,678	......	......
August, 1910.......	1,027,931	495,829	532,102	......	......
SAO PAULO TRAMWAY, LIGHT & POWER COMPANY.					
August, 1911........	$303,796	$114,037	$189,759	......	......
August, 1910........	258,704	93,370	165,335	......	......

General News

Construction News.

ASHVILLE, ALA.—The Ashville [illegible] Company [illegible] contemplates the installation [illegible]

ELBA, ALA.—The Pea River Power Company [illegible] for the construction of a new power plant to cost about $150,000. The work will include a 25-ft. dam and power house. The plant will be located in Coffee County. The company supplies electrical service in Troy, Dothan and several other cities. Charles Henderson, of Troy, Ala., is [illegible] the plant.

TROY, ALA.—The city of Troy has contracted with the Pea River Power, of Elba, Ala., to supply electrical energy to operate the municipal electric-light system. Electricity will be distributed through the munici[illegible] as at present.

PHOENIX, ARIZ.—Bids will be received until Oct. 10 for the construction of the south side power station for the Salt River Valley Water Users' Association. The power house will be of reinforced concrete construction, 40 ft. x 60 ft. The plant will have an output of 3000 hp. [illegible] A. Van der Veer is secretary.

HARRISON, ARK.—The Harrison Electric Light & Ice Company is extending its system to East Harrison to provide residents of that section with electrical service.

PARAGOULD, ARK.—Improvements and extensions are being made to the electric plant of the Crystal Ice Company, involving an expenditure of about $30,000. The company has established a day service and is equipping its plant to provide for the increased service. Contracts have been placed by the company for a 150-hp Corliss engine and a 150-kw generator, at a cost of $15,000.

BAKERSFIELD, CAL.—Plans have been completed by the Pacific Telephone & Telegraph Company for the erection of its new telephone exchange building on Twentieth Street, the cost of which is estimated at [illegible]

CALEXICO, CAL.—The installation of a municipal electric-light plant in Calexico is under consideration. A committee has been appointed [illegible] make investigations and secure estimates of cost of same.

[illegible]ORNING, CAL.—The Sacramento Valley Power Company is extending its transmission lines into the Fountain Finnell ranch, which was [illegible]ntly purchased by Louis Titus. The owners propose to develop [illegible]er from the wells and use pumping plants. M. J. Barnet, of Fresno, [illegible], will have charge of the ranch.

[illegible]ORRIS, CAL.—The Siskiyou Electric Power & Light Company, of [illegible]eka, Cal., has applied to the Town Trustees for a fifty-year franchise [illegible] operate an electric system in Dorris.

[illegible]RESNO, CAL.—Preparations are being made by the San Joaquin [illegible]ght & Power Company for the erection of a transmission line from [illegible]dera to Gustine, work on which will begin in the near future.

FRESNO, CAL.—Preparations are being made by the San Joaquin [illegible] & Power Company for a large hydroelectric power development in [illegible] Big Creek basin, work on which will begin early next spring. The [illegible]ject will include the construction of three large dams and a power [illegible]nt. The proposed system will be larger than the plant recently com[illegible] at [illegible] Valley.

LOS ANGELES, CAL.—Plans are being prepared by the Police De[illegible]tment to install a signal-light system in the Highland Park and Gar[illegible]. Residents of the section will defray part of the ex[illegible]

LOS ANGELES, CAL.—The Los Angeles Railway Corporation is re[illegible]ted to be considering an issue of bonds to the amount of $2,500,000 [illegible] provide funds for extensions and improvements to its system. C. A. [illegible]nderson is secretary and treasurer.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has [illegible]en granted a franchise by the County Supervisors to construct an [illegible]ctric railway from Schuetzen Park to a connection with the present [illegible]uth Pasadena system, work on construction of which will begin at [illegible]ce.

MARYSVILLE, CAL.—The Chamber of Commerce has appointed a [illegible]mmittee to secure funds for the erection of electric-light arches on [illegible]. The cost of the system is estimated at about [illegible] [illegible]so proposed to install the system on other streets.

OAKLAND, CAL.—The Oakland & Antioch Electric Railway Company [illegible]as awarded a contract for the construction of its proposed railway from [illegible]akland to Walnut Creek to the Shattuck-Edinger Company.

PASADENA, CAL.—The City Council has authorized Mayor Thum [illegible] enter into negotiations with J. T. Harris, of Santa Monica, Cal., for the [illegible]rection of an experimental plant at the city farm for the disposal of [illegible] by electricity. The city will have an option on the plant with the privilege of purchasing it within forty days after its installation. The tentative contract submitted to the Council provides for the construction, at Mr. Harris's expense, of a unit with a reducing capacity [illegible] with electrical and magnetic appliances and operated thirty days free of expense, the city agreeing to install pipe connections with the sewer system and to furnish electricity free of charge. After that period the city reserves the right to purchase or reject the plant within ten days. The entire cost of the experimental plant is not to exceed $5,000.

PETALUMA, CAL.—The Pacific Gas & Electric Company is planning to extend its transmission lines from Petaluma to Penngrove and also from this city to Mountain Avenue district and through the Sunny Slope district.

QUINCY, CAL.—Plans are being considered for the construction of an electric railway to extend from Indian Falls, near Quincy, to a junction with the Western Pacific Railroad in Indian Valley. G. H. Goodhue, of Indian Falls, is interested in the project.

RIVERSIDE, CAL.—The extension of the street-lighting system on Orange Street from First to Sixth Street is being considered by the Board of Utilities. The cost of the work is estimated at $1,370.

SACRAMENTO, CAL.—The Citizens' Light & Power Company, of Sacramento, Cal., is reported to have been absorbed by the Great Western Power Company. The company was recently organized by a number of local capitalists and has secured large contracts to supply electricity for lamps and motors, which, it is said, have been turned over to the Great Western Power Company. The present arrangements indicate that the substation of the Great Western Power Company at Eighth and R Streets will be the distributing center in Sacramento.

SALINAS, CAL.—The Board of Supervisors has granted F. G. Baum, representing the Monterey Gas & Electric Company, a franchise to erect transmission lines over the county roads in the Salinas Valley. The price for the franchise was $200.

SAN DIEGO, CAL.—The City Council has adopted a resolution to install an improved arc-lamp lighting system on Fifth street.

SAN FRANCISCO, CAL.—F. G. Baum & Company, engineers, have been granted a franchise to erect a transmission system through Monterey County. An extension of about 70 miles will be made to the present lines.

SAN FRANCISCO, CAL.—The Secretary of Agriculture has canceled the Nevada-California Power Company's pipe-line permit on Bishop Creek, in the Inyo Forest, and has ordered the San Francisco Forest Supervisor to investigate the company's reservoir permit.

SAN FRANCISCO, CAL.—The Placer Electric Company, recently incorporated, is reported to have purchased the holdings of J. J. Bryson on the north fork of the American River in Placer County. It is understood that the company will acquire other water rights and electric power properties in that neighborhood.

SAN JOSE, CAL.—Application has been made to the Board of Supervisors by C. P. Andrews for an electric railway from San Jose to New Almaden, a distance of about 11 miles.

SAN JOSE, CAL.—The Board of Supervisors has granted the petition of the Great Western Power Company for a franchise for the erection of an electric transmission line throughout the county, bids for which will be received until Nov. 6.

SANTA ANA, CAL.—The Board of Trustees has entered into a contract with the Southern California Edison Company to supply energy at 8 cents per kw-hour. The company agrees to discontinue its injunction suit to restrain the city from enforcing a 7-cent rate.

SUSANVILLE, CAL.—The Board of Trustees has granted a franchise to erect and maintain transmission lines for the distribution of electricity within the corporation of Susanville.

SUTTER CITY, CAL.—The Pacific Gas & Electric Company is planning to erect a substation in Sutter City to supply this district with electricity for lamps. Work will soon begin on construction of same.

WEAVERVILLE, CAL.—The Board of Supervisors has granted the Trinity Dredging Company a franchise to erect and maintain electric transmission lines over the county roads near Lewiston for a term of fifty years. The amount paid for the franchise was $144.

WHEATLAND, CAL.—The Pacific Gas & Electric Company has commenced work on the construction of a transmission line from Wheatland to the Huntington tract, a distance of 4 miles. The company will supply electricity for irrigation work.

WILLOWS, CAL.—The Northern California Power Company is contemplating extending its transmission lines to Arbuckle.

WALLINGFORD, CONN.—The Board of Electrical Commissioners has rejected all bids submitted for the construction of the addition to the electric-light plant, all proposals being too high.

TAKOMA PARK, D. C.—The Town Council has authorized Mayor W. G. Pratt to enter into a contract with the Potomac Electric Power Company, of Washington, D. C., for lighting the streets of the town. Incandescent lamps of 40 cp will be used. The contract will amount to $1,500 annually. At present the town is lighted with oil lamps.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Oct. [illegible] United States [illegible] Miss.; Lexington, N. C.; Milledgeville, Ga.; Mount Sterling, Ky.; Waxahachie, Tex.; Waycross, Ga.; Big Stone Gap, Va.; Shreveport, La., and Port Arthur, Tex., in accordance with drawings and specification, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

JACKSONVILLE, FLA.—Sealed bids will be received by the Board of Trustees for Water Works and Improvement Bonds, Jacksonville, Fla., until Oct. 4 for furnishing the following: For 1000 galvanized crossarm braces and bolts, 900 galvanized ground wire arms and bolts, 1000 galvanized crossarm iron and bolts, 1000 galvanized pole steps, 200 galvanized guy rods, 116,000 ft. 750,000 circ. mil, bare copper cable, 20,000 ft. No. 2 bare copper ground wire, 50,000 ft. ⅜-in., 11,500 lb. galvanized guy wire, 45,000 ft. No. 12 copper rubber and weatherproof twisted pair telephone wire, 12,000 ft. 400,000 circ. mil, three-conductor varnished cambric armored cable with junction boxes and potheads, 200 high-tension porcelain insulators, 500 porcelain strain insulators and 2000 separate thimble iron insulator pins. Plans and specifications may be seen at the office of the board and at the office of the Scofield Engineering Company, Arcade Building, Philadelphia, Pa. W. M. Bostwick is chairman of board.

ATLANTA, GA.—The Buckhead Improvement Company has applied for a charter for the purpose of securing general improvements to real estate in Buckhead and vicinity, and the installation of electric-light and power plants, water-works, sewerage and gas plants. R. F. Maddox, L. C. Hopkins, J. L. Ridley and others are interested in the company.

ATLANTA, GA.—The Atlanta Northeastern Railway Company, which proposes to build an electric railway from Atlanta through Roswell into northeast Georgia, has filed amendments to its charter so as to extend the railway from Midway, in Forsyth County, to Creighton, in Cherokee County, and also to increase its capital stock from $50,000 to $1,200,000. J. M. Penderis, president, and J. L. Murphy, vice-president.

CLARKSVILLE, GA.—The installation of an electric-light plant and water-works system in Clarksville is reported to be under consideration. John Martin is said to be interested in the project.

DOERUM, GA.—The city of Doerum is reported to have awarded the contract to install an electric-light system to J. B. McCrary & Company, of Atlanta, Ga., to cost about $7,000.

ELK CITY, IDAHO.—Plans are being considered by the Welch Tunnel Gold Mining Company for the construction of a hydroelectric plant to supply electricity for operating its mines. R. K. Welch is general manager.

SILVER CITY, IDAHO.—The Swan Falls Power Company is contemplating the erection of a new transmission line from Rich Gulch to Flint, a distance of about 7 miles.

BEECHER, ILL.—The Village Board has granted a franchise to the Beecher Light & Power Company to install and operate an electric-light plant in Beecher.

BELVIDERE, ILL.—Franchises have been granted by the City Council to the Belvidere City Railway Company and the Elgin & Belvidere Electric Company to construct and operate electric railways on the streets of the city for a period of twenty years. The city line will be allowed to carry passengers only and is forbidden to use steam or third-rail system. The Elgin & Belvidere Electric Company is given the privilege to furnish passenger, freight and mail service, subject to restrictions.

CHAMPAIGN, ILL.—The Illinois Traction Company is reported to have entered into a contract with the Illinois Central Railroad Company to supply electricity for lamps and motors for the new shops of the railroad company near this city.

CHESTER, ILL.—The City Council, it is reported, is making investigations with a view of purchasing the local electric-light plant to be owned and operated by the municipality.

DU QUOIN, ILL.—The Du Quoin Utility Company is planning to install new electric arc lamps on the streets, at a cost of about $3,500.

FITHIAN, ILL.—The Village Board is considering the question of installing an electric-light plant in Fithian.

MANHATTAN, ILL.—The Board of Trustees has granted the Economy Light & Power Company, of Joliet, Ill., a fifty-year franchise in Manhattan and a ten-year contract for street lighting, under the terms of which the company is to furnish twenty-seven tungsten cluster lamps at $44 each per year. Provision is also made that electricity is to be furnished to private consumers at the same rate as paid in Joliet.

OGDEN, ILL.—The Village Board is contemplating the installation of an electric-light system in Ogden. Negotiations are under way with the Illinois Traction System with a view of securing electricity from that source.

PAXTON, ILL.—The citizens have voted to issue bonds to the amount of $17,000, the proceeds to be used to install a municipal electric light and power plant to supply electricity to light the streets and to operate the pumping station in connection with the water-works system.

CONNERSVILLE, IND.—The Commercial Club is interested in a project to build an electric railway to Rosedale and other suburbs north of Connersville.

MADISON, IND.—The plant and holdings of the Madison Light [illegible] Railway Company have been purchased by the Cincinnati & Madison Traction Company. It is said that the transfer of the property means the early construction of the proposed electric railway from Madison to Scottsburg. It is understood that improvements will be made to the lighting system.

SOUTH BEND, IND.—An order has been placed by the Indiana & Michigan Electric Company with the Rochester Bridge Works, of Rochester, Ind., for structural steel for its new power plant, amounting [illegible] 000.

VINCENNES, IND.—Bids will be received by the Brindley Company, 17 Battery Place, New York, N. Y., until Oct. 15 for work on the Vincennes, Washington & Eastern Traction Company's interurban electric railway in southern Indiana, 36 miles in length, as follows: For about 250,000 yards of excavation, laying 6-in. x 8-in. x 8-ft. ties, 2-ft. centers and 60-lb. rails; gravel ballasting from 6 in. below ties (gravel obtained locally); about 400 tons of structural steel for bridges; concrete piers and abutments for the above bridges; furnishing 100,000 ties 6-in. x 8-in. x 8 ft. and 2000 7-in. x 13-in. x 35 ft. poles.

ALBIA, IA.—A committee, consisting of L. T. Richmond, J. E. Loeb and J. M. Gass, has been appointed to look into the question of securing electrical energy from the proposed hydroelectric plant at the Keokuk dam.

BOYDEN, IA.—Plans are being made by Veenschoten Brothers for the installation of an electric light plant and auto garage in Boyden, Ia.

DES MOINES, IA.—The contract for ornamental lamp standards for cluster lamps on West Seventh Street has been awarded to the McDonnell Iron Works, of Des Moines, Ia.

KEOKUK, IA.—The War Department is reported to have approved detailed plans for the construction of the large lock to be built by the Mississippi River Power Company at Keokuk. The lock will be 40[illegible] ft. long by 110 ft. wide and will have a 40-ft. lift in low water. Hugh L. Cooper is consulting engineer.

REDFIELD, IA.—The installation of a municipal electric-light plan[t] and water-works system is under consideration, for which bonds t[o] the amount of $15,000 have been voted.

CHANUTE, KAN.—A proposition has been submitted to the Cit[y] Council offering to supply electricity at 2 cents per kw-hour in Chanut[e] by W. E. Reynolds, of Erie, Kan., and C. D. Reynolds, of Chanute. The plan includes the erection of a hydroelectric plant on the Neosh[o] River at Austin, 5 miles from Chanute, where they have purchabse a dam built many years ago to supply power to operate a flour mill, whic[h] was destroyed by fire. A site has also been purchased a short distanc[e] from the dam on which it is proposed to erect a large flouring and a[l]falfa mill. The city owns a municipal electric plant, which was co[n]structed ten years ago, which is now inadequate to meet the demanc made upon it.

CHAPMAN, KAN.—At an election held Sept. 14 the proposition t[o] issue bonds to the amount of $25,000 to provide for funds for the i[n]stallation of an electric light plant was carried.

FT. LEAVENWORTH, KAN.—Sealed bids will be received at th[e] office of quartermaster until Oct. 25 for furnishing cable and electric supplies as follows: 950 ft. lead sheet cable, 500,000 circ. mil; 450 f[t.] 250,000 circ. mil, two circuit breakers, six inclosed fuses, thirty wa[ll] insulator hangers, 100 porcelain insulators, thirty clamp hangers, thr[ee] knife switches, twelve wrought-copper terminals and one recording wat[t] meter. W. Van Duyne is quartermaster.

GLASCO, KAN.—The City Council has authorized the Mayor to ent[er] into a contract with the Concordia Electric Light Company for rebuildi[ng] the transmission line between Glasco and Concordia. The Concord[ia] company will rebuild the line to carry 33,000 volts and furnish equ[ip]ment, including transformers, insulators, etc., and will furnish electric[ity] at the switchboard in Glasco. Under the new contract the company w[ill] assume the cost of rebuilding the line and the entire cost of maintenan[ce] of same.

KANSAS CITY, KAN.—The contract for the construction of t[he] power station and boiler house for the proposed municipal elect[ric] light plant has been awarded to the J. W. Ferguson Construction Co[m]pany, for $23,669; the contract for the construction of the foundatic for the two buildings was let to the Alpine Construction Company [for] $9,984.

KANSAS CITY, KAN.—Sealed bids will be received at the Cour[t] Chamber, City Hall, Kansas City, Kan., until Oct. 3, for furnishing [and] installing steam turbines, generators and induction motor-exciter, dri[ve] units upon foundations furnished by the city in the municipal elect[ric] light plant at Quindaro, Kan., and for switchboard plant at Quinda[ro]. Also for furnishing 450 arc lamps and necessary equipment for same.

SOUTH HAVEN, KAN.—At a special election held recently bo[nds] were voted for the installation of a municipal electric-light plant [and] water-works system.

HICKMAN, KY.—The Kentucky Southwestern Railway, Elec[tric] Light & Power Company, which proposes to build an electric interur[ban] railway from Paducah toward Mayfield, Union City, Clinton and H[ick]man, will also construct a belt line to run from near Milburn to L[o]laceville, thence to Blandville, to Wickliffe and from Wickliffe b[ack] to Paducah. The entire project will involve an expenditure of at [about] $4,000,000.

LOUISVILLE, KY.—It is expected that the large addition to e

plant of the Kentucky Electric [illegible] Ky., will be [illegible] about Dec. [illegible]

LOUISVILLE, KY.—W. O. H[illegible] making use of the water power developed at the falls of the Ohio, opposite the city. If the plan is feasible, it is stated that Eastern capitalists have expressed [illegible] Mayor Head believes that the power can be utilized, although engineers who have studied the question are doubtful as to this.

LAFAYETTE, LA.—The City Council is reported to have provided for an issue of $60,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant, water-works and other improvements.

NEW ORLEANS, LA.—Owing to the increase in rates for electricity [illegible] the New Orleans Railway, Light & Power Company, Fuerst & Kramer, Ltd., have announced that they will install a power plant to operate their works.

CORINA, MAINE.—The local electric-light plant was destroyed by fire on Sept. 20. At present the town is without electrical service.

VAN BUREN, MAINE.—The Van Buren Light & Power Company has applied to the State Highway Commissioner for authority to carry its transmission line on the new international bridge between Van Buren, Maine, and St. Leonards, N. B. The request involves the authority for the use of the bridge and the right to transmit electricity out of the State.

WATERVILLE, MAINE.—The Central Maine Power Company has purchased a controlling interest in the Waterville & Fairfield Railway & Light Company and the Waterville & Oakland Street Railway Company. Through this deal the company secures entire control of the water in the Belgrade chain of lakes.

BOSTON, MASS.—The directors of the Boston Elevated Railway Company have called a special meeting of the stockholders to authorize an issue of bonds not to exceed $5,000,000 to provide funds for construction and equipment, for floating debt, purchase or real estate, etc.

CHICOPEE, MASS.—The Electric Light Commissioners have approved the report of C. W. Whiting, of Boston, Mass., consulting engineer, recommending improvements to the municipal electric-light plant involving an expenditure of $90,000. The report did not include equipment for the street-lighting system and the commissioners have recommended an extra $6,000 for that purpose.

HOLDEN, MASS.—At an election held recently the proposition to build an electric distributing plant, the cost not to exceed $10,000, was carried. The Selectmen have engaged William D. Thompson, of Worcester, Mass., as consulting engineer in connection with the installation of an electric-lighting system in Holden.

WOBURN, MASS.—Work has begun on the proposed addition to the Bay State Street Railway Company's power station in East Woburn. The building will be 37 ft. x 67 ft. The equipment will include a 400-hp boiler and a 1200-hp engine. The five boilers in use will be rebuilt. The total cost of the improvement is estimated at $130,000. Andrew Moffatt, of Lowell, Mass., has charge of the work.

WORCESTER, MASS.—The County Commissioners have made arrangements with the Worcester Electric Light Company to supply electricity for lamps and motors at the courthouse.

ALLEGAN, MICH.—The property of the Allegan Light & Power Company has been taken over by W. A. Foote, president, and J. B. [illegible]te, general superintendent of the Commonwealth Power Company, Jackson, Mich. It is understood that the new owners will make improvements to the plant and service.

ALPENA, MICH.—The property of the Alpena Mutual Benefit Telephone Company is reported to have been purchased by M. T. Streeter, of Lansing, Mich., representing the Onaway Telephone Company. It is understood that Alpena will be the center of an independent system in this part of the State and a new plant with metallic circuits will be [illegible] here.

BATTLE CREEK, MICH.—A site has been purchased on West Jackson Street by C. W. Post, on which, it is stated, he will erect a newspaper publishing office, power plant and other buildings.

KALAMAZOO, MICH.—The Commonwealth Power Company is reported to be contemplating the erection of a steel tower transmission line between Kalamazoo and Otsego.

LANSING, MICH.—Plans have been approved by the State Railroad Commission for an exensive water-power system contemplated by the Consolidated Power & Light Company, of Detroit, Mich., which includes the construction of five dams to supply power for a high-tension electric transmission system. Bonds to the amount of $500,000 have been [illegible] by the commission. The company proposes to operate in Clare, Midland, Ionia, Belding, St. Johns, Alma, St. Louis and Saginaw. J. L. Hudson is president of the company, and C. L. Abbott vice-president and manager.

PENTWATER, MICH.—The new transmission line of the Stearns Lighting & Power Company to Pentwater and Hart is nearly completed. A 1000-hp turbo-generator is being installed in the local power house, which will increase the generating capacity of the plant by 50 per cent.

FARMINGTON, MINN.—It is reported that a company has been organized to establish an electric-light plant in Farmington, to cost approximately $5,000. C. S. Lewis is secretary of the company.

GILBERT, MINN.—We are informed that plans are being considered for the construction of a hydroelectric plant to supply electricity in Gilbert, Aurora and Gilbert, but as yet no preliminaries have been arranged.

LINDSTROM, MINN.—It is reported that the Minneapolis General Electric Company is contemplating extending its system to Lindstrom and Center City.

MORRIS, MINN.—The City Council is considering the installation of cluster-lamps, at a cost of about $3,000.

WINONA, MINN.—Howard Morris, of Milwaukee, Wis., receiver for the Winona Railway & Light Company, has appointed R. M. Howard, of Clinton, manager of the Winona plant.

LAUREL, MISS.—The Gulf States Investment Company, which owns the local electric-light and power plant, is contemplating the construction of a street-railway system, for which application for a franchise will soon be made to the City Council. P. H. Saunders, of Laurel, vice-president of the company, is interested in a project to build an interurban railway from Laurel to Hattiesburg.

SPRINGFIELD, MO.—Plans are being prepared by the Ozark Bell Telephone Company for the erection of a long-distance copper circuit telephone line from Springfield, Mo., to Memphis, Tenn., to cost approximately $100,000. The new line, which will be independent of all other lines, will be strung on the Western Union Telegraph poles along the "Frisco."

OAKLAND, NEB.—Negotiations are under way between A. T. Martin, of Denver, Col., and local business men with a view of installing an electric-light plant in Oakland.

COBRE, NEV.—The Western Asset Company is planning to build a hydroelectric plant on the Little Salmon River to supply electricity to operate its mines near Valley Pass. An electric smelting plant is to be erected at Contact.

MORRISTOWN, N. J.—Extensive improvements are contemplated by the Morris & Somerset Electric Company to its system, including the erection of an addition to its power house on Whipple Street to provide space for the installation of additional machinery, contracts for which have already been placed. The company has purchased a 350-hp Babcock & Wilcox boiler, one 750-kw, 2300-volt, steam turbo-generator set and a 25-kw generator from the Allis-Chalmers Company, of Milwaukee, Wis.; surface condenser and pumps from the C. H. Wheeler Mfg. Company, of Philadelphia, Pa.; a marble switchboard and transformers from the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa. The company is extending its transmission line to Florham Park for the purpose of supplying electrical service in that place. Street lighting equipment for Florham Park has already been purchased.

PRINCETON, N. J.—The contract for building a conduit system and piping in power house in connection with the construction of the graduate school at Princeton University has been awarded to John L. Reid, of Newark, N. J., for $28,987.

TRENTON, N. J.—The Trenton Street Railway Company has issued $300,000 in bonds, the proceeds to be used for improvements and betterments to its property.

WEST ORANGE, N. J.—The Town Council has authorized a renewal of the contract for street lighting with the Public Service Electric Company for a period of five years. Under the terms of the new contract the company is to supply arc lamps at $80 each per year, which is a reduction of $5 per year from the price paid under the present contract.

BROOKLYN, N. Y.—Sealed bids will be received by C. B. J. Snyder, superintendent school buildings, Department of Education, Park Avenue and Fifty-ninth Street, borough of Manhattan, New York, N. Y., until Oct. 2 for installing electric equipment in additions to and alterations in Boys' High School, on Marcy Avenue, between Madison and Putnam Streets, Brooklyn, N. Y. Blank forms, plans and specifications may be obtained at the above office and also at the branch office, 131 Livingston Street, Brooklyn, N. Y.

GENESEO, N. Y.—The Board of Trustees has granted the Geneseo Gas & Electric Company a new franchise for a period of twenty-five years to supply gas and electricity for lamps, heat and motors. The franchise also provides for a twenty-four-hour service.

HARTWICK, N. Y.—Preparations are being made by the Electric Power & Heating Company for the installation of a street-lighting system [illegible]

NEW YORK, N. Y.—Sealed bids will be received by the Board of Health, Department of Health, Fifty-fifth Street, New York, N. Y., until Oct. 3, for furnishing and installing electric and gas fixtures, temporary supply feeders, etc., together with all necessary alterations and other work incidental thereto, for two concrete pavilions on the grounds of Riverside Hospital, at North Brother Island, borough of the Bronx. Blank forms and plans for the above work and further information may be btained at the office of the chief clerk of the Department of Health. Ernst J. Lederle, Ph.D., is president of Board of Health.

SILVER SPRINGS, N. Y.—The General Electric Company has been awarded the contract for furnishing electrical equipment for the proposed municipal electric-light plant, including generator, exciter, switchboard, etc., and wiring streets.

BRYSON, N. C.—It is reported that the Council has engaged C. G. Logan, of Waynesville, N. C., electrical engineer, to take charge of the installation of the proposed municipal electric-light plant, machinery for

[illegible] at about $9,000.

[illegible] proposition to issue bonds for the installation of an electric-light plant to a vote is under consideration.

RALEIGH, N. C.—The business men have submitted a proposition to the Board of Aldermen offering to pay for the installation of cluster lamps on Martin and Fayette Streets, providing the city would furnish electricity to maintain them.

RUTHERFORD, N. C.—The Town Council has awarded the contract for equipment for the proposed municipal electric-light plant to the Carolina Electrical Company, of Raleigh, N. C.

BOWLING GREEN, OHIO.—The receivers of the Lake Erie, Bowling Green & Napoleon Railway Company, which operates an electric railway extending from Tontogany to Woodville and an electric plant and hot-water heating system in Bowling Green, have secured from Federal Judge Killits authority to commence work on improvements to the system, involving an expenditure of $50,000. It is proposed to rebuild and enlarge the local plant. The work will be done under the supervision of C. B. [illegible]

BRADFORD, OHIO.—The Town Council has granted C. C. Smith a franchise to construct and operate an electric-light plant in Bradford.

CANFIELD, OHIO.—Application has been made to the Council by Jarvis Smith for a franchise to install and operate a natural gas and electric-light plant in Canfield.

CINCINNATI, OHIO—The power plant, car barns and rolling stock of the Cincinnati & Eastern Interurban Company were completely destroyed by fire on Sept. 22, causing a loss of about $125,000.

CINCINNATI, OHIO.—The Cincinnati, Georgetown & Portsmouth Railroad Company and the Ohio River & Columbus Railroad Company have been consolidated. The deal is said to have involved about $3,000,000. It is understood that the Ohio River & Columbus Railroad will be equipped for electrical operation. Robert Hackney has been elected president and treasurer and E. E. Garbreath vice-president and general manager.

CLEVELAND, OHIO.—The City Council has voted to submit the proposition to issue $2,000,000 in bonds, the proceeds to be used for the erection of a municipal electric light plant, at the election to be held in November.

COLUMBUS, OHIO.—Proposals will be received by the Director of Public Safety, City Hall Building, Columbus, Ohio, until Oct. 6 for furnishing lead-covered underground cable for the sub-department of fire of the Department of Public Safety as follows: For 3116 ft., twenty-pair lead-covered underground cable; 3225 ft. fifteen-pair lead-covered underground cable; 1739 ft., ten-pair lead-covered underground cable; 856 ft., five-pair lead-covered underground cable. E. L. McCune is director of public safety.

CUYAHOGA FALLS, OHIO.—The Village Council has passed an ordinance granting the Falls Rivet & Machine Company a franchise to erect and operate a power, lighting and heating system, provided the plant is built within six years.

DELAWARE, OHIO.—The Delaware Electric Light, Heat & Power Company has submitted a proposition to the City Council offering to sell its plant to the city for $137,500.

LOVELAND, OHIO.—The Loveland Citizens' Electric Company has filed amendments to its charter, changing its name to the Loveland Electric, Ice & Water Company.

TOLEDO, OHIO.—The Toledo, Ann Arbor & Jackson Railroad Company, recently organized, it is reported, is contemplating taking over the property of the old Toledo, Ann Arbor & Jackson electric railway, which was organized in 1905, and built an electric railway, 20 miles in length, the next year and then ceased operations. The new company will be capitalized at $500,000, of which the proceeds of $300,000 will be used in purchasing the assets and property of the old railway and the remainder for further construction.

COLLINSVILLE, OKLA.—The contract for construction of the proposed municipal electric-light plant has been awarded to C. A. Reece, of Collinsville. Bonds to the amount of $45,000 were recently voted to provide funds to install the plant.

ALSEA, ORE.—The Forest Service is planning to erect a telephone system between Alsea and Florence, a distance of 15 miles.

BAY CITY, ORE.—The new plant of the Tillamook Public Service Company was recently put in operation. The company has been awarded a contract for lighting the streets of the city. The contract calls for twenty-five arc lamps. The plant has sufficient output to supply 1400 lamps. J. H. West is superintendent.

BURNS, ORE.—James D. Fellows, who was recently granted a franchise to operate an electric-light system in Burns, has purchased a power site and is planning to build a plant on Emigrant Creek, and the local electric-light plant owned by Horton Brothers has also been taken over. It is expected to have the new power plant in operation early next spring. Arrangements are being made to supply electricity for lamps from the present system by the middle of next month. It is proposed to secure power from the flour mill. J. E. Wheeler is associated with Mr. Fellows in the enterprise. The proposed p[illegible] develop about 400-hp and a twenty-four hour service will be established.

EUGENE, ORE.—The Oregon Electric Railway Company has been granted a franchise to construct and operate a loop line in Eugene. C. R. Gray is president of the company.

EUGENE, ORE.—The Portland, Eugene & Eastern Railway Company has awarded the contract for road construction on its proposed railway from Eugene to Corvallis to William Case. Work on equipping the Alsea branch for electrical operation will begin in October. A. Welch is manager.

HERMISTON, ORE.—The Hermiston Telephone & Electric Company, recently organized, is planning to install a system throughout this district, with central station at Hermiston.

HOOD RIVER, ORE.—The Pacific Power & Light Company has closed its electric plant in Hood River. Electricity for this district is supplied from the White River power plant over the new transmission line, via The Dalles.

LEBANON, ORE.—Plans are being prepared by the Lebanon Lumber Company for the construction of an electric power plant to supply electricity for lamps and motors for its mill.

MARSHFIELD, ORE.—The Smith-Powers Logging Company is reported to be contemplating the installation of a central electric power plant to operate a lumber mill.

McMINNVILLE, ORE.—Plans are being considered for the installation of an ornamental street-lighting system in the business district. It is proposed to install ornamental lamp standards, each carrying three lamps and to place the wires underground.

PORTLAND, ORE.—The City Council has granted a revocable franchise for a period of two years to the Mount Hood Railway & Power Company for the extension of its electric railway to Montavilla, connecting with the lines of the Portland Railway, Light & Power Company.

SPRINGFIELD, ORE.—The Oregon Power Company has submitted a proposition to the City Council and the Commercial Club offering to install an ornamental street-lighting system in Springfield. The company agrees to install the system and divide the cost into equal monthly payments on a five-year contract. At the expiration of the contract the system will become the property of the city.

PANAMA.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C. until Nov. 20 for furnishing electric towing locomotives for the canal locks. Blanks and general information relating to this circular (No 650) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

GLENDON (R. F. D.), EASTON, PA.—The Glendon Power Company has applied to the Town Council for a franchise to erect electric transmission lines through the town.

MAHANOY CITY, PA.—Negotiations have been closed whereby the property of the Schuylkill Gas & Electric Company, of Mahanoy City has been taken over by the Harwood Electric Company, of Hazleton Pa. Electricity for operating the local system will be supplied from Harwood and the plant in Mahanoy will be used as a substation.

MOUNTVILLE, PA.—The Borough Council has adopted an ordinance providing for the installation of a street-lighting system. It is proposed to install ninety incandescent lamps of 40 cp.

WILKES-BARRE, PA.—The Wilkes-Barre Light Company, recently organized, has been granted a seventy-five-year franchise to operate in Wilkes-Barre. John J. Cumming and Joseph Dunfee, of Syracuse, N. Y are interested in the company.

MANILA, P. I.—Sealed proposals will be received at office of Major C. H. McKinstry, officer in charge of defensive works, Headquarters Philippines Division, Manila, P. I., until Dec. 4, 1911, for furnishing engines, generators, synchronous converters, and potential transformers. Further information can be obtained on application to the above office or to Chief of Engineers, United States Army, Washington, D. C.

UNION, S. C.—Extensive improvements have been made to the municipal electric-light plant and water-works system. The interior of the plant has been remodeled and all steam and electric lines placed in ducts under the concrete floor. New equipment has been installed, including a 75-kw, three-phase, 60-cycle, "Hawthorn" generator, direct connected to a 135-hp Harrisburg engine, with necessary switchboard. R. A. Easterling is superintendent.

ADAMS, TENN.—Plans are being considered for the construction of an electric-light plant in Adams. A stock company has been organized to operate the system. A site has been purchased on which the proposed plant will be erected. H. W. Tyson, of Glenraven; D. F. White and J. D. Stoltz, of Adams, are interested in the project.

CHATTANOOGA, TENN.—The Merchants' Association has submitted a proposition to the Board of City Commissioners for the establishment of an ornamental lighting system. The association agrees to erect and maintain the lamp standards and wiring, provided the city will furnish electricity for same.

MEMPHIS, TENN.—The Commissioner of Public Utilities, Grounds and Buildings has authorized the Merchants' Power Company to erect sixty-two additional arc lamps on Main Street from Railroad Avenue to Concord Avenue.

MEMPHIS, TENN.—Application has been made for a charter for the West Tennessee Traction Company by A. G. Riley, Alfred Sohm, W. W. Swift and C. L. Winchester. The company will be capitalized at $100,000 and proposes to build an electric railway from Memphis to Jackson, thence to Nashville.

SHAWANEE, TENN.—It is reported that plans are under way for construction of a dam on Powell's River, at [illegible] miles south of Shawanee. Electricity generated at the plant will be transmitted to Middleboro and Jelico, and will also supply power to operate an electric railway to the pinnacle at Cumberland Gap and on to the Lincoln Memorial University and thence to Shawanee.

CAMERON, TEX.—The City Council has granted the Hamilton Brothers Construction Company a fifty-year franchise to install and operate new water-works and lighting systems in Cameron.

COMMERCE, TEX.—The capital stock of the Commerce Ice & Power Company has been increased from $35,000 to $50,000.

DEL RIO, TEX.—D. B. Chapin and associates, who are preparing to erect a large dam across Devil's River to obtain a water supply for irrigating about 150,000 acres of land and to operate a hydroelectric plant, have completed surveys for the proposed work. The dam will be about [illegible] high.

DENTON, TEX.—The Denton Traction Company has applied for an amendment to its charter permitting it to supply electricity for lamps now instead of waiting five years longer, as authorized under the original charter. The company offers to supply electricity at 12½ cents per kw-hour against 15 cents per kw-hour charged by the municipal electric plant. In consideration for the amendment it is said that the company will supply energy for street lamps for five years free of charge.

DERMOTT, TEX.—The Dermott Townsite Company, it is said, is planning to install a lighting system. Frank M. White is general agent.

FORT WORTH, TEX.—The Stone & Webster Engineering Corporation, of Boston, Mass., has awarded the contract for grading its interurban electric railway between Fort Worth and Waxahachie, a distance of about 35 miles, to Denison & Ramsay, of Lubbock, Tex. The contract for grading the proposed electric interurban railway between Fort Worth and Cleburne, 29 miles in length, has been awarded by the Stone & Webster Engineering Corporation to the Texas Building Company, of Fort Worth.

FOWLERTON, TEX.—The Fowler Brothers Land Company is reported to be contemplating the installation of an electric-light, ice and cold-storage plant, to cost approximately $40,000. B. D. Hatcher is manager of farm sales department. Fowlerton has not a post office.

BRIGHAM CITY, UTAH.—At an election held recently in the newly incorporated town of Honeyville the proposition to issue bonds to the amount of $12,000 for the installation of an electric-light plant and water-works system was carried. The cost of the electric-light plant is estimated at [illegible]000, and the water-works system at $7,000.

MONROE, UTAH.—The Town Council has authorized a special election to be held Oct. 12 to submit the proposition to issue $10,000 in bonds, the proceeds to be used to purchase the local electric-light plant, to be owned and operated by the municipality.

PROVO, UTAH.—The Knight Power Company is contemplating further extensions to its system in this State. The company is planning to erect another plant early next year to be located about 8 miles from the present plant on Snake Creek, near Heber.

SALT LAKE CITY, UTAH.—An isolated electric generating plant will be installed in the Daniels Theater building, now being remodeled.

SALT LAKE CITY, UTAH.—Plans are being considered for the construction of an electric railway from Salt Lake City to Provo and Payson, for which preliminary surveys will be made. George M. Cannon, of the Real Estate Association, is interested in the project.

DANVILLE, VT.—Investigations are being made by the St. Johnsbury Electric Company, of St. Johnsbury, in Danville with a view of extending its system to that village. The plan contemplates lighting the streets as well as the residences.

ST. JOHNSBURY, VT.—Work has begun on the erection of a new generating plant for the St. Johnsbury Electric Company on the Carrick property. The H. P. Cummings Construction Company, of Ware, Mass., has the contract. The power house will be 120 ft. by 30 ft.

RICHMOND, VA.—Application has been made to the City Council by the Richmond & Henrico Railway Company for a franchise to supply electricity for lamps and motors along the streets over which its railway operates. The company, it is said, is planning to extend its railway in sections of the city not now served by street railways. The power house of the company is located at the foot of Nicholson Street, which it proposes to enlarge if granted a franchise to supply electrical energy for commercial and domestic purposes.

ATTALIA, WASH.—Negotiations have been closed between the Pacific Power & Light Company and the Attalia Land Company whereby a substation will be erected in Attalia, work on which will begin at once.

BLAINE, WASH.—Property has been acquired at the international boundary by G. H. Wescott as a site for the proposed electric power plant of the British Columbia Electric Railway, which proposes to supply electricity in Blaine. Electrical service is now supplied by a municipal plant.

CHEHALIS, WASH.—The Chehalis & Cowlitz Railroad Company, it is said, will equip its system through Chehalis for electrical operation.

ELLENSBURG, WASH.—We are informed that improvements are contemplated to the municipal electric-light plant, involving an expenditure of about $30,000. G. M. Miller, of Ellensburg, Wash., is engineer in charge.

KLICKITAT, WASH.—The Pacific Power & Light Company is erecting a 66,000-volt transmission line, for emergency purposes, from its power plant on the Little Klickitat River to The Dalles, Ore. A distributing system will later be built in the Horseshoe Bend district, near Klickitat.

LYLE, WASH.—The Puget Sound Bridge & Dredging Company, of Seattle, Wash., is reported to have secured the contract for construction of a dam on the Klickitat River, near Lyle, for the Northwestern Electric Company, of Portland, Ore., in connection with its proposed hydroelectric power plant.

MORTON, WASH.—The Town Council has granted a franchise to A. W. Van Arsdale to install an electric light and water system in Morton.

SEATTLE, WASH.—Plans are being considered by the Seattle, Renton & Southern Railway Company for the erection of a substation on Rainier Avenue.

TACOMA, WASH.—The Federal Court has ordered the foreclosure and sale of the property of the Home Telephone Company of Tacoma to satisfy a judgment of $1,637,000 and interest on the company's bonds due for two years past. The city of Tacoma, it is said, may purchase the property.

WATERVILLE, WASH.—The Wenatchee Gas & Electric Company is reported to have acquired the Waterville electric power plant on the Entait River. It is understood that improvements will be made in the service.

BENWOOD, W. VA.—The Ohio Valley Electric Company has applied to the County Commissioners for a franchise to erect transmission lines over the county roads from Benwood to Moundsville and into Sherrard and Mozart districts.

ENDEAVOR, WIS.—A stock company is being organized in Endeavor to develop a water power to operate an electric light and power plant. The company will be known as the Endeavor Light & Power Company and will be capitalized at $10,000. A transmission line, 10 miles in length, will be erected. For further information address W. H. Burwell, of Endeavor, Wis.

VICTORIA, B. C., CAN.—The Special Council committee has awarded the contract for the installation of cluster lamps on Fort Street to Hutchinson Brothers, at $5,827.

MIMICO, ONT., CAN.—The ratepayers have voted in favor of the by-law providing for the installation of a local electric distributing plant in Mimico. Energy for operating the system will be supplied by the Hydroelectric Power Commission.

OTTAWA, ONT., CAN.—The Canadian Bell Telephone Company has announced that it will increase its capital stock from $12,500,000 to $15,000,000.

SARNIA, ONT., CAN.—Contracts have been awarded by the Sarnia Gas & Electric Company for equipment for its power plant as follows: To the Goldie McCulloch Company, of Galt, Ont., Can., for boilers receivers, piping, a condenser and a mixed-pressure turbo-generator; three-phase, 60-cycle generators to Kilmer, Pullen & Burnham, of the Swedish General Electric Company; to the Canadian Westinghouse Company for three excitor sets; for switchboard to the Canadian General Electric Company; the Deane Steam Pump Company, of Holyoke, Mass., for pumps and water weigher to Henry Worthington, of New York, N. Y.

STEELTON, ONT., CAN.—Tenders will be received by James Robinson, town clerk, until Oct. 3 for installation of an electric-lighting system as follows: Contract B—Erection of brick substation and house tower. Contract K—Furnishing and erecting complete electrical equipment for lighting system, including substation equipment. Contract M—For fire alarm equipment. Plans and specifications may be seen at the office of the town clerk, Steelton, and at the office of Chipman & Powers, engineers, 204 Mail Building, Toronto, Ont., Can.

MONTREAL, QUE., CAN.—The Shawinigan Water & Power Company has decided to issue $1,000,000 in additional capital stock, to be offered to the shareholders at $108 on the basis of one new share for each nine shares now held. Part of the proceeds will be used to cover a portion of the cost of the new power development which has been in course of construction during the past year and a half. This development will double the output of the electrical plant and furnish the power necessary to carry out the contract recently made with the Montreal Light, Heat & Power Company. The company expects to place its new plant in operation by Oct. 1.

OAXACA, MEX.—Maurice Clark, operating mining property in the Chivo Mountain district, is reported to be at the head of a project to supply that mining district with electricity for lamps and motors.

New Industrial Companies.

THE CANTON ELECTRIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $3,000,000 to develop and manufacture a number of electrical inventions. The officers of the

[illegible] Philip Nevins, [illegible] I. E. A. Konigsberg, secretary and treasurer; the directors are Dr. J. H. Bair and General J. L. Weaver.

THE DRIEST-HOERBER COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $25,000 for the purpose of manufacturing surgical, chemical, electrical and scientific instruments. The incorporators are C. Dreist, C. Hoerber, of New York, N. Y., and L. M. Day, of Atlantic City, N. J.

THE EASTERN NOVELTY & LIGHTING COMPANY, of Westfield, Mass., has been granted a charter with a capital stock of $50,000 to manufacture novelties in lighting apparatus. J. C. Thompson is president and G. H. Sharp, of Westfield, Mass., treasurer.

THE ELECTRIC RAILWAY MAINTENANCE ASSOCIATION, of New York, N. Y., has filed articles of incorporation with a capital stock of $50.000 for the purpose of doing a general consulting and electrical engineering business. The incorporators are: Albert B. Herrick, 230 West Twenty-second Street, New York, N. Y.; Clarence G. Boyden, 940 Fox Street, the Bronx, New York, N. Y., and John K. Mann, 2584 Bedford Avenue, Brooklyn, N. Y.

THE ELECTRIC TRUCK COMPANY, of Kansas City, Mo., has filed articles of incorporation with a capital stock of $2,000. The incorporators are John M. Egan, Louis H. Egan and J. A. Harder.

THE FLORENCE ELECTRIC TRAY COMPANY, of Chicago, Ill., has been incorporated by Florence L. Crombic, William H. Benes and Elnar C. Howard. The company is capitalized at $75,000 and proposes to manufacture and deal in electrical and other specialties.

THE HIMES-COX STUDIOS, of New York, N. Y., has filed articles of incorporation with a capital stock of $60,000 to manufacture and deal in lighting fixtures, globes, bronzes, etc. The incorporators are F. Himes-Cox, G. O. Howe and S. S. Newton, of New York, N. Y.

THE GEORGE A. JACKSON COMPANY, of Boston, Mass., has been incorporated with a capital stock of $25,000 to deal in electrical supplies and machinery. E. I. Jackson is president, and G. A. Jackson, of Newton, treasurer.

THE JONES MARTIN COMPANY, of New York, N. Y., has been incorporated by D. Carroll Jones, 611 West 111th Street, New York, N. Y.; Miles I. A. Martin and Charles C. Kiefer, both of 160 Broad Street, Newark, N. J. The company is capitalized at $25,000 and proposes to manufacture and deal in scientific and electrical instruments, etc.

THE KROTZER COMPANY, of Buffalo, N. Y., has been granted a charter with a capital stock of $10,000 to manufacture machinery, motors, engines, etc. The incorporators are: Louis E. French, I. G. Holendar and Christopher M. Baldy, all of Buffalo, N. Y.

THE LAMAR ENGINEERING COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $12,000 by George M. Sachs, Siegfried M. Sachs and S. E. Schuchart, all of New York, N. Y.

THE MAXANT ENGINEERING & MANUFACTURING COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $100,000 to do a general mechanical, electrical engineering and manufacturing business. The incorporators are: Basil Maxant, Frank Maxant and William D. Johnson.

THE MIDLAND ELECTRIC HEATING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to do a general electrical manufacturing business. The incorporators are: Richard W. Thornton, Julius Goldszier and Henry Hiestand.

THE MULTIPLE STORAGE BATTERY COMPANY, of New York, N. Y., has been incorporated by R. K. McGonigal, C. W. Schadler and J. Cornillios, all of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in electrical apparatus.

THE NEW ENGINEERING & CONSTRUCTION COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: G. C. Stiegler, G. W. Dillman and B. M. Grawl, of Wilmington, Del.

THE NEW STATE CONSTRUCTION COMPANY, of Prescott, Ariz., has been incorporated with a capital stock of $100,000 to engage in electrical construction work and to deal in electrical supplies. The officers are W. B. Shelvley, president; W. H. Tharp, vice-president, and V. H. Melick, secretary and treasurer.

THE ORNAMENTAL LIGHTING POLE COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of manufacturing lighting poles, supplies, etc. The incorporators are: Harvey S. Tonks, 17 Battery Place; Ernest Ziegler, 135 Broadway, both of New York, N. Y., and William J. Nunes, 82 Clark Street, Jersey City, N. J.

THE PEARSON ENGINEERING COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 to manufacture engines, pumps, etc. F. W. Hayden is president and W. E. Pearson, of Boston, Mass., treasurer.

THE PENNSYLVANIA ELECTRICAL CONSTRUCTION COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $50,000 by Thompson H. Lukens and Bruyn Snyder, of Philadelphia, Pa., and Edwin R. Cochran, Jr., of Wilmington, Del.

THE RANSOME ENGINEERING COMPANY, of New York, N. Y., has been incorporated by Ernest J. Ransome, 910 Madison Avenue, Plainfield, N. J.; A. Wilfred Ransome, 923 Woodland Avenue, Plainfield, N. J., and J. Walter Neville, 859 Sixty-first Street, Brooklyn, N. Y. The company is capitalized at $50,000 and proposes to do a general contracting business.

THE REFLEX INSPECTION LIGHT COMPANY, of Mount Vernon N. Y., has been incorporated with a capital stock of $25,000 by Gusta Musskern, August Benkert, 43 Stevens Avenue, and William H. Pease 119 Washington Street, all of Mount Vernon, N. Y. The compan proposes to manufacture and deal in inspection lamps, etc.

THE SMITH GASOLINE MOTOR COMPANY, of New York, N. Y has been granted a charter with a capital stock of $350,000 for the pur pose of manufacturing and dealing in motors, engines, automobiles, etc The incorporators are: W. H. White, Jr.; D. M. Baldwin and W. I Bardy, all of New York, N. Y.

THE H. F. SMITH'S ELECTRIC LOCK STRIKE COMPANY of Richmond, Va., has been incorporated with a capital stock of $50,000 The officers are H. F. Smith, president; George J. Hooper, vice-presiden and J. S. Hopkins, secretary and treasurer. The company proposes t manufacture and sell Smith's electric lock strike.

THE SUPERVISING ENGINEERING COMPANY, of Portland Maine, has been incorporated with a capital stock of $50.000 to do general engineering business. H. Knowlton is president of the com pany and W. J. Knowlton, treasurer, both of Portland, Maine.

THE TELEGRAPHONE SALES COMPANY, of Providence, R. I has been incorporated by Ralph V. Hadley, of Providence, R. I.; Benjam F. Lindemuth, of Bristol, R. I., and Col. Frank T. Easton, of Providenc R. I. The company is capitalized at $1,000,000 and proposes to manufa ture and deal in telegraphonic and telephonic instruments, phonograpl graphophones and all kinds of electrical instruments; also acquiring pa ent rights and similar privileges for any invention and selling paten etc.

New Incorporations.

MARTINEZ, CAL.—The Mt. Diable Telephone Company has been corporated with a capital stock of $5,000. The officers are: H. C. W more, president; Charles Gordon, secretary, and Percy Douglas, treasur

ATLANTA, GA.—The Etowah Valley Railway Company has be granted a charter with a capital stock of $50,000 for the purpose building a railway from Ball Ground in Cherokee County extendi along the Etowah River to the Tennessee line in Towns County. T incorporators are: G. R. Glenn, H. D. Curley, John H. Moore a others. The headquarters of the company will be located in Atlanta.

CHRISTOPHER, ILL.—The Christopher Electric Company has fi articles of incorporation with a capital stock of $20,000. The incor rators are Thomas Horn, Albert E. Pike, H. M. Rea and T. D. Pa hill.

OTTAWA, ILL.—The La Salle Electric Railroad Company has fi application for a charter to build an electric railway from Ottawa Mendota, a distance of 26 miles. Work on construction of the propo railway will begin this fall. The officers are G. H. Dodge, preside Boyd Weaver, secretary; O. D. Weaver, Jr., treasurer, and Fred Abraham, chief counsel, all of Chicago, Ill.

CONNERSVILLE, IND.—The Hydro-Electric Light & Power C pany has been incorporated with a capital stock of $10,000 by J. Sade, Lewis R. Johnson and E. D. Johnson.

RICHMOND, IND.—The Richmond & Eastern Traction Company been granted a charter with a capital stock of $50,000. The direc are: S. E. Jones, W. H. Quigg, C. Jordan and A. G. Bartel.

PORTLAND, MAINE.—The Santiago Light, Heat & Power Comp has filed articles of incorporation with a capital stock of $250,000 for purpose of doing a general lighting, heating and power business. officers are W. W. Copeland, of Whitman, Mass., president, and G. Colt, of Winchester, Mass., treasurer.

HENDERSONVILLE, N. C.—The Hendersonville Traction Comp has filed articles of incorporation with a capital stock of $100,000 construct and operate an electric railway and light and power pl The incorporators are: N. C. Statton, D. S. Pace and others.

Personal.

MR. HARRY F. WALKER, formerly of Jacksonville, Ill., has been appointed manager of the properties of the Illinois Telephone Com at White Hall, Ill.

MR. J. N. PREWITT, chief electrician of the Trinity & Br os Valley Railway Company, has tendered his resignation, effective 1. Mr. Prewitt's successor has not yet been named.

PROF. JOHN PRICE JACKSON, dean of the School of Engineering of Pennsylvania State College, was elected at the recent meetin of the Pennsylvania Electrical Association the first honorary membe of that body.

PROF. W. S. GORTON, of Johns Hopkins University, will take in electrical engineering department of the Massachusetts Institute of Technology the work of Prof. H. W. Smith during the absence abroad of the latter.

[illegible] R. M. HOWARD has been ap[illegible] Way & Light Company. Mr. H[illegible] [illegible]en Bay Gaslight & Street Railwa[illegible] [illegible]ars' experience in electrical work.

[illegible] HUGH L. COOPER, of New Y[illegible] [illegible] River Power Company, which [illegible] at Keokuk, will speak Oct. [illegible] Electrical Interests on "Engineering Features of the Keokuk Water [illegible] Company."

[illegible] [illegible]at of the General Electric Company of Texas, with headquarters at [illegible] Chicago last [illegible] which he was [illegible]

[illegible] F. HAROLD B. SMITH, who has been in charge of the electrical [illegible]ering department at the Worcester Polytechnic Institute, is leaving [illegible] absence. Prof. J. O. P[illegible] [illegible]ector, and Mr. R. L. Witham, of the cl[illegible] will be at [illegible] work in electrical [illegible]

[illegible] PIERCE [illegible] succeeds Prof. George R. [illegible]teen at Worcester Polytechnic Institute in the work of theoretical [illegible]cal engineering. Mr. M. F. Clement succeeds Mr. R. H. Taber [illegible]aduate assistant in the electrical engineering departmnt. Mr. [illegible] is now with the Westinghouse company in Pittsburgh.

[illegible]R. JENS BACHE-WIIG, engineer of the Westinghouse Electric & [illegible]ufacturing Company in charge of alternating-current generator [illegible]d rotary converter design, has been appointed by the Norwegian [illegible]vernment professor in electrical engineering at the Norwegian Tech[illegible] [illegible] in Trondhjem, Norway, to take effect Jan. 1, 1912.

[illegible]R. GEORGE B. COLEMAN, special power engineer of the Rock[illegible] Electric Company, will give an illustrated lecture on that [illegible]y to manufacturers and business men and the general public [illegible] [illegible]ter part of October, on "The Electric Motor in the World's Work." [illegible]is will be illustrated by three dozen pictures of motor drives in [illegible]ckford, together with views from plants all over the United States.

[illegible] KENNELLY who attended as an A. I. E. E. delegate the [illegible]etings in Turin of the International Electrotechnical Commission and [illegible] International Electrical Congress, in which latter he served as presi[illegible]nt of one of the eight sections, sailed for home on Sept. 22. After [illegible] adjournment of the congress, Dr. Kennelly served on a jury at [illegible]ege, Belgium, which made an award of $2000 for the best triennial [illegible] offered by a student of the Montefiore Technical Institute.

[illegible]R. A. N. RICHARDSON, who is general superintendent of the [illegible]nsas City Electric Light Company, was for a number of years located [illegible] Ann Arbor, Mich., with the Washtenaw Light & Power Company, [illegible] Washtenaw division of the Eastern Michigan Edison Company, [illegible] to Kansas City in November, 1910. The former general man[illegible]er of the Kansas City company, Mr. R. E. Richardson, has been suc[illegible]eded there by Mr. Louis M. Egan, the son of Mr. John M. Egan, presi[illegible]ent of the company. Mr. R. E. Richardson is now general manager of [illegible] Commonwealth Power Company, with offices at Jackson, Mich.

[illegible] WEEKS was appointed an official delegate to rep[illegible] American Institute of Electrical Engineers at the National [illegible]vation Convention meeting at Kansas City, Mo., Sept. 25 to [illegible] Mr. Weeks, who is now a consulting engineer of Kansas City, is a [illegible]r of the Institute and was an early vice-president, and in 1889-90 [illegible] National Electric Light Association. To him also be[illegible] the honor of having designed the association's badge. In the [illegible]ction of older central-station men the Kansas City convention of [illegible] Mr. Week's presidency still [illegible] [illegible]est attendance and most notable program of all the meetings held up [illegible]

[illegible] P. T. GLIDDEN, who was elected general manager of the [illegible]ouisville Lighting Company, of Louisvile, Ky., as announced in these [illegible] last week, is forty-three years old, and has [illegible] years' [illegible] in the business. He has been vice-president and general [illegible] the Eastern Pennsylvania Power Company, [illegible] Easton, Pa. This company was [illegible] plants in Easton, Bangor, East Bangor, [illegible] Port[illegible]nd and Stroudsburg, Pa., and Mount Tabor, N. J. Other plants are [illegible]erated at Dover and Columbia, N. J. Mr. A. M. Worthington, whom [illegible] Glidden succeeds Oct. 15, has been in the service of the Louisville [illegible] company for seven years, and has been in the business for [illegible] years. He is [illegible] and [illegible]tends to seek a milder climate in the hope of securing relief.

Trade Publications.

LIGHTING FIXTURES.—The Delta-Star Electric Company, Chicago, [illegible] distributing a new catalog describing a full line of "Mazda" light[illegible]g fixtures for indoor and weatherproof service. Photometric curves [illegible]e given by the use of which the proper reflectors can easily be selected [illegible] a given installation.

BELL SINGLE-PHASE MOTORS.—The Bell Electric Motor Com[illegible]y, Garwood, N. J., has issued a catalog illustrating and describing [illegible] full detail its line of high-efficiency single-phase motors. The points [illegible] superiority of the Bell motor are brought out in seventeen reasons [illegible] plants for power equipment.

MOTORS FOR INDUSTRIAL USE.—[illegible] the Mechanical Appliance Company, Milwaukee, Wis., the various types of Watson motors, in ratings ranging from ¼ hp to 30 hp, are illustrated and various applications to industrial problems suggested. Constant and adjustable speed direct-current machines for all standard voltages and single-phase, two-phase and three-phase motors for standard frequencies and voltages are obtainable in either horizontal, vertical or back-geared type.

UNITY POWER-FACTOR SINGLE-PHASE MOTORS.—With this title the Wagner Electric Manufacturing Company, St. Louis, has issued a bulletin (No. 94) describing in detail its new type of unity power-factor single-phase motor. It will be recalled that this new type of motor was formally announced at the New York convention in May of the National Electric Light Association. In addition to illustrations of the motor, both alone and as installed for work, there are a number of curves bringing out the unique characteristics of the machine.

AUTOMATIC TIME SWITCH.—The Hartford Automatic Time Switch Company, of 97 Warren Street, New York City, is inclosing its time switch in a new type of case. This is dust-proof and weather-proof, with a rubber-gasketed door equipped with a Sub-Treasury lock. The switch is a device by which electric current is automatically turned on and off at such times as the user desires, and requires no attention other than weekly winding. Special switches are furnished to meet unusual requirements. The switch is described in full in an attractive leaflet which the company is distributing.

DE LAVAL STEAM TURBINES.—"Steam Turbine Centrifugal Pumps and Other Centrifugal Machinery" is the title of a 32-page booklet or album issued by the De Laval Steam Turbine Company, of Trenton, N. J., illustrating and describing briefly the several lines of machinery manufactured by that concern, including single-stage turbines for driving machinery of all kinds and for rope and belt transmission; turbine-driven centrifugal pumps for water works, for general water service in industrial plants and for boiler feeding, hydraulic pressure work, etc.; velocity staged turbines without gears for direct connection to high-pressure blowers, centrifugal pumps, etc.; multi-stage impulse turbines with gears for driving large direct-current generators, fans, centrifugal pumps and other moderate or low speed machinery; multi-stage impulse turbines without gears in large sizes for direct connection to high-speed alternators; motor and belt-driven centrifugal pumps for all services and heads; multi-stage centrifugal pumps for all services and heads; multi-stage centrifugal air compressors and De Laval speed reduction gears for various services. The same company has also issued in pamphlet form a reprint of a paper by Mr. Francis Head on "Comparative Tests of Large Engine and Turbine-Driven Centrifugal Pumps."

BUSINESS NOTES.

MR. EDW. JUMONVILLE, secretary-treasurer of the Interstate Electric Company, Ltd., of New Orleans, since its inception in 1903, and Mr. Reynolds Yundt, of the same organization, are making arrangements to go into the electrical supply business in New Orleans.

TERRY STEAM TURBINES.—Mr. J. S. Cothran, of Charlotte, N. C., has been appointed the sales agent of the Terry Steam Turbine Company for North and South Carolina. Mr. Cothran's offices will continue to be at Charlotte, N. C., where he has long been identified with the trade.

THE REYNOLDS ELECTRIC FLASHER MANUFACTURING COMPANY has opened a branch office for the Pacific Coast and adjacent States in the Electric Building, San Francisco, with Mr. Henry F. Frosch in charge of the office. A complete stock of standard types of flashers will be carried for immediate deliveries.

THE ROBB ENGINEERING COMPANY, Ltd., Amherst, N. S., have recently sold heating boilers to the following companies: C. C. Young Company, Winnipeg, Man.; John Plaxton Company, Winnipeg, Man.; H. G. Hagen & Company, Amherst, N. S.; Gorman, Glancey & Grindley, Edmonton, Alta.; R. C. Thomas & Company, Calgary, Alta.

THE CONNECTICUT TELEPHONE & ELECTRIC COMPANY and the Connecticut Shock Absorber Company, of Meriden, Conn., have jointly opened up a new branch at 819-A Boylston Street, Boston, Mass., under the management of William A. Ellis, who was formerly sales manager for the Bi-Motor Equipment Company, of Boston. Mr. Ellis has been identified with the automobile trade almost since the start and is very well known by the trade throughout New England. The Connecticut Company will carry on hand in its Boston office a large stock for the accommodation of the trade.

SWARTWOUT OIL SEPARATORS.—The American Gas & Electric Company, Scranton, Pa., recently placed its third order with the Ohio Blower Company, Cleveland, Ohio, for a 24-in. Swartwout horizontal oil separator. Swartwout products have also been ordered for the following plants: Enid Electric & Gas Company, Enid, Okla., one 14-in. cast-iron exhaust head; Delaware & Hudson Company, Albany, N. Y., one 12-in. cast-iron exhaust head; Western Electric Company, two 8-in. horizontal receiver separators; Yost Electric Company, Toledo, Ohio, one 20-in. and one 30-in. rotary ball-bearing ventilator, and Lowell Gas Light Company, Lowell, Mass., three 36-in. copper rotary ventilators.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 19, 1911.

Furnished by Robert Starr Allyn, 10 Exchange Place, New York.

1,003,416. REGULATOR; J. C. Barry, Schenectady, N. Y. App. filed Sept. 13, 1907. For boosters connected in series with secondary batteries.

1,003,430. SWITCH; R. Cawyer and J. D. Gates, Mercury, Tex. App. filed Jan. 14, 1911. Telephone switch for party-line circuits for cut-out.

1,003,431. SYSTEM OF MOTOR CONTROL; A. Churchward, New York, N. Y. App. filed April 9, 1909. Regenerative braking system of motor control for motor-driven vehicles using storage batteries.

1,003,453. MERCURY METER; E. S. Halsey, Nahant, Mass. App. filed April 22, 1908. The armature revolves in mercury.

1,003,455. ELECTRIC-ALARM LUBRICATOR; W. A. Hardwick, Memphis, Tenn. App. filed March 8, 1909. Sounds an alarm when the lubricator is exhausted.

1,003,456. ELECTROLYTIC APPARATUS; L. H. A. B. M. Hazard-Flamand, Boulogne-sur-Seine, France. App. filed Feb. 6, 1911. For dissociating oxygen and hydrogen. Has a gas-proof partition between the electrodes.

1,003,457. RETARDING MECHANISM; F. Heath, National City, Cal. App. filed Aug. 25, 1910. A flywheel, spring and cable for retarding the action of an electromagnet, as in railroad signals.

1,003,464. SYSTEM OF MOTOR CONTROL; L. Janisch and W. Linke, Berlin, Germany. App. filed May 7, 1909. The field is automatically weakened upon a decrease of speed. To protect anchor windlass, etc.

1,003,465. ALTERNATING-CURRENT MOTOR; C. L. Kennedy, South Braintree, Mass. App. filed Dec. 13, 1909. Automatically cuts out the starting winding and impedance.

1,003,476. TELEPHONE SYSTEM; A. D. T. Libby, Elyria, Ohio. App. filed July 15, 1909. Intercommunicating system. Connects any substation to outside lines.

1,003,506. VARIABLE-RATE METER; W. H. Pratt, Lynn, Mass. App. filed April 18, 1903. The indications are proportional to the product of the watt-hours times the price, which varies with the rate of consumption.

1,003,507. ASTATIC WATTMETER; W. H. Pratt, Lynn, Mass. App. filed January 25, 1910. Two four-pole armatures are mounted on a shaft and two four-pole series fields are mounted in operative relation.

1,003,547. TRANSFORMER SECONDARY; E. Thomson, Swampscott, Mass. App. filed Aug. 5, 1909. Welding-work holders are mounted on hinges to avoid the usual sliding support.

1,003,586. VENTILATED FUSE PLUG; F. C. Curtis, Troy, N. Y. App. filed Jan. 19, 1911. A gas-pervious ventilating packing is interposed between the body and cap.

1,003,600. REGULATION OF DYNAMO-ELECTRIC MACHINERY; H. Guttinger, Baden, Switzerland. App. filed Jan. 16, 1909. An operating sector rolls over a set of resistance-connected contacts; an electrically-controlled rotatable member moves the point of the sector.

1,003,604. ELECTROLYTIC PROTECTION; A. S. Herrick, New York, N. Y. App. filed Oct. 2, 1909. To protect earth conductors from electrolysis by stray currents from other conductors.

1,003,633. INDUCTION COIL; J. McIntyre, Jersey City, N. J. App. filed March 21, 1908. Improvements on Patents Nos. 796,851 and 868,468. To simplify the adjustment of the contacts.

1,003,634. INDUCTION COIL; J. McIntyre, Jersey City, N. J. App. filed Oct. 24, 1908. A non-rotatable contact bar is movable bodily relative to the other contact

1,003,649. INDUCTOR GENERATOR FOR IGNITION PURPOSES; H. J. Podlesak and T. E. Podlesak, Chicago, Ill., and Morristown, N. J. App. filed Sept. 25, 1901. Supports the permanent magnets without perforations; adjustable generation period.

1,003,659. ELECTROPLATING OF WIRE-CLOTH; F. J. Root, New York, N. Y. App. filed June 2, 1911. A strip is passed in and out of the plating tank over rollers.

1,003,673. ELECTRIC FUSE; J. A. Tornquist, Davenport, Ia. App. filed March 29, 1910. Inclosed strip.

1,003,676. ELECTROTHERAPEUTIC DEVICE; J. B. Wantz, Chicago, Ill. App. filed Oct. 21, 1909. Produces a combination of sinusoidal and alternating-current waves and also a so-called surging current.

1,003,677. PUSH-BUTTON SYSTEM FOR DESKS AND THE LIKE; B. L. Weaver and W. R. Miller, Middletown and Pennbrook, Pa. App. filed Dec. 17, 1910. Signal circuit buttons are carried by the sliding panel or shelf.

1,003,746. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed Jan. 28, 1909. A direct-current generator is mechanically driven by an induction motor, and supplies a storage battery and load circuit.

1,003,747. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed Dec. 10, 1908. Booster and storage-battery system.

1,003,789. CONTINUOUSLY OPERATING HIGH-TEMPERATURE RESISTANCE FURNACE; V. Popp and A. Minet, Paris, France. App. filed Jan. 16, 1911. A protecting wall extends around the tank inside of the granular resistor.

1,003,799. PROCESS FOR THE ELECTROLYTIC DEPOSIT OF METALS; A. Rodeck, Milan, Italy. App. filed June 6, 1911. The cathode and article both move.

1,003,817. BRUSH HOLDER FOR DYNAMO; C. H. Smoot, Chicago, Ill. App. filed Dec. 14, 1906. Double spring pressed and pivoted. For high-speed turbine work, etc.

1,003,829. ELECTRICAL SYSTEM OF DISTRIBUTION; E. Van Wagenen, New York, N. Y. App. filed July 12, 1909. A regulating dynamo controls the division of load between a storage apparatus and a main source of energy.

1,003,830. SEWING-MACHINE ATTACHMENT; D. Wald, O. C. Britsc and M. Taigman, New York, N. Y. App. filed March 8, 1911. D tachable motor and controller support.

1,003,839. INDUCTION MOTOR; J. R. Wiard, Lynn, Mass. App. fil May 10, 1909. Squirrel-cage type with high and low resistance mei bers on the rotor, which is automatically shifted after starting.

1,003,843. ROTATING COMMUTATOR; A. D. Williamson, Sheffiel England. App. filed Oct. 28, 1910. A divided ring surrounds tl commutator parts to overcome centrifugal force.

1,003,862. HIGH-SPEED TROLLEY; A. H. Armstrong, Schenectad N. Y. App. filed Sept. 3, 1908. The wheel carries resilient met contact blades and is rotated by a motor.

1,003,881. TROLLEY; F. Criest, Butler, Pa. App. filed April 14, 191 The wheel rotates and shifts laterally on a curved bearing pin.

1,003,882. ELECTRIC REGULATOR; S. Y. Culley, Covington, K App. filed Dec. 23, 1910. Resistance elements are cut into and o of mercury.

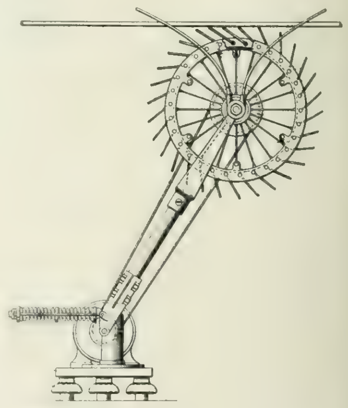
1,003,883. WATT-METER; C. R. D'Arcy, Wolston, Eng. App. fil Jan. 18, 1910. Alternating-current induction; potential and seri windings.

1,003,890. TROLLEY AND TROLLEY SUPPORT; C. E. Evelet Schenectady, N. Y. App. filed Aug. 21, 1908. The collector is swu up and down by fluid pressure controlled by slight movements of t arm.

1,003,902. THREE-POSITION SIGNAL; L. A. Hawkins, Schenectac N. Y. App. filed Nov. 7, 1908. A single magnet controls the mot for moving and holding the semaphore arm.

1,003,906. RESILIENT TROLLEY GUARD; J. P. Hopper, St. Lou Mo. App. filed April 26, 1911. The guard is slotted for the wh and supported by springs.

1,003,915. AUTOMATIC MOTOR STARTER; C. D. Knight, Schen



1,003,862.—High-Speed Trolley.

tady, N. Y. App. filed June 10, 1907. A plurality of switches connect the source with the motor through a transformer and t cut out the transformer.

1,003,919. DISTANCE-CONTROL SYSTEM; L. R. Krumm, Columl Ohio. App. filed Aug. 21, 1909. Two independent motors con the elevation and traverse of a searchlight.

1,003,923. METHOD OF MULTIPLE CONTROL; H. W. Leonard, N York, N. Y. App. filed Jan. 24, 1901. Commutator motors; tr control system, etc. Eighty-eight claims.

1,003,924. ELECTRICAL CONTROLLING MEANS; H. W. Leon Bronxville, N. Y. App. filed July 12, 1905. Alternating-current way system for gradual and wide range of speed control. Sixty-claims.

1,003,925. METHOD AND MEANS FOR CONTROL OF ELECT ENERGY, H. W. Leonard, Bronxville, N. Y. App. filed Dec 1905. Speed variation by voltage control, direct current; aims reduce size and cost of apparatus.

1,003,926. METHOD AND MEANS FOR CONTROLLING ELECT MOTORS; H. W. Leonard, Bronxville, N. Y. App. filed March 1906. Variable-speed control in direct-current systems, particul train motors. Eighty-eight claims.

1,003,927. MULTIPLE-CONTROL SYSTEM; H. W. Leonard, Br ville, N. Y. App. filed Jan. 24, 1910. Train system with t conductors. One hundred and eleven claims.

1,003,954. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. Feb. 3, 1910. Pendant with two push-buttons and oscilla

1,003,955. DYNAMO; L. E. Underwood, Lynn, Mass. App. filed 14, 1909. Arrangement of the field and connections for produci a output.

Electrical World

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THE INTERNATIONAL ELECTROTECHNICAL CONGRESS OF TURIN.

It is interesting and important to notice that the Turin Congress, which has just passed, has left a noteworthy historical position for its proceedings by establishing an effective plan for the convocation of similar congresses in the future. Hitherto such electrotechnical congresses have come into existence under the stimulus and opportunity of some international exhibition. Thus, each of the large world's fairs of the past twenty years has given rise to an electrical congress. In general, such an arrangement is most suitable, but there is always a tendency for electrical congresses to form in too rapid a sequence, and no machinery has been in existence for regulating their successive reappearances. Now, by the action of the Turin Congress, this important question has been relegated to the jurisdiction of the International Electrotechnical Commission, which, being a permanent international organization, enrolling nearly thirty different countries and all the important electrotechnical societies of the world, is especially qualified to decide where and when such congresses should be held, and so to arrange for their organization that they shall aid and foster the international work of the commission itself. In conformity with this excellent arrangement, the American Institute of Electrical Engineers has already invited the commission, through President Dunn, to authorize and support an International Electrotechnical Congress at San Francisco, in 1915, in conjunction with the Panama opening festivities and the San Francisco World's Fair. This invitation has been cordially accepted by the I. E. C., so that the road lies invitingly before the American committee of that body to organize and prepare for the San Francisco Congress.

The proceedings of the Turin Congress presented several noteworthy features from the technical point of view. In the first place, it is to be noted that the Turin organization committee bespoke in advance about thirty written "reports" upon specified topics of a highly practical nature, with the view to presenting, from the pens of various specialists in different countries, a summarized statement of the industrial status in these respective topics. This plan has certain advantages and certain disadvantages. The salient advantage is that the transactions of the Congress, when finally published, become historically valuable, as crystallizing the electrotechnical status in each industrial department at the date of the convention. The principal disadvantages are that the Congress is forced, from the start, into a stereotyped literary form, viewpoint and mode of thought. Moreover, although some of the reports thus invited have been most fortunate and excellent in quality, others have been somewhat bare and barren compilations, as though the authors selected had responded in a blind alley of thought. Had the communications presented to the

Congress been confined to the thirty-one set themes propounded by the organization committee, it is likely that the proceedings would have lacked spontaneity and partaken too much of categorical prescription. Fortunately, however, the committee invited the tender of papers at large outside of the list of rigidly practical topics, and forty-nine such papers were accepted and read, thus giving to the proceedings as a whole, not only a suitable dash of wholesome theory, to balance the set dishes of industrial practice, but also that indescribably valuable tinge of spontaneous variety which so characterizes the fields of modern applied science.

In view of the experience acquired in this valuable experiment of the Turin Congress, it is a question worth debating whether, in preparing for future congresses, their organizing committees might not advantageously restrict the number of set titles given out in advance to, say, a dozen, and make up the rest of the intellectual menu by inviting men well versed in as many directions of electrotechnics as possible to provide communications on topics of their own selection, with a view to securing not only a wide variety of topics, both theoretical and practical, but also a wide range of natural selection. It may be added that for the St. Louis Congress a plan somewhat along these lines was followed. A tentative list of authors and subjects was submitted to the chairman of each section for approval and revision, after which the invitations to authors were issued by the general secretary. The subjects were chosen to accord with the special knowledge of the one invited to contribute, who, however, was not limited to the precise topic suggested, and the form of papers was not specifically indicated. Whatever opinions may be held upon the Turin program, there can be no doubt that the plans of the organizing committee for carrying on and systematizing the work of the Congress in its various sections were excellently carried out, a boon for which the administrative staff, and particularly the secretaries, are to be held in praise.

Among the technical resolutions of the Congress, that on the unit of train acceleration in industrial traction is noteworthy, namely, the mile (or kilometer or verst) per hour per second. This unit, long championed by Mr. C. O. Mailloux, is amply capable of justifying itself from a practical standpoint, and is not likely to be superseded. From a strictly scientific point of view, this unit is not thoroughbred. It is a hybrid, involving two different units of time—the hour and the second. Theoretically, the meter per second per second would be a better fundamental unit, but practically such a unit would have no chance of being adopted. The difficulty in its path arises from our sexagesimal time, which is a miserable conglomeration, from the arithmetical standpoint, of 24 hours of 60 minutes of 60 seconds. Ten hours of 100 minutes of 100 seconds would have been far more easy to manipulate numerically, but no change in this ancient order of the day is likely to be inaugurated for generations to come, so that we must content our souls in patience with the continual differentiation between meters per day, meters per hour and meters per second. The human mind passes from the concept of dollars to cents by a path so easy as the shifting ... point in thought, but what intelligence is there among mortal that can jump in sixties with as little effort?

TEMPERATURE FLUCTUATIONS IN LAMP FILAMENTS.

Experimental observations indicate that the energy radiated from a body at one temperature to a body at a lower temperature varies directly as the difference between the fourth powers of the two temperatures measured from absolute zero. Throughout a limited range of temperature difference the transfer of energy is approximately proportional to the difference in temperature, so that the formula for expressing the rate of cooling of a body from a modera temperature elevation above its surroundings can safely be based on the assumption of a logarithmic decrement wi respect to time. This assumption is usually made wh dealing with the ventilation of dynamo-electric machine and transformers. Some very simple equations for repr senting the fluctuations in the temperature of incandescer lamp filaments can be derived on the basis of this assun tion, but the results obtained from such equations must quantitatively much modified to correspond with the fa on account of the relatively large difference in temperatu between the lamp filament and its surroundings. Howev qualitatively considered, the results are of considerable terest. In a recent issue of *Elektrotechnik und Maschinenb* there appeared an article by Mr. Fritz Kesselring show comparative results calculated for four different incand cent lamps. For the purpose intended the comparisons instructive, although the results should not be accepted quantitatively correct without experimental verificatio

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A REALLY HIGH VOLTAGE SYSTEM.

Even in these days a working voltage of 100,000 is s cient to mark an energy-transmission plant as decidedly of the ordinary. The experiences acquired at such treme pressure are somewhat different from those fam to the ordinary high-tension operator, and when one cou with this extreme voltage the difficulties which are enc tered in operating transmission lines over the mountair high altitudes and under ferocious stress of weather a dition is reached in which continuous operation is an e neering feat of no small importance. Such, howeve the situation in which the Central Colorado Power C pany, which has frequently been referred to in these umns, finds itself, and the account of its high-tension work elsewhere in this issue is of value to the engineering profession. The system, as our readers already kno a very extensive one with two great generating statio Shoshone and Boulder, each of approximately 10,000 and connections with several other plants of small size which can be used in time of emergency. The main t ns mission is at 100,000 volts at the power houses, over n rly 200 miles of high-tension system, the longest main trans sion being from Shoshone to Denver, 153½ miles. The line crosses the continental divide at three points, va ing in height from 12,000 ft. to 13,700 ft. above the sea and the weather conditions are, from all accounts, the most serious which are to be met by any high-tension syst in

this country, or probably in the world. In view of this fact the line structure is of particular interest. The standard support is a latticed steel tower rising 44 ft. above the ground on which the wires are supported by suspension insulators. The line wire is in the main No. 0 equivalent, six-stranded cable, laid over a hemp core. The spacing between wires is 10 ft. 4 in. and the middle point of the spans has a minimum clearance of 22 ft. The average span length is about 730 ft. It will be noted that the towers are not of extreme height, but that the liberal sag allowed permits of long spans, which are advantageous in minimizing the number of insulating supports. This line is one of the few in the country where the wind really rises to dangerous velocities, and some trouble has been experienced with swaying of the wires, producing short-circuits. In fact, at certain points where trouble has been extreme it has been found necessary to dead-end the line at each tower and then to guy the towers so that the conductors could be pulled up tauter than in the normal span and so relieved of the danger. At the worst spots the long spans themselves have been anchored by messenger cables stretched across the line and holding it in place by suspension insulators, the cables themselves being anchored into —.

As regards the general operation of the line, it is noticeable that high-tension switches are used in small numbers and with great caution. There are no automatic high-tension switches at all, and those which are manually controlled are only at the substations and the generating plants; moreover, the high-tension circuit is not opened while alive unless in extreme emergencies. In such lines the fewer switches the less temptation to play with them, and there is something to be said even for abandoning high-tension switching altogether. Thanks to good construction and effective insulators the system despite its high voltage seems to have had no more troubles than fall to the lot of many another operating at half the pressure. Lightning protection is carried out by the use of ground wires on part of the system and the installation at stations of electrolytic lightning arresters. These precautions seem to have been reasonably effective, for last July, in spite of lightning storms on fourteen days, there were but four cases of trouble on the high-tension lines. On a long high-voltage system like this the capacity of the line and the leakage and coronal losses are phenomena seriously to be reckoned with. The losses at no-load may and do rise to hundreds of kilowatts and the charging current is of a formidable size. Inductive load becomes a blessing, and in point of fact this long transmission line is worked very near to unity power-factor, with an average load-factor of 50 per cent. Aside from the matters pertaining strictly to the line, perhaps the most striking feature of the situation is the ingenious connection to the plant of the Denver Gas & Electric Light Company, one of the largest consumers on the system. The steam plant of this company is kept ready for operation in case of emergency and actually is operated regularly for part of the night load. A large bank of boilers is equipped with oil-burning apparatus, the particular fuel employed being water-gas tar from the gas department, kept in storage tanks and fed by a pipe line to the boiler-rooms under pressure. The pipe line has a core consisting of a ½-in. steam pipe through which live steam is passed in cold weather to prevent the oil from thickening. In case of need the whole bank of six boilers, kept hot by banked coal fires, can be given full heat from the oil burners in three minutes from a call to arms. Practice drills are suddenly sprung upon the operating staff once a week to keep them ready for action and the temporary interruption can thus be met without any material disturbance of service. The result of these precautions is very salutary, for while interruptions of service are actually few, the fear of them is put aside by the promptness with which the steam auxiliaries can be put into service.

DIRECT AND INDIRECT LIGHTING.

One of the very interesting papers at the convention of the Illuminating Engineering Society was that by Mr. J. R. Cravath on "The Effectiveness of Light as Influenced by Systems and Surroundings." This was in fact a comparison of the light required for reading ordinary print when that light was supplied by direct and indirect systems of illumination. It covered somewhat the same ground as a paper on a similar topic by Mr. Millar at the Boston convention of 1907, but the conclusions reached were radically different, and different, too, in ways so singular as to call for further investigation. Each series of experiments was carried out in somewhat similar fashion. A room of moderate dimensions was chosen and equipped both for direct and indirect illumination. Then a number of persons, supposedly without any interest in the results, were selected and individually required to determine the amount of light for comfortable reading. The illumination was then measured at the location of the paper read. In the experiments by Mr. Millar the observers were allowed to locate themselves wherever they saw fit in the room and read with the paper at the most comfortable angle. In Mr. Cravath's experiments each of the readers was placed in the same fixed position with the paper horizontal on the desk at which the reader sat. The chief further difference was that in Mr. Millar's test room the ceiling was a light buff in color and the walls white, while Mr. Cravath used ceiling and walls of smooth plaster very light cream in color, the room being considerably larger and somewhat lower than that employed in the earlier experiments.

The net result in Mr. Millar's experiments was 2.7 ft.-candles of direct illumination and 4.45 of indirect for comfortable reading. The smallest amount required by any one of the observers was 1.85 of direct illumination and 2.7 of indirect. In Mr. Cravath's experiments two illumination values were determined by each observer, one the minimum comfortable for steady reading and the second corresponding to the illumination considered ample for regular work. The latter condition corresponds practically to that in Mr. Millar's experiments with the difference that the test type used by Mr. Cravath was undoubtedly more easily read than that used by Mr. Millar. Comparing two distributions of indirect and of direct lighting, the average in ft.-candles required in the later experiments was 1.21 for indirect lighting and 1.34 for direct, the difference being, therefore, entirely

negligible, particularly in view of the very great differences between the results of individual observers in Mr. Cravath's tests, which differences were comparatively small in the earlier tests by Mr. Millar. A very interesting addition in the later experiments was the trial of direct illumination from an opaque shade hung just above the paper to be read, leaving the remainder of the room entirely dark. In this case the average estimate for ample reading light was 3.45 ft.-candles, more than two and one-half times the figure necessary with the ordinary direct or indirect systems.

In the analysis of these results Mr. Cravath judged the abnormal amount of light necessary for convenient reading in Mr. Millar's experiments to be due to the glare on the paper and in the eyes produced by the somewhat brilliantly illuminated walls, much more of the light in these experiments having reached the side walls directly than in his own tests. Both on general principles and from the statements in the earlier paper this opinion seems correct. The mere fact that in Mr. Millar's experiments 4.45 ft.-candles were required for easy reading is sufficient evidence of some decidedly adverse conditions operating on the eye, since from numerous tests, from school-house illumination for instance, as well as in offices and counting-rooms, it is perfectly clear that if the eye is given fair play it will work easily and up to its full efficiency on very much less light than this. To Mr. Cravath's experiments, on the other hand, one must take exception because of the enormous variations found between different individuals, and particularly on account of the very low illumination with which some experimenters were able to read with the utmost comfort by both systems of illumination. These facts indicate very plainly the existence of extremely large physiological or psychological differences either inherent in the individuals or accidentally interpolated in the experiments. For instance, there is every physiological reason for doubting whether 0.4 of a ft.-candle is ample reading illumination, even under the most favorable circumstances, for regular work, and this figure was reached by three of Mr. Cravath's experimenters. On the other hand, when using the desk shade two of his observers required in excess of 10 ft.-candles for reading ordinary type, showing again the existence of abnormal factors influencing these results.

The same differences with the same observers held for the establishment of the minimum illumination comfortable for steady reading. In this case the differences are ascribed, and in part no doubt correctly, by Mr. Cravath to differences of glare, which to a certain extent affects all brightly lighted surfaces. It seems likely, however, that the fixed position of the paper and the requirements that it should be read in a horizontal position may have influenced these results more than any of the external conditions of illumination. A mere difference in the height, sitting, of the various subjects and in the normal reading distance of their particular eyes would sufficiently influence the angle at which the type was read to change the conditions of glare in a very radical manner. Besides this, the data given for the various tests indicate pretty plainly very large psychological differences in what the subjects considered sufficient lighting, differences possibly complicated by uncorrected errors of vision. The less height and greater distance of the walls in Mr. Cravath's experiments undoubtedly reduced the general glare into the eye which, it seems likely, was responsible for the large figure in the previous investigation. It is interesting to observe that in the average the later results show that 1¼ ft.-candles to 1⅓ ft.-candles gives comfortable reading conditions where there is reasonable freedom from glare, an amount corresponding very well with the data of physiological optics. To sum up the results of these very useful investigations, they seem to show that efficiency in illumination by either system depends on the avoidance of specular reflection from paper and of strong extraneous light entering the eye from useless or unusual directions. With these conditions fulfilled there should be no material difference in ft.-candles required under any particular system of illumination, and Mr. Cravath's results, in which differences between individuals are enormously greater than those between systems, seem most effectively to enforce this conclusion.

THE MODE OF CONDUCTION IN GASES ILLUSTRATED BY THE BEHAVIOR OF ELECTRIC VACUUM VALVES.

An interesting paper appears in the July number of the *Philosophical Magazine*, by Dr. Oliver Lodge, and is couched in the characteristic literary style of that versatile writer. The paper relates to a particular type of electric valve. An electric valve may be defined as a conductor which permits electricity to pass through it more easily in one direction than in the other. At least three different types of electric valve are known, namely, (1) crystal rectifiers—so called—as used in wireless signaling; (2) electrolytic rectifiers, and (3) low-pressure gas tubes of the mercury-arc type. Dr. Lodge's paper describes a new form of valve of the third or low-pressure gas type, and curiously enough, the particular form he illustrates and describes is provided with a stop-cock mechanical valve of glass. His clear and simple method of describing the experiments made with this apparatus illuminates magically the whole process of electric conduction in solids and liquids, as well as in gases.

The idea suggested is that when a low-pressure gas conducting tube is subjected to a difference of electric potential the neutral gas-atoms are ionized at the anode or positive electrode; negative electrons enter the electrode from the atoms, which, then, being relatively bulky bodies move along at a leisurely gait of some kilometers per second toward the opposite electrode. As they are in no great hurry, they make no objections to going around corners or taking long paths. When they arrive at and near the cathode, or negative electrode, they help to produce a very powerful local gradient of potential at its surface. As soon as this potential gradient becomes steep enough and a certain critical value has to be exceeded, negative electrons are displaced from the cathode. Being extraordinarily small bodies—by belief 1/1700th of the mass of a hydrogen atom—these negative electrons are shot off from the cathode at a huge velocity, approximating that of light in air; but the total quantity of electricity they carry collectively is surprisingly small considering how much fuss they make and how much energy they contain at this velocity. The cathode stream of negative electrons

projected with high velocity, fly in bee lines perpendicularly away from the surface at which they are generated. The refuse to go in curves or to take devious paths, unless acted upon by electromagnetic forces.

According to the paper, when fast-flying minute negative electrons hit the leisurely and oppositely moving positive atoms, there may be occasional unions and neutralizations; but, as a rule, the collision does not result in a combination or neutralization. Nevertheless, a stream of positive atoms can be checked and arrested by the impact of negative electron fire. When in a relatively narrow alley, such as a long, straight tube, the negative projectiles are fired in the face of positive atoms, the advance of the latter is stopped and the electric flow is mainly stopped; that is, the tube has high resistance. But if a by-pass can be opened through a side door of the vacuum tube, through which the positive atoms can get around and reach the flank the cathode without encountering the rapid fire of cathode-stream maxims, the resistance of the tube will fall at once and the positive atoms can, in a certain sense, be seen to move along the by-pass and carry the current. The paper points out that within the substance of metals the minute negative corpuscles carry the electric current. In liquids and electrolytics both atoms shorn of electrons—that is, positive electrons as well as corpuscles or negative electrons—carry current, whereas in gases it is mainly the positives that do the conducting.

THE ILLUMINATING ENGINEERING SOCIETY CONVENTION.

At the recent convention of the Illuminating Engineering Society in Chicago one of the things not down on the program which came in for a share of discussion was the degree of success attained by the society in the broad field which it started out to cover by soliciting the co-operation of those directly engaged not only in illumination designs and installations but also in many other closely allied lines. Some criticisms have been made of the society "from within" recently to the effect that architects have not been induced to take as active a part in its affairs as had been hoped. Another criticism is to the effect that the *Transactions* of the society do not contain sufficient "ready to apply" information put up in neat packages ready to distribute to salesmen and non-technical men generally. Both of these criticisms seem to have been well answered. As to the architects, it is well known that it has been the constant effort of the society and its members to engage their interest, and while it is true that the membership roll includes a comparatively small number of architects, it is also true that there is an increasing respect for the work done by the organization among architects and that they are looking more and more to members of the organization for advice. It is hardly to be expected that architects will take active part in all the organizations of the numerous branches of engineering which go into the construction of modern buildings. There is still much to be done in the way of drawing the attention of architects to the necessity for studying illumination plans, but conditions are far better than they were five years ago. As to the criticism that the information obtainable from the *Transactions* is not of sufficiently popular character, it would seem that such reflections are really a tacit admission on the part of the critic that he is unable or unwilling to translate into practical and popular language the many useful and instructive things which appear in that publication.

A significant indication of the progress in illuminating appliances during the last five years was the session devoted to illuminating glassware. While this session was not particularly productive of fresh information on the subject, the very fact that enough new kinds of glassware have been brought out during the past five years to make possible several papers dealing with different varieties indicates the progress that has been made. Two papers took up questions relating to the methods of rating the commercial performance of illuminants. One of these suggested a new method of rating the useful life of incandescent lamps and the other called attention to the many diverse factors which enter into the total cost and useful performance of any artificial illuminants. It is well that we revise our ideas from time to time on these subjects, as some elements formerly not considered are found to enter into costs and life values. Perhaps the two most general tendencies noticeable in the papers and discussions were an increasing interest in daylight and an increasing emphasis on the importance of diffusion and of general as against localized and unidirectional illumination. Since daylight is recognized as having many qualities which are frequently lacking in artificial lighting as at present carried out, a scientific study of the exact characteristics of daylight which give it its superior qualities is desirable. The beginning of such a study and the announcement of some of the results was the subject of one paper.

On the subject of providing more general and diffuse illumination in ordinary practice two speakers called attention to the increasing tendency to provide more general illumination and do away with methods of lighting by individual lamps close to the work alone. The longest discussion of the convention took place over a paper in which the questions of diffused versus direct light for desk work and reading were involved. While the tests reported in the paper were inconclusive on many of the finer points, they indicated decisively the importance of giving more attention to the quality or diffusion of light on the work than has frequently been done in the past. Incidentally, the discussion of this paper naturally drifted into a controversy over the merits of direct and indirect lighting methods, and the interest excited fully demonstrated the truth of an editorial statement in these columns recently that it is necessary merely to bring up the question of direct versus indirect lighting to arouse a lively discussion at any gathering of illuminating engineers. One of the points brought out in this paper and discussion is that the factor of glare from paper under some conditions is so obtrusive and annoying that one can afford to go to much pains to get rid of it by proper diffusion. It is quite possible that in the near future specifications for satisfactory illumination will not only call for a certain value in illumination as measured on a horizontal plane, but will also include the illumination as measured in three or four inclined or vertical planes intersecting the same point, in order to determine whether the preponderance of illumination from one direction is so great that it is likely to cause trouble by glare from the work.

Convention of American Electric Railway Association.

The thirtieth annual convention of the American Electric Railway Association will be held at Atlantic City, N. J., on Oct. 10-13. Meetings will be held by the parent association and the affiliated Accountants', Engineering, Claim Agents' and Transportation & Traffic associations. Forty-six committees of the various associations have considered subjects relating to electric railways during the year and will present formal reports at the meetings. The sessions of the Engineering Association will start on Oct. 10 and meetings will be held each day until Oct. 13, when the concluding session will take place.

The committee reports to be received by this association will be on the following subjects: Education of engineering apprentices, power distribution, heavy electric traction, block signals for electric railways, engineering accounting, power generation, buildings and structures, way matters, equipment, rules of procedure for the committee of standards, and standards. Two of the reports in the foregoing list will be considered jointly with other associations.

It is expected that the attendance will be the largest that the association or its predecessors have had in any year. A large exhibit will be made by manufacturers on Young's Million-Dollar Pier.

An Anglo-American Electrical Gathering.

A notable gathering of electrical men attended a dinner given by Mr. Samuel Insull, of Chicago, at Delmonico's uptown restaurant in New York on the evening of Sept. 28, with Mr. S. Z. de Ferranti, president of the (British) Institution of Electrical Engineers, as the guest of honor. Other English guests were Mr. Charles H. Merz, consulting engineer, of London and Newcastle; Mr. Arthur Wright, of London, inventor of the Wright demand meter; Mr. J. R. Raven, mechanical engineer of the North Eastern Railway, of England; Mr. R. Thompson, assistant mechanical engineer, North Eastern Railway, and Mr. H. A. Couves, of Newcastle, assistant to Mr. Merz. To meet these visitors Mr. Insull invited a number of American electrical men. In all there were forty-seven gentlemen present. Mr. Thomas A. Edison, who would no doubt have honored the occasion with his presence if he had been in this country, is in Europe, and Mr. C. A. Coffin, president of the General Electric Company, arrived from a trip abroad on the very day the dinner was given and too late to attend.

Mr. de Ferranti was seated at Mr. Insull's right and Mr. Merz was at Mr. Insull's left. In an introductory speech Mr. Insull, himself an Englishman by birth, said that it gave him great pleasure to be the means of bringing together some distinguished countrymen of his and some of the leading electrical men of the United States. In speaking of Mr. de Ferranti Mr. Insull gave that gentleman credit for being the first man to mass the production of electricity, generating energy at high potential at a place where it could be produced cheaply and transmitting it to the area of supply. Mr. Wright was referred to by Mr. Insull as the "man who taught us how to sell electricity," for the Wright demand system is the basis of practically all methods of charging for electrical energy at the present day. Mr. Merz was spoken of as a man who has done wonders in the wholesaling of electrical energy, referring, of course, to the notable achievement in the Newcastle area in England.

In responding Mr. de Ferranti spoke on the subject of possible future reductions in the cost of producing electrical energy. The speaker predicted that in the future electricity would be the agent used for supplying energy needed for all purposes. Mr. Vanderlip, president of the National City Bank of New York, spoke on the financial aspects of the electrical industry, and Dr. Steinmetz paid a glowing tribute to the early work of Mr. de Ferranti in the generation of alternating current at high potentials and its transmission and distribution.

The dinner was held in the large banqueting hall at Delmonico's and was elegant in all of its appointments. The table was arranged in the shape of an ellipse and the center was a great mass of flowers and ferns. The wall decorations included American and British flags, and during the dinner there was instrumental music. A reception preceded the dinner, and at its close the gentlemen present extended their best wishes to the departing Englishmen, who sailed on the *Mauretania* this week.

Among the guests were officers of the leading electrical corporations of the country, financial, manufacturing and operating, and representatives of the engineering profession, including Messrs. F. B. Sprague, C. P. Steinmetz, F. Sargent, C. G. Curtis, H. G. Stott, W. L. R. Emmet, J. W. Howell, M. I. Pupin, C. F. Scott, D. C. Jackson and F. B. Crocker. The electrical press was represented by Messrs. James H. McGraw and Charles W. Price.

Milwaukee Company Section of N. E. L. A.

A successful meeting of the newly organized compan section of the National Electric Light Association in Mil waukee—the Milwaukee Electric Railway & Light Com pany Section—was held in the Public Service Building o the evening of Sept. 26. The attendance was 115, and M O. M. Rau, the president, was in the chair. The othe officers are: Vice-president, Mr. George G. Post; secre tary, Mr. F. A. Boehm; directors, Messrs. C. N. Duff James D. Mortimer, E. Douglas and R. H. Pinkley. M Rau, the first president of the section, delivered an in augural address, in which he pointed out the advantages o organized co-operation among the employees of the com pany. He made a plea for good fellowship, so that all em ployees will be not only co-workers, but friends. Furthe more, every member, as a result of the meetings, shou have a general knowledge of the work done in every depa ment of the company. A "question box" and a "suggesti box" were advocated, as well as a strong effort to bri about social and entertainment features.

Mr. T. C. Martin, secretary of the N. E. L. A., was pre ent and he felicitated the section on its promising beg ning. He told of his Pacific Coast trip and of havi addressed the British Columbia section in Vancouver a of assisting in organizing sections in Portland (Ore.), S attle, Spokane and a Twin City section in Minneapolis a St. Paul. He attended the convention of the Northw Electric Light & Power Association, which voted to affili with the National Electric Light Association, which l now more than 10,000 members and is the largest engine ing or semi-engineering society in the Western Hemisphe The work of the N. E. L. A. is largely educational in ch acter and the advancement of the section idea is perh the most important feature of that work. Usually e central station stands alone in its own community. To new ideas men must go outside their own districts. this purpose the N. E. L. A., with its various sections committees, is almost indispensable. A man must grow he is to stay in the business and his company section affo him a valuable opportunity. Mr. Martin concluded by tending the greetings of President John F. Gilchrist, of national association.

Mr. Rau then called on Mr. Post to read a communica from Mr. J. D. Mortimer, the vice-president of the Mil waukee Electric Railway & Light Company, who expre in sympathetic language the sincere interest of the comp in the formation of the section as a measure tendin to advance the mutual interests of employer and emplo e. The technical program of the evening consisted of the r ding of a valuable paper by Messrs. O. M. Rau and C

ost on "Our Electric System." The paper was illustrated lantern slides and was an excellent condensed description of the electrical generation, transmission and distribution of the Milwaukee Electric Railway & Light Company.

Edison in Hungary and Moravia.

Etienne de Fodor, general manager of the Budapest General Electric Company, entertained as guests Mr. and Mrs. Thomas A. Edison and party during their sojourn in Hungary and Moravia. Mr. Edison's party included his children, Madeline, Charles and Theodore Edison, and Major and Mrs. Oeser. Mrs. Oeser is a daughter of Mr. Edison by his first wife, her husband being an officer in the German army. Mr. Valentine, a special correspondent of the New York *World*, also accompanied the party.

Mr. de Fodor met the Edison party in Vienna on Sept. 9 and 10, and while there induced Mr. Edison to change his

Etienne de Fodor Mr. Alexander von Stromszky Mr. Thomas A. Edison. Mr. Francis Jehl.
Mr. Edison in Hungary.

and take a look at the Hungarian capital, where the guests arrived on Monday, Sept. 11. They were received at the railroad station by Mr. Francis Jehl, an old Menlo Park assistant of Mr. Edison, and many representatives of the press. The party were then conducted in Mr. de Fodor's automobiles to the Grand Hotel Hungaria, where a large crowd had already gathered who heartily cheered Mr. Edison. They were then escorted by Mr. de Fodor to the "state rooms," usually used only by royalty and persons of distinction, which he had reserved and placed at their disposal. Later in the day Messrs. de Fodor and Jehl conducted the party in automobiles around the city, showing them everything of special importance, including the royal palace, which interested Mrs. Edison very much, while Mr. Edison calculated the interest on the money invested and lost every year in keeping it up. Returning to the hotel about 7 o'clock, the party took a stroll on the "Corso" by the Danube, from which the beautiful position of Budapest can be best appreciated. Suddenly Mr. Edison was recognized by some one, and shortly a crowd accumulated that completely blockaded the promenade. Numerous reporters asked for an interview, with which request he complied upon condition that they would come with him to the hotel.

About 8:30 the guests were conducted by Mr. de Fodor into the "grand salle" to a banquet in their honor. The company was a brilliant gathering of Hungary's distinguished men, among whom were Count Khuen-Hédervåry, the present minister-president of Hungary; Koloman von Szell, former minister-president; Frank von Kossuth, the son of the great Kossuth; former minister Count Albert Apponyi and wife; Albert von Berzeviczy, the president of the Parliament; Professors Carl Zipernowszky, Söpkesz, and Ilosvay, Privy Councilors Alexander von Stromszky and Michael Kajlinger; Mr. Nash, the United States Consul-General; Mr. and Mrs. Mead, of Boston, and leading Hungarian editors. The banquet lasted nearly to midnight, and as the party started to leave the band struck up "The Star-Spangled Banner."

On the morning of Sept. 12 the Edison party made preparations for departure for Pressburg, leaving Budapest about 10:30. The streets before the hotel were so crowded that a large force of mounted police was on duty to keep order, and reporters and cameras abounded. When Mr. and Mrs. Edison appeared at the entrance of the hotel to step into their Daimler car, which had come up during the night from Vienna, the crowd cheered with such enthusiasm that the applause was heard on the other side of the Danube and it was remarked by many that such a reception had not been given to a foreigner for years. Messrs. de Fodor and Jehl took seats in the Edison automobile, while the rest of the party, including Major and Mrs. Oeser, Messrs. von Stromszky and Valentine, went into a Protos car that was placed at the disposal of the Edison party as long as they were in Hungary and Moravia by Mr. A. von Stromszky, the general manager of the Siemens-Schuckert Works. All along the route people cheered Edison as he passed. Unfortunately when automobiles reached the other side of the Danube embankment, opposite the Hungarian Parliament Buildings, the Edison car showed a defect in its differential gearing and could not be restarted. Mr. de Fodor then transferred Mr. and Mrs. Edison, Madeline and Theodore Edison into the Protos automobile and started on the journey for Pressburg across the Hungarian plains, while Major Oeser and Messrs. von Stromszky, Valentine and Jehl remained behind to take the afternoon train for Pressburg, in the meanwhile making arrangements to have the Edison car repaired in Budapest. A Daimler car was found at a garage, its differential taken out and mounted in the Edison machine, so that by 8 o'clock in the evening the Edison automobile, with an engineer of the Budapest General Electric Company acting as pilot, started for Pressburg, where it arrived about 4 o'clock in the morning. Those who went to Pressburg by train reached that place just about an hour later than the Edison party.

Mr. Charles Edison left the party in Budapest in order to take the 3 o'clock train for Hamburg, from where he sailed on the steamship *Kaiserin Auguste Victoria* for New York, so as to be in time for the continuation of his studies in college, while Mr. and Mrs. Edison and the rest

of the family were to sail from Hamburg on Sept. 28 on the [illegible].

Pressburg, it may be mentioned, is Mr. de Fodor's native town, and as the telegraph had announced that he was coming on with Mr. Edison and party they received an enthusiastic welcome. At the Hotel Savoy, upon whose roof "Old Glory" was fluttering, Mr. de Fodor had engaged a suite of rooms which he put at the disposal of Mr. Edison and his party. After a short rest the guests were taken around the city and shown all places of interest, chief among which were the old castle and the building where Napoleon signed a treaty of peace. In the evening dinner was taken in the garden terrace of the Savoy Hotel, where Mr. de Fodor introduced Mr. Edison to all the dignitaries of the city and to many old friends.

In the morning on Sept. 13 the party left Pressburg amid the cheers of its citizens, who had flocked to see Mr. Edison, while Mr. Palugyai and some members of the local automobile club led the way with their cars. In Pressburg Mr. van Stromszky said good-by to Mr. and Mrs. Edison and the others and was thanked for his kindness in putting the Protos car at their disposal.

After the pilot friends had left, Mr. Edison's automobile containing his family and Mr. Jehl, took the lead and started on its journey through the remaining part of Hungary and then entered Austria and Moravia, being followed by Mr. de Fodor's car containing Major and Mrs. Oeser and Mr. Valentine, the representative of the New York *World*.

Lunch was taken at Nickolsburg, and Brünn was reached about 3 o'clock in the afternoon. As Mr. and Mrs. Edison were not tired, they proposed to tour the city first and then go to the hotel. Mr. Edison was impressed when he saw the theater, for it was the first theater in the world that was completely lighted by the Edison system and in which there never was a gas jet. The theater was built in 1881 and finished in 1882, the work of installing it with the Edison system being intrusted at the time to Messrs. Francis Jehl and Etienne de Fodor, who were Mr. Edison's pioneers in Europe.

Arriving at the Grand Hotel, where a large crowd was awaiting Mr. Edison and where he was cheered most cordially, the party was led to the suite of rooms that Mr. de Fodor had engaged for them some days before and which is reserved for persons of distinction. Mr. Edison then retired for a nap, while Mrs. Edison and the children with Mr. Jehl had tea. During this time Mr. de Fodor was busying himself with all the arrangements for the farewell dinner which was served about 8:30 in the evening in the large dining-room of the hotel. Several generals and other high officers, together with the Mayor and Vice-mayor of Brünn, were present, and all requested Mr. Edison for his signature.

In the morning about 8 o'clock the street before the hotel was beginning to get blocked with people, so that it was necessary to call for a squad of police to keep order. At about 9 o'clock Mr. Edison and his party descended and were met with a shower of flowers and stirring cheers—"Hoch! Hoch! Hoch!"—at which Mr. Edison bowed and saluted. Then the Edison family got into their car, while the Major and his wife took seats in an automobile that the New York *World* had placed at the disposal of its correspondent, Mr. Valentine, and which had come up from Vienna the previous day.

Mr. de Fodor and Mr. Jehl took the lead in the Protos car and escorted the party out of the city to the Iglau road that leads to Prague. Here a short halt was made, here the last handshakes were given and sincere wishes exchanged, and then with uncovered heads Messrs. de Fodor and Jehl watched the automobiles containing Mr. Edison and his party pass onward, standing still until they had disappeared in the distance, returning then to their motor and starting for Budapest.

Proposed Extension of Cleveland Municipal Lightin[g] Plant.

The proposition to issue $2,000,000 bonds for the e[x]tension and improvement of the municipal lighting plant [in] Cleveland, Ohio, has been thrown into the political are[na] and is being buffeted about on all sides. Mr. Newton [D.] Baker, who has been spoken of as the natural and logic[al] successor of the late Tom L. Johnson and who is the cand[i]date for mayor on the Democratic ticket, has made the bo[nd] issue a plank in his platform. Director of Public Servi[ce] Lea is in favor of a municipal plant, but opposes the bo[nd] issue. He desires that the plant be allowed to grow fro[m] its regular earnings and is, therefore, opposing Mr. Bake[r's] arguments. He stated that he had asked Mr. Samuel Scov[il,] vice-president and general manager of the Cleveland Ele[c]tric Illuminating Company, if he would consider the sa[le] of the company's property to the city and received [an] affirmative reply. In reply, Mr. Baker asserted that [a] company paying 20 per cent dividends to its stockhold[ers] would not give up so easily as that and that he was not [at] all impressed with the statement. On a direct question fr[om] Mr. Baker, Mr. Lea said he was in favor of submitti[ng] to the people the question of buying the company's plant.

To support his contention Mr. Lea has prepared figu[res] showing the income and expenses of the municipal pl[ant] in 1910, as follows: Total revenue, $93,962.52; total c[ost] of maintenance, $64,370.81; adjustment of invento[ry,] $435.37; insurance, $117.90; depreciation (7½ per cent [on] $305,150.66), $22,885; taxes (on 33⅓ per cent of val[ua]tion at 3.48 per cent), $3,539.74; interest on bonded d[ebt] of $30,000 at 5 per cent, $1,500. This brings the total to $92,850.12 and leaves revenue over expenses of $1,112.

Deputy City Auditor Zimmerman estimates that the pr[op]erty is worth $310,905.86, as land does not depreciate [in] value. He says he would figure depreciation at 5 per c[ent] on buildings and 10 per cent on the other parts of [the] plant. This, he says, would bring the total depreciation to about $28,000. On the other hand he says the city [re]ceives only $10 per $1,000 taxes and that, therefore, [the] charge for taxes ought to be a little over $1,200 inst[ead] of $3,500.

Vice-President Scovil, of the Cleveland Electric Illu[mi]nating Company, asserts that the interest charge is [in]sufficient to cover the actual cost. Interest, he says, sh[ould] be charged against the entire investment of $360,000 in [the] plant. This figured at even 4 or 5 per cent would wipe [out] the profit of $1,112 on the business and leave someth[ing] over, but the charge should be at the rate of 6 per c[ent,] which would amount to over $21,000. He disagrees [with] Mr. Zimmerman on the matter of taxes, in that the p[lant] has nothing to do with the distribution, but only on [the] amount that must be paid.

Mr. Scovil then pointed out that there had been no ch[arge] made for any part of the salaries paid to the emplo[yes] of the offices of the city auditor, water works, purcha[sing] agent and director of public service, in all of which [work] on the municipal lighting plant is being done. Mr. [Zim]merman said he thought there should be an interest ch[arge] of 6 per cent on the investment of $310,000 and that [the] plant should stand some part of the salaries of those [who] have its business in charge.

The Electric Vehicle.

A meeting of the New England Section of the Ele[ctric] Vehicle Association of America was held at the E[dison] Building, Boston, Friday evening, Sept. 22, at which [Mr.] Day Baker reported for the parking committee tha[t the] authorities had given their consent to vehicle owne[rs to] leave their cars on certain convenient streets in the [city]

for indefinite periods, which is a considerable extension of privileges hitherto accorded.

Mr. Stephen G. Thompson, of the Public Service Electric Company, of Newark, N. J., was the speaker of the evening. He said that his company had spent some $50,000 in its vehicle department and that it was prosecuting a campaign of publicity which promises large results. He predicted an annual demand of 300,000 electric vehicles for the near future and stated that orders taken thus far this year exceeded those of the whole of 1910. "Merchants are studying transportation costs as never before," he said, "and the problem is up to the users what means shall be employed." He recognized the fact that custom and a certain amount of prejudice have to be combated and urged that the best methods of sale be employed.

Mr. Thompson believed that the electric commercial vehicle has as its best field the work of department stores, where the package is the unit and the delivery is in urban and suburban limits. The economic zone of these electric vehicles is, he considers, to be in a radius of about 17 miles from the base of operation. Beyond this the local express companies can handle goods to better advantage, distributing them from various centers. In many cases one machine will replace two horse vehicles. A leading department store saved $16,500 on an operating cost of $48,000. In Boston, where about 25,000 tons of heavy freight are handled daily, a concern using electric trucks saved a sum on its own operation that would equal if applied to all trucking in the city a sum of over $1,250,000 annually.

A table showing a typical department-store route of 11.3 miles, with fifty stops, showed 96¾ minutes running time, while 87¼ minutes was required for the delivery of the packages at the houses. The average speed, including stops, was 3.7 miles per hour, and exclusive of stops 7 miles per hour, the route being through congested streets. The cost of operating 1-ton and 5-ton trucks, as reckoned from figures of averages taken in a large installation, gave the apportionment of costs of the various items as follows:

ANNUAL COST OF ELECTRIC VEHICLES.

	One-Ton.	Five-Ton.
[illegible]		
[illegible]	3.4 per cent	3.7 per cent
[illegible]	11.3	12.8
[illegible]	4.3	[illegible]
[illegible]	4.2	3.5
	23.2 per cent	23.3 per cent
Maintenance:		
Tires	6.4 per cent	17.9 per cent
Batteries	10.8	14.0
[illegible]	8.5	7.6
Lubrication	0.2	0.2
	25.9 per cent	39.7 per cent
[illegible]	43.4 per cent	28.0 per cent
Energy for charging	7.5	9.0
	50.9 per cent	37.0 per cent

Mr. Thompson advocated co-operation between central-station managements and vehicle manufacturers and said that the attitude of the former should be unbiased as to any particular make of car, but rather they should advocate the interests of the electric vehicle generally. The sale of every car, of whatever successful type, makes subsequent sales easier. The development of the business represents an income of some $75 per car annually to the central station for every new car brought into use.

Asked if he considered it best for lighting companies to take the agency, Mr. Thompson said it is well for them to act as agents for two or three makes of cars, giving the customer a range of selection.

In the discussion that followed Mr. S. F. Smith, manager of the Salem Electric Lighting Company, said more literature should be available and the manufacturers should make greater efforts for business in the smaller cities. His company is putting in charging stations, which will be ready soon.

Mr. Willis M. Thayer, of the Hartford Electric Light Company, reported the status of the business in his city, where one grocer has five trucks. He finds the cost of electricity and repairs is from 1 6/10 cents to 2 cents per mile. His company furnishes battery service at a contract price for the year.

Mr. Fred. H. Smith, manager of the Worcester Electric Light Company, said he was neutral in his attitude toward manufacturers, but was willing to co-operate with all, and urged manufacturers to be active in Worcester. Mr. J. Walter Emery, of the Walker Vehicle Company, suggested that central stations have an inspection service and examine and keep cars in order by the year.

Col. E. R. Bailey believed the average speed of gasoline cars is under 20 miles per hour and that electric cars can average as high a speed. The latter have great advantage in congested streets. Prof. D. C. Jackson, of the Massachusetts Institute of Technology, stated that the institute is compiling data to show the comparative results of horse, gas and electric-vehicle transportation.

Mr. Mansfield reported that the committee on standardization of equipment is endeavoring to secure the adoption of a uniform charging plug for all makes of electric cars. Mr. K. L. Curtis, of the A. & J. M. Anderson Manufacturing Company, exhibited a universal plug which that company has made, which it is hoped will be acceptable to underwriters and lighting commissions. The apparatus meets the requirements of the New York authorities.

ELECTRIC VEHICLE CLUB.

At the first fall meeting of the Electric Vehicle Club of Boston, held on Sept. 13, the committee on charging stations reported that the Lawrence Gas Light Company had opened a new charging station in that city. Mr. March reported that two booklets are being prepared to send to prospective customers for electric vehicles, demonstrating their superiority to gas cars and trucks.

At the club's meeting and luncheon of Sept. 20 were considered in detail the plans under way for the 1912 Boston electric show, to be held Sept. 28 to Oct. 26 of next year. It was suggested that a model garage be established in the basement of the exhibition building, where the operations of charging and caring for vehicles would be conducted as an example to the public, as well as for the accommodation of electric-vehicle owners. Seventeen electric-vehicle manufacturers are represented in Boston, and it is hoped that all will exhibit at the show. Conventions will be held in Paul Revere Hall, in the exhibition building, at which various phases of electrical topics will be treated by experts. The show is expected to be the largest electrical exposition ever held. Floor space to the amount of 110,000 sq. ft. will be available for exhibits. The Boston Edison company, under whose auspices the show is to be held, does not expect to make a profit from the exposition, but is undertaking it with a view to the promotion of the electrical industry and to familiarize the public with the possibilities and economy of electric service. The Edison company will charge only 3 cents per kw-hour for energy used by the exhibitors. It is the plan of the management to allot the central space in the main floor of the building to electric-vehicle exhibitors. The whole section embraces about 12,000 ft. of exhibiting space.

The committee on charging stations reported that the Salem Electric Light Company had put in charging sets to accommodate twelve to sixteen vehicles and at Waltham the McGregor garage had also installed apparatus. The Waltham Dial Company is also prepared to perform the service. A set of lantern slides, showing various types of electric trucks and cars, is being prepared for use in the electrically operated stereopticon which is used by the Edison company to demonstrate electric developments to the public.

Convention of New England N. E. L. A. Section.

The fall convention of the New England Section of the National Electric Light Association was held last week at the Mount Washington, Bretton Woods, N. H. The session opened with an informal reception and dance on Wednesday evening, Sept. 27, about 200 having arrived, mostly by morning train from Boston, to which special parlor cars were attached for members and guests. A considerable number came by automobiles.

The session on Thursday morning was given over to reports and a paper on "Synchronous Condensers," by Mr. C. T. Mosman, of Boston.

SYNCHRONOUS CONDENSERS.

In outlining the operating characteristics of the over-excited synchronous motor as a condenser, the author applied the theoretical considerations to practical problems to show the conditions under which it is advantageous to install synchronous condensers for improving the operating conditions. The author stated that if in an existing plant the prime movers are running underloaded while the generators are loaded, or the raising of the power-factor by a reasonable amount will allow the shutting down of the generator unit, or the generator field coils are overheated, or the exciting system is not able to deliver sufficient voltage to maintain the generator voltage, or the wire and cables are overloaded on some feeders due to low power-factor, then the installation of synchronous motors or synchronous condensers on the feeders should be considered. Attention was called to the use of synchronous condensers by the Utica Gas & Electric Company, the Taunton municipal plant, the Attleboro Steam & Electric Company and the Hartford Electric Lighting Company.

After an early luncheon most of the company, including ladies, made the trip by cog-wheel railroad to the summit of Mount Washington. The atmospheric conditions were perfect and the view from the summit was all that one could ask, though the prevailing gale and a temperature of 22 deg. made the short stay somewhat trying. The five cars, each attended by its tiny, tip-tilted locomotive, then conveyed the party to the base, whence a combined train carried them back to Bretton Woods.

The banquet in the evening was a star feature of the convention. President Howard T. Sands introduced the speakers, Gov. Robert P. Bass. of New Hampshire, and Secretary T. Commerford Martin, of the National Electric Light Association. The latter had come by the fastest means available, from Chicago.

In introducing Governor Bass, Mr. Sands referred to his having been the leader in the fight for public-service regulation in New Hampshire.

REGULATION OF PUBLIC UTILITIES.

Governor Bass said that the people of the State had come to realize that uncontrolled monopolies are a menace to the public. "We ought to have real and not a semblance of regulation," he said. "Massachusetts led in providing limited regulation through its gas and electric light commission. By this means it protects the public without assuming absolute power." He declared that such regulation had resulted in placing the securities of lighting companies on a higher plane. He believed a commission ought to go to the length of having power to compel companies to comply with its decisions. He cited Wisconsin as the state having the most comprehensive regulation. New York, "under the compulsion of Governor Hughes," adopted a regulative tribunal. Connecticut, Vermont and, just recently, New Hampshire have provided commissions of regulation.

Governor Bass held that a commission's powers should secure to the public adequate service—that adapted to the needs of the community and the safety of employees.

An electric-lighting company should be relied upon to furnish good service because it pays to do so. The public is most interested in a low rate and often cannot discern the relation between the quality and price of service of this character. The rate ought to be high enough to secure good service and allow a fair return on the investment. "So long as electricity is sold at 2 cents for motor service and 15 cents for lighting some confusion is bound to arise in the public mind," the Governor declared.

Furthermore, the public ought to see to it that stock in such corporations is not watered. There should be close public regulation of stock issues. Such a rule should be acceptable to good business men, if not to promoters.

A commission ought further to protect the small consumer from the compulsion of helping to pay for the energy supplied to the large consumer. He recognized the advantages of a single company serving a given field and believed that to do its work effectively such a corporation should be protected from crippling competition.

New Hampshire, said Governor Bass, now has carefully drawn laws to safeguard both the consumer and the investor. Its public service commission is composed of able, fair-minded men. The State asks for the co-operation of public service companies with the new commission.

The next speaker was Mr. T. Commerford Martin, to whom the chairman happily referred as "the father of the association, to whom we all turn for advice and help in time of need." Mr. Martin said that there should be no objection to fair regulation, "but there are metes and bounds." The demand for regulation recently reached the proposal to give local authorities control of public utilities in the State of Oregon, but fortunately the scheme failed. In St. Louis the local public service commission scaled down the valuation of property bought by the city over $4,000,000. "Heaven save us from such regulation as that!" Mr. Martin exclaimed.

A recent visit to the Pacific Coast had shown the speaker that the training received by central-station men in New England was effective in placing them in prominent positions elsewhere. He brought an invitation from the Pacific Coast associations to meet with them in convention in Seattle, Wash., in June of next year.

Engineering methods, said Mr. Martin, are making rapid changes in our social and industrial relationships. A few years ago the mechanical problems were uppermost. To-day the concern of electrical men is more in the direction of government, the public and also the employee.

At the conclusion of the exercises President Sands said he felt sure Governor Bass would receive the co-operation of central-station owners and managements and called for three cheers for the Governor, which were given heartily.

The technical session of Friday morning opened at 9:30. At this time a driving snowstorm outdoors gave the landscape the aspect of Christmas. Mr. W. H. Vorce, of the Vermont Power & Manufacturing Company, of St. Albans, Vt., read a paper on "The Development and Application of Electricity for Domestic Uses."

ELECTRICITY FOR DOMESTIC USES.

After outlining the history of the development of electrical devices in general and heating devices in particular, the author called attention to the fact that the increasing difficulty of obtaining satisfactory servants has gradually created a demand for electric cooking devices, which seems to afford one of the most practical solutions of the domestic problem. Many central-station managers have profited by, and are continuing to reap the benefits of, this service, which it has been possible to render at a comparatively small outlay and with only a slight increase in operating expenses. The present cost of electric heating devices is not prohibitive and when intelligently directed the outlay for energy need not be great, being hardly more than for gas at average prices. However, the chief attraction of electric devices lies in the fact that they make cooking really clean, [illegible] and comfortable and so dainty that practically all of

the processes may be carried on in a dining-room. This pre-eminent feature is particularly appreciated by the householder who is obliged to prepare all of the meals herself, since the food can be served on the table with the least possible effort. With the present standard outfits that are now being offered by some of the manufacturers it is quite possible to produce results that cannot even be approached by any other method. After the necessary ingredients have been combind in the proper manner, the cooking itself is actually determined by a clock and is no longer a matter of guesswork or uncertainty.

The author described briefly some results obtained with an ordinary commercial fireless cooker having three compartments, the center one, 12 in. in diameter and 14 in. deep, being the only one equipped with an electrical heating element. Tests showed that with an input of approximately 100 watts it is possible to produce and maintain a temperature of about 400 deg. Fahr., which proved to be sufficient for ordinary roasting or baking. With this outfit, a toaster and 6-in. stove all of the cooking for a family of four was successfully accomplished at an expenditure of 9.6 kw-hours for all of the meals prepared for six days. The following results relating to the time required and energy used were obtained with the above-mentioned outfit: Baking two loaves of bread, 60 minutes, 0.1 kw-hour; baking one batch of biscuits, 50 minutes, 0.083 kw-hour; baking two pies, 60 minutes, 0.1 kw-hour; baking ten potatoes, 180 minutes, 0.3 kw-hour; baking three-layer chocolate cake, 50 minutes, 0.083 kw-hour; baking sponge cake, 50 minutes, 0.083 kw-hour; baking six custards, 50 minutes, 0.083 kw-hour; boiling potatoes, 150 minutes, 0.125 kw-hour; roasting 5 lb. of beef, 160 minutes, 0.267 kw-hour; roasting 4.75 lb. of lamb, 120 minutes, 0.2 kw-hour; boiling large ham, 120 minutes, 0.2 kw-hour; boiling oatmeal, 120 minutes, 0.2 kw-hour; boiling corned beef, 120 minutes, 0.2 kw-hour.

Discussion.

The paper, being of an exceedingly practical nature, called forth an extended discussion on the part of members. Mr. John West, of the Malden (Mass.) Electric Company, urged that to the devices mentioned should be added the electric refrigerator. He said that in wiring houses electricians should make provision for the ultimate introduction of food-preparing apparatus in kitchens and dining-rooms.

Mr. L. D. Gibbs, of the Boston Edison Company, described the House of Edison Light, now located at Newton Center, Mass., a description of which has already been given in the *Electrical World*. He stated that advertisements showing views of the house are being sent to prospective customers within a radius of 10 miles. While the house was located at Winchester, another suburb of Boston, the attendance averaged about 100 persons per day.

Mr. A. T. Holbrook, of the Excess Indicator Company, of Boston, stated that in Altoona, Pa., so many electric flatirons were in use that the lighting company was obliged to ask one of the larger motor users to shut down on Tuesdays, when the irons were in general use. He asked if it were not a matter calling for too great expenditure to secure the small household appliance business. Does it pay? To this a member responded that central-station people are not looking for profit on the introduction of new apparatus so much as to make the service as a whole necessary and attractive to householders.

Mr. F. L. Ball, of the Haverhill Electric Light Company, believed the cost of many of the devices is too heavy for the average householder. On the point made by Mr. Vorce that the cost of heating by electricity ought to be as low as 2 cents per kw-hur he doubted if most companies could afford to furnish the energy at that price.

Dr. Louis Bell, of Boston, said a campaign of education in the use of cooking apparatus, etc., should be undertaken. The subject requires a proper understanding of processes to be successfully carried on. He said attention should be called especially to the superior convenience of the electric devices. The gas companies were obliged to develop the uses of gas by long and persistent efforts; so also the electrict-lighting people must do.

Mr. Sands closed the discussion by calling attention to the fact that a more general use would result in lower prices; meanwhile the central-station companies must bear the burden of small or even no returns.

ACCOUNTING FOR SMALL CENTRAL STATIONS.

The next paper was by Mr. H. E. Gidney, auditor of the Malden Electric Company, on "The National Electric Light Association System of Accounting as Applied to Small Plants." Mr. Gidney claimed that so much depends upon a good system of accounts that all persons who have not yet adopted the system recommended by the N. E. L. A. should do so without further delay. The N. E. L. A. system of accounts is very useful as a basis of classification of subjects for correspondence and filing. Moreover, a company should have an accurate record covering the cost and description of property installed, not only for the use of the officers of the company, but for the purpose of obtaining the necessary authority from state commissioners to issue capital stock, bonds and other funded debt. He claimed that the N. E. L. A. standard classification of accounts is sound in principle and practical in scope and that it has been employed by a large number of companies throughout the United States and been found to meet their requirements satisfactorily. By its adoption a company will be able to make intelligent comparison with the results obtained by other companies using the same system. It is unnecessary to adopt the full classification of expense accounts, but the eight main divisions should be adopted by all companies.

Discussion.

In the discussion of Mr. Gidney's paper Mr. E. A. Barrows, of the Narragansett Electric Lighting Company, of Providence, R. I., said that the importance of correct accounting is being recognized more and more, now that public authorities demand a knowledge of details of public-service corporations. The system recommended is well adapted to lighting companies operating under varying conditions, because it is flexible. The meat of these accounts lies in the kw-hour averages, which are valuable for comparison with other periods and other companies. His company handles extensive accounts in detail. Income estimates and costs of extensions are compared and a standard for future extensions is thus established.

Mr. Sands said that the central-station manager to-day ought to know every thirty days just where he stands and not wait until the end of the year, as was the habit formerly.

The last paper of the session was by Mr. B. F. Fisher, Jr., of the Westinghouse Lamp Company, on "The Wire-Type Tungsten Lamp."

WIRE-TYPE TUNGSTEN LAMP.

Mr. Fisher stated that, although there are many processes of manufacturing tungsten filaments, all of them necessarily start with crude tungstic acid and end with pure tungsten. According to one of the principal processes, the paste made from tungstic acid by chemical process is forced through diamond dies and the filament is formed by electrical treatment, whereby all foreign matter is burned out of the paste and the particles of tungsten are sintered together into a continuous wire of pure tungsten. According to another development, there is obtained pure tungsten which is ductile when cold. The author stated that the property of ductility when cold is not natural with tungsten, and when heated to a high temperature the tungsten wire which has been made ductile will immediately start to crystallize to its natural state and become brittle when cold. He reported the results of tests which tend to show that tungsten filaments obtained by either the sintering process or draw-

ing process are of approximately the same tensile strength when the lamps are ready for shipment, the only difference being in the manner in which they retain their strength, which is slightly in favor of the sintered filament so far as percentage and uniformity are concerned. The appearance of the filaments is slightly different, in that the formed filament is of bright steel color with matt surface, whereas the drawn filament is of slightly darker color with a smooth surface. The electrical characteristics as to resistance, both while hot and while cold, are approximately the same and the ability to withstand high temperatures is the same.

One of the weak points in tungsten lamps has resulted from the rigid method of support. In the so-called wire type of lamp use is made of a filament in one continuous length from leading-in wire to leading-in wire, the filament being wound on supporting anchors so that it is free to move within these anchors, and is connected to the leading-in wires by flexible joints. To obtain flexibility in this type of lamp, the rigidity of the joint is overcome by wrapping the filament around the leading-in wire back of the joint, thereby obtaining the flexibility of a coiled spring. The lamps are sufficiently rigid to withstand all the ordinary abuse incident to use and they can be depended upon for any class of service. For example, a certain steam road subjected twelve 60-volt wire-type lamps to 400,000 shocks on a vibrating test without losing a single lamp.

At the conclusion of the reading of the paper Dr. Bell asked for more information on the subject of the transverse strength of the wire-tpye tungsten lamp, saying that the tensile strength is purely incidental. Mr. Fisher replied that the filaments are being made more dense than formerly.

It was voted to send a telegram of congratulation to Mr. James E. Davidson, a former president of the section, lately elected president of the Northwestern Electric Light Association, comprising the five States of Washington, Oregon, Idaho, Montana and Utah. A letter was read from Miss Harriet Billings, assistant secretary of the National Association, thanking the convention for its invitation to be present and speak. The question whether to hold one or two conventions a year in future was discussed, but no action was taken on the subject. The total registration of the convention was 230, of whom sixty were ladies.

Chicago Convention of the I. E. S.

The fifth annual convention of the Illuminating Engineering Society, held in Chicago, came to a close on Thursday, Sept. 28. According to the last official announcement the total attendance was 252. Of this number 142 were members, ninety-three guests and seventeen out-of-town ladies. This registration did not include the names of some who came late, and it is probable that the total attendance was about 275. Three of the seven sessions were reported in the *Electrical World* of Sept. 30, and the proceedings of the remaining four are summarized herewith.

SECTION DEVELOPMENT MEETING.

On Tuesday evening a section development meeting was held in the Congress Hotel, attended by the various section officers and managers. The session was presided over by General Secretary Preston S. Millar, of New York, and matters of constitution revision and membership dues were discussed.

The committee on constitution and by-laws of the society, comprising Mr. W. D. Weaver, New York, chairman; Mr. L. B. Marks, New York, and Mr. Preston S. Millar, New York, laid before the meeting its suggestion for changes in the constitution, inviting the approval of the section managers before presenting the amendments before the general society. The revisions indicated were chiefly of a routine nature, with the exception of the proposal to increase the number of section managers from two to five, to which the approval of the executive and advisory committees had been given. The other changes suggested were: Leaving to discretion of the general board of managers the matter of mailing to each member full membership roll yearly; revision of election methods of counting ballots, so that new officers can be officially informed of their election without waiting until annual meeting; provision to allow officers to sign checks on society's account in case of prolonged absence of secretary; change of annual meeting until date some time later than close of fiscal year, and provision for general secretary to take direct charge of revision of papers. The meeting approved these suggestions and at the regular convention session the following day the amendments were presented to the membership for the purpose of getting the one hundred signatures necessary to effect a change in the constitution.

A proposal to increase the membership dues from $5 to $7.50 a year met with objection from several of those present at the section meeting, who expressed the fear that this increased charge would cause a decrease in the membership of the society. Mr. L. B. Marks explained that the annual cost per member is now $6.50, the difference between this amount and the $5 annual dues being met from advertising in the *Transactions*. The moral and ethical advantages of having the society self-sustaining without the aid of outside commercial interests were urged by Mr. Marks, and the matter of a classification of membership under two or more grades paying different annual dues was also discussed, but no action on the matter of dues was made at the meeting.

PERFORMANCE AND COST DATA OF ILLUMINANTS.

The paper of Messrs. W. Harrison and H. H. Magsdick, of Cleveland, on "The Analysis of Performance and Cost Data in Illuminating Engineering" was presented Wednesday morning.

The authors presented arguments to show that in forming a satisfactory judgment of the relative values of lighting units consideration must be given to the cost as well as to the illuminating power. In determining the total operating cost of any system of lighting three items should be considered, namely: Fixed charges, which include interest on the investment, insurance and taxes, depreciation of permanent parts, regular attendance and other expense which are independent of the number of hours of use; maintenance charges, which include renewal of parts, labor and all costs except the cost of energy; cost of energy, which depends upon the hours burning and the rates charged. There is at present a demand for the establishment of equitable standards, so far as possible, and the compilation of data on commercial light sources in accordance with these standards. Work of this nature, when accomplished, will be of positive benefit both to the consumer and to the illuminating engineer.

Discussion.

Mr. Norman Macbeth, of New York, spoke of the difficulty of selecting the properly equipped but impartial operators to make the authoritative tests referred to by the authors. Prof. Sidney W. Ashe, of Harrison, N. J., said that while it is possible to determine the laboratory values of illuminants accurately there are the usual difficulties in reducing such results to values applicable for lamps in practical service. He also referred to the expense involved in making a set of private tests. Mr. R. B. Hussey, of Lynn, Mass., in discussing methods of street lighting analyzed the lamp costs depending on the hours of burning. For test purposes he also advocated the use of the volt-ampere basis, taking into consideration the power factor of the lamp. Mr. L. B. Eichengreen, of Philadelphia, said that although in testing gas lamps it is the effort to simulate service conditions, an allowance of 50 per cent depreciation value should be made. A gas lamp which had been in service 500 hours in a kitchen under severe conditions of grease and dirt was found to have depreciated 29 per cent, but after

cleaning returned to within 6 per cent of its original value. An indirect lighting installation after one year's service was found to have depreciated 50 per cent, but on cleaning was almost entirely restored. Mr. G. H. Stickney, of Harrison, N. J., referred to the disadvantages which may follow from too keen a competitive attitude between manufacturers, calling attention to the benefits of co-operation. Many large users, he said, are now making thorough investigations of illuminants under conditions which promise results more impartial, of course, than might be obtained by any manufacturer, however careful. Mr. R. F. Pearse said that the problem of the engineer is that of securing the greatest economy of illumination in terms of the energy expended. Mr. J. R. Cravath, of Chicago, declared that under some conditions the minimum values of lamp ratings must be used, as in the lighting of large areas where in certain parts of the room the intensity must not go below a fixed quantity. In closing the discussion Mr. Ward Harrison, of Cleveland, spoke of the appointment of an editing committee to revise such data on illuminants for the society's *Transactions*. He also referred to the importance and advantage of periodical cleaning of lamps and reflectors. A short interval should first be required between cleanings, he said, to impress the habit upon the man in charge, after which the latter may use his own judgment.

COMMITTEE ON PRESIDENT'S ADDRESS.

Following Messrs. Harrison and Magsdick's paper on cost data the report of the committee on the president's address was presented by Chairman J. R. Cravath, on behalf of the other members, Mr. W. H. Gartley and Dr. H. E. Ives. In this report Dr. Kennelly's paper was referred to as a classical discussion of a subject of great importance to illuminating engineering development. In illumination determinations the quantities and methods of measurement are not alone physical, but involve the physiological function of the eye, and the ideal of the experimenter would be to express light flux in a logical system of absolute units. While this is perhaps not immediately practicable the report observed that the scientific units of one age become the practical units of the next.

Dr. E. P. Hyde, of Cleveland, said that the appointment of a committee on research had long been contemplated, but had never been carried out. Mr. P. S. Millar, of New York, advocated the immediate appointment of such a committee, and suggested that resolutions to this effect be communicated to President Kennelly.

EVALUATION OF LAMP LIFE.

Mr. P. S. Millar abstracted the paper on "The Evaluation of Lamp Life," written by himself and Mr. L. J. Lewinson, of New York.

The authors outlined the history of the introduction of the 80 per cent candle-power criterion of useful life of incandescent lamps. In this country practically all specifications for plain and treated carbon lamps employ this basis of evaluation of lamp life, and in much of the practice it is gaining consideration in tests of tungsten-filament lamps. Among the disadvantages of the 80 per cent criterion was mentioned the fact that photometric errors of 1 per cent or 2 per cent, which are likely to be encountered in commercial work, may lead to inaccuracies in the evaluation of the life of as much as 5 per cent or 10 per cent. Moreover, the method assigns exaggerated importance to elements believed to be of lesser value, as a result of which other more important elements fail to receive due recognition. The authors claimed that the burning hours corresponding with the given candle-power depreciation do not afford a measure of useful life. They constitute merely a measure of the net rate of candle-power depreciation throughout a given period. They represent values which, generally speaking, vary inversely as such net rate of decline.

The authors proposed that the lamps be evaluated in terms of their candle-hours per watt throughout the test period divided by the hours in such period. According to the method proposed, the results are not subjected to the exaggerated effect of difference in candle-power maintenance, as under the old method. Test errors, particularly errors in photometric measurements, will affect final results very slightly. Improper selections of test periods will affect the final evaluation to a lesser degree than similar improper selection of candle-power decline elements under the present method. Most important of all, the adoption of the proposed method will attribute more nearly correct importance to the burning-out element, which under the old practice was somewhat obscured by the too complete reliance upon the candle-power element of performance. One prominent difficulty in the way of the application of the proposed method is the necessity for selecting some test period to represent the useful duration of life. In appraising the life of a lamp at any value short of the total burning hours risk of undervaluing the lamp for certain classes of service is incurred. This is a risk which for general purposes it is desirable to take, in order to secure a high standard of lamp performance which places a premium upon good candle-power maintenance and high efficiency, and does not hesitate unduly in penalizing long-drawn-out life when such life involves relatively low candle-power efficiency.

Discussion.

Mr. E. J. Edwards, of Cleveland, Ohio, said that the worth of a lamp to the customer is not measured alone in candle-power-hours. Considering the total light produced in one of the instances cited by the authors the difference on the new basis, he said, amounts to less than 1 per cent. He also made objection to the expression "candle-power-hours per watt," used in the paper. Mr. J. W. Howell, of Harrison, N. J., said that the determination by per cent of candle-power is natural, while that by hours is arbitrary, since lamps lose usefulness both by breaking and decline in candle-power. The older method, he pointed out, tends to exaggerate the difference in ratings, and as a result has probably been a stimulus to the improvement of the tungsten lamp. Mr. Ward Harrison, of Cleveland, Ohio, also pointed out the difference in apparent value between lamps rated by the old method and on the new basis. Taking one of the examples cited in the paper he showed that the cost of energy is more important than the lamp cost itself. Dr. E. P. Hyde, of Cleveland, recommended that the committee on nomenclature and standards consider the new method of rating described in the paper, and if it should think it advisable recommend the use of this basis for evaluating lamp life.

PHOTOMETRY OF LARGE LIGHT SOURCES.

The next paper, by Messrs. George H. Stickney and S. L. E. Rose, of Harrison, N. J., on "Photometry of Large Light Sources," was presented by Mr. Rose.

The authors outlined some of the particular features involved in the photometry of large and powerful light sources and described briefly the methods that are employed by the General Electric Company. Use is made almost exclusively of photometers that show the space distribution of the candle-power rather than those of the flux integrating type. For the past six years the constant-length and constant-intensity photometers have been practically abandoned in favor of the constant-radius photometer. This photometer affords a definite measure of "apparent candle-power" at the chosen distance, and from this value the mean spherical candle-power can be calculated.

The real difficulties in the photometry of large units are those introduced by the variation in color and intensity of the light. It is not uncommon to find reading varying from 20 per cent to 300 per cent of the mean. To minimize the errors attributable to variation in intensity either the maximum and the minimum intensities

measured are averaged or a large number of measured intensities are averaged.

The working candle-power standards are 40-watt tungsten lamps, which are checked at least once a week against substitution standards consisting of 250-watt tungsten lamps carefully seasoned and checked against two or more reference standards. The reference standards are carbon incandescent lamps with parallel-type filament furnished by the electrical testing laboratories and verified by the bureau of standards.

Discussion.

Mr. Preston S. Millar, of New York, spoke of the difficulty of measuring fluctuating light sources, and discussed matters of technique in the use of the photometer. Dr. H. E. Ives, of Cleveland, suggested the application of a photometer using the light of the lamp under test itself for comparison with its distribution in various directions to obtain the distribution curves of those lamps whose flux output varies widely. The fluctuation of certain classes of arc-lamps is due to variation of flux output rather than of distribution, and as such changes occur the accompanying variation of the temporary comparison standard with the flux under test would eliminate the results of these variations. After such a distribution set of tests had been made the whole set of results could be reduced to absolute units by a single comparison against a standard source. Mr. W. J. Cady, of Newark, Ohio, called attention to the effect of absorption in mirrors. He also described briefly the large photometer of the Holophane Company at Newark, which takes up three floors. Mr. W. F. Little, New York, said that he has found quick snap readings superior to slow, studied ones. The use of sectored disks he found to give trouble in photometering alternating-current lamp sources. Mr. F. H. Gilpin, of Philadelphia, described the use of a rotating disk screen with elliptical openings at the mirror. Mr. R. B. Hussey, of Lynn, Mass., said that in measuring arc lamps the double mirror is often little superior to a single mirror, since it is the total flux rather than the distribution of the lamp which varies from time to time. In a written communication Dr. A. S. McAllister, of New York, noted that the term "candle-power," unmodified, is not trustworthy when applied to lamps having parabolic or focusing reflectors. He also pointed out that a constant-radius photometer gives an absolutely accurate measure of the mean spherical candle-power.

PHOTOMETRY AT LOW INTENSITIES.

At Wednesday afternoon's session a paper on "Photometry at Very Low Intensities," prepared by Dr. Louis Bell, of Boston, was read by Dr. H. E. Ives, of Cleveland.

After calling attention to the difficulties encountered when attempting photometry with illuminations of less than 1 meter-candle, the author reported the results of tests showing that the difficulties can largely be overcome by "dark-adaptation," since a very little dazzling from stray light will spoil one's shade-perception, for joint differences in intensity-prolonged adaptation put the eye into a condition in which it can discriminate joint illumination in a way that is altogether surprising to those who have customarily worked with fields of ordinary intensity. The sensibility in dark adaptation increases slowly with increasing rapidity for the first ten minutes, increases at a prodigious rate for the next forty minutes, and then slowly reaches a constant value perhaps 8000 times the initial in about one hour.

With an imperfectly adapted eye exposed to casual light both shade perception and acuity are uncertain at illumination below 1 meter-candle, the fact being that with illuminations near and below 0.2 meter-candle the ability to discriminate between photometer fields is practically a junction of adaptation and has no significant mean value. However, with reasonably good dark-adaptation light-intensity discrimination is reliable down to the very lowest illumination. Under dark-adaptation acuity shows indications of great increase and there are found at least signs of returning color vision.

Discussion.

In opening the discussion Dr. P. W. Cobb, of Cleveland, called attention to the wide ranges of illumination through which the eye is capable of seeing and the variation of functions which control vision at various intensities. Although the idea is generally held that the rods and cones functionate separately, the cones giving the color sense at high intensities, while the rods give merely the white-light sense at low intensities, such a hypothesis is in part discredited by the fact that at very low intensities color vision is now found to return, although it had been supposed that the color sense was alone resident in the cones, which have very slight adaptation over a range of illumination. Prof. S. W. Ashe, of Harrison, N. J., said that all three of the elements of adaptation, glare and fatigue are involved in low-intensity measurements, and that fatigue must be properly recognized and accounted for if trustworthy results are to be obtained. Dr. H. E. Ives, of Cleveland, reported that during work in photometering various colored lights, using the sectional disk run at a speed where the flicker disappears, the values obtained for Fechner's law show a straight line down to a point where the function suddenly changes direction, thereby indicating that there cone vision has ceased and rod vision remains. While a red-light source gives a straight line a blue source cannot be measured at very low intensities.

EFFECTIVENESS OF LIGHTING.

Mr. J. R. Cravath, of Chicago, followed with his paper on "The Effectiveness of Light as Influenced by Systems and Surroundings."

In the paper were recorded the results of tests relating to the comparative effectiveness of direct and indirect lighting systems as at present commonly installed, in order to ascertain whether indirect installations should be designed for a higher or lower foot-candle intensity than direct installations.

The tests were conducted in a room 18 ft. 8 in. wide by 21 ft. long, the ceiling height being 10 ft. All daylight was excluded. The ceiling and walls were of ordinary smooth plaster, very light cream in color, and the floor was a reddish brown. In certain of the tests black curtains were so hung as to have the surroundings of the persons making observations entirely dark, except the small area of desk, paper and photometer plate. There were five outlets, one being located in the center of the ceiling, and the other four in approximate centers of the four quarters of the room. Both the flux of light and the position of the lighting units were varied until persons seated at the desk expressed satisfaction with the amount of illumination provided for reading purposes.

The paper contained records of tests made with twelve different subjects, ten readings being made with each subject in each test. The tests showed that within the range of commercial practice there is nothing in the theory that the eye requires less illumination on the work amid dark surroundings, or with dark walls, than amid light surroundings with good diffusion of light. In fact the reverse is true. The author expressed the belief that the explanation is to be found mainly in the matter of glare on the paper of the reading page. It was found that most of the subjects desired more light on the paper when the desk was in the center of the room, under the principal source of light, than when the desk was at one side of the room. This applies to both the direct and indirect systems of lighting.

The author concluded from the tests made that under ordinary working conditions the diffused character of

the light falling on the work has more influence on the comfort of seeing and the amount of required illumination than has the brightness of the surroundings. The greater the percentage of diffused or indirect light and the less the percentage of direct light from small sources the more satisfactory is the system likely to be for work under varying practical conditions. Extra brightness of surroundings with a diffusing lighting system may be produced experimentally which will necessitate higher illumination on the work, but for economical reasons such extreme conditions are not likely to become common, because they would be costly and troublesome to produce commercially. On account of the impossibility of properly diffusing the light to secure comfortable illumination on the work with dark surroundings under ordinary conditions of use, the glare from the work practically more than counteracts any gain in visual acuity in having the surroundings dark.

Discussion.

Mr. A. J. Sweet, of Newark, Ohio, commented on the growing attention now being given to the efficiency of light utilization at the eye and the significance to commercial development of the movement represented by Mr. Cravath's paper. While he admitted that Mr. Cravath's results are remarkably consistent, he observed that they are yet not really quantitative, but only "indicative" of the conclusions which the author had seen fit to draw. With a large number of unknown variables, said Mr. Sweet, a great number of tests would be required to fix any conclusion. Taking up the tables of Mr. Cravath's paper, the speaker analyzed them with the view of showing that in each case it was rather the instances of unidirectional lighting than indirect lighting which had required the higher intensities. The charge of glare effect, he therefore concluded, is not proved in the data submitted. Prof. S. W. Ashe, of Harrison, N. J., said that although a variety of test methods might be used in such determinations as the paper described, Mr. Cravath's explanation of his own method was very clear and his results should be easily duplicated if necessary. Acuity of vision, he pointed out, is affected by a great variety of conditions. Mr. A. J. Marshall, of New York, inquired the times of sittings and the times of day when the tests were made. In indirect-lighted rooms, he said, he had noted marked evidences of fatigue on the part of subjects. He indicated a line of fatigue tests which he proposes making on school children at the beginning and middle of both morning and afternoon school sessions, carrying out the tests for direct, indirect and semi-indirect lighting. Mr. Albert Scheible, of Chicago, who was one of the subjects of Mr. Cravath's tests, testified to his own difficulty in judging accurately the points he considered "comfortable" and "ample" illumination. The tests, he said, were made at a time of day when his own eyes were fatigued. A foreign experimenter whom he next quoted has found, said Mr. Scheible, that to avoid fatigue an intensity about twenty-five times the minimum possible visible value is required. Mr. F. J. Pearson, of Chicago, another of Mr. Cravath's subjects, declared that in his opinion too much latitude was left to the subject, and that unless the average subject had been a professional proofreader or other worker accustomed to continuous use of his eyes he could hardly be expected to estimate within a few minutes the values of intensity which he would consider comfortable for several hours' reading. Mr. Norman Macbeth, of New York, asked whether the results of a given subject were fairly uniform throughout the series or whether the values ranged over wide minimums and maximums. Mr. E. L. Elliott, of New York, remarked that with the wealth of physical data available to the illuminating engineer the important field of physiological subjects touched on by Mr. Cravath's paper is almost barren. He also cited an instance where a large institution had tested several systems of lighting in a room where 200 office workers were employed. After two weeks' experience with each of the several systems the vote was unanimous for the indirect-lighting method. While a bare lamp in the line of vision will for a brief time actually improve the vision of objects beyond, said Mr. Elliott, the painful and injurious eeffct of glare soon makes further vision impossible. Mr. F. L. Godinez, of New York, in a communication read by Mr. Lewinson referred to the effect of age on vision and the psychological importance of the character of illumination selected. Under these requirements he insisted that indirect illumination is not adapted for the home or for other places of social intercourse where soft shadows are required. In referring to the institution tests reported by Mr. Elliott, Mr. A. M. Klingman, of Chicago, said that the intensities used with the various systems were not the same.

On Thursday morning the discussion of Mr. Cravath's paper was resumed, Mr. L. B. Marks, of Chicago, opening the discussion. While the data submitted in the paper are of much value, he said, they are not conclusive. Differences in color of the lamps as they were brought up through a range of intensities by rheostats might have an influence on the results obtained. He also made the criticism that the comparison of the indirect lighting should have been made with a more carefully prepared direct-lighting system. A test later made by him in the same room where Mr. Cravath's experiments were made, he said, actually showed very little difference between direct and indirect lighting when the bare direct filaments were shaded by even such a simple diffusing medium as a handkerchief. Mr. P. S. Millar, of New York, said that readings should also have been taken of the brightness of surroundings and that the investigation should have divided the problems between those of diffusion alone and those comparing direct and indirect lighting, in which case even more important lessons might have been learned. A written communication from Mr. Bassett Jones, of New York, read by Assistant Secretary Langen, declared that Mr. Cravath's paper was simply a research into the effect of glare, and that the direct system of lighting used in the tests should have been arranged with care and judgment equal to those employed in setting up the indirect lighting. For many kinds of illumination, the writer concluded, a combination of direct and indirect lighting will be found most satisfactory. Mr. J. D. Israel, of Philadelphia, congratulated Mr. Cravath on the new line of investigation opened up by his paper. In reply to those who took part in the discussion Mr. Cravath called attention to the fact that conditions of diffusion are always very closely associated with surroundings and that it is almost impossible to divorce poor diffusion from dark surroundings. To make such a distinction, while perhaps of academic interest he admitted, would not be of practical or commercial use. Mr. Cravath said that he had watched for the fatigue referred to by previous speakers, but had reached no conclusions regarding its existence. The author also remarked in response to Mr. Marks' reference to his own supplementary test with handkerchief-covered direct lamps that the loss in thus screening the lamps had brought their efficiency even below that of the indirect-lighting system. In conclusion he urged more attention to glare from work caused by unidirectional light and to securing diffusion. This he said was the main lesson from his tests.

DAYLIGHT ILLUMINATION.

Following the discussion on Mr. Cravath's paper Dr. Ives presented the paper written by himself and Mr. M. Luckiesh, of Cleveland, on "Distribution of Luminosity in Nature."

The authors employed a photographic method of photometry for measuring the distribution of relative brightness in the vertical plane exposed to view in certain scenes in nature. Use was made of an absorbing screen to render the photographic action of different colors proportional to visual brightness. The photographs made through this

screen were measured for density at each point, and the distribution of brightness in the field of view was thereby determined.

Reports were given in the paper of observations made of two pleasant landscapes, two views of the same open landscapes under different conditions, a shady place in the park, a city street and two street views of remarkably unpleasant but yet instructive character. The result seemed to indicate that the normal eye can tolerate a higher brightness in flux of light above the horizontal than below. The eye recognizes as unpleasant the presence of large areas of nearly uniform high brightness. It can tolerate such a condition in the case of the sky, but it cannot tolerate a uniform high brightness in the foreground. The difference between pleasant and unpleasant conditions seems to lie chiefly in the presence or absence of variety.

The authors made lumeter measurements in order to obtain some idea of the absolute values of the surface brightness. Blue sky was found to measure 2.2 cp per square inch. A cumulus cloud in the same sky measured 10.4 cp per square inch. On an overcast, rainy day the sky had a brightness of 3.3 cp per square inch. On a darker overcast day the brightness fell to 1 cp per square inch. A cement pavement in the sunlight had an intrinsic brightness of 6 cp per square inch. The ratio between the brightest and darkest point of the average vertical distribution in the most varied landscape observed was about 20 to 1. The brightest object photometered was a white cloud, which had about half the intrinsic brightness of a Welsbach gas mantle.

Discussion.

Mr. G. H. Stickney, of Harrison, N. J., said that he had long owned to an instinctive appreciation of the principles contained in the paper by Dr. Ives and Mr. Luckiesh. Mr. Norman Macbeth, of New York, also complimented the authors and said that the paper brings out much valuable and desired information of use to engineers engaged in illumination work. Mr. A. J. Marshall, of New York, spoke of the need of architects' co-operation and conceptions in the design and arrangement of illumination to simulate most closely nature's requirements and standards of distribution.

AN APPLICATION OF THE LAW OF CONSERVATION.

Dr. A. S. McAllister, of New York, presented a paper on "The Law of Conservation as Applied to Illumination Calculations."

The author showed that the "inverse-square law," as applied to light sources of all types, and the "cosine law," as applied to surface sources and the illumination on planes, give results in strict conformity to the law of conservation in that the flux produced by any lighting source is neither increased nor decreased until utilized for illumination, when it is transformed according to the well-established laws of nature. Accordingly there is available an absolutely accurate method of determining the total flux which the lighting source must produce, which consists in multiplying the incident flux density over each surface by the absorption coefficient and in this manner making a summation over all of the areas illuminated by the source.

The paper contains detailed proofs of the equilux-sphere method of determining the illumination obtained from plane circular sources as outlined in our issue for Dec. 8, 1910, and of the absorption-of-light method of calculating the flux outlined in our issues dated Nov. 21, 1908, and May 26, 1910.

Discussion.

Prof. W. E. Barrows, Jr., of Armour Institute of Technology, Chicago, observed that the interesting relations brought out by Dr. McAllister's paper have heretofore gone unnoticed, and he congratulated the author on the simple terms of the demonstration. He also declared his approval of the author's expression of flux in lumens, which avoids the indefiniteness of other units. Dr. M. G. Lloyd, of Chicago, said that the paper gives an excellent short-cut method, but on account of the absorption which is met with in ordinary air Dr. Lloyd objected to "the law of conservation" being stated as a fundamental law of nature. In reply Dr. McAllister stated that the method described is equally applicable under all conditions of absorption, although the greatest simplicity is found by neglecting atmospheric absorption, which is of no importance in illumination problems.

RÉSUMÉ OF LEGISLATIVE ENACTMENTS

The next paper was by Mr. E. L. Elliott, of New York, and was a "Résumé of Legislative Enactments on Illumination."

After discussing the justification for legislative regulation of illumination, and calling attention to the work of the American Association for Labor Legislation and the American Association for Conservation of Vision, the author stated that the various scientific societies, particularly the Illuminating Engineering Society and the Ophthalmological Society, are natural tributaries to these two organized forces. He claimed that professional and scientific societies may properly be looked to as sources of scientific knowledge and reliable data, but publicity and legislation must be left to the social or humanitarian society. In order to render legislation on the subject of illumination effective, there should be developed a practical illuminometer which possesses the following qualities: Absolute portability, satisfactory accuracy in the hands of non-technical and inexperienced users and moderate cost. With such an instrument available the conditions of illumination can be accurately specified in the labor or factory laws. The paper contained a résumé of the legislation both in this country and in Europe.

Discussion.

Mr. E. F. Crittenden, of Washington, said that it is important to have legislators know and realize that illumination can be measured with fair accuracy, but he added that few, even experienced, observers can rely upon results within 5 per cent using any type of portable illuminometer as suggested by Mr. Elliott. Better, he said, should experienced inspectors be selected for the work, since such men would know how to interpret the results obtained and to apply these results practically. To get manufacturers to provide adequate lighting he recommended that they be shown that good lighting actually pays in increased production of work, instead of simply resting the case on the argument of saving the eyesight of employees. Mr. A. J. Marshall said that his conception of the portable instrument proposed by Mr. Elliott was one which should only supplement the inspector's own eye in making his rounds of factory interiors. In case the illumination should then fall below what the inspector considered necessary an experienced observer might follow with a precision instrument. Mr. G. H. Stickney, of Harrison, N. J., cited examples to show that much of our factory legislation, especially when directed at lighting, misses its real purpose, and that wise and definite laws are needed. Mr. J. R. Cravath, of Chicago, observed that while so many subjects in the field of illuminating engineering are yet indefinite it would after all be difficult for even experts to formulate laws. Dr. Winthrop Talbot, of Cleveland, Ohio, said he had just returned from the conservation congress at Kansas City, Mo., where a great movement has just been launched to conserve human efficiency. Legislation, he said, must not precede education too far. Dr. M. G. Lloyd, of Chicago, urged that the society take steps to abolish glaring automobile lamps. Mr. Elliott, the author of the paper, in

closing said that while many illuminating subjects are still indefinite, his own idea in preparing a set of laws would be to shut off the manifest abuses, some points of which are certain. He also referred to the industrial accidents which are caused by poor illumination, as shown by the greater number of such accidents during the darker months of the year.

ENGINEERING AND SALESMANSHIP.

The last paper of the convention, entitled "Illumination or Equipment," and written by Frank B. Rae, Jr., of New York, was presented by Mr. A. J. Marshall, of New York. The author claimed that there are to-day little more practical, usable data of actual scientific value on the subject of illuminating engineering than there were three years ago. This condition he attributes to the fact that the true engineers are too much interested in engineering for its own sake, rather than for the sake of the public. Realizing their superiority in this single subject, their effort is to rise further from the mass of humanity, rather than to assist humanity to reach their level. There is need for increased activity upon the part of the Illuminating Engineering Society in the compilation of data which will be of use to the practical man called upon to specify illuminating equipment. The intent of the modern sales... of energy and equipment is to work along scientific ..., and to employ such engineering data and principles ... can grasp. He may pervert these data to selfish ends, ... if the data formulated are fundamental and practical ... will stand upon their own merits.

Discussion.

... A. J. Marshall said that he disagreed with the author... s declaration that engineers are often over-interested ... engineering for its own sake. The purpose of the Illuminating Engineering Society, he pointed out, is to proceed ... the complex to the simple, making the subjects and ... ems of illumination comprehensible to anyone in... ted. Mr. Norman Macbeth, of New York, said that ... times those best equipped to collect information will ... and ask others to collect and digest it for easy use. E. C. Crittenden, of Washington, D. C., cited an in... e where a certain man, an illuminating engineer by ... had showed a deplorable lack of information regard... the effect of reflectors in increasing the apparent candle... r of a light source. Mr. E. L. Elliott said that the ... em of where to use science in advertising is often ... an art, and that where scientific facts fail to sub... iate the claim which the advertiser desires to make ... other form of argument must be resorted to.

RESOLUTIONS.

...fore the close of the convention Mr. A. J. Marshall ...ented resolutions of regret and respect regarding the ... death of Mr. L. R. Hopton, of New York. On ... of Mr. G. H. Stickney, of Harrison, N. J., the thanks ... e society were voted to the Chicago Section and to the ... committees and commercial organizations that con... ted to the success of the 1911 meeting. Final adjourn... of the Chicago convention was then taken.

SOCIAL FEATURES AND EXCURSIONS.

... Monday evening, Sept. 25, there was a reception and ... e at the Congress Hotel for members and guests and ... ladies of the convention. On Tuesday afternoon a ... mber of the visitors made inspection trips to various ... ces of interest. These included the Fisk and Quarry ...reet generating stations of the Commonwealth Edison ... mpany; People's Gas Building on Michigan Avenue, with ... high-pressure gas "arcs" and semi-indirect lighting fix... tres: Sears, Roebuck & Company's lighting plant; demon... ation room of the National X-Ray Reflector Company; ... raries and shops of the Armour Institute of Technology; ... ctric shop of the Commonwealth Edison Company; fix... the showrooms of the T. W. Wilmarth Company; lighting features of the Chicago & Northwestern Railway passenger terminal, and the International Municipal Congress at the Coliseum. There were also automobile trips for the ladies on Monday afternoon and Tuesday afternoon (with luncheon at the South Shore Country Club on the latter day) and a theater party on Wednesday afternoon.

The banquet held on Wednesday evening in the Florentine room of the Congress Hotel was of a rather informal character, and for that reason was the more enjoyable. During the earlier part of the evening excellent vocal and instrumental music was provided, and a professional entertainer interspersed songs in which all joined in the chorus. Later in the evening, under the leadership of Mr. Louis B. Marks, of New York, as toastmaster, a few were called upon for informal toasts. Among those responding were Past-presidents W. H. Gartley and E. P. Hyde; General Secretary Preston S. Millar; General George Harries, of Washington, D. C., president of the Association of Edison Illuminating Companies, who was toastmaster at last year's banquet; Mr. Homer E. Niesz, vice-chairman of the general convention committee, upon whom much of the responsibility of the convention arrangements fell, and Mr. Joseph D. Israel, of Philadelphia, who spoke on behalf of the out-of-town visitors to the convention.

The general convention committee consisted of Mr. John F. Gilchrist, chairman; Mr. Homer E. Niesz, vice-chairman, and Messrs. J. C. D. Clark, George C. Keech, F. A. Vaughn, W. E. Barrows, Jr., C. A. Howe, J. R. Cravath, F. J. Pearson, A. T. Hunt, W. C. Bauer and A. L. Eustice. Mr. George B. Foster acted with the committee, and Mr. Albert Scheible as convention arrangements secretary was particularly active in looking out for all details of the convention.

Convention of Georgia N. E. L. A. Section.

The first annual convention of the Georgia Section of the National Electric Light Association was held at Columbus on Sept. 26 and 27, the convention being called to order in the Masonic Temple by President John S. Bleecker, manager of the Columbus Electric Company. The address of welcome to the city was delivered by Mayor Rhodes Brown.

In his presidential address, Mr. Bleecker stated that at the time of the organization of the George Section there were twenty-one members of the National Electric Light Association in the State. Less than six months later, on April 6, 1911, there had been an increase of 100 per cent in membership, and at the present time the total membership is seventy-three, there having been a gain of 239 per cent in less than twelve months. The report of the committee on membership and finance, which was presented by the chairman, Mr. William R. Collier, showed that on Sept. 26 there were 14 Class A members, 38 Class B members, no Class C members, 1 Class D member and 21 Class E members, the total being 73. The chairman expressed the opinion that the large increase in membership during the past year could be equaled in the coming year.

CENTRAL STATION AND INSURANCE.

A paper entitled "Advantages of Co-operative Effort by Central Stations with Insurance Inspectors," by Mr. A. M. Schoen, chief engineer of the Southeastern Underwriters' Association, was read by Mr. F. G. Tupper, on account of the absence of the author. The author stated that, although approaching the subject from different directions and engaging in businesses essentially different in their natures, the electric company and the insurance company have a common interest in the reduction of risks, it being to the interest of both, as well as that of the inspector and the policy holder himself, to protect the latter against damage by electricity either to life or to property. The electrical inspectors for the insurance company devote their entire time to the prevention of electrical fires, and therefore become

specialists in this particular line. They learn of fires that never come to the attention of the central-station manager, and they have at their fingers' ends the details of such occurrences in 100 cities, whereas the experience of the central-station manager has been limited to a very few. Under these circumstances, it would seem that the inspector and the central-station manager should co-operate completely in methods tending to reduce the risks. Unfortunately, insurance companies are unable to maintain a corps of inspectors large enough to keep men constantly in individual places. The result is that most of the municipal inspectors are too busy with politics to care much about how the work under their supervision is done. Some of the inspectors are doing good, conscientious work, but a large part of the offices are absolutely farcical, and seem to be maintained only for political purposes. Mr. Schoen stated that he was not in sympathy with certain rules of the National Electrical Code, but since the majority of the people expressing views on the subject were opposed to his views, he now subscribes to and endeavors to enforce these rules. He stated that so long as each individual insists upon conforming only to what fully coincides with his ideas as to correct practices, chaos will prevail and uniformity in any direction will be impossible. Individuality is a most excellent trait, but when it develops into stubbornness, born of conceit, it ceases to be admirable. Each of the interested national bodies has a representative on the committee intrusted with the work of revising the code, and differences of opinion as to the propriety of any rule contained therein should not form legitimate reason for any unpleasantness between the station official and the inspector.

In discussing Mr. Schoen's paper Mr. L. S. Montgomery, of the National Metal Molding Company, called attention to the fact that the new electrical inspection rules passed by the Des Moines City Council on Sept. 13 require that permits to do electrical work shall be granted only to registered contractors who have filed a bond of $1,000. The newly appointed inspector, Mr. J. B. Dempster, is officially a member of the fire department, and is given authority to enter all premises where electric wiring is installed.

Mr. W. R. Collier, of the Georgia Railway & Electric Company, remarked that so long as politics is mixed up with inspection, the inspector will be unable to give his best attention to the work of inspection. He expressed the opinion that the customer would be willing to pay a small fee, provided by making such payment a good inspection would be guaranteed. Moreover, most central stations would be willing to pay a certain part of the fee.

Mr. E. C. Deal, of the Augusta-Aiken Railway & Electric Corporation, claimed that a high license renders it impossible for many parties without capital to go into the wiring business, and brings about a condition which results in two or three contractors combining and fixing the rate so that it is almost impossible for many persons to enjoy the benefits of electric lighting. He thought that the municipality should control inspection in such a way that the lighting company would not have to bear the burden of any defects in workmanship of the contractor.

Mr. E. S. Roberts, of the Savannah Electric Company, expressed the opinion that the city inspector should be required to pass an examination before he can take office. Such a plan would result in trouble in the political field, but the final outcome would be satisfactory to all parties interested.

Mr. G. K. Hutchins, of the Columbus Power Company, called attention to the fact that conditions with reference to political grafters are very much better at the present time than they were several years ago. Great progress has been made in this direction, so that at the present time the disposition is for the various interests to co-operate.

Mr. Burdett Loomis, Jr., of the Ware County Light & Power Company, outlined the results of the visit of an inspector to Waycross. The inspector ignored the central station, but pointed out defects in the wiring to many of the customers of the central station. Mr. Loomis thought it an unnecessary hardship upon the central station to call attention to poorly insulated wires on aerial secondary circuits. The insulation of such wire never lasts more than a few years, and it is improper for the inspector to imply that new wire should be erected at such intervals.

Mr. Deal claimed that troubles of the nature mentioned by Mr. Loomis can easily be avoided by proper co-operatior between the central station and the insurance inspector. The assumption that all independent wiremen are unscrupulou is incorrect; the fact is that most of them are good busi ness getters for the central stations, and many of them d just as much to protect the interests of the central statio as does the "new business" representative of the centra station itself.

Mr. F. G. Lumpkin, of Columbus, stated that by prope co-operation with insurance inspectors a certain centr station has been enabled to reduce its insurance premiu by between 10 to 15 per cent, the premium obviously bein less when proper electrical wiring is used than it woul be with improper wiring.

A motion introduced by Mr. Deal, that the executive con mittee be asked to appoint a committee for handling all i spection matters, from both an insurance and a municip standpoint, was carried.

ELECTRICITY IN TEXTILE MILLS.

Mr. George K. Hutchins, of the Columbus Power Co pany, presented a paper on "Electrical Energy in Text Mills," in which were discussed some of the merits of t electric motor and its peculiar adaptability to the textile i dustry. He presented statistics showing that on Dec. 1903, there were installed in textile mills 1053 motors, ha ing an aggregate rating of 64,313 hp; by Feb. 1, 1905, t number of motors had increased to 1740 and the aggreg rating to 87,614 hp; on Jan. 1, 1910, there were instal 10,491 motors, aggregating 302,119 hp, and on June 1, 19 16,450 motors were in use, the aggregate rating being 3 975 hp. In the seven and one-half years under conside tion the total increase in horse-power amounted to 603 cent, while the increase in the number of motors instal amounted to 1562 per cent. The statistics showed that electric drive is fast growing in popularity with the tex industry, for the requirements of which it is pre-emine fitted, and that the tendency is toward the use of sma units.

On Dec. 1, 1903, there were fourteen central stations s plying electrical energy to textile mills; on Jan. 1, 1 there were seventy-nine central stations doing so, thi nine of these being operated entirely by steam. Among distinctive features of the electric drive was mentioned great flexibility it introduces into all departments of mill, thus permitting the various processes to be kept anced and affording economical means in any departr for over-time work which might be required for the fir ing of special orders. The constant and uniform s serves not only to secure a better quality of product, experience has shown that there is obtained a substa increase in product, conservatively estimated at an ave of 10 per cent.

The textile mill affords a very satisfactory demand energy throughout its running hours, and should furnis attractive day load for any central station of sufficient to handle this class of business. The author gave stat ics relating to five textile mills in which the average of m mum demand taken for a twelve months' period show a ratio of demand to the motor rating installed varying om 71 to 96 per cent.

In discussing Mr. Hutchins' paper, Mr. F. P. Catc gs, of the Georgia Power Company, stated that of the 300 cotton mills in North Carolina, about 25 per cent are ow driven wholly by electricity. He remarked that the c of

electrical energy is not the first consideration in comparing electric with other drives; the fact of the matter is that the cost of energy is only about 5 per cent of the total cost of operation. The use of electric energy in the mill enables the production to be increased for the same equipment, and it is this fact which will have to be ultimately acknowledged and met by every mill owner, In a converted mill driven by electric motors one of the following results is always brought about: If the original production is maintained, the amount of energy required is reduced. If the energy required is not reduced, then there will be a considerable increase in production. Although the cost of energy is often set forth as being the essential element, and although the cost of electric energy is less than that of steam, yet the great advantage does not lie in the small cost of the energy, but in the indirect elements, such as the superiority of the electric motor, its general convenience, flexibility and adaptability, and its constancy of speed. The service can be considered from both the quality and quantity standpoint, and it is the quality standpoint which is the more important one. Mr. Catchings claimed that a new mill can be equipped or an old mill converted as a complete installation, so far as electric motors and wiring are concerned, for about $15 per hp maximum, and said the cost had been as low as $12 per hp. The cost of wiring a mill using 2200-volt motors, ranging in rating from 15 hp upward, is approximately $4 per hp. The reasons for applying motor drive in any industry resolve themselves into two main factors, either increasing the quantity of material produced or bettering the quality of the material, or a combination of both, resulting in any case in a reduction in the cost of the article.

One of the greatest advantages incident to the use of electric energy is the application of the graphic meter, by the aid of which are revealed facts the very existence of which may have been unknown before.

PINE FOREST DESTRUCTION.

A paper entiled "The Dying of the Pine, Cause and Remedy," was read by Mr. E. S. Mason, of the Bureau of Entomology, Washington, D. C. In introducing the speaker President Bleecker stated that the central stations are directly or indirectly dependent upon the forests for their well-being, in some cases for fuel and in other cases for water-power, and hence the subject of the paper is one in which central stations are much interested. Mr. Mason stated that the dying of the pine trees can be attributed to beetles. These beetles are attracted to any locality by the smell of pitch, so that when a living pine is cut the beetles are attracted to the neighborhood and immediately attack other trees. If one does not wish to put his timber in danger, he should not cut any living trees during the months of September and October. From November through the winter months the trees that turn light green, yellow or greenish brown should be cut down and their bark destroyed in order to protect the remaining timber.

In reply to questions by Messrs. Charles J. Swift, J. S. Bleecker, G. K. Hutchins, E. C. Deal, C. D. Flanigan, and T. F. Land, Mr. Mason stated that in case lightning strikes a pine tree the tree should be burned in order to remove the odor of pitch which might attract the beetles. Co-operation between neighbors is necessary in order to rid the neighborhood of beetles, but legislative action in this connection would be unwise. Chemical processes for destroying the beetles have not been developed, on account of the enormous expense that would be involved.

STEAM TURBINE.

Mr. E. H. Ginn, of the General Electric Company, Atlanta, Ga., read a paper dealing with the low-pressure steam turbine, by means of which it is possible to utilize efficiently the energy of steam from approximately atmospheric pressure down to 28 in. vacuum. The author stated that 1 lb. of saturated steam expanded with perfect efficiency from a gage pressure of 150 lb. to 1 lb. gage pressure is capable of doing approximately 132,000 ft.-pounds of work. If expanded from 1 lb. gage pressure to 28 in. vacuum, it is capable of doing approximately 118,000 ft-pounds of additional work. On account of the practical limitations of cylinder dimensions and exhaust ports, it is impossible for reciprocating engines to utilize the high degrees of vacuum. In the case of turbines, however, the exhaust chambers and escape ports can be built of any desired size, so that the turbine can utilize successfully the energy which it is impossible to utilize with the reciprocating engine. The effect of adding a low-pressure turbine with a condenser to a reciprocating-engine system is almost to double the permissible output of the plant, without burning any more fuel and without increase of boiler equipment. On the other hand, if reciprocating engines were re-arranged for condensing operation, and condensers were installed without low-pressure turbines, the maximum gain in output would not exceed 25 per cent. For example, the author showed that in a certain installation the maximum load which a reciprocating engine unit would carry was 1265 kw non-condensing and 1470 kw condensing, and with a low-pressure turbine the maximum load that can be carried with the same system would be 2500 kw.

In reply to questions by Messrs. J. T. Chambers, of Atlanta; E. C. Deal, of Augusta; C. M. Young, of Columbus; W. R. Collier, of Atlanta, and J. H. Adams, of Augusta, Mr. Ginn stated that the amount of steam consumed by the auxiliaries in low-pressure turbine installations does not exceed 6 per cent. The result of losing vacuum entirely is practically the same as losing steam pressure, all of the power of the turbine being lost. However, when a mixed-pressure turbine is employed the load is carried properly even when the vacuum is lost. When admitting high-pressure steam into a mixed-pressure turbine, no trouble is caused by the intermixture of high-pressure and low-pressure steam.

ELECTRIC HEATING DEVICES.

Mr. L. L. Warfield, of the Westinghouse Electric & Manufacturing Company, Atlanta, read a paper in which were briefly described various types of electric heating devices. The author claimed that since all the energy supplied to the resistor produces heat, the efficiency of the resistance material cannot be improved, and hence any advance that can be made in heating apparatus design must be along the line of more efficient utilization of the heat. It has been definitely shown that two heating elements exactly alike, operated in exactly similar irons, one subjected to heavy pressure in assembling and the other having the holding-down bolts tightened with an ordinary wrench, will operate under the same wattage, but the one to which pressure was applied will be at a very much lower temperature than the other. although both produce eventually the same temperature in the ironing faces. The difference in temperature is due to the poor thermal contact between the parts in the iron to which no pressure was applied. It is thus essential to secure good thermal contact if the temperature of the resistor element is to be kept low. The idea of good thermal contact is being applied successfully now in the design of water heaters, disk heaters, toasters and other small stoves.

For heating large volumes of water or other liquids the popular form of heater is constructed from flattened copper tubing, in which the flat resistor elements are assembled under pressure. One of the most successful applications of this type of heater is found in the water sterilizers for hospital service. Water in such cases is heated to a temperature corresponding to a steam pressure of 15 lb. per sq. in. One of the circulating heaters operated at 250 watts brings the water in a six-gallon sterilizer to 15 lb. pressure per sq. in. in one hour, after which an input of 688 watts maintains the pressure.

In the case of frying pans and chafing dishes, a thin flat resistor insulated with mica plates is placed in the bottom and between two separate pans and subjected to heavy pressure. In neither case is there any easily destructible part. The pan itself may be immersed in water and cleaned without fear of injury to the heater, since it is sealed water-tight. In the coffee percolator use is made of an immersion type of resistor, in which the heat is concentrated on the small valve well, so that the percolation will begin with cold water in the vessel in less than 1.5 minutes from the time the energy is supplied. The consumption of this outfit is 350 watts.

Electric cooking in the home has begun to be at least not uncommon. The utility toaster stove, the chafing dish, coffee percolator, disk stove, tea kettle, frying pan, small water heaters and many other small devices are being manufactured and sold in constantly increasing quantities. The cost of operation is not found to be prohibitive, while the ease and safety of operation are features that appeal to every woman.

Mr. W. R. Collier, of Atlanta, said that the percentage of repairs on heating elements is comparatively low, and in almost every type of heating apparatus of first-class manufacture very little trouble is encountered in replacing the defective element. The greatest part of the repairs are to broken attaching jacks and broken attaching plugs and cords. It is a mistake to use porcelain attaching plugs on any type of heating apparatus. The average customer is careless in the use of the cord, and the result is that a great number of attaching plugs have to be replaced every year. They should be made of some indestructible material, such as molded mica or hard rubber. From the electrical standpoint the cord in use at present is excellent, but from the mechanical standpoint it is practically a failure. During the year 1910 the total cost of repairs on flatirons and other heating apparatus by the Georgia Railway & Electric Company amounted to only about $100. The question presents itself, therefore, as to whether or not it would be good policy for the company to repair free of cost electrical heating apparatus used by its customers, just as it does with lamps. This method would seem to be advantageous from the standpoint of keeping the apparatus in commission.

Mr. Thomas W. Peters, of Columbus, stated that the Columbus Electric Company has made arrangements whereby any heating device can be bought by a customer on long-term payments. Ninety per cent of the heating devices placed in service under these conditions are paid for finally. In the case of tailors who use large electric irons the energy is sold at motor-service rates. This arrangement has proved satisfactory, in view of the fact that the irons are not in use during the lighting load peak. Mr. Calendar, of the General Electric Company, Atlanta, called attention to the fact that the Athens Electric Railway Company follows the plan of making all repairs to flatirons free of charge. This plan has worked satisfactorily.

Mr. Warfield claimed that central stations have expended proportionately too much time in introducing flatirons instead of other devices. The flatiron increases the load on Tuesday, but has no effect on the load on other days of the week. The lowest point in the daily load is about 6 o'clock in the morning. For increasing the load at this time the baker's oven is particularly advantageous. Central stations would do well to sell energy for use in the baker's oven at from 2 to 6 o'clock in the morning at a very low rate. A baker's oven can be purchased at from $300 to $900.

Mr. G. K. Hutchins, of Columbus, called attention to the advantageous features of the fireless cooker, on account of the low cost of the apparatus and the small cost for the energy to operate it. Mr. E. C. Deal, of Augusta, remarked that the cords used with heating devices are far from perfection. With sixty-four electric irons used ten hours a day for five and one-half days a week, for about eight months in a year, 150 cords were required for renewals. The manufacturers could do more for themselves and for the central station, in the way of advancing the sale of heating irons, by improving the cord than in any other way. This result is of even more importance than reducing the cost of the iron.

In reply to a question by Mr. Deal, Mr. Warfield stated that the price of ranges varies from $50 to $125, according to the size and number of separate units employed. An electric range that will do practically everything that an ordinary range costing $42 can accomplish can be purchased for about $50, so that the price of the electric range may be considered not to be excessive, even at the present time.

A paper entitled "The Importance of Wave-Form to Central-Station Operation," by Mr. M. T. Morrison, of Atlanta, was read by Mr. W. R. Collier. The author outlined the methods that have been employed for analyzing emf waves of alternators and described briefly the disadvantageous effects produced when the wave-form departs considerably from the sinusoidal.

The following officers were elected for the coming year: Mr. William R. Collier, Georgia Railway & Electric Company, Atlanta, president; Mr. E. C. Deal, of the Augusta Aiken Railway & Electric Corporation, vice-president Messrs. R. P. Mayo, O. A. Farrar and M. L. Sperry, executive committee, and Mr. Thomas W. Peters, Columbus Railway Company, secretary and treasurer.

The social features of the convention included an informal reception given on Tuesday night at the Muscogee Club and a trip to Goat Rock on Wednesday afternoon. For this trip a special train was furnished by the Georgia Section of the N. E. L. A. A picnic lunch and other refreshments were furnished by the following manufacturing companies: General Electric Company, Westinghouse Electric & Manufacturing Company, Electric Storage Battery Company, Western Electric Company and the Allis Chalmers Company. The Hardaway Contracting Company and the Stone & Webster Engineering Corporation were hosts upon the arrival of the members and guests at Goat Rock, where the dam and many points of interest were explained.

Convention of Association of Edison Illuminating Companies.

Following are abstracts of papers presented at the annual meeting of the Association of Edison Illuminating Companies held at Spring Lake, N. J., Sept. 19-21:

HIGH-POTENTIAL DISTURBANCES.

The report of this committee, of which Mr. P. Junkerfeld, of Chicago, is chairman, deals with its investigation of the following topics: Turbo-generators and reactors; circuit-breakers; series and shunt instrument transformers; fuses for shunt instrument transformers; relays; synchronizing recorder; aluminum-cell arresters for underground cable systems; underground-cable systems supplying magnetite-arc lamps; underground-cable systems of 20,000 and higher volts; inspection and tests of apparatus and material.

The committee drew attention to the heating problems which manifest themselves in the ever-increasing size of turbo-generators. With the higher-voltage coils the difficulty of getting rid of the heat because of the thicker insulation is such that the rise in temperature of a 6600-volt generator may without danger be considerably greater than that of a 10,000-volt generator. This difficulty is reflected in a recent order for 20,000-kw units wound for 4500 volts instead of 9000 volts.

During the year definite progress has been made in connection with the use of reactors external to generators, in connection with busbars, and in the design of machines possessing sufficient total reactance within their own windings. Experience has been too limited to present any fa...

; to the probable value of external coils from an operating ·ewpoint, but the general opinion seems to be that the total ıactance of the circuit should be approximately 8 per cent. ıe conclusion is also reached that a generator should be ilt with the highest amount of internal reactance con- ·tent with the best design of generator, considering ecially temperature and voltage, and, where it is not fficient, external reactance should be used in addition. eactors in connection with busbars have been used to ctionalize powers of 50,000 kw, and while this method luces slightly the efficiency of large stations the security ined thereby is believed to be sufficient reason for the actice. Where parallel operation is desired limiting re- tors are inserted in the busbars between the various ....

The principal advancement noted by the committee in oil rcuit-breakers has been along the line of improved baf- ig within the oil pot, so as to prevent excessive pressure thin the pot, as well as the expulsion of large quantities oil. The committee suggests in the case of tank-type cir- it-breakers that the leads be insulated with oiled linen ere they pass through the porcelain insulators, so as to ain an additional factor of safety. High-tension series trument transformers still add their quota to the list of turbances noted throughout the year, and the committee ices the need of an indestructible series instrument nsformer.

The criticism made by the committee against shunt in- strument transformers built for 4000 volts and over is ected to the arrangement of the terminal projecting above the transformer case. It is felt that a plug and socket rangement, amply insulated to prevent contact from the tside, would be a great improvement.

As regards fuses for shunt instrument transformers, two types of inclosed form of fuses have been developed, one which is inclosed in a long fiber tube and the other in a gular porcelain tube, but operating data from these are not available. Some improvements have also been made in the carbon tetrachloride fuses, as described by the com- mittee last year. The experience of several of the principal companies indicates that high-tension fuses of the types eviously used very frequently open, not because of any fect in the apparatus to be protected, but because of in- rent weakness in the fuse itself. Fuses of the liquid type, it would appear, cause less trouble.

An account is given of a relay for which correct selective action is claimed. One element of this relay, which is nor- mally shunted, consists of a series motor so designed that the field will be saturated at a current corresponding to a definite overload on the series transformers to which the motor is connected. Up to saturation the speed of the motor is dependent upon the amount of overload, but beyond that point the speed of action is fixed. The distance of travel of the contact arm of the various relays is adjusted so as to be greatest at the switch within the generating station. Should a short-circuit occur on the line, therefore, all of the motors would be saturated, and the relay nearest the fault, having a shorter time interval than those between it and the station, throws the proper switch, causing all of the other relays to drop back into normal position im- mediately.

Space is also given in the report to a discussion of the synchronizing recorder, in which small holes are burnt in a thin sheet of special paper placed over the face of the indicator, the holes indicating the exact position of the in- strument needle at the time the control switch and also the oil switch were closed. The purpose of the instrument is to give a tell-tale record of the exact position of the in- dicator needle when the generators are thrown in parallel.

Considerable diminution of trouble has been effected by equipping cable systems and busbars with aluminum-cell arresters, although the committee emphasizes the necessity of careful maintenance where aluminum arresters are used. When charging aluminum-cell arresters the induction from the line oftentimes disturbs adjacent telephone lines. An insufficient development of a film at the time of charging also causes potential rises sufficient to discharge lightning arresters on the low-voltage side of transformers. This latter occurrence may be avoided by charging the cells in- dividually from low pressure and building up the film formation so that it can be charged in the regular manner. Fluctuations in the current taken by magnetite lamps, as compared with ordinary direct-current lamps, indicate that underground cable used in connection with magnetite lamps may be subjected to higher voltage variations. In order to avoid this one company uses a form of static device, the purpose of which is to discharge the circuit at intervals to relieve it of any static charge.

During the past year two comparatively large cable sys- tems of 20,000 volts have been installed, on which joint and cable troubles have been noted. Experience indicates that the break-downs are much more frequent during the hot summer months, due, it is believed, to the drainage of the compound with which the paper is impregnated. The com- mittee is of the opinion that there is room for improvement in American cable-manufacturing methods and cites the case of a Berlin company which has placed an order for 157 miles of paper-insulated cable for operation at 30,000 volts as an instance of the greater progress made abroad in cable manufacture.

Under the caption of inspection and tests of apparatus and materials the committee urges the need for more thor- oughness, particularly in the production of apparatus and material, and recommends that every reasonable effort be made to effect proper inspection of material and proper factory tests before shipment.

The report of which the above is a brief abstract was the sole topic of Wednesday evening's session and drew forth what was said to be the best discussion ever presented before a technical society. The points discussed had to do with many untried problems and difficulties with which the large companies are now confronted, and so interesting were the facts and suggestions brought out that it was midnight before the session was brought to a close.

STEAM TURBINES.

The steam-turbine committee reported no new develop- ments, but emphasized the need of manufacturers consider- ing details of design as affecting the time needed for mak- ing repairs. No radical changes have been made in con- denser practice either, but attention is called to the fact that oil systems should be most carefully protected by in- closing the main supply and filter tanks by brick walls separating them from the main operating rooms. No sources of ignition, such as gas jets, motors with com- mutators, etc., should be permitted in proximity to the oil- piping system, because the danger from escaping oil has been shown to be serious. The recording and indicating Pitot-tube type of steam-flow meters built by the General Electric Company were described and their usefulness for daily observations of boiler-house conditions was pointed out at length. Appended to the report were notes by the General Electric Company, the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company, out- lining improvements in construction made in both the steam turbine and the generators. The General Electric Company has built six-stage vertical turbines of 15,000-kw and 20,000- kw ratings and two standard horizontal units of 7500-kw and 4000-kw ratings. It has also developed a three-stage 1500- kw machine. High-speed generators for turbines are now built with solid forged rotors, but the General Electric Com- pany no longer sanctions the use of high-voltage windings on high-speed machines, recommending instead windings of moderate voltages in connection with transformers or auto- transformers. The Westinghouse company has in contem- plation turbines of 30,000-kw rating, and is also at work on

turbines of 200-kw rating and under; for mixed lighting and heating loads automatic bleeder turbines have been devised. Where, after long service, undue erosion of the walls of a turbine has taken place brass liners have been inserted to advantage. The electric company points out the advantages of the radial slot and of the parallel slot in rotors of turbo-generators, claiming that the latter is better adapted for high-speed machines, while the radial slot is better for slow-speed machines. The company builds its large turbo-generators with sufficient internal reactance to limit the instantaneous short-circuit current to less than fourteen times normal current, the limit indicated by tests and experience to be safe. A test of a 7500-kw machine driven by a water-wheel showed a maximum instantaneous current only eight times normal rated current. The company points out that damage to windings depends on the duration and number of short-circuits, as well as on the short-circuit current.

PROGRESS IN TRANSMISSION OF ELECTRICAL ENERGY.

A paper, the full title of which was "What the Central Stations Can Gain from the Latest Progress in Electric-Power Transmission," was prepared by Mr. Philip Torchio, of the New York Edison Company, and read in his absence by Mr. Lieb. A comprehensive review of the commercial and economical features, as well as constructive details and operating experience, is given in a report presented simultaneously by the author at the International Congress of Applications of Electricity in Turin, at which Mr. Torchio represents the Association of Edison Illuminating Companies. The report deals extensively with hydroelectric transmissions and calls attention to operating records which show remarkably good reliability of service for the extra-high-tension systems. This is probably owing, among other reasons, to the fact that the extra-high-tension lines are operated as main trunk lines with few and well-designed receiving substations in constant charge of expert operators. The report also shows that the cost of equipment for these substations is relatively small if the energy received is large, but prohibitively high if the installation is small. These considerations point out the fact that for best all-around economy the hydroelectric transmitting systems on the one hand and local central stations on the other, at least as far as operation is concerned, should be correlated in one system in order to take full advantage of the respective economies of cheap primary energy and economical distribution. It is evident that local central stations by becoming the sole distributors of energy for all services in a given district would be in a position to realize enormous savings both in investment of substations and distributing lines and in the cost of operation and maintenance, as well as in general expenses and management. Furthermore, from a commercial standpoint the co-operation of these central stations, with their reserve steam plants and skilful operating forces always available, would enhance the value and improve the service of the hydroelectric transmissions. In the light of the information contained in the report, the author reviews the possibilities of interchanging steam-power between distant systems for the purpose of regulating the operation of the less efficient plants for emergency and peak loads. Considering from the commercial aspects the possibilities of long-distance energy trunk lines, the author says that in the territory traversed by the lines there may be a number of adjoining towns, manufacturing centers, railroads, local street and interurban railways and lighting central stations. An interconnection between these smaller central-station plants and the main trunk line would give to each small central station the same facilities that are enjoyed by the larger ones in dealing with large customers and service requirements of all kinds. In dealing, for instance, with enterprises like railroads operating through territories of different companies the advantages of being able to make a common contract are very apparent. From the appreciation of these mutual advantages and the incidental operating and investment economies derived from the joint operation of common trunk energy lines it would appear that the latest progress in extra-high-tension transmission opens the avenue for the central station to enter into a great new field of expansion. This growth would also benefit the public largely, as it will make feasible industrial developments of great economic and sociological importance.

METERS.

Due to the expiration of certain of the Tesla basic patents last December, the induction-meter situation change materially during the year and many new meters appeare on the market. The meter committee of the Edison associa tion, therefore, directed its investigation to these nev meters, and although the field is not yet an open one, pend ing the expiration of certain Shallenberger patents on Jan 1, 1912, the situation, in the opinion of the committee, i very promising in the progress already made in the direc tion of a cheaper meter. These developments have applie wholly to induction meters. Descriptions of the meters in vestigated form part of the report. The greater part of th report, however, is given over to Section 9 of the mete code as presented by the meter committee of the N. E. L. A at its last convention, supplementing which are additions t Sections 5 and 6, presented for the first time. The addition have to do with wiring protective devices for meters, loca tion, choice and wiring of meters, installation device methods for verifying connections and rules, and precau tions for meter installation work. With these additions th committee feels that the meter code is complete and may b accepted as standard for some time to come, pending suc revision as may be necessary due to the test of time ar changes in the art. It expresses gratification that the met code has been adapted by public-service commissions.

ELECTRIC VEHICLES.

The report of the committee on electric vehicles indicat that great progress has been made in the introduction this type of wagon and carriage during the past year. T committee, however, is firm in its belief that the gr majority of central stations are not doing all they can further the more rapid use of all classes of electrics in th respective territories and thus build up a highly profita off-peak load. It has been reported to the committee tl as of Sept. 1, 1911, users have invested $10,000,000 in el tric trucks and $30,000,000 in electric pleasure vehicles a that the total yearly value of the energy needed to oper these cars properly, figured at 4 cents per kw-hour, amou to $1,800,000.

The manufacturers advise that of the above total sales electric vehicles to Sept. 1, 1911, not less than 1000 elec trucks at a value of $2,500,000 and 5000 electric pleas vehicles at a value of $10,000,000 have been sold during year ending Sept. 1, 1911. It is estimated that the va of the electricity necessary to charge the batteries of vehicles sold during the one year will not be less t $420,000, on the basis of energy at 4 cents per kw-h The reports from the various electric-vehicle manufactu also indicate a very large increase in business this year any previous year, one manufacturer of commer vehicles reporting more business done the first three mo is of this year than in the whole of last year. As indica of the enormous possibilities for growth in this business e committee cites the twelve years' sales of all kinds of c tric vehicles to Sept. 1, 1911, at $40,000,000, whereas or one year ended Sept. 1, 1911, a total of $12,500,000 o ll types of electric vehicles was sold, indicating that 31.3 er cent of all the electric vehicles sold and in use to date re sold during the one year ended Sept. 1, 1911. This he committee states, should cause all to consider very care lly whether everything that can be is being done to obtain is desirable new business.

Convention of Kansas Electric Association.

Following are abstracts of the papers presented at the ·al sessions of the Kansas Electrical Association, which ld its fourteenth annual meeting at Independence, Kan., ursday and Friday, Sept. 21 and 22.

POWER INSTALLATIONS.

Friday morning's program was opened by Mr. W. T. ·an, of the General Electric Company, Chicago, who exbited and explained a number of lantern slides illustrating andard and special applications of electric-motor drive d new types of motors.

Prof. C. I. Corp, of the University of Kansas, at wrence, followed with a paper on the "Effect of Size Units on Cost of Power." As an example Professor rp had investigated the relative efficiencies of several erent kinds of motive power for operating a pump in a ewery where a 160-hp engine-driven generator plant was eady installed, although this unit would have been only e-fourth loaded by the pump. In his conclusions the eaker found that while the old plant would have an absole theoretical efficiency of 1.67 per cent, based on the heat its in the coal, a motor-driven pump would show an ciency of 6.61 per cent and a steam pump 9.35 per cent, licating the last, in this case, as the desirable means of ive.

APPRAISALS, ETC.

"The Value of Public Utilities" was the title of a paper Mr. Clinton S. Burns, of Kansas City, Mo. After dissing the importance of proper and correct appraisals of blic-utility properties in establishing bases for rates, taxes, c., Mr. Burns entered upon a discussion of "franchise lues," "going values" and other of the recently developed nceptions which must be taken into account by the apaiser in determining the intangible values that, in addition the physical plant, make up the actual value of an operng utility.

Prof. C. A. Johnson, of the university staff at Lawrence, llowed with his paper on "Some Factors in Electric ghting." In discussing the effect of too intensely illumited surfaces in the field of view the speaker made the int that, after its millions of years of evolution, the ina of the eye, while becoming accustomed to a brightly hted upper field like the sky, is yet very sensitive to high ensities in the lower half of the picture. This fact, he is evidenced by the tendency to snowblindness and l receive consideration in any artificial lighting eme. Professor Johnson also referred to the harmful ects of ultra-violet rays, flickering light sources, visible d glaring light sources in the field of view, etc. In plan- llumination of interiors he directed attention to the f "warmth" given by certain colors and the necessity certain amount of shadows while obtaining a "soft" g effect.

WIRES AND LINE CONSTRUCTION.

L. G. Martin, of the Okonite Company, New York, ke next on the subject of "Better Insulation." Referring the new rules of the Board of Underwriters, he suggested t these might well have been even more drastic and outed a series of tests to determine both the chemical and chanical properties of the rubber insulation used on es, in addition to the electrical resistance offered by the terial. Mr. Martin advocated the rigid subjection of nples of all insulated wire used to the tests which he cribed.

Mr. W. H. Pennell, chief engineer of the Missouri & nsas Telephone Company, Kansas City, read a paper on joint use of poles by telephone and electric-light comies, following the new specifications that have been ued by the American Bell company for such joint-pole struction. The speaker enumerated the economy and advantages of the joint construction, which separates the telephone and lighting wires a distance of 6 ft., ample to prevent induction or danger of crosses. The specified construction requires a pole only 5 ft. higher than that needed for single duty. In many places it has become the policy for the telephone and central-station interests to bear jointly the building of new pole lines, although only one may have immediate use for the poles.

Mr. L. O. Ripley, of Wichita, closed the central-station program with a brief discussion of the difficulty of getting some employees to handle customers tactfully, as well as the difficulty with which some customers are handled.

ELECTION OF OFFICERS.

The convention committees appointed by President Murrow at the opening meeting were as follows:

Nominating Committee—Messrs. A. L. Newman, Arkansas City; C. H. Talmadge, Kansas City, Mo.; C. H. Rathert, Junction City.

Auditing Committee—Messrs. W. S. Newman, Kansas City, Mo.; W. H. Fellows; H. W. McGruder, Liberal.

Resolutions Committee—Messrs. M. T. Flynn, Kansas City; A. G. Purdy, Topeka; G. A. Seabury, Kansas City, Mo.

Committee on 1912 Convention—Messrs. L. O. Ripley, Wichita; C. C. Brown; B. F. Eyer, Manhattan.

The report of the nominating committee selecting association officers for the following year met the unanimous approval of the convention and the following were declared elected:

President, Mr. B. F. Eyer, Manhattan; first vice-president, Mr. J. H. Rathert, Junction City; second vice-president, Mr. W. J. Welfert, Winfield; third vice-president, Mr. M. T. Flynn, Kansas City; secretary-treasurer, Mr. J. D. Nicholson, Newton. Executive committee, Messrs. L. O. Ripley, Wichita, chairman; A. G. Purdy, Topeka, and W. E. Sweezey, Junction City.

PRESIDENT-ELECT B. F. EYER.

Prof. B. F. Eyer, the president-elect of the Kansas association, is professor of electrical engineering at the Kansas Agricultural College, Manhattan, and is also vice-president of the local central-station company. Professor Eyer attended both the University of Chicago and the Armour Institute of Technology, being graduated from the latter in 1902, and has since received his E.E. degree. Besides instructional work at the university and the care of his own private electrical interests in the Manhattan company, Professor Eyer has devoted some time to consulting work for a number of the smaller Kansas central stations. He is a member of the National Electric Light Association and is an associate of the American Institute of Electrical Engineers.

On invitation of President-elect Eyer the 1912 convention of the Kansas Association will be held at Manhattan at a date in the fall yet to be determined upon.

Convention of Northwest Electric Association.

Following are abstracts of the papers and discussions at the final sessions of the Northwest Electric Association, which held its annual convention at Tacoma, Wash., Sept. 21-23.

Friday's session began with the reading of the paper of Mr. Arthur Gunn, Wenatchee, Wash., on "New-Business Methods for the Small Central Stations."

CENTRAL-STATION NEW-BUSINESS METHODS.

In this paper the author outlined the characteristics which should be possessed by the managers of small plants if they are to be successful. The characteristics mentioned include ambition, intelligence, information, industry, tact, perseverance, courage, common sense and a feeling of dissatisfaction with what he is and what he has accomplished. It is essential for him to lend his energies to giving a satisfactory service. His motto should be "Charge what the service is worth and deliver all that the customer pays for." He should seek to give the customer that type of installation from which he will get the largest business return for his money.

Suggestions relating to methods of accounting to be employed in connection with national and state legislation were briefly outlined in a paper by Mr. C. M. Huggins. The author stated that there has been a great change in the attitude of corporations toward commissions during the last two or three years, and it is now appreciated that while there may be considerable annoyance in complying with the numerous demands made by the commissions and considerable extra expense is entailed in doing so, yet much benefit has been derived from their oversight. The time is rapidly approaching when investors will be very chary indeed of securities of public-utility companies which are not under commission regulation. Although absolutely uniform classification of accounts for all operating companies would not be desirable on account of differences in local conditions, yet the corporations should adopt such reasonable forms, with the fewest possible complications, as will most readily furnish information desired by the various commissions.

Discussion.

In a discussion Mr. Fred Shields, Moscow, Idaho, laid stress on the fact that the fixing of rates in small central stations was a different problem from that confronting larger stations, as it was not as easy to explain a complicated rate schedule to the small municipalities as to the larger cities.

The matter of the extension of lines to outlying districts was also discussed and different experiences were narrated. A number of interesting cases of the methods employed for securing new business in small towns were outlined by several speakers.

At this point Mr. McMicken, Portland, Ore., in behalf of the Pacific Light & Power Company, the Portland Gas & Electric Company and the Byllesby Company, invited the Association to hold its next annual convention in Portland, Ore.

The paper of Mr. C. N. Huggins, Portland, Ore., entitled "Methods of Accounting in Connection with National and State Legislation," was next presented.

In the discussion that followed it was stongly urged that a uniform system of accounting should be adopted; it was also urged that a valuation of water powers should be established.

The next paper to be read was entitled "Central-Station Problems," and was prepared by Mr. A. C. McMicken, Portland, Ore.

CENTRAL-STATION COMMERCIAL PROBLEMS.

The author discussed the several competitors of electricity. He stated that in some of the cities gas competition represents the most serious problem. Gas at $1 per 1000 cu. ft. represents serious competition among certain classes of customers. However, a 250-watt tungsten-lamp equipment can compete successfully with the so-called gas arc, both in illumination and in the cost of operation at the commercial rates charged in the larger cities. In the line of cooking, energy at 3 cents per kilowatt-hour is equivalent to gas at $1 per 1000 cu. ft. Although much of the operation of the electric range occurs during off-peak hours, yet the fact remains that some of the load does overlap the peak. It is therefore questionable whether electric cooking at the low rate necessary to compete with gas represents profitable business for the average central station company to solicit.

The most serious competitor with the electric motor in the Pacific Coast cities is the oil-burning isolated manufacturing plant. With oil fuel, which can be purchased at from 70 cents to $1.25 per gallon, certain isolated plants are producing energy at as low as $30 per hp-year. It has been shown in a number of instances that the manufacturer is willing to pay a little higher cost per year for electricity, provided the output of his factory can be increased by the installation of motors, the reduction of friction losses usually accomplishing the desired results. Although the rapid adoption of small high-efficiency lamps by residence consumers has been a source of worry to certain central-station managers, the fact is that the high-efficiency lamp, generally speaking, has been a boon to the central station, making it possible to secure much business which could not formerly be obtained and educating the public to the use of more light.

Discussion.

Discussion of this paper was taken up at the afternoon session. A question arose as to the advisability of extending lines where a certain revenue was not guaranteed. I the larger cities it was deemed advisable to endeavor t reach all consumers, even though a given income is not i sight, inasmuch as the franchise practically entitles th people to the service if desired; whereas in the small town and outlying districts it perhaps would be wiser to exten lines only where a given income could be realized. It wa pointed out that the tendency not to build to prospectiv consumers in the cities tended to create a feeling for mu nicipal ownership.

Mr. T. C. Martin, secretary of the National Electri Light Association, was introduced to the convention at th morning session, and explained the advantages to be gaine by affiliation with the national association. He assure the association that it would in no way lose its identity o state rights, and would be greatly benefited by the assis ance received from the national association in matters o pernicious legislation, etc., and the distribution of valuab literature. He showed where other minor associations ha benefited to a great extent by such affiliation, and urge a like action on the part of the Northwestern associatio The matter was referred to the executive committee fo action.

Mr. S. E. Doane, of the National Electric Lamp Associ tion, was then introduced, and addressed the convention o the lamp situation, stating that it was only a matter time when tungsten-filament lamps would universally ta the place of carbon-filament lamps, and showing where tl would be of benefit both to the central station and the cc sumer. He stated that these lamps would be supplied low wattages within a short time, and also dwelt on t value of the rate committee and its work.

The first paper at the afternoon session was that of M R. E. Thatcher, Seattle, on "Meter Accuracy in Relati to Central-Station Income."

METERS AND CENTRAL-STATION INCOME.

Mr. R. E. Thatcher presented a paper in which attention was called to the importance of meter accuracy with relation to central-station income. He stated that the energy at the meter is the finished product, and anything affecting the registration of the energy affects the gross income, so that a saving as small as 2 per cent in the gross income may determine whether dividends will be paid or not. The watt-hour meter is an instrument having an inherent tendency to under-register the energy passing through it. As a general proposition an average increase of from 1 per cent to 1.5 per cent in the accuracy of meters will more than pay the cost of making tests. Mr. Thatcher stated that the results obtained with cupped-diamond jewels in direct-current meters have been highly satisfactory, the life being about five times that of the sapphire jewel. The flat diamond with a ring-stone sapphire guide has not proved satisfactory. In making periodic tests of meters it is desirable to use a phantom load. One of the most convenient methods is that involving the use of small storage batteries for supplying current to the series coils. Very satisfactory results have been obtained with portable automobile batteries rated at 60 amp-hours. Phantom loads for alternating-current meters can easily be obtained by means of series transformers. A convenient lamp-bank load for use in testing small meters consists of twelve 32-cp and two 16-cp tubular lamps placed in a wooden carrying frame, upon which are located the controlling circuits. The lamps are so arranged that they may be connected two in series across 220 volts, or all in parallel across 110 volts.

Following Mr. Thatcher's paper, Mr. J. G. Finley, Spokane, read a very exhaustive treatise on the conditions obtaining with the different companies in this regard.

Mr. H. M. Winter, Seattle, then read his paper on "Electric Heating and Kindred Uses of Electricity."

ELECTRIC HEATING.

Domestic and commercial electric heating and cooking, domestic electric heating and the domestic application of motors were interestingly described in this paper. Among the heating devices the flatiron was said to be the greatest revenue producer, the average monthly consumption being about 6 kw-hours. Second to the flatiron among the heating and cooking devices is the toaster, which consumes 650 watts or less. The average monthly consumption of the toaster is approximately 3 kw-hours. On account of the high initial cost of electric heating and cooking appliances, in the majority of homes individual articles, such as hot plates, broilers, frying pans, cereal cookers, grids, etc., are purchased from time to time, the expectation being thereby to acquire finally a complete set. The average connected load with the large kitchen outfits is approximately 5 kw. Where the connected load is approximately 5 kw the average kilowatt-hours used per month is about 150. Many of the central-station managers have expressed themselves as being of the opinion that until the manufacturers develop an electric range with a lower maximum demand than can be obtained at present it will not be wise to advocate the use of electric cooking exclusively in the home.

Mr. Cheney, of Seattle, one of the staff of the Washington Underwriters, was then introduced, and addressed the meeting on the necessity of all wiring in small towns, without inspector service, being done with the utmost care, to eliminate fire risk. He stated that endeavors were being made to have the agents of the different light companies in these small towns appointed inspectors, to see that all electrical work was properly done.

The executive committee, after discussing the proposition of the Northwestern association affiliating with the National association, recommended such affiliations.

At the meeting on Saturday, Sept. 23, a paper by Mr. N. W. Brockett, Seattle, entitled "Legal Aspects of the Light and Power Business," was read and discussed. The subject was treated under the heads of organization, water-rights, business organization, franchises, right-of-way, protection of lines, contracts, collections and liability. Each of these was handled in an instructive manner. In appendices were outlined decisions on water rights in Washington and petitions for franchises.

The final paper of the convention was one presented by title dealing with municipal ownership.

MUNICIPAL OWNERSHIP.

In a report prepared for the taxation committee of the Seattle Chamber of Commerce much information was given concerning the municipal ownership and operation of the central station in Seattle. According to the report the city lighting plant is charging and collecting from the taxpayers through the general fund an average of $181 per kilowatt-year for street lighting, while private consumers are obtaining service at from $40 per kilowatt-year to $80 per kilowatt-year. The plant is charging and collecting from the taxpayers through the general fund an average of 4.62 cents per kilowatt-hour for street lighting, while private consumers obtain rates as low as 1.5 cents per kilowatt-hour. The report claims that electric lighting and motor service is being furnished to the private consumers at

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less than cost of manufacture and distribution when all the elements of expense are considered.

Instead of the more usual "question box" certain of the members prepared questions which were answered in a formal manner by other members. Messrs. C. H. Cleaver and Arthur Gunn submitted in this way questions relating to supplying energy in small quantities for general domestic service and in larger quantities for railway service, which were answered by Messrs. H. V. Gates and R. A. Willson.

AFFILIATION WITH N. E. L. A.

As a result of a recommendation to the executive committee the following resolution was unanimously adopted:

"That the report of the executive committee on the question of affiliation with the National Electric Light Association be and the same is hereby approved and ratified with the understanding that the present autonomy of the Northwest Electric Light & Power Association be retained, and the power of collection of dues and other funds be fully retained by this association, the secretary of this association to remit to the National Electric Light Association an amount not exceeding one-half of the fees now charged by the national association, as such amounts may become due; this resolution to take effect Oct. 1, 1911."

Changes were made in the constitution so that hereafter Class A and Class B members will not have to pay an

initiation fee, the annual fee of Class B and Class C members will be $5, and the president cannot be re-elected to serve for two years after his expiring term.

The president and secretary were instructed to make formal application covering the affiliation of the Northwest Electric Light & Power Association with the National Electric Light Association.

A motion that the constitution of the N. W. E. L. & P. A. be amended so as to conform in all details with the requirements of the N. E. L. A., and that the inserting of the necessary clauses into the constitution be left in the hands of the committee on amendments, its powers to be limited to the resolution already adopted, was promptly voted down.

The following officers were unanimously elected: Mr. J. E. Davidson, Pacific Light & Power Company, Portland, Ore., president; Mr. J. M. Kincaid, Port Townsend, Wash., first vice-president for Washington; Mr. George Harding, Coeur d'Alene, Idaho, second vice-president for Idaho; Messrs. H. L. Bleecker, Spokane, Wash.; W. J. Grambs, Seattle, Wash.; Arthur Gunn, Wenatchee, Wash.; O. B. Coldwell, Portland, Ore.; M. D. Spencer, Eugene, Ore.; L. B. Faulkner, Olympia, Wash.; J. S. Thronton, Aberdeen, Wash.; Douglass Almond, Anacortes, Wash., executive committee. Mr. Norman W. Brockett was appointed by President Davidson as secretary-treasurer to succeed himself.

ENTERTAINMENT FEATURES.

On Thursday afternoon, Sept. 21, the visiting ladies were the guests of the Washington Water Power Company on an automobile trip to the Spokane Country Club. Tea was served at the club house, and a pleasant social afternoon was spent, the party returning to Spokane in the evening. At 8:30 in the evening an informal ball was held at the Hall of Doges. Seventy-five couples attended this function. At 11:30 lunch was served in the "Hall of Palms." The affair was admirably handled and an atmosphere of welcome and hearty fellowship pervaded the hall.

On Friday morning the ladies at the convention were the guests of the Spokane-Inland Railway Company on an excursion to Hayden Lake. About forty ladies attended the function and dinner was served at the lake.

Friday evening was given over to the viewing of Spokane by electric light, and all members expressed great surprise at the modern, up-to-date illumination of the city, the number of display windows and signs and the substantial, high-class character of the signs as well as the lack of gas installations.

On Saturday afternoon the visiting guests were entertained by the Washington Water Power Company on an automobile sight-seeing excursion throughout the city. About fifty availed themselves of this opportunity.

On Saturday evening the closing banquet was held at Davenport's Restaurant, about 125 members being present. The lady visitors attended a theater party in a body as the guests of the Washington Water Power Company.

On Sunday seventy-five members were taken on an automobile inspection trip to the Long Lake and Little Falls plants of the Washington Water Power Company.

Public Service Commission News.

WISCONSIN COMMISSION.

The Milwaukee Electric Railway & Light Company has been authorized by the Railway Commission to issue $2,000,000 of refunding and extension mortgage bonds, in denominations of $1,000 each, to bear interest at the rate of 4½ per cent per annum. The issue is authorized for the purpose of supplying the company with funds to pay an outstanding indebtedness incurred by reason of additions and extensions made to the property during the year ended Aug. 1, 1911. The bonds must be sold for money and for not less than 85 per cent of par value. The mortgage deed has been made by the company to the Trust Company of America and W. H. Leupp as trustees.

The commission recently heard the arguments on the petition of the Manitowoc & Northern Traction Company for authority to increase its fare between Manitowoc and Two Rivers from 10 to 15 cents. The company's charter provides for a 10-cent fare, but the traction company contends that this rate does not yield a sufficient revenue to pay all legitimate expenses. The company recently won its case in court, but upon suggestion of the court the commission was asked to investigate the conditions and fix the amount of the fare.

MARYLAND COMMISSION.

The Hagerstown Railway Company has petitioned for permission to purchase 267 shares, at $50 per share, of the Myersville & Catoctin Railway Company. This purchase, if allowed, will transfer control to the Hagerstown Railway Company and will be an additional step in the consolidations which have lately occurred in the interurban lines of western Maryland.

A public hearing on the proposed new rates of the Chesapeake & Potomac Telephone Company will be given Oct. 18, beginning at 10:30 a. m. At the same time the commission will consider the report of Messrs. D. C. and W. B. Jackson, the Boston experts, on the proposed rates, which was recently submitted to that body and printed in pamphlet form by the commission. The new rates were submitted to the commission several months ago and it made many changes, including the abolition of flat-rate unlimited service. Some of the changes are reductions, while others are apparently increases. The subject is so complicated that the commission secured the services of the experts, who took up the questions involved with Charles E. Phelps, Jr., the chief engineer of the commission. The Messrs. Jackson recommend the adoption of the new schedule with some minor changes.

NEW YORK COMMISSION NEWS.

On Oct. 16 the Public Service Commission for the First District will consider the petition filed by various organizations of stationary engineers against the rates now charged by the New York Edison Company. It was alleged in this petition that the rates charged to small consumers are exorbitant as compared to those charged to large ones.

An application has been received from the Dry Dock, East Broadway & Battery Railroad Company for authority to change from the use of horse cars to storage-battery cars on its Avenue B and Canal Street lines. The company is a part of the Third Avenue system, now operated through receivership. A hearing is scheduled for Oct. 13.

A hearing has been ordered to be held on the application of the New York & North Shore Railroad Company for authority to issue bonds to the amount of $1,500,000 and stock to the amount of $771,764, proceeds of which are to be used for improvements. Mr. Edward M. Bassett, formerly a member of the commission, represents the road in the application.

OHIO COMMISSION NEWS.

Two applications for exchange service between Independent and Bell Telephone Companies and two applications for the sale of Bell properties to Independents have been filed with the Public Service Commission at Columbus. In the cases of the latter supplemental petitions asking for the exchange of service were also filed. The hearings were set for Oct. 6.

The applications for exchange of service were made by the Mount Sterling Telephone Company and the Van We[illegible] Telephone Company, while President B. E. Sunny and Secretary C. E. Mosly, of the Central Union, signed for the company. The contracts submitted for approval provi[illegible]

that the local companies shall receive 25 per cent of the long-distance tolls originating on their lines, or if they establish branch switchboards, then they are to receive 60 per cent of the tolls. The Bell company is to pay the taxes on the long-distance lines, but the local companies may rent its instruments at the rate of $1 per year, delivered at Indianapolis. According to the contracts, the Central Union has reserved a measure of control over the local companies, as they will not be permitted to make any switchboard or other connections with any other lines without the written consent of this company. On the other hand, decisions of the federal court, rendered some years ago, were to the effect that local companies are under obligations in giving public service to afford connections with other lines that apply for them and cannot limit themselves to connections with the lines of one long-distance company exclusively unless no requests for connections are made.

Applications for the sale of Central Union properties to local Independent companies were received from the Citizens' Telephone Company, of Delaware, and the Ashtabula Telephone Company, of Ashtabula. In the petitions it is stated that duplication of service either results in rendering the business unprofitable to the companies or imposes an undue burden upon the public.

The value of the Central Union property at Delaware is placed at $10,573, which the Citizens' Telephone Company says it is willing to pay. At Ashtabula the value of the Central Union property is given as $17,950, with the addition of $1,450 for toll lines in Ashtabula County. There the saving to users is placed at $2,448 per year.

Opposition has developed to the merging of the plants at Delaware and Ashtabula. Those who have made complaint claim that the step will result in an increase in the rates for service so far as the public is concerned. Under the circumstances the commission will be compelled to make a rigid investigation in both cases to ascertain for itself the probable results of consolidation.

The commission has received a written complaint from Mayor Baehr, of Cleveland, alleging that the service given by the Cleveland Telephone Company and the Cuyahoga Telephone Company is inefficient.

This step was taken by Mayor Baehr following the adoption of a resolution by the City Council requesting him to file complaint. The resolution was offered by Councilman Townes because of numerous complaints made by merchants on West Twenty-fifth Street and was adopted by unanimous vote of the members. The matter had been under discussion for some time and councilmen had investigated to some extent before the resolution came before them.

Another resolution prepared by Councilman Townes authorizes the city clerk to insist that Cuyahoga County delegates to the constitutional convention make an effort to secure an amendment that will authorize the cities to own and operate telephone systems in competition with the privately owned plants. This was brought about through the belief that a material advance in rates will be made when the two local companies are consolidated, as it is expected they will be. Council has the advice of a telephone engineer to the effect that a plant with a capacity for 25,000 telephones can be installed complete, buildings and underground work, for the outlay of $3,500,000. The Cleveland Telephone Company now claims 40,000 subscribers, so it would seem that a plant of the size under consideration would not be sufficient to take care of the business if the rates fixed are sufficient to take a great amount of business from the two old companies, even when combined.

Secretary Radcliffe, of the Public Service Commission, has rendered an opinion to the effect that telephone companies may increase their rates without consulting the commission, but that they must file their schedules with it. Then, upon complaint or upon its own initiative, the commission may make an investigation and afford relief if it finds that the rates are excessive. It was the general opinion that the new law made it impossible to increase rates until some further legislation was secured along that line.

The report of the Cuyahoga Telephone Company, of Cleveland, filed with the commission, shows that it is furnishing service in about seventy-five instances free of cost. These are given under the head of "Schedule of Special Contracts." The commission will look into the nature of these contracts. The only free or reduced-rate service allowed under the new laws is to the United States government, the State, county, city and charitable institutions and to officers and employees of the company.

Assistant City Solicitor A. J. Dwyer, of Dayton, has rendered an opinion that the telephone companies of that city may continue to furnish service to the public schools at special or reduced rates. He states that the boards of education are subdivisions of the State and that the new public-utilities law provides for this. The schools are now paying $350 per year for their service, while the cost would be about $3,000 if the full rates were paid.

ONTARIO HYDROELECTRIC COMMISSION.

The Lindsay Light, Heat & Power Company, which prior to Sept. 29 had no franchise, decided to sell its entire plant and system. The town secured an option on the plant, and a valuation of $230,000 was placed upon it by the Ontario Hydroelectric Commission. In the meantime the Seymour Power Company came forward with a somewhat higher offer to the Lindsay Light, Heat & Power Company than the town had made and also offered very favorable terms to the town corporation of Lindsay in exchange for the granting of the franchise. On Sept. 29 the ratepayers carried a by-law granting a franchise to the Lindsay Light, Heat & Power Company, but the passing of this by-law by the ratepayers does not in any way preclude them from voting on the by-law to be submitted on Oct. 12 providing for the purchase of the Lindsay Light, Heat & Power Company's plant by the town. The passing of the first by-law has occasioned considerable comment in the town, as in the event of the defeat of the by-law on Oct. 12 the Seymour Power Company will secure possession of the Lindsay Light, Heat & Power Company and, with it, the franchise granted to the latter company by the ratepayers on Sept. 29.

CURRENT NEWS AND NOTES.

Colorado Electric Club.—At the midweek lunch on Sept. 28 of the Colorado Electric Club Mr. J. C. Hendricks, manager of the Denver baseball team, explained how the Jovian method of "altogether all the time" had been successfully applied to his team and had secured to it the pennant by the largest percentage margin of any league in the country.

* * *

Rockford (Ill.) Electrlc Show.—The armory at Rockford, Ill., has been secured for an electric show and the business sessions of the Illinois State Electric Association, which will hold its annual meeting Oct. 24, 25 and 26 in Rockford. Among the speakers will be Mr. H. E. Chubbuck, general manager and executive officer of the Illinois Traction System; Mr. John C. Gilchrist, president of the National Electric Light Association; Mr. W. A. Fox, of the Commonwealth-Edison Company, and Mr. Frank Baker, of the North Shore Electric Company.

* * *

Census of Electric Meters in Second Commission District, New York.—The New York Public Service Commission, Second District, has made a census recently of the total number of watt-hour meters in service in the district. Returns were received from 297 companies, which showed a total of 162,488 meters in use as of July 1, 1911.

A few companies which operated a small number of meters did not report in time to have their records included in the census, but it is estimated that the addition of the meters of these companies would increase the total to 165,000 meters. This amount includes, of course, all of New York State, excepting Greater New York, which is under the jurisdiction of the First District commission. If the average investment per meter, including installation expense, is assumed at $18, which is probably a low estimate, this would mean a total investment in recording watt-hour meters of nearly $3,000,000 in the Second Public Service District.

* * *

Dr. Steinmetz's Annual Lecture in Chicago.—A lecture by Dr. C. P. Steinmetz, of Schenectady, has become a regular annual feature of the joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers. This year Dr. Steinmetz's subject will be "Reactance in Alternating-Current Circuits," and he will speak on the evening of Oct. 25, probably at Fullerton Hall, Art Institute.

* * *

Value of Electric-Sign Advertising.—It is stated that the electric-sign space on the roof of the Studebaker Building, covering half a block above Forty-eighth Street, between Broadway and Seventh Avenue, New York, has been leased at a price close to $25,000 a year. The conditions of the sign lease imply that the roof cannot be used for any other purpose. The new sign, which will cast its blaze of light down Broadway and Seventh Avenue, in the theater district, will proclaim the virtues of a breakfast food.

* * *

A Better Sign Ordinance Urged for St. Louis.—The need for more liberal provisions in the St. Louis electric-sign ordinance, which now restricts displays to positions within 18 in. of buildings, was urged in a talk by Mr. Ell C. Bennett, of St. Louis, before the St. Louis League of Electrical Interests, on Sept. 26. The speaker declared that spectacular electric signs, brilliantly lighted streets and brightly illuminated store windows attract visitors and serve as a stimulus to trade. The enactment of a better sign ordinance, said Mr. Bennett, should be the first work of the business organizations of the city.

* * *

American Society of Municipal Improvements.—The eighteenth annual convention of the American Society of Municipal Improvements was held in Grand Rapids, Mich., on Sept. 26 to 29 inclusive. Such subjects as garbage disposal, street cleaning, paving, sewer specifications, water supply, etc., were discussed. Mr. E. A. Fisher, city engineer of Rochester, N. Y., delivered the report on street lighting, and Mr. Joseph E. Putnam, assistant city engineer of the same city, read a paper entitled "Some Examples of Ornamental Street Lighting." Mr. E. A. Kingsley, of Little Rock, Ark., was elected president.

* * *

Chicago Subway Project.—Mayor Harrison of Chicago has sent to the City Council a proposed ordinance formally establishing a permanent commission to design, construct and maintain a subway system for passenger railway service in the city of Chicago. The City Council is to select the routes, but the commission is to have charge of the work, including the location of underground utilities affected by the building of the subway. The present subway commission is a temporary body and consists of Mr. John Ericson, city engineer; Mr. E. C. Shankland, a consulting engineer, and Mr. James J. Reynolds, a railway expert. The Mayor's proposed ordinance was referred to the committee on local transportation.

* * *

Toronto Muncipality to Take Over Suburban Electric Railway.—The board of control of the city of Toronto, acting on advice of the corporation counsel, has decided to give notice of the city's intention to take over, at the expiration of the franchise on Nov. 16, 1912, those portions of the Toronto & Scarboro Railway (now the Toronto & York Radial Railway) Company's line which lie within the city limits of Toronto. The sections to be taken over include the line operated by the Toronto Railway on Queen Street East from Howard to Oak Avenue, the Scarboro line on the Kingston Road from Queen Street to the east limit of East Toronto, the line on Queen Street from the city limits to Munro Park, and 300 ft. of line on Gerrard Street in East Toronto.

* * *

Commercial Section of the N. E. L. A.—The executive committee of the Commercial Section of the National Electric Light Association held a meeting Sept. 25 in Chicago. Mr. H. J. Gille, Minneapolis, chairman of the section, presided, and Mr. Philip S. Dodd, of Cleveland, the secretary, performed the duties of his office. Messrs. George Williams, New York; F. H. Golding, Rockford; G. N. Tidd, New York; Joseph E. Lukes, Reno; Joseph F. Becker, New York; H. L. Parker, Baltimore; John Meyer, Philadelphia; W. H. Hodge, Chicago; T. I. Jones, Brooklyn, and L. M. Wallace, Boston, were selected to direct committee work for the Seattle convention of next year. The Commercial Section has experienced a rapid development within the last two years and has now over 1200 members.

* * *

Brooklyn Company Section of N. E. L. A.—With the largest attendance in its history, the Brooklyn Company Section of the N. E. L. A. held its first fall meeting on the evening of Oct. 2, with Mr. M. J. Shugrue, president of the section, in the chair. Mr. H. W. Cluthe, of the fiscal department, presented a paper on "Rendering Bills for Electric Service," and Mr. T. W. Flowers, of the auditing department, one on "Storeroom Organization and Accounting." Each of these papers counts twenty points for its writer in the company's competition for delegates to the Seattle Convention. After animated discussion of the papers, and motion pictures, Mr. John F. Gilchrist, president of the N. E. L. A., was introduced, and made an interesting address on "Property Valuations," in which he pointed out the propriety of including an efficient organization among the assets of a company. Mr. W. W. Freeman, past president of the N. E. L. A., made a few remarks which were followed by refreshments and music by the company orchestra.

* * *

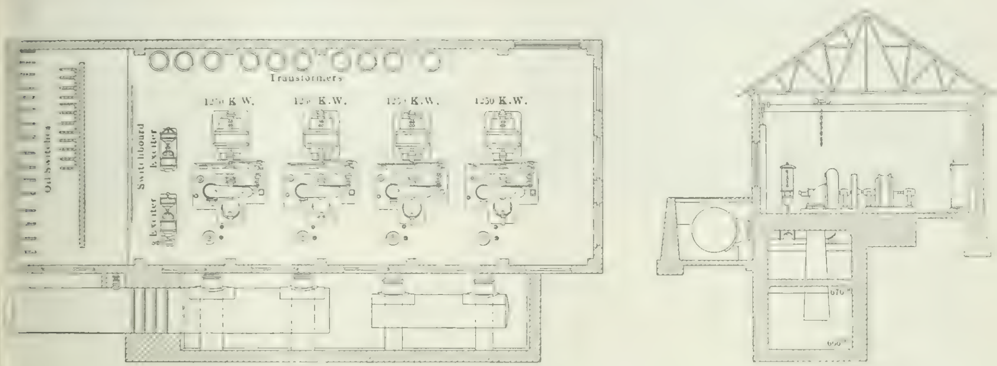
Newspaper Reporters and Technical Conventions.—An unpleasant feature of the recent Chicago convention o the Illuminating Engineering Society was due to the mis directed attention which it received from the newspape press. A city press association supplied to the daily news papers alleged interviews and brief reports of the proceed ings so grotesque as to tend to give the meeting, in the eye of the public, the character of an assemblage of men crav ing for sensational notoriety. One of the officers of th society was quoted as making disparaging remarks abo the local gas company, which discourtesy, if true, woul have been at once resented by numerous representatives c the gas industry present as members of the society. A other member was made to say that glaring lights "dra human faces into wrinkles and bring on premature age c the facial expression," and still another is quoted in hea lines of several papers as saying that "artificial light caus tuberculosis." It is perhaps unnecessary to say that no of these gentlemen made any of the remarks in these a leged verbatim quotations. Some of the headlines that a peared are as follows: "Called Arc Light Unhealthy "Glare or Color in Light Makes People Crazy or Ugly "Light Causes Disease, Engineers Are Told." Chicago w lose prestige as a convention city, at least for technic bodies, if such journalistic buffoonery is unchecked by t responsible editors of newspapers.

HIGH-HEAD HYDROELECTRIC DEVELOPMENT IN NEW YORK.

Plant of the Mohawk Hydro-Electric Company at Ephratah, Fulton County.

Inflow Turbine Operated Under Head of 300 Feet Energy Transmission at 22,000 Volts.

There has recently been completed at Ephratah, N. Y., a hydroelectric station, unassuming in appearance, but embodying marked hydraulic and other engineering features. The available head at the station is approximately 300 ft. and the equipment at present installed aggregates 3750 kw.



Plan

Cross Section

Fig. 1—Plan View and Sectional Elevation of Mohawk Hydroelectric Station.

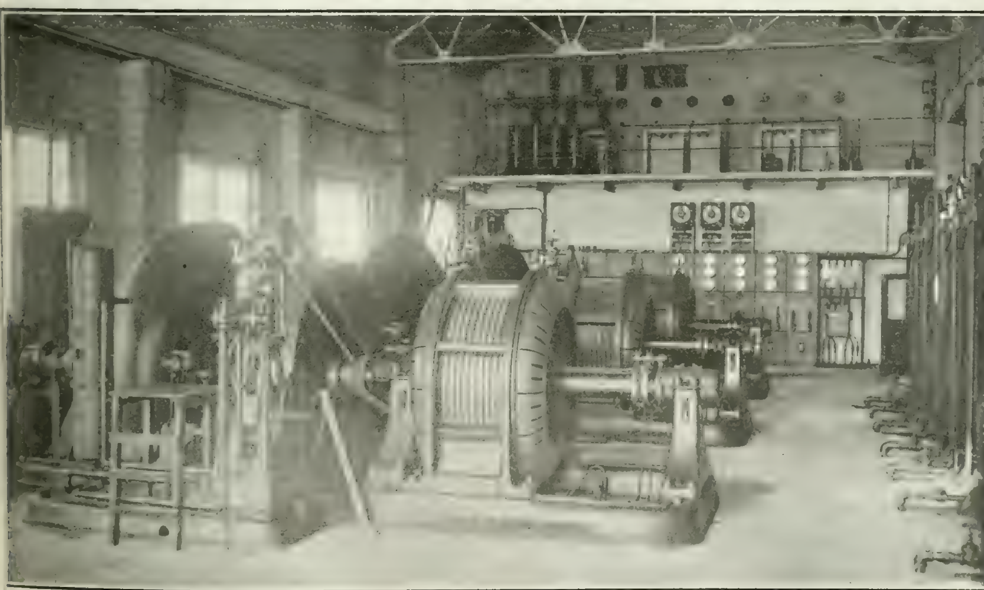


Fig. 2—Interior of Power House, Showing Wheels and Alternators and Transformers at Right.

Garoga Creek, whence the station receives its supply, has its source in the southern slope of the Adirondack Mountains and flows in a southwesterly direction to the Mohawk River, which it enters near Ft. Plain. On the headwaters of the creek are Peck and Caroga Lakes, which furnish storage for the development. A dam with a crest length of 1700 ft. and a maximum height of 40 ft. is built at the outlet of Peck Lake, while at the north end of the lake there is a timber-crib and earth-fill dike with a crest length of about 1900 ft. and a height of about 40 ft. Both of these dams serve to impound the water in the lake, which, with the existing storage afforded by Caroga Lakes, renders available for power purposes approximately 1,250,000,000 cu. ft. of water.

About 10 miles down stream a forebay dam has been constructed a short distance below Garoga village. This dam has a maximum height of 60 ft. and a crest length of about 750 ft. From the forebay dam the water is conveyed through a concrete tunnel 400 ft. long and 7 ft. in diameter; thence through a continuous-banded wood-stave pipe 78 in. in diameter a distance of 8600 ft.; thence through a 96-in. continuous-banded wood-stave pipe a distance of 1460 ft.; thence through a steel penstock 96 in. in diameter for a

distance of about 1000 ft. to the power house. A reinforced-concrete surge tank 25 ft. in diameter and about 50 ft. high is erected 2300 ft. from the station to protect the line against water hammer and to provide a considerable water storage reasonably near to the power house to insure close regulation on the sudden changes of the load.

Fig. 3—Forebay Dam, Showing Spring Flood.

Fig. 5—Exterior of Power House.

The generating station is constructed of rubble masonry and is 103 ft. long and 38 ft. wide. Views of the exterior and interior of the station are reproduced herewith, as are also a plan and sectional elevation of the power house showing the arrangement of apparatus. The hydraulic apparatus comprises three 1750-hp Francis-type wheels built by the S. Morgan Smith Company. The wheels run at 720 r.p.m. and are equipped with Lombard governors and hydraulic relief valves. Each is direct-connected to a 1250-kw, three-phase, 60-cycle, 2300-volt alternator built by the General Electric Company, which company also supplied the rest of the electrical equipment. The units are fitted with 10,000-lb. flywheels. Sufficient floor space is available for an additional unit of the same rating as those at present operating. A Pelton waterwheel drives a 50-kw exciter unit, which may also be driven by an electric motor.

Fig. 4—Water Passing Over Weir. Load, 1966 Hp.

An additional motor-generator set is provided as a reserve exciter unit. The pipe line is carried along one side of the station and branches are taken in to the turbine wheels, a smaller branch supplying the exciter wheel. As indicated, any of the branches can readily be cut out by valves fitted to the feeders close to where they enter the building. Pressure on the pipe line is maintained constant by the surge tank mentioned above, which relieves the wheels of fluctuations in pressure in the line.

One photograph (Fig. 4) illustrates the weir installed in the tailrace for testing the units in the power house. This shows in a striking manner the small quantity of water required to produce nearly 2000 hp with the high head at which this plant operates.

The 2300-volt energy is stepped up to a tension of 22,000 volts by oil-insulated, water-cooled transformers. There are seven transformers at present installed in the power house with space for three future units, and these are arranged along the side wall of the station as shown in the engraving, making a very simple layout and one easily kept under surveillance. The control board is located at one end of the room.

About one-half of the station output is transmitted to Johnstown and Gloversville over the transmission line of the Fulton County Gas & Electric Company, a distance of 10 miles, feeding lamp and motor circuits of the latter company, the tension being, of course, reduced. Fig. 8 shows

Fig. 6—78-In. Wood-Stave Pipe.

a typical A-frame transmission tower used on this lin There are four transmission wires in addition to the groun and telephone circuits, the fourth transmission wire beir held in reserve. It is proposed eventually to equip the lir

with two more wires so as to obtain a double transmission circuit. The station apparatus is protected by horn-gap type of lightning arresters and close regulation is obtained by means of a Tirrill regulator. The switchboard is fitted with the customary indicating and recording instruments.

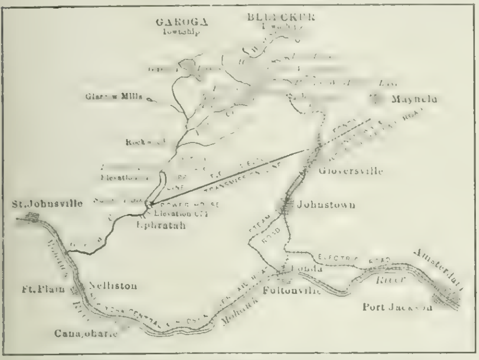


Fig. 7—General Plan of Mohawk Company's Development.

The transmission line to Gloversville runs in practically a straight line from the power house to the receiving station of the Fulton County Gas & Electric Company at Gloversville and is made up of "A" frame and four-legged towers, the spacing of towers being about 450 ft.

The design of the various hydraulic and electrical appliances has produced very satisfactory operation. The large volume of water in the surge tank available for sudden demands and the increased size of the pipe line from the surge tank to the power house, as well as the heavy flywheels, in addition to the governors and relief valve, have resulted in a remarkably constant voltage, the instruments showing a very slight variation under fluctuating loads.

The station has been in successful operation since Feb. 28. It was erected by the Kerbaugh-Empire Company under the supervision of Mr. E. A. Little, superintendent. The firm of Barclay Parsons & Klapp were the consulting engineers for the work. The New York office of the Mohawk Hydro-Electric Company is at 60 Wall Street and the officers are

Fig. 8—Typical "A"-Frame Tower of Transmission Line.

as follows: President, Mr. William Barclay Parsons; vice-president, Mr. W. J. Douglas; secretary, Mr. A. J. Nichols; chief engineer, Mr. H. M. Brinckerhoff. Mr. F. T. Coldwell, Ephratah, N. Y., is the superintendent of operation.

HIGH-TENSION TRANSMISSION EXPERIENCE IN CENTRAL COLORADO.

Combined Steam and Hydroelectric System Transmitting a Maximum Distance of 300 Miles.

Details of Oil Supply for Boilers, Mountain-Line Construction, Switching Arrangements and Electrical Tests of System.

The most conspicuous high-tension transmission development in the eastern section of the Rocky Mountains is that of the Central Colorado Power Company, which supplies electricity for general lighting and motor service throughout a large portion of the State lying between Glenwood Springs, Denver and the limits of the system of the Northern Colorado Power Company. As recently described in our columns, the Central Colorado system receives electrical energy from two generating plants, one being located at Shoshone, in the Grand River Cañon, and the other in the outskirts of Boulder, the equipment rating of each station being 10,000 kw. The principal markets served are Denver, Leadville, Georgetown, Idaho Springs, Central City, Breckenridge and Glenwood Springs. Energy is sold at Boulder to the Northern Colorado Power Company, which also operates a generating plant of its own at the Lafayette coal mines.

The extreme distance covered by the Central Colorado Power Company's service, including the northern district of Colorado during periods when energy is purchased by the Northern company, is about 300 miles. Energy is transmitted from the Shoshone and Boulder stations to Denver at 100,000 volts, each station being of the hydroelectric type. The Northern Colorado company transmits at 44,000 volts and serves a territory extending from Lafayette and Boulder northward to the Greeley and Ft. Collins districts.

The transmission system of the Central company extends from Shoshone to Denver and from Boulder to Denver, comprising about 182 miles of three-phase, 60-cycle line, carried on suspension insulators supported on steel towers. The line crosses the Continental Divide at three points, whose altitude ranges from 12,000 ft. to 13,700 ft. above sea level, and the operating conditions are among the most severe in the country. The high-tension circuits of the company consist of the following lengths of three-phase line, all wire being of copper: Shoshone to Leadville, 63.44 miles, No. 0; Leadville to Dillon, 31.26 miles, No. 1; Dillon to Denver, 58.82 miles, No. 0; Boulder to Denver, 27.23 miles, No. 1. Each conductor consists of a hemp-center, six-stranded cable, the spacing between phase wires being 10 ft. 4 in. About 1400 towers are required in the high-tension service, the local distribution of the company being handled by 13,200-volt and 6600-volt circuits carried on wooden pole lines. The standard tower is of A-frame design and rises to a height of 44 ft. above the ground, the foundations extending to a maximum depth of 6 ft. The minimum clearance of the wires in the middle span is 22 ft. from the ground. The average span between towers is about 730 ft., the maximum span being 2500 ft.

The generators are Y-connected, but all transformers except at Boulder are connected in delta, on both the primary and the secondary sides. The generators at Shoshone and Boulder deliver energy at 4000 volts to the primaries of transformers, raising the potential to 100,000 volts, each pair of machines being provided with three 3333-kw transformers. The lower voltage service is handled mainly by circuits ranging in size from No. 4-0 copper to No. 9 iron wire, the latter being used on short taps to the premises of small consumers, on account of its superior strength and cheapness. The six-strand cable was used on the high-tension line mainly on account of its increased smoothness. The low-tension pole line is built of 30-ft. to

40-ft. cedar and native-pine poles treated at the gains and butts by carbolineum. Over the Argentine Pass, at an elevation of about 13,700 ft., the high-tension line is duplicated for a distance of about 3 miles, the maximum distance between the two parallel sections being about 1 mile.

The transformers at Boulder station are Y-connected in order to give a better voltage ratio, the neutral point being ungrounded. Two ground wires are installed throughout the entire length of the Boulder-Denver line, and for 5 miles on either side of all substations on the Glenwood line, including the generating plant at Shoshone. Between Leadville and Dillon and across the Argentine and Hagerman Passes a duplicate grounding equipment is also in service. The ground wire consists of a 0.5-in. Siemens-Martin steel cable grounded to the cross-arm on the top of the tower through a mechanical clamp.

In some of the spans on the eastern slope of the range, where the line crosses the openings of canyons, excessive wind velocity has in the past shaken the conductors and at times mixed them up on the overhead structure, so that it has been necessary to dead-end the line at each tower and to guy the tower itself, increasing the horizontal stress in the line to a point nearer the elastic limit of the wire, and in one case the spacing of the phase wires themselves had to be somewhat increased. The guy wires consist of 0.5-in. Siemens-Martin steel cable, and on a few greatly exposed spans in the canyons the tower construction has been supplemented by the use of two ⅝-in. steel messenger cables.

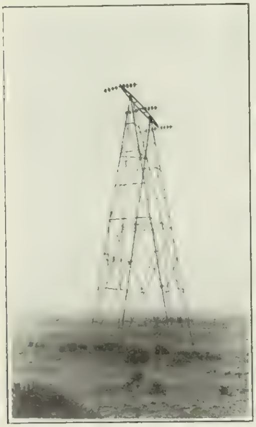


Fig. 1—Dead-Ending Line on Tower.

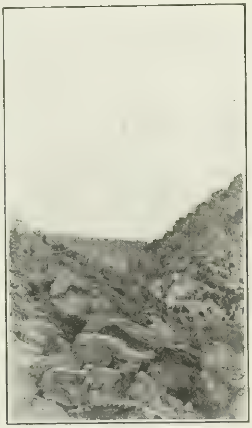


Fig. 2—Use of Suspension Insulator and Messenger Wire.

These cross the canyon at right angles to the direction of the conducting wires, and the latter are attached to the messengers either by dead-ending at strain insulators or by suspension insulators. The messenger cables are anchored into the rocks with eyebolts. On the upper portions of the passes sleet has at times attained a maximum diameter of 6 in. on the steel conductors used in these locations. Sleeve joints of copper are used on the line throughout the greater part of its length. Jumpers are used in the usual manner at all dead-ended spans.

No automatic oil switches are installed in the high-tension line, and oil switches of the manually controlled type are in use on the high-tension line only at the substations. The generators at each plant are provided with manually controlled solenoid-operated oil switches, and the outgoing lines are passed through disconnecting switches before being carried to the steel towers. Care is taken not to open the high-tension circuit when it is alive except under conditions of extreme emergency. Automatic oil switches are installed in the substations on the low-tension side of the system, but reverse-power relays are used only at the Denver substation in connection with the distribution of energy to the Denver Gas & Electric Light Company.

At Leadville the Central company operates in emergency connection with a 2500-kw steam auxiliary station, the boilers of which are kept partially banked, and in which an oil-burning system is available for the rapid raising of steam in case of a shut-down on the transmission system. Auxiliary hydroelectric service is also available for the Central system at local plants of small rating in Georgetown and Idaho Springs, and the Northern Colorado Power Company's steam station at Lafayette can feed energy back into the system if necessary. The total generating rating of all these systems, including steam plants owned and operated by the Denver Gas & Electric Light Company, is about 50,000 kw, and the energy distributed in co-operation with these various sources of generation is utilized in the mining and agricultural fields of the State and in the city of Denver for general lighting and motor service. The maximum load on the Central Power Company's system aggregates about 14,500 kw. The present load-factor is about 50 per cent, and the power-factor is usually unity.

The principal generating plant of the Denver company is the so-called West Side station, which is connected with the Central Colorado Power Company's system by a 13,200-volt, double, three-phase tie-line installation terminating in a bank of three 1600-kva transformers at the West Side plant and originating at a substation owned by the Central company which is located about 3 miles outside the center of the city. The high-tension circuits from Shoshone and Boulder are brought to the latter substation and by means of two pairs of 2500-kva transformers connected in open delta the potential is reduced from 100,000 volts to 13,200 volts. The tie-line installation to the West Side station is carried overhead, there being two three-phase circuits of 500,000-circ. mil aluminum in use. At the West Side station the potential is reduced to 2200 volts for the general distribution of energy throughout the city. Under present conditions of operation the Denver company purchases from 5000 kw to 6000 kw from the Central company; the day load is entirely carried on the latter service, the night load being divided between the two systems. During the day two Curtis turbo-alternators rated respectively at 2250 kw and 5000 kw are floated on the 2200-volt West Side station busbars, the generators running as synchronous motors, and being prepared to assume the load almost instantly in case of a partial or complete interruption of the hydroelectric supply.

Six boilers are equipped with oil-burning apparatus, all being of Heine make and having a total rating of 2850 hp. The boilers are of the hand-fired type, and water-gas tar is used for fuel in emergency service, the tar being obtained from the gas department of the Denver company. The tar is stored in two 10,000-gal. steel tanks, located underground and outside the West Side station, concrete saddles being used to support the tanks, each of which is 3 ft. long and 6.5 ft. in diameter. From the storage tanks the tar is forced into a 5000-gal. pressure tank by a steam pump, the tank being about 30 ft. above the burners. By gravity feed a 4-in. pipe line delivers the oil to the boiler-room, the oil being supplied to the burners at a pressure of about 15 lb. per square inch. The oil pump is a double-acting equipment with 4-in. x 3-in. x 6-in. cylinders. The oil-feed line is provided with a ½-in. steam pipe inside its indoor length for the purpose of preventing the thickening of the oil in cold weather. Each of the storage tanks is also equipped with a steam coil of the same size, and about 80 ft. of pipe is used in the two. A 1-in. steam line is also carried through the pressure tank and delivery line in the outside section of the latter.

The burners are of the Best type, with a by-pass valve, at each providing for the blowing out of the oil-delivery nozzles by steam when desired. The burners deliver oil

through ¾-in. lines to the fronts of the boilers, the injected flame being carried into the furnace at a height of 8 in. above the firebrick grate lining. Two burners are installed per boiler. One boiler is equipped for oil burning only, and this is kept in operation all the time to maintain the oil

care to provide for continuity of service under all anticipated conditions. Each incoming 100,000-volt line is controlled by a high-tension oil switch, a high-tension transfer bus with oil switch being provided between the two lines. These switches are of the solenoid-operated type, with hand

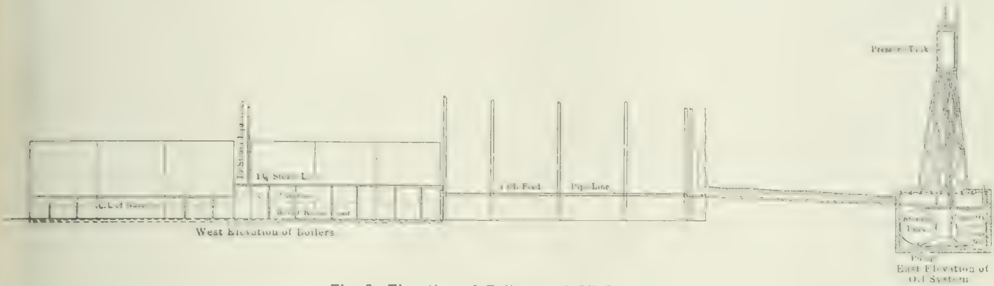


Fig. 3—Elevation of Boilers and Oil System.

circulation, about 600 gal. of tar per day being consumed in the furnace. Non-return stop valves are installed on all boilers with oil burners. The stop valves are drained by ¾-in. pipes through check valves to a feed connection at the hand-hole plate at the bottom of the boiler water leg, and the condensation of the steam main is also returned to the water leg through a receiving tank and trap system. About 800 lb. of water per hour is delivered by condensation from the main header to the boilers, there being about ... sq. ft. of surface in the main piping.

In normal operation the steam pressure in the oil-burning boilers is maintained at from 2 lb. to 5 lb. below that in the rest, coal fires being banked as much as possible in the oil-burning furnaces. In case of an interruption of the hydroelectric service a gong rings in the boiler-room. All dampers are at once opened, and next all ash doors are closed, after which the oil burners are cut into service. The burners of all six boilers can easily be cut in inside of ... minutes, and in three minutes the full heat of the flames is available. Once a week a practice drill is carried out, the time of the drill being known only to the chief operating engineer of the station. At this drill the connection with the hydroelectric system is cut off and the burners are thrown into service as quickly as possible. In a typical service interruption the load on the station was about 6000 kw, 4000 kw being suddenly dropped by the Central Colorado company. This threw a demand for about 4000 kw upon the boiler plant without an instant's warning. The oil burners were at once thrown into service and the Denver company's load was carried with a drop in frequency of only half a cycle. After the boilers have assumed the load at normal steam pressure the oil-burning system is shut off and the balance of the interruption is

control only, and automatic switches are located only on the secondary or 13,200-volt sides of the step-down transformers at the substation. Direct current for the operation of the solenoids is obtained from a small storage battery charged through a motor-generator set. The oil switches on the 13,200-volt side of the station are of the solenoid type, with automatic operation in most cases. A tie switch is provided on this side of the system between the two incoming lines, and beyond the bus-junction switch an oil switch is included in each of the lines running to the West Side station and the so-called Lacombe station of the Denver company. Disconnecting switches are installed on each side of all high-tension oil switches, to permit safety in inspection and repair work.

At the West Side station, which is the operating center of the Denver system, the two incoming tie lines from the Central company's substation are multipled on a set of busbars connecting with the step-down transformers, and on the secondary side of the latter connection is made with the West Side 2200-volt station bus through two oil switches, one being equipped for non-automatic operation and the other, nearer the bus, for operation by automatic reverse-power relay connections. The local feeders from the West Side busbars are installed in two switchboard sections, one section being supplied with energy directly from the busbar and the other from tie-line connections tapping the incoming power leads half way between the two oil switches *A* and *B*. An auxiliary connection is also

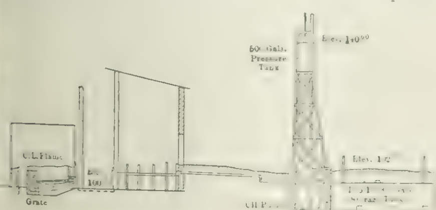


Fig. 4—Section Through Boiler and Oil System.

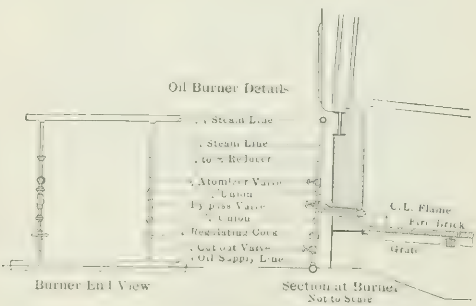


Fig. 5—Oil-Burner Details.

carried by coal fires on all portions of the boiler plant which may be required.

The accompanying diagram shows the principal operating connections at the Central Colorado company's Denver substation and between the stations of the Denver company and the former. These have been worked out with great

made between the switchboard and the Lacombe station, the latter being tied in with the Central company's substation through an 11,000-volt, three-phase line which necessitates the use of an auto-transformer installation to secure the proper secondary voltage on the tie line at the substation. At the Denver company's generating plants each

lead between the machine and the switchboard is connected with an automatic oil switch operated by a time-limit, reverse-power relay.

In normal operation the tie switch *L* between the two incoming 100,000-volt lines at the Denver substation is open, the tie switch *G* between the 13,200-volt leads being closed. In case trouble occurs on the Shoshone line, for example, which would be sufficient to shut down a generator if not relieved, the following procedure occurs: Secondary tie switch *G* opens by the action of the instantaneous reverse-power relay 2 or similar relay 3, through reversal of flow of energy from the turbo-units at the West Side plant. If the system has been operating with the high-tension tie switch *L* closed, this will also be opened by the action of the above relays. Boulder generating station now feeds energy back through the West Side station to time-limit reverse-power relay No. 4, opening the oil switch *J* and switch *A*. The operator at the West Side plant then ascertains whether the interruption is continuous or not by noting the condition of the pilot lamps on feeders 1 to 12. If these are out, he opens switch *B* at once by remote control, and closes *A*, which puts the foregoing feeders on the 2200-volt station bus. He then arranges with the Central company to synchronize across switch *B* or to synchronize at the substation after the switch *B* is closed. In case switch *A* opens and the pilot lamps indicate that the Central company's service is intact the two companies synchronize across switch *A*. Similar instructions apply to the handling of the service between the Central company's substation and the Denver company's Lacombe station.

On the switchboards of the Central Colorado company's operators are line ammeters and remote-control switches by which any generator may be disconnected from the system. In case of trouble the station operator lowers the voltage

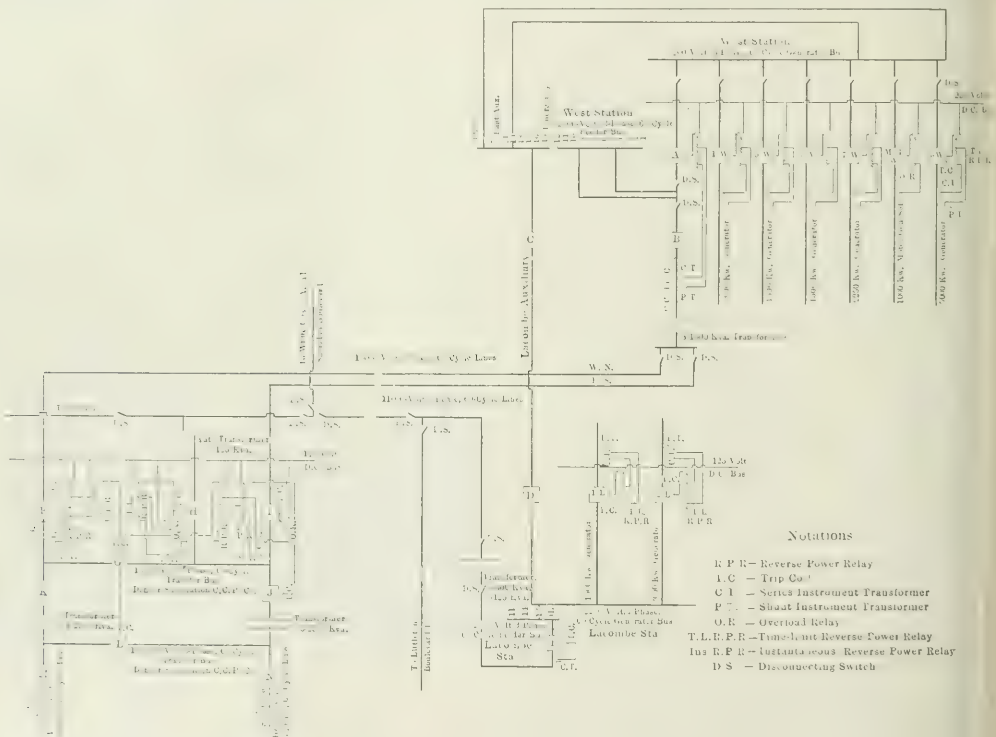


Fig. 6—Diagram Showing Connections Between Central Colorado Company's Substation, Lacombe, and West Stations.

cutting off the secondary circuit from the Shoshone transformer line. The operator of the Denver substation then opens oil switch *N*, closes switch *L* through his remote-control battery circuit, closes *J* and usually closes switch *G*. The Boulder station then carries the load until the emergency is over.

When the trouble is removed the operator at Denver receives orders to synchronize the lines. He opens switches *L* and *J*, closes Shoshone line switch after making sure that the line voltages are in time phase, closes *G* and instructs the station operator at Shoshone to take the proper proportion of the load. Time-limit reverse-power relays 1 and 4 are mechanically interlocked so that only one can be closed at any given time.

At the West Side station of the Denver company, in case the hydroelectric service is momentarily interrupted, the reversal of energy flow from the turbo-alternators opens and gets the generating units under control as soon as po-sible. If the trouble does not burn clear in a few secon the line may be opened by cutting out the generators. T substation operators are instructed when necessary to op particular sections of the line feeding energy from the tra forming points, and so far as possible the system is operat so that in case of trouble the load on each side of the fa t can be carried by the two stations at the ends of the syste, each feeding energy to the disconnecting switch nearest trouble.

At present two complete patrols of the line are m:e weekly, and after severe lightning storms special patrols e made. The line work is handled by a force of fourt n men, including a foreman, whose headquarters are at D-ver. From 8 miles to 22 miles of line per man is the assignment. Most of the inspection is done on the 100,000-volt system. In summer the work is handled on horseback d

in winter on snowshoes. On each side of the Argentine and Hagerman Passes are located two linemen's cabins, these being used as winter quarters by an average of two men per cabin. Telephone connection is maintained with the entire system, and the continuity of service on the most difficult portions of the line is in the hands of this force. Insulator repairs are made only when the line is shut down, and special care has been taken at all disconnecting switches on the high-tension circuits to provide for grounding the phases when the line is open.

High-tension oil switches receive a thorough inspection monthly. No trouble has been experienced on the combined telephone and telegraph circuit that ties the system together, this being carried on a separate pole line on the company's right-of-way, which has a maximum width of 100 ft. Line-n carry portable telephones, pliers and a few small tools. the heavier supplies are maintained in 4-ft. x 4-ft. den huts located about 5 miles apart on the average. ty-two of these supply houses are in service on the tem. Fuses are not used on the system except in con-tion with certain low-tension distribution circuits. Line-ground each phase when working upon the line, and ke weekly reports to the headquarters office in Denver, ere a load dispatcher or system operator is on constant The line is equipped with section switches, by which rolmen can isolate portions from 12 to 15 miles in gth, the load being carried from each end in such in-ces. Aluminum-cell lightning arresters are in service substations and in the generating plants, and have given ellent satisfaction.

July, 1911, the system averaged less than two inter-tions per customer, and the total duration of outages on entire system, including both high-tension and low-sion service, was 11 hours 37 minutes. There were 1.24 dental interruptions per customer and 0.16 prearranged -offs per customer. On the 100,000-volt system in July, 1, there were only two accidental interruptions. In one e lightning broke a roof bushing, cutting off the Sho-ne plant for one minute and the Dillon substation three nutes, the Leadville substation being off for one minute. e Boulder station was not affected. In the second case insulator failed on a steel tower, thereby causing the lder station to drop one phase, the Denver company's tem being disconnected for five minutes. There were prearranged disconnections of the high-tension line repairs on four sections, aggregating four hours of -service. During the month there were fourteen days ightning storms on the system, low-tension disturbances g caused in four cases and high-tension disturbances four instances.

The principal line improvements effected by the company have been the dead-ending of certain spans as outlined above, the tightening of cables on spans subject to swinging shorts, the use of storm guys on towers, about 150 structures having been guyed thus far, and the use of compound-filled bushings on high-tension transformer leads in place f the former oil-filled bushings. The diameters of the shings have also been increased. Another improvement nsists in the strengthening of the connecting links between unit sections of the suspension insulators. No difficulty s been encountered in the operation of high-tension tches, and the insulators have given excellent service. e aluminum-cell lightning arresters have also given ecial satisfaction.

The following tests on the system are representative:

Ninety kilovolts at Shoshone, 500-kw loss; charging cur-nt, 45 amp. Approximate connections, 5000-kw Y-con-ted alternator, three transformers at Shoshone, delta-nnected.

No load losses, Shoshone-Denver line.

One hundred and fifty-three and one-half miles three-phase No. 0 copper, spacing 124 in. One hundred kilovolts at Shoshone, 1200 kw loss; charging current, 50 amp. Ninety kilovolts at Shoshone, 500 kw loss; charging current, 45 amp. Approximate connections, 5000-kw Y-connected alternator, three transformers at Shoshone, delta-connected.

No load losses, Shoshone-Leadville line.

Sixty-three and one-half miles, three-phase No. 0 copper, 124 in. spacing. One hundred kilovolts at Shoshone; line loss, 210 kw, rainy day; charging current, 18 amp. Ninety kilovolts at Shoshone, line loss; 80 kw, rainy day; charging current, 16 amp.

No load losses, Denver-Boulder line.

Twenty-seven and three-fifth miles single-phase connection, No. 1 copper, spacing 124 in. One hundred kilovolts at beginning of line; corona and insulator losses, 11 kw. Ninety kilovolts at beginning of line; corona and insulator losses, 6.5 kw.

The commercial development of the company is illustrated by the fact that in January, 1910, six months after the Shoshone plant was started in service, the company had a commercial connected load of 10,581 hp and sold 2,103,785 kw-hours. In July, 1910, the connected commercial load was 16,268 hp and the sales were 2,490,712 kw-hours. In January, 1911, the connected load was 20,171 hp and the sales were 3,073,773 kw-hours, and in July, 1911, the connected load had risen to 22,623 hp and the sales of energy to 4,508,006 kw-hours. The Boulder plant was placed in operation in the late spring of the present year. The standard motor service rates of the company are based upon a fixed charge varying from $39 down to $12 per hp-year, plus an energy charge varying from 1.3 cents to 0.5 cent per kw-hour, according to the consumption.

REMOTE CONTROL OF MUSICAL INSTRUMENTS

A System Employing the Ordinary Paper Music Roll and Providing Control of Expression.

By Norman G. Meade.

The growing demand for automatic musical instruments, including pipe organs, orchestrions and pianos, has led to the development of several types of remote electric control, many of which embody disadvantages, including the expensive brass music roll as used in the straight electric control.

The writer has developed a system of electrical operation for musical instruments in which the customary paper music roll is employed and in which are several novel features, described in this article. In this system the

Fig. 1—Plan View of Player.

translating device is entirely separate from the piano or organ and may be located where convenience dictates.

The mechanism includes a chamber, or hollow cylinder, having a series of holes in one wall, means for exhausting the air from the chamber, a series of spring-contact members, and pins which are fitted loosely into the holes in the chamber wall and which are adapted to effect the closure of electric circuits through one or more of the spring-contact members when atmospheric pressure is

applied to their outer extremities. These contact members correspond in number and relative location to the keys of a piano or organ and several additional contact devices are provided which are adapted to effect the automatic control of the tempo, or rate of playing, and the touch, or force with which the piano hammers are actuated. The admission or exclusion of air pressure to the chamber depends upon the perforations in the music roll, which is

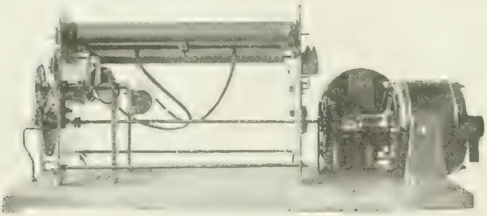


Fig. 2—Side View of Player.

passed over the chamber from one roll to another in a well-known manner, and additional perforations, as will be explained later, provide for the control of expression.

In the accompanying illustrations Fig. 1 is a plan view of the translating device or player. Fig. 2 is a side elevation, Figs. 3 and 4 end elevations, and Figs. 5, 6, 7 and 8 detail views of the device shown in Fig. 1. In the latter figure the vacuum chamber, the rolls for supporting the music strip, the framework, motor and gearing are shown. The air is exhausted from the vacuum chamber by means of the oscillating pumps, shown in Fig. 2. A main driving shaft of the mechanism is rotatably mounted in stationary bearings and connected to the motor by a train of gears. The pump shaft is driven from this main shaft by sprocket wheels and by a chain gear, as shown in Fig. 3.

The rolls are rotatably mounted upon shaft projections between the end brackets and spur-gear wheels are attached to corresponding ends of the rolls on the extremities of the shaft projections, which extend through the frames. A bevel-gear wheel is attached to the oposite shaft projection of the front roll, as shown in Fig. 4. This meshes with another bevel gear attached to a threaded shaft having a traveling nut. When the music is being played the nut travels toward the left. When the tune is finished a predetermined perforation in the music roll

Fig. 3—End View of Player.

causes the circuit to be closed through the electromagnets which actuate the lower of the two switches shown in the illustration. The closing of this switch closes another circuit through the electromagnets shown in Fig. 3. The armature of these magnets disconnects the gear from the take-up roll, disconnects the pumps and rotates the music roll in a direction to rewind the paper. Referring again to Fig. 4, the travel-nut on the screw shaft, which now rotates in the reverse direction to that traveled when the music is playing, returns to the right-hand side and trips the upper switch at the completion of the rewinding of the music roll, thus stopping the motor. The motor is started by pressing in a rod projecting from the frame.

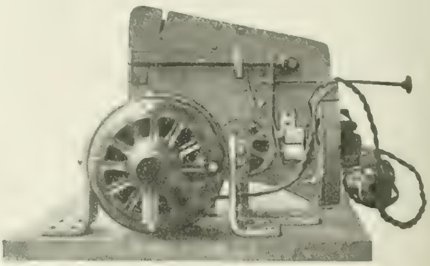


Fig. 4—End View of Player.

In obtaining the expression, particularly variations in tempo and touch, the device shown in Fig. 5 is employed. It consists of a plurality of stationary contact-ring segments, a rotatable engaging contact arm with a ratchet wheel attached thereto, and an electromagnet whose armature actuates a pawl. Connected to the ring contacts are several sections of resistance, one being in circuit with the motor and one in series with the magnets operating the keys of the musical instruments.

Fig. 6 is a cross-sectional view of the pneumatic chamber. The frame is represented by *a*; *b* is a curved metal plate with the perforations *c* for the air to enter the small, narrow chamber *d*, passing thence through the hole *e* to the pin *f*. This presses down the spring *g* onto the contact *h*, closing the circuit through the magnet connected with it.

The magnets may be connected to the under side of the keys to pull them downward or to the upper side, as shown in Fig. 7. As the distance between the centers of the magnets is relatively greater than that between two adjacent keys, they are staggered and placed in three horizontal rows as shown.

The electromagnet shown in Fig. 8 comprises practically a closed magnetic circuit of rectangular shape. The core member is provided with a magnetizable strip that is rotatably attached to the core proper and is adapted to

Fig. 5—Device for Varying Tempo.

close the magnetic circuit completely when a magneti field is produced by energizing the magnet winding. Thi movable member is mechanically connected to one of th piano keys by means of a wire or strip the lower extren ity of which is hooked into engagement with an eyelet.

Fig. 9 is a diagram of the circuit connections. Th motor may be of any suitable type having a variable-spee characteristic and may be supplied with energy from an

suitable source. The connections shown are for a compound-wound, direct-current motor and may be traced as follows: Energy is supplied from a relatively high-voltage circuit through a variable resistance *R* and a switch *S*

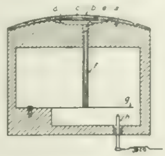


Fig. 6—Cross-Section of Pneumatic Chamber.

to the motor. The variable resistance is intended to effect the speed regulation of the motor rather than to serve as a starting rheostat, and in case an alternating-current motor is employed for driving the device this resistance can be replaced by an auto-transformer or other suitable means for varying the voltage applied to the motor circuit. As illustrated, the resistance *R* is controlled by a device such as that shown in Fig. 5, and under normal conditions the movable contact arm occupies a position

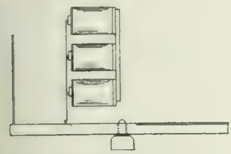


Fig. 7—Magnet Connected to Upper Side of Key.

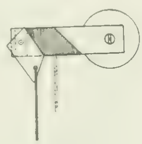


Fig. 8—Electromagnet

such that approximately half of the resistance is included in the motor circuit and, therefore, a speed variation is permitted in either direction. A reasonable amount of the music roll is left without perforations so that the motor may have an opportunity to accelerate, and, when normal conditions obtain, the roll will be traveling over the inlets in the vacuum chamber at a substantially constant speed. As predetermined perforations in the music roll pass over the inlets corresponding to the desired keys, cer-

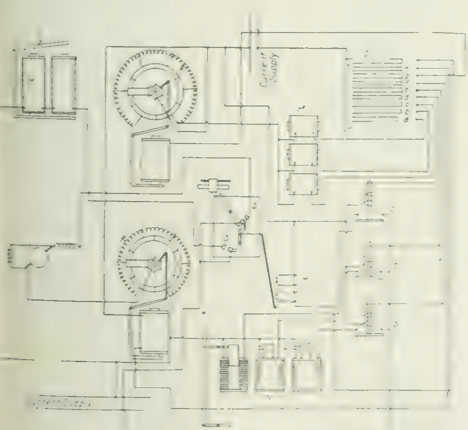


Fig. 9—Diagram of Connections.

tain of the pins in the vacuum chamber are given a downward motion so that the corresponding contact fingers engage the stationary contacts. A circuit is now completed from the source of supply to the comb or notched strip *C*, through the stationary contact terminals and conductors to windings of magnets *M*, the circuit being completed from these points through a single resistance *R* to the negative terminal of the battery. The resistance *R* is representative of any suitable voltage-varying means and may be mechanically arranged, as shown in Fig. 5. In this case, as before, under normal conditions the movable contact arm occupies such a position that approximately one-half the resistance is included in the circuit.

Inasmuch as the function of the pedals of a piano or organ is well known, it is unnecessary to describe them, but with the system here described these parts are actuated as illustrated in Fig. 9 by means of electromagnets *N*. These magnets are provided with windings and movable core members that are severally connected to the pedal-actuating rods by means of links. The magnet windings may be energized selectively by the closing of the control switches *S*. These switches are electrically operated, being equipped with magnet windings, which, in turn, may be energized when contact fingers *d*, *e* and *f* are moved into engagement with their co-operating stationary-contact terminals. It will be readily understood that the desired pedal action may be effected by providing suitable perforations in the music roll for selectively applying air pressure to the pins that correspond to the contact fingers *L*.

The regulation of the tempo is effected by increasing and decreasing the active portion of the resistance *R*, and the touch or the force with which the hammers are actuated may be varied by decreasing or increasing the active portion of the resistance *R*. The regulation of the resistances is dependent upon the actuation of the contact fingers *h* and *g* and is similarly effected.

When the music strip has been wound onto the roll until all of the music-producing perforations have passed the intake holes in the vacuum chamber, a single perforation is provided for actuating a spring-contact member *i* which completes a circuit through the magnet *M* to close the switch *S*. The closure of this switch energizes the magnet windings of another electromagnet from the main source of energy. This reverses the music roll, which rewinds as has already been described.

MOTOR TESTING.

Equipment and Instructions for Testing Electric Motors in Industrial Plants.

By Samuel P. Goodale.

One of the benefits attending the introduction of electrical distribution of power in industrial plants is the ease with which measurements of power requirements and use may be made. Another benefit of which advantage is being taken more and more is the analysis which may often be made of machine action by the aid of recording or curve-drawing wattmeters. It is the purpose of this article to outline some of the methods and utilities of testing motors in service in manufacturing plants. Such tests are of interest to three classes of people: (1) Motor builders, who must know the requirements to be met in various industries in order intelligently to plan and sell their products; (2) central stations, whose interest is of the same general order, and (3) manufacturers who desire to conduct their plants under the most economical and advantageous conditions. In general, similar methods will meet the needs of these three classes.

Obviously the equipment should comprise as few pieces of apparatus as will serve the purpose thoroughly. The most essential meters for testing motors are voltmeter, ammeter, indicating wattmeter, recording wattmeter and watt-hour meter. For alternating-current work these may be chosen of such capacity that, with the aid of transformers, one meter of each kind will serve for any range of motor sizes. Care must be taken to choose meters whose own power requirements will not overtax the transformer's

capacity and, conversely, to choose transformers of sufficient size for the meters. It may be noted that trade bulletins do not give specific information on this point. A considerable amount of care in choosing meters best adapted for the conditions to be met will be well repaid.

The use of meters in testing is much facilitated by the provision of a permanent stand on which they may be placed. The stand should provide ample room for meters, switches and connections, be of such size and shape as not to interfere with its location near the motors to be tested, and be easily movable. Switchboard-type meters can best be mounted on an upright panel and portability secured by mounting the panel upon a truck, the top of which will provide room for the transformers. If available, the portable-type meters are more desirable. A box form of structure has the advantage of affording better protection to the meters and connections and being well adapted for shipment, but, on the other hand, it is more complicated and inaccessible. A table is, in general, the most convenient and adaptable form of construction for a testing stand. Fig. 1 shows side and end views of a table which has been used with much success in testing an installation of three-phase, 550-volt motors ranging in size from 3 hp to 175 hp. With very few changes this form may be adapted to almost any conditions met in testing motors in service.

The table top is made 2 ft. x 4 ft. The legs are set in somewhat to give more clearance when moving the set through narrow aisles. An upright wooden panel is bolted near one end of the top to provide for a recording wattmeter and watt-hour meter, the available meters being of a switchboard type. Flexible meter leads (not shown) project through the table top and are so arranged as to go directly to the proper binding post without any crossing when the meters are in position.

On both sides and at one end boards are nailed to the table legs and extend down about 13 in. Rigidity is thus secured as well as room for other attachments which add to convenience and adaptability. A rectangular hole is cut out of the board on one side to make room for a fiber panel *A*, with binding posts, to which are connected the leads from the meters. From other binding posts on the same panel leads are carried to the terminals of the test set. By connecting the proper binding posts with suitable jumpers any desirable scheme of connections for the meters, with or without the transformers, may be easily worked out and changes made when necessary. It should be noted in passing that a connection panel of this sort may be made so complicated as partly to destroy its value.

Fig. 1—Side and End View of Test Table.

Its use should be limited to those connections which are likely to need changing, and so employed it contributes markedly to the convenience and ease of manipulation. The meter fuses, *B*, are mounted adjacent to this connection panel.

To facilitate connections to the motor circuit use is made of fuse blocks, *C*, mounted on the end board of the table. The fuse clips of these blocks form the terminals of the test set. Wires attached to the caps of blown fuses, as indicated in Fig. 1, form a connection between test set and motor circuit exactly resembling the familiar plugs and cord used on telephone switchboards. If the motor is protected by a circuit breaker and no fuse block is conveniently located, it will be necessary to use some other form of con-

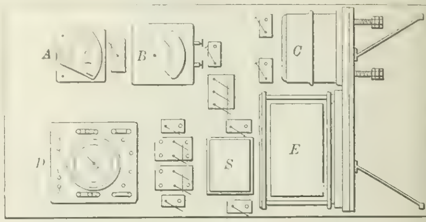


Fig. 2—Arrangement of Meters and Switches.

nection to the motor circuit. For this purpose Dossert connectors are both neat and convenient.

The table is set loosely on a flat truck made for the purpose and prevented from slipping by cleats on the truck. Pieces of felt or other elastic material placed under the table legs absorb vibration and jar and lessen their injurious effect upon the meters. The flat top of the truck forms the logical place for transformers and any other material needed.

Fig. 2 is presented to show the arrangement of meters and switches used. *A* indicates the voltmeter; *B*, ammeter; *C*, watt-hour meter; *D*, indicating wattmeter; *E*, recording wattmeter. One three-pole switch is provided to cut al current off potential leads and a single-pole switch for short-circuiting each meter current coil. Two two-pole, double throw switches are used to reverse the direction of curren in the series coils of the indicating wattmeter and provid for entirely disconnecting those coils when using the watt meter alone to determine power-factor. One single-pole double-throw switch permits of throwing the voltmeter t either one of two phases. These switches are all smal knife type and in addition to their other use permit th removal of meters while motor is in use, this being some times desirable. They are mounted in such location as t indicate their use and are wired through the table to Knife switches are preferred to snap switches, as thei position is apparent at a glance. A sketch, *S*, showing th permanent wiring of the table is placed where it ma be readily consulted and a glass cover is used to keep free from dirt. The sketch will save tracing out wiring reliance on memory and is, in fact, a necessity when tl use is intermittent.

Protection to the table and meters and provision again accidental contact may be provided according to the circur stances of use. In particular the connection panel, fus and fuse block terminals should be covered in such a w as to afford complete protection against accidental conta without interfering with easy access. A hinged cov would be suitable. The permanent wiring is protected the construction used.

It is very convenient and quite possible to be able move the test set from one part of a factory to anotl without removing meters. The meters should, howev be rugged in construction and much care be taken lest sh and jar from moving affect the delicate bearings. M portable indicating meters are provided with a device lock the moving element in place while the meter is bei handled and this feature should be looked for. T moving elements of recording and watt-hour meters m be secured by blocking with folded strips of paper. Rub tired wheels are effective in lessening vibration, though no means necessary. The provision made on the t

illustrated is in the form of felt placed under the table legs as before mentioned, supplemented in some cases by a mat of cotton placed under the different meters.

Relay-type recording wattmeters deserve special consideration. These meters are usually provided with adjustments to control their sensitiveness and quickness of action, changes being needed to adapt them to the characteristics of different circuits. If a meter of this type is used it should be mounted so that the various points of adjustment are accessible without removing the meter from its place. It is a peculiar fact and one worthy of mention that a particular meter of this type gave notably better results when subjected to the vibration in the factory rooms than when located on the station switchboard.

In making a test the indicating meters should be observed at regular intervals, five minutes being a common and convenient choice, and the readings noted. At the same time speed of the motor should be taken with a tachometer, if one is available, or with a common revolution counter, and the load conditions should be noted. Load conditions may be considered to be number and kind of machines in actual use in a group drive or the variable conditions affecting the result on an individually driven machine. The temperature of the motor should be taken at regular intervals, which need not correspond with the intervals chosen for the other readings. All readings, except temperature, should be taken at as nearly as possible the same instant after each interval. A fair approximation is made possible by practice.

The duration of the test should be sufficient to admit of striking a fair average from the readings taken and to permit of a good recording curve. In general, a full morning or afternoon run, giving about five hours, will furnish excellent results, but in certain cases it is preferable to choose the time covering one or more complete cycles of operation.

It is of the utmost importance that all data bearing on the test should be taken at the time. Nothing is more exasperating than to find essential information lacking in an otherwise full and complete test report. Knowledge and understanding of the operations and functions of the driven machinery are needed in order that important facts may not be overlooked. The data to be secured include number and kind of driven machines, as well as their important specifications, room temperature and conditions. Anything abnormal, such as scarcity of help, lack of raw material, poor layout or condition of machinery, method of lighting, lack of supervision, etc., has a decided effect upon production and must be noted if full utilization of tests is desired or looked for. Friction and shafting load are important items.

Method and order are of importance in setting down the readings and data taken and will facilitate analysis and deduction of important points. This refers particularly to the test report which will have to be made from the observed readings and data. The first step in making up the test report will be to determine a form to be used. The readings, corrected to their true value, may then be set down in definite sequence. A form found satisfactory in practice is shown in the accompanying table.

TEST NO. 52, ——— MANUFACTURING COMPANY, APRIL 14, 1911.

[illegible]me	Volt.	Amperes.	Kilowatts	Electric Horse-power	Revolutions per Minute.	Temperature.	Frames in Use
[illegible]	573	120	80	107	...	90	12-3-4
.55	562	102	74	99	796	...	13-5-4
	579	95	62	83	....	99	13-5-4
[illegible]	570	100	61	81	796	..	13-4-4
.10	573	96	64	86	...	107	12-4-3
[illegible]	558	104	66	88	793	.	14-5-3
[illegible]	540	110	70	94	.	115	13-5-4
[illegible]	579	98	68	91	796		13-5-4
[illegible]	576	103	68	91		122	14-6-4
[illegible]	573	92	64	86	807	..	13-5-4
[illegible]	564	100	67	90	.	128	13-5-4
[illegible]	561	98	66	88	790	...	13-5-4
* * *	* * *	* * *	* *	* * * *	* * * * *	* * *	* * * * * *
50	570	77	54	72	.	151	12-0-4
	564	85	58	78	802	...	12-3-4
	561	86	56	75		152	11-4-4
[illegible]	573	93	62	83	790	...	11-4-4
[illegible]	576	90	58	78	.	152	12-5-4
[illegible]	570	94	64	86	785	..	13-6-4
20	567	96	66	88	. .	155	13-6-4
25	567	100	66	88	775	..	13-6-4
[illegible]	564	104	65	87	.	155	13-6-4
[illegible]	564	105	68	91	785		13-6-2
40	567	100	62	83	....	159	14-5-2
[illegible]	564	96	62	83	808	..	12-4-2
[illegible]	564	76	50	67	....	159	11-4-1
[illegible]	570	60	42	56	795	.	7-4-0
	558	50	38	51	....	157	4-4-0
[illegible]	[illegible]	120	80	107	815	159	14-6-4
[illegible]	540	50	38	51	761	..	4-4-0
[illegible]	[illegible]	90	60	81	797	..	[illegible]

Motor No. 1 (General Electric Company, No. 64204).
550 volts, 75 amp, 75 hp. three-phase, 40 cycles, Class 6-75-800.
Type I, Form L.
Location:—No. 1 Spinning Room.
Load —
15 Whitin Spinning Frames,
256 Spin., No. 24 Warp Yarn.
6 Fales & Jenks Spinning Frames,
208 Spin., No. 7 Warp Yarn.
4 Mason Spinning Frames,
176 Spin., No. 24 Warp Yarn.
Weather:—Cloudy and damp. About 50° F.
Room Temperature:—Rose uniformly from 69° F. to 82° F. Temperature at motor level 2 to 7 degrees higher.
Humidity:—78% to 85%.
Spin. Speed (average), 8,000 Whitin & Mason, 5,000 Fales & Jenks.
Spin. per electric horse-power, 56.
Shafting takes electric horse-power (see Remarks).
Load Factor:—79%.
Remarks:—
There is a peculiar fluctuation in the power taken by this motor which prevented close reading of meters and made it difficult to get good graphic curve. The fluctuation was most marked with shafting only running.
Speed variation due to waterwheels being overloaded and steam-driven unit used at times to bring speed up.
Total time lost in making repairs to frames equal to 1½ frames stopped for entire period.
No second-hand in room during test.
Supply of roving small and insufficient.
Load-factors for Saturday and Monday mornings following this date were 67% and 72% respectively. Corresponding loads in electric horse-power were 76.2 and 80.7.
Column headed "Frames in Use" shows the number of frames of each make in use at each interval in the order noted under "Load."

The corrected readings are set down in vertical columns opposite the time at which they were taken and other values, such as horse-power and power-factor, figured from them. At the bottom of each column are noted the maximum, minimum and average values found in that column, thus serving to show very quickly the important facts. It may be noted that the quickest method of figuring the average is to assume a figure which a glance down the column will indicate to be approximate and then to add or subtract the difference between this figure and the readings, each in turn, to obtain an amount which, divided by the number of readings, will give the difference between the assumed and actual average value.

The heading of the report gives sufficient information to identify the particular test, and the further data obtained are set down at the right of the readings. Analysis of the data should be carried far enough to deduce the facts of immediate interest and value, the character of these being determined by the purposes of the test, which may relate more particularly to the behavior of the motor or to the

characteristics of the load or other matters of interest. Further analysis may be made later if desirable or if additional information is required.

It will be of interest to glance briefly over this report and note what information it contains. As the heading indicates, it is one of a series made in a particular plant. The motor rating is given in full and it may be noted that the motor records in this plant cover the entire history of this motor. The excess of current in proportion to power developed shows the motor not to be in first-class condition. This is further confirmed by the existence of a fluctuation in power consumed so rapid and violent that it was only with difficulty that the recording wattmeter could be adjusted to give a readable curve. As the action was even more violent when the motor was running light, it is evident that the fault lay in the motor itself. Temperature readings show that in spite of the defect the motor was still usable and could, in fact, have carried a larger load safely provided that the fault were not so localized as to throw an excessive strain on some particular part of the windings. The average voltage, being slightly high, indicates a supply circuit amply large. Neither the average value nor the extremes vary enough from normal to have an injurious effect upon the motor or its operation.

Speed of the motor varied over somewhat wide limits and, in explanation, we find a note to the effect that a steam-driven generator was used at times when the water-power was insufficient to carry the connected load to speed, and it may easily be inferred that the steam-driven unit was not used until the waterwheels had actually gone below normal speed. The variation was of consequence rather as

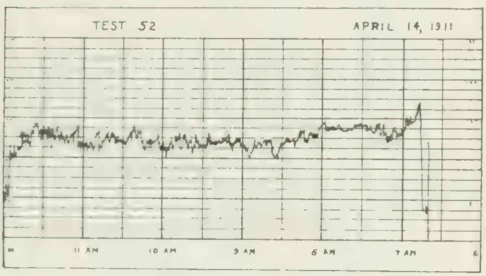


Fig. 3—Recording Wattmeter Chart.

affecting the quality and quantity of the product than as being injurious to the motor.

The load carried by the motor is described somewhat briefly. As several makes of spinning frames were included, it would be difficult or impossible to analyze the power requirements of each separately, but an average showing the number of spindles driven per horse-power has been computed. This is the usual basis of comparison between the power requirements of various spinning frames. Power consumed by the shafting is not noted because of the defect mentioned, which made an accurate determination impossible. It would be an important item to know both in order to judge whether the amount of power so used was excessive and also to determine, at least roughly, the amount of power lost per frame because of the method of driving, which value would serve as a basis of comparison with individually driven frames.

It is generally preferable to include losses in motor and shafting when determining the power requirements of a given installation, since thus all power which must be paid for—whether the power be generated or purchased—may be determined. The percentage of electric horse-power input to the motor corresponding to the motor efficiency will determine the power required by the driven machinery alone if that information is required. As may be inferred, electric horse-power input to the motor is the standar unit adopted for power in the series of test records c which this forms one.

The load-factor or percentage of time machinery was i use during the test is important. It is derived with fa accuracy by dividing the number of frames in use at eac five-minute interval by the total number of frames. Tl load-factor proper for spinning frames may be taken fr published figures or calculated for a given set of conditioi and a comparison with the observed amount shows ho fully machinery is being utilized. Special conditions co tribute to a low factor in the test shown and we find note (1) Several machines under repair, (2) lack of oversigl (3) lack of raw material. Load-factor is of value n only as indicating the efficiency at which a department being operated, but also as indicating whether the lo on the motor may not be increased by a more intensi utilization of the connected machinery. In connection w other tests it indicates the normal percentage of use of termittently operated machinery, a figure of use wh determining motor sizes for extensions and changes.

Important information, not otherwise discoverable, n be noted during a test owing to any abnormal conditi being immediately indicated by the meters, whereby inv tigation may be made at the time when the cause is m evident. Defects not suspected may thus be brought notice.

The recording wattmeter chart, shown as Fig. 3, i most valuable portion of the test record. While it is t that meters may and do have inherent faults and we nesses, they are, on the other hand, far more accurate reliable than human observers. Thus they serve to ch the results obtained by observation. A further check afforded by the use of a watt-hour meter, though it was availed of for this test.

Test records may have a value for future reference ceeding their immediate use. Tests such as described be considered as standards of reference to be suppleme by simpler tests from time to time. Their value depe largely upon the ability of the tester and his recogni and record of important facts concerning the motor-dr machinery and general conditions. Familiarity with uses and peculiarities of meters is always desirable often essential. Curves drawn by recording meters according to the characteristics and adjustment of meter and may be misleading. Accuracy of the me may, and should, be assured by frequent checking calibration. Errors due to improper use must be gua against by the tester.

Having made tests to serve as standards, other sin forms of testing may be employed to note variations in particular, to note a falling off in manufacturing ciency due to defects in machinery or labor. A very cellent method of continuous testing is found in the of a recording meter, which may be connected to va circuits in rotation and serve to show variations, whic sufficiently marked, may be further investigated. method may not be fully and economically available installation comprising a large number of small mo and may be supplemented by readings taken on the va motors with an indicating wattmeter or ammeter. rapid work of this kind an ammeter is far more convenient than a wattmeter and serves to show variations qui as accurately. Defects in individually driven machines may be located when an inspection of the machine discloses nothing wrong.

Electrical meters are of value for other forms of testing. The actions and operation of particular machines m be analyzed and the structure and design requiring least wer determined. The effect of variations may be studied with ... results—that of dynamometer testing—is in ... tice difficult and costly. Misconceptions exist regarding the actions of machines in common use. A case m be

cil in the spinning frame, familiar to all cotton-mill men. Roughly quantitative tests show that power supposed to be …ed by the weight and motion of various parts is … the resistance of the air to the motion of the product … rn—through it. In an ordinary case air resistance absorbs an average of 10 per cent and a maximum of 20 per … f the total power required, these figures being con…

…e amounts are hardly negligible and yet they ar only coming into general knowledge among spinners th ugh tests made by electricians. It may be noted in …g that exact tests on spinning frames demand a regu… f conditions very difficult to obtain, and that the …y of obtaining exact results is added to by the …umber of bearing surfaces, the frictional resistance …ch decreases for some time after starting. The …ns occurring can, however, be followed more close… the aid of electrical meters than in any other …

…er type of meter deserves mention, although it … considered electrical only in that it employs elec… to overcome a mechanical difficulty. The meter …es a drum driven by suitable clockwork and carry… per chart (ruled to correspond with time) on which …ore pens rest and draw a line or lines which are …ted or changed in position by the action of electro… in unison with the starting and stopping of a par… nachine or machines. The meter will, therefore, in…ate during what times the machines connected to it we… in use. Obviously, it might have been employed in … t outlined above to have relieved the tester of a … his observations and have given a more accurate … Its value is considerable in the case of certain …ently operated machinery, such, for example, as …ickers or spinning frames in a textile plant. It …e of more utility than a recording wattmeter placed … oreman's office and connected by him to different … in turn—a plan which has been suggested as a …ne.

…gh tests may be made to determine the conditions un… which a motor is being operated, it should be remem… that the motor is entirely secondary to the driven …ery. It is only the means by which power is applied …eeded. While it is important and essential to know … otor is being operated and is operating properly, …omically important facts deduced from tests con… driven machinery. When only a limited range …nation is called for the tester must judge whether … nformation, necessarily acquired, shall be reported … hom. At the present time it is rare that the full … value of electric-motor testing is recognized or …

TESTING POLYPHASE METERS.

In…uctions for Central-Station Testing, Using a Rotating Standard.

By W. O'D. Ryan.

…bably the most convenient method of testing polypha… meters is to connect the series coils in series and the …hunt coils in parallel and test as a single-phase met…. With this arrangement it is necessary to halve the … of the meter under test. The connections for … one type of three-phase, three-wire meter by … f rotating standards in the manner described is shown in Fig. 1. If the connected load is used and consist of induction motors, care must be taken that the pha… relation is not reversed: thus, in Fig. 2, the wire re…o…d from the upper left-hand binding post must connect to 1 on the right to preserve the same phase relation as in Fig. 1; otherwise the motors would be reversed.

In testing polyphase meters furnished with series transformers the 10-amp coil of the standard is used unless the secondary current is first measured by inserting an ammeter and is found to be within the capacity of the 1-amp coil. The 1-amp winding should not, however, be

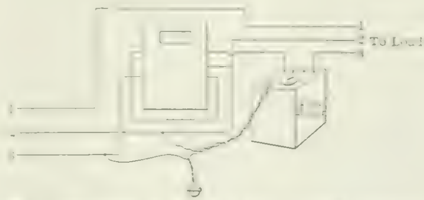


Fig. 1—Connections for Testing with Rotating Standard.

used except where control of the load is possible. In the case of switchboard meters it is safest always to use the 10-amp winding, as a sudden increase of load might result in injury to the 1-amp winding. Where series transformers are used one transformer must be short-circuited and disconnected from the meter when testing with coils in series. The constant of the test meter must be multiplied by the series transformer ratio. If both series and shunt transformers are used the constant of the test meter must be multiplied by the product of the raito of transformers.

As an example, suppose it is required to test a 150-amp, 2300-volt, three-wire, three-phase meter, series transformer ratio, 40:1; shunt transformer ratio, 20:1; disk constant of meter, 300.

Connecting the coils in series the disk constant becomes 300/2, or 150. Using the 10-amp, 110-volt coil of the standard meter, the constant of which is 0.6, the testing constant of the standard becomes $0.6 \times 40 \times 20 = 480$. The percentage of accuracy will then be the quotient, revolutions meter under test $\times$ 150/revolutions standard $\times$ 480.

Polyphase meters with series and shunt transformers may be tested without transformers, but in this case the disk constant must be divided by the product of the ratio of transformers. If polyphase meters with series transformers are tested on one phase at a time, then the series transformer on the phase not being measured should be short-circuited, the potential circuits being left connected.

The rotating standard may be used to calibrate either Westinghouse, Fort Wayne or Stanley meters, it merely being necessary to determine the watt-hours per revolution of the disk of the particular meter to be tested, and to use

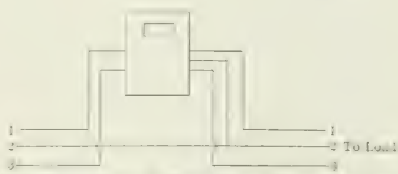


Fig. 2—Connections of Three-Phase, Three-Wire Meter.

this figure as a multiplying factor in the same manner as the constant is used on General Electric meters when checking them with the standard meter.

In calibrating or testing, the constant of all General Electric meters denotes the number of watt-hours per revolution of the disk. Other manufacturers do not all express the constants of their meters in the same manner. When otherwise expressed it becomes necessary to find

the watt-hours per disk revolution of the meter to be tested in order that it may be calibrated by the standard in the same manner as General Electric meters.

This factor can be readily determined from the testing constant of the meter. Thus for Westinghouse meters divide the testing constant by 3600, and for Fort Wayne and Stanley meters divide the testing constant by 36. If k denotes the testing or calibrating constants and x the watt-hours per revolution of the disk, then:

$x = k/3600$ for Westinghouse meters.
$x = k/36$ for Fort Wayne meters.
$x = k/36$ for Stanley meters.

Having found the number of watt-hours per revolution of the disk of the meter to be calibrated, one proceeds in the same manner as when calibrating General Electric meters, using the factor x as a constant. When the meter is correct the revolutions of the standard meter multiplied by the constants are equal to the revolutions of the meter under test multiplied by x and the ratio of these quantities gives the per cent accuracy.

The testing constant of type A, two-wire Westinghouse meters is volts $\times$ amperes (as marked on the dial or counter) multiplied by 1.2. For type A meters with series transformers, but tested without them, the testing constant is volts as marked on counter multiplied by 6, since these meters are 5 amp ($5 \times 1.2 = 6$). For type A meters with series and shunt transformers, but tested without them, the testing constant is 600. For type A

WESTINGHOUSE METERS—TWO-WIRE.

	Type A.		Type B.	
Amperes.	100 Volts.	200 Volts.	100 Volts.	200 Volts.
5	.166	.333	.333	.666
10	.333	.666	.666	1.33
20	.666	1.33	1.33	2.66
40	1.33	2.66	2.66	5.33
80	2.66	5.33	5.33	10.66

FORT WAYNE METERS.

Constant.	Watt-Hours per Revolution.	Constant	Watt Hours per Revolution.	Constant.	Watt-Hours per Revolution.
9	.25	90	2.5	360	10.0
18	.50	108	3.0	432	12.0
24	.66	144	4.0	576	16.0
36	1.00	180	5.0	720	20.0
54	1.50	216	6.0	864	24.0
72	2.00	288	8.0	900	25.0

STANLEY METERS.

Constant	Watt-Hours per Revolution
20 Sec.	
30 "	.833
45	1.25
60	1.66
90 "	2.50
120	3.33

meters tested with series and shunt transformers multiply the constants as found above by the ratio of transformers. For polyphase type A meters with series and shunt transformers, but tested without them, the testing constant is 1200. For three-wire, single-phase type A meters the testing constant is volts $\times$ amperes, as marked on the counter, multipled by 2.4.

The testing constants for type B and C meters are found in the same manner as for the type A meters except that the volt-amperes as marked on the dial must be multiplied by 2.4 instead of 1.2.

The testing constants of Fort Wayne meters are given in the instruction book furnished by the Fort Wayne company. Until recently the constants were not marked on the meter itself. However, in meters now being shipped the testing constants are marked on the cup.

The constants for Stanley meters are marked on the cover and denote the seconds per revolution for 100 watts.

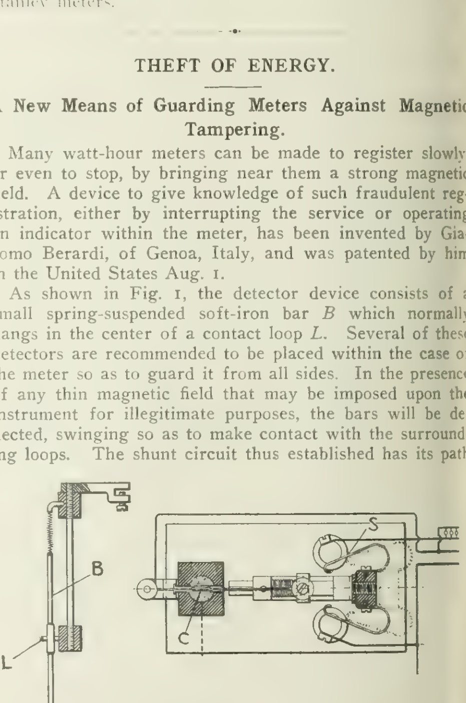
The accompanying tables give the watt-hours per revolution of various sizes Westinghouse, Fort Wayne and Stanley meters.

THEFT OF ENERGY.

A New Means of Guarding Meters Against Magnetic Tampering.

Many watt-hour meters can be made to register slowly, or even to stop, by bringing near them a strong magnetic field. A device to give knowledge of such fraudulent registration, either by interrupting the service or operating an indicator within the meter, has been invented by Giacomo Berardi, of Genoa, Italy, and was patented by him in the United States Aug. 1.

As shown in Fig. 1, the detector device consists of a small spring-suspended soft-iron bar B which normally hangs in the center of a contact loop L. Several of these detectors are recommended to be placed within the case of the meter so as to guard it from all sides. In the presence of any thin magnetic field that may be imposed upon the instrument for illegitimate purposes, the bars will be deflected, swinging so as to make contact with the surrounding loops. The shunt circuit thus established has its path



Figs. 1 and 2—Arrangement of Detector Device.

completed through a capsule of powdered graphite an calcium carbonate (C, Fig. 2), the resistance of whic causes the generation of heat sufficient to melt a piece o lead wire, releasing a set of contacts and opening the mai circuit at S. Another modification operates to throw ove an arm, indicating that the meter has been magneticall tampered with.

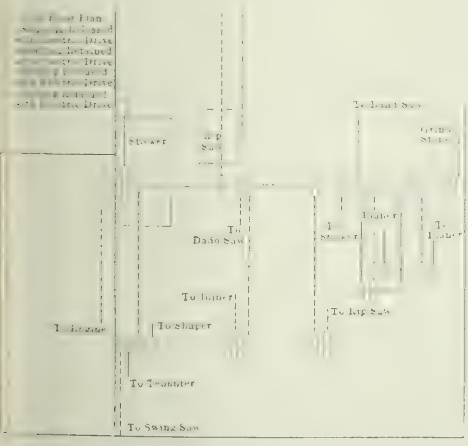
Where desired, the inventor also provides a method c utilizing the magnetic action of the detector shunt curre to work the main-circuit switch, instead of using its hea ing effects as first described. A solenoid switch is a ranged with a high-resistance winding of copper and Ge man-silver turns, which normally bridge the closed ma switch contact. When the detector acts its shunt circu is closed through the solenoid winding, magnetizing t latter's floating core, which is caused to come up with hammer-blow action, opening the main switch conta These contacts are then held open continuously by t diminished current deflected through the winding, due the switch being open. To restore service after the e ternal magnetic influence has been removed the main li switch must now be opened, de-energizing the solenoid a permitting its contact to fall closed by gravity, after whi operation may again proceed normally. In the powd and-fuse modification, the inventor explains, the resistan

powder mixture can be adjusted to give any desired degree of sensitiveness, so that service will not be interrupted by seismic disturbances, passing magnetic fields or other causes resulting in the detector bar being momentarily swung against its contacts.

THE ELECTRIC DRIVE IN A LUMBER MILL.

An Analysis Showing the Saving Through the Replacement of Steam by Electricity.

No better illustration can be given of the advantages of the electric drive than in cases where it forces competing native powers out of business in the face of unusually low fuel costs. Through the courtesy of Mr. B. W. Mendenhall, commercial agent of the Utah Light & Railway Company, of Salt Lake City, the following particulars are given of the successful introduction of the electric drive in a representative lumber mill, the adoption of electricity having been effected on the basis of a lower operating cost per year than the original steam plant of the concern was capable of meeting, even when refuse sawdust and shavings were burned under the boilers. The Utah Light & Railway Company made a careful investigation of the operating costs in the case in hand, submitting an engineering report in which the power consumption, present and estimated costs were reviewed, including a diagram of the premises,



Plan of Mill.

showing the shafting and belts released by the introduction of electric driving.

The central-station organization pointed out that the ideal arrangement for the use of electric energy is a separate motor for each machine, but suggested that when the energy saving by this method ceases to pay at least 15 per cent on the investment it is not a success from a strictly financial point of view, although the cleanliness, convenience and flexibility of such an installation sometimes make it more desirable. The conditions at the plant did not appear to warrant the exclusive use of the individual drive. The arrangement suggested and which was followed in the lumber plant was as follows:

On the first floor of the mill the machines, all individually driven at a motor speed of 1700 r.p.m., were: Rip saw, 5 hp; planer, 10 hp; 12-in. sticker, 10 hp; swing saw, 3 hp. On the second floor the machines were: Individually driven—Planer, 7.5 hp; 6-in. sticker, 5 hp; rip saw, 5 hp; joiner, 3 hp; dado saw, 3 hp; motor, 1700 r.p.m. each; band saw, 3 hp; motor, 1120 r.p.m. Group-driven—Tenoner, shaper and mortiser, 5 hp; sander, emery wheel and grindstone, 5 hp; both motors, 1700 r.p.m. All motors offered were of the three-phase induction type, wound for 220 volts, 60-cycle service. The motor ratings were selected on the basis of making sure that the size was adequate for the service, without danger of insufficient power at any given machine.

Careful tests of the power requirements of the steam-driven establishment showed the following demands:

Maximum load on day of tests	[illegible]
Average total load on day of test	8.8 hp
Friction load on day of test	5.5 hp
Average total productive load on day of test	3.3 hp

The average total productive load, if the machines had been fully loaded during the entire time on the test date, not including the 5.5 hp of friction, would have been 7.96 hp. This figure was used in the cost estimates which drove the steam engine from the plant, rather than the actual average productive load. From the records of the lumber company the following yearly costs of steam power were deduced for two successive years: First year, $1,176; second year, $1,366, giving an average of $1,271, or $106 per month. The principal items were coal (required in addition to sawdust and shavings), average $600 per year, and engineer's wages, average $526 per year, other smaller items being oil, waste, packing, engine repairs and miscellaneous. None of these smaller items much exceeded $40 per year individually.

COST OF ELECTRICAL OPERATION.

The average load used in the estimated cost of electric service was based on the supposition that all machines in use during the day of test were operated at their maximum capacity for the entire time that the machines were in service. As the machines were only operating under maximum load for approximately 50 per cent of the time that they were in operation, a large factor of safety was apparent in the estimated cost of electrical service.

The average load of 7.96 hp-hours per day, with twenty-six days' service per month, was 1240 kw-hours, and at 4.6 cents per kw-hour the energy cost was $57.10 per month, to which was added oil at $1.50; so that the total yearly cost of electrical operation was $703, compared with $1,271 for steam. The estimated saving by the use of electricity was $568 per year, and this led to the installation of the motor drive.

The old steam plant was given additional advantages in determining the relative yearly cost of operation, and still electricity won the day. Thus, the electrical costs were figured upon a total operation of 312 days per year, against an actual service by the old steam plant of 256 days. The average number of workman-hours with steam drive was 24.5 per day, while with electricity this came to 36. The estimated cost of motors was $1,219 installed, the cost of placing the motors at the mill door being $1,080, material to be used in the installation work $108 and labor of wiring $31. The costs of pulley bushings, labor and material for motor platforms and the erection of motors were not covered. A special point was made of the fact that the only item which would be lost in case the factory moved would be the labor charge for installing the wiring. Another point in favor of electricity was that the old steam plant was fast approaching a period of costly repairs, which would be forced upon the owners if a reasonable efficiency of operation was to be assured.

The installation of the electric drive resulted in the elimination of the main shaft and three auxiliary lines of shafting, besides cutting out fifteen belts of varying length and size. The results of the first year's operation were as follows:

Total cost of energy	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Maximum demand	[illegible]

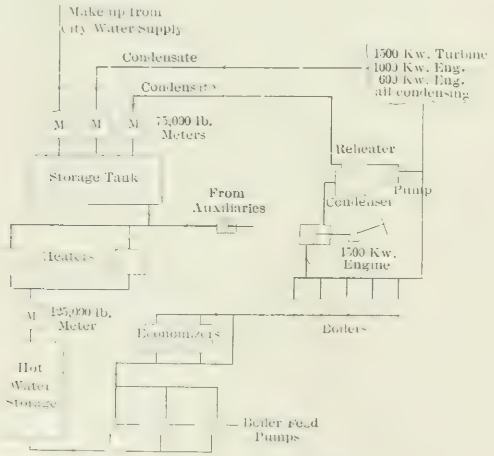
The installation operated at full capacity during only one month of the year. Under normal conditions the power bill will run between $55 and $60 per month. In spite of the availability of shavings and sawdust at zero cost the introduction of electricity has cut the expense of operating the mill by over 50 per cent.

CONTINUOUS STEAM TEST OF A CENTRAL-STATION PLANT.

Practical Value of Metering All Water Used by a Condensing Steam Plant.

Conditions approximating a continuous plant test are made possible in the station of the St. Joseph (Mo.) Railway, Light, Heat & Power Company by the provision of water meters in the boiler-feed lines, as well as in the make-up supply pipe and the return lines from the condensers serving the various engine and turbine units. The accompanying sketch will make a detailed description of this piping layout unnecessary.

The water meters used are of the Hammond float-discharge type, comprising two vessels which are alternately filled and emptied by the float-controlled valves. The large totalizing meter, which can measure 125,000 lb. per hour, holds 2000 lb. of water per side. The smaller meters on the make-up and condensate-return lines are each capable of measuring 75,000 lb. of water per hour and hold 1250 lb. per side. All of these meters are located in the boiler-room in more or less inaccessible places, but by means of



Arrangement of Apparatus for Continuous Metering of Water in St. Joseph Power Plant.

electric contacts are closed each time the meters' trip-counting dials are operated in the engine-room, where a direct reading of the quantity of water being used can be obtained at any time.

At present the condensate returned from the condenser of the 1500-kw Curtis turbine and one 1000-kw and one 600-kw engine unit is collected into a common storage tank and returned through a single meter, while the 1500-kw engine has its own separate meter. A separate meter is now being provided for the turbine, so that its performance can be watched more closely. Tests can be made on any unit under the present layout, however, by manipulating valves, so that the condensate of only the unit under test is returned through the meter, the other being by-passed directly into the storage tank.

City water is used to make up the losses in the condensing system, which have averaged slightly less than 15 per cent. When the notoriously muddy Missouri River is sometimes fairly clear this raw water is used directly for boiler-feed purposes.

The three smaller meters are mounted over the storage tank, which is supported on the boiler-room roof trusses. The feed-water heaters are of the open type and are operated up to 7 lb. pressure. The totalizing meter normally receives water at about 180 deg. Fahr., although this temperature may fall very low when the heaters are not in use. The water meters are warranted to be accurate within 2 per cent, and it is found that, due to the compensative expansion of both the water and metal vessels, this accuracy is practically unaffected by temperature. The economizers are arranged for series or parallel-flow operation of both gases and water.

The practical value of such a meter installation has proved important in the case of the St. Joseph plant. Continuous figures on the quantity of water purchased, water evaporated and steam used by each unit are now available, and these have indicated the points where steps to improve operating efficiency have been taken. The boiler evaporation was found low, and these units are accordingly to be pushed. The prime-mover units which are giving the best performance have now been determined and the less efficient ones are being reserved for peak-load operation. The entire plant is operated at a steam consumption of 26 lb. per kw-hour, including all auxiliaries, boiler blow-offs, etc. The most efficient unit on the floor, the 1500-kw engine, has been found to take only 22 lb. of steam per kw-hour.

Mr. A. J. Purinton is general superintendent of the St. Joseph Railway, Light, Heat & Power Company, Mr. H. A. Cowgill is electrical engineer and Mr. R. A. Foresman is the engineer in charge of the power plant.

UNDER-WATER COAL STORAGE.

Submerged 10,000-Ton Coal-Storage Pit at Omaha.

At Omaha in the past strikes of coal miners have proved as expensive to power-plant operation as in the experience of many other cities. As is well known, coal in dry storage even six months will lose as much as 25 per cent of its fuel value, while its tendency to spontaneous firing is an additional source of trouble. For these reasons, unfortunately, it does not pay to keep large quantities of fuel continually in stock to guard against possibility of strike shortage, while, on the other hand, the matter of acquiring a large coal reserve quickly becomes a problem after the first rumors of a strike are abroad.

Coal can be stored under water, however, almost indefinitely without loss of its fuel value. This has been well proved by tests, and such under-water storage, it will be seen, offers an opportunity for holding large coal reserves almost indefinitely against a time of need. With this idea of guarding against strike shortage, following recent expensive experience, the Omaha Electric Light & Power Company is just completing the installation of a great under-water storage pit capable of holding 10,000 tons, with the bunker contents enough for three months' operation of its 13,000-kw plant.

This submerged storage pit, as shown in the accompanying illustrations, measures 100 ft. x 116 ft. in plan and 22 ft. deep below the water level, which is in turn 23 ft. below the crane runway. It will submerge 7000 tons of coal, while 3000 tons more can be piled on above the water level. The coal is unloaded from cars run alongside the pit by means of a grab bucket carried on a crane of 145-ft. span. The coal-car track passes directly above the hoppers leading to the coal crushers, which in turn discharge into the conveyors, elevating the fuel to the overhe

bunkers. This arrangement provides that the ordinary route of the fuel is from the cars to the boiler-room, the storage pit always being kept filled with a fixed quantity of coal.

The storage pit is of reinforced concrete and is carried on nearly 400 piles at 5-ft. centers driven to bed rock 19 ft. to 30 ft. below the semi-liquid quicksand. The presence of this quicksand made it necessary to reinforce the structure

motor at 300 ft. per minute, and the trolley is operated at a similar speed by a 16-hp motor. The main hoisting is performed by two motors, one of 45 hp and the other of 30-hp rating, giving a hoisting speed of 120 ft. per minute. With this crane bucket a 50-ton car has been unloaded in twenty minutes. The cost of each handling of the coal is estimated to be about 4 mills per ton, whether from car to pit or pit to crusher hoppers.

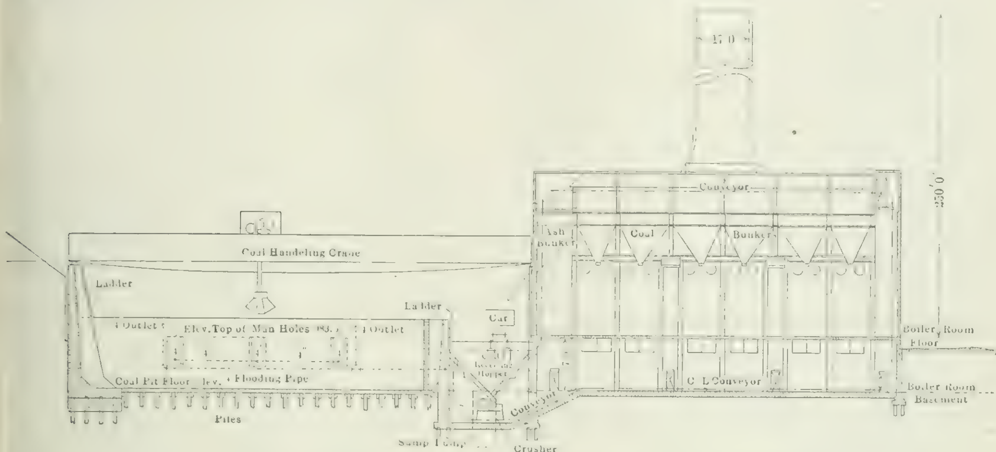


Fig. 1—Section Through Under-Water Storage Pit and Power House, Omaha.

for both internal and external pressures to prevent collapse of the pit when empty. The piles are capped with 2-ft. 6-in. concrete slabs, reducing the stresses in the pit floor, which is 12 in. thick.

Besides the steel reinforcing in the floor, old rails have been embedded in the concrete at 1-ft. distances, their heads being flush with the waterproofed floor surface, to serve as an armor against the impact of the bucket when removing coal from the pit. These rails and the pit forms and interior are well shown in Fig. 3.

The side walls are 4 ft. thick at the bottom, tapering to

Fig. 2—Crane Bucket Filling Under-Water Coal-Storage Pit from Car.

2 ft. 6 in. at the top. The submerged storage has been so constructed as to be capable of extension in both directions as the plant grows.

Spanning the pit and the crusher hoppers, a total width of 145 ft., is the 5-ton bucket crane, made by the Toledo Crane & Bridge Company, and one of the largest of its kind ever built. This crane is made up of two girders 12 ft. apart, between which runs the trolley carriage with its 2-cu. yd. bucket. The bridge is propelled by a 45-hp

On account of the notorious muddy sediment of the Missouri River, on the banks of which the plant stands, waste water from the plant supply (which has been allowed to settle in sedimentation basins) is used to fill the coal-storage pit. For draining the pit outlets fitted with valves are provided just above the sewer level, so that the water can be drained down to this point by gravity, beyond which the same sump pump used to fill the pit can be brought into service for the purpose of discharging its contents into the sewer.

The Omaha under-water coal-storage pit is estimated to

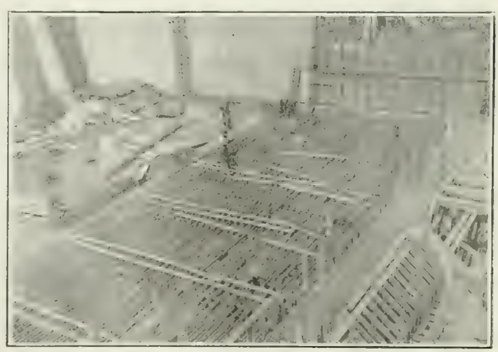


Fig. 3—Floor of Storage Pit During Construction, Showing Old Rails Used as Armor.

have cost about $70,000, a part of this being due to the unusual and difficult conditions of quicksand on which the pit had to be foundationed.

Mr. H. A. Holdrege is general manager of the Omaha Electric Light & Power Company, and Mr. C. T. Anderson is chief engineer of the power plant. The under-water coal-storage pit was constructed under the designs and supervision of Sargent & Lundy, consulting engineers, Chicago.

LETTERS ON PRACTICAL SUBJECTS

CONDENSATION IN RIGID CONDUIT

It is very generally recognized that in places subject to vapor or dampness the open-knob and tube method of wiring gives better satisfaction than the more expensive rigid-conduit system. Even in the ordinary work where dampness does not exist troubles have been encountered owing to condensation in the conduit. Water-tightness in the conduit is not of necessity desirable, and the writer knows of instances where in vertical runs it has been found best to provide draining outlets. The condensation troubles usually exist in conduit work installed during the winter months and made water-tight. At first there are very few complaints, but after a while instances of shock are reported with certain types of switches. In one case switches with other insulation were substituted, but the remedy was only temporary, the shocks manifesting themselves after a lapse of a few months. The trouble was traced to condensation in the runs and as a remedy every switch box in the run was removed and in its place a box with an extra outlet substituted, the outlet in each case being at the bottom of the box and left unplugged. Where this was impossible a hole was chipped in the bottom of the box. It was surprising to note that with this means of ventilation and drainage all trouble disappeared. In the switches which first gave trouble hard black vulcanite was used for insulation and this absorbed the water of condensation in the conduit. A switch with non-hygroscopic insulation was tried, but there was sufficient moisture in the conduit to form a path for surface leakage. It is safe to assume that if either switch was not connected to the conduit in which condensation took place no trouble would have been found. The inspection bureaus, it is true, require a lead covering over the wires used in conduit when the latter is installed in a damp place and is not water-tight, but their rules would not cover the instances I have in mind where the trouble was traced to condensation in places presumably dry. In the crusade being made in very many places to limit the installation of wires to that inclosed in rigid iron conduit, the question of dampness and condensation is apparently lost sight of. So far as the writer's observations have gone, when properly installed, exposed wiring without conduit is safer than that inclosed in conduit and defects are more readily noted. Its appearance is, however, not as pleasing as a straight conduit job, but where appearances do not count for much, especially in factory and mill work, it is not unusual to find the exposed wiring in highest favor. Oftentimes a combination in which conduit and condulets are employed to protect the circuits from the floor to a point about 8 ft. up the wall and where exposed work is used above this point makes a better installation, conduit being preferable to a wooden box for side-wall protection of the wires. Where conduit is employed on ceilings over ovens or boilers, for instance, the combination of heat and condensation may ruin the insulation of rubber-covered wire. Even if condensation is not present, a weatherproof insulation is better than rubber in such a location.

St. Louis, Mo. FRANK WRIGHT.

VENTILATING FOUNDATIONS.

It is now well recognized that every reasonable expedient should be adopted that will insure a plentiful supply of cooling air for electrical machinery. The manufacturers are utilizing very "open" construction in the machines that they build so that air can have access to the current-carrying parts and keep them cool, thereby enabling maximum duty to be performed with a minimum of material. In some cases fans or blowers that direct streams of air against the active material are mounted on the rotating parts. Even railway motors are arranged for "forced ventilation" so that a maximum output can be obtained from a motor occu-

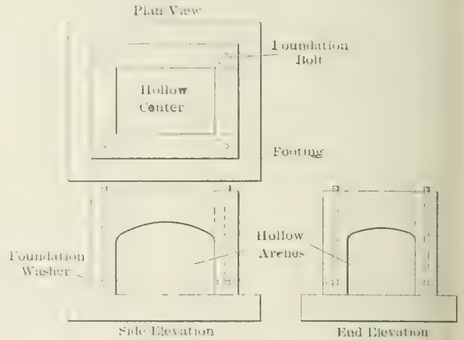


Fig. 1—Plan and Sections of Ventilated Foundation.

pying a given space. These examples indicate the importance of arranging all electrical machines so that an ample amount of cool air will circulate around them when they are in operation. Inasmuch as the output of almost al machines is limited by the temperature rises of certair

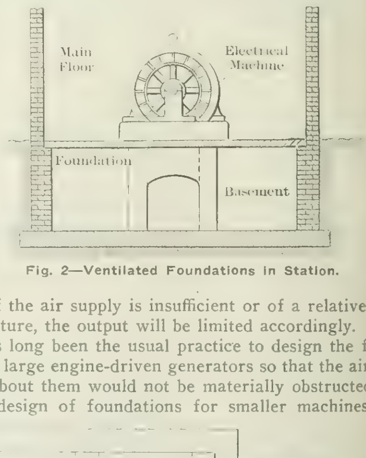


Fig. 2—Ventilated Foundations in Station.

parts, if the air supply is insufficient or of a relatively hig temperature, the output will be limited accordingly.

It has long been the usual practice to design the found: tions of large engine-driven generators so that the air circ lation about them would not be materially obstructed. B in the design of foundations for smaller machines (pa

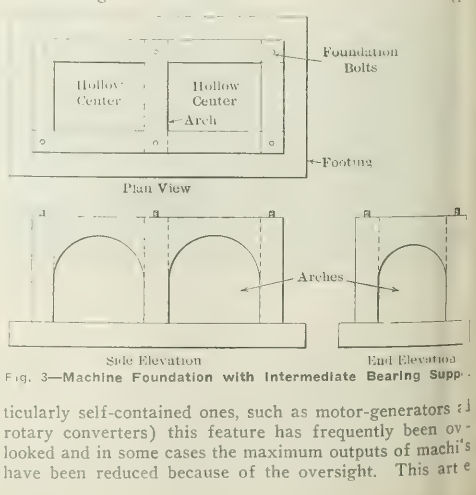


Fig. 3—Machine Foundation with Intermediate Bearing Supp·

ticularly self-contained ones, such as motor-generators a rotary converters) this feature has frequently been ov looked and in some cases the maximum outputs of machi s have been reduced because of the oversight. This art e

s written to call attention to some methods of constructing foundations for self-contained electrical machinery that will insure a good supply of cooling air.

One form of so-called "ventilated" foundation is illustrated in Fig. 1. The foundation is hollow in the center

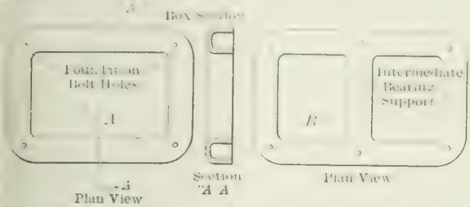


Fig. 4—Plan Views and Section of Bed Plates.

and has arched holes through each of its four sides. It really consists of four arches arranged in the form of a hollow rectangle. The foundation is designed to extend between the basement floor and the main floor of a station as suggested in Fig. 2. It relieves the main floor of the weight of the machine that it supports. The basement should be well ventilated so that cool air will be drawn in and rise into the station as it is heated by the machine.

Besides affording thorough ventilation the foundation of

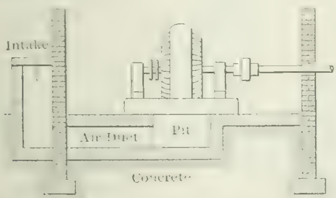


Fig. 5—Sectional View Showing Air Duct Into Pits.

Figs. 1 and 2 is very economical of material. The ordinary practice in constructing a foundation for the application of Fig. 2 would be to build it solid from floor to floor or, possibly, to hollow it out somewhat in the center. With the design of Fig. 1 all of the material that would be wasted in a solid construction is saved. Although this foundation might be constructed of masonry, concrete is probably a cheaper material for most localities. A 1:3:6 mixture

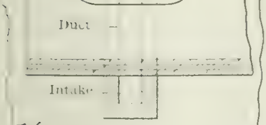


Fig. 6—Plan View Showing Air Duct Into Pit.

poured very wet into substantial wooden forms will provide a thoroughly dependable foundation.

The arrangement of the foundation-bolt holes in the bed plate and the form of the bed plate of the machine to be supported often determine the design of the foundation. The foundation shown in Fig. 1 is arranged for a machine requiring four foundation bolts, while that of Fig. 3 is for one requiring six bolts. The bolts should be extended almost to the bottom of the foundation and should have washers on their lower ends, as suggested in Fig. 1. At *A*, Fig. 4, is shown the plan view of the bed plate for the foundation of Fig. 1 and at *B* is shown that for the foundation of Fig. 3. An arch should always be arranged in a ventilating foundation under an intermediate bearing support (if there is one) in the bed plate, as shown in Fig. 3, so that the support can be firmly "grouted in" to the foundation. If such an arch is omitted difficulties may result from vibration.

It should be noted that where the foundation extends from basement to floor, as in Fig. 2, the footing of the foundation and the floor may be combined, so that in some cases a separate footing may not be necessary, although, as a rule, for a rational design it is necessary to make a concrete foundation footing thicker than a concrete floor.

Inadequate ventilation is often afforded to generators driven by waterwheels. Frequently there is no basement under the generator room, which makes it a little difficult to provide a source of cool air supply. In such cases an air duct from the outside of the building, or from some place where the air is always cool, should be brought into the machine pit, possibly after the manner outlined in the sectional view of Fig. 5 and the plan view of Fig. 6. The pit should be ventilated for both horizontal and vertical generators. The air duct is best constructed of concrete or brick set in cement mortar and should in every case be at least large enough so that a man can crawl through it to clean it or so that, if it is short, it can be readily cleaned with a scraper. Obviously the size of the duct must be reasonably proportional in relation to the capacity of the machine that it supplies with air.

Albany, N. Y. CLARENCE G. MEYERS.

FOLDER FOR FILING ENGINEERING CLIPPINGS.

The writer has experienced the usual difficulties in attempting so to file engineering clippings that they would be readily available. Unless such clippings are filed in such a manner that they can be quickly found when needed they are of little real worth, whatever may be their intrinsic value. After trying a number of different systems a system of envelope files was devised that has proved very useful to the writer, at least.

These envelope files are made by taking a number of envelopes of large size and binding them together with brass paper fasteners in book form. They are bound on the edge opposite the flaps and thin pieces of cardboard serve as covers for the folders. The flaps are then folded inside of the envelopes, thus forming a pocket in which the clippings can be filed.

There is a file, or book, for every main subject and one or more envelopes for each subdivision. The envelopes are given numbers and all the clippings filed in a particular envelope are indexed under that number. In addition to this the clippings in a particular envelope are lettered A, B, C, etc., in the order they are accumulated. On the face of the envelopes is a table giving the titles of the clippings opposite the file letters.

This system of filing has proved very satisfactory, as when it is desired to look up some subject it is possible to turn directly to the envelope containing the clippings on that subject and read off the titles of all the clippings directly from the face of the envelope. It is then possible to pick out the ones it is desired to refer to without going through the whole bunch, as the clippings are put into the envelopes in the order of their file letters.

Kenyon, R. I. H. M. NICHOLS.

TROUBLE WITH AN INDUCTION MOTOR.

Before being called upon to investigate trouble I was informed that a 25-hp induction motor, driving the pump in

an ammonia compression refrigerator system, after a few minutes' operation became hot. It always started up nicely, but after full speed was thrown in the trouble commenced. The windings became hot, the bars in the squirrel cage rotor got red-looking, the speed fell off and then the fuses went. Everything was examined, loose connections looked for, voltage measured, the pumps gone over to see if an overload might not be the cause and, finally, the motor was entirely dismantled. Such was the condition in which I found things.

Repeating all the former tests and examining the rotor and trying out phases did not show anything out of the ordinary, so the motor was reassembled. I next gave attention to the auto starter and immediately discovered the seat of the trouble. A sliver of wood about 4 in. long was found floating in the oil. This was removed and the case replaced, when the motor was started again; no further trouble was experienced.

The reason for the previous failure was the fact that the sliver of wood got caught in the contact jaws at the full-speed notch, throwing the motor on single phase, although starting on the three phases. The three phases, being fully loaded under normal operation, one phase naturally could not bear up under its triple duty.

Joseph, Ore. J. J. REZAB.

SHORT-CIRCUIT CAUSED BY FORCING CONDUIT BETWEEN SERVICE WIRES.

The accompanying engraving of a cabinet box and length of conduit shows the results and effects of a short-circuit which was caused by the conduit being forced down between the two service wires that entered the cabinet box through this section of conduit. It will be noted that the conduit is all melted, and had it not been installed in a

Effect of a Short-Circuit on Cabinet and Conduit.

fireproof compartment the short-circuit would have resulted in a very bad fire in one of the local 5-cent theaters. The accident was caused by workmen on the roof stepping upon the conduit, which was run over the roof, forcing it down between the two feeder wires, as mentioned.

Oklahoma City, Okla. H. W. BRUNELL.

A TRANSFORMER MISCONNECTION.

While it is a simple matter to connect three transformers to a three-phase circuit, the accompanying diagrams will illustrate how equally simple it is to go wrong. Fig. 1 shows a diagrammatically correct delta connection to a circuit, *a, b, c,* the corresponding points on the transformer primaries being numbered as shown. The secondaries are not shown. In this particular instance the

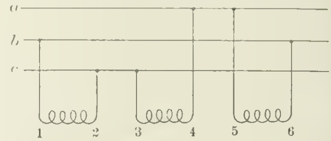


Fig. 1—Diagramatically Correct Delta Connection.

three transformers were set up in a railway substation to step down the voltage and to provide taps for starting the rotary converter from the alternating-current side. An iron-pipe framework was erected above these transformers, which were arranged in a row side by side, and upon these were fastened three heavy wires, *a, b, c,* for convenience of connection. As in Fig. 2, the first trans

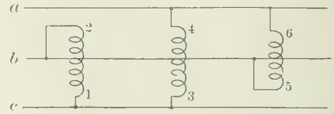


Fig. 2—Misconnection of Transformer.

former has its terminals connected to *bc*, the second to *a* and the third to *ab*. The terminals were, therefore, ru in as short a line as possible to the lines *abc*, as in Fig. : a natural mistake if one forgets the polarity. As was t be expected, there was trouble and the circuit-breake kicked out every time an effort was made to start the cor

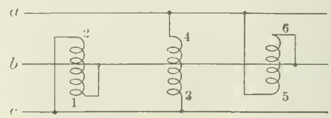


Fig. 3—Proper Connection of Transformer.

verter. By numbering the circuits as shown and checkii with Fig. 1 Fig. 3 was obtained, showing the prope although more lengthy, connection. It is not always co venient to carry such a diagram around or possible quick to find it should one have it. To construct such a di gram at any time it is only necessary to draw Fig. 4, t

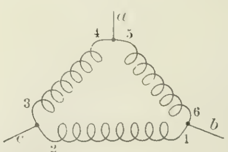


Fig. 4—Diagram of Delta-Connected Transformer.

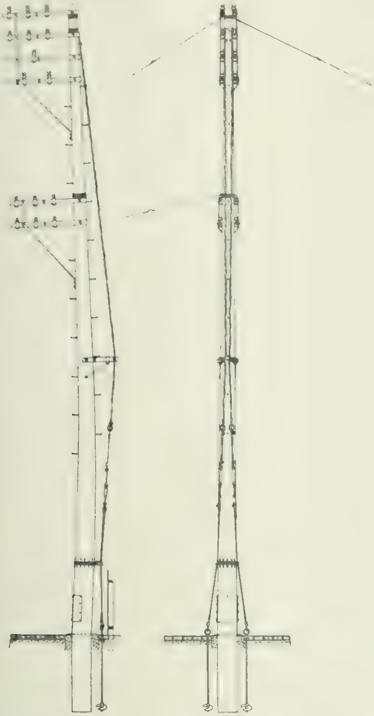
ordinary conventional delta representation, and number t ends of the windings consecutively from one to six. T junction points *a, b, c* will therefore correspond to sir lar points in Fig. 3.

San Francisco, Cal. R. J. JENKINS

INCREASED STRENGTH OF POLE BRACED TO GROUND ANCHOR

The accompanying sketch shows a problem in pe construction which doubtless has confronted many er neers at some time. This pole was erected to act a a corner pole, the company fully expecting to place :d

maintain guy wires across private property. After the pole was up conditions arose which would not permit the necessary guy wires, so that it then became necessary to devise means of holding the strain. The pole itself is 55 ft. in length, set 6 ft. in the ground, in an L alley, surrounded



Method of Strengthening Corner Pole.

by brick pavement up to the abutting property. Since the pole was of a size not equal to withstanding the strain, it was decided to brace it by screwing two 8-in. Matthews anchors into the ground, each about 12 in. away from the pole on the property line. Attached to each anchor is one set of double 3/8-in. strand, made fast at the top of the pole under the first gain. Strain insulators and turn-buckles were inserted in each strand, arranging a strut at about the center of the pole, and then tightening up on the turnbuckles.

This method was found to work out satisfactorily in every detail. It appears to the writer that the pole will withstand twice as much line pull when constructed in this manner as compared with the usual manner of attaching the guy at the top of the pole and at the surface of the ground. In the latter case the strength of the pole at the surface is all that can be depended on and it is necessary to concrete the pole. By the use of the anchor as shown, the pole is in compression and the guy wire in tension, the breaking point being transferred to about the center. It is believed that the pole will bend considerably before breaking, until finally the guy wire will take nearly all of the strain. This construction was easily installed, did not require any special concreting as in the old method and did not require the changing of poles or selection of a specially heavy pole. The cost of concreting was also saved.

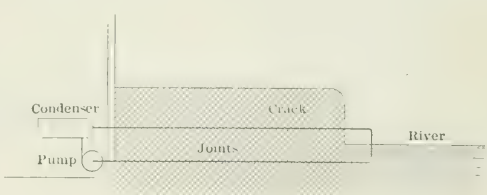
The entire rearrangement of guys, installation of anchors, etc., was accomplished in four hours' time with five men, whereas changing poles, transferring arms and wires and concreting would have required about sixteen hours for the same number of men. In the older construction of bracing the pole by guying it to its own base it is evident that the breaking strength of the pole at its base, the critical point, will be in no way affected or increased. But when guyed to ground anchors as described the tensile strain is transmitted to the steel guy while the pole remains in compression. Evidently the latter construction is not only twice but as many times as strong as the steel cables and anchors acting at 1-ft. radius arms are stronger than the outer wood laminæ of the pole. Under these latter conditions it is probable that when the pole ultimately fails this will occur by buckling when carrying a very high tensional load rather than by breaking off at the ground as the former construction is liable to do at much lower loads.

St. Louis, Mo. JOHN L. FAY.

FRACTURED CONDENSER DISCHARGE PIPE IMPAIRED VACUUM.

About two years ago, while serving as engineer in charge of a small steam-turbine station, the vacuum on the condensers of the several 750-kw units was noticed to drop suddenly and none of our efforts availed to restore the exhaust pressure to the point where it was formerly maintained with ease. The circulating pumps were inspected and proved to be operating the same as before, but it was quite apparent that the quantity of water being moved was much less than formerly. After the pumps had been thoroughly gone over and found in good order it was suggested that perhaps a leak had developed at some joint in the upper discharge return line, impairing the syphon effect of the circulating system and thus requiring the pumps to elevate the water between the pipe levels as well as to move it against skin friction. Following this clew pits were dug at each joint of the 100-ft. run of 20-in. pipe between the station and the stream bank. So far as could be determined every joint where trouble would be likely to develop was as tight as on the day installed. The peculiar failure of the pumps was then attributed to some mysterious cause beyond the ability of mere station engineers to discover, and for a time the plant continued to run under impaired vacuum. Finally, in the course of some excavations made to change the discharge outlet from a point too near the intake, where the warmed discharge water would not be returned to the condensers, the real trouble with the vacuum was discovered.

On baring a length of the discharge line about 8 in. back from one of the joints an annular crack was found extending completely around the pipe and exposing an opening of 1/8 in. This crack, doubtless due to temperature-change contractions of the big pipe, had not been discovered when the joints were investigated before. Admitting air to



Sectional View of Installation.

the pipe, as it did, the syphon vacuum in the condenser circulation was destroyed and the pumps had been required to raise all of the cooling water 7 ft. or 8 ft. as well as to move it through the pipe line.

Minneapolis, Minn. H. L. JENSEN.

QUESTIONS AND ANSWERS

I[illegible] current generator armatures that I have [illegible] several coils per pole per phase in the winding. What advantage does this type of winding possess? H. B.

The winding described is known as distributed winding and results in better wave form. Moreover, the use of a large number of turns is necessary when the voltage is high. In order to minimize the number of slots several conductors are placed in one slot, thus giving jointly several turns per slot with a reasonable number of slots per pole.

[illegible] oil switches how may one determine what breaking capacity is necessary? G. P. W.

For generating stations it is usual to require the oil switch to have a breaking capacity of three times the normal rating of the apparatus installed without reference to the capacity of the feeders or apparatus controlled. It is questionable if a short-circuit current greater than this can be sustained. In substation practice the rule is to consider the maximum power that can be ruptured by an oil switch as equal to one-quarter of the square of the emf between wires divided by the resistance of one of the wires.

Is enameled wire suitable for use in making meter coils the extreme pressure between [illegible] wires of which does not exceed 5 volts? G. H.

Enameled wire should prove excellent for meter coils. It is said to be absolutely non-hygroscopic and is not affected by temperatures that would prove destructive to either silk or cotton insulation. Moreover, the space-factor of enameling wire is much better than even that of a single-silk-covered wire, being, say, 65 per cent for the former as compared with 55 per cent for the latter. It is said that a thickness of enamel only 0.0008 in. thick can withstand 1500 volts.

In a reply given to H. L. O. in the Questions and Answers column last month it was stated that split-pole converters are not built except for 25-cycle circuits. I have seen a 60-cycle split-pole converter. S. C. E.

We have been informed by the General Electric Company that it has built split-pole converters for 40 and 60 cycles also. A 500-kw, 245/260-volt, 60-cycle machine is in operation in one of the stations of the Rochester (N. Y.) Railway & Light Company and two 1000-kw, 40-cycle, 240/280-volt machines are operating in the Schenectady Works of the General Electric Company. A number of smaller 60-cycle machines have also been built.

How many transmission circuits leave the Lockport station of the Sanitary District? What is the voltage and what the highest load [illegible] A. A. B.

From the Lockport (Ill.) hydroelectric generating station of the Sanitary District three transmission circuits extend to the terminal station in Chicago, a distance of 30 miles. The transmission tension is 44,000 volts, three-phase, and the maximum amount of power carried on each circuit is 8000 kw, or about 180 amp at 44,000 volts. The three wires of each circuit are of aluminum and each is equivalent to a No. 000 copper wire. Seven of the nine wires are supported on pin insulators and two on suspension insulators.

In a 440-volt, 60-cycle, two-phase system, two 220-volt lamps connected in series are used as test lamps. These lamps when connected across a certain wire on each phase give a brighter light than when connected directly to the two wires [illegible]. What is the explanation? S. Van B.

In a 440-volt, two-phase system, with interconnected phases the electromotive forces between the leads are as follows: Distinguish the leads of one phase as A and A^1, and the leads of the other phase as B and B^1. The electromotive force between A and A^1 is 440 volts; that between B and B^1 is 440 volts; that between A and B is about 310 volts; that between A and B^1 is 310 volts; that between A^1 and B^1 is 310 volts, and that between A^1 and B is 310 volts. If two similar lamps are connected in series across between A and A^1 or B and B^1, each will be subjected to 220 volts; but if an individual lamp is connected between one lead of phase A and one lead of phase B it will be subjected to 310 volts.

Given two three-phase lines of the same voltage and frequency, but operated from different generators, and suppose that an induction motor rotates in the same direction when operated on either of these lines. If the two generators have never been operated in parallel before, is it safe to close the switch between the two generators when one phase of one generator is in synchronism with one phase of the other generator connected to the other line? F. D. E.

Two polyphase generators can be considered to be in proper condition for placing in parallel if their electromotive forces are equal and one phase of one generator is in synchronism with the corresponding phase of the other generator, provided the rotation of phases on one generator is the same as the rotation of phases on the other generator. In the case mentioned by you the rotation of phases is undoubtedly correct when the two machines operating separately cause a certain induction motor to rotate in the same direction. The individual leads from the two generators, which should be connected directly together, should be identical with the three leads connected to the terminals of the induction motor. That is to say, if the leads on the induction motor are marked A, B and C, then the lead on generator No. 1, which is connected to lead A on the induction motor, should be connected to the lead on generator No. 2, which had been connected to lead A on the induction motor. The same statement applies to leads B and C.

Two exciters are employed in a hydroelectric station containing two 1000-kw units; one wound for 146 amp and 120 volts and the other wound for 125 amp and 120 volts. The speed of the first is 1500 r.p.m. and that of the second is 1400 r.p.m., both being belted to the same shaft. As one alternator is used at a time it is sometimes necessary to change the exciters on the circuit in order to inspect the exciter running, and as there is no equalizer connection between the exciters there is a question as to the proper method to use in this case without shutting down or causing three 150-hp motors 10 miles away to fall out of step. At first one attendant would stand at the busbar switch of one exciter and another attendant would throw in the busbar switch of the other exciter when the first opened his exciter circuit. This method, while it works properly, does not have the earmarks of good practice, and we would like to know how to run the exciters in parallel so as to effect the change without shutting down. B. E. C.

Two 120-volt, direct-current generators can be connected directly in parallel, provided the voltages are properly adjusted, without employing any equalizer connection in case the machines are not too highly over-compounded. You make no mention of the compounding of the machines, and as the machines are used as exciters, and probably for no other purpose, it is likely that they are not highly over-compounded. In any event, however, since they are both belted to the same shaft, they can be adjusted to equality in voltage, placed directly in parallel and any constant load properly divided between them by the use of field rheostat in the ordinary manner. If the machines are used exclusively as exciters, no reason exists for having them over-compounded. However, over-compounded machines could be used for this purpose. In case the machines used are over-compounded, a short-circuiting connection can be placed around the series field coils in each machine, thereby converting them into shunt machines, and they should operate properly for all loads, both when in parallel and when used separately.

Central Station
Management, Policies and Commercial Methods

ENERGY CONSUMPTION OF CONCRETE MIXERS.

Motor-driven concrete mixers deliver from 1½ cu. yd. to 2½ cu. yd. of mixed concrete per kw-hour consumed. The figure will be found to vary slightly with the length of motor-operated conveyor used, but as the mixer is the principal load and the hoisting demand is intermittent the average consumption recorded in mixing concrete for conduits, wall footings, tunnels, etc., has been found by a large user of motor-driven mixers to be about ½ kw-hour per cubic yard.

PURE WATER, PURE ELECTRIC LIGHT.

Illinois, like a number of other Western States, has a law forbidding the use of public drinking cups, and as a result collapsible paper cups make very acceptable souvenirs. For distribution among visitors to its booths in the various shows held in the Coliseum, Chicago, the Commonwealth Edison Company has had prepared a number of small paraffined folding cups, inclosed in envelopes which bear the legend: "Health demands purity in all things—pure foods, pure water, pure air and electric light, the only perfectly sanitary and healthful artificial illuminant—keeps the air pure. We wire houses at cost, two years to pay."

ELECTRIC PUMPING AT WEBB CITY, MO.

The water supply of Webb City and Carterville, Mo., will hereafter be supplied by motor-driven pumps. The joint water-works company serving the two nearby communities has just installed five Downie double-plunger deep-well pumps, each capable of delivering 500 gal. per minute from the 300-ft. depth and driven by 25-hp Westinghouse 25-cycle motors. The pumps discharge into a 5,000,000-gal. reservoir. Energy for the water-works is purchased from the system of the Empire District Electric Company at the rate of $1.25 per month for each hp connected, plus 1⅛ cents per kw-hour consumed.

ELECTRIC APPARATUS FOR RESTAURANT KITCHEN.

The New York Edison Company has closed a contract with the Childs Company for energy for its new restaurant building at 194-196 Broadway, New York City. Among the motor-driven equipment which will be operated from the mains of the central-station company are the following: A 2-hp potato-peeling machine, a ½-hp batter mixer, a 2-hp dumb-waiter, a 10-hp ice-machine, a 2-hp pump, a ½-hp pump for drinking water, five 2-hp dish-washing machines and two 10-hp ventilating fans. There will be twenty-six arc lights in the basement, twenty-eight arc lights on the first floor, twenty-three arc-lights on the second floor, and about 250 incandescent lamps. A sign lighted by 150 2-cp lamps will be placed upon the building front .

SPECIAL FEEDER TO DETERMINE DIVERSITY FACTORS.

In making a study of diversity factors and other ratios of central-station significance Mr. A. N. Richardson, general superintendent of the Kansas City Electric Company, has had an extra feeder, which is carried along one of the main streets of the city, reserved at present for residence-customer connections only. The average and maximum demands, consumption, etc., of this feeder will be recorded and average diversity factors in this way obtained. After a year's test of residential loads a number of business houses and commercial consumers will be connected to the same feeder and figures secured on these classes of business. The changes and varied demands to which an ordinary feeder is subject make it difficult if not impossible to obtain such customers' data without some special feeder provision.

PUMPING A POWER PLANT'S FUEL SUPPLY.

The plant of the Kansas City Electric Light Company, at Baltimore and Thirteenth Streets, is located in the midst of the steam-heating load which it serves, but is nearly a mile from the nearest railroad track. Formerly seven three-horse teams were required to haul the fuel for this plant, which contains 3600 hp in boilers.

A 4-in. oil pipe-line has now been laid directly to the station from the Missouri River power plant of the company, 7000 ft. distant, and the crude petroleum burned under the boilers is pumped this distance against a pressure of 90 lb. by Worthington duplex steam-driven pumps in the river station. A 6-in. feed-water pipe parallels the oil line and will be used for supplying purified water to the steam-heating boilers when the water-treatment plant is completed in the riverside station. With its steam units exhausting non-condensing into the heating lines the plant will thus be unique in its freedom from auxiliary apparatus.

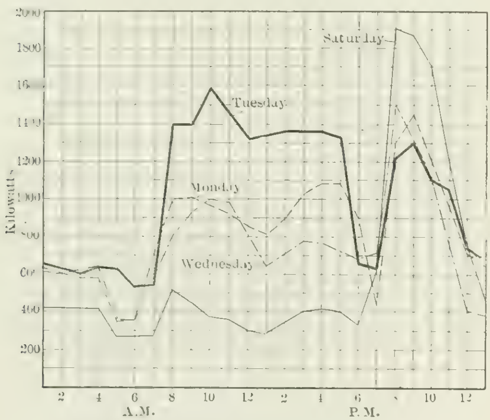
MOTOR DRIVE OF THE LONGEST DRAWBRIDGE.

The longest drawbridge ever built is worked by central-station energy and operated at a cost quite small compared with what it would have been had an isolated plant been provided. This bridge carries the tracks of the Illinois Central Railroad across the Missouri River at Omaha, Neb., and has an open draw of 520 ft. It is operated by a 50-hp motor, which can swing the heavy steel structure through an arc of 90 deg. in 90 seconds. As a precaution against accident to the line wires interrupting service, the bridge is supplied with energy over lines from the plants of both the Omaha Light & Power Company and the Council Bluffs (Ia.) Citizens' Gas & Electric Company, on opposite sides of the river. A double-throw switch is provided, so that in case of failure of one circuit the other can be substituted. Each electric company makes a minimum charge of $5 a month for readiness to operate the bridge, and as the draw is not often used the total consumption of energy never exceeds the minimum charges, totaling only $10 a month. To maintain a special plant to operate such a bridge would, of course, cost more than $100 a month.

ELECTRIC HEATING LOAD AT ALTOONA, PA.

At the recent convention of the Pennsylvania Electric Association Mr. E. B. Greene, superintendent of operation of the Penn Central Light & Power Company of Altoona, Pa., exhibited some curves showing the effect of the heating load on the station operation on Tuesday. Altoona is a

typical railroad town with a population of over 50,000, and there are in use at the present time over 4200 flatirons. Most of the washing and ironing is done in the homes of the people at Altoona, and the ironing load on Tuesday makes itself felt in the steam stations, oftentimes necessitating an extra unit during the day and an extra fireman in the boiler room. Load curves for Monday, Tuesday, Wednesday and Saturday, July 31, Aug. 1, 2 and 5, respectively, are shown herewith, from which it will be evident that the peak load on Tuesday, due to the use of flatirons, comes at 10 o'clock in the morning, exceeding the evening peak by 300 kw. It will also be seen that the ironing load affects Monday's and Wednesday's curves in addition, the morning peak being highest on the first three days of the week, being 1000 kw on Monday and Wednesday, 600 kw on Thursday at 11 o'clock, 400 kw on Friday at the same hour and 500 kw on Saturday at 8 o'clock. Tuesday morning's peak exceeds Monday morning's peak by 600 kw and, as shown in the diagram, the load begins to pile up at 7 o'clock in the morning and does not begin to drop again until after 5 o'clock in the afternoon. The lighting load does not come



Effect of Flatirons on Altoona's Load Curve.

on until after 7 o'clock in the evening, owing to the length of day at that time of the year. The curves indicate what can be done with the electric flatiron in the average city. In Altoona the desire to use the flatiron has been the means of causing many householders to install electricity.

ELECTRICALLY COOKED HOT CAKES IN A DES MOINES RESTAURANT.

The manager of the Boston lunchroom, Des Moines, Ia., desired an attractive electric hot plate for cooking griddle cakes in his front window. As Mr. J. L. Bradfield, contract agent for the Des Moines Electric Company, could find no suitable device on the market he drew up plans for an original hot plate of aluminum, using three 400-watt disk-heating elements. The aluminum top, designed for three cakes, as made, measures 8 in. x 20 in., the disk elements being set into the underside of this casting.

To secure an efficient temperature control of the plates the three 400-watt elements are arranged to be connected in parallel across 110 volts for the high heat and all three in series across 220 volts for the low heat. The accompanying sketch shows the ingenious application of a double-throw, three-pole switch for obtaining these connections. On the low-heat position only one of the contact clips is in use, the others being left in place for the mechanical stability of the switch, which is mounted on the hot plate.

On the first day that the electric griddle was installed 3000 cakes were baked on it, each order of three cakes averaging ninety seconds. During the rush hours the 1200-watt high heat is used, but at other times of the day when orders are intermittent the low-heat series position, taking 533 watts, keeps the plate hot enough for service.

The aluminum surface requires no greasing, and as the

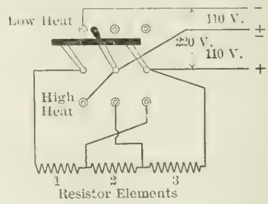


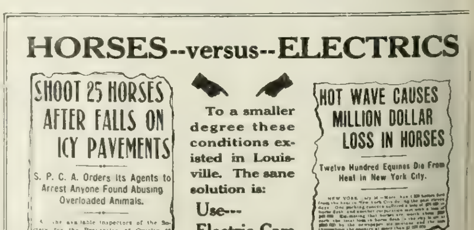
Diagram of Connections for Electric Hot Plate.

metal is a good heat conductor the cakes are cooked uniformly to an appetizing golden brown. The two hot plates now in use cost about $20 apiece as built specially. The lunchroom proprietor is delighted with the performance of the hot plates as well as the advertising they afford his place.

THE ELECTRIC VEHICLE IN LOUISVILLE.

The Louisville Lighting Company, through its business-promotion department, which is in charge of A. T. Macdonald, has succeeded in increasing not only interest in electric vehicles, but has added largely to the number in use in that city. *Chained Lightning*, issued by the company, has been one of the most successful means of co-operation. A department is given up to this feature each month, pictures and stories having reference to the use of both passenger and freight-carrying cars being reproduced. Local examples are given wherever possible of the satisfaction gained through the use of this type of car. In the near future a special electric car edition will be issued by Mr. Macdonald, who edits the paper.

A selected list, consisting of about 2000 names, who are now consumers of electric current, is used in connection with a postcard campaign having to do with electric vehicles, the same idea being applied in other directions. Prospective purchasers of cars are told about the electric vehicle in this manner and the use of rectifiers and other more or less technical features explained in a simple way.



Electric-Vehicle Advertisement.

Largely as the result of this exploitation, supplement by the references to the principal points in favor of elect cars, which are made in the regular newspaper advertis of the company, many installations of charging appara have been made.

The newspaper advertising which is being done cons

f advertisements for electricity in connection with light, eat and motor service, but a consistent part of the campaign has been in favor of electric vehicles. The fact that he exploitation has been successful is shown by the increase n the number of cars. When the work was started two years ago there were only nineteen cars of this sort in Louisville. Now there are over 100, with prospects for the number being increased to 200 within the next few months.

In order to secure for owners of electric vehicles the proper service, the Louisville Lighting Company secured the establishment of a maintenance garage by George Keeler, a Louisville battery expert, quarters being fitted up immediately in the rear of the company's offices. Mr. Keeler has organized the Keeler Company, securing the agency for a pleasure vehicle and an electric truck, the latter being the first commercial car of this kind introduced in Louisville.

The traffic department of the lighting company is co-operating with electric vehicle manufacturing companies which have been organized in Louisville. The Electric Vehicle Company has just begun to turn out trucks operated by electric power, while the Continental Car & Equipment Company has completed equipment of a section of its plant for this purpose. The Louisville Lighting Company has given descriptions of these enterprises in *Chained Lightning* and will co-operate with them in other

The advertisement reproduced herewith is from *Chained Lightning*, showing the advantages of the electric car over the horse. The ad is the work of Mr. Macdonald.

JOPLIN HAS AN ELECTRIC SIGN FOR EVERY BUSINESS.

Two years ago the little city of Joplin, Mo., had not a single electric sign. Now there are 200 in use, averaging sixty lamps each.

Curiously enough, the first sign installed was for an undertaker. Feeling the competition, it was not long until the other leading director of funerals had ordered one, too. These two undertakers' electric signs, only a short distance apart, are shown in Fig. 1.

Electric signs on livery stables throughout the country are about as plentiful as the eggs of the fabled roc, but Joplin has a couple of such displays, one with a prancing steed atop it being reproduced in Fig. 2. In addition there are several spectacular displays, and a couple of buildings, including the electric company's office, are outlined with

Fig. 1—Two Undertakers' Electric Signs at Joplin, Mo.

tungsten lamps. Joplin is in the midst of the zinc-mining district and one of the unusual commodities advertised by electric light is dynamite, an announcement which sometimes startles the gentle visitor.

The electric company's window, lighted to the unusual intensity of 27 ft.-candles, is made the means of many attractive displays, which are changed frequently enough to attract attention.

Signs are operated on a flat-rate basis, at a cost of 15 cents per 4-cp. 5-watt lamp per month, including patrol ser-

Fig. 2—One of Joplin's Unusual Electric Signs.

vice. The electric company sells standard business signs on an instalment plan, when desired, allowing the purchaser to pay 15 per cent of the price in cash and the remainder in twenty-four monthly payments.

Mr. T. C. Bradshaw is illuminating engineer for the Empire District Electric Company, which furnishes the lighting for Joplin and neighboring towns of the Empire lead and zinc-mining district.

COMBINATION ICE-ELECTRIC PLANT OPERATION.

A talk of much practical value and interest on the subject of combination ice-electric plant operation was given by Mr. W. E. Sweezey, of Junction City, Kan., before the Kansas electrical convention at Independence, Sept. 21.

Mr. Sweezey has had nine years' experience in combination-plant operation and at present has a 35-ton plant in connection with his central station. The same boilers do the work of both plants, the demand of each varying almost exactly inversely as the other. The figures of coal consumption submitted by Mr. Sweezey show how the sum of the two demands is nearly constant, one increasing almost exactly as the other falls off. The following table shows the tons of coal burned and the electricity and ice produced during six typical months of winter and summer:

	June.	July.	August.	November	December.	January.
Tons coal burned	670	675	700	580	620	600
Kw-hours generated.......	108,780	111,710	122,500	146,430	162,121	155,160
Tons ice made	[illegible]	1,055	1,050	112	54	32

To make a single ton of ice, observes Mr. Sweezey, costs about as much as to make 10 tons. In the Junction City plant the same engineers and firemen are employed the year around, as the coal burned and energy converted are practically uniform throughout the twelve months. The only extra labor required by the ice plant is for "pulling" the cakes from the cans, which for the 35-ton outfit costs about $5 a day. This amounts to an extra labor cost of about 25 cents per ton of ice, but, of course, in the plant accounting the general station charges as well are divided up

equitably between the ice and electric departments. As the result the unit cost of producing a kw-hour in summer, when the output is decreased by 33 per cent, is almost exactly the same as during the heavy loads of the winter months.

Mr. Sweezey remarked that a town unable to support twenty-four-hour service should not consider the installation of a combination ice plant. He admitted, however, that the establishment of the ice end, making all-day service possible, might soon justify itself through the day load of fans and motors obtained, probably later making it worth while to run on through the winter with the day load acquired.

When a plant is operating efficiently on a condensing basis motor-driven compressor pumps may be desirable. If the station has a good load-factor and the generator engine is exhausting into the atmosphere, however, a steam-driven compressor may be preferred, since all the steam it passes, with perhaps more, will be needed as distilled water for ice-making.

At Junction City it is now planned to install a steam turbine with a surface condenser, the water recovered from which will be free from oil and excellent for ice-making. Motor-driven compressors will be used. No trouble is expected in shutting down the refrigerating machinery during the peak lighting load. If the tank be carried along at about 12 deg. above zero, Fahr., the compressor can be shut off twelve hours without danger, for the tank temperature will remain below freezing at least as long as this if properly insulated. The danger lies in the tank temperature reaching a higher value and melting the ice of the cakes against the car surface. When this water later re-freezes it will expand, straining or bursting the cans.

Ice storage is of real advantage to a plant, often enabling it to run fully loaded during the partial-demand periods of fall and spring and to shut down altogether during the winter, when only a few tons per day are used. For packing ice for shipment straw trampled down around the cakes is used, the top layers being covered with a bed of straw 1 ft. thick. Paper has also been used for this purpose.

The present Junction City plant is operated at an output of 5 tons of ice per ton of coal, or about 1½ hp-hours per pound of ice. With his turbine equipment Mr. Sweezey expects to decrease this to ½ hp-hour per pound of ice.

CENTRAL-STATION EXPANSION AT MONTROSE, COL.

Coincident with the development of the ranch country in west central Colorado the Montrose Electric Light & Power Company has enjoyed a substantial increase in business. The total number of customers on the company's lines has increased from 492 to 685 within the past two years and at present about 20 per cent of the population is included in the list of the company's patrons, this being one of the largest proportions of consumers to population in the West. Of 772 residences now in the town only 112 remain unwired for lighting service.

The company generates its own electrical energy at a steam plant near the business center of the town, the installation consisting of three horizontal return tubular boilers operated at 120 lb. and three engine-driven alternators delivering energy at 2300 volts. The generating units consist of a 50-kw set directly driven by an Ideal engine, a 150-kw machine directly driven by a Chuse engine and a 150-kw generator belted to a Ball engine. The first two engine units named are of the tandem compound type and the other equipment is a simple engine operated only in emergency service. All engines in the plant are run non-condensing and the average fuel consumption of the plant in 1910, burning slack coal of about 11,000 heat units per pound, was 8.8 lb. per kw-hour. The plant furnishes twenty-four-hour service.

EMERGENCY CENTRAL-STATION PUMPING SERVICE.

A recent addition to the company's connected load is a municipal pumping plant designed to increase the pressure

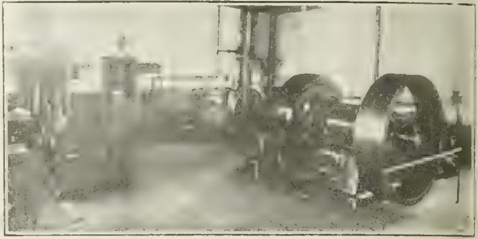


Fig. 1—Interior of Generating Plant.

on the local water system in case of fire. The company holds itself in readiness to supply energy at any instant of the day or night to this station, which is located about 1500 ft. from the plant and which contains a two-stage centrifugal pump having a capacity of 750 gal. per minute, directly driven by a 100-hp, 2200-volt, three-phase, 60-cycle induction motor equipped with an auto-transformer starter. A circuit of No. 6 copper connects the pumping station with the power house. The supply of water for the town is obtained from the Cimarron River, the normal pressure at hydrants being 70 lb. There are forty-two double hydrants, 16 miles of 8-in. and 10-in. mains and 2.5 miles of from 4-in. to 8-in. distributing pipe in service.

The new pumping plant displaces a steam-driven installation and is designed to raise the water pressure to 125 lb, in case of a fire demanding an ample supply of water at high pressure. The pump takes water from the Uncompahgre River, which flows through the town beside the station and forces the water through a check valve into the regular urban system. A relief valve set at 125 lb. is installed at the station and a check valve is located in the incoming main from Cimarron about 1.5 miles from the business center to prevent the motor-driven pump from forcing water backward into the reservoirs.

In case of an alarm of fire the operator at the company station ascertains whether the high-pressure service

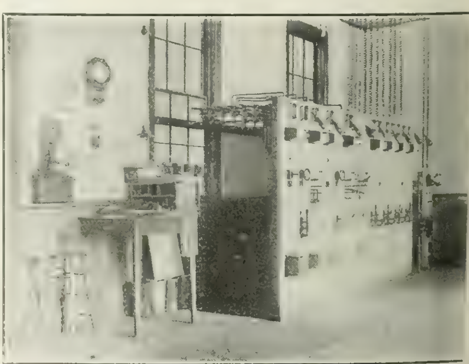


Fig. 2—Switchboard.

needed, and if so starts the motor by an oil switch loca[ted] on the main station switchboard, it being unnecessary [for] anyone to go to the pumping installation proper. The mo[tor] can be brought up to full speed under load in thirt[een] seconds, and in a recent trial the water pressure was rai[sed]

120 lb. in sixteen minutes. The system has been found especially useful in dealing with fires occurring in the daylight hours when the pressure tends to run low on account of the irrigation of lawns and gardens. The pumping plant is owned by the town and payment for the service is based upon a minimum charge plus a kw-hour rate for excess energy consumed. The protection furnished by the installation, which has been in service only a few months, has resulted in more favorable insurance rates within the town. The motor and starting equipment have proved thoroughly reliable in service.

The company has a total connected load of 646 kw, including 288 kw in lighting service, 193 kw in motors, thirty-four electric fans and over 300 flatirons, besides 55 kw in miscellaneous heating and cooking devices. The rates for lighting run from 14.4 cents to 9 cents net, depending upon consumption, and motor-service rates run from 10 cents to 4 cents per kw-hour. A minimum charge of $1.35 per month is made in lighting installations. The motor service includes, besides the pumping station, a brick and tile yard using an 85-hp motor, planing mills, foundry, machine shop and three newspapers. All the butcher shops in town are also provided with motor service and the principal laundry is a customer.

The street lighting is supplied by twenty-eight alternating-current 6.6-amp series arc lamps operated on an all-

Fig. 3—Exterior View of Office.

night and every-night schedule. A recent extension of the company's connected sign-lighting load is illustrated in the accompanying view of the company's own office, which was illuminated in outline by twenty-seven 5-watt tungsten lamps, a sign containing sixty lamps of the foregoing size and an interior installation of twelve 100-watt tungsten lamps. The office has a frontage of 23 ft. and a depth of 6 ft. The company makes a flat rate for sign lighting which nets about 6 cents per kw-hour.

RANCH LIGHTING CIRCUITS

A special lighting circuit about 5.75 miles long has just been put in service at the expense of the company between the generating plant and a group of large fruit ranches lying at the west of the city. Continuous service is given on this circuit to thirty-eight customers, fourteen transformers being installed. The usual rating of transformers on the line is 3 kw, the maximum unit being 5 kw. The line consists of a single-phase circuit of No. 6 copper carried on glass insulators and wooden cross-arms and poles, the latter being of Idaho cedar, 30 ft. in length with 6-in. tops and set in concrete foundations to a depth of 18 in. below ground. The pole bottoms are carried to a depth of 5.5 ft. Seven pole-type lightning arresters are installed on the line and the cost of its installation, including construction, meters and transformers, was $800 per mile. Mr. C. L. Lower is manager of the company.

A MOTOR-OF-ALL-WORK ON A MISSOURI FARM.

Mr. C. D. Bellows has a 640-acre farm 4½ miles from Maryville, Mo., and not only lights his house, barns and grounds by electricity delivered over his own transmission line from the Maryville central station, but performs his

Fig. 1—Farm Motor on Skids Driving Feed Cutter.

farm work with a 20-hp induction motor, mounted on skids, which can be moved about his place and attached at any of the numerous connections in his barns and silos.

The three-phase, 60-cycle, 2300-volt transmission line was built by the local electric-light company, of which Mr. C. C. Hellmers is manager, at the expense of Mr. Bellows, and is of best construction, with painted poles, creosoted butts, etc., costing the owner about $425. In the case of another line serving a farm installation 4 miles northeast of Maryville the farmer attempted to economize in building his own line and this work has given much trouble.

Mr. Bellows' meter is mounted in a pole box at his farm and he pays the same rate as the regular Maryville town customers.

The lines on the farm premises are tapped at nine points for motor connections. At each of the three barns and four silos the taps are brought to knife switches, from which hang the wires for attaching under the binding posts of the motor unit terminals. The motor which is used for general work about the Bellows farm is a 20-hp machine of the three-phase, squirrel-cage induction type mounted on 8-in. x 8-in. skids, with its starting compensator. The motor unit can be rolled up to any machine to be driven, the wires being slipped into the terminal blocks and the switch closed. The cut-out switches are, of course, ordinarily left open

Fig. 2—Cutting and Elevating Ensilage with 20-hp Squirrel-Cage Motor.

when not in use, to prevent contact between the jumper wires. In Fig. 1 the motor is shown driving a feed cutter in one of the barns. In Fig. 2 the same motor is seen driving an ensilage cutter, and also operating the blower which elevates the ensilage into the concrete silo.

This motor has been handled in the characteristic rough manner given farm machinery and is frequently left out in the rain and wet weather without perceptible damage. It has now been in service nearly two years. Mr. Bellows also pumps his water supply by electricity, having a special 5-hp motor for this purpose.

During the last season forty-five acres of corn on this farm were cut up into ensilage, the work being done by the 20-hp motor in a day and a half, or less than half the time formerly required with a gasoline engine. The Bellows installation is a thoroughly practical one, which has been given two years of the hardest service, and the owner declares that he would on no account return to the gasoline engine he formerly used.

Wiring and Illumination

COTTON-MILL ILLUMINATION.

At the semi-annual meeting of the National Association of Cotton Manufacturers, held in Manchester, Vt., Sept. 27-30, a paper entitled "Practical Considerations in Cotton-Mill Illumination" was presented by Mr. J. M. Smith. The author claimed that the proper criterion for cotton-mill illumination is duplication by artificial light of the work obtained by daylight. Daylight conditions should be simulated at night to such an extent that the entire room will be brightly enough lighted to have a cheerful appearance and give the idea of wide-awakeness. The light should be acceptable to the operators. It should be free from qualities injurious to the eyes, and, what is nearly equivalent, it should cause as little fatigue as possible. With the progress and improvement that is being made in the humanitarian features of factories the mill owners will soon be required to give proper attention to these matters. If bad lighting conditions are allowed to continue without efforts being made to alter them, legislation will be enacted to control the matter.

Two general classes of illumination should be employed in mill lighting, namely, general and local. There should be, first, a uniform illumination of sufficiently high intensity to permit work in any part of the room. This result is ordinarily accomplished by distributing units placed approximately in squares over the entire area to be lighted. Local illumination is obtained by the use of a single lamp with a reflector to light a relatively small area. Where tungsten-filament lamps are used the 40-watt and 60-watt sizes, equipped with intensive reflectors, have proved very popular. There is a considerable range for choice as to reflectors. Proper light distribution can be obtained from either the steel or the glass type. The reflector used should be of such design as to cover the lamp sufficiently to protect the eyes of the workers from the direct glare of the filament. The steel reflector is somewhat lower in first cost than the glass reflector, while the depreciation due to dust is about equal for the two types. On the other hand, it is possible to determine easily when a glass reflector has been properly cleaned, whereas the efficiency of the metal-type reflector may be considerably impaired without this fact being easily detected by inspection.

WIRING OLD RESIDENCES.

The usual householder is in fearful expectancy of the damage which will be done during the wiring of his home, and for this reason postpones or gives up altogether having the work done. To show the timid that these fears are groundless and that houses are wired with a minimum of damage and dirt, Mr. C. F. Farley, contract agent for the Kansas City Electric Light Company, has had photographs taken of actual wiring jobs during the progress of the work. These pictures are substantially bound and mounted for the use of the solicitors in the housewiring campaign now under way in Kansas City. The photographs show various types of wall, ceiling, fixture and switch outlets, proving the small damage and dirt produced during a modern wiring job.

Enlargements of these pictures, mounted on electrically lighted easels and arranged with receptacles for house-wiring literature, are also placed in drug stores in the residential sections, and the druggists are offered rewards $5 each for all house-wiring contracts secured throu[gh] them. A similar offer of $5 per house wired has been ma[de] to all employees of the electric company, other than soli[ci]tors, who bring in contracts.

The present house-wiring campaign in Kansas City [is] conducted on a cost basis, the company giving the custom[er] a year in which to pay. New customers secured by the co[m]pany's solicitors are given a card with the names of t[he] twenty-four contractors who compose the local associat[ion] having an agreement to perform work at a fixed price [per] outlet. The customer may choose any one of these he-

OUTLETS.

Number of Outlets.	Old House Wiring, Class "A," Single Flooring Taken Up and Relaid.	Old House Wiring, Class "B," No Flooring Taken Up or Relaid	New House Wiring, Class "C"
5	$19.81	$14.86	$ 9.91
6	22.31	16.73	11.16
7	24.81	18.61	12.41
8	27.31	20.49	13.62
9	29.81	22.36	14.91
10	32.31	24.24	16.16
11	34.06	25.55	17.03
12	35.81	26.86	17.91
13	37.56	28.17	18.78
14	39.31	29.48	19.66
15	41.06	30.80	20.53
16	42.81	32.08	21.41
17	44.56	33.42	22.28
18	46.31	34.73	23.16
19	48.06	36.05	24.03
20	49.81	37.36	24.91
21	51.56	38.67	25.78
22	53.31	38.98	26.76
23	55.06	41.32	27.53
24	56.81	42.61	28.41
25	58.56	43.92	29.28
26	60.31	45.24	30.16
27	62.06	46.55	31.03
28	63.81	47.86	31.91
29	65.56	49.17	32.78
30	67.31	50.49	33.66
31	69.06	51.80	34.53
32	70.81	53.11	35.41
33	72.56	54.42	36.28
34	74.31	55.70	37.16
35	76.06	57.05	38.03
36	77.81	58.36	38.91
37	79.56	59.67	39.78
38	81.29	60.97	40.64
39	83.24	62.43	41.62
40	85.31	63.98	42.65
41	87.46	65.60	43.73
42	89.51	67.17	44.75
43	91.56	68.67	45.78
44	93.61	70.21	46.80
45	95.66	71.75	47.83
46	98.71	74.03	49.36
47	99.76	74.82	49.88
48	101.81	76.36	50.91
49	103.86	77.92	51.93
50	105.91	78.43	52.96
51	107.96	80.97	53.93
52	110.01	82.24	55.01
53	112.06	84.05	56.03
54	114.11	86.11	57.06
55	116.16	87.05	58.08
56	118.21	88.66	59.11
57	120.26	90.20	60.13
58	122.31	91.80	61.16
59	124.36	93.27	62.18
60	126.41	94.81	63.21

sires, and the contractor, on completion of the work, is paid by the company in full at the price agreed upon. This amount is later collected from the consumer in twelve monthly instalments. The schedule quoted relates only to

Solicitors' Photographs Showing How House-Wiring Is Done with Slight Annoyance.

ne-payment contracts. If a customer wishes to pay cash he is advised to call for bids. The company takes no part in these cash transactions, but as a result of its campaign the total number of old houses wired by contractors in this ne is more than twice the twelve-payment contracts ured.

The schedule of costs agreed to by the contractors has en figured by them as allowing the minimum of fair profit. Recently this schedule was decreased 25 per cent. The average cost of wiring in the Kansas City campaign has proved to be about $45 per house. The company's twelve-month payment offer relates to wiring only and is not extended to covering the cost of fixtures.

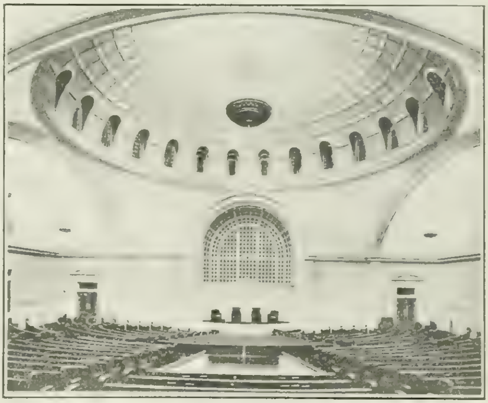
On the preceding page are shown the wiring prices arged by the Kansas City contractors for various classes structures, which have been figured on local conditions nd costs.

The Kansas City campaign is supplemented by an attractively printed booklet, "Your House Wired for Electric ght." This explains in simple, clear language the doestic applications of electricity and the ease with which ring can be done.

INDIRECT LIGHTING OF A DOMED AUDITORIUM.

One of the first applications, if not the only one, of indirect lighting to a large domed interior has just been made in the illumination of the auditorium of the Eighth Church of Christ, Scientist, at the corner of Forty-fourth Street and Michigan Boulevard, Chicago. The large room measures 92 ft. x 100 ft. over all and its central feature is a circular dome, 60 ft. in diameter and 50 ft. in height, measured from the floor to its apex.

Suspended by massive chains from the center of this dome is the principal indirect-lighting unit, a huge white bowl 7 ft. 6 in. in diameter and probably the largest indirect fixture ever built. The bowl, which hangs 12 ft. below the top of the dome, contains twenty 250-watt tungsten lamps, each in an individual inverted silvered reflector. These



Indirect Illumination of a Large Domed Interior.

lamps are controlled under twenty separate circuits so that any intensity of illumination required in the auditorium can be obtained from the switchboard just behind the rostrum.

At either side of the main dome are arches, treated in the same cream-color tint as the rest of the church interior. Each of these side arches is lighted by three indirect-fixture bowls, each bowl containing five 100-watt tungstens. The rear of the auditorium is similarly lighted by six bowls, each containing six 100-watt units.

A Chicago city ordinance requires that in public halls a fixed proportion of the lighting for every 100 sq. ft. of floor surface must be controllable from one of the principal entrances to the room. These emergency lamps are grouped among the other lamps in the indirect fixtures so that a fair degree of illumination can be obtained from the switch in the public entry if the hall is to be entered when otherwise dark. The general illumination is, as already mentioned, controlled from the panel box behind the rostrum.

For cleaning and renewing lamps the large central indirect fixture is hung by a worm gear and can be lowered to the floor. Its lamps are supplied through flexible cables which are normally laid up loosely over the dome ceiling. The smaller indirect fixtures are reached by means of a ladder.

Letter to the Editor.

Evaluating Depreciation.

To the Editor of Electrical World:

Sir:—It is evident from recent articles and discussions that the engineering profession is taking a decided interest in problems of depreciation. The recent articles in the *Electrical World* and elsewhere serve to bring out very forcibly the confusion of terms to which Mr. Henry Floy called attention in his A. I. E. E. paper. The need for a more general agreement on terminology, for which Mr. Floy made a plea, is shown more and more clearly with each new publication.

The greatest confusion seems to come in trying to state what constitutes the "value" of property subject to depreciation. This value at any time is generally conceded to be the new value, less depreciation. But as the "value" may be arrived at on different theories, and as value depends on a large number of factors, many engineers in their anxiety to give fair weight to efficiency of operation seem to have confused "operating efficiency" with "value," and in some cases use these terms interchangeably. Then with "value" stated in terms of "operating efficiency" they subtract such "value" from new value based on cost, and thus working backward get a misleading figure that they call "depreciation." Since real depreciation, arrived at by saner methods, is a very different quantity, it follows that several brands of depreciation, "absolute," "theoretical," etc., are on the market, a variety to suit every taste and purpose.

Without attempting to give a political economist's definition of "value," but considering the term only as applied to an electrical property, the writer would describe value as something depending upon the quantity and selling price of *useful service remaining* in the particular bit of apparatus being appraised, and to the then owners—plus salvage value of course. Obviously the description does not make appraisal any easier, but it may, if acceptable, give a definite goal to work toward.

For the purposes of appraisal a given machine should only be allowed the estimated value of service, to present owners, remaining in a machine. When the machine has really reached scrap value it should be allowed no value whatever as a part of a plant. The scrapped machine should be regarded as so much cash in the bank and should at once be converted into cash by selling it for its scrap value. It should be borne in mind, however, that if there is any economically efficient service left in the machine, either as a reserve, or as insurance, or for any other purpose, it follows that scrap value has not been reached for that machine.

Value of a particular machine, to a particular owner, at any given time, is a perfectly fixed thing, no less fixed because difficult, or impossible, to determine. Engineers, in making appraisals, should so regard value and should think of their work as an effort to determine as exactly as possible an obscure but exact quantity.

New value has generally been considered as original cost—various overhead charges, such as engineering, interest during construction, insurance, bond discount, contractors' profit, promotion, expenses, etc., being added. To the writer's mind all of these overhead charges are, in fact, a *part* of original cost, since it is usually impossible to produce a plant without such expenses. Perhaps, if in appraising properties engineers should stop calling the bare individual price of machinery, buildings, etc., "total cost," afterward adding on the overhead charges—but should instead in each appraisal enter each reasonable overhead charge as a "cost" (cost of engineering, cost of legal services, cost of promotion, etc.)—the total would seem more reasonable to an uninformed public. It seems to the writer that many a warm controversy could have been saved simply by such a change in the usual method of tabulating an appraisal.

However, disregarding the difficulties of appraising both new value and value after use, it is certain that the difference between new value and any later value is depreciation. If now we admit that value is value, and is the *same quantity,* whether called value for capitalization, value for rate making, value for paying taxes, value for determining annual depreciation or for any other purpose, we shall have to say that depreciation is an equally definite thing. The definite character of a quantity must not be confused with the difficulty of measuring that quantity. The wave-length of sodium light was just as fixed a thing a thousand years ago as now, though probably there was no one on earth a thousand years ago who could measure it. So the uncertainty in estimating the value of a public utility is wholly due to the difficulty of appraisal and not to anything else. If all this be conceded, one engineer may estimate the depreciation of a property at one figure and another man may put the same thing at another figure, but neither engineer may properly say, "If the figure is for tax purposes it is one thing, and if to figure rates on it is quite another."

If a machine depreciates $5 per year for ten years depreciation in ten years is $50. Operating expenses should have been charged $5 each year on account of that machine. These propositions are so self-evident that it is astonishing to find so large a section of the engineering public contradicting them.

Of course if a public utility has failed to collect the proper depreciation fund each year or has collected proper amount and instead of properly applying it has paid unearned dividends, about all that can be said is that the public utility is in a bad way. It is not fair to the people to fix up several rates of depreciation, one to use in valuing plant, another to use in getting operating expenses, etc. What has happened is that part of the value of the plant has been improperly divided up among individuals, and capital should be written off in the same proportion.

Under ideal regulation the public utility would have been forced to collect enough money to balance depreciation and to spend that money properly on the plant, keeping its value constant.

Now comes the most interesting feature of the business. Nobody can say with certainty just what the depreciation will be each year. A board of public utilities must therefore allow an ample rate of depreciation—which means too large a rate. This also means that the public pays money into the depreciation fund faster than the property actually depreciates and that as the depreciation fund is expended the plant grows more valuable year by year. Proper public regulation of a successful utility will therefore mean a con-

stantly increasing plant, bonds absolutely secure, gilt-edged stock issues, fixed capitalization (except as new capital is put in) and constantly decreasing rates to the public.

As to the manner in which depreciation takes place, the exact shape of the depreciation curve, etc., all of these matters are controversial and not susceptible of positive determination in any particular case. Is it not best to get, as closely as can be done, the average expectancy of life and assume a straight-line depreciation based on life? The process is simple and probably as accurate in the end as any other.

New York, N. Y. GEO. L. HOXIE

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Best Proportion of Copper to Iron in Transformers.—C. FELDMANN AND A. C. LOOS.—In the last few years several papers have been published on the design of transformers, the results of which are not in complete accord with the commercial designs. Moreover, some of the results contradict each other. Thus Pohl and Bohle conclude that the total expense for iron and that for copper should be equal, while Pichelmayer finds that the total copper cost should be a little higher (20 per cent as maximum) than the total iron cost. The present authors have developed further the method of Pohl and Bohle so as to take into account all considerations and reduce the calculations as much as possible. The problem is to find the best dimensions for a transformer with an efficiency above a given value so as to make the cost a minimum. The general formulas are developed and applied to a numerical example. The authors first discuss the design of small transformers. One of their conclusions is that if the best dimensions in the calculation give a sufficiently high efficiency, but not sufficiently large cooling surface, it is in general cheaper to increase the cooling surfaces by modifying the best dimensions found by calculation than it is to reduce the losses and thus increase the efficiency. Finally the special points which must be considered in the calculation of large transformers are discussed.—*Elek. u. Masch.* (Vienna), Sept. 3 and 10.

Leakage Reactance of Transformers with Concentric Windings.—J. REZELMAN.—The author tests experimentally a 15-kva transformer by the same experimental method which he has used in analogous cases to test the usual formulas for the leakage reactance of transformers with concentric windings. One of the practical results obtained is a correction in the usual formulas, since the short-circuit test shows that the stray flux proper of the secondary winding is practically negligible compared with the primary stray flux. He also discusses the regions where the stray flux is superimposed on the main flux.—*La Lumière Elec.*, [illegible]

Rotor Ventilation.—A note on a recent British patent (30,233, Sept. 7, 1911) of the British Thomson-Houston Company (General Electric Company of this country). Ventilating spaces are provided with channels extending from one part of the periphery to another. The ends of these channels are arranged at different angles to the radial [illegible], so that the forces tending to throw the air out of the rotor are different at the two ends of the channels. By this method it is claimed that the windage losses are avoided and the rotor diameter reduced.—*Lond. Elec. Eng'ing*, Sept. [illegible]

Balancing Transformer.—R. NEUMANN.—A paper on a method of C. P. Steinmetz for converting an unbalanced three-phase system into a balanced system by means of a single three-phase transformer with adjustable number of windings. The present author shows that this method may be easily explained by diagrams with the aid of a number of little-known theorems of plane geometry. These theorems are first stated and proved and then applied to Steinmetz's method.—*Elek. u. Masch.* (Vienna), Sept. 10.

Transformer Diagram.—MOELLINGER AND GEWECKE.—A mathematical paper in which the authors develop a simple diagram by means of which after a no-load test, a short-circuit test and a resistance measurement it is possible to find quickly the ratio of transformation and the phase difference between the primary and secondary voltages at all loads.—*Elek. Zeit.*, Sept. 14.

Measuring Slip.—A. BRUCKMANN.—An illustrated English translation of his article abstracted some time ago in the Digest on stroboscopic methods of measuring the slip of induction motors.—*Lond. Electrician*, Sept. 15.

Lamps and Lighting.

Radiant Efficiency of Arc Lamps.—H. P. GAGE.—An account of an experimental investigation the object of which was to determine the radiant efficiency and the mechanical equivalent of the light from the right-angle electrode arc (that is, an arc between two electrodes placed at a right angle) and the Bremer flaming-arc lamps. In discussing the limits of visibility the author shows that the A line 0.76μ is not a suitable point to take for the limit of the visible spectrum. Examination of luminosity curves shows that it would be preferable to assume this limit to be at 0.68μ. If all radiation of greater wave-length than 0.68μ be removed the resulting decrease in light can be neglected. The measurement of radiant energy was made with a radiomicrometer. The kick, or ballistic, method was used. The kick is proportional to the final deflection and to the energy. The calibration of the radiomicrometer in absolute units, using the Nernst filament and the Hefner lamp, showed a general agreement between the energy of the Nernst filament as calculated from the energy input and as derived from Angström's value of the radiation from the Hefner lamp. A modification of the method of Angström was used to determine the radiant efficiency of the right-angle electrode arc, the yellow-flame arc and the white-flame arc. The greatest efficiency was found in the arc stream between yellow-flame electrodes, the electrode tips being shaded. With this arc the light energy constitutes 39 per cent of the energy radiated. The highest efficiency from black-body radiation is from the positive crater of the carbon arc. An efficiency of from 8 per cent to 12 per cent may be expected from this source. Calculations of the mechanical equivalent of light from these data show that 1 watt can produce as high as 30 cp of white light and 39 cp of orange light (yellow-flame electrode). This is much higher than has previously been supposed except from the data of Angström, which give 21.3 cp per watt when recalculated for the limit 0.68μ.—*Phys. Review*, August.

Mechanical Lamp Tester.—In French railway stations metallic-filament lamps are largely used, but on the trains themselves carbon lamps have been retained. However, tests will be made to determine the suitability of the new types of metallic-filament lamps under the conditions of railway service. For this purpose Mr. Vincent, of the Western Railroad Department of Paris, has designed a simple apparatus for testing incandescent lamps by subjecting them to repeated shocks. The device used for the purpose is shown in Fig. 1. The lamp is fitted into a socket which is mounted upon a small board *A* hinged at one end, while the other end is movable and is actuated by a cam *B* fixed to the shaft *C*. Each time the cam revolves the end

[illegible] down, thus giving a definite shock to the lamp. By means of a spring *D* the amount of this shock can be adjusted and made heavy or light. The shaft is driven by a small electric motor and carries at its further end a counter so that the number of revolutions can be read off. For testing the filament when burning normally or otherwise heated by the current the method shown in Fig. 2

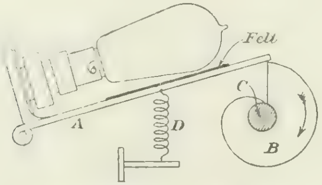


Fig. 1—Diagram of Lamp Tester.

is used. Current from the mains first passes to the motor and to the lamp which is in parallel with it. In series with the lamp, however, is a solenoid *A* of very low resistance. This solenoid normally holds up the main switch *BC*, but should the lamp filament break the current through it will fail and the core will drop and thus open the switch in the motor circuit. The motor then stops and the number of shocks which the lamp has withstood can be read off on the counter. In order to test the lamp when the filament is cold the following method is employed: A small current is passed, which simply acts as a detector and shows whether the lamp is broken or not. In this case, too, the current is

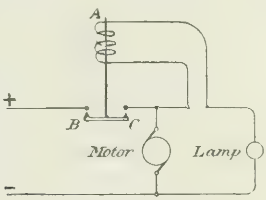


Fig. 2—Connections for Hot Tests.

passed through the lamp for a short time during each revolution. The same apparatus as that described above is used except (see Fig. 3) for an extra rotating contact maker, which carries a long segment *D* and a short segment *E*. For the greater part of a revolution the current passes through the solenoid and not through the lamp and for a short time it passes through the solenoid and the lamp in series. The time is too short to cause the lamp to become heated by the current and the solenoid normally keeps its core held in position. Should the filament be broken the current fails in the solenoid for an instant and this suffices for the core to drop and open the switch. In any case the

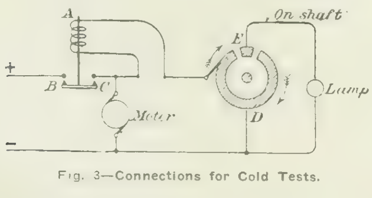


Fig. 3—Connections for Cold Tests.

apparatus goes on working without needing any attention, so that it can be left to itself and the number of shocks is always exactly recorded at the end of any length of time.—Lond. *Electrician*, Sept. 22.

Multiple-Filament Incandescent Lamp.—A note on a recent British patent (1907, Sept. 7, 1911) of Messrs. G. F. Richardson and R. J. Crowley. A lamp in which two or more filaments are used has one end of each connected t a common contact plate at the bottom of the lamp, whicl is insulated from two other contact plates to which the othe ends of the filament are attached. A bridge piece, half o which is insulated and half conducting, is rotatably fixe in the lamp stem, making contact with the two plates, s that the filament which makes contact with the insulate part of the bridge piece is cut out of circuit. It can, how ever, be switched in by rotating the bridge. The plunger in the lamp socket are always in contact with the commo contact plate and the bridge when the lamp is in position.- Lond. *Elec. Eng'ing*, Sept. 14.

Black Body.—R. A. Houstoun.—In a continuation of h long serial on studies in light production the author no deals with the theory of the black body and the fundament laws of radiation.—Lond. *Electrician*, Sept. 15.

Installations, Systems and Appliances.

British Central Station.—An abstract of the financial r port of the West Ham municipal electric station for la year. There is great progress over the previous year. Tl output for private lighting has increased by no less th 15.6 per cent. In view of the extensive use of metalli filament lamps this indicates that the use of electricity f lighting is making rapid strides. Motor service and heati show the large increase of 24.2 per cent and now are t predominating factor in total output, accounting for 14,51 555 kw-hours out of 22,690,266 kw-hours sold for all pu poses. The other items included in this total are: Tracti 5,182,257 kw-hours; private lighting, 2,253,904 kw-hou and public lighting, 735,550 kw-hours. While the reven per kw-hour has remained practically constant for light —namely, 5.56 cents, as against 5.58 cents a year ag there is an increase in the revenue per kw-hour recei from the motor service sales. The average price obtai for motor service was 1.20 cents per kw-hour, compa with 1.16 cents in the previous year. The total generat cost per kw-hour sold was 0.68 cent; the distribution c 0.10 cent; the management cost, 0.12 cent; total cost, excl ing capital charges, 1.18 cents, and including capital char 1.90 cents, while the total revenue was 1.98 cents per l hour. Hence there was a surplus of 0.08 cent per kw-h against a deficit of 0.08 cent last year.—Lond. *Electric* Sept. 15.

Electric Heating and Cooking Apparatus.—A. Str hardt.—The first part of an illustrated paper presented fore the German Association of Electrical Engineers. author first reviews briefly the different systems of hea by electricity and then describes typical commercial hea and cooking apparatus. The paper is to be conclude *Elek. Zeit.*, Sept. 14.

Wires, Wiring and Conduits.

Two-Point Lamp Control.—It is found desirable to ha lamp, for instance, in the sleeping-room, controlled f two points of the room, or a lamp in a hallway contr from a switch in the hallway and also from a switch in

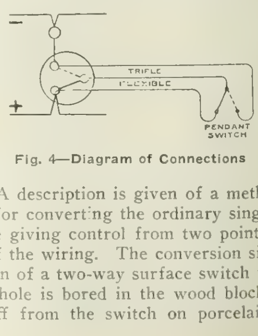


Fig. 4—Diagram of Connections

upper floor. A description is given of a method of M A. P. Lundberg for converting the ordinary single-way s ch control to one giving control from two points withou ny disturbance of the wiring. The conversion simply inv es the substitution of a two-way surface switch for the si le-way one. A hole is bored in the wood block and a ple flexible led off from the switch on porcelain button or

rough insulated screw eyes, to the desired extension point, onsisting of a two-way pear switch for bedroom use or ne of surface pattern for ordinary use. The simplicity of e adaptation is shown in Fig. 4, where it will be noticed at the leads are not interfered with in any way when aking the change and that, contrary to usual custom, the common" terminals of the two-way switches are internnected. To leave the switch point as it was originally a simple matter, the two-way switch being made to act s a single-way one by short-circuiting two of the terminals, e flexible and extension switch being disconnected. This rovides for the case of the obstinate landlord who reuires the installation left as it was found.—Supplement Electrician, Sept. 15.

Wireless Connectors for Cookers.—D. S. MUNRO.—The r points out that for electric cooking installations in lences flexible connections represent a source of nce. He describes a system of wireless connections h he has devised. Single heaters with two plugs or e heaters with three plugs may be used, and it is neces-

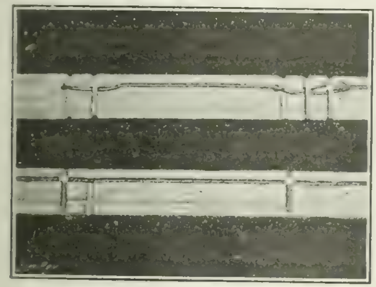


Fig. 5—Method of Wiring.

ary to fit the heaters with standardized parallel prongs, y ¼ in. in diameter and with centers ¾ in. from the base. he prongs may be about 2¾ in. long for large heaters and 1½ in. long for small ones and have, say, 1½-in. centers. metal or wood table, or shelf, may be used, so long as the rface is faced with metal, usually zinc. The surface is earthed." On the top of the table are screwed two lengths f grooved and polished slate. These form a casing and over for the cables and also carry the contact sockets. ube contacts are fixed at intervals across the seam been the two slabs of slate. These contacts consist of eces of tube brazed to small terminal blocks. The blocks e held in the grooves of the slate and hold the contacts rmly without further fixture. The tubes present a perectly smooth and uninterrupted channel for cleaning-out urposes. The negative cable is carried in a groove in the pper slate and is looped through its negative contact termi-

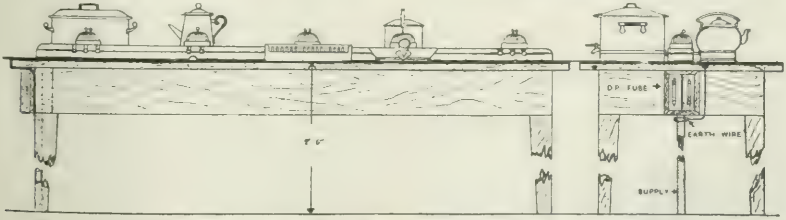


Fig. 6—Cooking Table with Replaceable Fuse and Earth Connections.

s. The positive is carried in a groove in the upper slate d is looped through the switches which sit on the top the slate. Switch wires pass through holes to the positive ntact tubes. The method of wiring a single circuit feedg one two-socket and one three-socket connection is shown in Fig. 5. Fig. 6 shows a cooking table prepared for kitchen use, with replaceable fuse and "earth" connection. The inner surfaces of the two slates are so cut that when they are screwed together and to the table there is no possibility of water getting through the seam into the cables. The upper slate has vertical grooves to guide the prongs of the

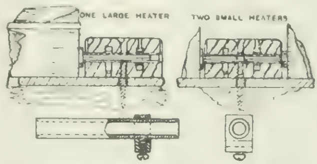


Fig. 7—Design of a Tube-Contact Socket.

cookers into their sockets, and, of course, as the prongs are inserted the metal bottom of the vessel makes a sliding and good electrical connection with the earthed table top. The ends of the contact tubes do not project to the surface of the slate, so when the vessel is withdrawn it is quite free from contact with the circuit, even should the switch be accidentally left in the "on" position. There is, therefore, no possibility of shock. The design of the tube contact sockets is shown in Fig. 7. The positive and negative tube sockets are of the same simple type and are interchangeable.—Lond. *Electrical Review,* Sept. 15.

Electrophysics and Magnetism.

Impedances in Parallel.—J. HERZOG.—The first part of a paper giving a series of diagrams and geometrical theorems for the graphical representation of all the numerous problems concerning the parallel connection of resistances, inductive reactances, capacity reactances and impedances in general.—*Elek. u. Masch.* (Vienna), Sept. 17.

Brownian Movements.—H. FLETCHER.—A paper in which the continual agitation of a small particle suspended in a gas, known as the Brownian movements, is entirely explained by the kinetic theory of gases, both qualitatively and quantitatively. The value of the fundamental electric charge obtained from gaseous ionization is the same as that obtained from electrolysis. The irregular values of e apparently resulting from the work of Ehrenhaft and Przibram are entirely explained by the Brownian movement theory.—*Phys. Review,* August.

The Age of the Earth.—J. JOLY.—The recent contributions to the data bearing on the subject of the age of the earth have strengthened the evidence derived by two very different methods of computation; that based on the study of solvent denudation and that based on the accumulation of radioactive waste products in minerals. While the indications of both lines of inquiry seem individually rendered more definite by these advances, the divergence in their final results has, if anything, become intensified. The author reviews critically the opposing methods and discusses the possibility of their reconciliation. In view of the great difficulties which he finds in endeavoring to get such a reconciliation he questions the foundations of the radioactive method. The fundamental assumption is that the

parent radioactive substance, uranium, has always in the past disintegrated at the present rate. He suggests that possibly there may have been a different and a greater rate of decay in the past. In this case the accumulation of transformation products in minerals, in place of being a measure of geological time, serves to shed light upon the rate of transformation of the primary radioactive bodies in the past.—*Phil. Mag.*, September.

Fluorescent Röntgen Radiation.—C. G. Barkla.—When substances are exposed to Röntgen radiation they emit X-radiations of two distinct types. One of these radiations, like the primary in penetrating power and general properties, has been termed the scattered radiation, being analogous to light scattered from small particles. The other, a completely transformed X-radiation, has been termed the characteristic secondary X-radiation, the homogeneous secondary X-radiation, and latterly and preferably the fluorescent X-radiation, on account of its similarity to fluorescent light. The author discusses at length the characteristic features of fluorescent X-radiation. He deals at length with the evidence of its homogeneity. Unlike the scattered radiation the fluorescent radiation is uniformly distributed around a polarized beam of X-rays. It is also uniformly distributed in a plane containing the direction of propagation of the primary radiation. Thus the intensity is entirely independent of the direction of electric force or of propagation of the exciting primary beam. Each element has its own charactertistic fluorescent line spectrum in X-rays. This is very conveniently represented as in a spectrum of ordinary light, except that without a knowledge of the wave-length it is necessary to define the radiations by their absorption in some standard substance. "It is scarcely too much to say that all the phenomena connected with the transmission of X-rays through matter may be readily explained in terms of a few simple laws expressed with reference to these spectra."—*Phil. Mag.*, September.

Ultraviolet Light from Low-Pressure Discharges.—E. W. B. Gill.—An account of experiments relating to the distribution of the intensity of ultraviolet light emitted from the various parts of an electric discharge at low pressures. The results show a systematic variation with the change of pressure, and the chief result is that after the pressure corresponding to the minimum sparking potential for two fixed electrodes has been passed the character of the discharge is radically changed.—*Phil. Mag.*, September.

Electrochemistry and Batteries.

Resistance and Arc Furnaces.—A note on some experiments made by Mr. W. Conrad on the relative advantages of electric resistance and arc furnaces with special reference to the alleged unsuitability of resistance furnaces for the smelting and melting of iron and steel. Conrad's argument is that, with the practically feasible current intensities, it is out of the question to heat a liquid conductor like iron by using it as a resistance. The ordinary laboratory experiments are made in resistance furnaces rather than in arc furnaces, because the former are more convenient. Laboratory furnaces can be cooled, moreover, when the high temperatures make the walls conductive, but that is hardly possible in practice; hence carborundum furnaces are worked for a time and then dismantled. When the liquid resistance conducts much better than the furnace material the objection that the walls also conduct would not be fatal. But when that is so the liquid conductor does not absorb the electrical energy to a profitable degree. Potential measurements which Conrad made in calcium carbide furnaces, in which arc and resistance heating are combined, convinced him that only 1 per cent of the heat energy consumed was due to the conduction of the current through the mixture, while the arc supplied 99 per cent, and it could be seen that the carbide formation was taking place chiefly where the arc had been playing. In his experiments on iron he filled a furnace with 1300 kg of steel (1 per cent of carbon) after raising the two suspended electrodes. He inserted into the bath two oblique steel rods, 3 m in length and 36 mm in diameter, as test electrodes for the resistance determinations with direct currents. These determinations were made twenty-eight hours and fifty-three hours after filling the furnace; it was found that the gradual heating of the furnace by the fluid metal made very little difference in the resistance values. The cold electrodes had a resistance of 0.000117 ohm per meter; the total resistance of the bath was 0.00085 ohm and 0.00080 ohm (first and second measurements), and the resistance of the bath alone, 0.00027 ohm and 0.00026 ohm. That would yield a specific iron resistance of 22 ohms per meter length and per square millimeter section, and the liquid iron would therefore conduct only 1/22 as well as mercury and 1/100 as well as cold iron. This conductivity of the iron was really lower than one should expect, supposing the resistance of iron with rising temperature to increase at the rate shown by ordinary experiments. But in any case the resistance would be far too low for efficient resistance heating. Since the liquid iron is no longer magnetic, it is the I^2R heat which is of moment, and for this particular arc furnace, which is fed by two arcs in series at 3000 amp and 110 volts, the 0.00027-ohm resistor would absorb only 2.4 kw, which means 0.73 per cent of the amount that the two arcs could supply. The heat generated in this way would be about that of a small iron stove and could easily be balanced by cooling. A resistance furnace with cooled electrodes would therefore be apt to lose more heat through the electrodes than they could introduce, and to secure efficient heating currents of enormous intensity would be required. These consideration would affect direct-resistance steel furnaces of the Gin and also of the Girod types. Conditions are more favorabl with induction furnaces and also with furnaces of th Roechling-Rodenhauser combined induction and resistanc heating type, in which electrodes of large surface, covere with a layer of material which conducts only when hot, ar embedded in the furnace bottom for direct auxiliary hea ing of the bath.—Lond. *Eng'ing*, Sept. 15.

Units, Measurements and Instruments.

Analysis of Periodic Curves.—J. R. Ashworth.—A illustrated description of a simple graphical method for tl harmonic analysis of a cyclic function. Use is made of simple graphical procedure and a transparent device to r duce the arithmetical calculations as much as possible.- Lond. *Electrician*, Sept. 15.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—P. Brenot.—A very full illu trated description of the wireless telegraph station which operated on the Eiffel Tower in Paris.—*La Lumière Ele* Sept. 2.

Miscellaneous.

Technical Education.—A. Reisset.—With reference the recent French paper of Le Chatelier on higher technic education, the author gives a review of a paper on t same subject by Meyer before the Association of Germ Engineers and of the discussion recently held in Lond before the Society of Civil Engineers. It is thought tl a crisis has been reached now in the problem of techni education and that this crisis is international.—*La Lumi Elec.*, July 29, Aug. 12.

Presidential Address.—P. Rosling.—In his president address to the Victorian Institute of Electrical Engine the author deals especially with the practice of combinat of professional work with contracting work, which he c demns. He then urges the Institute to take in hand education of the electricity committee of the Melbou municipal electric station on the question of rates motor service and heating service.—Lond. *Electric*, Aug. 25.

Book Reviews.

…e Design of Static Transformers. By H. M. Hobart. New York: D. Van Nostrand Company, 1911. 174 pages, 101 illus. Price, $2.

Gisbert Kapp and Prof. J. A. Fleming supplied the pro-…ssion a dozen years ago with the earliest treatises on …e design, efficiency and operation of transformers. …hough there appeared within that period a fairly extensive …terature on the subject, mainly in the form of articles and …apers published in technical journals, the number of …orks dealing more or less fully with one or other aspect …f the subject is but small. In the present volume Mr. …obart supplies a much-needed manual on the design, con-…ruction and regulation of transformers of various types. …r a lengthy introduction, in which matters of general …est are touched upon, the author adds a bibliography of …l papers which may be read with understanding and …t by the student after perusing the present short …ise. It is to be regretted that the author saw fit to …fy the apparatus treated by the word "static," which …l carries one back to the days of unscientific nomencla-… long since revised.

…tric Central Stations. Distribution Systems: Their Design and Construction. By Harry Barnes …ear and Paul Francis Williams. New York: D. Van Nostrand Company, 1911. 374 pages, 139 illus. Price, $3.

…e treatment of the subject of this volume implies a …ral knowledge of electrical theory, but much may be …ofitably studied by practical men who have not had a …ll technical training. The matter covered relates to voltage regulation, line transformers, protection apparatus, overhead and underground construction, alternating-current circuits and distribution economics.

Physical Significance of Entropy. By J. F. Klein. New York: D. Van Nostrand Company. 98 pages. Price, $1.50.

A somewhat philosophical disquisition, as distinguished from an arithmetical discussion, on the subject of entropy and of the second law of thermodynamics. It requires some study of the book to find a definition of what is meant by the term "entropy," although the whole book is devoted to the subject. The following are, however, statements tending to define the term as quoted from page 41:

(*a*) Entropy is a universal measure of the "disorder" in the mass points of a system.

(*b*) Entropy is a universal measure of the irreversibility of a state and is its criterion as well.

(*c*) Entropy is a universal measure of Nature's preference for the state.

(*d*) Entropy is a universal measure of the spontaneity with which a state acts when it is free to change.

These statements are presumably irrefragable, but they are somewhat metaphysical and suggest the order of ideas contained in the longer catechism. If a few arithmetical illustrations were employed in the book of the way in which entropy is used by engineers it would help the average technical reader.

It is curious that the growth of literature purporting to answed the query "What is entropy?" only serves to obscure further the physical significance of the term—which appears to indicate that the mathematical formula which represents entropy has no actual physical significance.

New Apparatus and Appliances

A METHOD OF OVERCOMING PEAK-LOAD TROUBLES.

Those who have studied the peak-load problem will be …terested in a novel solution which has been quite success-…l in the municipal lighting and water-works plant of the …ty of Lachine, Canada. In this instance the low cost and …atisfactory operation of a 400-hp steam turbine unit are …ilized in effecting the economy. In the Lachine plant a …-in., two-stage, double-suction turbine pump, with a capac-…y of 6,000,000 gal. per twenty-four-hour day, is utilized to …ovide water supply and fire protection for the city, the …ater pressure being ordinarily 80 lb. per square inch and …r fire 120 lb. per square inch. Energy is purchased by …e year on a basis which is all right for lighting the city …d for pumping at all times of the year except the three …inter months, during which the lighting load is greatest. …was figured that operating the pump by steam for four …five hours a day during that period could be made less …pensive than buying sufficient electrical energy to operate …tirely by electricity. As further advantages of an auxil-…ry steam installation the insurance rate on the pumping …ation could be reduced and the city could be better lighted …ring fall evenings without incurring unreasonable addi-…onal expense. It was therefore decided to arrange the …mp for operation by a 400-hp induction motor the greater …rt of the time, but by a steam turbine during the peaks in …e lighting load in winter and in case of accident in the …ectric line. The installation was supplied by the John Mc-…ougall Caledonian Iron Works, Montreal. The pump, of …orthington make, runs at 900 r.p.m. and is direct-connected to an Allis-Chalmers-Bullock motor on one side and a 400-hp four-stage Kerr turbine on the other. Either driving unit can be thrown into or out of use instantly by means of clutches on the shaft.

A GUY CLAMP WITHOUT BOLTS.

A guy clamp that is said to eliminate some weak points in bolted guy clamps and which, it is stated, can be installed

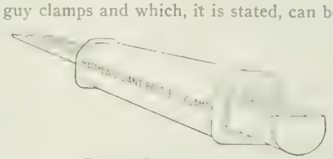


Fig. 1—Boltless Clamp.

in one-tenth of the time used for installing a three-bolt clamp has been put on the market by W. N. Matthews & Brother, of St. Louis.

Fig. 2—Boltless Clamp Installed.

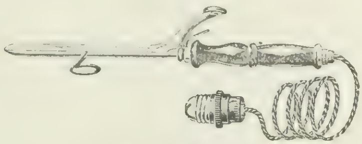
In installing a boltless clamp, illustrated in Fig 1, the sleeve is slipped over the end of the strand, then the strand is wrapped around the pole or a loop made through

the anchor eye, whence the wedge is driven in toward the pole on the anchor. It is said the strand will break before the clamp will slip.

The clamp is made in two sizes, the smaller fit for ¼-in. to 5/16-in. strand inclusive and the larger for 5/16-in. to 7/16-in. strand inclusive.

ELECTRIC CURLING IRON.

A feature of the design of the new electric curling iron recently developed by the Pelouze Electric Heater Company, 232 East Ohio Street, Chicago, is the readiness with which it quickly attains a temperature ready for use, although it is impossible for the heating element to become hot enough to burn the hair. While the efficiency of an electric curling iron is not relatively important, since its total energy consumption is small, the demand of the Pelouze iron has been reduced to a point, 20 watts, which will not operate many meters. The iron can be left in circuit indefinitely, it is said, without becoming overheated. Several improvements incorporated in the construction of



Electric Curling Iron.

the cord and handle of the new iron also obviate cord troubles. The heating element in the iron is free to revolve so that the entire system of cord and heater rotates inside the handle and stem of the device. The Pelouze curling iron weighs 7 oz.

LUMINOUS ARC LAMPS FOR RAILROAD TERMINALS.

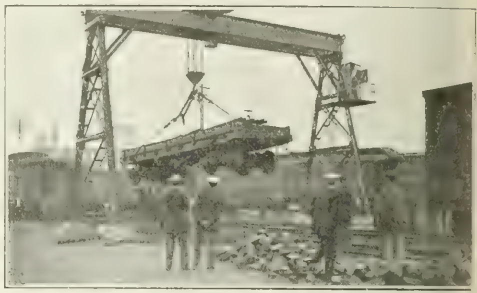
The adequate illumination of railroad terminals presents many difficulties not encountered elsewhere. The prevalence of smoke and steam and the presence of light-absorb-

Illumination of Train Shed by Luminous-Arc Lamps.

ing deposits of soot and cinders require the use of light units of high intrinsic brilliancy, large volume and great penetrating power. For this class of service multiple luminous arc lamps are particularly suitable in that the light is emitted from the entire arc stream and, consequently, is of much greater volume than that of the arc lamp in which the arc is practically non-luminous and the source of light is limited to the incandescent tips of the carbon electrodes. Another feature, which enhances the value of these lamps for use in smoky places, is the location of the reflector inside the inclosing globe, thereby effectually removing it from the tarnishing effects of the moist and dirty atmosphere.

RAILROAD ELECTRIC CRANE.

The accompanying illustration shows a 20-ton electric crane which has just been erected over the Allentown Terminal Railroad tracks at Allentown, Pa. The crane has a

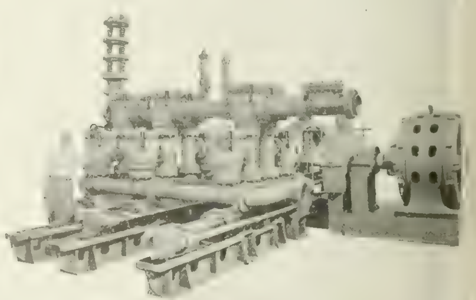


Electric Crain Lifting a 22-Ton Load.

38-ft. span and a 12-ft. driveway. The illustration shows test which was made Sept. 19, when a 15-ton gondola c containing 7 tons of rails was lifted. This made a total two tons over the rated capacity of the crane, which w made by the Mar's Brothers Company, of Philadelphia.

LARGE ELECTRICALLY DRIVEN MINE PUMP.

The El Oro Mining & Railway Company, of El O Mexico, has just installed what is said to be one of t largest motor-driven pump equipments ever built for u watering a mine. The pump, which was built by the Goul Manufacturing Company, Seneca Falls, N. Y., has a cap ity of 500 gal. per minute. The construction is such t the pump can be readily dismantled and lowered down ordinary mine shaft, and when assembled it requires v

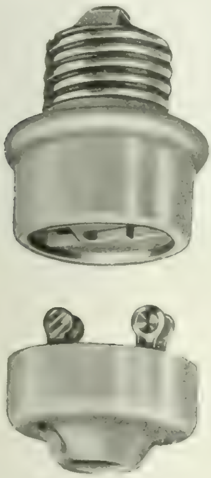


Electrically Driven Mine Pump.

little head room. The pump will be installed in the bot of the mine and will work against a head of 1300 ft. e driving motor is a 200-hp, three-phase, 50-cycle, 440-t, 485-r.p.m. Westinghouse machine, connected with doue reduction gearing giving the crank shaft of the pum a speed of 35 r.p.m.

NEW SEPARABLE ATTACHMENT PLUG.

Where attachment plugs are used with lighting fixtures onsiderable side strain is put on the fixture, because the ap of the ordinary separable attachment plug will not eparate except when pulled straight out from the base. he plug illustrated herewith, made by the Cutler-Hammer Ianufacturing Company, of Milwaukee, Wis., has an ffective locking arrangement to hold the cap in place, but eparation can also be effected by pulling in any direction. his prevents the injurious side strain on the fixtures. The rea of contact provided is large, and the screw shell is



Separable Attachment Plug.

curely attached to the porcelain by two screws, so as not be pulled off through carelessness in screwing the plug to the socket or receptacle too tightly, as in the case here only one screw or rivet is used. The rating is 660 atts, 250 volts. Two styles are made, one having a rcelain cap and the other a cap of black composition. he base in both cases is porcelain.

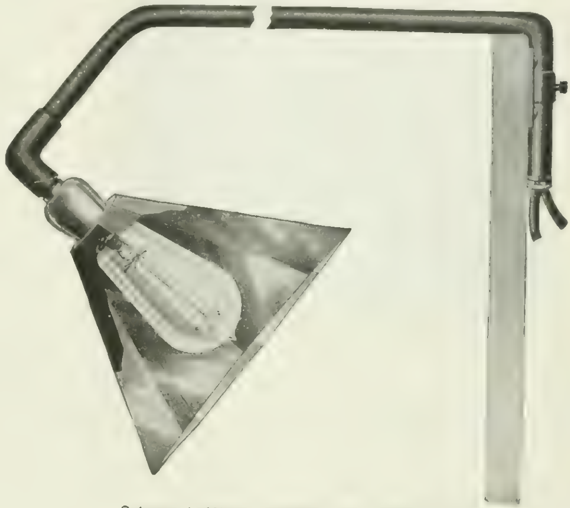
A HURRY-UP MOTOR-SERVICE INSTALLATION.

With the first coming of a recent hot spell the Kansas ity Breweries Company found itself in urgent need of 5 hp additional motor service to drive its refrigerating chinery. On Thursday morning the Kansas Electric ght Company was appealed to for this power, but it was und that a motor-generator set would be needed to deliver the direct-current pressure employed at the brewery. No such machine could be located in Kansas City, and telephone messages to St. Louis and Chicago proved likewise fruitless. Finally a 90-kw set was run down at Schenectady, N. Y., ready for shipping, and a telegram to the New York officials of the express company urgently requested them to have a special car in Schenectady the following morning for the 7-ton shipment. All this happened on Thursday.

Friday morning this special car left Schenectady. It was transferred at Chicago on Saturday and reached Kansas City Sunday noon. In two hours the car had been delivered to the brewery sidetrack by a special switch engine and the machine was being unloaded. Meanwhile the service lines had been run to the plant, a switchboard, complete with instruments, meters, etc., was installed and connected up and by Monday midnight the new motor-generator set was in service—four and a half days after the customer had placed his order.

BILLBOARD LIGHTING.

Illuminated billboards or bulletin boards are increasing in number, and to meet the demand for a reflector especially designed for this class of illumination the Reynolds Electric Flasher Manufacturing Company, of Chicago, has brought out what it calls the "Reco" mirror reflector.



Octagonal Mirror Reflector for Billboard Lighting.

The reflector is octagonal in shape, and this, it is said, causes the light to be diffused evenly to every part of the sign or surface to be lighted. The interior of the reflector is lined with mirror glass, reflecting all of the light from the lamp. Glass, having a smooth surface, does not tend to accumulate as much dirt as painted reflectors or enameled reflectors. Furthermore, it may be cleaned easily.

Since the introduction of the tungsten lamp there has been a considerable movement in favor of illuminated signboards. This form of sign advertising is effective both day and night and it has the added advantage that it helps to light sidewalk and street. Many municipalities are said to favor illuminated billboards. The average cost of electrical energy with this reflector is said to be less than 1 cent an hour for each 100-watt tungsten-lamp unit. The reflector is made of galvanized iron, thoroughly reinforced, and is provided with a heavy waterproof brass socket.

INERTIA GEAR FOR CORLISS ENGINE VALVES.

A new type of admission valve mechanism, styled the "inertia gear" by its designer, Mr. Ernest A. Moore, chief engineer of the Bates Machine Company, Joliet, Ill., and now regularly used on all Bates Corliss engines, is offered to overcome inherent faults of existing types of admission valve gears. With this gear the disengaging parts, instead of being forced into and held in their path by springs, rollers or other devices, travel in the desired path by natural forces involved in the movement. The dashpot arm is in the form of a bell crank, one arm carrying the dashpot rod and the other the catch block. The arm is keyed to the valve stem and a sleeve on its inner side fits into a bored

recess in the steam bonnet, thereby gaining great bearing surface. The steam arm is driven by the valve rod in the usual way. A substantial boss on the steam arm carries the latch shaft, on the inner end of which is firmly mounted the knock-off bar, these two parts forming practically one solid piece of steel.

The knock-off ring is controlled by the governor and carries the knock-off cam and safety cam. The latter comes into operation only in the event of some mishap to the governor, when the cam is thrown into such a position

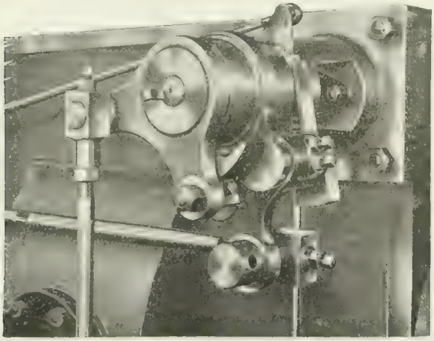


Fig. 1—Corliss Valve Mechanism.

that the valve cannot be opened. The operating movements are as follows: In opening the valve the valve rod moves to the left, the latch shaft engages with the block and continues in this path until the knock-off bar comes into contact with the knock-off cam and is forced outward, raising the latch until the block is released. The dashpot then comes into action and returns the arm to which the block is attached to the original position. The follower pin is firmly fixed to the steam arm and acts only in the event of the dashpot failing to close the valve. The construction and balancing of the latch shaft and its knock-off bar attachment are such that the inertia due to the reciprocating motion and the gravity of the parts assures an automatic latching action at the end of the return stroke between shaft and block without the use of any spring or mechanical device of any kind, and in turn assists the unlatching at the point of cut-off, thereby reducing the reaction on the governor. The depth of the latching and the amount of clearance of the catch blocks may be set to a nicety and with the greatest ease while the engine is running full speed.

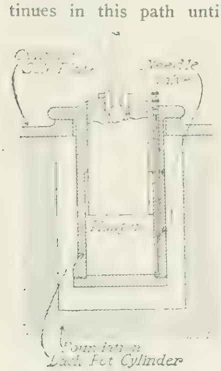


Fig. 2—Dash Pot.

This arrangement is accomplished by the two adjusting screws. This valve gear has been tested and found to work positively and quietly up to the limit speed of vacuum dashpots, considerably over 250 r.p.m. The dashpot now used on Bates Corliss engines is also of special design and is said to be remarkable for quick action, noiseless operation and durability. It is set beneath the soleplate, is made without packing or leather of any kind, and the method of cushioning enables it to act over the wide range of lifts without there being any necessity for adjustment.

DIRECT-CURRENT MOTOR STARTERS.

The Allen-Bradley Company, of Milwaukee, has placed upon the market a new line of direct-current electric motor starters, to be used for automatically starting shunt, series

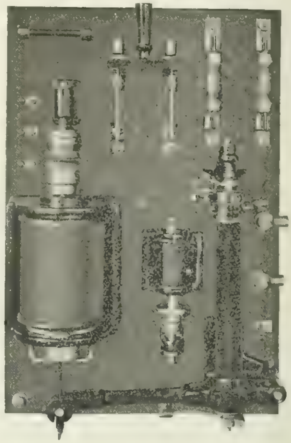


Fig. 1—Direct-Current Motor Starter.

and compound motors. They are especially adapted fc starting motors under heavy load. Simplicity, durabilit reliability and compactness are claimed as features of th machine. The motor is started by simply closing the lir switch and the starter will automatically accelerate tl motor to full speed. The operator is not called upon to e: ercise either skill or judgment, even when the motor started under a very heavy load. For this reason the starters are very desirable when ignorant help must be r lied upon to start motors.

These devices are of the Allen-Bradley carbon compre sion type, the resistance being secured through the impe fect contact between the surface of prepared graphite disl

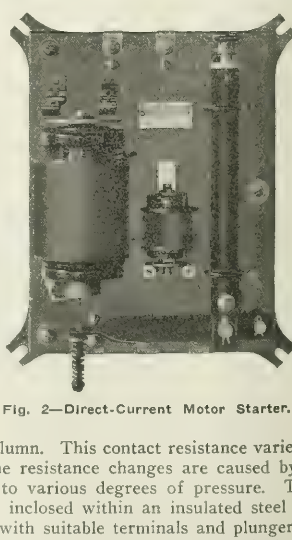


Fig. 2—Direct-Current Motor Starter.

piled in a column. This contact resistance varies with p s- sure, and the resistance changes are caused by subjec g the column to various degrees of pressure. The colu ns of disks are inclosed within an insulated steel tube, w h is provided with suitable terminals and plungers for tr s- mitting the pressure to the disks. Such inclosed colu ns constitute a complete resistance unit. These graphite ks

re well adapted for rheostatic service, as they will not rush or break, are not affected by any temperature that hey have to encounter, cannot be fused, will not corrode, nd are not changed to any considerable degree by years of ervice.

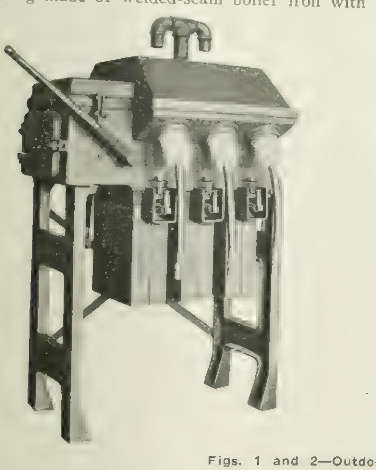
The operation of this machine is as follows: When the ain switch is closed, the motor circuit is made through e fuses, resistance unit, current relay and the motor armaure. At the same time the solenoid circuit, which is conected directly across the line and takes a current which is small fraction of one ampere, is closed, and the plunger f the solenoid is drawn up, which produces a pressure on e resistance unit and increases the current in the motor rcuit to the predetermined value at which the current re- is set. When this value is reached the current relay rates and opens the solenoid circuit, which reduces the agnetic pull and allows the solenoid plunger to drop back ightly. This action increases the resistance in the motor rcuit, which decreases the current sufficiently to allow relay to close again. Similar cycles of operation are ated as the motor accelerates, and each time the plunger rawn a little further into the solenoid, until contacts on top are pushed together, which short-circuits the curnt relay and resistance unit, making them inoperative and mpleting the operation of starting the motor.

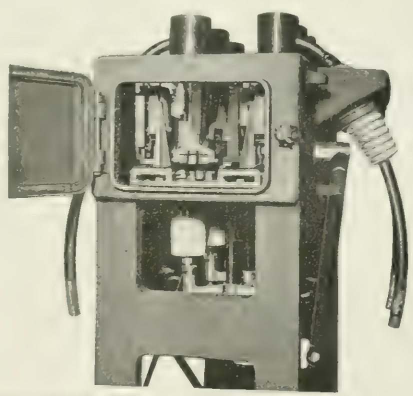
In starting the motor with this device the current is als held down to a certain predetermined value, and it is impossible to overload the motor by too rapid starting. he current relay is calibrated in amperes, and may be set suit existing conditions.

OUTDOOR TYPE OIL CIRCUIT-BREAKERS

meet the demand for a simple but absolutely reliable or-type oil circuit-breaker for moderate capacities and ges, the Westinghouse Electric & Manufacturing Com- has placed on the market a modification of its type B eaker, which has been successfully used as an indoor pe for some years past.

The present breaker has a separate tank for each pole, tanks being made of welded-seam boiler iron with an





Figs. 1 and 2—Outdoor-Type Oil Circuit-Breakers.

lating lining, thus permitting an easy inspection of the tacts. The breaker may be either automatic or nontomatic in the tripping operation. The automatic tripg is effected by the use of series transformers loced as an integral part of the circuit-breaker, one transfmer for a two-pole breaker, three for a three-pole baker and two for a four-pole breaker. This arrangent affords absolute protection under all conditions, and the manufacturers do not advise the use of less than three transformers for a three-pole breaker. The breaker is full automatic in its action, that is, cannot be held in closed position while a continued overload or short-circuit exists on the line.

The outdoor hand-operated-type breaker, as shown in the accompanying illustrations, is entirely self-contained and is mounted on a substantial cast-iron frame that can be set in any location and requires no foundation, bed-plate or base. This feature renders the installation of the breaker a very simple and inexpensive matter. The fact that each pole is inclosed in a separate tank renders the inspection of the contact mechanism a very easy matter.

The overload series transformers are mounted within the inclosing case of the breaker, thus being thoroughly protected from the weather and accidental contact with the operator. The leads from these transformers pass directly to the trip coils of the breaker, which are also inclosed in the housing. Insulated leads are brought out through heavy corrugated porcelain bushings, as shown in the illustrations, and are left of a sufficient length to enable connections of any kind convenient to the installation that is about to be made.

Sight gages are supplied on each oil tank for determining the height of the oil and the tank is filled with the oil through a plug located just above the sight gage, so that both of these operations may be performed without removing the tank. In the end of the housing is a hinged cast-iron door fastened by means of a bolt and winged nut, which permits ready access to the calibration mechanism. The breakers are calibrated before leaving the works for the service on which they are to be used. Leads for indicating lamps that show the position of the contacts are brought out on the under side of the case and may be carried to any convenient location for the lamps.

The breakers shown in the views herewith are hand-operated, but are also made for electrical operation.

A wooden closing bar is furnished for closing the breaker, which is inserted in the socket connected to the contact mechanism on any occasion when it is desired to close the breaker, and then removed, the handle socket serving as an indicator of the position of the contacts. A vent pipe with a double opening is attached to the top of the weatherproof housing to permit the escape of gases arising at the time of the operation of the breaker under load. The housing is so constructed that it can easily be removed, permitting a ready inspection of all parts of the breaker; at the same time, when assembled it forms an entirely waterproof compartment. All live metallic parts inside the case are well insulated and any danger of flashing from them to the case is eliminated.

Industrial and Commercial News

The Week in Trade.

Prospects for increased business are improving, and a more cheerful tone is shown in many branches of trade. Retail lines, in general, are showing expansion, and with advancement of the season orders for fall goods are being placed on an encouraging scale. Demand for fabrics of nearly all classes is improving and enlargement in this field is expected, as stocks in jobbing hands are thought to be rather low. More activity is taking place in the textile districts of New England, where many woolen mills are resuming work and others are operating on day and night schedules. Railroads are placing more liberal orders for equipment and several large contracts for cars, locomotives and rails have been let during the week by roads in various parts of the country. It is expected that an increase in orders from the roads will be forthcoming as soon as prices become more stable. Steel output is fairly good as an outcome of price reductions, and the pig-iron market is more active, though in both lines the buying is chiefly for early delivery. Export bookings are helping to expand operations at the mills. The sensational developments in the stock markets last week have had very little effect upon any branches of trade other than steel. The government report on the cotton crop, issued on Monday, indicates the largest output in the history of the country, the estimate placing the total crop at 13,868,337 bales, which, if realized, will be almost 1,000,000 bales in excess of last year's figures, and 200,000 bales in excess of the record output in 1904. Business failures for the week ended September 28, as reported by *Bradstreet's*, were 248, as compared with 236 last week, 211 for the corresponding week in 1910, 195 in 1909, 225 in 1908 and 177 in 1907.

The Copper Market.

Sales to foreign and domestic consumers in the closing days of September showed a slight expansion, in consequence of which the report of the Copper Producers' Association for the month will be a trifle more favorable than had been expected. An increase of at least 5,000,000 lb., however, in the stocks of marketable copper seems certain. Foreign buying increased after improvement in the outlook for settling the Moroccan controversy, and the advance has been maintained this week. Domestic consumers have shown signs of low stocks by calling for delivery of October copper, but

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.80	11.90	.....
October	11.80	11.90	11.85
November	11.80	11.90	11.85
December	11.80	11.90	11.85
January	11.80	11.90	11.85

The London market, October 3, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	54 17 6	55 13 9
Standard copper, futures	54 18 9	55 15 0

Extreme fluctuations for this year.

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

with prospects for better prices they continue to buy only from time to time and for immediate shipment. Prices were shaded slightly during the week, and some sales were made to domestic interests at 12¼ cents, delivered thirty days, while some of the export business of the week was closed at 12⅛ to 12.15 cents f.o.b. New York. A firmer tone appeared later in the week and 12¼ to 12⅜ cents delivered thirty days were prevailing prices. London prices advanced slightly from 5s. to 10s. Standard copper in New York was dull throughout the week. Rumors of a copper merger backed by both American and foreign capital have been in evidence, but there is little probability of a consolidation at present. The necessity for a grouping of interests with a view to regulating prices and output is apparent, particularly in view of prospects for increased production expected from some of the refineries. This expected increase forms one of the strongest influences leading consumers to keep out of the market in the hope of lower prices. Although export business has shown a falling off in the past few weeks, the total exports for September were 25,745 tons, making a total of 249,496 for the first nine months of the year, which is an increase of 37,545 tons over the corresponding period in 1910. Exports for the present month, including Oct. 4, are 547 tons. The daily call on the Metal Exchange Oct. 3 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

Appalachian Power Company.—Officers of the Appalachian Power Company, which was incorporated under th laws of Virgina in May as previously mentioned in these col umns, are: H. M. Byllesby, president; M. A. Viele, Arthur S Huey, Otto E. Osthoff and Frederic W. Stearns, vice-presi dents; Elmer Dover, secretary; R. J. Graf, M. A. Morriso and Robert E. Scott, assistant secretaries; R. J. Graf, treas urer; B. W. Lynch and Herbert List, assistant treasurer The directors of the company are: H. M. Byllesby, A. S. Huey J. J. O'Brien, R. E. Scott, M. A. Viele, O. E. Osthoff, H. W Buck, Elmer Dover and F. W. Stearns. The authorized cap italization of the company consists of $25,000,000 first mor gage, 5 per cent, thirty-year bonds, of which $5,450,000 has bee issued; an issue of $15,000,000 7 per cent preferred stoc cumulative from Oct. 1, 1912 and redeemable after thr years at the option of the company at 112 and accrued div dend, of which $2,180,000 has been issued; and $10,000,0 common stock of which $6,000,000 has been issued. In a dition to the utilties originally purchased, the company h acquired the electrical properties in Wytheville, Va., so that now owns utilities in Marion, Wytheville and Pulaski, Va., a in Bluefields, Cooper, Simmons, Bramwell, Spicertown, P cahontas, Keystone and Welch, in the Pocahontas coal fiel of West Virginia. The company owns five water-power si on the New River in Carroll, Grayson and Pulaski count in Virginia, and controls two reservoir sites and an additio water-power site, all of the lands, water rights and utilit being free of all indebtedness other than the first mortg bonds of the company. Work is now advancing rapidly on development of two of these water-powers. One of th known as Development No. 2, is to have a capacity of 20, hp at a net head of 49 ft., and the second, known as Devel ment No. 4, is to have a capacity of 9000 hp at a net head 34 ft. Contracts have been placed with the I. P. Morris Co pany, of Philadelphia, for seven 3000-kw (34-ft. head) wa wheels, with the General Electric Company for the co sponding generators and switchboards, and with the Westi house Electric & Manufacturing Company for transform Energy will be generated at 11,000 volts and transmitted 80,000 volts. Owing to the abundance of timber in the tion and to the rugged nature of the country, wooden p will be used instead of steel towers. Contracts for the c ductors have been awarded to the Aluminum Company America. Substations are being located at Roanoke, Pul Wytheville, Bluefields and Switchback. A contract has b closed with the Pocahontas Consolidated Collieries for al their electrical requirements for a term of twenty years, with the Zenith Coal & Coke Company for a term of t years. By developing the three remaining powers and viding suitable steam reserve, an additional 53,200 hp a per cent load factor can be obtained. It is estimated construction work will be completed by Oct. 1, 1912. A statement of earnings June 1, 1913, it is believed, will s gross earnings of $958,300, operating expenses of $289,000, net earnings of $669,300; charges and preferred dividend of $425,100, leaving a surplus applicable to common stock of $244,200, or more than 4 per cent on the total issue of $6,0 000 par value of common stock. The management of he company and the general engineering is under directio of H. M. Byllesby, of Chicago, with whom Messrs. Viele, B k well & Buck, of New York, are associated in charge of he hydraulic development, power houses and high-tension d ri bution.

Georgia Railway & Power Company.—It is learned that e Georgia Railway & Power Company, which was recently ncorporated with a capital of $27,000,000 as mentioned in the ssue of Sept. 23, has contracted to purchase the property of he Atlanta Water & Electric Power Company, and will lease e property of the Georgia Railway & Electric Company. While announcement has not been made of the terms of the ases, J. J. Spalding, of Atlanta, one of the incorporators, ives an outline of their scope and of the purposes of the ompany in the following statement: "The Georgia Railway Power Company has in mind to acquire the water-power roperties of the Georgia Power Company, the Atlanta Water Electric Power Company, and to acquire by lease the Georgia ailway & Electric Company, and especially to construct and perate in connection with the development of these water-owers a system of interurban electric railways. By leasing e Georgia Railway & Electric Company the new company ill acquire the supplemental steam plants situated in Atlanta, hich will enable it to double the capacity of the water-power evelopment by supplementing it in dry weather, and also ble the new company to protect all of the towns and cities n it reaches with lines, in case of accident or emergency. of the money furnished is coming from Canadian and nglish sources. The new company will be organized under eorgia laws and all of its properties will be subject to taxa-n in Georgia. The lease of the Georgia Railway & Electric pany will guarantee its present dividend, payable quar-, and also all of its indebtedness, liabilities and obligations."

Large Westinghouse Orders.—Among recent contracts ed by the Westinghouse Electric & Manufacturing Com-is one from the commission government of Tacoma, , for the entire switchboard and auxiliary apparatus for wer house, substation and transmission line of the 27,000-ydroelectric plant the city is erecting. About six tons of r alone will be used in the construction of the switch-. The amount involved in the contract, which also in-s a large amount of details and supplies, is in the neigh-od of $85,000. Among other orders are the following: the Susquehanna Railway, Light & Power Company for quadruple-equipment, direct-current motors with con-from the Kokomo Public Utility Company, of Kokomo, for one quadruple-equipment, direct-current, interpole r with control; from the Ft. Madison (Ia.) Street Rail-ompany for two double-equipment, direct-current motors control; from the New York, New Haven & Hartford ad Company, of New Haven, Conn., for four single-phase ay motors; from the Cincinnati Traction Company, for five double-equipment No. 318 motors with control.

Tenders for Toronto Tube Railway.—The Board of Con-f the city of Toronto has prepared specifications for the osed double-track subway railway line, known as the -Teraulay Street Tube," and are asking for tenders to be in by Nov. 1, in order to ascertain the probable cost of ndertaking, so that the tube question may be submitted vote of the ratepayers at the municipal election on Jan. t. The proposed line is 3 miles long. James Forgie and Vipond Davies, of the firm of Jacobs & Davies, of New ork, who made a special report on tube railways to the ronto special committee last year, have stated that their m does not propose to put in a tender for the Toronto tube e Charles H. Rust is city engineer.

British Electrical Manufacturers' Association.—The Na-tional Electrical Manufacturers' Association, of Great Britain, s been reorganized and is now named the British Electrical anufacturers and Allied Trades' Association. A well-paid retariat has been established, which will carry out a pro-am for the promotion of due consideration and discussion of questions affecting the electrical manufacturing industry. ody will, in general, watch over and protect the interests engaged in the industry, look out for legislative matters d, by means of representatives throughout the world, supply ormation relating to possible orders, etc. W. H. Dunlop, es manager of the British Westinghouse Company, has been pointed to the post of secretary.

Commonwealth Edison May Change Fiscal Year.—With view to conforming with the requirements of the govern-nt calling for a complete report of the financial conditions d earnings of corporations in connection with the tax law, the management of the Commonwealth Edison Company is considering a change in the date of the fiscal year, to end Dec. 31, instead of Sept. 30, as at present. This matter will probably be considered at a directors' meeting Oct. 17. In case this change is made, the directors will probably make a change in the date of the annual meeting of stockholders to some time in February, instead of the last Monday in November, as is now the case.

Auglaize Power Company.—Rapid progress is being made on the 6000-kw hydroelectric plant of the Auglaize Power Company on the Auglaize River, near Defiance, Ohio, and R. R. Livingston, of 2 Rector Street, New York City, who designed the plant, says that it will be in operation by February, 1912. The company was incorporated July 1, 1911, and plans to supply energy in Lima, Defiance and Toledo, Ohio. An initial equipment of five 1000-kw, 2300-volt water-wheels and generators, with governors, has been ordered from the Allis-Chalmers Company. Switchboards and transformers for the 60,000-volt transmission line have been ordered from the General Electric Company.

New Platinum Prices.—A new record for platinum prices was made Oct. 3 when they were quoted in Maiden Lane, New York, at $47.50 an ounce for hard platinum and $45 an ounce for soft platinum. These figures represent an advance of $5 an ounce since the first of the year, and still higher prices are expected. The price in 1905 was $18.50 an ounce, which increased rapidly in 1906, reaching $38 an ounce for soft platinum and $40 for hard platinum in December. A decline to approximately half these prices took place in February, 1907, continuing until August, 1908, when an upward movement was made.

General Electric Orders.—The Charleston (S. C.) Mining & Manufacturing Company has placed an order with the General Electric Company for a 1250-kva, 2300-volt, three-phase horizontal turbine to operate at 3600 r.p.m., for use in their plant at Fort Meade, Fla. The company has had a 500-kw General Electric steam turbine in operation for nearly six years. The Anaconda Copper Company, of Butte, Mont., has placed an order with the General Electric Company for thirteen locomotives, which will be used for increasing its ore-handling facilities.

Meetings of Maryland Public Utility Companies.—At the annual meeting of the Consolidated Gas, Electric Lght & Power Company, in Baltimore, Oct. 2, Van Lear Black, first vice-president of the Fidelity Trust Company, was elected a director, replacing S. Reading Betron, resigned. Other business was of routine nature. Retiring directors of the Maryland Electric Railway Company were re-elected at the annual meeting of the stockholders on Oct. 2. Old officers of the company were also re-elected.

Hoskins Manufacturing Company Takes Over International Electric Meter Company.—Under date of Oct. 2 the Hoskins Manufacturing Company, of 453 Lawton Avenue, Detroit, Mich., announces that it has taken over the business and property of the International Electric Meter Company of Chicago. The Hoskins company assumes all liabilities of the International company. The business of the latter will be removed to Detroit and conducted by the Hoskins company.

Virginia Railway & Power Company.—According to the New York office of the Virginia Railway & Power Company, an expenditure of $600,000 will be made shortly for additions to the Richmond power station of the company and for various improvements to the traction properties. The company has declared an initial semi-annual dividend of 1 per cent on its common stock, payable Oct. 20 to stockholders of record as of Oct. 7.

Growth of Traction Systems in Spokane.—Although street-railway building in Spokane, Wash., began as recently as 1902, the total investment now represented in the city by the systems of the Washington Water Power Company and the Spokane Traction Company is close to $42,000,000, and the city is said to have the third greatest system of electric railways in the United States.

Tri-City Railway & Light Equipment.—J. G. White & Company have purchased four 300-kw, 1200-volt motor-generator sets, one 2000-kw, five 1000-kw and four 200-kw transformers, for distribution at the Davenport, Rock Island and Moline stations of the Tri-City Railway & Light Company.

Aluminum Notes and Prices.—The aluminum market is steady, and ingots for remelting are held at 20@22 cents spot No. 1, the base for large ingots. Rods and wire are quoted at 31 cents and sheets at 33 cents, the prices being those of Oct. 3.

Financial.

The Week in Wall Street.

Absence of disturbing influences has caused a mild recovery in the stock market, and while trading is light in volume a better tone is noticeable. Last week closed with Steel shares on an upward trend, and under this lead many stocks made small gains on Friday and Saturday. Further gains were made on Monday, but there was a marked decrease in the volume of transactions. United States Steel advanced to 62⅝ early in the day, but declined in the later trading and closed at opening prices. The most conspicuous gain of the day was a 3½-point rise in United States Rubber common, other issues on the list showing only fractional advances. The final condition report of the Department of Agriculture indicating a record cotton yield was the chief topic in financial and

NEW YORK.

	Sept. 26.	Oct. 3.	Shares Sold.		Sept. 26.	Oct. 3.	Shares Sold.
All. Ch......	6	6*	400	Int. Met., pf.	41	42	5,100
All. Ch., pf..	16½*	16½*	———	Mackay Cos.	83*	82¾*	100
Amal. Cop...	47⅝	49⅛	228,600	Mackay, C.,pf.	72½	72½*	———
Am. D. T....	20½	33⅛*	———	Man. Elev...	131¼*	132*	250
Am. Loco....	33⅝	35½*	2,000	Met. St. Ry..	15*	15*	———
Am. Loco., pf.	104½*	105⅛	———	N.Y.&N.J.Tel.	139½*	139½	———
Am. Tel. & C.	80½*	80½*	———	Steel, com...	56⅞	60⅝	2,576,500
Am. T. & T..	134½	133⅜	18,250	Steel, pfd....	107¼	109¼	66,133
B. R. T......	73⅜	73¾	12,360	W. U. T....	77¼	77⅜	5,190
Gen. Elec....	144	148½	11,900	West'h, com.	61	62¾*	3,000
Int. Met.....	13¾	15	6,300	West'h, pf...	110½*	110½*	———

PHILADELPHIA.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Am. Rys...........	44	44	Phila. R. T........	21	21⅞
El. Co. of A........	11⅝*	11⅝	Phila. Elec.........	16¼	16¾
Elec. St. Bt'y......	50	51	Phila. Trac.........	82*	82¾
Elec. St. Bt'y, pf....	30*	30*	Union Trac.........	48½	49¾

CHICAGO.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Chi. City Ry.......	186*	186*	Com. Edison........	134	134
Chi. Elev. Rys......	24*	24*	Chi. Subway........	1⅝	2¼
Chi. Elev. Rys., pf..	89½*	89½*	Chi. Telephone......	122*	120
Chi. Rs., Ser. 1....	92*	92*	Nat'l Car...........	101*	101*
Chi. Rs., Ser. 2....	27*	27*	Nat'l Car, pf.......	118½*	118½*

BOSTON.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Am. T. & T.	134½	133⅝	Mex. Tel...........	6*	3*
Cum. Tel	150½	149⅞*	Mex. Tel., pf.......	6*	6*
Edison	285	280*	N. E. Tel..........	143¼	143¼*
Gen. Elec..........	144	148	W. T. & T.........	15	18*
Mass. E. Ry........	17*	19	W. T. & T., pf....	95	95*
Mass. E. Ry., pf....	87½*	89¾			

*Last price quoted.
Shares sold for the week, Sept. 25 to Sept. 30.

industrial quarters during the day. Tuesday's market was very dull, and business was light, accompanied by wavering prices, the apparent cause of which was the halting attitude shown on foreign exchanges resulting from European controversies. Decline in money rates on foreign exchange was the most important feature of the day. Lower rates were quoted in Berlin, Vienna and London, indicating relief in the money strain. A further sign of improvement in financial affairs is found in the fact that bond transactions in September were the heaviest since January, total sales amounting to $62,625,000, which is an increase of $15,147,500 over the previous month, and slightly in excess of September, 1910. Activity in American Tobacco issues was a leading cause of the increase in bond transactions during the month. The Street is showing very little interest in the Turkish situation. Rates in the money market October 3 were: Call, 2@2¼ per cent; ninety days, 3¾@4 per cent. The quotations in the tables are those at the close October 3.

Financial Notes.

Stone & Webster Companies.—Securities of several companies under Stone & Webster management are being offered at attractive prices. Among these offerings is the 6 per cent preferred stock of the El Paso Electric Company, which owns the securities of local companies doing the entire electric railway and practically all the electric lighting and power business in El Paso, Tex., the electric lighting and power business in Juarez, Mexico, and operates an electric railway between El Paso and Juarez. Gross earnings of the company for the twelve months ended July 31, 1911, were $667,937, and net earnings after deduction of all charges were $182,154, representing over three times the amount required to pay 6 per cent dividends on the $1,000,000 preferred stock. Dividends at the rate of 5 per cent are now being paid on $1,000,000 common stock. Another offering is the 6 per cent cumulative preferred stock of the Pensacola Electric Company, which does the entire electric-railway business in Pensacola and owns the securities of the Escambia County Electric Light & Power Company, which furnishes all the electric lighting and power service in the city. The property has been under Stone & Webster management since 1906. Its gross earnings in the twelve months ended July 31, 1911, were $285,249, and the net earnings after deduction of all charges were $51,612, or over two and one-half times the $18,000 dividends on $300,000 preferred stock. The Railway & Light Securities Company's collateral trust 5 per cent bonds, third series, due 1939, are also available. The company was organized in 1904 for the purpose of holding for income or for sale the securities of transportation, illuminating, power or other public service corporations. It now holds securities in thirty independent companies, seventeen of which are under Stone & Webster management. The income of the company after deduction of all expenses shows over two and one-half the 5 per cent interest requirements on the three series of collateral trust bonds aggregating $1,394,000. First consolidated mortgage 5 per cent gold bonds of the Jacksonville Traction Company are included in the list. This company has acquired all the property and assumed the obligations of the Jacksonville Electric Company, and now does the entire electric railway business in Jacksonville, Fla. Its earnings in the twelve months ended July 31, 1911, were over twice the amount required to pay 5 per cent interest on all bonds outstanding.

Electric Properties in Oregon.—Annual reports filed with the Oregon State Railroad Commission give the records of the following companies: Portland Railway, Light & Power Company: Electric railway—total operating revenue, $3,871,032; total operating expenses, $2,015,788; net operating revenue, $1,855,244; net income, deducting all expenses, $1,656,257; passenger revenue, $3,466,708; freight revenue, $273,095. Chief items of miscellaneous revenue: Light and power, $1,415,261; Vancouver ferry, $33,624; locks and canals, $17,454; total funded debt, $4,346,600; taxes accrued, and yet due, $119,954; total cost of property to June 30, 1911, $29,860,462; total mileage of track in operation, 262.7; dividends of 2½ per cent were declared on $5,000,000 preferred stock and dividends of 2 per cent on $35,000,000 common stock. Oregon Electric Railway Company: Total operating revenue, $616,079.79; total operating expenses, $323,512.28; net income, deducting all expenses, $167,404.10; passenger revenue, $485,142.44; freight revenue, $100,693.37; total mileage of track in operation, 71.2. Astoria & Columbia River Railway: Total operating revenue, $603,847.77; total operating expenses, $339,994.84; net income, deducting all expenses, $146,335.15; passenger revenue, $37[illegible]459.63; freight revenue, $122,420.70; total mileage of track in operation, 79.60.

American Traction & Power Company.—The board of directors of the American Traction & Power Company, which was recently incorporated in Delaware with a capitalization of $500,000, as mentioned in the issue of Sept. 23, has completed the organization of the company by election of officers. The company has begun the consideration of plans for extensive traction developments in the South, in accordance with the purposes specified in its incorporation papers, which include the organization, financing, operation and construction of steam and electric railroads and power companies in Southern States. The American Traction & Power Company is a holding corporation for the Yazoo Valley (Miss.) Electric Railroad, Light & Power Company and the Kentucky Southwestern Railway, Light & Power Company.

September Incorporations.—During September papers filed in the Eastern States for companies with an authorized capital of $1,000,000 or over, including increases in capital, aggregated $77,004,000, which is a decrease of $10,346,[illegible] from August figures, and an increase of $18,904,000 over totals on September, 1910. Papers filed by other companies with a capital of $100,000 and over, including states other than those in the East, made a total of all incorporations for the month of $156,912,000, which compares with $1[illegible]509,000 in August and with $114,593,000 in September, 191[illegible]

Salt Lake & Ogden Railway Bonds.—Banking houses are placing $75,000 first mortgage, 5 per cent gold bonds of the Salt Lake & Ogden Railway Company, which are dated February, 1909, and due Feb. 1, 1934, but are callable at 105 and interest after Feb. 1, 1914. The company operates a high-speed interurban electric railway, 35½ miles in length, on private right of way between Salt Lake City and Ogden, serving a population of 130,000. Its capital stock, authorized and issued, is $1,500,000 in addition to which $2,000,000 first-mortgage bonds are authorized, of which $1,075,000 has been issued, and $925,000 is reserved. The larger part of the proceeds of the $1,000,000 bonds first issued was devoted to improvements and the completion and electrification of the line. The proceeds of these $75,000 bonds will be used to pay part of the cost of track extensions. In addition to the bonds the stockholders' investment is over $900,000, not allowing for the franchises, all of which are satisfactory and do not expire until 1955. The $925,000 of bonds still in escrow can be issued only for 75 per cent of the cost of extensions and additions, provided net earnings are twice the interest charge. Gross earnings of the company for the year ended July 31, 1911, were $320,963, and net earnings, after deduction of taxes, were $126,745.

Earnings of Mexican Telegraph Companies.—Effects of the political disorders in Mexico in the past few months are reflected in the decreased earnings of the Mexican and Central & South American Telegraph companies. Estimated earnings of the Central & South American Telegraph Company for the quarter ending Sept. 30 indicate a decrease of $33,000 in gross earnings, as compared with receipts during the corresponding quarter in 1910, with a loss of $20,500 in net and of $22,650 in surplus available for dividends. Corresponding losses are expected in the returns of the Mexican Telegraph Company, and it is believed that gross earnings in the September quarter this year will be about $12,500, which would represent total gross receipts of $175,000, as compared with $187,000 last year. Net earnings are expected to show an equal decline, and a falling off of about $10,500 is thought probable in the surplus available for dividends. These declines are regarded as of temporary nature only, for the resources of the country are abundant and resumption of normal conditions is advancing rapidly.

Dayton Power & Light Company.—Final organization of the new consolidated company in Dayton, Ohio, known as the Dayton Power & Light Company, whose prospective formation was described in these columns June 22, was effected at a meeting Oct. 2, at which the following directors and officers were elected and qualified for the coming year: Directors—Messrs. F. M. Tait, E. P. Mathews, H. E. Talbott, F. T. Huffman, J P Breen, Maurice Costello, A. J. Conover, A. M. [illegible]ing, M. J. Warner, William Stroop, L. K. Funkhauser, H. Kiefaber and Charles Wurchet. Officers—F. M. Tait, president and general manager; E. P. Matthews, vice-president; [illegible] L. Campbell, treasurer; L. K. Funkhauser, secretary; M. J. Warner, assistant secretary and assistant treasurer; O. H. Hutchings, superintendent; B. H. Gardner, sales manager. The Dayton Power & Light Company has declared a quarterly dividend of 1½ per cent on the preferred stock of the company, payable Oct. 15 to stockholders of record as of Sept. 30. The large increase in capacity which the company is installing will shortly be placed in operation.

Republic Railway & Light Company.—Gain in gross earnings of the Republic Railway & Light Company in the seven months ended July 31 was $56,300 over the returns in the corresponding period last year, and an increase of $33,100 was shown in net earnings in this time. August and September returns are said to be much larger than in the corresponding months last year. Present earnings indicate that the company will show over 2¾ per cent on its common stock this year, about 4 per cent in 1912, and close to 5¼ per cent in 1913. The plans of the company call for large expenditures in the next few years for improvements and betterments to the properties. About $300,000 is to be spent for this purpose this year as previously mentioned in these columns, and an equal amount will be spent next year. This will be increased to $500,000 in 1913, to $700,000 in the year following, and to almost $1,000,000 in 1915. Prospective business and proper maintenance in the next five years, it is believed, will justify these expenditures.

Winnipeg Electric Railway Shows Improvement.—Total net revenues of the Winnipeg Electric Railway Company for the seven months ended July 31 were $1,096,226, as compared with $897,135 in the same period last year, which is an improvement of about 22 per cent. Net earnings in July were $170,600, as compared with $132,260 in July, 1910, and were larger than those of any month this year since January, when the total was $157,795. These figures point out the likelihood of net returns for the year approaching $2,000,000, which fully justifies the recent increase of 2 per cent in the dividend rate, which now stands at 12 per cent per annum.

Boston Elevated $5,000,000 Bond Issue Authorized.—Stockholders of the Boston Elevated Company, at a special meeting Sept. 29, authorized the directors of the company to issue negotiable bonds to the amount of $5,000,000. The proceeds will be used to provide means for construction and equipment and to pay the floating debt of the company. Of the 104,255 represented at the meeting, only thirteen shares were voted against the issue.

Philadelphia Rapid Transit Company.—The August report of the Philadelphia Rapid Transit Company shows total gross receipts of $1,794,989. Net earnings amounted to $668,772, and fixed charges to $736,683, leaving a deficit of $67,910. The deficit for the two months ended August 31, 1911, was $93,151. Old officers of the company were re-elected at the recent directors' meeting.

Tri-State Telegraph & Telephone Company Sold.—The Southwestern Telegraph & Telephone Company has purchased the Tri-State Telegraph & Telephone Company and will shortly assume charge of the exchanges at Osceola, Wilson, Blytheville and at several other places in Arkansas now operated by the company.

DIVIDENDS.

Associated Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Bell Telephone Company, of Pennsylvania, quarterly, 1½ per cent, payable Oct. 16.

Boston Suburban Electric Company, quarterly, preferred, $1 per share, payable Oct. 16.

Fort Smith Light & Traction Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Mexican Power Company, semi-annual, preferred, 3½ per cent, payable Nov. 1; quarterly, common, 1 per cent, payable Oct. 16.

Nebraska Telephone Company, $1.50 per share, payable Oct. 10.

Northern States Power Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Ottumwa Railway vs. Light Co., quarterly, preferred, 1¾ per cent, payable Oct. 16.

San Diego Consolidated Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Virginia Railway & Power Company, semi-annual, common, 1 per cent, payable Oct. 20.

Western States Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

REPORTS OF EARNINGS.

Period.		Gross. Earnings.	Operating. Expenses.	Net. Earnings.	Fixed Charges.	Net Surplus.
ATLANTIC CITY ELECTRIC COMPANY.						
August,	1911	$50,061	$14,544	$34,517	$7,546	$26,971
August,	1910	46,146	16,187	29,959	4,854	25,105
CANTON ELECTRIC COMPANY.						
August,	1911	$22,068	$12,100	$9,968	$3,139	$6,829
August,	1910	19,482	10,019	9,463	3,276	6,187
CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.						
August,	1911	$603,239	$360,401	$242,838	$50,637	$192,201
August,	1910	571,856	322,490	249,365	49,603	199,762
MUNCIE ELECTRIC LIGHT COMPANY.						
August,	1911	$21,559	$11,851	$9,708	$6,429	$3,279
August,	1910	18,686	11,019	7,667	4,534	3,143
PHILADELPHIA COMPANY.						
August,	1911	$1,493,155	$1,038,372	$793,612	$594,004	$199,607
August,	1910	1,559,234	979,773	880,261	580,501	299,760
ROCKFORD ELECTRIC COMPANY.						
August,	1911	$26,649	$14,797	$11,852	$6,764	$4,818
August,	1910	25,762	18,201	7,561	6,065	1,496
SCRANTON ELECTRIC COMPANY.						
August,	1911	$54,499	$23,400	$31,099	$12,574	$18,525
August,	1910	50,353	22,056	28,297	10,866	17,431

General News

Construction News.

PIEDMONT, ALA.—It is reported that an election will be held Oct. 18 to vote on the proposition to issue $25,000 in bonds, the proceeds to be used for the installation of an electric-light plant and extensions to the water-works system.

TUSCALOOSA, ALA.—Application has been made to the City Commissioners by F. G. Blair and H. B. Foster for a franchise to build and operate an electric power plant and street railway system and also for a natural and artificial gas plant in Tuscaloosa.

PRESCOTT, ARIZ.—The Arizona Power Company is planning to build a transmision line from Poland Junction to Crown King, via Mayer and Blue Bell. R. S. Mason is chief engineer.

CLARKSVILLE, ARK.—It is reported that surveys are being made by Winters & Dove, of Fort Smith, Ark., in connection with the installation of a municipal electric-light plant.

LITTLE ROCK, ARK.—The Southwestern Telegraph & Telephone Company has purchased the plant and holdings of the Tri-State Telegraph & Telephone Company and will take over the exchanges at Oscela, Blytheville, Manila, Wilson and Luxora.

MURFREESBORO, ARK.—Application has been made to the Council by E. C. Ellsworth, of Murfreesboro, Ark., for a franchise to install electric-light plant, water-works and ice plant in this town.

ANAHEIM, CAL.—The Board of Trustees has awarded the contract for the erection of an addition to the municipal power plant to W. W. Scott.

AUBURN, CAL.—The Placer Electric Company is reported to have purchased a half interest in the Rawhide mine at Towle and the Home Picket mine at Last Chance, and is planning to erect a large hydroelectric power plant on the American River, near Auburn.

CORONA, CAL.—The Sierra Light & Power Company is reported to be contemplating the reconstruction and improvements to its power plant and distributing system in Corona.

COTTONWOOD, CAL.—Plans are being considered by the Sacramento Valley Power Company for the erection of a transmission line from Cottonwood to Dry Creek, to supply power for gold dredging work.

CROCKETT, CAL.—Work will soon begin on the erection of a new cable from the south tower in Crockett to the north tower of the Pacific Gas & Electric Company on the Solano shore to replace the old cable which was burned out three years ago.

EUREKA, CAL.—The Board of Supervisors has granted the Western States Gas & Electric Company a franchise to erect and maintain transmission lines in District No. 3.

FRESNO, CAL.—A complete telephone system is to be established along the route of the Guaranty Pipe Line Company from the Midway oil fields to Ventura, bids for construction of which are now being received.

FRESNO, CAL.—Bids will be received by the Board of County Supervisors until Nov. 7 for sale of a franchise to erect transmission and distributing lines from the San Joaquin River to different sections of the county for a period of fifty years, for which application was made by the Pacific Light & Power Corporation, of Los Angeles, Cal.

FULLERTON, CAL.—The Board of City Trustees has entered into a three-year contract with the Southern California Edison Company for street lighting. The contract calls for 500-watt, 250-watt and 50-watt tungsten lamps with center-type suspension.

GREENVILLE, CAL.—The Seneca Mining & Milling Company is reported to be contemplating the erection of a hydroelectric power plant on its power site on the Feather River.

GREENVILLE, CAL.—Preparations are being made by the Indian Valley Electric Light & Power Company to extend its transmission line from Greenville to Crescent Mills and Taylorsville. The company has purchased water rights along the north fork of the Feather River amounting to about 50,000 in. of water and is planning to erect a plant at that point in the spring and also another transmission line from there to Indian Valley to supply electricity for lamps and motors in that vicinity.

GRIDLEY, CAL.—The Gridley Produce & Canning Company is contemplating the installation of an electric-light and power plant to supply electricity to operate its works.

GRIMES, CAL.—The Northern California Power Company is contemplating extending its transmission lines to Grimes.

KNIGHTS LANDING, CAL.—The Pacific Gas & Electric Company is planning to erect a transmission line from Knights Landing to Howell Point for supplying power through special contract.

LEWISTON, CAL.—The Trinity Dredging Company has been granted a franchise to erect transmission lines in this district for a consideration of $144.

LOS ANGELES, CAL.—The Board of County Supervisors has awarded the contract for the installation of engine-driven generator units in the Hall of Records to the C. C. Moore Company, for $21,611.

LOS ANGELES, CAL.—The Southern California Edison Company is reported to have engaged Charles McBride, civil engineer, to investigate possible power sites in the Sierra Nevada Mountains, San Joaquin Valley district.

LOS ANGELES, CAL.—The Board of County Supervisors is advertising for sale an electric railway franchise from San Fernando to the Junction of Fifth and Paicoma Avenues, in the Paicoma section, for a period of forty years, bids for which will be received until Oct. 30.

LOS ANGELES, CAL.—The Board of Public Service Commissioners has adopted a resolution favoring the submission to the voters of the proposition to issue $5,500,000 in bonds to provide for a complete distributing system for all municipal and commercial light and power business within the city limits.

LOS ANGELES, CAL.—Parkinson & Bergstrom, architects, Security Building, Los Angeles, Cal., have awarded the contract for furnishing and installing electric-lighting fixtures in the eleven-story Chester Building, at Spring and Fifth Streets, to the Meyberg Company, West Sixth Street, Los Angeles, Cal., for $5,650.

OAKLAND, CAL.—Work will begin at once by the Oakland Traction Company on laying track for its Hopkins Street railway, about 3 miles in length. Orders have been issued for double-tracking of San Pablo Avenue from West Berkeley through Albany to the intercounty line. Work will also begin immediately on the East Sixteenth line in Oakland.

OROVILLE, CAL.—It is reported that the Oro Water, Light & Power Company has purchased a large interest in the Butte & Tehama Power Company and the Sierra Irrigation Company.

REDLANDS, CAL.—K. C. Wells and the University Realty Company are interested in a project to build an electric railway on Colton Avenue from the University of Redlands to a junction with the Pacific Electric Railway at Orange Street.

RIVERSIDE, CAL.—The Southern California Edison Company, it is reported, is contemplating the construction of a substation on the property recently acquired in Riverside.

SANTEE, CAL.—Work has commenced on the construction of the proposed electric power-plant for James Ballantyne, near El Cajon.

SAN BERNARDINO, CAL.—The City Council has granted Fred B Mechling a franchise to construct and operate an electric system tc supply electricity for lamps, heat and motors in San Bernardino.

SAN FRANCISCO, CAL.—Plans and specifications are being preparec for the power house and equipment of the Geary Street Municipal Rail way by A. M. Hunt, of San Francisco, Cal., consulting engineer.

SAN FRANCISCO, CAL.—The contract for installing a complete elec tric-lighting system at Ft. Miley, Cal., has been awarded to the McFel Electric Company, 201 Sansome Street, San Francisco, Cal., at $17,210.

SAN FRANCISCO, CAL.—The Pacific Fire Extinguisher Company, o San Francisco, Cal., has secured the contract for switchboards, switche conduit work, etc., in the new building of the Bankers' Investment Con pany, on Geary Street, at $8,400.

SAN FRANCISCO, CAL.—The Board of Supervisors has granted Pa B. Fay permission to build a double-track railway on Bryant Stre to connect existing tracks on Army Street and Twenty-sixth Stree The line will be operated by the United Railroads Company.

SAN FRANCISCO, CAL.—It is reported that the United Properti Company has awarded contracts amounting to $2,000,000 for electric equipment. What the order consists of has not been announced, but is believed to be the first move toward important extensions of the K Route system.

SAN FRANCISCO, CAL.—Bids will be received by the Board Public Works, David Hewes Building, Market Street, San Francisc Cal., until Nov. 1 for forty-three double-end, pay-as-you-enter, clos steel motor cars, with four extra trucks, complete with axles, whe and motors, for the Geary Street Municipal Street Railway. T road will not be constructed immediately, as planned, owing to temporary injunction prohibiting the building of the line on Po Lobos Avenue.

SUTTER CREEK, CAL.—It is reported that new electrical pumpi machinery will be installed in the Poundstone mine.

TERRA BELLA, CAL.—The Ducor-California Hot Springs Telepho Company, a co-operative organization, has been formed to constr and operate a telephone system in this district. L. S. Wingrove president.

UPLAND, CAL.—The Ontario & San Antonio Heights Electric R way is reported to be contemplating extending its railway from Upl to Cucamonga. This road is operated by the Pacific Light & Power C pany, of Los Angeles.

VENICE, CAL.—The Abbot Kenney Company, it is reported, is planning to install a large electric plant in Venice, at a cost of about $100,000. It is understood that orders have already been placed for machinery.

WOODLAND, CAL.—The Sacramento Valley Westside Electric Railway Company has instructed its attorney to prepare application for franchises in Yolo, Colusa, Glenn and Tehama Counties. Charles L. Donohoe, of Willows, is president of the railway.

MONTROSE, COL.—The Montrose Electric Light & Power Company has applied to the Council for a twenty-year franchise. If granted a franchise the company guarantees to expend $100,000 for extensions and improvements to its plants.

EAST HAMPTON, CONN.—Extensive improvements are contemplated to the electric plant of the East Haddam Electric Light Company, located at Leesville. It is proposed to extend the service to East Haddam.

HARTFORD, CONN.—The Senate has passed the new bill for a charter for the Connecticut River Power Company which contains suggestions made by Governor Baldwin and is acceptable to him.

NEW BRITAIN, CONN.—Three new boilers are being installed in the power plant of Landers, Frary & Clark Company, of New Britain, Conn. The output of the plant is being increased to provide power for the new factory building now being erected on Center Street.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company has awarded the contract for equipping its branch road from Branford to New Haven, 12 miles in length, for electrical operation to Joseph A. Lyons, 237 Lincoln Street, New Haven, Conn.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until Oct. 12, under proposal No. 550, for furnishing 15 miles of galvanized wire, steel No. 6; 240 miles of galvanized wire, steel No. 14, and 5,000 ft. of wire, phosphor bronze, seven-strand, No. 14. Captain R. J. Burt is disbursing officer, Signal Corps, United States Army.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 24 for furnishing at the navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 3983—four ash-hoisting engines. Schedule 3984—two turbo-generator sets. Schedule 3989—1100 lb. bar brass. Newport, R. I., Schedule 3989—10,000 lb. brass tubing. Applications for proposals should designate the schedule desired by number.

JACKSONVILLE, FLA.—At an election held Sept. 26 bonds to the amount of $500,000 were authorized for municipal improvements, of which $35,000 will be used for improvements to the electric-light plant and water-works system.

AMERICUS, GA.—Steps have been taken by local capitalists toward the organization of a company for the purpose of establishing an electric-light system and gas plant in Americus and surrounding territory. The proposed company will be capitalized at $50,000. Frank Lanier and Frank Sheffield are interested in the project.

ATLANTA, GA.—It is reported that plans have been completed for consolidating all the hydroelectric power plants in the Piedmont region. The properties will be taken over by the Georgia Railway & Power Company, recently incorporated with a capital stock of $27,000,000.

SAVANNAH, GA.—Extensive improvements will be made to the In- Street station of the Savannah Electric Company, work on which has already begun. New equipment will be installed, including two ...rs of 400 hp each, one 500-kw generator, 75-kw generator, exciter, ... The cost of the work is estimated at $100,000.

CISSNA PARK, ILL.—The Iroquois Telephone Company is contemplating extending its system to Cissna Park. New cables will be erected and other improvements made.

DIXON, ILL.—The installation of an ornamental street-lighting system in Dixon is reported to be under consideration. It is proposed to erect single lamp-posts, ten to the block, for seven blocks.

FREEPORT, ILL.—The Freeport-Madison Electric Railway Company ...ed into a contract with Hugh G. Palmer, of Yorkville, for the construction and financing of the first section of its railway from Freeport to Cedarville, a distance of 16 miles. The railway will eventually ...d from Freeport, Ill., to Madison, Wis. W. T. Raleigh, of Freeport, is promoter.

HAVANA, ILL.—The Illinois Valley Gas & Electric Company, which recently purchased the property of the Havana Electric Company, will ... temporary repairs to the plant. The company, it is reported, will ... a new electric plant in Havana next spring.

HILLSBORO, ILL.—A meeting of the stockholders of the Sanga- Valley Railroad Company will be held Nov. 29 to vote on the question to increase the capital stock of the company to $100,000, proceeds to be used for extensions and improvements to the prop-..., including the construction of new bridge, purchase of new cars, ...r machinery, extension of the railway north of Hillsboro and to ... its share of the paving in Hillsboro. John E. Melick, of Spring..., Ill., is president of the company.

NORTH ILION, ILL.—A proposition whereby the Ilion municipal electric-light plant will supply electricity for lamps in North Ilion, to be paid for by the town of Herkimer, is under consideration by the officials of Herkimer. North Ilion is part of the town of Herkimer ... is nearer to Ilion than Herkimer. If the Herkimer board approves the contract, electricity will be transmitted to North Ilion at once.

ORANGEVILLE, ILL.—The Village Board has granted C. W. Bennett, of Black Earth, Wis., a franchise to operate an electric-light plant in Orangeville for a period of fifteen years. The board also awarded a contract for street lighting under the terms of which Mr. Bennett is to furnish twenty 100-cp tungsten street lamps at $500 per year. The village reserves the privilege of purchasing the plant at the end of ten and fifteen years by giving six months' notice. If the plant is not taken over by the municipality at the end of fifteen years the franchise will be extended another five years.

PANA, ILL.—The Pana Commercial Club has taken up the proposition of installing an ornamental street-lighting system in Pana.

SYCAMORE, ILL.—The City Council has awarded the contract for the installation of the new electric-lighting system to the DeKalb-Sycamore Electric Company for $2,750. The Council has also authorized all poles, wires and other overhead equipment, with the exception of the trolley and suspension wires of the interurban company, to be removed on State Street from Main to California Street.

WAUKEGAN, ILL.—The Illinois Tunnel Company, it is reported, is contemplating extending its telephone service to this city.

COLUMBUS, IND.—The merchants of this city have contributed $2,500 for the installation of ornamental cluster lamps in the business section of the city. The City Council has agreed to give $1,000 and maintain the lamps after they are installed.

HAMMOND, IND.—The Hammond Steel Barrel Company, recently incorporated with a capital stock of $100,000 is planning to build a new plant on the Calumet River, to cost about $50,000. The plant will be equipped for electric-motor drive. J. F. Lafave is president and N. C. Cunningham is secretary.

MICHIGAN CITY, IND.—The Board of Trustees of the Indiana State Prison has awarded the contract for the installation of a power plant and pumping plant for the State Prison, located in Michigan City, to the Ft. Wayne Electric Works, at $11,500. The equipment will include two 150-kw Ft. Wayne generators direct connected to Fleming-Harrisburg engines, switchboard and two Platt centrifugal pumps with Ft. Wayne motors. A. J. Hammond, of South Bend, Ind., is consulting engineer for the Board of Trustees.

MUNCIE, IND.—Ball Brothers, manufacturers of fruit jars, are erecting a zinc-plating factory near their fruit jar plant. The plant will be equipped for electrical operation throughout.

TERRE HAUTE, IND.—A 300-kw electric generator is being installed in the Deep Fourth Vein mine north of West Terre Haute. The work is being done under the supervision of Claude Erwin, electrical engineer.

BURLINGTON, IA.—Preparations are being made for extensive improvements and extensions to the power plant of the People's Gas & Electric Company, including the installation of a new engine and generator. It is understood that a number of manufacturing plants propose to utilize electricity to operate their factories. The company also operates the local street-railway system.

DELHI, IA.—A proposition has been submitted to the Town Council by W. R. Furman, of Delhi, Ia., who owns water rights at Troy Mills, offering to supply electricity in Walker at 1½ cents per kw-hour. Mr. Furman states that if the town of Walker or private capital will erect a transmission line from Walker to the Troy Mills water-power he will purchase a new waterwheel and generator. He estimates that the transmission line would cost from $500 to $700 per mile.

FT. DODGE, IA.—Preparations are being made by the Ft. Dodge, Des Moines & Southern Railway Company to enlarge its power station.

IOWA FALLS, IA.—At an election held recently the proposition to grant O. F. Peterson, of Des Moines, Ia., a franchise to build and operate an electric-light plant in Iowa Falls for a period of twenty-five years was carried.

MANCHESTER, IA.—A contract has been awarded for the installation of sixty-five electroliers, each carrying five lamps, on Franklin Avenue.

OSKALOOSA, IA.—The Des Moines River Power Company is reported to be contemplating the installation of a 10,000-hp power plant.

REDFIELD, IA.—At a special election held recently the proposition to issue bonds to the amount of $15,000, the proceeds to be used for the installation of an electric-light plant and water-works system, was carried.

VAN HORNE, IA.—It is reported that it is proposed to issue $10,000 in bonds for the construction of an electric-light plant to replace the one that was burned.

OSBORN, KAN.—Rollins & Westover, of Kansas City, Mo., consulting engineers, have been engaged to prepare plans and specifications for a municipal electric-light plant for Osborn, Kan.

SOUTH HAVEN, KAN.—We are informed that bonds to the amount of $7,000 have been voted for the installation of a municipal electric-light plant. As yet no engineer has been engaged. J. R. Britton is city clerk.

WATERVILLE, KAN.—The installation of a municipal electric-light plant in Waterville is under consideration, for which bonds have been issued.

LIVERMORE, KY.—The Smith Cooperage Company is reported to be contemplating the installation of a power plant.

NEWPORT, KY.—The Board of Aldermen has awarded a contract

to the Great Western Electric Company for placing the wires of the fire department underground.

VERSAILLES, KY.—The Kentucky Traction & Terminal Company is reported to have awarded a contract to Fred J. Rump, of Versailles, to construct a combined electric substation and passenger and freight depot. The electric equipment will include a 300-kw rotary converter. The main plant of the company is to be located at Lexington, Ky.

WHITEHALL, MD.—It is reported that preparations are being made by the Whitehall Manufacturing Company, which has recently acquired paper mills in Whitehall, practically to rebuild the plant. It is understood that contracts have been placed for the installation of an electric-light plant to supply electricity for lamps and motors for the mills and for lighting the buildings in the vicinity of the plant. F. M. Rudolph, it is said, will be superintendent.

AMHERST, MASS.—The plant and holdings of the Amherst Gas Company are reported to have been purchased by Cabot, Thompson & Eustis. A new set of directors have been elected.

BOSTON, MASS.—At a special meeting of the stockholders of the Boston Elevated Railroad Company, held Sept. 29, the directors were authorized to issue negotiable bonds to the amount of $5,000,000, to provide means for construction and equipment and to pay the floating debt of the company.

CHELMSFORD, MASS.—The Selectmen have awarded a contract to the Lowell Electric Light Corporation for lighting the streets of the town. The new contract will save the town about $1,100 per year in the territory at present lighted with oil, gas and electricity. About 12 miles of pole lines will be erected. It is expected to have the entire system installed in about three months.

EASTON, MASS.—The installation of an electric-lighting system in Easton is under consideration. The Edison Electric Illuminating Company of Brockton has offered to supply the service and furnish street lamps under a ten-year contract at the same rate as charged in Mansfield.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has applied to the Selectmen for locations for its pole lines through West and North Falmouth. The company has not yet decided on the location of its permanent power station. Eugene Carpenter is treasurer of the company.

FRANKLIN, MASS.—The Union Electric Light Company has been granted a franchise to erect its transmission line in Wrentham to the Foxboro line. The company has also petitioned the Selectmen of Plainville for a franchise in that town.

GARDNER, MASS.—The Gardner Electric Light Company is extending its electric service to Barre, Templeton and Belchertown. The company is supplying lighting service on a flat-rate basis with excess indicator.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has applied to the State Railroad Commission for permission to increase its capital stock from $1,948,100 to $6,848,100, the proceeds to be used for extensions, improvements, refunding debt, etc.

WALTHAM, MASS.—The Board of Aldermen is considering the question of authorizing all wires in the business section of the city to be placed underground.

BARAGA, MICH.—Bids will be received by the village of Baraga at the office of James McMahan, village clerk, until Oct. 16, for construction of an electric-light plant and improvements to the water-works system as follows: 1—Construction of brick building, 42 ft. x 89 ft., with extensions. 2—A 120-hp gas producer plant, one 85-hp and one 35-hp gas engine or oil engines of same size. One 400-gal. triplex pump. 3—Electrical installation. One 50-kw generator, switchboard, etc. 4—Pole line and wiring. 5—Gravity pipe line. 6—Reinforced-concrete reservoir having a capacity of 180,000 gal. 7—Wells. Each of the above to be installed complete and to include all auxiliaries. Plans and specifications are on file at the office of the village clerk and at the offices of the Oscar Claussen Engineering Company, St. Paul, Minn., consulting engineer.

CROSBY, MINN.—It is reported that a company has been organized by H. De Groat, William P. Harrison and Grace Weiss, of Duluth, Minn., to establish a water, light and power plant. The company will be capitalized at $50,000.

DULUTH, MINN.—The City Council has directed the Duluth Street Railway Company to extend its railway from Seventy-first and Grand Avenues to New Duluth, Minn.

FARMINGTON, MINN.—A company has been organized in Farmington, to be known as the Farmington Electric Light & Power Company, for the purpose of supplying electricity in this town. The company is in the market for electrical material of all kinds. The plant is equipped with a 220-volt, three-phase system. The officers of the company are: A. H. Sprute, president; F. H. Eddy, vice-president and manager; Charles S. Lewis, secretary, and C. A. Carlson, treasurer.

MAYNARD, MINN.—Application has been made to the Council for a franchise to install an electric-light plant in Maynard.

THIEF RIVER FALLS, MINN.—It is reported that bids for the erection of an auxiliary steam plant have been laid aside until the committee has investigated oil plants. Bonds to the amount of $40,000 were recently voted for improvements to the municipal electric plant.

FORSYTH, MO.—The Ozark Power & Water Company, Chemical Building, St. Louis, Mo., is contemplating the construction of a hydro-electric plant on White River, about 2 miles from Forsyth, to cost about $550,000. Holman & Laird, of St. Louis, Mo., are consulting engineers.

MONETT, MO.—Work has commenced on the construction of the proposed municipal electric-light plant, for which bonds to the amount of $35,000 were voted in the spring of 1910. The construction of the plant has been delayed by litigation instituted by the private company now operating in Monett.

UNIONVILLE, MO.—Plans, it is reported, are being considered for the reconstruction and extension of the municipal electric-light plant and water-works system for which bonds to the amount of $10,000 have been voted. B. H. Bonfoey is Mayor.

TERRY, MONT.—The proposition to grant a ten-year franchise to E. H. Phillips to establish an electric-light plant in Terry will be submitted to a vote on Oct. 9.

GRAFTON, NEB.—The contract for construction of the proposed electric-light plant and water-works system has been awarded to the Alamo Engine & Supply Company, of Omaha, Neb., for $12,490. Elmer L. Jensen, of Harvard, Neb., is engineer.

HINSDALE, N. H.—The Selectmen of Hinsdale have entered into a contract with the Twin State Gas & Electric Company, of Brattleboro, for street lighting for a period of ten years. The contract calls for 40-cp lamps at $17 each per year and 80-cp lamps at $20 per lamp per year. The company agrees to put its line in thorough repair and to install new street fixtures. It is proposed to replace the 40-cp lamps on Main Street with lamps of 80 cp.

CHESTER, N. J.—The lighting commissioners have entered into an arrangement with the Bernards Water Company, of Bernardsville, N. J., to light the streets of the town with electricity. The service will be supplied from the Forest Hills plant.

CLAYTON, N. J.—At an election held recently the citizens voted against the proposition to issue $10,000 in bonds for the installation of a municipal electric-light plant. A bill was passed by the last Legislature giving Clayton authority to borrow $10,000 for the construction of a municipal light plant.

PATERSON, N. J.—The contract for the installation of the fire and police alarm system has been awarded to the Gamewell Fire Alarm Company for $21,750.

RED BANK, N. J.—T. F. Hylan, of the Blackall & Baldwin Company, who was engaged by the commissioners to prepare plans and specifications for the proposed municipal electric plant in Red Bank, has submitted his report to the commissioners. He estimates the cost of the plant at $35,000 and the annual cost of operating same at $8,350, including interest on the investment. At present it costs the town $9,560 per year for municipal lighting.

IOLA, N. M.—B. E. Kern, of Deming, N. M., and associates are making arrangements to install a large central electric power plant to supply electricity to operate pumps and motors for the purpose of irrigating about 32,000 acres of land in this section. The project includes the installation of producer gas generators, gas engines, electric generators, 100 pumps of 1000-gal. capacity each, 100 motors of 25-hp each and 50 miles of transmission lines. A well will be driven upon each tract of 320 acres and a pump installed. The cost of the work is estimated at $260,000.

LAS CRUCES, N. M.—The Tri-State Telephone Company has been granted a franchise to install a telephone system at Las Cruces. D. D. Clark is local representative.

BINGHAMTON, N. Y.—Mayor John J. Irving has signed the ordinance passed by the Council calling an election to vote on the proposition to issue bonds to the amount of $158,000 for the installation of municipal electric-light plant in Binghamton.

NEWBURGH, N. Y.—The City Council has awarded a contract for fifty-three ornamental lamp standards, each to carry two globes, to the Ornamental Light Company, of New York, N. Y., at $55 each. The contract for erecting the new standards was awarded to the Central Hudson Gas & Electric Company, at $16 each.

NEW YORK, N. Y.—The contract for the installation of a conduit and electric-wiring system in the new post office building in New York, N. Y., is reported to have been awarded by the supervising architect to the Van Wagoner Construction Company, 1133 Broadway, New York, N. Y., at $55,720.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until Oct. for installing electric elevators and ash hoist in the Washington Irving High School, located on Irving Place, between Sixteenth and Seventeenth Streets, Borough of Manhattan, N. Y. Blank forms, plans and specifications may be seen at the above office.

OLEAN, N. Y.—The contract for construction of underground conduit in Olean by the New York Telephone Company has been awarded to the Dunkirk Construction Company, of Dunkirk, N. Y.

PENN YAN, N. Y.—Among the improvements contemplated at Keuka College is the installation of an electric-light plant. William J. Tyler, secretary and superintendent of the Penn Yan, Keuka Park & Branchport Railway Company, has given the use of an engine and William Morris has contributed an engine. The plant will be installed at once.

SYRACUSE, N. Y.—Complete plans and specifications for extend

the underground service of the fire alarm telegraph system have been submitted by E. A. Fitzgerald to H. E. Hessler, commissioner of public safety. As soon as plans are approved proposals will be called for.

TONAWANDA, N. Y.—The Frontier Electric Railway Company, which was recently granted a franchise to operate an electric railway through North Tonawanda, will apply to the Board of Aldermen for a franchise to operate its proposed railway through Tonawanda. The new road will be built over a private right of way.

WAPPINGER FALLS, N. Y.—The Garner Print Works & Bleachery has recently remodeled and extended its electric-light system in Wappinger Falls. A twenty-four-hour service has been established, electricity being supplied for lamps and motors. Lester McKenney is electrical engineer.

CHARLOTTE, N. C.—Proposals will be received by the Board of Water Commissioners of the city of Charlotte, at the office of A. H. Hearn, clerk, until Oct. 17, as follows: For furnishing two 300-hp motors, two 5,000,000-gal. centrifugal pumps, one 3,000,000-gal. steam pump, transformers and switchboard, two boilers and setting same, laying about 9 miles of 24-in. cast-iron pipe and furnishing valves. Plans and specifications are on file at the above office and in the office of Gilbert C. White, engineer, Charlotte, N. C.

NASHVILLE, N. C.—It is reported that L. L. Davenport is interested in a project to establish an electric-light plant to supply electricity in Nashville. It is proposed to form a company to operate same.

BARBERTON, OHIO.—The Barberton Light & Power Company is reported to be contemplating extensions and improvements to its plant to meet the increasing demand for electrical service.

BEAUMONT, OHIO.—Arrangements are being made by J. J. Henry, for the erection of a large central power station at Beaumont, Ohio, with the purpose of utilizing the waste coal in the Hocking Valley for fuel to generate electricity for long-distance transmission. Surveys for the proposed plant will soon be made under the supervision of the J. G. White Company, of New York, N. Y. The cost of the plant is estimated at $1,500,000. It is proposed to supply electricity to all the mines in the Hocking Valley district and to towns and railways in that vicinity.

CLEVELAND, OHIO.—The Pennsylvania Railroad Company is reported to have been granted a permit to erect a power plant at the foot of West Fiftieth Street, to cost approximately $75,000.

DENNISON, OHIO.—The high-tension transmission line between Dennison and New Philadelphia, Ohio, has been completed. Electricity for operating the local system and the Dennison-Uhrichsville street cars will be supplied from the plant at New Philadelphia. The local plant will be converted into a substation and a motor-generator set installed for use in case of emergency.

STEUBENVILLE, OHIO.—Extensive improvements and extensions, it is stated, are to be made to the system of the Tri-State Traction & Light Company in Steubenville as soon as the improvements now under way at the East Liverpool plant are completed. The cost of the work is estimated at about $40,000.

MULDROW, OKLA.—Sealed bids will be received at the office of the town clerk, Muldrow, Okla., until Oct. 10 for construction of combined water-works system and electric-light plant, to cost approximately $33,000. Plans and specifications are on file at the office of the city clerk and the office of the Western Engineering Company, 703 American National Bank Building, Oklahoma City, Okla. E. A. Miller is city clerk.

ASHLAND, ORE.—The Siskiyou Electric Power & Light Company, of Yreka, Cal., which owns the Ashland Electric & Power Company, has been instructed by the City Council to remove its poles and wires from the streets by Oct. 15. The city claims that the company is operating without a franchise. The Siskiyou company has submitted a tentative proposition to the Council offering to settle difficulties permanently by taking over the municipal electric plant, assuming the bonded indebtedness amounting to $105,000 and other considerations, including contract for fixing of rates for service during the period of the fifty-year franchise it asks.

HOOD RIVER, ORE.—A proposition has been submitted to the City Council by Samuel Samson offering to supply electricity for lamps and motors in Hood River at 50 per cent lower than the present charge. If the offer is accepted Mr. Samson will erect a transmission line from his plant on Wind River, near Stevenson, Wash., to Hood River.

KENO, ORE.—Plans are being considered by the Siskiyou Electric Light & Power Company for the erection of the necessary transmission system to tie its subsidiary electric-power plants with its main generating station at Keno. L. J. Ban is in charge of the work.

ONTARIO, ORE.—The Snow-Moody Development Company is planning to install an electric-pumping plant on the Snake River.

PENDLETON, ORE.—Estimates have been submitted to the City Council by the Pacific Power & Light Company and the Pacific Telephone & Telegraph Company as to the cost of placing wires underground in the business section of the city. The cost to the power company is estimated at $20,900 and that to the telephone company at $20,000.

PORTLAND, ORE.—The Oregon Electric Railway Company is planning to erect five new substations in the near future.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has made application for several franchises for extensions in the east section of the city.

PORTLAND, ORE.—Plans are being prepared by the Portland Railway, Light & Power Company for extending its electric railway from Rose City Park to a point near the Columbia River.

PORTLAND, ORE.—An electric-light and power plant will be installed in the twelve-story addition to be erected to the Oregon Hotel, plans for which are being prepared by Doyle, Patterson & Beach, of Portland, architects.

SALEM, ORE.—The City Council has passed ordinances providing for the installation of ornamental lamp standards, each carrying three lamps, in the business section of the city.

THE DALLES, ORE.—Application has been made to the City Council by N. C. Evans, of Hood River, Ore., for an electric-light and power franchise at The Dalles. A reduction of 25 per cent in the present rates is offered. Mr. Evans owns a power site on the Hood River and proposes to erect a 7000-hp hydroelectric power plant with transmission lines to this place and Mosier.

PANAMA.—The date for receiving proposals for plant and materials for the hydroelectric station at Gatun as per circular No. 648 has been extended from Oct. 9 to Oct. 24. Major F. C. Boggs is general purchasing officer.

PHILADELPHIA, PA.—A proposition to convert the old Fairmount pumping station into an electric generating plant to supply electricity for lamps for Fairmount Park is under consideration by Mayor Reyburn and other city officials.

MANILA, P. I.—Sealed proposals will be received at the office of Major C. H. McKinstry, officer in charge of defensive works, Manila, P. I., until Dec. 4, for condensers, pumps, feed-water heaters and forced draft fans. For further information apply to the above office or to the Chief of Engineers, United States Army.

DUPREE, S. D.—A franchise has been granted to T. E. Sexton to install a telephone system in Dupree.

BRISTOL, TENN.—W. J. Oliver, of Knoxville, Tenn., has completed the construction of a dam across the Wautauga River, in Carter County, for the development of 3000 hp to be transmitted to Bristol. The transmission line from the power house to Bristol has been completed by the Wautauga Power Company and the company will soon be ready to supply hydroelectric power in this city.

ALVIN, TEX.—The Alvin Water, Light & Ice Company and the Alvin Ice, Light & Power Company have been consolidated. Arrangements are being made to organize a new company to be capitalized at $40,000.

AUSTIN, TEX.—Plans have been prepared by J. C. Dumont and associates for the construction of a 15-ft. dam across the Colorado River near Austin for the purpose of securing a water supply to irrigate about 10,000 acres of land. The proposed dam will be 350 ft. long, built of reinforced concrete and will also supply power for generating electricity to be transmitted to neighboring industrial enterprises. The plant will have an output of 300 hp.

BRUNNER, TEX.—The plant of the Brunner Water & Light Company has been completed and placed in operation. The company is chartered to supply water and electricity in Brunner and surrounding territory, including Chaneyville.

CARLSBAD, TEX.—Plans which have been accepted for the new tuberculosis sanitarium at Carlsbad include a power and light plant. It is understood that bids will soon be asked for construction of same. Henry T. Phelps, of San Antonio, Tex., is architect.

COMMERCE, TEX.—The Gulf Cities Telephone Company, it is reported, is contemplating putting its cables underground in the business section of the city and installing a flashlight police-alarm system.

DENTON, TEX.—The City Council is reported to have awarded a contract to the Briggs-Weaver Company, of Dallas, Tex., for improvements to the municipal electric-light plant, to cost about $10,000. The work will include the installation of a 200-kw alternating-current generator and a 300-hp Corliss engine.

ELECTRA, TEX.—It is reported that plans are under consideration to form a company for the purpose of establishing a plant to supply electricity in Electra.

GUFFEY, TEX.—The Beaumont Ice, Light & Refrigerating Company is extending its electric transmission system to the oil field adjacent to Guffey to supply electricity to operate the pumps. The present steam pumping plant will be replaced by electric motors.

HARLINGEN, TEX.—At an election held recently the proposition to issue bonds to the amount of $22,000 for water works and electric-light plant was carried. It is understood that contract for construction of the plants will soon be let.

HEARNE, TEX.—The O'Neil Engineering Company, of Dallas, Tex., is reported to have been awarded the contract for construction of electric-light plant and water-works plant. The electric plant will have an output of 75 kw. The cost of the work is estimated to be in the neighborhood of $30,000.

MARLIN, TEX.—A franchise has been granted to J. B. Earle, of Waco, Tex., to install a telephone exchange and system in Marlin.

PORT LAVACA, TEX.—The Port Lavaca Light, Ice & Power Company is reported to be contemplating enlarging and improving its system. It is proposed to enlarge the cold-storage and refrigerating departments and install a 125-hp engine.

WACO, TEX.—The City Commissioners are reported to be contemplating the construction of a municipal electric-light plant, for which bonds to the amount of $250,000 have been voted. It is said that negotiations between the commissioners and the Waco Gas & Electric Company relative to a new lighting contract have ceased.

KAYSVILLE, UTAH.—The stockholders of the Davis County Light & Power Company have decided to increase the capital stock of the company from $50,000 to $150,000, the proceeds to be used for improvements and extensions to its system, including the erection of an auxiliary steam power plant for use during low water periods and emergencies. It is also expected that the company will extend its distributing system to supply electricity to all the towns in Davis County.

LOGAN, UTAH.—The Trustees of the Agricultural College of Utah have awarded the contract for the construction of an electric-light plant for the college to M. J. Moran, of Ogden, Utah, at $17,000. The plant will be located at the mouth of Logan Canyon and will supply electricity for the State building at Logan the surplus to be transmitted over the transmission lines of the Telluride Power Company to Salt Lake City and Ogden, to furnish electrical energy to the State University, State penitentiary and the reform school. The plant will be under the supervision of the Board of Trustees of the Agricultural College.

SALT LAKE CITY, UTAH.—The City Council, it is reported, has authorized the installation of 200 new street arc lamps.

SALT LAKE CITY, UTAH.—The Salt Lake Commercial Club is considering a proposition to illuminate South Temple and Third South Streets from Main Street to the railroad station.

ROANOKE, VA.—The Roanoke Railway & Electric Company is planning to erect a new substation at Mason's Creek on the Salem line. The station will have an output of 500 hp and will supply electricity to operate its railway between the city limits of Roanoke and Salem.

WEST POINT, VA.—The Town Council has granted the People's Light, Heat & Power Company a franchise to supply electricity for lamps and motors in West Point. John R. McRae is president of the company.

CHEHALIS, WASH.—The Board of Commissioners of Lewis County has granted the Washington-Oregon Corporation a franchise to erect a transmission line from Chehalis to Meskill, in return for which the company has agreed to supply electricity for lighting the court house, free of charge, as long as the franchise is in effect. The cost of lighting the court house is about $250 per year.

GOLDENDALE, WASH.—The Pacific Light & Power Company, which recently took over the local electric plant, has been granted a franchise by the County Commissioners to erect a transmission line from Goldendale to Centerville, a distance of 7 miles. The company is said to be preparing to make extensive improvements to the plant.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has awarded the contract for the erection of a new electric plant in North Yakima to Pinner & Griffith, of North Yakima, at a cost of $23,400. The City Council has awarded the Pacific Power & Light Company a contract to supply electricity for an ornamental street-lighting system. Cluster lamps will be installed.

SEATTLE, WASH.—The Board of Public Works has approved an ordinance providing for the installation of a central fire-alarm system, to cost approximately $45,000.

SPOKANE, WASH.—Plans have been prepared by the city of Spokane for an ornamental street-lighting system on the Monroe Street bridge.

VANCOUVER, WASH.—The Mount Hood Railway & Power Company has been granted a franchise to operate an electric railway in Vancouver for a period of fifty years. The company contemplates extensions to its railway system in Vancouver and Clarke Counties, involving an expenditure of about $1,000,000.

WALLA WALLA, WASH.—Mayor Cropp, in a message to the City Council, recommends the construction of a municipal electric-light plant.

NEW MARTINSVILLE, W. VA.—The property and franchises of the New Martinsville Electric Light, Heat & Power Company will be sold at auction on Oct. 26 by George Hook, trustee.

ASHLAND, WIS.—It is reported that preparations are being made by the Ironwood & Bessemer Railway & Light Company for the erection of a transmission line from Mellen Falls to Ashland, a distance of 27 miles.

PLYMOUTH, WIS.—It is reported that bonds to the amount of $20,000 will be issued, the proceeds to be used for rebuilding the municipal electric-light plant.

LETHBRIDGE, ALTA., CAN.—Sealed tenders will be received by G. W. Robinson, secretary and treasurer of the city of Lethbridge, until Nov. 24 for furnishing and installing the following equipment for the municipal power station extension: Section B—Boilers and accessories. Section C—Mechanical draft and economizer. Section D—Steam turbo-generator and condensing equipment. Section E—Steam-driven exciter. Section G—Substation equipment. Plans and specifications can be obtained from Arthur Reid, superintendent engineer, of Lethbridge, Alta.

VERMILION, ALTA., CAN.—Tenders will be received by C. V. Ceasar, secretary and treasurer of Vermilion, until Oct. 16, for furnishing and installing the following equipment: Section A—Steam boiler, feed pumps, heater, etc. Section B—Steam engine. Section C—Electric generator and switchgear. Plans and specifications may be obtained on application to C. V. Ceasar, secretary and treasurer, or from Bowring & Logan, engineers, 34 Victoria Street, Toronto, Ont., Can.

VICTORIA, B. C.—The British Columbia Electric Railway Company has awarded a contract to Moore & Pethick for an extension of its railway along the Saanich peninsula for a distance of 18 miles.

NIAGARA FALLS, ONT., CAN.—It is stated that the new Q. V. N. F. park boulevard, between Niagara Falls and Ft. Erie, will be lighted by electricity. It is proposed to erect ornamental lamps standards with cluster lamps 100 ft. apart on the boulevard.

NORWICH, ONT., CAN.—The by-law authorizing the town to purchase the local electric-light plant was carried at an election held Sept. 15. It is understood that electricity for operating, the system will be secured from the Hydroelectric Power Commission and a twenty-four-hour service established.

TORONTO, ONT., CAN.—Tenders will be received by the chairman of Board of Control, City Hall, Toronto, Ont., Can., until Oct. 18 for furnishing overhead and pole-line materials, including No. 00 trolley wire, 300,000-circ. mil feeder wire, steel tubular poles, span wire, hangers, ears, insulators, pins, etc., plans and specifications for which may be obtained on application to the Department of Railways and Bridges, office of the city engineer, Toronto. G. R. Geary, Mayor, is chairman of board.

BUCKINGHAM, QUE., CAN.—The James Maclaren Company, of Buckingham, has awarded a contract for the construction of a dam across the Lievre River above High Falls, located 25 miles from Buckingham, to Haney, Quinlan & Robertson, of Montreal, Que. J. B. McRea is engineer in charge.

New Industrial Companies.

THE CONLAN ELECTRICAL MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $25,000. The company proposes to manufacture electric switches, plugs, receptacles, etc. The incorporators are G. A. Reading, M. E. Reading and W. H. LaForge, of New York, N. Y.

THE ELECTRIC MAIL CARRIER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000 for the purpose of manufacturing and dealing in mechanical appliances and devices. The incorporators are: C. E. Reid, of New York, N. Y.; W. J. Griffiths, Jr., and C. G. Rice, both of Mount Vernon, N. Y.

THE KARTZMARK SAFETY DEVICES COMPANY, of New York, N. Y., has been granted charter with a capital stock of $20,000 and proposes to do a general mechanical engineering business. The incorporators are: George B. Hinckley, 71 Windsor Avenue, Buffalo, N. Y.; Otto Kartzmark, 7901 Third Avenue, Brooklyn, N. Y., and Otto Griswold, 25 Magnolia Avenue, Jersey City, N. J.

THE KENDRICK ELECTRIC COMPANY, of Seattle, Wash., has been incorporated with a capital stock of $30,000 by R. G. and T. C. Kendrick to manufacture and deal in electrical machinery.

THE SHOCKLESS CURRENT ELECTRIC & MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: C. Sulzner, G. Kuenatle and C. E. Luburg, of Philadelphia, Pa.

THE SIEMUND-WENZEL ELECTRIC WELDING COMPANY, of Washington, D. C., has filed articles of incorporation under the laws of Delaware. The company is capitalized at $100,000 and the incorporators are: W. R. Gravenor, B. L. Hackenberger and H. J. Pack, o Washington, D. C.

THE UNIVERSAL TURBINE COMPANY, of Jersey City, N. J., ha filed articles of incorporation with a capital stock of $300,000. Th company proposes to deal in machinery. The incorporators are: H Stanley Todd, 80 West Fortieth Street; William Donahue, 1 Libert Street, both of New York, N. Y., and M. Casewell Heine, 16 Osborn Terrace, Newark, N. J.

THE WEEKS REFLECTOR COMPANY, of New York, N. Y., ha been incorporated by Philip Huetwohl, Schuyler M. Meyer, 71 Broa way, and Reginald Sanford, 217 William Street, New York, N. The company is capitalized at $10,000 and proposes to manufacture luminating appliances, reflectors, etc.

THE WINKLER CONSTRUCTION COMPANY, of Augusta, Main has filed articles of incorporation with a capital stock of $1,000,000 f the purpose of manufacturing and installing machinery, power equipmer etc., and building power houses and factories. E. M. Leavitt is preside and treasurer and Lewis A. Burleigh, clerk.

New Incorporations.

PHOENIX, ARIZ.—The National Power Company of Mexico l been incorporated with a capital stock of $1,000,000. The officers a Edward S. Field, president; Walter R. Grogan, vice-president, a Conrad Krichner, secretary and treasurer.

CALISTOGA, CAL.—The Calistoga Electric Company has been corporated with a capital stock of $25,000 by D. R. Wedamand, C.

Crouch and E. M. Billings. The company proposes to purchase electricity from the Napa Valley Electric Company for distribution in Napa Valley.

CHICAGO, ILL.—Articles of incorporation have been filed for the Oak Hill Street Railway Company with a capital stock of $20,000 to construct and operate street and interurban railways. The incorporators are: Charles Pullman, I. A. Isaacson and L. S. Watts.

NORTHWOOD, N. D.—Articles of incorporation have been filed for the Northwood Mill & Light Company with a capital stock of $25,000 by David D. Hiebert, of Harvey, Otto O. Restodius, of East Grand Forks, and Otto Sangstad, of Northwood.

MANHEIM, PA.—The Manheim Suburban Electric Company has been granted a charter with a capital stock of $100,000. W. W. Griest, of Lancaster, Pa., is one of the incorporators.

Personal.

MR. THOMAS A. EDISON sailed from Europe for home on September 28.

MR. H. H. SCOTT, of Henry L. Doherty & Company, has gone abroad for a two months' recreation trip.

MR. HAROLD W. PRICE, of the electrical engineering department of the University of Toronto, Canada, has been appointed associate professor of electrical engineering.

MR. VAL. A. FYNN, consulting electrical engineer and designer for the Wagner Electric Manufacturing Company, has returned to St. Louis after spending three months in Europe.

MR. CHARLES S. WINSTON, chief engineer for the Kellogg Switchboard & Supply Company, of Chicago, has been elected president of the Alumni Association of the University of Chicago for the year 1911-1912.

MR. W. H. PAPE, who for five years has been general manager of the Pittsburgh & Butler Street Railway Company and the Butler Passenger Railway Company, has resigned his position to go into manufacturing business for himself.

PROF. HARRIS J. RYAN, of the electrical engineering department of Stanford University, California, has been granted a year's leave of absence in order to conduct some investigations in connection with the Los Angeles aqueduct.

MR. M. H. PEININGER, formerly Iowa representative of the Globe Machinery & Supply Company, has accepted the position of general manager of that company, succeeding Mr. R. W. Richardson, who goes with H. M. Byllesby & Company, Chicago.

MR. A. H. KROM, formerly employed by the Commonwealth Edison Company as commercial and illuminating engineer, has been appointed in charge of the illuminating engineering and sales of the Chicago branch of the Haskins Glass Company, of Wheeling, W. Va.

PROF. ALEXANDER D. DU BOIS, who was instructor in electrical engineering at Cornell University last year, has entered upon his duties as assistant professor at Purdue University. Prof. Du Bois, who is a native of Springfield, Ill., is a graduate of the University of Illinois.

MISS GRACE T. HADLEY, formerly associate editor of the *Electric St. Louis Magazine*, the publication of the Union Electric Light & Power Company, St. Louis, has joined the editorial staff of *Popular Electricity*, Chicago, in which she will conduct a department of interest to women readers.

MR. ERNEST P. KORST has been appointed new-business manager of the Ottumwa (Ia.) Railway & Light Company. Mr. Korst is a brother of Mr. Phillip H. Korst, general manager of the Janesville Electric Company, and was formerly located at Spokane, Wash., Sand Point, Idaho, and Eugene, Ore.

MR. A. M. BUCK, M.E., for two years assistant professor of electrical engineering at New Hampshire College and for the past year professor of electrical engineering at the Clarkson School of Technology, has been appointed assistant professor of railway electrical engineering at the University of Illinois. Mr. Buck is a Cornell graduate of 1904.

MR. CALVERT TOWNLEY, assistant to President E. M. Hepp, of the Westinghouse Electric & Manufacturing Company, has been placed in charge of the auxiliary Westinghouse organization to succeed Mr. George C. Smith, who resigned to devote his time to the interests of the engineering firm of James Stewart & Company, of which he is a partner.

MR. JAMES P. McGRADY, treasurer of the Worcester Electric Manufacturing Company, Worcester, Mass., was married Oct. 3 to Miss Edna E. Kett, of Fairhaven, Vt., the wedding taking place at the home of the bride's mother. The bride is a daughter of the late Mr. H. Kett, of the Victor Slate Company, who was well known in electrical circles.

MR. T. C. MARTIN, secretary of the National Electric Light Association, encountered a feature not down on the program on the occasion of his recent address before the British Columbia Section of that association at Vancouver, B. C. He was presented with an N. E. L. A. section badge made of British Columbia gold. This gift is now one of the choicest of Secretary Martin's trophies.

MR. CHARLES C. TENNIS, president of the Tennis Company, has been elected vice-president of the Pittsburgh & Butler Street Railway Company in charge of operation. Mr. Tennis is a native of Juniata County, Pennsylvania, and has been for some years actively engaged in the construction and operation of electric-railway properties in Pennsylvania, Ohio, Indiana and Kentucky.

MR. GEORGE A. DAMON, dean of Throop Polytechnic Institute, of Pasadena, Cal., begins this year his active duties as supervisor of electrical, mechanical and civil engineering. Mr. Damon also retains his connection with the Arnold Company, which has been occupied recently in making an investigation of the transit situation in Los Angeles. Mr. Royal W. Sorensen is professor of electrical engineering at Throop Institute.

MR. W. H. TIMBIE has been appointed head of the applied science department at Wentworth Institute. Prof. Timbie is a graduate of Williams College in the scientific course and was formerly instructor at Pratt Institute, Brooklyn. He is author of a treatise on the elements of electricity. Mr. Philip Brooks, assistant to Mr. Timbie, was graduated from Pratt Institute, where he was instructor for two years subsequent to graduation.

DR. HENRY PHELPS GAGE, who has been conducting experiments relating to light phenomena at Cornell University during the past three years, has become associated with the Corning Glass Company, Corning, N. Y., to devote his time for the present to the photometry of railroad signals. Dr. Gage graduated from Cornell University with the degree of A.B. in 1908. He received the degree of M.A. in 1909, and Ph.D. in 1911.

PROF. A. L. WILLISTON, for the past twelve years director of the School of Science and Technology of Pratt Institute, Brooklyn, has resigned that position to become principal of Wentworth Institute, a new trade school in Boston. Prof. Williston is a graduate of the Massachusetts Institute of Technology and before going to Pratt Institute in 1898 was a member of the faculty of his alma mater and of Ohio State University. He will make his home in Brookline, Mass.

MR. F. H. TIDNAM, general manager of the Oklahoma City Gas & Electric Company, is abroad on an extended vacation visiting relatives in England. Before his return to the United States next month he plans to tour Germany and other Continental countries. While this is primarily a pleasure trip, Mr. Tidnam has a business mission abroad in connection with the European rights for a reinforced-concrete pole for which he is the patentee. During Mr. Tidnam's absence Mr. W. R. Molinard is acting general manager at Oklahoma City.

MR. HARRISON T. MATTHEW, who is now in Denver and who will spend some time in Colorado, Utah and the Pacific Coast States on a special mission for the *Electrical World* and the McGraw Publishing Company, made many warm friends in Chicago during his three-year sojourn in that city as Western manager for the *Electrical World*. Before leaving, Mr. Matthew was entertained by his office associates at a dinner given in his honor at the Chicago Athletic Club and was presented with a diamond-studded watchfob as a memento of a pleasant companionship.

PROF. H. H. HIGBIE has been appointed head of the electrical department at the new Wentworth Institute in Boston. Professor Higbie is a graduate in electrical engineering from Columbia University. After teaching steam and gas-engine laboratory practice at Columbia, he was instructor in the same subjects at the University of Michigan, after which he entered the electrical engineering department of that university as instructor in dynamo-electric machinery. For several years he was assistant professor of electrical engineering, in charge of the dynamo and photometric laboratories at Michigan. He has also made a specialty of electrical illumination.

MR. E. C. CARPENTER, who has been with the Indiana Union Traction Company interests for some years in various capacities, has been appointed manager of the Pittsburgh & Butler Street Railway Company and the Butler Passenger Railway Company to succeed Mr. W. H. Pape. Mr. Carpenter became connected with the system in Anderson, Ill., under Mr. Charles L. Henry twenty years ago and served under Mr. Henry during the construction of the first interurban electric railway in Indiana, between Anderson and Summitville. He has remained with the Anderson City Railway and its successor, the Indiana Union Traction Company, continuously since that time.

DR. CLARENCE A PIERCE, who has been appointed assistant professor of theoretical engineering at the Worcester Polytechnic Institute to succeed Dr. George R. Olshausen, received his B.S. degree at Wesleyan University in 1902 and his M.S. degree in 1904. For seven years he has been instructor in electrical engineering at Cornell University, where in 1908, he received the degree of Ph.D. He has specialized in electrical engineering, physics and mathematics, and has published many important articles. He is co-author with Dr. Frederick Bedell of a text-book on direct-current and alternating-current testing which is now in its second edition.

MR. ALFRED CRAVEN, who has been acting as chief engineer of the New York Public Service Commission since Sept. 23, 1910, when Mr. Henry B. Seeman resigned, has been appointed chief engineer at a salary of $15,000. Mr. Craven graduated from the United States Naval Academy, Annapolis, in 1867. He served in the navy until 1871 and then became connected with the State Geological Survey of California. After some years of private practice he entered in 1884 the service of the New York Aqueduct Commission and in 1900 became a division engineer of the old New York Board of Rapid Transit Commissioners. He succeeded Mr. George S. Rice as engineer in charge of subway construction in 1884.

GENERAL GEORGE H. HARRIES has resigned his position as vice-president of the Washington (D. C.) Railway & Electric Company and is closing up his affairs in that city to become a member of the operating staff of H. M. Byllesby & Company, Chicago. He will make his home in the latter city. General Harries has been a successful public utility operator for fifteen years. He is president of the Association of Edison Illuminating Companies, treasurer of the National Electric Light Association and second vice-president of the American Electric Railway Association. He obtained his military title during the Spanish-American war. General Harries has given much time to broad movements of civic development, serving as secretary of the Washington Board of Trade in 1898 and 1899. He will be an acquisition to the Byllesby forces.

MR. CHAUNCEY L. WILLIAMS, the recently appointed Western manager of the *Electrical World*, with headquarters in Chicago, is an advertising man of ability and experience. He is a native of Madison, Wis., and a University of Wisconsin man, class of 1894. Several of his early years were spent abroad, and after leaving college he engaged in the general book-publishing business in Chicago as a member of the firm of Way & Williams, whose enterprise more than one Western author has reason to thank. Later he became the Chicago representative of the *Engineering Review*, and three years afterward he accepted the position of Western manager for the *Architectural Record*, which position he held for ten years, resigning a short time since to join forces with the *Electrical World*. Mr. Williams is a man of force and may be described as a thorough student of the modern school of constructive advertising salesmanship. He is a member of the Psi Upsilon fraternity, the City Club, of Chicago, and the Missouri Athletic Club, of St. Louis. He is married and with his interesting family makes his home in Hubbard Woods, a North Shore suburb of Chicago.

Obituary.

MR. CHARLES J. DAVIS, forty-six years old, general foreman of the electrical department of the Baltimore & Ohio Railroad Company, died last week in Baltimore after an illness of two weeks. Mr. Davis had been in the employ of the company since 1907 as general foreman of the electrical department. Prior to that time he was in the employ of the General Electric Company. His home was in Auburn, N. Y.

MR. EVERETT COPLEY, of the New York sales office of the Westinghouse Electric & Manufacturing Company, died at his home in New York on Thursday, Sept. 27, of typhoid fever. Mr. Copley was graduated from the University of Kansas in 1906, where he won a scholarship which gained him membership in the Phi Beta Kappa Society. Upon leaving college he entered the employ of the Westinghouse company and was engaged in the work of the electrification of the New York, New Haven and Hartford Railroad. About three years ago he entered the New York sales office of the company, where his great capability and thorough knowledge of electrical work soon gained for him the admiration of his fellow-employees, and a bright future was the prediction of everyone associated with him. Mr. Copley was twenty-five years of age and was a member of the Crescent Athletic Club of Brooklyn.

Trade Publications.

MERCURY-ARC RECTIFIERS.—Bulletin No. 4871 describes the General Electric Company's mercury-arc rectifiers for battery charging and supersedes that company's previous bulletin on the subject.

CONTROL APPARATUS FOR STEEL MILLS.—Bulletin No. 4873, recently issued by the General Electric Company, illustrates and describes in considerable detail that company's control apparatus for steel mills, including automatic compensators, contractors, master controllers, rheostats, controllers, etc.

DE LAVAL STEAM TURBINE.—In a 32-page pamphlet entitled "A Steam Turbine for Driving Direct-Current Generators," the De Laval Steam Turbine Company, of Trenton, N. J., presents an extended discussion of the different types of steam turbines and their comparative merits. The booklet describes the De Laval multi-stage geared turbine, as applied to driving direct-current generators and to the direct-driving of centrifugal pumps, blowers and air compressors and for rope or belt transmission.

AIR PUMPS.—Bulletin 103, issued by the Wheeler Condenser & Engineering Company, Carteret, N. J., is devoted to the Wheeler-Edwards air pump for operation in connection with surface condensers handling both air and condensed steam. The function of the air pump and its relation to the condenser proper are first taken up, and then the construction and operation of the pump are discussed in detail and a comparison of its efficiency with other types of pumps handling air and condensate is made. The bulletin contains upward of fifty illustration, including photographs of single steam-driven, twin steam-driven, triplex motor and steam-driven pumps, twin steam-driven pump with separate hot well, combined engine-driven single air pump and centrifugal pump, combined motor-driven triplex pump and centrifugal pump, and also several charts relative to the question of air and its removal from condensers.

BUSINESS NOTES.

THE LEWIS-ROTH COMPANY has removed its office from the Real Estate Trust Building, Philadelphia, to the Denckla Building, Eleventh and Market Streets, same city.

DEMAND FOR TRANSFORMERS.—The Moloney Electric Company, of St. Louis, which opened a branch office in Windsor, Ont., not long ago, reports the receipt of a large number of orders recently.

THE SIMS MAGNETO COMPANY now occupies its large plant at Bloomfield, N. J., the main building of which occupies four and one-hal acres, and has two floors. All machinery is electrically driven. The plant is entirely for the manufacture of magnetos for automobiles.

THE CROUSE-HINDS COMPANY, of Syracuse, N. Y., had an exhibit of condulets, panelboards, switches and head-lamps at the recen convention of the Illuminating Engineering Society in Chicago. Th display was visited by a number of the members of the society attendin the convention and elicited favorable comment.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, of S Louis, announces the appointment of Mr. P. L. Lewis as sales repre sentative in Texas. Mr. Lewis, who will make his headquarters i Dallas with an office in the Scollard Building, takes the place of M J. A. Gelzer, who severed his connection with the above concer several months ago.

GOVERNMENT ORDER FOR ORNAMENTAL LAMP STANDARD AND BRACKETS.—The Flour City Ornamental Iron Works has bee notified under date of Sept. 26 by James Knox Taylor, supervising arch tect for the United States government, that its bid for lamp standards an brackets in iron and bronze had been accepted. There were eight cor petitors and the award was unanimous.

TRUMP TURBINES.—The Trump Manufacturing Company, Sprin field, Ohio, is working its plant until 9 p. m. owing to a congestion orders. During the past two months orders have been received f twenty-one turbines, aggregating 22,000 hp. The sizes ranged from in. to 56-in. wheels for heads ranging from 15 ft. to 480 ft. Horizon and vertical types are about equally represented, and several spec types are included.

EXCESS INDICATOR.—The Excess Indicator Company, of Boston, closed a contract with the Connecticut River Transmission Compa through the Gardner Electric Light Company, the local distribut agent, for a general application of the excess indicator in houses Gardner, Mass. At present about 600 residences are supplied with el trical service, and of these some 400 are paying less than $1 month, 50 cents per month being the minimum monthly charge. W the excess indicator the company is securing a large number of new c tracts on the basis of a minimum of $1 per month. In Worcester use of the indicator is already extensive. Many flats are being wired a flat rate of 1 cent per watt per month net, in advance. The gen rate is for a six-lamp service at $1.50 per month. The Gardner ser above referred to is being extended to three neighboring towns, Ba Templeton and Belchertown, on a flat basis with excess indicator. J. White & Company, of New York, operating managers for several elec lighting companies, have adopted the excess indicator in Wilming Del., and East Liverpool and Steubenville, Ohio, and the surroun district. The American Gas & Electric Company, of New York, other large operating syndicate, has adopted the system in Scranton, Wheeling, W. Va., Muncie, Ind., and Rockford, Ill. Several thou excess indicators are in use in these cities. In New England they e been in use for some time in Concord and Claremont, N. H., St. Al ns and Swanton, Vt., and other smaller cities and towns.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention in November, 1911.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. lard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treas r, Eugene W. Stern, 103 Park Ave., New York City. The Council ts the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Honorary secre y, Ralph W. Pope; acting secretary, F. L. Hutchinson. Engineering cieties Building, 29 West 39th St., New York. Meetings, second F ay of each month, excepting June, July, August and September.

American Electric Railway Accountants' Association. Secretary, [illegible] L. Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., October 9-13, 1911.

American Electric Railway Engineering Association. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

American Electric Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

American Physical Society. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

Arkansas Association of Public Utility Operators. Secretary, W. [illegible] Thorpe, Little Rock, Ark.

[illegible] of Iron and Steel [illegible] Engineers. Secretary, James Farrington, Steubenville, Ohio.

Association of Railway Telegraph Superintendents. Secretary, P. [illegible] Drew, 135 Adams St., Chicago.

[illegible] of Railway Electrical Engineers. Secretary, J. Andreu-etti, Chicago & Northwestern Railway, Chicago. Next annual meeting Hotel La Salle, Chicago), November 6 to 10, 1911.

Association of Edison Illuminating Companies. Secretary, N. T. [illegible]lcox, Lowell, Mass.

Colorado Electric Light, Power & Railway Association. Secretary, [illegible] D. Morris, 323 Hagerman Building, Colorado Springs, Col.

Electric Vehicle Association of America. Secretary, Harvey Rob[illegible]son, 124 West 42d St., New York. Meetings, fourth Tuesday of each [illegible]

Electric Club, Chicago. Secretary, N. F. Obright, 1500 American [illegible] Chicago. Meets every Wednesday noon, 303 Wabash Ave.

[illegible] Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electric Trades Association of Philadelphia. Secretary, J. W. [illegible]rum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

Electrical Contractors' Association of State of Missouri. Secre[illegible] Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

[illegible]ctrical Salesmen's Association. Secretary, Francis Raymond, 125 [illegible]gan Ave., Chicago. Annual meeting, Chicago, January each year.

Electrical Trades Association of Canada. Secretary, William R. [illegible]aveley, Royal Insurance Building, Montreal, Can.

[illegible]ctrical Credit Association of Chicago. Secretary, Frederic P. [illegible] Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, [illegible]

Electrical Trades Association of the Pacific Coast. Secretary, [illegible]bert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. [illegible]nthly meeting, San Francisco, second Thursday of each month.

[illegible]ectrical Trades Society of New York (Member National Electrical [illegible]t Association). Secretary, Franz Neilson, 80 Wall St., New York. [illegible]l of Directors meets second Thursday of each month.

[illegible]pire State Gas and Electric Association. Secretary, Charles H. [illegible]apin, Engineering Societies Building, 29 West 39th St., New York.

[illegible]rida Electric Light & Power Association. Secretary, H. C. [illegible] West Palm Beach, Fla.

[illegible]inois State Electrical Association. Secretary, H. E. Chubbuck, [illegible]

[illegible]minating Engineering Society. Secretary, P. S. Millar, Engi[illegible]ng Societies Building, 29 West 39th St., New York. Sections in [illegible] York, New England, Philadelphia and Chicago.

[illegible]dependent Electrical Contractors' Association of Greater New [illegible] Secretary, L. H. Woods, 2355 Jerome Ave., New York.

[illegible]diana Electric Light Association. Secretary, J. V. Zartman, In[illegible]

[illegible]ernal Combustion Engine Association. Secretary, Chas. Kratch, [illegible] W. Indiana St., Chicago. Meetings, second Friday of each month.

[illegible]ernational Association of Municipal Electricians. Secretary, [illegible] L. George, Houston, Tex.

[illegible]ternational Electrotechnical Commission (international body [illegible]senting various national electrical engineering societies contributing [illegible] support). Secretary, C. le Maistre, 28 Victoria St., Westminster, [illegible]don, S. W., England. Next meeting at Berlin in 1913.

[illegible]wa Electrical Association. Secretary, W. N. Keiser, Dubuque, Ia.

[illegible]wa Street & Interurban Association. Secretary, L. D. Mathes, [illegible], Ia.

[illegible]nsas Gas, Water & Electric Light Association. Secretary, [illegible] D. Nicholson, Newton, Kan.

[illegible]ouisiana Electrical Association. Secretary, W. H. Bower Spangen-b[illegible], 627 Poydras St., New Orleans, La. Meets third Monday of each [illegible]

[illegible]aine Electrical Association. Secretary, Walter S. Hyman, Water-[illegible], Maine.

Michigan Electrical Association. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electrical Association. Secretary, T. C. Gordon, Little Falls, Minn.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., second week in June, 1912.

National Electric Light Association, Canadian Section. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

National Electric Light Association, Georgia Section. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

National Electric Light Association, Mississippi Section. Secretary, A. H. Jones, McComb City, Miss.

National Electric Light Association, Nebraska Section. Secretary-Treasurer, S. J. Bell, David City, Neb.

National Electric Light Association, New England Section. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

National Electric Light Association, Pennsylvania Section. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

National Electric Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electric Credit Association. Secretary, Frederic P. [illegible], 343 Marquette Bldg., Chicago.

National Fire Protection Association. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

National Independent Telephone Association. Secretary, Joseph B. Ware, Grand Rapids, Mich.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New Orleans Electrical Contractors' Association. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

Order of Rejuvenated Sons of Jove. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct. 16-18, 1911.

Pittsburgh Electric Booster Club. Recording Wattmeter, O. R. Bombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

Society for the Promotion of Engineering Education. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

Society of Wireless Telegraph Engineers. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

Southwestern Electrical & Gas Association. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

Street Railway Association of the State of New York. Secretary, C. G. Reel, Kingston, N. Y.

Vermont Electrical Association. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next annual meeting Jan. 23-25, 1912.

Western Society of Engineers. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Wireless Institute. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 26, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,004,[illegible]. LAMP; [illegible] Euler, Elizabeth, N. J. App. filed Nov. 4, 1910. Ball and socket connection between an incandescent bulb and its socket.

1,004,005. ELECTRIC-LIGHTING SYSTEM FOR TRAINS, ETC.; T. Ferguson, Altringham, England. App. filed Oct. 21, 1910. Combination battery and axle-driven dynamo with voltage-compensating arrangement.

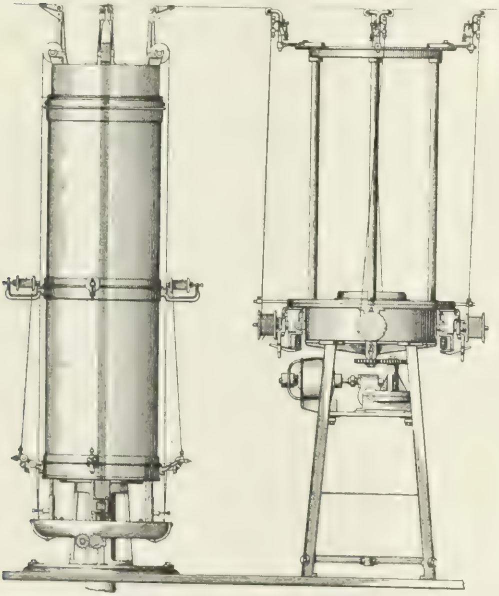
1,004,010. PUMP-CONTROLLING SWITCH; C. Gamer, Ft Worth, Tex. App. filed May 31, 1910. Float-controlled, for keeping cellars, etc., dry.

1,004,012. CURRENT-RELAYING APPARATUS; H. Gerdien, Berlin, Germany. App. filed Jan. 7, 1911. The strength of a luminous discharge is influenced by a magnetic field.

1,004,038. PRINTING TELEGRAPH; C. L. Krum, Chicago, Ill. App. filed Sept. 6, 1906. A shifting element and the printing devices are controlled by the selecting apparatus so as to increase the possible number of selections.

1,004,089. CONTROLLER FOR ELECTRICAL APPARATUS; F. L. Sessions, Columbus, Ohio. App. filed Jan. 9, 1904. For mine-locomotive motor systems, etc.

1,004,101. CABINET FOR POLE-CHANGERS AND BATTERIES; R. C. Stone, Muncie, Ind. App. filed Oct. 27, 1910. The parts are all carried by supports laterally removable from a casing.



1,004,251.—Machine for Coating Wire.

1,004,102. VOLTAGE REGULATOR; S. B. Storer, Syracuse, N. Y. App. filed Dec. 5, 1905. The secondary of a transformer is wound upon two rotatable reels, so that the number of effective turns may be varied.

1,004,106. VAPOR CONVERTER AND CONTROLLING DEVICE THEREFOR; P. H. Thomas, Montclair, N. J. App. filed Jan. 20, 1905. The container is pivoted on knife edges and tilted by a solenoid.

1,004,111. FLUID-PRESSURE BRAKE; W. V. Turner, Edgewood, Pa. App. filed Oct. 17, 1908. Automatic and electrical control for air brakes with triple valves.

1,004,119. ELECTROPLATING APPARATUS; J. Weber, Jr., and O. Cope, Toledo, Ohio. App. filed April 27, 1911. A rotatable drum for plating small metallic articles.

1,004,152. HIGH-FREQUENCY APPARATUS; W. Dubilier, Seattle, Wash. App. filed Nov. 21, 1910. A circular electrode rotates inside of an annular electrode.

1,004,165. ELECTRICAL IMMERSION HEATER; W. W. Hanscom and A. L. Langerman, San Francisco, Cal. App. filed March 20, 1909. A tubular device with the heating elements within the [illegible]

1,004,170. DEVICE FOR PRODUCING HIGH-FREQUENCY OSCILLATORY CURRENTS; F. Jacoviello, Parma, Italy. App. filed March 12, 1910. Gas is passed through two tubular electrodes

1,004,230. ELECTRIC MOTOR OR GENERATOR; H. A. Balcome, Boston, Mass. App. filed Nov. 17, 1910. Artificial cooling is decreased as the speed increases.

1,004,235. LIGHTNING ARRESTER; L. S. Brach, New York. A filed Oct. 5, 1909. A carborundum block is held between two carl blocks under pressure.

1,004,244. SPRING-JACK SWITCH; E. B. Craft, Hackensack, N. App. filed Feb. 11, 1911. A plate bent to hold a plurality of ja and their insulation.

1,004,249. ELECTROLYZING APPARATUS; J. H. Fischer, E. G. Luing and A. W. Collins, Milwaukee, Wis. App. filed March 14, 1 For producing oxygen and hydrogen. Separate cell cases.

1,004,251. MACHINE FOR COATING WIRE; G. Gustave, Chic. Ill. App. filed Oct. 21, 1907. Wire is passed and repassed thro an annular baking furnace.

1,004,286. LIGHTNING ARRESTER; S. E. Mark, Coatesville, 1 App. filed Oct. 21, 1909. An attachment for residence teleph lines.

1,004,290. TELEPHONE SYSTEM; C. W. McKibben, Beaumont, T App. filed July 29, 1909. An impedance device is interposed in receiver branch.

1,004,306. SWITCHBOARD PLUG; O. A. Spencer, Bloomer, Wis. filed Nov. 18, 1910. The plug body and tip are secured to the ductor.

1,004,314. ACTUATION OF CONTROLLERS AND THE LIKE I ELECTRIC MACHINERY; H. B. Van Daalen, London, Eng. filed May 13, 1910. A single arm actuates two or more rheostat

1,004,316. HANGER FOR ELECTRICAL CONDUCTORS; T. W Racine, Wis. App. filed Nov. 22, 1909. Has trips to connect ends of trolley-wire sections so as to cut out a broken part.

1,004,321. COMBINATION SAFE AND VAULT PROTECTOR; E. West, Los Angeles, Cal. App. filed Nov. 11, 1909. Permut. means controls the signal mechanism.

1,004,369. SYRINGE; A. Ciolfi, Cincinnati, Ohio. App. filed Dec. 1909. Electrodes are arranged in the circulating passage to e decomposition or electrification.

1,004,379. ELECTRIC REGULATION; J. L. Creveling, New Y App. filed April 13, 1911. Generator voltage is automatically erned in accordance with the duty.

1,004,383. AUTOMATIC ELECTRIC SWITCH; E. W. Davis, Chi Ill. App. filed Oct. 22, 1910. The switch is operated by a para netic solenoid core. For electric signs and flashers.

1,004,420. CONTRACTING DEVICE FOR ELECTRICAL MEAS ING AND INDICATING INSTRUMENTS; E. Haagn, H. Germany. App. filed Dec. 21, 1907. When the current reaches a tain point the circuit is closed and then immediately opened a other point so as to prevent arcing.

1,004,421. MEANS FOR DRIVING (RINGING) OF CHURCH BI AND THE LIKE; G. L. Halvardson, Stockholm, Sweden. filed Aug. 11, 1910. The bell is driven by a motor and the cl of speed of the motor reverses the running switch.

1,004,437. ALTERNATING-CURRENT MOTOR; A. Kimble, Ch Ill. App. filed May 15, 1905. A hand tool, such as a drill, w speed-controlling sleeve on the handle.

1,004,452. INDUCTION COIL; W. Meyer, Chicago, Ill. App. Nov. 27, 1908. A number of primary windings with inter are connected in multiple across a source of current and i ductive relation to a single secondary.

1,004,453. INDUCTION COILS; W. Meyer, Chicago, Ill. App. Nov. 27, 1908. A plurality of primary windings and interr are arranged in series and in inductive relation to the singl ondary.

1,004,460. THERAPEUTIC LAMP; N. W. Newton, Battle Creek, App. filed May 29, 1908. An arc lamp and reflector are carr a post vertically and revolubly mounted in a resistance coil.

1,004,469. METHOD OF CHARGING ELECTRIC FURNACES; Robinson, Niagara Falls, N. Y. App. filed Jan. 6, 1911. A of bituminous coal is interposed between the charge to be and embedding material.

1,004,479. BRUSH HOLDER FOR MOTORS OR GENERATOI L. Sessions, Columbus, Ohio. App. filed June 12, 1906. The is pressed by a pivoted member, an adjustable member and a pressed member.

1,004,518. ELECTRIC SIGNAL; D. E. Zinn, W. Winfield, Pa. filed Dec. 19, 1910. Mine railway signal to indicate the posi a switch.

1,004,530. PROTECTIVE DEVICE; E. E. F. Creighton, Scher N. Y. App. filed Feb. 23, 1907. The flow of line current posed by an arc having the surface of an electrolyte as a trolytic cathode.

1,004,531. LIGHTNING ARRESTER; E. E. F. Creighton, Schenecta N. Y. App filed July 9, 1907. A spark gap, an electroly c denser and a liquid electrode arrester in series.

1,004,532. LIQUID-ELECTRODE ARRESTER; E. E. F. Cr Schenectady, N. Y. App. filed July 9, 1907. Mechanical de ls of a jar arrester.

1,004,533. ELECTROLYTIC LIGHTNING ARRESTER; E. F Creighton, Schenectady, N. Y. App. filed Sept. 2, 1908. Al inum electrodes of such size that the current density will start ar to the electrolyte.

1,004,534. LIQUID-ELECTRODE LIGHTNING ARRESTER FOR POLYPHASE LOW-VOLTAGE CIRCUITS; E. E. F. Cr Schenectady, N. Y. App. filed Sept. 2, 1908. A plurality o nodes are connected to the line conductors and the liquid cathode is grounded.

1,004,535. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed Dec. 22, 1908. Two sets of electrodes of equal area.

1,004,536. ELECTROLYTIC LIGHTNING ARRESTER WITH GAP AND BLOW-OUT; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 2, 1908. An aluminum cell is shunted across an electr. magnet in series with a gap.

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CONTENTS.

THE ELECTRIC VEHICLE SITUATION.

This week's convention of the Electric Vehicle Association of America demonstrates anew the difficulty of the task of bringing into co-operation the diversified interests which must work in harmony if the electric vehicle is to be properly exploited. It is almost amusing to note the pressure being brought to bear on the central-station industry by manufacturer, user and garage owner alike; the one to get the central station to introduce his product, the second to give him a preferential rate and the last to subsidize him. This condition is not favorable for the electric-vehicle industry. Certainly gasoline machines would never have attained their present popularity if those commercially interested had spent their time in criticizing in turn the distiller of gasoline, the makers of dry cells and all contributing to the manufacture, sale and operation of the automobile. The central-station industry has given of its time, thought and money to further the interest of the electric vehicle. It has been responsible for much of the progress achieved in the last three years and even in the face of the meager returns thus far has shown no decrease in interest. The discussion at the meetings in New York showed that there were blows to give as well as blows to take, and the net result was by no means unfavorable to the central station. What is sorely needed is real enthusiasm on the part of all in a general forward movement in which petty commercial differences will be adjusted for the common good. Aside from harmonizing conflicting interests what is now sorely needed in the electric-vehicle campaign are reliable operating data. There has been a surfeit of generalities and of glittering statement, and it is surely time to replace publicity metaphysics with prosy business exploitation. In no way can the Electric Vehicle Association of America better achieve its ends than by placing in the hands of every central station data on the results already obtained in electric-vehicle practice. Facts are stubborn things and these the central-station industry needs in the present stage of electric-vehicle exploitation. Progress is certainly being made, but it is possible for it to be made faster, and enthusiastic concerted action and reliable operating data are the best means to this end.

VISUAL ACUITY WITH COLORED LIGHTS.

The brief paper by Mr. Dow in the current issue points out some of the complications encountered when one attempts to determine visual acuity for lights of different colors. The recent investigations of acuity with light approximately or fully monochromatic show clearly enough that, other things being equal, the effect of monochromatism is a considerable increase in acuity owing to the abolition of the chromatic aberration of the eye. This point

seems to be fully established, but the subsidiary question as to whether one kind of monochromatic light is materially greater in its power of revealing detail than another is, as regards the eye, still unsettled. Mr. Dow points out that, owing to the different positions of the focal surfaces in the eye for objects at different distances, and for the eye in different stages of accommodation, vision may be made easier or more difficult for monochromatic light of any particular kind. In very near vision good definition can be had by violet monochromatic light, when by red light it would be very indistinct. At considerable distances, and particularly if the eye is slightly myopic, vision by red light is easier than by blue. If an observer wears glasses the particular color seen with the easiest accommodation at any particular distance depends on the power of the glasses employed. The differences induced by difference of focus with respect to possible accommodation are large, certainly larger than any differences due to the mere difference of wave length in the lights employed. This is well shown in some of the experiments of Mr. Luckiesh to which Mr. Dow refers.

Mr. Luckiesh conducted his acuity tests at a distance of about 1 m, a very convenient one for the particular acuity target employed. Two of the observers, however, who wore glasses, obtained results differing radically from those reached by the others. Now the fact is that when the errors of refraction in an eye are corrected by the oculist they are customarily either corrected for distant vision or for a reading distance of about 14 in. It is only in very unusual cases that spectacles for a working distance as long as 1 m are prescribed, and consequently these observers undoubtedly fell into just the difficulty that Mr. Dow indicates, of having the focal images fall in the wrong place for easy accommodation with the glasses used; hence the discordant readings which resulted. Had these experiments been directed to the comparison of monochromatic lights of various colors the same sort of errors would have been likely to enter. Considering these facts, one can compare the effect of lights of different colors properly only when working at a distance which permits of effective accommodation for any of the colors compared or when using correcting glasses which will bring these colors within comfortable range of accommodation.

According to Lord Rayleigh's theory of optical instruments, the eye should give somewhat better resolving power for short wave lengths than for long. Such is, no doubt, the case, but the practical phase of the matter is whether, considering the actual imperfections of the eye as an optical instrument, this difference can be made apparent. It certainly cannot be made apparent, to judge from Mr. Dow's experiments, unless correcting lenses are employed to bring each of the colors compared within range of accommodation. Even if this is done, the eye is subject to spherical aberration, to the diffusion of more or less light, very generally to small degrees of astigmatism often too small to be worth correcting for ordinary purposes—and to zonal aberrations which may appear when there is a great change in the aperture of the pupil. Whether the theoretical differences of resolving power can be made evident in spite of this complex of errors of refraction seems somewhat doubtful. At all events, it has never yet been demonstrated. The gain from using monochromatic light, provided the color is such as to fall, or easily be brought, within the range of accommodation, appears, however, to be well established. Inasmuch as monochromatic light can be obtained at fair efficiency only through a limited range of the spectrum the more intricate question just raised is chiefly of academic interest. In photomicrography there is a considerable gain by the use of violet or even ultraviolet light, but this is a totally different matter, since the microscope can be easily focused for any required wave length and is very much more perfect optically and better corrected for chromatic and spherical aberrations than is the eye.

UNSATISFACTORY ILLUMINATION OF FEDERAL BUILDINGS.

In the course of a recent address before the Electric Clut of Chicago Mr. L. B. Marks, who, as an engineer of reput and the first president of the Illuminating Engineering So ciety, should know what he is talking about, charged tha the neglect of the simplest principles of good illuminatioı by the Treasury Department of the United States Govern ment is "absolutely disgraceful." The situation, as de scribed by Mr. Marks, is serious, because the Treasur Department has custody of a very large number of federa buildings scattered throughout the country, and the lightin of these public buildings, instead of being an example t others, is only too often crude, harsh and inartistic Usually the federal buildings—the postoffices, custor houses, court houses and structures of similar purpose—ar prominently placed in the various communities served an frequently they are structures of considerable architectur pretension. It is, therefore, particularly to be regrette that the lighting of these buildings falls so far behind th standard set by the work of engineers who have made careful study of the practical applications of illumination.

Of course, Mr. Marks' criticism might have embraced much wider field, for the examples of scientific illuminatic to be found in any class of buildings are few in numb as yet. But the government buildings are so conspicuou and, in the case of postoffices, so close to the life of tl people, that it is a pity that any department which responsible for them should exhibit what is apparent contempt for the work of the illuminating engineer. T efforts thus slighted are indeed important, for it is certa that the study of problems of illumination that has be made by engineers in recent years has made possible bett illumination. More intelligent lighting means, among oth things, decrease in eye strain; and as the number of Am icans with defective eyesight is so great as to be alarmi this one aspect of illuminating engineering is of very gr importance. If, as is said to be the case in the Treas Department building at Washington—to cite one example bare lamps are used in the field of vision, it is high ti that an effort be made to arouse this department of government from its complacent lethargy.

It is charged that the salaries paid by the governm to the men in the Treasury Department responsible for terior illumination are entirely inadequate. Ample fu

eem to be available for what may be spoken of as archi-ectural exuberances and experiments in federal buildings, ut such a practical necessity as good illumination seems o be the Cinderella among the arts in the opinion of the rchitects and custodians of the Treasury Department. his ought not to be so, but, as remarked by one of the peakers during the discussion in Chicago, so long as the ngineering public acquiesces in the existing condition of ffairs the situation will probably continue. If the engi-eers would interest themselves sufficiently to agitate for etter illumination in public buildings the people would ndoubtedly recognize the justice of the complaint, and, hrough their representatives in Congress, bring about a orm.

IPROVEMENTS IN FLAMING-ARC LAMPS.

The flaming-arc lamp, despite its enormous light-giving ficiency, has never made in this country anything like the eadway which it has always secured abroad. The funda-ental difficulty appears to have been the short life of the ectrodes, for the one thing dearest to the heart of the merican central-station manager is a long-burning lamp, nd this the ordinary flame arc is not. Electrical practice as not yet wholly broken away from the feeling that a mp is a lamp if it looks tolerably bright, regardless of ficiency, and no light-giving power, however great per att, can really excuse in the popular mind the vice of ort burning-hours. Rather recently there has been a termined effort both here and abroad to overcome this rticular difficulty with the flaming arc and to produce a mp not only able to give a high luminous efficiency, but quiring only infrequent trimming. The usual forms of ming arc have in the main required trimming every ght, and hence their care has been rather expensive per mp-hour even if still modest per candle-power-hour.

Some three years ago the Jandus "regenerative" lamp, brought out in England, made a long stride toward the on of the life difficulty, in this case by reverting to principle of the inclosed arc, but providing ventilating s for carrying off the solid products of combustion and ace for their deposit where they would be out of the ay. Despite some crudities in the early lamps of this ake, the main object of the innovation was attained, in at the life of the electrodes increased to 80 hours, while ill retaining an efficiency materially greater than that of y arc lamp using other than flame electrodes. Since then considerable group of long-burning flame lamps has peared, most of them using the principle of close in-osure, although the various examples differ materially actual mechanism and in the provisions made for dis-sing of the products of combustion. Whatever the fail-gs of the carbon arc, it has one conspicuous merit in that e products of combustion are gaseous, colorless and odor-s. All the usual types of flaming arcs produce a dense ite deposit of oxides, which, if not carried off by suitable ntilating arrangements, soon clog the mechanism and fog the globe. The electrodes in use in these modern g-burning lamps are all typically flame electrodes, hough varying slightly in composition. The requisite burning time has been generally attained by increasing either the length or the diameter of the electrode, by varying its composition or by some combination of these three fac-tors. Long burning secured by extreme length of electrode is apt to lead to a somewhat unsightly and clumsy lamp. Life due to increased diameter tends to unsteadiness, while if reached through any radical change in the composition of the electrodes by the addition of restraining substances, the punishment is inefficiency.

The proposition of using a highly efficient flaming arc with electrodes enduring from 75 to 100 or more hours is certainly a very attractive one. It is attractive in the same way as the original inclosed arc, which forced its way into practice a dozen years ago. Like the old inclosed arc, too, the new lamps are very generally capable of construc-tion for both direct and alternating current, which is a great convenience. The final result of the innovation appears very hopeful. The time has gone by when long burning at the expense of efficiency will be tolerated by the public, even if one should find managers willing to try it. The objection to the inclosed-flame lamp, irrespective of its particular form, is chiefly the temptation that will be mani-fest toward reaching a long life at the expense of efficiency. It is quite certain that 75 to 100 hours may be reached while still retaining excellent luminous return for the output required. If the manufacturers and users have strength of mind enough to let the matter rest there, the art will have been enriched by a very useful type of illuminant. We foresee, however, that some back county will call for a lamp of greater life, and call so loudly that lamp makers will, unless endowed with unusual fortitude, listen and yield, with the result of loud claims for the longest-burning lamp on earth and a sudden hush when categorical inquiries are made as to the efficiency. The solemn fact is that one can-not have one's cake and eat it, too, in arc-lamp practice or anywhere else.

If one has, let us say, 100 grams of highly efficient elec-trode and burns it under conditions that give it a very long life he will not get the same luminous flux as if he had burned the same amount of light-giving material in a shorter time. If he attempts to dodge the issue by juggling with the composition the result is generally worse, and every step taken to increase life by such means is usually a step backward as far as luminous efficiency goes. It may be possible to get an improved electrode better than any we now have and still giving a long life, but the same electrode burned intensively will go to a much higher efficiency. In other words, great as the advantage of long life is from a practical standpoint, and promising as are some of the lamps now available, particularly for use with alternating current, one must be constantly watchful lest the same temptations that led to the downfall of the inclosed carbon arc may bring to grief the inclosed flaming arc. Its de-velopment is beginning in a very promising manner, and it will be a subject for genuine regret if failure should come through over-insistence on extreme burning life. It is a case where it would be desirable to proceed very cautiously, and to watch with a jealous eye the maintenance of that luminous efficiency which has given the flaming arc in general its present conspicuous position.

Contents of Huge Storage Reservoir of LaCrosse Water Power Company Sweep Black River Valley in Wisconsin.

Damage estimated at more than one million dollars is reported in the valley of the Black River of Wisconsin, following the release of a deluge of water by the hydraulic works of the LaCrosse Water Power Company at Hatfield, Oct. 6. Heavy rains in the vicinity had caused the rise of the upper reservoir of the company at Dells, and an earth-wall of this dam is reported to have given way, in spite of the efforts of 300 workmen, discharging its flood upon the main Hatfield dam, 5 miles below. Fortunately this concrete structure, 50 ft. high and 500 ft. long, held securely even with a sheet of water 13 ft. thick pouring over its crest and over the earth dykes at the ends of the dam and the raging waters continued 15 miles downstream to the village of Black River Falls, where the principal damage was done. At Black River Falls a municipal water-power dam and plant had been erected (described in the *Electrical World*, June 1, 1911), and the backwater and eddies caused by this dam are said to have deflected the flood through the principal part of the town, destroying most of the business blocks and rendering many of the 2000 inhabitants homeless. The municipal plant was completely demolished.

The 8500-kw plant of the LaCrosse Water Power Company at Hatfield is in point of reservoir capacity and head one of the largest, if not the largest, hydroelectric undertakings in the Middle Western States. Its two great reservoirs comprise hundreds of acres of pond area, and its water-wheels utilize an available head of 91 ft. to 100 ft. The plant is near Hatfield, approximately 50 miles from the cities of LaCrosse, Wis., and Winona, Minn., both of which obtain electrical energy from the 8500-kw station over a joint transmission line. The principal water storage of the power company's plant was the Dells reservoir, where a comparatively low-head dam impounded a huge area, normally discharging through its concrete head gates and spillway into the old river bed, which was in turn flooded by the principal Hatfield dam 5 miles below. The Dells dam was thus relied upon only for season storage, and it was this dam, according to the accounts received, which suffered an injury to one of its earth wing-walls, discharging its water suddenly into the lower reservoir. The lower reservoir, closed by the 50-ft. Hatfield dam and having an area of nearly 700 acres, is of an average depth of 50 ft., 10 ft. of which is available for draw-down. From the northwest end of the Hatfield dam to the power house,

Fig. 1—Hatfield Dam Before the Flood.

13,000 ft. distant, was led the power canal, 100 ft. wide, cut into the side slope of the valley. In the effort to relieve the pressure on the main dam this canal is reported to have been dynamited. The power house, of brick, steel and concrete, measures 146 ft. by 57 ft. in plan and provides for four 2400-kw water-wheel generators, two of which are installed. A total head of 91 ft. or more is available at the power house through the construction of the supply canal,

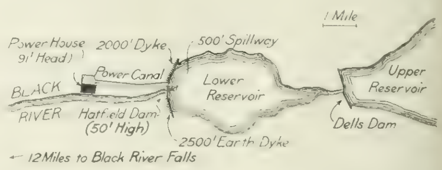


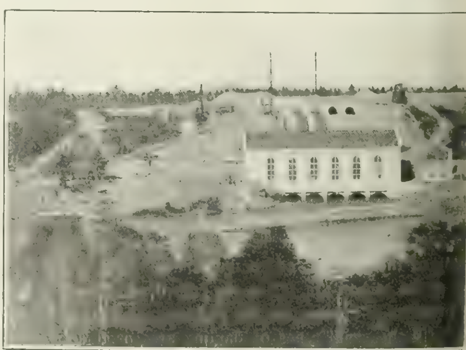
Fig. 2—Map of LaCrosse Water-Power Development.

2.5 miles in length from the dam. During the flood operation of the water-power plant was, of course, interrupted, and auxiliary steam plants were started up at LaCrosse and Winona.

Not only was the flood in the river a big one, but the quantity of water flowing in the river was more than doubled, perhaps trebled, for a short time by the emptying of the Dells reservoir. The Dells dam was constructed subsequent to the Hatfield dam and, of course, no provision was made at the Hatfield dam to protect from any flood greater than that which would naturally occur in the river. The Hatfield dam has a spillway 489 ft. long and the dikes were built 12 ft. higher than the crest of the dam. A flood of 60,000 or 70,000 second feet, therefore, could have been safely passed over the dam. This would have been an extremely large amount of water from a drainage area of 1264 sq. miles located in a district of low rainfall. A complete illustrated description of the LaCrosse Water Power Company's development appeared in these columns March 31, 1910.

While the flood which rushed down the Black River valley was not of the overwhelming proportions of the Austin, Pa., disaster, the water at points below rose rapidly to a stage of 40 ft. or more almost without warning. Had the main Hatfield dam failed under the terrific strain of discharging the flood over it (which reached a depth of 13 ft. along its 500-ft. spillway) it is impossible to guess what might have been the extent of the calamity in the town below through the sudden release of this additional huge quantity of water. The water-power company had been fighting the rising waters in the upper reservoir for a week and had made desperate efforts to reinforce the weakened dyke which later failed.

The municipal-plant dam at Black River Falls, which



LaCrosse Power Station from East Side of River.

held partially responsible for the local damage in holding back the tremendous discharge of water which struck it without warning, was a concrete structure developing a head of 18 ft. Although designed for a total capacity of

800 kw. the first 400-kw unit was installed, driven by one of a future pair of 400-hp runners, sufficient for carrying the present load on the plant. During the worst of the flood the main streets of the town were 20 ft. to 30 ft. under water and the foundations of many buildings were swept away, the structures themselves tumbling into the flood. In spite of the property damage no losses of life are confirmed. Several instances of personal courage were reported during the disaster. As soon as the caretaker of the upper Dells dam discovered the break he rode desperately throughout the night warning occupants of imperiled homes to seek higher ground. For hours the flood-stricken towns were cut off from communication with the outside world until telephone linemen swam to and climbed the poles of the remaining lines, reporting the disaster through their test sets. Mr. W. J. Ferris, formerly of Chicago, is president and general manager of the LaCrosse Water Power Company, and Mr. W. S. Woods is chief engineer.

Boston Electric Vehicle Club.

The weekly luncheon and meeting of the Electric Vehicle Club of Boston was held at the Edison Building in that city Wednesday noon, Oct. 4. Mr. Herbert W. Moses, manager of the 1912 Boston Electric Show, was chosen chairman of the meeting.

Secretary L. D. Gibbs explained the plans of the Boston Edison Company for a flashing electric vehicle sign on Boylston Street, Boston. Mr. Whiting, for the committee on co-operative advertising, urged the importance of enthusiasm in the campaign now going on. Mr. Day Baker suggested that plans for the co-operative advertising be made known well in advance, so that agents could secure adequate appropriations for the purpose from their firms. Mr. A. F. Neale, of the Baker Motor Vehicle Company; Mr. Baker, of the General Vehicle Company; Mr. Whiting, for the Bailey Company, and Mr. Emery for the Walker Vehicle Company, all stated that they would take space each week. Other dealers and agents are expected to come into the campaign in a short time.

On motion of Mr. Mansfield it was voted that the secretary be instructed to write the president of the Electric Vehicle Association of America stating that the club had voted unanimously to join with the New England Section of the Electric Vehicle Association of America and the Edison Electric Illuminating Company, of Boston, in inviting the national association to hold its annual convention in Boston next year during the 1912 Electric Show.

Mr. Frank J. Stone outlined plans to increase the interest in the electric vehicle, which include a banquet, to which the Governor and city officials will be invited, and the plan was adopted by vote of the club and a committee of five appointed to take charge of the matter.

It was announced that sixty-one new electric vehicles have been sold in Newark, N. J., since the electric vehicle campaign was opened there.

Mr. Baker reported that a 1-ton gasoline truck cost $3,270 for repairs in one year, and the average haul was about 28 miles per day. Mr. Eldredge cited the case of a gasoline car that was in use fourteen months on which the repairs cost over $2,000. He stated that from conversations with gasoline truck owners all over New England he knew of none that was economical on the basis of ton-miles. The next meeting will be held Oct. 18.

A flashlight photograph was taken of the members in attendance at the meeting. The club was started as a result of the indorsement of electric vehicles by the Boston Edison Company. It has been a valuable adjunct in the campaign and gives an opportunity for the interchange of ideas and information by vehicle agents in Boston and vicinity. From twenty to thirty-five men are in attendance at the weekly luncheons furnished by the Edison Company at its building.

Santa Rosalia, Mexico, Hydroelectric Plant.

The Mexican Northern Power Company, composed of Canadians, which is constructing a great hydroelectric enterprise on the Conchos River, 25 miles distant from Santa Rosalia, Chihuahua, now has more than 1000 men employed in the work. The dam is partly finished. Besides storing water for operating the proposed hydroelectric plant, which is to have a capacity of about 50,000 hp, it will be the means of affording a water supply for irrigating 200,000 acres of land situated in the valley of the Conchos River. The company is operating under favorable concessions granted by the state and federal governments. It began construction work about two years ago and carried it on steadily until the outbreak of the revolution last fall. For several months a shortage of labor interrupted operations, but this condition is now relieved, and it is announced that the big enterprise will be finished by June, 1913. The project involves the expenditure of about $15,000,000 gold, making it one of the most important foreign industrial works now in progress in Mexico. In order to afford transportation facilities for conveying material and supplies to the construction camp a standard-gage railroad was constructed from Santa Rosalia to the dam site, a distance of 22 miles. The electric-transmission lines from the hydroelectric plant will run to the cities of Chihuahua, Parral, Jiminez and a number of smaller towns, as well as to many of the principal mining camps of the State.

Convention of Iron and Steel Electrical Engineers

An account of the first three days' sessions of the Association of Iron and Steel Electrical Engineers, which met in convention at the Hotel Imperial, New York City, Sept. 25-30, was published in last week's issue. Three papers were read at Thursday morning's session as follows: "Design of Electrically Driven Central Pumping Station," by Mr. F. W. McKee, of the Jones & Laughlin Steel Company; "The Regulating Storage Battery in Steel Works Service," by Mr. F. W. Woodhull, of the Lukens Iron & Steel Company, and "Prime Movers in Central Power Stations," by a representative of the Westinghouse Machine Company. As pointed out last week abstracts of papers and discussions are withheld until after their appearance in the transactions of the association. On Thursday afternoon a visit was made to the works of the Crocker-Wheeler Company at Ampere, N. J.

On Friday morning the association was the guest of the General Electric Company at its Harrison lamp works and a luncheon was served in the Hotel Martinique when the visitors returned to New York. The Friday afternoon session was given over to a consideration of lighting for steel mills, Messrs. S. R. Fortune, of the Cooper Hewitt Electric Company; C. J. Mundo, of the General Electric Company, and W. Harrison, of the National Electric Lamp Association, presenting papers in which the respective products of their companies were extolled. A paper was also prepared on steel-mill illumination by Mr. H. M. Gassman, of the Tennessee Coal, Iron & Railroad Company. The paper was read by Mr. B. R. Shover, who also discussed the subject of steel-mill lighting at some length. Mr. Gassman called attention to the defects of arc lamps and of flaming-arc lamps for steel-mill service and favored in their stead the installation of tungsten lamps of large size rather than clusters of smaller tungsten lamps. His company had made the substitution with profit. Mr. Shover cited some tests made on 50-volt and 100-volt, 40-watt tung-

sten lamps by the Carnegie Steel Company. The lamps were placed in a machine which subjected them to shock and the results given by Mr. Shover showed that the lower voltage lamp was more rugged, withstanding on an average 11,505 shocks to 3697 shocks by the 100-volt lamps.

It was decided to hold the next annual meeting of the association during the last week in September, and Boston, Washington, Detroit and Milwaukee were considered as being desirable cities in which to convene, the last-named city having the most advocates. No definite city was chosen, however, the matter being left to the executive committee.

Annual Meeting of the Empire State Association.

The annual meeting of the Empire State Gas & Electric Association was held on Oct. 6 at the Engineering Societies Building, New York City. In the absence of the president, Mr. M. J. Brayton, Utica, it was called to order at 10 a. m. by Mr. R. M. Searle, of Rochester. The reading of the minutes of the previous meeting was dispensed with, and Mr. C. H. B. Chapin, the secretary, then read the report of the executive committee. The report of the treasurer, Mr. A. B. Beadle, New York, was then presented.

Mr. C. G. Durfee, Rochester, presented the report of the committee on electric meters. Among various matters discussed the committee brought out the fact that several manufacturers had placed on the market recently meters of small capacity which, while being accurate to a high degree, are much cheaper than the older types. The committee considered that these would be helpful to the various companies, particularly the smaller companies, and would enable them to replace gradually old types of meters with new types and especially to substitute induction meters for the commutator type meters on alternating-current circuits. It was urged by the committee that companies that are not making periodic tests of meters in service should introduce this practice, as it would certainly be to their advantage to do so.

Mr. T. R. Beal, of Poughkeepsie, presented the report of the committee on taxation, which gave a summary of laws or recent amendments to existing statutes relating to this subject.

In the discussion on the subject by this committee Mr. R. M. Searle suggested for serious consideration by the companies a plan whereby the taxes may be shown on each bill rendered to a consumer. That is to say, the total amount of each customer's bill would be divided between the total charge for the service and the proportionate taxes which would accure in each case. The Rochester Railway & Light Company, Mr. Searle added, would be perfectly willing to introduce a system of this character, believing that it would show the facts in relation to questions of taxation more clearly than any other means that have been considered. Mr. Searle added that the present form in which taxes are levied upon public-utility companies is a form of indirect tax upon the community, because whatever taxes are levied are added in turn to the cost of the service rendered. However, as taxes are now levied they are not shown in such detail that the consumers realize the extent to which they are burdened. If a public-utility company pays an amount of taxes in a community greater in proportion than other companies or individuals, it simply collects the taxes from its customers. The larger the tax is in the aggregate, the larger the provision that must be made in expenses for its payment. To levy the tax in this indirect manner compels resident householders to pay a larger proportionate tax than alien owners of property. The members felt that they would like to study the subject and Mr. Searle was asked to submit his remarks in printed form in order that they may be given further consideration.

Mr. E. C. Scobell, Rochester, chairman of the committee on accounting, reported verbally that the committee is suggesting to the State Board of Tax Commissioners and the New York Public Service Commission, Second District, the advantages of making their forms of report uniform as far as possible. The committee is working to have the form of report simplified as much as possible, and, if feasible, to have the details reduced in number.

Attention was called by their committee to the fact that if advantage is to be taken of the amendment to Section 69 of the Public-Service Commission's law relating to the issue of securities for reimbursement of the treasury, application should be made prior to Jan. 1, 1912.

In the discussion which followed the presentation of the report of the committee on accounting one of the members called attention to the proposed order of the Public Service Commission, Second District, in reference to the numbering of poles. The secretary was directed to ask the commission to fix a date for a conference with representatives of the companies before the final issue of the order.

Mr. Searle, as chairman of the committee on calorimetry, reported progress. It is expected that a valuable report on this subject will be made next year.

Mr. H. W. Peck, Rochester, chairman of the committee on arrangements, reported that, in view of the success with which the district meetings held during the year had met, similar gatherings would be held during the coming season. The committee has decided upon the following months, meeting places and subjects : November, Syracuse, street lighting; January, Buffalo, railroad crossings; February, Poughkeepsie, accounting; March or April, Fulton, new business; May, Ithaca, joint use of poles and suburban distribution; June or July, Rochester, use of auto trucks.

Mr. J. T. Hutchings, general manager Rochester Railway & Light Company, discussed at length the possibilities for public-utility companies contained in the new Stanley electric cooker which is to be placed on the market by the General Electric Company. It was suggested that if the heater could be sold by public-utility companies at a reasonable price, and a fixed rate per month charged for its use in households, the possibilities of making the improvement an important source of revenue were good. At the request of the chairman, Mr. F. C. Bates, of the General Electric Company, also discussed the possibilities of the electric cooker. At the conclusion of the morning session the members went to the Engineers' Club for lunch.

MR. SEARLE ON CIVIC RELATIONS.

Mr. R. M. Searle discussed the question of the extent to which public-service companies should enter into civic relations. He described in detail the activities of the Rochester Railway & Light Company in these matters. Fourteen officials of the company are members of the Chamber of Commerce, and a number are represented on various committees of that body. The company has three members in the Rochester Ad Club and twenty in the Rochester Engineering Society. At the time of two annual meetings of national organizations at Rochester this summer, the Grand Army of the Republic and the Shriners, the company was represented on committees of arrangement. The company is also represented on the Water Power Race Commission and has several members in the various social and country clubs of the city. The costs of all these memberships are met by the company. At each social, political and business gathering the company is represented by someone in authority. The representative has full authority to speak for the company on any subject that may be brought up, if he tells the truth. The men have authority to go to Albany and represent the company before committees or commissions, with full authority so long as they tell the truth. A subordinate wh

may go has the same authority as if his superior officer had gone in his stead. One man representing the company attends all fairs, club picnics, civic luncheons, etc.

The policy which led to the attitude of the company in these respects has developed from meetings held every Friday, at which forty or fifty men are present, and every subject of importance to the company is discussed in order that all may be well posted concerning general affairs. A representative of the company attends labor gatherings and other similar meetings. If the company is attacked at any meeting that takes place, the representative of the company who is present makes a clean, frank statement of the position of the company. Mr. Searle added that, while so much had been done in this direction, the real question was, "Can the company afford not to do more of it?" but that the general officials, who had full knowledge of the art, should not hamper the operations of the company by failing to have others in its employ just as well qualified to discuss its affairs. The theory of the Friday meetings is that a complete and critical view of the affairs of the company will be presented for the consideration of those who attend. The meetings give a breadth of view that is a great advantage to every man. They train men to be prepared to stand on their feet and discuss questions and give information regarding the affairs of the company that could not be acquired in any other way. It was particularly gratifying that there had never been a single opportunity for criticism of the men for their action at public gatherings.

One instance showing the advantage of prompt action was mentioned by Mr. Searle. He attended a hearing before the State Water Supply Commission, at which an attorney made an attack on the company. During the hearing Mr. Searle asked to be sworn and told the lawyer that he was ready to be cross-examined under oath regarding the statements that had been made affecting the Rochester company. The result of the hearing was that the position of the company was made plain and the attack was answered as soon as it was made public. If the question of recognizing the attack had had to be referred to the directors, a good deal of delay would have occurred before the position of the company could have been set right in the minds of the public.

Employees who are given authority to speak for the company in this way have to have the same feeling toward the board of directors and superior officials that they would have toward a father. The company does not believe in holding toward its men an attitude which in effect says, "Why didn't you say this or that?" The theory is that procrastination would easily cost the company one hundred times more than any possible errors of judgment. The officials and employees who have authority in these matters understand that they are to do something and that they will be supported by their superiors. With this feeling developed as it is a man goes out with courage to do business, get a contract or defend the company, and all who have anything to say tell the same story all the time.

Mr. Searle suggested the disappointed feeling of men who would fear that censorious criticism would be visited on them for what they did. The criticism at the Friday meetings is of a constructive nature. A man who goes out to do business for the company knows that when a thing is right to do he has authority to do it. If a meeting to consider the affairs of a charitable institution is held, a representative of the company is present, and he knows that he has authority to donate a gas stove, if it appears to be right. He does not have to refer the question to a superior officer or to the board of directors. If an executive, Mr. Searle said, tries to shoulder too much responsibility it leads to trouble. Other officials ought to be thoroughly competent and to know ten times as much of the details of their work as executive officials. All they need is enthusiasm. If they go to the executive with a proposition and he agrees with them, they go ahead and make a success of it. If he says "No," the men get discouraged and in time stop making suggestions.

If the men are not competent to decide what is right, the company should get men who can decide questions themselves. The theory is that if an assistant is competent to do the work in case of the death of his superior, he is competent to represent the company at any time. The attitude of the company in these matters extends through all the officials and subordinates, and even to the office boy, who has authority to go into offices and remind officials that callers are waiting to see them. Continuing, Mr. Searle said that no policy of this character could succeed unless the executive officials had the manliness to stand by subordinates who might make honest errors of judgment. He said that five daily newspaper representatives see officials of the company every day. Any man has authority to talk to the reporters if he tells the truth. The reporters find a good deal of news in what the company does when the officials themselves would not realize that they had anything worth publishing. It is a physical impossibility for the executives to do all the work. The real work of management of the company is done by subordinates.

After Mr. Searle finished his talk it was voted that the remarks be printed for distribution to the members of the association.

In subsequent discussions on general subjects attention was called to the recent decision of the United States Circuit Court regarding the value of the Des Moines (Ia.) water system.

The election of officers resulted as follows: President, Mr. R. M. Searle, Rochester; first vice-president, Mr. C. G. M. Thomas, Flushing; second vice-president, Mr. J. C. De Long, Syracuse; treasurer, Mr. Stuart Wilder, Westchester Lighting Company; secretary, Mr. C. H. B. Chapin, New York.

Convention of the Electric Vehicle Association of America.

The second annual convention of the Electric Vehicle Association of America was held Oct. 10 in the Engineering Societies Building, New York City. There were three sessions—morning, afternoon and evening—in addition to a short business session which preceded the work of the convention proper at which routine work, including proposed changes in by-laws, was disposed of. On the recommendation of the nominating committee the prsent officers were proposed for re-election in order that the program mapped out by them last year might be carried out to fruition. Mr. E. S. Mansfield on behalf of numerous electrical interests in Boston extended an invitation to the association to hold its next annual meeting in Boston during the electrical show in that city, which will open in the Mechanics' Building Sept. 28, 1912.

PRESIDENT'S ADDRESS.

The meeting was opened by the delivery of the presidential address by Mr. W. H. Blood, Jr. In one year, he said, the association has succeeded in enrolling a membership of 200, and it was pointed out that the National Electric Light Association was nearly ten years in securing an equal membership. In this country there is invested, he said, $10,000,000 in electric trucks, and $30,000,000 in electric pleasure vehicles, and nearly one-third of these amounts has been spent within the last twelve months. Mr. Blood suggested that the activity of the Electric Vehicle Association of America might have something to do with the recent great increase. The prospective purchaser of a commercial electric car no longer asks "Will it work?" He knows that it will, and now simply wishes to ascertain what it costs to move a ton a mile, and how

many days in the year a truck can be depended upon. On the other hand, the electric vehicle salesman has now little difficulty in proving to the satisfaction of a prospective purchaser that the cost per ton mile for handling merchandise within city limits is lower when the electric truck is used than when any other means are employed, and that the electric truck is a far more reliable piece of apparatus than the gasoline truck. It was pointed out that during the hot wave last July 3752 horses died of exhaustion in the four cities of New York, Chicago, Philadelphia and Boston alone, representing a property loss of about $1,000,000.

Mr. Blood said that the activity of the makers of gasoline cars who have taken up the manufacture of commercial trucks during the past year or two has been phenomenal, and that sales of cars of this type have simply emphasized the almost universal tendency toward mechanically operated trucks. The gasoline and the electric truck are not, in a general sense, competitors; each has its own field, and the field of the electric is fast widening. Moreover, while the price of gasoline (through deterioration of quality) is steadily rising, the price of electricity is constantly going down, which condition has a significance that no business man can fail to appreciate.

Referring to the field for mechanically operated vehicles Mr. Blood said that over the streets of Boston alone 25,000 tons of freight are handled, on the average, every day in the year, and that the total freight handled by wagons throughout the country is certainly more than ten times as great as that handled by all of the railroads put together. A rough estimate of the number of power wagons necessary to do the trucking in this country which can be advantageously handled by electric power indicates that nearly 3,000,000 of such wagons would be required. Mr. Blood called upon the central stations of the country to see that not gasoline but kw-hours are used for this work, and asked vehicle manufacturers to place in the hands of the public electric vehicles capable of properly accomplishing the service required of them, to supply storage battery manufacturers and requested rugged and efficient batteries which may be used by any one.

The work of the various committees of the association was appreciatively mentioned, particularly that of the committee on standardization and of the committee on rates and charging stations. A national publicity campaign has been prepared and funds for carrying it on are now being gathered. The hope was expressed that national advertising will be supplanted by consistent and continuous local advertising, both on the part of vehicle manufacturers and the central stations. The usefulness of the association, Mr. Blood said, had been demonstrated beyond a doubt, and every one connected with the electrical industry should be enrolled upon its list of members. A provision of the constitution makes it easy to form branch organizations in centers of local activity, and the hope was expressed that during the coming year a number of these, similar to the New England branch now doing most successful work in the city of Boston, will be formed. The committee on education has arranged to establish in trade schools and as part of the Y. M. C. A. courses regular courses of instruction and exhibits, which will familiarize the young men of the country with the simplicity and efficiency of the electric vehicle, its motor and its battery.

On motion of Mr. Hayden Eames it was decided to print the president's address and to distribute it broadcast to all interested in the electric vehicle.

COMMITTEE REPORTS.

After the reading of the president's address and at other times during the day various standing committees presented their reports. The standardization committee exhibited a charging plug constructed to pass 100 amp continuously and to have an overload capacity of 150 amp. Voltages equivalent to thirty and forty-two lead cells were already standardized and the committee suggested a get together meeting, when the matter of speeds, loading spac one-motor versus two-motor equipment and guarantee mileage could be threshed out. The insurance committe reported the results obtained from 5000 blanks solicitin statistics on vehicles and expressed the hope of soon effec ing a preferential rate for pleasure and commercial electri vehicles. The transportation committee suggested that representative of the association join with a committee the National Association of Automobile Manufacture and endeavor to have the classification committee of th railroads make a distinction between gasoline and electr cars in freight rates. The membership committee report a total of 197 members acted on, with twelve more follow, and with thirty-two applications from one fir Of the seventy-three active members of the associatio twelve are vehicle manufacturers, forty-eight are centra station companies, three are publishers and ten are man facturers of accessories. There are five auxiliary membe and 119 associate members at the present time. The me bership is distributed as follows: One hundred and fort seven on the Atlantic Coast, thirty-two in the Midd States and eighteen west of the Mississippi River. Th committee on garages reported on conditions in the gara on Atlantic Avenue, Boston; the committee on papers co mented on the lack of data available to members throu papers and the committee on rates for charging stations h a printed report, but copies were not received up to t close of the convention. The report in substance w given by Mr. Mansfield and showed that in the matter rates central stations certainly made concessions to t electric vehicle. The committees on contests and on t establishment of courses of training in electric-vehicle pra tice reported progress.

VEHICLE COMMERCIAL PROBLEMS.

The first paper presented was prepared by Messrs. R. Lloyd and John Meyer, of the Philadelphia Electric Co pany, and was entitled "Electric-Vehicle Commercial Pro lems." Among the commercial problems to be solved the central station in attempting to promote the use electric vehicles the authors laid particular stress upon value of salesmanship. Attention was called to the go results obtained from proper salesmanship in problems lating to the substitution of electric motors for steam gines, etc. The representative attempting to promote use of electric vehicles should study the stable practic the facilities for loading at the store, routing, the load be carried, and in addition thereto the disadvantages of present system as compared with the advantages of the p posed system. While the industry is in its infancy central stations should be willing to do many things this nature for the promotion of the cause, but the ti will come when the central-station managers will re against furnishing all the brains and labor necessary take care of electric vehicles. Co-operation with elect vehicle company salesmen is the goal to be reached central stations. These salesmen should be made fami with the policy of the central station in the territory which they operate and should be advised in regard rates, etc., so as to permit of their making statements will be confirmed by the central station. The central tion should not be expected to contribute to a natio advertising campaign, for this is peculiarly the functi of the vehicle manufacturer. However, the central sta can co-operate by means of local advertising and intellig salesmanship, and the result should be of mutual ben to the user, the vehicle manufacturer and the central tion. The voltage of vehicle batteries should be so selec that they can be charged conveniently from central-sta mains, of which the normal emf is usually between 105 v and 115 volts. An attempt should not be made to alter system to suit the battery, but the battery should be mad to suit existing systems. One of the first requisites for

introduction of the electric vehicle in any city is the establishment of a properly equipped garage. During the period of introduction, before there exists a demand for charging service, it is difficult to induce private parties to establish electric-vehicle garages and vehicle salesmen therefore look to the central station for the inauguration of charging facilities. After this branch of its business becomes a money-making proposition it could well be turned over to other parties with whom the central station could then co-operate.

Discussion.

The paper was discussed by Messrs. J. C. Bartlett and R. Whitney, of Philadelphia; W. H. Blood, Jr., and E. Mansfield, of Boston; A. Churchward, of Lynn, and W. Lunn, of Chicago. Mr. Bartlett discussed the paper from the viewpoint of the garage man, Mr. Whitney from the viewpoint of the manufacturer and the others from the central-station standpoint. Mr. Bartlett claimed that a technical man lacked enthusiasm and was a failure as a salesman. He emphasized the advantages of a trouble man and stated that the majority of troubles were due to undercharging, dragging brakes and to the commutator of the motor. Garages charging a flat rate of from $30 to $35 a month for charging, washing, cleaning and delivering an electric vehicle were failures according to the speaker, who also claimed that the garage should have a profit of about 4 cents per kw-hour on the energy sold. He said that unless the garage was subsidized by the central-station company it could not be made profitable. The bulk of his argument was directed against the central stations.

Mr. Whitney also called attention to some of the shortcomings of some distribution systems where, because of cost of copper, it was necessary to connect a battery across a 220-volt circuit and waste about half of the energy in a rheostat. High rates for energy, he claimed, affect the sale of electric vehicles, the buyer usually looking at the cost of energy as the cost of operating the vehicle.

Mr. Mansfield maintained that the central station should join in the plan for national advertising, as what will help the electric-vehicle industry will help the central station. He voiced the lack of enthusiasm apparent and said the vehicle industry needed some ginger to quicken it. Where enthusiasm existed there was no trouble in disposing of electric vehicles and no vexed questions needing settlement. Mr. Lunn said that in Chicago, where two trouble men are employed, experience shows that they do not go over the same defects twice after having once pointed out the remedy to the user.

ACCOUNTING SYSTEM FOR ELECTRIC TRUCKS.

The second paper at the morning session was written on the above subject by Mr. E. W. Curtis, Jr., of New York City, who described a system of accounting for electric trucks which involved the use of forms for keeping records in order that results obtained by users in one part of the country could be compared with the results obtained in another part. The records were divided into three distinct items—maintenance, operation and performance—and methods for determining under which heading each item of expense should be placed were described in detail. The author claimed that in the application of any system designed to obtain operating records time is one of the most important elements, and incidentally it is the most flexible. For this reason a time stamp and time clock should be used in conjunction with the forms in order to insure the greatest accuracy in this direction, and accuracy can be further improved by the use of clock-recording instruments on the trucks.

Discussion

Messrs. L. A. Coleman, of the United Electric Light & Power Company, New York, and A. L. Holmes, of the New York Edison Company, both discussed the paper and commented on some of the forms given therein. Mr. Coleman claimed that there was too much complication and bookkeeping involved to make the suggested system of use, especially in the hands of a driver. Both the speakers explained the forms used by their respective companies.

GARAGE ILLUMINATION.

The author of this paper, Mr. J. G. Henninger, of Cleveland, discussed in general the lighting of large and small garages and referred briefly to the principles underlying the proper illumination of a garage by day and by night. He emphasized the point that there should be plenty of outlets conveniently located, no matter how large or how small the garage may be. In a small garage, just large enough to house one machine and a charging set, there should be at least two lamps, one located on the ceiling and arranged so as to light the entire building interior, and a second portable lamp to be fitted to a long cord for both inspection and bench work. For convenience there should also be a lamp in front of the building, controlled from both the house and garage. In larger garages the general illumination should be such that a portable lamp would not be necessary, except for the inspection of the interior of a car, or for close work such as adjusting the brushes on a motor or making some close adjustments on a gasoline engine. Numerous outlets for portable lamps should be arranged about the building for the latter purposes. Plans of typical garages with wiring diagrams formed part of the paper, which was illustrated by stereopticon.

Discussion.

Mr. C. A. Littlefield, of the New York Edison Company, in discussing the paper called attention to the fact that in very many cities the presence of numerous outlets, even if not used, would result in a higher cost for energy owing to the systems of charging in vogue. He also commented on the paper from the viewpoint of the illuminating engineer.

EFFECT OF LOW TEMPERATURE ON THE ALKALINE STORAGE BATTERY.

Mr. Walter E. Holland, of Orange, N. J., presented a paper in which attention was called to an extensive series of low-temperature tests made upon the Edison alkaline storage battery by the Electrical Testing Laboratories, at the suggestion of Mr. Edison, in order that users of this battery might have full knowledge of its weak points, as well as of its advantages, and thus be able to handle it intelligently and avoid trouble. The tests showed that there is a critical temperature for the electrolyte, which varies with the rate of discharge, below which the capacity falls to a low value, and the lower the rate of discharge the lower is this critical temperature. It was found, however, that as soon as the battery was warmed to a temperature above the critical value the full capacity of the battery was obtained in every case. It was evident, therefore, that the chemical action which takes place in the battery is retarded below certain critical temperatures. In service it is necessary to prevent the electrolyte temperature from falling below the critical values. With a battery box well closed up a wagon taken out of a garage in which the temperature has been kept at 65 deg. can stand idle in the street at a temperature of about 7 deg., with a light breeze blowing, for a period of four hours before the electrolyte drops in temperature to 55 deg., below which the vehicle might become stalled if a large current were required. Mr. Holland claimed that the few cases where trouble was experienced with pleasure vehicles were invariably in cold localities, the conditions usually being that the battery was charged about once a week in a public garage and in the meantime was kept in an unheated shed, being used only for very short runs. In such cases as this heating units should be installed inside the battery compartment, to be operated by

the battery during the idleness of the vehicle. As soon as the battery is put in use in propelling a vehicle it will warm itself. The alkaline storage battery has been at a great disadvantage because of vehicle practice standardized by the older lead battery. Unsuitable motors, low-rate charging apparatus and ventilated battery compartments have been the principal hindrances, but these are gradually being overcome by progressive manufacturers.

Discussion.

Messrs. E. Higgins, representing the manufacturers of the Detroit electric vehicle, and F. E. Queeney, of Gimbel Brothers' New York garage, both testified to the excellent service received from the Edison battery in winter when proper precautions were taken to cut off the air supply and inclose the battery in an easily removable cover. The first speaker said that out of the 4000 cells in use by his company in New England no serious trouble was noted due to loss of capacity owing to cold weather. In New York the trouble was trifling.

VEHICLE-BATTERY PRACTICE IN CENTRAL STATIONS.

A paper on this subject was read by Mr. S. C. Harris, of the battery department of the New York Edison Company. The author showed to what extent standardization of equipment would prove of advantage to central stations. He stated that a determined effort should be made to secure standard methods, both in the construction and in the operation of vehicle batteries. Differences in the design of battery compartments cause an unnecessary amount of confusion and waste of time in the charging of batteries. In some cases half an hour or more is required to make a change of batteries, which, if more conveniently arranged, could be changed in not over ten minutes. The battery compartment should be arranged so that all of the cells are easily accessible for inspection, cleaning and watering. The battery itself should be standardized, so far as construction is concerned. There are in use at the present time many different styles of straps, any one of which would prove satisfactory. Many different makes of rubber jars are employed, while it would be preferable to select any one for standardization. In the operation of the vehicle batteries by the central-station garages there is a lack of uniformity in method. Some of the stations make use of curve-drawing instruments, others employ indicating voltmeters, some use ammeters, some watt-hour meters and others use amp-hour meters with automatic circuit-breakers. The amp-hour meter is being extensively employed for ascertaining the condition of the battery while in service in the vehicle. However, this meter does not indicate the condition of the battery, but indicates only the amount of charge or discharge, and it may mislead a switchboard attendant into believing that the battery is fully charged, when in reality considerable more charge is necessary. When used by inexperienced persons the readings of the meter may prove misleading under extraordinary conditions of charging. When a battery has been overdischarged it is best to disregard the meter for subsequent charges, as well as for regular overcharges. The author called attention to the fact that differences of over 100 per cent in the life-miles of batteries during practically the same kind of service are now found to exist. The cause may be improper operation or it may be poor plate manufacture, but whatever the cause may be combined effort should be made to locate it and find a remedy therefor.

Discussion.

The paper was discussed by Messrs. Bruce Ford and C. Blizard, of Philadelphia; W. Yeager, of Brooklyn; H. Alexander, P. D. Wagoner and F. E. Queeney, of New York, and G. W. Lunn, of Chicago. Mr. Ford said that from the paper one might infer that there are any number of proper methods of charging and told of the various means of telling when to stop a charge. He also spoke of the advantages of the amp-hour meter in vehicle practice Mr. Blizard said that if vehicle manufacturers could determine on one, two or three sizes of battery it would be an easy matter to standardize. Mr. Wagoner expressed the same opinion. Mr. Yeager spoke on better standards higher development of battery equipment and the proper operation and care of vehicles. Mr. Lunn claimed that the amp-hour was necessary on commercial cars.

Mr. Alexander, who is consulting engineer for a numbe of department stores in New York, said his experience indicated that the less a driver concerns himself with amp hour meters the better the service. Drivers are not in telligent when instruments are considered and all that coul be expected is that he would give the vehicle the same at tention that he would give a horse, leaving to the garag the rest of the care. He said that in delivery service th electric vehicle can only use about one-third of its capacit If it delivered 200 packages a day it did a good day's wor and that amounted to about 20 miles. Notwithstandin this, however, it compared favorably with the horse-draw vehicle. He said battery renewals were a large drawbac and suggested a battery that would have sort of a "smasl ing point"—that is, it could be returned to the maker would wear out when it needed cleaning. If the batte could be cheapened so that cleaning became unnecessa it would be an advantage. The care of the battery w expensive, Mr. Alexander said, and its upkeep should given over to an inspection department maintained manufacturers.

THE BATTERY TRUCK CRANE.

A paper on this subject was prepared by Mr. R. Rogers, of Schenectady, N. Y., and describes a machi designed by the General Electric Company which is a co bination of hoist, crane and vehicle. The latter is a 1-t storage-battery truck, made very short and having t battery mounted on the top of the frame at the rear e over the traction wheels, where it acts as a counterwei for the crane. The wheels are smaller than normal a have a greater speed reduction to the drive wheels, in or to insure a high draw-bar pull. The springs under front end are of double strength to bear the overhu weights liable to be handled by the crane. The batte motor and controller are of standard type. A cr arranged to swing at 180 deg. is mounted on the extre front of the vehicle, and is supported near the upper by a pivoted "A" frame and guy rods and at the bott by a large ball and socket joint. The crane is equip with rope and chain slings, barrel tongs, bale grapples, hooks, snatch blocks and small tools. The hoist is a c pact, weather-proof motor, controller, gears and truck one unit, capable of lifting one ton 20 ft. per minute. handles 30 ft. of cable and receives its energy from vehicle battery. The hoist is bolted to the vehicle fr at the foot of the crane, and the cable passes up thro the hollow top pivot over the sheaves and ending i swivel hook. When loads of a half ton or less are han the pulley is removed and the swivel hook is used dire The hoist-controller handle is connected to a lever venient to the operator, who pulls to raise, pushes to lo and releases to stop at any point, the lever returning to central or off position automatically. The hoist cont beside the automatic holding brake, a load brake, w prevents excessive speeds when lowering. The machir is applicable for hoisting, hoisting and carrying on the l and for towing trailers. The manner of using it for t se operations was explained at length by the author.

Discussion.

The paper was discussed by Messrs. T. I. Jones of Brooklyn; R. M. Lloyd, of Long Island City, and H. M. Harding, of New York.

THE ELECTRIC VEHICLE IN SMALLER CITIES.

The fact that electric vehicles have not been generally ıtroduced in the smaller cities was attributed in a paper v Mr. F. H. Golding to three causes. First, the central ation does not appreciate the value of vehicle charging as source of revenue. Second, the central-station operator 'els that because of some peculiar local condition, such as rades, paving or character of community, the introduction f electric vehicles into his city cannot be successfully :complished. Third, a desultory hit-or-miss campaign has :sulted in a few vehicles, but failure to instruct vehicle ırchasers properly and to oversee operation has caused hicles to fail to give satisfaction to the users. In order show what can be accomplished in the way of intro- ng electric vehicles in the medium-size city the results ...ned at Rockford, Ill., were outlined. There are now e in this city, which has a population of about 45,4..0. 5 electric pleasure vehicles and eighty private charging uipments. The success of electrically driven vehicles in is city is due in a large measure to the fact that the ric company employed a capable battery and motor for the purpose of instructing owners in the care and ation of the vehicles and batteries. It is estimated the annual cost of operation of an electric vehicle in ford is about as follows: Energy for charging, $60; y maintenance, $30; tire maintenance, $40; vehicle enance, $50, the total being $180.

Discussion.

Golding's paper, which was read in his absence by A. Hunnewell, of Lowell, Mass., brought forth more ssion than any other paper read before the meeting. of the discussion was relevant and some irrelevant subject matter in hand. Mr. Hunnewell told what is done at present by his company in displacing horse- vehicles and securing data which he hoped would service to his company in approaching prospective of electrics. Mr. H. T. Sands, of the Tenney organ- n, objected to the assertion that the central station not appreciate the value of the electric-vehicle load, ining that the large majority do appreciate it and ly desired to know how to get at it. He cited an instance illustrate how backward garages are to take up the mat- of electric vehicles. His company in one of the New nd cities offered to install a charging set, agreed to it in repair, instruct garage men how to use it and give the garage owner 20 per cent of the profit, but would accept the proposition, and his company had to a garage itself.

Alexander cited instances where central stations led no facilities for charging, and also said the cost o rectifiers was too high and the life of the tube too short, ough the rectifier was remarkably efficient in opera- t. As compared with an electric machine his records s w that the gasoline machine is out of service twice as ch as the electric, and the repairs cost four times as ch. Mr. Bartlett also mentioned some instances where t central station offered no inducement to electric-vehicle u rs. Mr. Thompson, of the Public Service Electric npany, gave testimony as to the value of having an e ineer as a salesman, stating that in Newark they had a engineer and his sales averaged two a week. Mr. Rus- s, of the General Electric Company, stated that the life o rectifier tubes averaged 1000 hours.

he difficulties encountered in small cities by department s es were evidenced by Mr. Queeney, who related the t bles of his company in getting garage service in Long B nch and in Far Rockaway. In order to show that the v icle manufacturers are themselves backward in pushing t r wares Mr. Thompson, of the Public Service Electric pany, stated that his company offered to expend $3,000 in publicity work if the manufacturer would spend $300, a found no one to accept the offer. Mr. Sands stated that in one instance eight inquiries were forwarded to manufacturers, and in 80 per cent of the cases no demonstration could be obtained. Mr. T. I. Jones said there were a dozen live prospects in Brooklyn at the present time and no attempt is made by the manufacturer to effect a sale. One concern desires twenty-five 5-ton trucks at the rate of three a month, but only one manufacturer up to the present is willing to make a demonstration to secure the order. Of nine charging stations maintained by the Brooklyn Edison company not more than two earn $1.50 a month, and the largest earns but $14 a month. Messrs. Hayden Eames, Day Baker, C. D. Marsh, F. J. Stone and others also joined in the discussion.

IMPEDIMENTS TO THE GENERAL INTRODUCTION OF POWER WAGONS.

At the evening session Mr. Hayden Eames, of Cleveland, gave a paper on the above subject. Among the impediments to the general introduction of the motor vehicle the author claimed that the psychological difficulties are by far the greatest. It will be necessary not only to educate owners and prospective users of such vehicles, but education must be directed also towards employees, who in most cases must modify their point of view and methods before the introduction of motor vehicles can be expected to be general. The principal economical virtue of the motor vehicle lies in its labor-saving characteristic. Under almost all conditions the wages of the drivers form the largest single item of expense. If the work of the man operating the new machine is arbitrarily limited to only what he can do with the old nothing is gained. In all regular delivery systems the problem is not only to lay out routes to fit the new machine, but to select the machine sizes so that the largest possible machine that can be fully loaded will completely empty itself over a selected route during a day's work. When motor vehicles are substituted for horse-drawn vehicles the method of loading and unloading, of handling packages, shipping-room arrangements and routine must be altered in order to take advantage of the new facilities. An investigation of the work accomplished by horse-drawn vehicles used by different express companies in New York City showed that teams were idle 40 per cent of the total time. A considerable portion of this idleness was due to the fact that the horses needed rest, and the men adjusted their loading periods with this end in view. The motor vehicle requires no rest, and hence the loading time can be considerably decreased. However, it is difficult to persuade the average user that the idle periods in a day's work in any way affect a comparison of the draft animal and the motor vehicle. The author concluded that the whole question of the rapid introduction of the motor vehicle is to-day one of public education. No associations, no corporations nor individuals are in a better position to provide this education than are the central stations, and no one, except possibly team users, are more likely to reap so great ultimate profit.

Discussion.

Mr. C. E. Michel, St. Louis, explained the difficulties encountered in introducing electric trucks, by reason not only of the inertia relating to the established use of horses, but also on account of the active competition of the gasoline car. The electric-car salesman finds himself handicapped on account of the fact that the gasoline-car salesman offers to the prospective customer an article which is well advertised and concerning the merits of which the prospective customer is already fairly well acquainted, while the customer is ignorant of the electric truck offered to him. Mr. Michel suggested that the National Electric Light Association, the Association of Edison Illuminating Companies and the Electrical Vehicle Association of America form a joint committee for the purpose of compiling data relating to the cost of operating gas, electric

and horse-drawn vehicles. With such data at hand the salesman of electric trucks would be in a much better position to introduce electric vehicles for supplanting horse-drawn vehicles or in competition with the gasoline vehicles.

Mr. P. D. Wagoner remarked that the keynote of the whole situation relating to the introduction of electric vehicles is education. The prospective users must be properly instructed concerning the possibilities of decreasing the time consumption in loading, the advantages of motor vehicles over horse-drawn vehicles and the specific advantages of electric over gasoline trucks.

Mr. Arthur Williams claimed that the arguments presented in Mr. Eames's paper are of such convincing nature that the paper should be placed in the hands of all owners of horse-drawn vehicles in New York. He pointed to the advantageous features of properly worded advertising matter, and claimed that the most effective form of advertising is that which calls attention to "repeat orders." Instead of pointing out the defects in other electric vehicles a salesman should lay stress on the excellence of the vehicle he is attempting to sell, and no more effective argument can be offered than that relating to "repeat orders."

Mr. W. P. Kennedy remarked that not all owners of electric vehicles appreciate the advantage of training the drivers in the operation of vehicles before placing them in sole charge. To this fact can be attributed many of the apparent failures of electric vehicles to perform the duty which should reasonably be expected. Mr. Kennedy remarked that the fact that certain department-store owners who have had in service for a number of years many electric vehicles continue to use horse-drawn vehicles is not due to the fact that the electric vehicles are unable to show a considerable saving over the horse-drawn vehicles. In one particular case where the electric vehicles were known to be operated at one-third less cost the department-store owner claimed that the investment necessary for substituting additional electric vehicles for horse-drawn vehicles could be more advantageously invested in the department store, in which the profit was even greater than the one-third saving by the substitution of one type of vehicle for the other.

CENTRAL STATION BACK OF ELECTRIC VEHICLE.

Mr. E. S. Mansfield, of Boston, gave an illustrated talk on the indorsement of the electric vehicle by central stations. The paper was devoted to a detailed discussion of the campaign of education for the introduction of the electric vehicle in which the Edison Electric Illuminating Company of Boston is now engaged. This campaign has been outlined in our columns in earlier issues. The author stated that it is not to be expected that every central station will institute a vehicle campaign on the same scale as that in Boston, but a proportionate amount of well-directed energy in this direction will bring about results beneficial to the electrical interests and increase the revenue to the central station. No electric company is so small that it cannot make use of some form of electric vehicle, and the electric interests are the logical ones to take the first step. If one or more agents can be induced to enter the field it is better for the central station not to undertake to sell electric vehicles, but if this condition cannot be brought about the local company is justified in taking the agency for what it considers the best make of electric vehicles until private interests are willing to assume the responsibility of representation, at which time the central station should relinquish its agency and continue its work along the line of co-operation. At least one first-class electric garage and charging station should exist in every city or town served by an electric-lighting company. It is better that such a charging station should be under private management, but, in any event, charging facilities should be provided, and the central station should undertake to do this work if efforts fail in other directions.

Discussion.

President Blood remarked that no one can now clai that the central station is not doing its part to hasten th introduction of the electric vehicle.

Mr. W. H. Francis, of the Edison Electric Illuminatin Company of Boston, being called upon by President Bloo described a trip made by him from Boston to New York i a Bailey electric roadster during the present week. The ca are of a new type designed for business as distinguishe from pleasure and touring service. They are built with low body mounted with a three-point suspension, givi maximum flexibility to the front axle and correspondi smoothness in riding. During the 244-mile run partial complete battery charges were obtained during the lun hour or evening at Worcester, Springfield, New Hav and Stamford. The following data were noted during t trip:

	Miles	Hours	Miles per Hour	Amp. Hours Mile
Boston to Worcester......	45	2.15	20.0	2.7
Worcester to Springfield.	53	2.30	21.2	2.55
Springfield to New Haven	64	3.12	20.0	2.77
New Haven to Stamford..........	43	2.0	21.5	2.58
Stamford to New York	39	2.15	17.3	2.2
Totals	244	12.12	20.0	

Each car is equipped with sixty Edison cells, the ma mum charging emf of which is 1.85 volts per cell, and mean running emf of which is 1.2 volts per cell. T car carried two passengers.

THE MOVING OF CITY FREIGHT WITH ELECTRICITY.

Mr. William P. Kennedy presented data, in the nature a progress report, relating to the moving of city frei with electricity, a subject which had recently been assig to him for investigation. He stated that considerable d culty had been encountered in compiling the necessary for a complete report, hence he was unable to submi formal report at the present time. His investigat showed that no complete record is kept of horse-dr vehicles in New York City, other than those kept for pu hire. There are in use only 1260 trucks coming under head. It would seem, therefore, that the horse-dr vehicles not being registered are not required to pay t in the city of New York. In the city of Chicago a la proportion of trucks are held for public hire, 90,000 ho drawn trucks being registered. During 1910 13,000 tons of freight entered the port of New York and al 12,000,000 tons were sent out. About 7,500,000 tons w handled in coastwise trade at the New York piers. Kennedy estimated that the handling of this frieght horse-drawn vehicles costs on an average 38 cents per while the cost would be only about 15 cents per to handled by electric vehicles.

ELECTION OF OFFICERS.

As mentioned in the first part of this account, the no nating committee recommended the re-election of the p ent officers, which was done as a matter of form in he manner prescribed by the constitution. The officers ele ed are as follows: Mr. W. H. Blood, Jr., president; Ir Arthur Williams, vice-president; Mr. C. E. Firestone, se retary; and Mr. Harvey Robinson, 245 West Forty-se nd Street, New York, treasurer and assistant secretary. he board of directors of the association is as follows: Me rs. H. H. Rice, Frank W. Smith, P. D. Wagoner, Louis l rr, W. P. Kennedy, Frank L. Dyer, James T. Hutchings, Luis A. Ferguson, W. W. Freeman, F. M. Tait, Hayden E ies and Charles Blizard.

Annual Meeting of the American Electric Railway Association.

The most successfully conducted convention in the history of the American Electric Railway Association or its predecessors was held during the present week at Atlantic City, N. J. The convention was the thirtieth annual gathering and it was attended by representatives of about 475 electric railway companies. Meetings were held by the parent association and by the allied Accountants', Engineering, Claim Agents' and Transportation and Traffic Associations. The affiliated Manufacturers' Association made the finest exhibit that has ever been presented for the inspection of delegates to the convention. Exhibits were made by 225 companies.

Abstracts of some of the reports presented before the Engineering Association are given herewith.

COMMITTEE ON GENERATION.

To facilitate investigation and report subjects discussed by this committee, which made its report to the Engineering Association on Oct. 11, were assigned to sub-committees of one, whose reports are included, as follows:

Mr. H. G. Stott: "Investigation of economical increase of boiler capacity for service and peak conditions"; "forced draft"; "possible improvements in apparatus or methods for increasing the boiler-room operating economies."

Mr. R. A. Dyer: "Direct-current turbo-generators larger than 500 kw."

Mr. L. P. Crecelius: "The purchase of bituminous coal under heat-unit specifications"; "the best standard voltage and frequency to be adopted for three-phase turbo-alternators with reference to size as related to voltage."

The chairman, Mr. Crecelius, took up the matter of a report on "boiler settings" with Dr. D. S. Jacobus, who consented to prepare a report but was delayed so that it was impossible to include it in time for publication.

In addition to the members of the committee named the following are members of the committee: Messrs. W. E. [illegible]n, William Von Phul, B. F. Wood, A. R. Myers, [illegible] Gates and A. Wolff.

In his paper on developments in the generation of steam Mr. Stott said that several important steps have been taken in producing new measuring instruments for use in the boiler room and in a more complete recognition of the fact that the boiler and furnace of the future must be able to conform more closely to the load curve than in the past. While the standard method of boiler testing gives an accurate average result, it does not give any idea of what the boiler is doing for short intervals of time. Two distinct types of indicating apparatus are now available; first, the Venturi meter, which is used preferably to measure the water fed to the individual boiler. The second method is the use of a steam flow-meter of the Pitot tube type. A third measuring instrument of almost equal importance, for measuring the amount of coal fed to each boiler, has also been developed. In the furnace the principal improvement seems to be in the intelligent use of forced draft in order to obtain high rates of combustion when required. To meet the enormous variation of load in railway plants in an economical manner, taking into consideration not only operating and maintenance charges, but also fixed charges, the best solution seems to be to design the boiler-room equipment for maximum operating economy at the average load of the plant and be prepared to sacrifice some slight loss in efficiency at the higher and lower loads. Several methods of doing this are available, the most obvious one being to install two stokers or grates under each boiler so that one may be banked during the lighter loads. A second method, which is as yet incompletely developed, is the use of oil in burners protected by the bridge wall from the grate or stoker on which coal is being burned. A third method is the use of some form of grate or stoker which can be operated economically with natural draft up to say 150 per cent of rating, with best economy at 100 per cent rating.

Mr. Crecelius, in his paper on the best standard voltage and frequency to be adopted for three-phase turbo-alternators with reference to size as related to voltage, submitted figures indicating that 11,000 volts is the most satisfactory standard transmission emf for most systems requiring large steam turbo-alternators. Considerations of simplicity and economy demand that the voltage of the generators be the same if possible. The proper protection can be secured best by connecting the necessary current-limiting reactors mounted on non-magnetic cores between the generator and bus, and the reactors should have a reactance of approximately 6 per cent. The use of a three-phase, star-connected, 11,000-volt, 25-cycle generating system with grounded neutral seems particularly advantageous for conditions existing in the average American city of over 200,000 inhabitants where the energy is generated by means of steam turbines, and it is a debatable question whether this does not constitute one of the principal limitations to large turbo-generators.

Mr. Dyer in his report on direct-current turbo-generators larger than 500-kw rating quoted a comprehensive letter of the Westinghouse Electric & Manufacturing Company. This company has constructed a number of 500-kw, 1500-r.p.m. units. It has not built any 600-volt railway sets of greater rating or entertained any serious requests for bids. From information taken from the technical press, however, it is stated that units up to 750 kw or 800 kw at a voltage of 250 kw up to 1500 kw at 600 volts have been built by several different European electrical concerns. The average speeds of such size units are in the neighborhood of 1500 r.p.m. and 1200 r.p.m. respectively. The small number of such sized machines in operation and the experience of the manufacturers in this country seem to indicate that the demand for such machines is not great.

Mr. Crecelius in his paper on the purchase of bituminous coal under heat-unit specifications gave a list of reports prepared by the United States Geological Survey and the Bureau of Mines. He also gave the text of the contracts used by the Interborough Rapid Transit Company, of New York, and the Cleveland Railway. Throughout the reports the government has been exceedingly careful to advise against the use of specifications purely on a heat-unit basis. It recommends that a careful examination of plant conditions be made and a fuel supply be selected in accordance with the conditions revealed. The most careful attention should be given to the nature of the existing furnace equipment, draft and load; the character of coal best suited to the plant conditions; the number of heat units obtainable for a unit price; the cost of handling the coal and ash; and the possibilities of burning the coal without smoke or other objectionable features. In general it is stated that in any market the coal obtainable at the lowest price is the most economical provided the furnace equipment is suitable. If the furnace is not so designed as to permit the use of the cheaper coal it should be changed.

REPORT OF COMMITTEE ON POWER DISTRIBUTION.

The report on power distribution was presented before the Engineering Association on Oct. 9 by the following committee: Messrs. A. F. Hovey, chairman; G. W. Palmer, vice-chairman; S. L. Foster, A. S. Richey, E. J. Dunne, S. D. Sprong, William Roberts, C. R. Harte and J. J. Brennan (resigned).

Specifications for overhead crossings and electric transmission lines framed by this committee in conjunction with committees of the National Electric Light Association, the American Railway Engineering Association and the American Institute of Electrical Engineers are published as an appendix to the report. The specifications have been adopted by the Association of Railway Telegraph Superintendents.

A sub-committee on line-material standardization was appointed with a view to making as many as possible of the units of construction interchangeable, but it was unable to make a report, and this matter will go over until next year.

Outline drafts of specifications for the joint use of poles, specifications for overhead crossings of trolley-contact wires over railway tracks and specifications for overhead crossings of foreign wires with electric-railway wires have been prepared and tentatively adopted by the committee. Through the 1912 committee the association should get in touch with various other associations and prepare a joint report on this subject.

The committee reported on the following matters in addition to those mentioned: Specifications for high-tension, three-conductor, paper-insulated, lead-covered cables; specifications for single-conductor, paper-insulated, lead-covered cable for 1200 volts; specifications for 30 per cent Para rubber compound; recommendation for standard-grooved trolley wire in sizes other than No. 0000; a paper on concrete, latticed and tubular poles; definitions of cable and strand; specifications for No. 00 round hard-drawn copper trolley wire.

The report of the committee on energy distribution was discussed by Messrs. A. F. Hovey, E. N. Lake, G. W. Palmer, William Roberts, R. D. Coombs, L. P. Crecelius, Harry Barker, Farley Osgood and H. H. Adams.

REPORT OF COMMITTEE ON EDUCATION OF ENGINEERING APPRENTICES.

The report of the committee on education of engineering apprentices was presented before the Engineering Association on Oct. 9. This report was prepared by Messrs. Walter H. Evans, chairman; W. G. Gove and H. A. Benedict. It was considered advisable at this time to confine investigation to that class of engineering apprentices that will be employed in the maintenance of electric-railway equipment in the rolling-stock department. The observations of the committee led to the conclusion that, taking the country over, there has never been a time when a greater necessity existed for the proper training of young American boys in mechanical trades than is presented now. The committee submitted a schedule as a recommended course of training to develop a thorough electric-car mechanic. The total time of apprenticeship actually served would be forty-eight months. Seventeen years of age is the best time to start.

REPORT OF COMMITTEE ON HEAVY ELECTRIC TRACTION.

The committee on heavy electric traction confined its report, made to the Engineering Association, to the following subjects: Location and clearances for third-rail working conductors; location of electrical end conductors on cars and locomotives, and location of automatic train stops.

As a result of conferences with committees of the American Railway Association and the American Railway Engineering Association a diagram has been prepared showing location and clearance lines for third-rail working conductors, which it is understood will be satisfactory to the committees of those associations. It has been thought advisable to confine attention at this time to the establishment of such standard location and clearance lines as affect the relation of the third-rail construction to rolling equipment and leave for subsequent consideration such standard location and clearance lines as affect the relation of the third-rail to permanent-way structures. It is recommended, however, that the incoming committee take up the question of permanent-way construction lines as bearing upon the space required for the installation of third-rail working conductors, with the object of recommending a standard satisfactory to the committees of the three associations. The committee therefore recommends standards and also terms which have been adopted by the American Railway Engineering Association.

The subject of the location of electrical end connection on cars was considered by a sub-committee. It is im portant for all roads, in the opinion of the committee, t adopt as far as possible the Master Car Builders' standard for location of mechanical and hose connections, but i view of the wide variation in practice regarding electric connections it will probably be impossible, at least for considerable time, to adopt a definite standard for eac type of connection. It would seem feasible, however, t define certain space at the ends of cars to be used in elec tric service either at once or at some furture time.

As the use of automatic train stops actuated in connec tion with the signal system as a means of protection again failure to see or obey the signal is increasing, especially c electric railways operating in subways and tunnels, tl committee makes certain suggestions regarding the prop location of trip arms along the track and contact devic on cars, which may be regarded as "recommended practic until such time as the use of train stops becomes su ficiently general to justify the adoption of a standa location.

The members of the committee are Messrs. E. R. Hi chairman; E. B. Katté, vice-chairman; W. S. Murray, J. Davis, Hugh Hazelton and E. F. Gould.

REPORT OF COMMITTEE ON EQUIPMENT.

The committee on equipment, of which Mr. M. V. Ayr was chairman, submitted a report dealing with the heati and ventilation of cars, design of car bodies for lig weight, design of car trucks for light weight, design electrical equipment of cars for light weight, standa couplers and air signals and control connections for int urban service. Concerning the changes that could be ma with advantage in order to lighten the electrical equipm of cars, the committee stated that motors could be designed with special reference to the elimination of u necessary material, use could be made of higher sp motors with greater ratio of gear reduction, forced ve lation could be employed, the working temperature co be raised by the use of heat-resisting insulation and speed could be increased by field-circuit control.

The weight could be minimized by the use of sheet m gear cases, which becomes possible by the substitution autogenous welding for riveting. The use of forced ve lation has been regarded for years as a probable devel ment of electric car equipment. There is no doubt tha affords means for greatly increasing the steady load-car ing capacity of motors. With modern motors of interp construction there will hardly be any circumstances un which the heating will not be the practical limit of rat and forced ventilation affords an effective means of creasing the rating.

The plan of raising the working temperature by use of heat-resisting insulation has been tried in sev instances with very encouraging results. The possibilit operating at higher temperatures, which has been bro about by the introduction of interpole design, means gre output from a given motor or a lighter motor for a g output. Asbestos and mica have been used with some cess as heat-resisting insulating materials, but the most couraging results have been attained by the impregnatio armature and field coils with the bakelite compound, w upon being baked becomes hard and dense like amber, of great heat-resisting powers. Bakelite is prepare in two forms, one a fluid resembling shellac, and the oth a thick paste. The former is used for painting and imp nating coils, and the latter for filling in interstices. The seems to be good reason for believing that the treatm of armature and field coils with this substance will p ve very valuable, both as a means of reducing the siz of motors for a given duty and as a method of prolon the life of motors already in service.

When the interpole type of motor is employed the eld

/eakening method of increasing the speed can be utilized D advantage. The control apparatus is arranged so as) provide one extra notch for high-speed running. When ɪn on this notch part of the turns of the field winding re cut out of circuit, thus weakening the field and increas- ɛg the speed.

Of the methods outlined above for reducing motor eights none is inconsistent with any of the others, and would by no means be impossible to combine all of them a one motor. There seems, therefore, to be good reason expect that the near future will see marked improve- ents in the electrical equipment of cars, resulting both in a increase in efficiency and a reduction in weight.

REPORT OF COMMITTEE ON WAY MATTERS.

he committee on way matters, of which Mr. J. M. rned was chairman, submitted a report covering girder d standard T-rail sections, with a view to recommending andards, including also an investigation for suitable echanical joints for these sections; organization and rules r the proper government of the way department; shop cilities and working equipment for the way department, d the cause of nosing of cars and its effect on unequal ar of gauge line of track. The committee recommended at increased attention be given to the discussion of the estion of the use of preservative methods for timber ed for track construction. It also recommended that all mpanies consider the adoption of suitable apparatus for nding the heads of rails at the joints, which apparatus also valuable for removing corrugations in the heads of ls, where such defects exist.

RT OF THE JOINT COMMITTEE ON BLOCK SIGNALS FOR ELECTRIC RAILWAYS.

The report of the committee on block signals for electric ilways, of which Mr. J. W. Waldron was chairman, con- d brief descriptions of the various signaling systems in service throughout the United States, and a digest laws and rulings concerning the installation of block nals on electric railways. On account of the rapid elopment taking place in new apparatus and methods of naling the committee did not feel justified in reporting ar definite conclusions. However, it suggested certain for the 1912 committee. This work would relate to ling on single-track and double-track interurban rail- ws operating under various headways and at various

REPORT OF THE COMMITTEE ON STANDARDS.

committee on standards, of which Mr. Paul Winsor chairman, considered certain matters referred to it the 1910 committee on equipment and the 1910 com- e on way matters. It suggested the standardization he taper for pinions. The time was not considered ripe the adoption of certain other matters as "standard," ar the committee recommended instead that they be adopted ecommended practice" rather than as "standard." r the head of recommended practice were discussed ed steel wheels, gauge for mounting wheels, open-hearth st l wheels, gauge of track on curves, layout of track hes, mates and frogs and symbols for recording sur-

RT OF COMMITTEE ON BUILDINGS AND STRUCTURES.

he committee on buildings and structures, of which Mr. M tin Schreiber was chairman, submitted reports relating to conomical maintenance, proper facilities for employees an proper installation of fire protection of carhouses and te inals, including open yards. It recommended that for th eport of 1912 consideration should be given to standard ge ral specifications and form of contract for railway str tures, review of standard carhouse construction, with re mmendations and proper waiting rooms and shelters fo lectric railways.

REPORT OF COMMITTEE ON RULES OF PROCEDURE OF THE COMMITTEE ON STANDARDS.

The committee on rules of procedure of the committee on standards, of which Mr. Paul Winsor was chairman, submitted seventeen rules covering procedure in the adoption of standards up to the time of their submission to letter ballot. It was recommended that the standing committees of the association make all necessary investigations and definite recommendations regarding proposed standards, and that the functions of the committee on standards be confined to reviewing such recommendations before they are presented to the association in convention for discussion and reference to letter ballot.

Toronto Meeting of the American Electrochemical Society.

Following are abstracts of papers read at the meeting of the American Electrochemical Society not noted in our issue of Sept. 30:

TRANSFORMATION OF AMORPHOUS CARBON INTO GRAPHITE.

A paper by Mr. C. W. Arsem, of the Research Laboratory of the General Electric Company, gives a review of the various opinions at present held concerning the conditions under which the different forms of amorphous carbon are transformed into graphite, together with the results of an experimental investigation of the two following points: First, whether heating alone to a high temperature transforms a pure form of carbon into graphite and, second, if this is not the case, whether it is possible to cause this transformation to occur by heating the carbon, well mixed with a quantity of mineral matter, insufficient to form carbides with all the carbon present. This latter point is suggested by Dr. Acheson's hypothesis that the formation of carbides plays an important rôle in the transformation of carbon into graphite.

Graphite is defined as that allotropic form of carbon having a specific gravity of 2.25 to 2.26.

The results of the investigation show that all the pure forms of carbon which have been tested when fired above 3000 deg. reach a limiting density which is not appreciably raised by the addition of small amounts of mineral matter. The end product is graphite in some cases and not in others. Pure petroleum coke, heated without addition of mineral matter, is converted into graphite of excellent quality, while lampblack, although it increases in density, does not reach the value corresponding to graphite, nor acquire any of its other physical properties, even when heated with various oxides.

TUNGSTEN OR MOLYBDENUM WIRE RESISTORS FOR ELECTRIC LABORATORY FURNACES.

A paper by Messrs. R. Winne and C. Dantsizen, of the Research Laboratory of the General Electric Company, of Schenectady, N. Y., described two types of electric laboratory furnaces in which ductile tungsten or molybdenum in wire or ribbon form is used as the heating element. On account of their hight melting points and relatively low cost tungsten and molybdenum are well adapted for such purposes.

The one type of furnace described is a crucible furnace, the other type a tube furnace. The heating cylinder in which the crucible is placed in the first type and the tube in the second type are made of alundum. In the first type a wire of ductile tungsten or molybdenum is wound in a helical groove on the outer surface of the alundum cylinder. In the second type molybdenum ribbon is wound around the alundum tube. In both furnaces an atmosphere of hydrogen is maintained. They can be used at temperatures of 1700 deg. C. and 1600 deg. C. respectively.

The paper was discussed by Messrs. Northrup, Hering, Kohn and Saunders.

RESISTIVITY OF SODIUM AND POTASSIUM.

A paper by Dr. Edwin F. Northrup gave new data on some electrical properties of sodium, potassium and their alloy in the temperature range from 0 deg. C. to 200 deg. C. Whenever these metals, or their alloy, pass through the melting point there is a very abrupt change in the resistivity (an increase in resistivity by 52 per cent for potassium).

Potassium has a high temperature coefficient of resistance (0.0058) in the range from 20 deg. C. to 80 deg. C. The temperature coefficient of the alloy of potassium and sodium, instead of being approximately the mean of the coefficients of sodium and potassium when liquid, is only between a third and a fourth of the mean value of the coefficients of its constituents in the same temperature range.

The ratio of the resistivity at 20 deg. C. of sodium to copper is 3.058, but the density of copper is almost exactly nine times that of sodium, which, in round numbers, makes sodium three times as good a conductor per unit of weight as copper. Hence it could compete with copper as a conveyor of electric energy if it cost anything less than three times as much as copper per pound, provided, of course, energy-carrying capacity were the only consideration. It has been suggested before now that sodium might be used in iron pipes in a practical way for carrying electric energy.

Dr. Northrup suggests that, inasmuch as electrochemical processes often necessitate the carrying over short distances of enormous currents, the consideration of the proposal might be with advantage taken up afresh.

ELECTRIC RESISTIVITY OF IRON ALLOYS.

A paper by Prof. Charles F. Burgess and Mr. James Aston gave an account of measurements of the electric resistivity of a long series of iron alloys made up from electrolytic iron. As the chief result it appears that all three of the elements of arsenic, silicon and tin, which are beneficial to the magnetic properties of iron, have the desirable accompaniment of high electrical resistivity. Among the materials adapted for high-resistivity resistors various combinations of iron with nickel, chromium and silicon are most suitable.

The change of resistance due to heat treatment in general follows the changes of physical hardness due to the treatment. Annealing usually results in a decrease of resistance. Quenching is uncertain in its effect; usually there is an increase of resistance with physical hardening of the bar.

REPORTS.

At the conclusion of the Thursday afternoon meeting Mr. FitzGerald presented the report of the special committee which had been appointed to consider methods for raising the standard, if possible, of the papers published in the *Transactions*. This report had been approved the night before at the meeting of the board of directors.

Mr. Edward R. Taylor presented a set of recommendations which will be presented at the coming National Conservation Congress.

ELECTROCHEMISTRY IN CANADA.

The first paper of the Friday session was presented by Dr. S. Dushman on electrochemical and electrometallurgical developments in Canada. He first reviewed briefly the existing electrochemical plants, including the manufacture of calcium carbide, calcium cyanamide, ferrosilicon, aluminum and phosphorus, electrolytic lead refining at Trail and electrolytic parting of gold and silver in the Ottawa Mint.

The second part of the paper discussed the possibilities of further developments, dealing in detail with the mineral resources of Canada, the available water-powers and transportation facilities.

METALLIC CERIUM.

A long paper by Dr. Alcan Hirsch gave an account of a very extended investigation, carried out at the University of Wisconsin, on the preparation and properties of metallic cerium. As starting materials use was made of the un purified rare-earth residues from monazite sand obtained as a by-product in the incandescent gas-mantle industry.

The author describes in detail the preparation of anhydrous cerium chloride and anhydrous fluoride and then deals with the preparation of metallic cerium. Aluminothermic methods do not give the pure metal, but this may be obtained by electrolysis of the chloride. The difficulties which were to be overcome in this electrolysis are discusse in great detail and detailed instructions given for the pro cedure.

The paper was discussed by Dr. Whitney, Dr. Parsons Dr. Northrup, Dr. Richards, Dr. Brown and Mr. Hansen.

THERMAL CONDUCTION AND CONVECTION IN GASES.

A paper by Dr. Irving Langmuir gave an account of a experimental investigation of thermal conduction and con vection in gases at extremely high temperatures.

The first experiments were made with a glowing Nerns filament in air. Later, however, in order to extend th range of temperature, experiments were made with a ductil tungsten filament in a hydrogen atmosphere. Figures ar given on the power consumption of the filament as a func tion of the temperature.

MEASUREMENT OF SMALL GAS PRESSURES.

A paper by Dr. C. F. Hale dealt with the measurement c very small gas pressures by a method in which the indica tions are not dependent upon the use of mercury.

The manometer of Pirani depends on the fact that at lo pressures the heat conductivity of gases is a function the pressure. He connects to the system under test an ord nary tantalum lamp, the filament being heated by current a constant voltage. As the gas pressure in the system decreased more and more the heat lost by conducti through the gas is continually decreased, consequently t temperature of the filament mounts steadily and with t temperature the resistance of the wire increases, there cutting down the current. One has only to calibrate a meter readings against the indications of some form manometer.

ELECTROCHEMISTRY IN NORWAY.

Dr. Joseph W. Richards, who had just returned fr abroad, then gave a concise description of some of t Norwegian electrochemical and electrometallurgical wo which he visited this summer. They included an alumin plant operated by the Héroult process, a nickel refin (separating of copper and nickel by the Hybinette proces a plant of the Badische Company for making sodium nitr from atmospheric air by the Schoenherr process, an alu num plant of the British Aluminum Company, a meta sodium plant, the large carbide and adjoining cyanam works at Odda and an electric zinc plant, using the modi electric zinc furnace of De Laval, and an electric steel pl Reduction of iron ore to pig iron in the electric furnac not yet carried out in Norway, but will be started next y There are also the large Notodden works for mak nitrates from air by the Birkeland-Eyde process.

Electric energy can be bought in Norway from po companies at $6.50 per hp-year, while the cost of genera energy is stated to be between $4 and $5 per hp-year.

ZINC PLATING ON WIRE.

The last paper of the meeting, by Mr. Alfred Sang, d with his process of galvanizing steel wire by heatin electrically in zinc oxide or zinc dust. The best tempera is 550 deg. C. About 154 kw-hours of electrical energ is required per long ton of wire of any diameter. The th of the process, as well as of the sherardizing proces is discussed at some length; his process is considered to special case of hot galvanizing.

After a vote of thanks to all who had contributed to the genuine success of the convention the meeting adjourn

New York Electrical Show.

The Electrical Exposition of 1911 opened in the new …rand Central Palace, Lexington Avenue, New York, on …ct. 11 and will remain open to the public until Oct. 21. …e affair was formally launched into being at a luncheon …ven by the New York Edison Company in the afternoon … which members of the Electric Vehicle Association of …merica and persons well known in the electrical industry, …cluding Messrs. T. A. Edison, N. Tesla, G. Dunn, and J. …ilchrist, were present. Mr. J. W. Lieb, Jr., acted as toast…aster and advantage was taken of the occasion by the …oducers and consumers of copper to present to Mr. Edi…

View of the Electrical Show at New Grand Central Palace.

… of electrolytically refined copper suitably en… and mounted on an ebony pedestal. The presenta…eech was made by Mr. C. W. H. Kirchhoff, president … American Institute of Mining Engineers, and the …is accepted on behalf of Mr. Edison by Mr. F. L. … Addresses were also delivered by Mr. G. B. Cor… and Mr. C. W. Price. There were about 200 guests …nt.

… first, second and third floors of the New Grand …l Palace are given over to the show, the third floor …g a track for automobiles and being set aside ex…cluively for automobile uses. The building does not serve to …t off the exposition as did Madison Square Garden in pre…ous years although it has greater floor area. Im…me…e columns and pillars are everywhere apparent and fro… no place can one obtain a comprehensive view. That sen… of splendor and dazzling brilliance which impressed the visitor entering Madison Square Garden at previous electrical shows is not obtained in the present exhibition. The exhibits themselves are of much more popular interest than was the case at previous shows and the management has striven to bring out prominently the application of electricity to the trades. There are arranged on the second floor of the building a number of industries in miniature in all of which electricity is now used extensively. The United States Government has also a number of very interesting exhibits. These include the electric school and commissary department of the navy; a spectacular exhibit from the coast defense division of the army, in which a battleship is blown up by submarine mines; a signal corps exhibit; a display of old electric inventions from the National Museum; a layout from the Department of Agriculture and a collection from the Bureau of Standards.

A number of electric automobile manufacturers have exhibits of their newest cars on the ground floor and opportunity is afforded for demonstrating the cars on the track on the third floor. The usual array of apparatus made by manufacturers of motors, meters, switches, vacuum cleaners, cooking and heating appliances, glassware, fixtures, vibrators, therapeutic machines, etc., is in evidence.

The New York Edison Company, The United Electric Light & Power Company, The Edison Electric Illuminating Company, of Brooklyn, and the New York & Queens Electric Light & Power Company have spaces allotted them. The New York Edison Company has a display of charts, diagrams, models and photographs demonstrating methods

of handling business. There is also a reception ... at one end of the hall, while on the opposite end are an illuminating engineering display, a printing establishment in operation, a window lighting display and a collection of photographs. In another part of the building the company has in operation an electric dining-room and a model kitchen.

The New York & Queens Electric Light & Power Company has arranged its booth for reception purposes where its customers are entertained. The company operates in the borough of Queens and this is the first time it has taken space at the electrical show.

The United Electric Light & Power Company has the choicest location in the show, its booth being in the center of the exhibition and towering above all others. The feature of its exhibit is a portrayal of modern store lighting and a practical demonstration of appliances used in business. The double-deck booth is so divided and so arranged that each store has its individuality and independent treatment and equipment. A barber shop, grocery store, clothing store and electric supply store are shown. Each store has had careful attention directed to

Exhibit of the New York Edison Company.

its illumination, the object being to show the proper method of applying electricity to store lighting and other practical purposes. The upper part of the booth is used as a tea and reception room. Musical and vocal entertainment are provided for guests as well as a light collation. Electric cooking appliances are employed in connection with the latter.

The Edison Electric Illuminating Company of Brooklyn has returned to its first love in that it has arranged an exhibit of a strikingly artistic and attractive home. The model apartment shown some years ago by the same company proved the most attractive drawing card of the exposition at that time and the present exhibit has already demonstrated its worth for gathering people to it. The home is divided into a kitchen and laundry, dining-room, bedroom, parlor, reception room and entrance hall and porch, each room being as complete and as clearly a model of what it should be as time, pains and money can make it. The many electrical devices which have been developed and introduced in recent years to add to the health, comfort and convenience of the household are shown in actual service.

Public Service Commission News.

MASSACHUSETTS COMMISSION.

The first of a series of hearings on the use of deman indicators by electric-lighting companies was held by th Massachusetts Gas and Electric Light Commissioner Oct. 6. The immediate occasion for the hearing was recent legislative resolve, which called upon the commis sion "to investigate the operation of demand indicator so called, and to determine whether or not it is expedie to regulate or prohibit the use of such meters." The boar is required to report to the next Legislature by Jan. 1 1912. Several consumers appeared before the board a complained that the indicators used by the Edison Electr Illuminating Company of Boston are inaccurate and t system used to compute bills is unfair. Demand indicato are used in office buildings and in industrial plants and i dicate the demand at certain times. Representative Call han, who drafted the bill that led to the legislation, sa that the case before the commission is based on the co tention that the indicators, while intended as measuri devices, do not accurately measure the current. The i dicator, he contended, should be tested by the sealer weights and measures. At present, however, there is public inspection. He said it was unfair that the c sumers should be rated on the basis of the cost of a pl large enough to furnish the maximum demand, because maximum demands do not occur simultaneously.

Everett W. Burdett, Esq., counsel for the Massachus Electric Lighting Association, stated that if there is public demand for a change of system the companies terested would like to know it, but at present the princi underlying the use of the demand indicator is conside sound. There should, of course, be assurance that dicators are accurate, and the Gas Board is the pro tribunal to deal with that phase of the subject. Engin Carpenter, representing both sides at interest, favored use of the indicator. A second hearing on the subject be held by the commission Oct. 27, when the lighting c panies' position in the matter will be given.

NEW YORK COMMISSION.

As the result of a hearing held by the Public Ser Commission, Second District, last week, on the applica of the Amsterdam Edison Electric Light & Power C pany for authority to exercise franchises for the const tion of poles, etc., and distribution of electricity for l and power in the village of Akin and the towns of Am dam, Mohawk and Florida, Montgomery County, Com sioner Sague, who conducted the hearing, announced he would recommend that the requested permissio granted to the company. Congressman Theron Akir Akin, asked several questions of Attorney Charles D. bet, who appeared for the applicant. No company present supplying electricity to the localities which th plicant company intends to enter.

The Public Service Commission for the Second Di has authorized the Ft. Plain Gas & Electric Light, and Power Company to lease to the Mohawk Hydro-El Company its plant in the village of Nelliston until 1921, with the option of renewal for a period o years thereafter. The Mohawk Hydro-Electric pany is authorized to exercise a franchise granted b th village of Nelliston on Dec. 20, 1910, to furnish e tricity for light, heat and power in that village. The pany is also authorized to exercise franchises grant b the town boards of Ephratah and Palatine to build el tric transmission lines in these towns. The company i authorized to issue its first mortgage thirty-year 6 per ent bonds to the amount par value of $56,000 to provide nds for the building of the transmission line and the equi ent necessary to operate under the franchises mentioned. The bonds are to be sold at not less than 92.

WISCONSIN COMMISSION.

The commission has given its decision on the matter of ie joint application of the LaCrosse Gas & Electric Com-'iny and the La Crosse Water Power Company to the 'fect that the commission act as arbitrator in interpreting e meaning of certain provisions in a contract between applicants. The applicants are parties to a contract, rding to the terms of which the water-power company required to furnish electric energy to the gas and elec- company at the rate of 1 cent per kw-hour and in 'se of failure to furnish such energy is to pay the "actual ation operating expenses" of operating the latter's steam 'ants. The contract further provides that, as a penalty interrupted service, the water-power company shall pay expenses of operation of the gas and electric com-s steam plants when it is necessary to run these 's because of interrupted service and shall receive no neration whatever until an amount of energy equal to oo kw-hours shall have been generated; for amounts xcess of this the water-power company is to pay only ifference between the actual station operating expenses the 1-cent rate provided in the contract. When it mes necessary to operate the steam plants because of ack of hydroelectric power the water-power company quired to pay the gas and electric company at the rate 500 per month as rental, this figure representing the st at 6 per cent on the plant investment.

question in debate was whether the item "main ice, supplies and expenses," as charged by the gas any in the expense account, was properly included in erm "actual station operating expenses." An examina-of the accounts showed that the matter of repairs con-ted the major portion of the above item. The pro-ngs at the hearing indicated that the views of the ctive parties were diametrically opposite on the sub-presented for arbitration. The water-power company nded that the term "actual" was used to make sure nly actual station operating costs, such as labor, fuel, nd waste, would be charged. On the other hand the pretation given by the gas and electric company was in case of failure to furnish energy as required in the ract the water-power company was to pay such ex-s—exclusive of the penalty provision—of the gas and ric company in the generation of energy, that the cost ergy to the latter would be the same as it would have had the former company performed its part of the act. This interpretation would include all items under ead of operating expenses—repairs, depreciation, etc. exact wording of the clause in controversy was not l in any of the authorities investigated by the com-on, but from the facts presented at the hearing, the rities consulted and partially cited in the case and rcumstances having a bearing upon the matter the ission was of the opinion that the term "actual station ting costs" as used in the contract properly includes st of repairs to the power plant of the LaCrosse Gas ectric Company during the periods of its operation sitated by the failure of the water-power company to the agreed amount of energy.

OHIO COMMISSION NEWS.

a hearing of the application of the Mount Sterling he Bell telephone companies to connect their lines be-the Ohio Public Service Commission last week. Mr. R. Schryver, secretary of the local company, testified that it ninety-nine-year contract with the United States phone Company by which it was to have the exclusive t to all the long-distance business passing through the ange, but that the United States Telephone Company agreed to allow the Bell wires to be installed as com-tors. Testimony was adduced to show that the same litions exist with relation to the Van Wert Telephone Company, where the Bell lines are also seeking admission to the exchange. Those opposed to this move argue that the Bell and United States companies are both owned by the same financial interests and that they have merely been waiting the passage of legislation that would allow them to consolidate.

City Solicitor Newton D. Baker has informed Mayor Baehr that it is not incumbent upon him or anyone to place specific instances of poor telephone service before the Public Service Commission in order to have an investigation made, but that under the new law the commission may investigate upon any form of complaint or may do so without any complaint and upon its own initiative. Mayor Baehr, however, says that there are plenty of instances of inadequacy, and data is now being secured and will be presented to the commission at an early date.

Attorneys for the Columbus Gas Company, Columbus, have intimated that they may test the constitutionality of the new public utilities law on the ground that it implies the taking of property without due process of law. An appeal for a lower rate for gas had been filed with the commission and at the hearing the attorneys declared that the law makes no provision for notifying gas companies in cases such as this, where they may sustain a loss of income through a possible reduction of rate. The legality of the petition filed with the commission was also questioned.

MARYLAND COMMISSION NEWS.

The Maryland Public Service Commission handed down a decision requiring the Western Union Telegraph Company to re-establish a branch office in the Belvedere Hotel, the terms of the lease to be approved by the commission.

There is a probability that a special investigation of the telephone service of Baltimore will be instigated by a committee of the Merchants' & Manufacturers' Association. The utilities committee of the association met last week to discuss the report of the experts who came here from Boston to investigate telephone conditions at the request of the Public Service Commission. There are many local business men who are not pleased with the report of the Boston experts and are in favor of having a committee of their own conduct an investigation.

CURRENT NEWS AND NOTES.

COMMONWEALTH EDISON N. E. L. A. BRANCH.—The membership of the Commonwealth Edison Company's branch of the National Electric Light Association is now 1274, or about one-sixth of the total Class D membership of the association. The annual banquet of the Chicago Section will be held the night of Nov. 1.

* * *

JOVIAN ANNUAL CONVENTION.—Mr. J. V. Dostal, national Jupiter of the Sons of Jove, has announced the general program of the Sons of Jove convention on Oct. 17-19 in Denver. This will include a smoker on Tuesday evening, Oct. 17; a business session Wednesday morning; a Jovian torchlight parade and special illumination Wednesday night; a second business session Thursday morning, and the national rejuvenation and banquet on Thursday evening, Oct. 19. The rejuvenation will be staged far more elaborately than at any previous convention, new apparel, apparatus and "business" being provided to add to the solemnity of the occasion. The banquet at the Brown Palace will follow Denver precedents in previous joviations. A sharp contest between Pittsburgh and Philadelphia for next year's convention is promised.

* * *

NEW ENGLAND SECTION I. E. S. OFFICERS.—As a result of a recent letter ballot the following have been declared

elected officers of the New England Section of the Illuminating Engineering Society: Prof. H. C. Clifford, chairman; Mr. H. C. Jones, secretary; Messrs. J. S. Codman and W. S. Farrow, managers.

* * *

Examination for Assistant Electrical Engineer.—The New York State Civil Service Commission, Albany, N. Y., will hold an examination for the position of assistant electrical engineer. The salary is $600 to $900 per annum, with maintenance. Applications must be filed on or before Nov. 3.

* * *

A. I. E. E. Standardization Rules.—The revised standardization rules of the American Institute of Electrical Engineers, which were approved under date of June 27, 1911, have been issued in bound form with blank pages interleaved. The publication is sold in this form for 25 cents, or 15 cents in paper covers.

* * *

Tests of Electric Meters.—Of 6209 tests of customers' meters reported to the New York Public Service Commission, Second District, during August, 1911, 339, or 5.46 per cent, were fast; 4775, or 76.9 per cent, were accurate, and 1095, or 17.64 per cent, were slow. Of a total of 238 companies, thirty-eight did not report for this compilation. Of the companies that made reports 105 made no tests.

* * *

Inventors' Periodical.—On Nov. 1 the publication will be commenced of a monthly journal to be called *The Inventors' Outlook,* having for a purpose to represent the interests of inventors, including the advocacy of laws to protect their rights. The publication will be issued monthly architectural engineering, the remainder being divided among the mining, sanitary and railroad engineering courses.

* * *

University of Illinois Enrolls Three Hundred Electrical Students.—Of the 3620 students enrolled this year at the University of Illinois, Urbana, 1206 are in the engineering schools, of which Dr. W. F. M. Goss is dean. Of these 290 are taking the electrical engineering courses, 275 mechanical engineering, 251 civil engineering and 306 architectural engineering, the remainder being divided among the mining, sanitary and railroad engineering courses.

* * *

Examination for United States Signal Service Electrical Assistant.—The United States Civil Service Commission will hold examinations on Nov. 22 to secure eligibles to fill vacancies as they occur in the position of electrical assistant in the United States Signal Corps, who will receive a salary of $1,080 per annum. Further particulars are given in Circular No. 847, a copy of which may be procured by addressing the commission at Washington, D. C.

* * *

Armour A. I. E. E. Branch.—At the first regular October meeting of the Armour Institute of Technology Branch, A. I. E. E., held in Armour Mission Hall, Thursday evening, Oct. 5, Mr. C. R. Schuler, of the 1912 class, read a paper on "Outdoor Arc Lighting," in which he described the characteristics and applications of the better-known series-type illuminants, including magnetite arc, flaming arc and tungsten incandescent lamps. Mr. L. H. Roller is chairman of the Armour Branch.

* * *

Twin Cities Electrical Show.—The third annual electrical show of the Northwestern Electrical Show Association will be held in the Armory, Minneapolis, on March 16-23, 1912, and already preparations are under way. The Minneapolis Commercial Club has offered prizes for electrical apparatus made by students. Prof. W. T. Ryan, of the University of Minnesota, and Professor Cook and Professor McClintock, of the local high schools, are the committee in charge. The Minnesota Electrical Association will hold its annual convention during the week of the show. Mr. R. W. Clark, 15 South Fifth Street, Minneapolis, the manager of the show, says that the 1912 exhibition bids fair to be a record breaker.

* * *

Electric Irrigation in New Mexico.—Preliminary steps have been taken by the Virtue Mining Company and the farmers of San Simon valley looking to the installation by the former concern of a large hydroelectric plant and the construction of an extensive system of transmission lines through the valley to provide power for operating irrigation pumps upon the farms. The proposed hydroelectric plant will be located in Clear Creek canyon and will utilize a head of several hundred ft. The grade leading up to the fall is about 1000 ft. to the mile, thus providing for future extensions. The San Simon valley is underlaid with a basin of water at a shallow depth and considerable development in the matter of bringing this water to the surface by wells upon which pumps have been installed has already been accomplished. It is planned by the Virtue Mining Company to run a network of electric transmission lines through the valley so that the power may be utilized for operating the irrigation pumps.

* * *

British Columbia Water-Powers.—In connection with the probable ultimate electrification of a portion of its line in the mountains, the Canadian Pacific Railway has acquired a water-power on the Adams River, which flows into South Thompson River near the west end of Shuswap Lake. The Adams River flows out of Adams Lake and is capable of developing 100,000 hp at two different points between the lake and its confluence with the South Thompson. It is in a heavily timbered country, where extensive lumbering operations are now being carried on. During a recent visit to the Okanagan Valley Sir William Mackenzie, president of the Canadian Northern Railway, bought the Coteau water-power and a charter for building an electric railway through the fruit-growing belt on both sides of Okanagan Lake. The Coteau is capable, it is said, of developing 7000 hp, which is sufficient to operate the proposed tram system. If built it will prove a feeder to the steam road which the company proposes to build into the Okanagan from Kamloops.

* * *

Superheating in Steam Turbines.—The current issue of the *Patent Office Gazette* contains the opinion of the Commissioner of Patents in an interference case involving superheating in connection with the steam turbine. There were three parties to the proceedings, namely, Messrs. C. G. Curtis, S. Z. de Ferranti and T. G. E. Lindmark, the dates of the respective United States patent applications being Oct. 2, 1905; Oct. 31, 1903, and Jan. 16, 1903. Mr. Curtis originally relied for conception and reduction to practice on an application filed April 9, 1897, but it was decided that a patent granted April 9, 1899, to Young anticipated Curtis, whereupon the latter abandoned the original application and filed another in 1905. Mr. de Ferranti contended that he should, with respect to priority, be entitled to the benefit of his British application, dated Nov. 11, 1902. The commissioner made a distinction between superheating which causes the steam to have the same temperature when it enters one superheater as that when it enters the next, and superheating in which the temperature is progressively augmented. On the latter ground priority was awarded to Lindmark, which decision was later sustained by the Court of Appeals of the District of Columbia.

DISTRICT ELECTRICAL SERVICE.

[P]lant of Colorado Springs Light, Heat and Power Company.

[C]ombined Steam and Hydroelectric Generation—Hydraulic Head of 2350 Feet—Data of Tests of High and Low Pressure Steam Turbines—Electric Vehicle Development

One of the most progressive central-station systems in [th]e Rocky Mountain district is that of the Colorado Springs [L]ight, Heat & Power Company, located in the municipalities [o]f Colorado Springs, Colorado City and Manitou and lying [at] the eastern base of the celebrated Pike's Peak Range, at [a]n altitude of from 6000 ft. to 8000 ft. above sea level. The [di]strict served by the company is of primary interest to the [tou]rist and health seeker; but apart from this it has [g]ained a considerable industrial development and illus[tra]tes the extent to which electricity may be efficiently [app]lied to the needs of a diversified community having [com]paratively few manufacturing plants of a miscellaneous [cha]racter.

[T]he company's system is of particular interest on ac[cou]nt of the generating equipment employed, the inter[con]nection of a hydroelectric plant at Manitou and a steam [pla]nt at Colorado Springs to secure economical operation, [the] introduction and sale of electrical energy to large [wo]rks occupied in the reduction of gold-bearing ores mined in the Cripple Creek district and the [illegible] of electricity throughout the community as a whole.

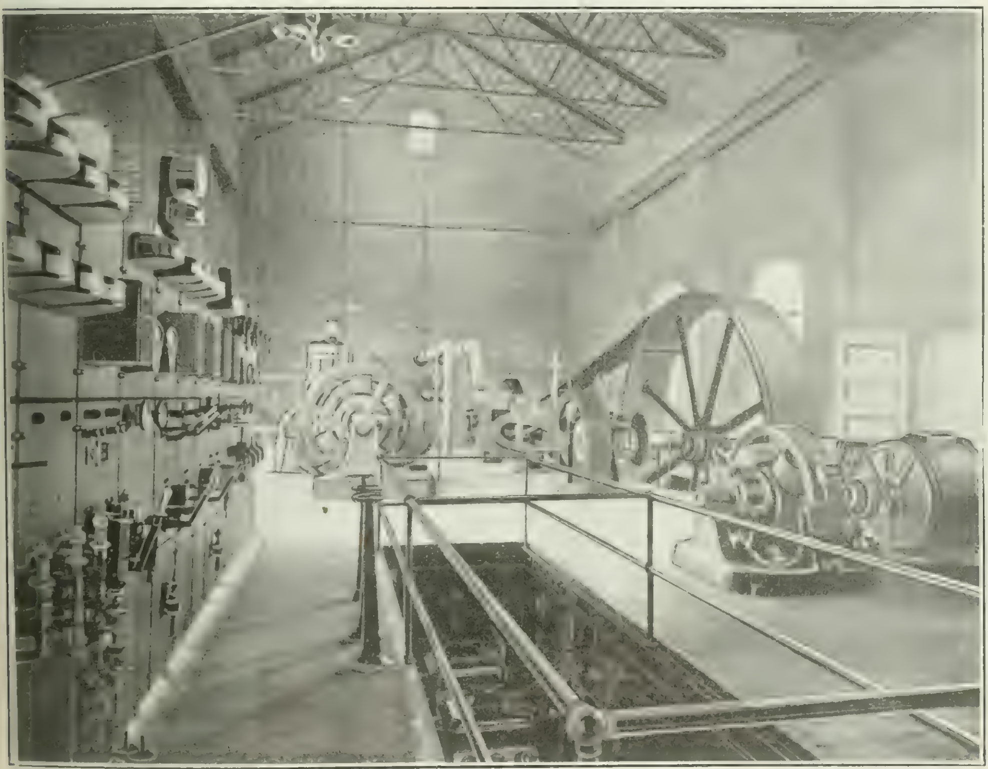


Fig. 1—Interior View of the Colorado Springs Station.

CENTRALIZED POLICY.

Within the past few years the company has been carrying forward a centralizing policy in connection with the generation and distribution of its service, which has been of great benefit to the community. Economy of production has resulted from the co-ordination of its steam and hydroelectric plants, and the community has correspondingly gained from the standardization of rates throughout the area reached by the company's lines. Both from the engineering and accounting points of view the service has been improved and an operating organization of high efficiency has been developed. Conspicuous in the company's progress has been the evidence of a close co-operation with the municipal authorities in the direction of street lighting and the illumination of public buildings, the equipment now in service at Manitou and on the exterior of the El Paso County Court House at Colorado Springs illustrating in a marked degree the effectiveness of central-station service in giving a progressive tone to the area supplied.

Along commercial lines the company has done much to encourage the introduction of electric pleasure vehicles, signs, window lighting and flatirons, and although the local gas business is conducted by the same management the introduction of electricity has been pushed with more vigor than is found in many cases of purely electric properties.

GENERATING PLANTS.

The generating installations of the company consist of a hydroelectric plant at Manitou, rated at 2250 kw, and a steam-driven station on the northeast side of Colorado Springs, with a rating of about 4750 kw, making a total available normal production of 7000 kw. The steam plant is utilized as the principal point of regulation for the system of interconnected lines resulting from the topography of the company's territory, and the major part of the company's output is distributed from substations located in Colorado Springs and Colorado City, including branch lines tapped off the inter-substation circuits for the supply of some of the larger gold-reduction works utilizing the company's service.

HIGH-HEAD HYDROELECTRIC PLANT.

The hydroelectric station at Manitou is one of the most celebrated plants of its character in the world, the effective operating head being 2350 ft. The station is located in a gorge at the base of Pike's Peak, and derives its water supply from the public reservoirs of the city of Colorado Springs, the latter being located in the Pike's Peak Range at elevations of from 9000 ft. to 14,000 ft. above sea level. Water is delivered to the plant through a steel pipe line about 17,000 ft. long, the pipe being installed in the following sections: Upper line, spiral-riveted, diameter 20 in., length about 4000 ft.; middle line, lap-riveted, diameter 21 in., length about 9200 ft.; and pressure line, double butt-strapped, triple-riveted and bolted flanges, metallic gaskets, diameter 20 in., length about 3800 ft. The hydrostatic pressure on the pipe line at the entrance to the station is about 1020 lb. per square inch, and the company has given unusual attention to the hydraulic problems involved in the installation, which was owned by the Pike's Peak Hydroelectric Company prior to the recent purchase of that property by the Light, Heat & Power Company.

The Manitou plant contains three 750-kw, 6600-volt, three-phase, 60-cycle General Electric revolving-field alternators, each being direct-connected to an 86-in. Pelton wheel having a normal speed of 450 r.p.m. Water is supplied to each of these units by a 45-deg. branch from the incoming pipe line, the supply pipe diameter being 10 in. and the nozzle diameter 2 7/16 in. There are also

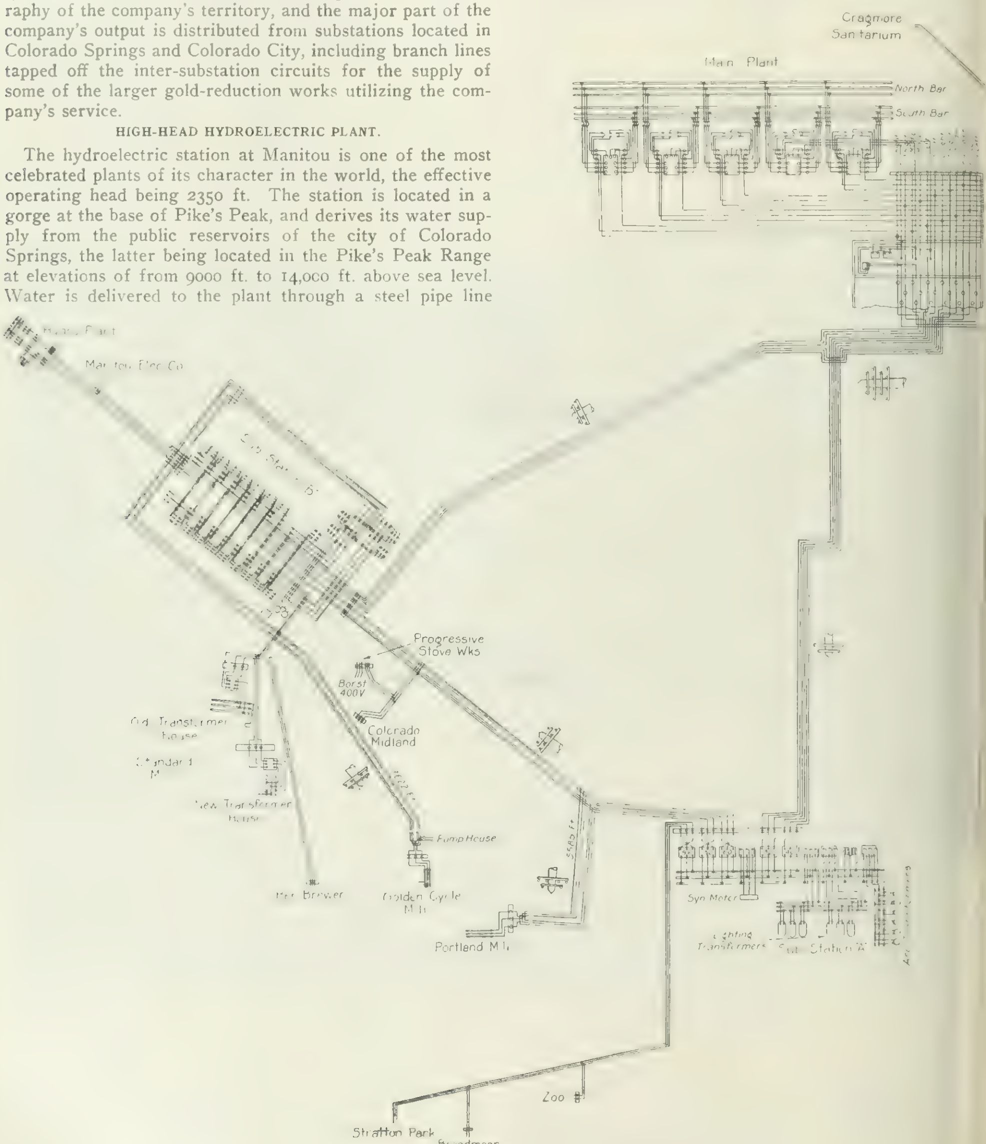


FIG. 2—Distribution System of Colorado Springs Light, Heat and Power Company.

rvice two 45-kw, 125-volt General Electric flat-comunded exciters, each being direct-driven at 975 r.p.m. by 42-in. Doble wheel, receiving water from the branch e equipment supplying the main units. The exciterel supply lines are 2 in. in diameter and the delivery zles are ⅜ in. in diameter. The pressure end of the e line is anchored to a concrete foundation between ts and the lower end is equipped with four relief valves to open at from 1200 lb. to 1500 lb. per square inch, and iarging into the power-house tailrace through 2½-in. s. Each main unit is provided with a gate valve, located the supply branch and driven by a ½-hp, 125-volt di-current motor. About thirty minutes are required closing the gate valve. The company has found that gle-gate valves are the only type which is successful er the conditions of head utilized, it being practically ssible to keep either double-gate or wedge-type valves t. The wheels are controlled by an oil-pressure sysoperated from Lombard governors and needle valves,

Fig. 3—Pipe Line to Generating Station at Manitou.

il pump being driven by a 2-hp motor. The turbinen is served by a 10-ton Whiting hand-operated crane.

HYDROELECTRIC IMPROVEMENTS.

xtensive tests have been carried on by the company g the past year or two with the object of improving efficiency of the equipment. The agreement between company and the city precludes the use by the company more water than is required by the community for estic and industrial purposes, the quantity varying ely at different times. In view of the importance of lucing energy at Manitou so far as possible, rather in the company's steam plant, exhaustive studies were e of the shape of the nozzles and buckets, the losses g segregated and compared under different conditions. flow of the stream was investigated by means of weirs, tubes and micrometer gages, and the shape of the zles changed to approximate more closely the theoal proportions. During the tests of the wheels inigations were also made of the friction losses in the e line, with the result that the losses under the high head employed are considerably less than were anticipated by the ordinary formulas. As a result of the various changes in the wheel and nozzle design the efficiency of the hydraulic units has been increased from about 65 per cent to 80 per

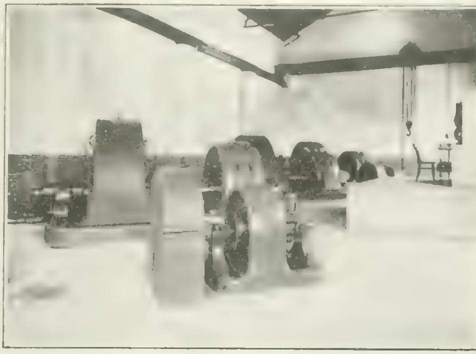


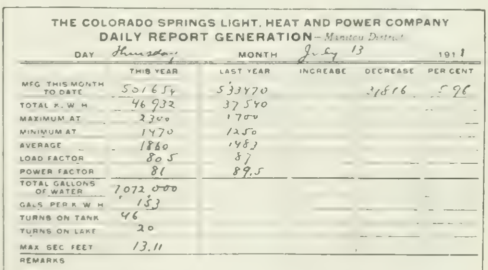
Fig. 4—Interior of Hydroelectric Plant at Manitou.

cent, the former figure having been in effect at the installation of the hydroelectric plant about eight years ago.

A recent improvement at the Manitou station is the installation of a lightning arrester and switch house of brick and concrete construction, in which are located switches and arresters for the outgoing lines, including various local distribution circuits for Manitou. The main switchboard in the plant is equipped with air valves controlling the oil switches used on the circuits, the latter being actuated by compressed air furnished by a 2-hp motor-driven compressor. The details of these oil switches have previously been described in these columns. An important improvement on the hydraulic side of the station consists in the installation of V-shaped baffle plates of cast iron in the path of the discharge from the waterwheels. These plates turn the water backward toward the wheels and eliminate the troubles usually encountered in the discharge of tail water from plants of high head. The high-tension room contains an outfit of General Electric multi-gap lightning arresters, three generator switches, three line switches and a paralleling switch, the latter serving to throw the outgoing inter-station lines into multiple operation. One set of busbars is installed.

LOCAL DISTRIBUTION AT MANITOU.

From the Manitou plant the local distribution service of the town is handled at 2300 volts for both commercial and street lighting, the usual series tub transformers being installed for the latter. The local motor service includes many small motors, operating machinery in spring-water-bottling works and small pumps and ventilating fans in restaurants and summer resorts. The street lighting at



THE COLORADO SPRINGS LIGHT, HEAT AND POWER COMPANY
DAILY REPORT GENERATION—Manitou District
DAY Thursday MONTH July 13 1911

	THIS YEAR	LAST YEAR	INCREASE	DECREASE	PER CENT
MFG THIS MONTH TO DATE	501654	533470		31816	5.96
TOTAL K. W. H.	46932	37540			
MAXIMUM AT	2300	1700			
MINIMUM AT	1470	1250			
AVERAGE	1860	1483			
LOAD FACTOR	80.5	87			
POWER FACTOR	81	89.5			
TOTAL GALLONS OF WATER	7,072,000				
GALS PER K. W. H.	153				
TURNS ON TANK	46				
TURNS ON LAKE	20				
MAX SEC FEET	13.11				
REMARKS					

Fig. 5—Daily Report from the Hydroelectric Station at Manitou.

Manitou is accomplished by about 300 100-watt tungsten lamps equipped with close-fitting radial-wave glass reflectors, the lamps being mounted about 12 ft. above the street level. The distribution of light is unusually effective. The service is mainly of an all-night character. Other electrical applications at Manitou include the illumination of the celebrated "Cave of the Winds" in Williams Cañon by incandescent and projector lamps, the lighting of the Mount Manitou Scenic Incline Railway by twenty 100-watt tungsten lamps, which outline the entire route against the side of the mountain, so that it is visible for a distance of about 12 miles, and the operation of the inclined railway

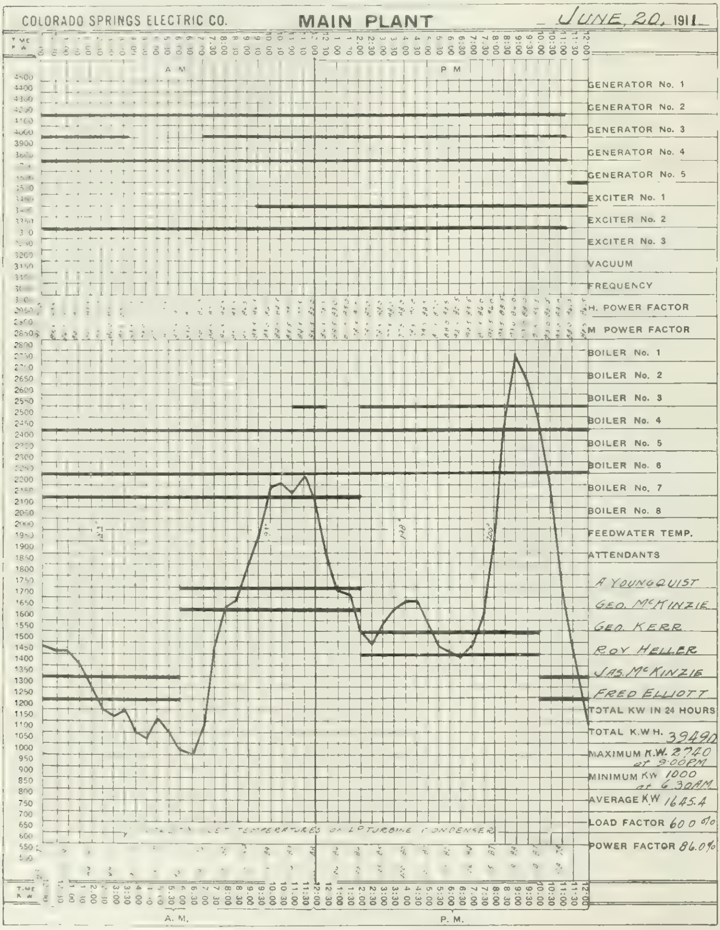


Fig. 6—Generating-Plant Record.

cars. The latter are of the cable type, one car counterbalancing the other, and are operated by a 75-hp, 220-volt, three-phase induction motor belted to hoisting machinery located at the top of the incline. Three 25-kw step-down transformers are installed at the summit of the incline and reduce the potential from 6600 volts to 220 volts for the motor service. Separate meters are installed for the motor and lighting service of the inclined railway, and selector switches, horn-gap and aluminum-cell lightning arresters are in use. The hoisting machinery is driven off a 72-in. pulley by a 16-in. belt running to a 16-in. motor pulley.

REPORTS.

Daily reports at the Manitou station include comparison of the output on a monthly and diurnal basis, load-facto power-factor and water consumption data. On a recer typical day the plant produced 46,932 kw-hours, the max mum load being 2300 kw, the minimum load 1470 kw, th load-factor 80.5 per cent, the power-factor 81 per cent, tl water consumption at maximum load 13.11 sec.-ft. and tl water consumption per kw-hour 153 gal.

MAIN STEAM PLANT.

The steam plant of the company contains two 500-hp ai five 400-hp water-tube boiler operating at 160 lb. withou superheating. Coal is pu chased from a mine about 15 ft. north of the plant, which located on a mesa about 5 mil from the center of Colora Springs. The generating equi ment consists of three 750-k 6600-volt, three-phase, 60-cycl revolving-field alternators, ea direct-driven at 90 r.p.m. by 24-in. x 44-in. x 48-in. ho zontal Corliss engine; a 100 kw Westinghouse low-pressu turbo - alternator, deliveri three-phase, 6600-volt curre at 1800 r.p.m., and a recen installed 1500-kw Allis-Ch mers high-pressure turbo-alt nator of similar electrical r ing. The engine-driven alt nators are operated mainly connection with the low-pr sure turbo set, the engines l ing run non-condensing a discharging into the turb through a 22-in. main exha running the entire length of station. The piping is arrang so that the engines can be hausted into the atmosphere desired through an 18-in. tr line. The high and low-pr sure turbines have also been stalled to permit joint op tion, the valve arangement p mitting the former to exha into the latter when desira The company has obtaine steam consumption as low 21.2 lb. per kw-hour when r ning the two turbines togeth

Coal is delivered to the st plant by dump cars runn from the mines to the boi room, a motor-driven c being used to haul the to the desired point at a storage pocket in front of the furnaces. The cost handling is about 3 cents per ton, and the fuel use a lignite, averaging about 9500 pound-Fahrenheit ther units per pound, the cost at the station being about $1.35 ton. The capacity of the coal cars is 5 tons each, and motor which hauls the cable has a rating of 7½ hp. coal cars are required for the plant's service. The wa supply of the station is obtained from a reservoir loc ed about 18 miles distant in the mountains. Natural dra is employed, and this is obtained from a brick stack 17 ft high and having a maximum diameter of 13 ft. The produced is about ⅝ in. of water column.

A feature of the steam plant is a home-made cooling [illegible]wer 120 ft. long by 35 ft. high, with a pond beneath, from [illegible]ich injection water is drawn. The low-pressure turbine [illegible]hausts into a hot well, which discharges into the tower [illegible]rough a 14-in. pipe, a Westinghouse-Le Blanc condenser [illegible]ing installed between the turbine and the hot well. The [illegible]gh-pressure turbine exhaust is ordinarily delivered to a [illegible]onnersville jet condenser discharging into a hot well [illegible]rough a 22-in. pipe, the well being connected with the [illegible]oling tower by a 12-in. line. Injection water for the [illegible] Blanc condenser is taken from a cold well at the end of [illegible] [illegible]ling pond through a 12-in. pipe and a second line [illegible] the same size is used for supplying the condenser of the [illegible]gh-pressure turbine. The high-pressure turbine con-[illegible]nser is equipped with a centrifugal circulating pump, [illegible]rect-driven by a 60-hp, 220-volt Allis-Chalmers induc-[illegible]n motor, and the Le Blanc condenser is provided with a [illegible]-hp motor-driven pump. Feed water is handled by a [illegible]-hp National heater and by an American heater of the [illegible]me rating. In operating the low-pressure turbine the [illegible]gines are used if the load exceeds about 1800 kw; other-[illegible] the high-pressure turbine is operated condensing.

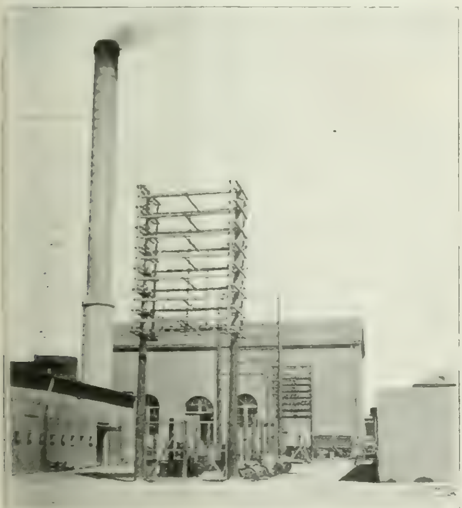


Fig. 7—Exterior of Substation, Colorado Springs.

[illegible]on as the load reaches 1800 kw the service demanded [illegible]e reciprocating-engine units is sufficient to give a [illegible]able steam consumption per kw-hour, and above this [illegible] the engines and low-pressure equipment are more [illegible]t than the high-pressure turbine.

TESTS.

[illegible]ts of steam consumption at the station have shown [illegible] with the 1500-kw high-pressure turbine operating con-[illegible]g 20.4 lb. of steam are required per kw-hour; with [illegible] reciprocating engines and low-pressure turbine in [illegible]ion the steam consumption is 18.3 lb.; with the two [illegible]es operating together, 21.2 lb., and with the high-[illegible]re turbine operated non-condensing the water rate is 37 lb. The vacuum during these tests was 21.5 in. and th[illegible] average barometer 23.8 in. At the altitude of Colorado S[illegible]ings water boils at about 198 deg. Fahr. Since the ex[illegible]ust turbine was installed the force in the fireroom has be[illegible] reduced by seven men. No change was made in the en[illegible]ne-room or at the switchboard as a result of the intro-du[illegible]ion of the low-pressure unit.

TEST OF 1,500-KW HIGH-PRESSURE TURBINE.

[illegible]he following steam-consumption test was recently run by the company upon the 1500-kw, high-pressure turbo-alternator. The turbine-driven generator is rated at 1500 kw at 65 per cent power-factor:

Kilo-watts.	Steam per Kw Hour.	Steam Cor'ctd for Moisture	Steam Pressure.	Inlet Pressure.	Vacuum.	Temperature Injection Water.
1,760	17.1	16.5	[illegible]	126	21.2	61
[illegible]	[illegible]	18.1	161.5	131.5	21	[illegible]
[illegible]	[illegible]	32.6	160.5	[illegible]	21.7	[illegible]
1,590	16.6	16.0	159	116	20.9	[illegible]
[illegible]	17.4	16.8	160	[illegible]	20.8	57.5
2,260	21.5	20.8	157	147	20.6	57
[illegible]	17.5	16.9	156	146	20.5	[illegible]
[illegible]	28.8	27.8	[illegible]	112	21	60
[illegible]	22.4	21.6	160	89.5	21.3	58.2
[illegible]	22.0	21.2	[illegible]	129	20.7	60

The turbine was operated condensing and independently in this test.

TEST OF LOW-PRESSURE TURBINE AND ENGINES.

Shortly after the installation of the low-pressure turbine equipment the following test was run in connection with the reciprocating engines and turbine, the former being operated non-condensing in connection with the latter:

Duration of test	24 hours
Coal consumed	259,810 lb.
Barometer pressure	11.55 lb
Gage pressure	148.1 lb.
Absolute pressure	159.7 lb.
Feed temperature	164 deg. F.
Average load	2,105 kw.
Steam per kw-hour	20.95 lb.
Coal per kw-hour	5.15 lb.
Moisture in steam	2 per cent
Dry steam per kw-hour	20.6 lb.
British thermal units in coal	8,537

MINOR ECONOMIES.

Apart from the studies of station economy which the company has made along the line of comparing the efficiencies of different combinations of generating machinery, the operation of the plant has been improved within the past few years by the reconstruction of the coal-handling system, by the improvement of the cooling tower and by changes in the furnace arrangement of the boilers. The original coal-handling system involved the haulage of fuel from the mine track to the boiler-room by hand-barrows. In the cooling-tower service the company has found that by using interstices made by assembling ordinary wooden fence pickets the cooling of the condensed steam is much more effective. On account of the high evaporation at the altitude of the station it is necessary to make up about 80 per cent of the water passed through the boilers.

The furnace improvement consists of the installation of sets of cylindrical firebrick tiling on the lowest and highest rows of tubes, circular sections being used on the lower level and semi-circular tubing being applied to the upper row. The tiling is 4 in. in diameter, and three lengths of 12 in. each are attached to the bottom tubes, two lengths of 12 in. each being fastened to the upper row, all within the first pass of the boiler. The tiling gives a Dutch-oven effect to the furnace and tends to lengthen the time required for the gases to pass through the boiler, with a resulting gain in economy of operation. Other improvements in the steam plant include the packing of two 75-hp engines' valve stems and piston rods with a composition of seven parts tin and one part copper, with resulting increase of service reliability. The cylinders of the large Corliss engines have also been lined with a ⅝-in. steel casting in each case, by which method the original rating of the engines has been maintained for a number of years after the original lining had become worn out. The present fuel consumption of the plant averages about 4.3 lb. of coal per kw-hour in all-day service.

6600-VOLT LINES AND SUBSTATIONS.

Substations are located at Colorado Springs and Colorado City. Each substation is connected with the other by two three-phase tie lines, and, similarly, the steam plant is connected with the two substations by two three-phase circuits, so that electrically these lines form a triangle with double sides. Between the steam plant and Colorado Springs substation two circuits of No. 1 copper, 4.9 miles in length, are run, two circuits of No. 0 copper being run 8 miles between the plant and the Colorado City substation. The two substations are 3 miles apart and are connected by two circuits of No. 1 copper. Between the hydroelectric plant at Manitou and the Colorado City substation two No. 3/0 circuits are run, the distance being 3.5 miles. The potential carried on all these lines is 6600 volts. Two sets of busbars are provided at the steam plant and the regulation of the system is effected by a Tirrill regulator on the main switchboard. By means of double-throw oil switches any outgoing line may be thrown upon either bus set. At Colorado City any incoming line or outgoing feeder may be operated upon either of two sets of busbars, including the local lighting and power service and the special 6600-volt power circuits supplying the larger gold-reduction mills. A 50-kw series lighting transformer is in use at Colorado City for street service, and the local 2300-volt service is also handled by a step-down transformer equipment, but the main purpose of the substation is to serve as a switching and metering point on the system.

NEW COLORADO SPRINGS SUBSTATION.

The substation in Colorado Springs is a new building recently completed by the company. It is located in the business center at the intersection of Sahwatch and Cucharras Streets, adjoining the original steam plant of the company. The substation is a brick and steel structure 85 ft. long by 40 ft. wide, and from it all the local lighting and power service of the city of Colorado Springs is

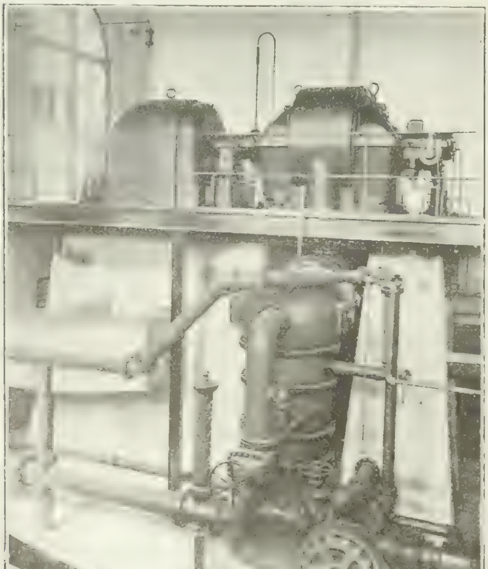


Fig. 8—Low-Pressure Turbine and Condenser at Colorado Springs.

handled, with the addition of exhaust and live-steam heating distributed to the Antlers Hotel and other consumers in the mercantile district. The equipment includes six 375-kw, 6200/2250-volt transformers of the water-cooled type for local lighting service, including small alternating-curre motors; seven tub transformers for street lighting; thr motor-driven feeder regulators; switchboards for arc ligh ing and commercial service; a 500-kw synchronous moto

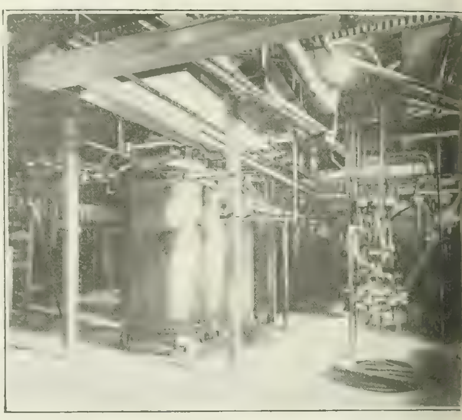


Fig. 9—Basement of Substation at Colorado Springs.

generator set, and a 75-kw induction motor-generator supplying 550-volt direct-current power service to the c ter of the city; a 500-kw Curtis turbo-alternator an 300-kw Bullock alternator, driven by a single-cylin engine, the two latter outfits being used in connection w the steam-heating service and operated non-condensing all times. These units are utilized mainly during the wi months, the summer steam-heating service being supp through reducing valves from a boiler plant located i building adjoining the substation. The engine and turb are operated at 120 lb. steam pressure, and each genera delivers 2300-volt, three-phase current to the substat busbars, a single set being provided.

The transformer equipment is located in the substat basement, the floor being provided with openings facili ing the handling of such apparatus by a 20-ton ha operated crane, which sweeps the operating room.

The main switchboard consists of fifteen panels dev to feeder service, transformers, an exciter set of the turb driven type, the two alternators and the motor-gener sets. Five panels are provided for the arc board. All station wiring is installed in conduit. A special featur great operating value is the location of remote-con switches governing the incoming 6600-volt lines insic sound-proof telephone booth on the main floor of the station. The 6600-volt lines are controlled by solenoid- oil switches located in the basement. The push buttons trolling these switches are mounted on a marble panel 3 long by 20 in. wide, each switch button being wired wi pilot-lamp outfit showing in red and green the conditio the corresponding circuit. A high-tension voltmete mounted above the panel.

STATION LOG.

An unusually complete daily log is kept at the main p a letter-size sheet being the standard. A typical lo reproduced herewith, showing for June 20, 1911, a maxi load of 2740 kw, a minimum load of 1000 kw, an ave of 1645 kw and a load-factor of 60 per cent. The p factor for the twenty-four hours was 86 per cent. Th shows the hours of service of each generating unit, the er units and the attendants. On the reverse side of each log are provided spaces for special notes of operatio a summary of the output of the station. On the day trated the exhaust turbine delivered 11,680 kw-hour the total station output being 39,490 kw-hours. The ex

[..]ine was operated practically all the time, with one or [..] reciprocating engines. A similar chart is prepared daily [..]nnection with the output of gas manufactured by the [..]pany, which also controls the gas production and dis[..]ation in the city.

OUTPUT STATISTICS.

[T]he company prepares monthly an exhaustive tabulation [..] its kw-hour output and distribution, comparing suc-

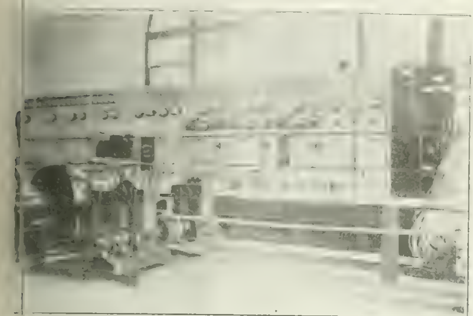


Fig. 10—Switchboard at the Colorado Springs Plant.

[..] years. In 1910 the company generated a total of [..]620 kw-hours, and distributed the following output: [..]eduction works, 16,399,010 kw-hours; miscellaneous [..]ting-current motors and lighting, 1,422,195 kw-hours; [..] lighting, Colorado Springs, 637,560 kw-hours; [..]lo City, 121,301 kw-hours; direct-current motors, [..] kw-hours; general lighting by station meters, in[..]g losses in lines and transformers, 3,905,300 kw-hours; [..]istribution, 23,462,152 kw-hours. Of the total output [..]e year the hydroelectric station generated 11,827,950 [..]rs, and the main steam plant 12,961,750 kw-hours. [..]aximum load on the hydroelectric station for the year [..]30 kw and at the main plant 4840 kw. The maxi[..]oad on the system was 5160 kw. The average yearly lo[..]-factor for the hydroelectric station was 88.5 per cent, fo[r] the steam plant 51.8 per cent and for the entire system 69 per cent. The street lighting of Colorado Springs was su[pp]lied for 4004 hours 33 minutes, the average number of la[m]ps in service being 276, and the wattage per lamp 506.1 [..] station. The lamp outages totaled 6934 lamp-hours. [..] alternating-current commercial-lighting load [..]o kw.

RATES.

[..]resent the company has 5883 customers, 6479 meters [..]n service. The lighting rates for residential service [..] cents per kw-hour, less 1 cent if paid within [..]fied date. A minimum charge of $1.25 per month, [..] cents for prompt payment, is rendered. A connec[..]arge of $2 per meter is made if a connection is made [..]ree months or less. The commercial lighting rate [..]ompany is 11 cents per kw-hour for an average use [..] hours per month, energy in excess of the above [..]billed at 6 cents per kw-hour, with a 10 per [..]scount on each rate for prompt payment. Motor[..] rates are offered on a sliding scale, ranging from [..]ts per unit for 150 kw-hours or less per month to 4.[..]ents for over 1200 kw-hours per month, with a 10 per ce[nt] discount. An alternative power rate is in service, [..]ing, subject to 10 per cent discount, from 7 cents pe[r] kw-hour for the first 25 kw-hours per month down [..] cent per kw-hour for each additional unit con[..]sumed above 100,000 kw-hours, plus fixed charges deter[..]mined by the amount of connected load involved in each [..]allation. A single contract blank is used for all forms o[f] [el]ectric service, stickers being attached in each case to sh[ow] the rates offered for the particular kind of con[..]sumption.

SIGN LIGHTING.

Conspicuous among the developments of the company's commercial department are the exploitation of electric-sign and window lighting, the stimulation of electric pleasure-vehicle business and the conduct of an electric flatiron campaign. In handling sign lighting the company sells the sign either for cash or in instalments, requiring from four to twelve monthly payments. The rate for sign and window lighting, based upon four hours' use of the lamps connected, nets about 6 cents per kw-hour. In other words, the sign rate is based upon a charge of $1.50 per 2-cp lamp of 15-watt rating per year, less 10 per cent discount. Carbon lamps are chiefly used, although the company is considering the general application of tungsten lamps to sign-lighting service. In several cases a flat-rate contract is made for sign lighting. The most striking example of spectacular lighting is afforded by the El Paso County Court House, which is outlined from tower to basement by about 2480 lamps of 2-cp rating, these giving a total connected load of 37.1 kw, which is carried daily in the summer season from dusk to midnight. In Manitou the local post-office building is outlined in electric lights, the cost being met by progressive citizens of the town. A beginning has also been made in long-hour lighting by the installation of small incandescent lamps in street-corner transparencies giving the names of intersecting thoroughfares. Electric signs are also widely used by rooming houses, laundries, drug stores, parks and mercantile establishments generally. In its electric flatiron campaign the company offered 6-lb. irons through solicitation for a fifteen-day free trial, and in 1910 about 1020 irons were installed, besides 104 miscellaneous heating appliances and washing equipments. The irons were sold for $1 down, plus 50 cents per month, until the cost of $4.50 was met. About 80 per cent of the company's customers are now supplied with electric irons.

ELECTRIC VEHICLES.

The electric-vehicle business is growing rapidly in Colorado Springs, although it is as yet somewhat hampered by competition between commercial garage owners. About seventy pleasure cars are now in use in the city, whose level streets and superb scenery offer an unusually attractive field for this kind of transportation. There are upward of half a

Fig. 11—Distribution Line in Alleys at Colorado Springs.

dozen commercial garages, and numerous private charging equipments have been placed in service. In general the cost of maintaining electric runabouts varies from $30 to $40 per month. In a representative garage of the better class a rental charge of from $12 to $15 per month is made, plus a charge of 10 cents per kw-hour for battery service, the latter including oiling and cleaning. The central-station company does not charge electric vehicles com-

mercially, preferring to leave such business to the garages. Many owners store their machines at home and utilize the garages only for charging and minor repairs. The electric company has recently purchased a 700-lb. electric vehicle and a 1000-lb. truck for meter installation and other service covering wide areas of its territory. Three all-electric garages are now in service in Colorado Springs.

In the small-motor field numerous motor applications are in service, including all but one of the hotels, restaurants, small shops, mercantile establishments and the large number of petty business enterprises which thrive in a city which is widely known as a tourist center. There is but one isolated plant in the city. The most conspicuous hotel installation is that of the "Antlers," which includes a varied equipment of motors for auxiliary service, electric baths and lighting. About 28,500 kw-hours per month are consumed by this establishment. The company's steam-heating rates vary from 70 cents per 1000 lb. for the first 10,000 lb. of steam condensed per month to 45 cents for each 1000 lb. condensed per month above 90,000 lb.

UNIT STATISTICS.

The company's gross income per capita from the sale of electricity in 1910 was $10.50. Including the sale of steam heat, the per capita income, exclusive of gas sales, was $11. The electric-lighting income was $6 per capita. The watts station rating per capita is 175.

OFFICERS.

The officers of the company are: President, Mr. George Bullock, New York; first vice-president, Mr. R. W. Chisholm, Colorado Springs; second vice-president, Mr. S. J. Dill, New York; secretary and treasurer, Mr. J. W. Ryter, Colorado Springs; assistant secretary and treasurer, Mr. Henry Morgan, Colorado Springs; general manager, Mr. George B. Tripp, Colorado Springs; superintendents, Mr. Donald Kennedy, Colorado Springs, and Mr. E. L. Benton, Manitou.

WIRELESS TELEGRAPH ANTENNÆ.

Operating Characteristics of the Umbrella Type of Aerial.

By David Darrin.

DURING the month of May, 1911, an investigation of the operating characteristics of a wireless-telegraph aerial was made at Cornell University by Messrs. F. R. Killick, F. H. Best, D. Darrin, A. L. Richey, S. B. Kent, H. B. Reynolds and L. F. Fuller, students under the direction of Instructor F. H. Kroger. It is believed that a report of the results of this investigation will prove of general interest at this time.

The experiments performed related to a determination of the factors affecting the design of the umbrella-type aerial, the investigation covering the effect produced upon the receiving efficiency by varying each of the following elements, the others remaining constant: Angle of inclination of antenna wires, length of antenna wires, wave-length of signals, number of antenna wires and quality of signals.

WEATHER CONDITIONS.

One important element entering into all experimental and practical work in this field is the variation in results obtained under various weather conditions. This factor is hardly capable of more than a very rough analysis, but a method was employed to correct the observations for all variations due to changes in weather conditions from day to day. In general, the weather during May, when the tests were made, was very hot and dry, but there were some cloudy, moist days, so it was thought advisable to apply a correction for weather conditions.

EQUIPMENT.

Of primary interest and importance in the review of this work is a clear understanding of the nature of the apparatus used. A large portion of this apparatus was c[on]structed by the members of the test party and at a v[er]y small expense.

The sending station was located at Franklin Hall, wh[ere]

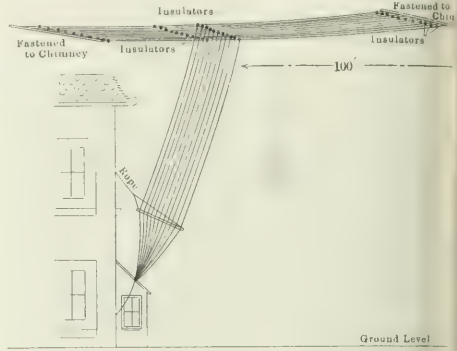


Fig. 1—Sending Aerial.

there was erected a 100-ft. eleven-wire aerial of the [hori]zontal type shown in Fig. 1. The sending equipment consisted of an open-core transformer, a variable tu[ning] helix, a variable reactance coil, a variable resistance fr[om] a fixed and a rotary spark-gap, a sending key and me[asur]ing instruments for recording the sending data, nam[ely] voltmeter, an ammeter and a wattmeter for the 220 primary circuit and two hot-wire ammeters for the [high-]frequency secondary or aerial circuit. This apparat[us is] shown diagrammatically in Fig. 2. The receiving e[quip]ment at Franklin Hall consisted of variable inductanc[e,] variable capacity tuning apparatus, silicon detectors [and] sensitive double-receiver head telephone, as shown in [Fig.] 3. For the purpose of determining the wave-length o[f sig]nals when sending there was also installed at this st[ation] a wave-meter, as shown in Fig. 4, equipped with a [vari]able capacity, a variable inductance, a silicon detecto[r,] both a telephone receiver and a very sensitive hot[-wire] ammeter.

The receiving station was located on Cornell H[eights,] approximately 2000 ft. from the sending station. It [con]sisted of a square wooden tower measuring 8 ft. x 8 [ft. at] the bottom, 3 ft. x 3 ft. at the top and 43 ft. in h[eight,] with a pole extending from the top to a height of 57

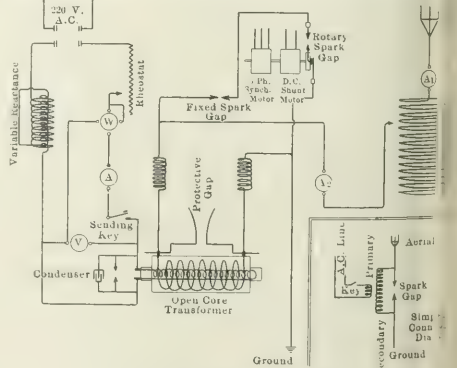


Fig. 2—Sending Station Circuits.

shown in Fig. 5. A small shanty was placed ins[ide the] tower at its base to hold the receiving-station app[aratus.] The aerial at this station was of the umbrella ty[pe and] was the one on which the tests were made. An ir

lar vas placed around the above-mentioned pole and arra ed so as to be easily raised and lowered for necessary adj stments and changes in the antennas. From this collar lexible leads ran down the side of the tower to the re ing instruments and then to the ground. Also from ollar as a center the antenna wires radiated outward.

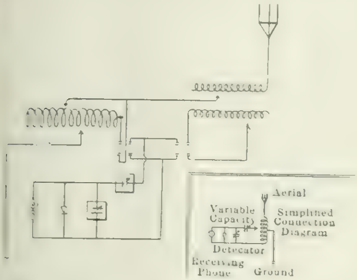


Fig. 3—Receiving Circuit at Franklin Hall.

n in Fig. 5. The receiving equipment here con- f two variable inductances (coarse and fine adjust- for tuning, a silicon detector and a sensitive double- head-telephone and, for all of the quantitative test ments of receiving currents, a very sensitive am- f the Fleming type was made and used. This in- t is shown in Fig. 7 and is the same as that de- by Prof. G. W. Pierce in his "Principles of Wire- legraphy," wherein he demonstrated that the deflec- f the instrument are proportional to the square of rrents through it. From this fact it follows that the roots of these deflections are proportional to the s, and in the following discussion the current values ined in this way. The limited time available for lid not permit the determination of the absolute f the receiving currents, but as all data are used nparative way only, this fact does not detract from e of the results obtained. For the purpose of com- ing orders to the sending station there was also at this station a sending set consisting of a bat- f eight dry cells, a small auto spark coil, a fixed zinc spar-gap and a sending key, as shown in Fig. 6.

TESTING METHODS.

first two tests were performed together in the fol- manner: The sending station was arranged to adi e energy in the form of electric waves at constant mp age and constant wave-length (the contact sending ey ing held down continuously during the whole of each

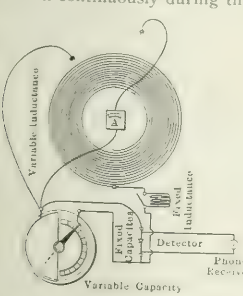


Fig. 4—Wave-Meter.

un approximately five minutes in order to have a steady nin rrupted outflow of energy). At the receiving station he rial was tuned for maximum reading of current re- eive under varying conditions of length of antenna wires nd gle of inclination of antenna wires with the verti- al. A hand-level was used to obtain the readings of height h, and "current" readings were simply the square roots of ammeter deflections.

The third and fourth tests were run in a manner very similar to that of the first two. The sending station was operated to give constant amperes radiation as in tests one and two, but the wave-length was varied for tests three and four. The receiving data were obtained in a similar manner to that for the first two tests and the only

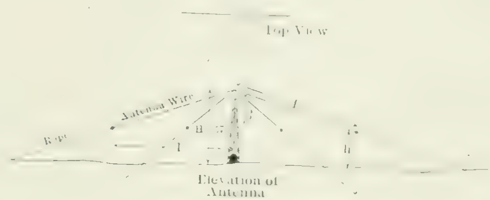


Fig. 5—Receiving Aerial.

difference was that a change was made in the variable elements. The receiving data taken May 22 for 500 m (1640 ft.) wave-length served as a basis for correction of the observations of receiving current values in all other tests at the same wave-length, but under varying weather conditions. The fact that these other tests were made on different days and under widely different weather conditions made necessary the application of some correction to bring them all to the basis of weather conditions on one day. Hence, on May 22 readings were taken at a constant value of the angle of inclination and at varying values of length of antenna wires and the results of these observations were recorded graphically, as shown on the weather correction of Fig. 8. From this curve a corrective constant was obtained for the readings at each value of length of wires.

The fifth test will be discussed under the heading of "Results" for the reasons there explained.

RESULTS OF TESTS.

For the sake of clearness in summing up the results obtained in the various tests it is thought best to refer to the statement of the objects of these tests and to take up the five points there outlined in regular order. Each of

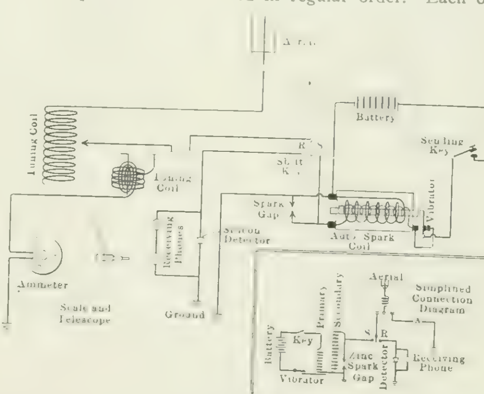


Fig. 6—Receiving-Station Circuits.

these is capable of being discussed entirely independently of the others, and this will be done. Finally, in closing a general discussion of the results as a whole will be given with an explanation as to the way they may be applied to the practical design and operation of wireless stations.

The angle of inclination of the antenna wires has a

very important bearing on the receiving efficiency of an umbrella-type aerial. In Fig. 9 are plotted curves representing the results of the first and second tests, and from an inspection of these curves three points stand out very clearly, namely: That the receiving current increases with an increase of the angle of inclination of the antenna wires; that the rate of this increase is greater as the length of antenna wires increases; that for any constant value of length of wires the rate of this increase decreases as the

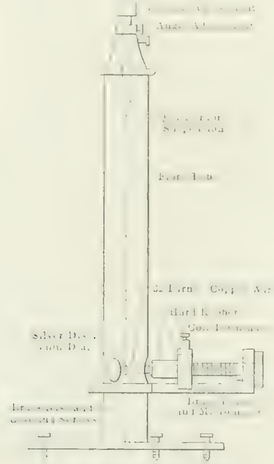


Fig. 7—Receiving Ammeter

angle of inclination increases. From the curves it might be predicted that the maximum receiving current for any given length of wires would be obtained at some value of their angle of inclination approximately equal to 90 deg., but as no tests were made at values of β exceeding approximately 75 deg., the exact position of the maximum point in these curves can only be predicted roughly. The curves would appear to be hyperbolic in form, but no mathematical statement of their general form of equation would be allowable without more extensive investigation and more complete data on that point.

The length of antennae wires is also a very important factor in the design of this type of aerial. From the curves of Fig. 9 a second set of curves for the same data was derived, as shown in Fig. 10. An advantage of this second set is that the ratio of L/H is used, thus eliminating the actual values of L and H, and making the application more general. Two points stand out most prominently in

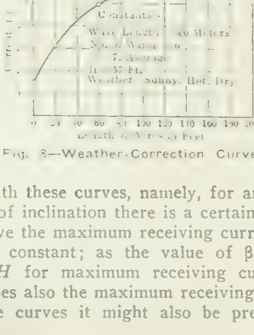


Fig. 8—Weather-Correction Curve.

connection with these curves, namely, for any given value of the angle of inclination there is a certain value of L/H which will give the maximum receiving current, other conditions being constant; as the value of β increases the value of L/H for maximum receiving current also increases, as does also the maximum receiving current.

From these curves it might also be predicted that at some value of β approximately equal to 90 deg. any crease in the value of L/H would produce an increase in receiving currents. This can only be roughly predicted cause no tests were made at values of β exceeding 75 The dotted-line curve on Fig. 10 passes through the mum point on each of the solid-line curves and its will be discussed in the final summary.

The wave-length of signals has an interesting and portant bearing on the receiving efficiency of this ty aerial. A glance at the curve of Fig. 11 will reveal fact that an increase in wave-length produces a dec in receiving current and vice versa, other conditions maining constant. This curve would seem to be h bolic in form and would indicate that an infinite recei current might be attained if the wave-length could be duced to an infinitesmal. This relation was not inv gated through a sufficiently wide range to allow of

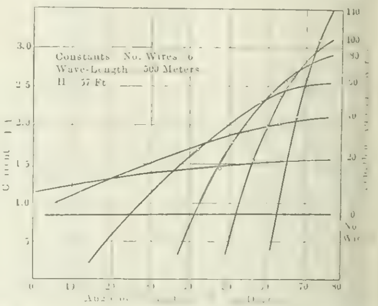


Fig. —Variation at Current with Angle of Inclination

statement of the mathematical form of the equation o curve and a further study of the limits in the applic of the curve might disclose facts of value in the pr of wireless-energy transmission.

The number of antenna wires has a decided bear the receiving efficiency, as shown in Fig. 12. This hardly requires discussion except to call attention t fact that the extra expense and bother of installing maintaining an aerial of more than six wires is not fied by the slight increase in receiving current obta by such increase in the number of wires.

The quality of signals was the last feature to be i gated in determining the elements that effect the rec

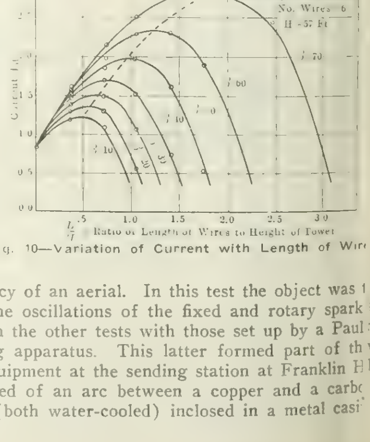


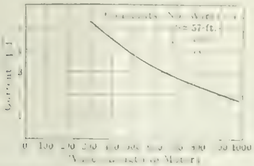
Fig. 10—Variation of Current with Length of Wir

efficiency of an aerial. In this test the object was t com pare the oscillations of the fixed and rotary spark ap as used in the other tests with those set up by a Paul n arc sending apparatus. This latter formed part of th wireless equipment at the sending station at Franklin H l and consisted of an arc between a copper and a carbo electrode (both water-cooled) inclosed in a metal casi con-

[illegible]ing an atmosphere of illuminating gas and exposed to avery powerful magnetic field perpendicular to the axis [illegible] electrodes. Owing to trouble in the operation of the [illegible] the results obtained were very unsatisfactory, but the [illegible]ance of such tests as were made is as follows:

	Spark Discharge.	Poulsen Arc
[illegible], meters	500	800
[illegible]	1.2[illegible]	1.35

[illegible] fact that under poor operating conditions and in [illegible] of greater wave-length of oscillations the arc pro-

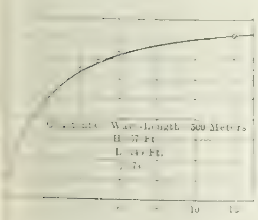


[illegible] 11—Variation of Current with Wave Length.

[illegible] a higher value of receiving current would suggest [illegible] possibility that under favorable conditions it might be [illegible] superior to the spark discharge as a sending medium.

SUMMARY.

[illegible] general discussion of the results as a whole will be confined to a short explanation of the manner in which these results can be applied to the designing or remodel[illegible] of wireless aerials of the umbrella type and will close [illegible] a word as to the field for further investigation and [illegible]ment in this line. As previously stated, six wires [illegible] sufficient in any case and more than six will give [illegible] very slight increase in receiving efficiency. The [illegible]s been clearly demonstrated that an aerial which is [illegible]rly designed for high receiving efficiency will have [illegible] sending or radiating efficiency, while the converse is [illegible]cessarily true; for this reason only the receiving effi[illegible] was considered in making the tests. Generally the [illegible] of β, the angle of inclination of the antenna wires. [illegible] be made over 75 deg. unless poles are used to sup[illegible] the outer ends of these wires. From the dotted-line [illegible] on Fig. 10 it will be noted that, if the angle β can be [illegible]ined or assumed, a value of L/H for maximum re[illegible]g current can be obtained from the curve by interpo[illegible] Assuming then that $\beta = 65$ deg. is to be used, it is [illegible] from the dotted line curve, Fig. 10, that the best [illegible] can be obtained by using wires 1.5 times as long [illegible] as their height above the ground at their



[illegible] 12—Variation of Current with Number of Wires.

ends. If poles are to be used, the writer believes [illegible] a value of $\beta = 90$ deg., approximately, should be [illegible]ined, and that in this case the longer the wires are [illegible] greater will be the receiving current within reason[illegible]ab[illegible] limits. It must be understood that an increase in length of wires means an increase in wave-length unless se[illegible]s capacity is introduced into the oscillating aerial circuit, and this is not desirable for several reasons, mainly because of lack of sensitiveness in tuning. The increase in wave-length in turn means a decrease in receiving currents, so that the increasing of length of wires if carried too far may cause a decrease instead of an increase of receiving currents. A knowledge of the approximate range of

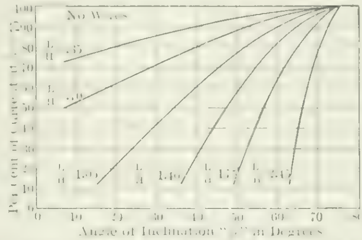


Fig. 13—Variation of Per Cent of Current with Angle of Inclination.

wave-lengths to be received should, of course, precede any work on the design of the aerial, but with that knowledge and the above curves a very efficient aerial can be made.

Fig. 13 has been derived from Fig. 9 by assuming that $\beta = 75$ deg. is the highest value of angle of inclination obtainable and taking the current at this value as 100 per cent. From these curves for various lengths of antenna wires can be determined immediately what per cent increase in receiving current can be obtained by an increase of β with any given length of wires. This information would be of service in deciding upon the advisability of changing the dimensions of an aerial already in operation.

A very important point which could not be investigated in this series of tests is the effect of varying H, and this would be a simple and very interesting point for future investigation. Experiments should also be made on the effect of variation of β from 0 deg. to 90 deg. and from 90 deg. to 180 deg. Further experiments on the effects of varying wave-length on the values of receiving currents would without doubt reveal some valuable information.

AN 18,000,000-GAL. PUMPING LOAD.

The Kansas City Electric Light Company has just begun service on its contract with Armour & Company to pump 18,000,000 gal. of water per twenty-four hours for the latter's Kansas City packing plant. For several years the electric company has been furnishing the packing plant 6,000,000 gal. daily from a motor-driven pump on a barge anchored in the Kansas River near its generating station.

Intake and Well for Alluvial River Having 40-ft. Rise.

The permanent new installation for delivering the larger quantity comprises a 500-hp, 6600-volt, 25-cycle motor, driving a single-stage centrifugal pump. This equipment is located in the basement of the company's generating station.

The pump delivers into a 30-in. pipe leading to the packing plant, against a hydrostatic head of 111 ft. This water is used principally for cooling purposes in the refrigerating plants, and is required in nearly uniform quantities throughout the twenty-four hours.

The former 6,000,000-gal. pump, with its motor, was mounted on the barge to take advantage of the shifting channels of the Kansas River. The barge can be anchored over any deep channel which remains when the river is very low. The pump discharges through a 20-in. flexible hose into a vertical riser mounted on a pier abutment. This pipe is tapped with flanged openings at 1-ft. intervals, so that the hose can be accommodated to the varying heigh of the river.

The accompanying sketch shows the special intake f both the plant condensing water and the Armour suppl This intake has been designed to operate with the 40- rise and fall in the Kansas River and Missouri Riv levels. The 40-in. inlet pipe will pierce the new prot tive level, entering through a valve and elbow the concret strainer well, 16 ft. in diameter and 55 ft. deep. T strainer panels divide this well into two unequal parts, fro the smaller of which the suction line of the pump takes i water.

Central Station
Management, Policies and Commercial Methods

LARGE NUMBER OF NEW CONTRACTS IN DETROIT.

August was an exceptionally busy month for the Edison Illuminating Company, of Detroit, the net gain in new customers being 1059. Even this record was broken, however, in September, when the total number of contracts closed was 2249, representing a net gain of 1173 customers. According to the 1910 United States Census, Detroit had a population of 465,766, and its ratio of electric-light users to total inhabitants, especially among the smaller residences, is among the highest for the cities of the United States. The sales manager of the Detroit Edison Company is Miss Sarah M. Sheridan.

WANTS NO REVENUE THAT IT DOES NOT EARN.

One great point made by the Byllesby electric-service properties is in keeping in touch with the public. Constant efforts are made to emphasize this point. The following card, inclosed in local letters by the Mobile (Ala.) Electric Company and signed by the president of the company, is an example:

"The Mobile Electric Company wants no revenue that it does not earn. Its management believes that an utility corporation can be conducted to the satisfaction of the public and stockholders—and be fair to each. No individual nor any corporation can be absolutely perfect; the best we can do is to make an earnest effort always in the right direction. You will find us anxious to investigate defects and errors and to apply correction. Do us the favor of making our office the *first place* you lodge a complaint."

ELECTRIC SIGNS IN BALTIMORE.

Baltimore is rapidly becoming a brighter city at night through the installation of electric signs. During the past two months more have been put up than the entire number previously installed. Even the smaller shopkeepers are receptive of the proposition of electric signs, and by great effort all former restrictions regulating the length of these signs have been repealed by the authorities. The local electrical contractors have set an example and practically every dealer in Baltimore has erected a creditable mechanical sign. The Blumenthal-Kahn Electric Company has a fan with streamers waving with good effect; Prather & Company have a very massive sign that can be seen for squares away, and Eugene Rosenfeld & Company are erec ing a sign at the present time, which will probably ecli anything so far erected in Baltimore. The flasher whi will operate this sign is represented as being the most co plicated one ever made and it is on exhibition in th windows on North Howard Street. The Consolidated G Electric Light & Power Company has solicitors at wo and the company is mailing literature to its consumers e plaining the advantages of the electric sign for advertisi purposes.

SEVEN THOUSAND ONE HUNDRED INCANDES CENT LAMPS IN TOWN OF 2100 POPULATION.

The town of Sabetha, Kan., with a population of 21 has 7100 incandescent lamps connected to its munici electric-lighting system. Of a total of 700 houses, (have the electric light and exhaust steam heat from municipal lighting plant is supplied to 500 houses and el tric power to factories and many houses for domestic p poses. The plant has also an ice-making auxiliary. George E. Johnson, a graduate of Armour Institute, engineer for the town, which also owns its water wo Mr. Johnson is assisted in his engineering work by wife, who is a sister of Maude Adams, the actress.

HOUSE-WIRING RESULTS OF CHICAGO TW YEARS-TO-PAY CAMPAIGN.

As the result of the two-years-to-pay campaign ina urated by the Commonwealth Edison Company four ye ago, 2933 houses have been wired at a total cost of $431, or an average outlay of about $147 per house. The Co monwealth company now has 144,000 customers in Chica

CENTRAL-STATION STEAM HEATING IN LOUISVILLE.

An ordinance has been introduced in the General Cou of Louisville creating a franchise for the supply of st heat in the central section of the city. The ordinance put forward by the Kentucky Electric Company, of wh R. E. Hughes is president.

The ordinance provides the following rates: On a m basis, $1 per 1000 lb. for less than 2500 lb. of condensa and 50 cents per 1000 lb. for excess. The flat rate is b on the required condensation and may equal but not exc

10 cents per square foot for the heating season. A discount of 10 per cent from the rates is to be given by the operating company.

In its appeal for the passage of the franchise ordinance the Kentucky Electric Company emphasized the fact that a marked abatement of the smoke nuisance will be effected and that in the manufacture of steam for heating purposes the company can assure the emission of no smoke, a provision being inserted in the ordinance providing that the franchise and bond be forfeited in the event that smoke is discharged.

A petition in favor of the franchise circulated among business men affected resulted in 250 names being secured, these including bankers, owners of office buildings, etc. It is said to be certain that practically all private plants in the steam-heating district will be abandoned when the new system is installed. The Board of Fire Underwriters of Louisville has also transmitted to the Mayor a communication stating that a reduction in fire insurance rates will follow the elimination of private heating plants in the business district.

The Kentucky Electric Company has stated that its rates will be made so low that private-plant operators will find it profitable to purchase the central service and that the installation of the heating system is for the prime purpose of enabling it to eliminate the necessity for private plants, thus to get the electric business now being held back by reason of private plants being kept in operation to supply ...

The ordinance which has been introduced provides for the sale of the franchise at public auction. It is not known whether any of the other local lighting companies will enter a bid for the privilege. The upset price is fixed at $500.

INCOME AND OUTGO OF A LARGE CENTRAL-STATION'S CASH.

Mr. George E. Burns, of the accounting department of the Commonwealth Edison Company, Chicago, read a paper on "The Income and Outgo of Our Cash" before the company's N. E. L. A. Section at Handel Hall, Chicago, on ... 3, giving some interesting figures of the magnitude of the business handled by the Chicago company.

The gross earnings of the Commonwealth company are ... about $13,000,000 annually, out of which is paid ...00,000 for expenses, including depreciation. The 3502 employees of the company earn an annual wage of $2,759,- ... an amount approximately equal to that returned as dividends to the stockholders, the balance of the surplus being carried to the reserve. The accounting department, which handles customers' bills, company business, etc., ...e employs 177 persons. The six credit men who pass all new contracts are members of this department. Seven thousand contracts per month, or 425 per day, are handled by this group.

Where a new customer's credit is in doubt he is required to file a deposit or a guarantee signed by a property owner. Of the company's 144,000 customers, however, only 6968 ... have deposits. The present number of deposits totals ...9,000 and earns 5 per cent interest for its owners. Thirty-four bookkeepers are employed to make out customers' bills, post accounts and prepare accounts for collection, each bookkeeper having about 4500 customers to take care of. During August, a typical month, 162,000 bills were sent out. The light and power business for that month totaled $771,000 and the railway business $250,000. About one-fifth of the light and power bills are paid directly to the company's thirty-four collectors. Nearly ...000 or 5 per cent of the customers take advantage of the express company's office collection plan, by which, with a fee of 5 cents additional, electric bills can be paid at any of the numerous offices of the express company scattered throughout the city. Of the 5-cent fee, 2 cents goes to the agent receipting for the payment and 3 cents to the express company. To provide for errors, rebates, etc., about one-half of 1 per cent has to be carried over, while an equal amount is allowed for uncollectible bills, but through credits received these items total only about three-fifths of 1 per cent of the total amount billed.

Mr. E. F. Smith, chairman of the section, who presided at the meeting, called attention to the significant relation between the total salary roll and the dividends returned to the stockholders, amounts which are practically equal. Referring to the growth of the Commonwealth Edison Section of the N. E. L. A., he said that the membership of that section now equals one-sixth of the entire Class D membership of the association. Messrs. H. E. Addenbrooke, D. W. Roper, J. W. Ferguson and E. J. Fowler also took part in the brief discussion which followed.

After a short recess Mr. Harry P. Smith entertained the meeting with vocal selections and was followed by Mr. Frank Savage, who, on account of the illness of Mr. J. T. Mountain, read a paper prepared by Mr. Mountain on a recent trip made by the two to Panama, South American and West Indian points. The paper was illustrated with a number of interesting lantern slides.

THE GROUNDING OF SECONDARIES IN THE ROCKY MOUNTAIN REGION.

By W. J. Canada.

Up to October, 1908, the grounding of secondaries for protection against entrance of higher than normal voltage into connected buildings had received no attention in the Rocky Mountain region. The successful operation of lighting circuits in several Eastern cities with the grounding was considered no argument in favor of placing grounds on secondaries in high altitudes, where lightning troubles were judged to be more severe and the grounding apparently an invitation for trouble.

Investigation and trial of this connection were strongly urged upon service companies by the Rocky Mountain Fire Underwriters' Association. Data were presented on deaths and fires obtained throughout the entire country and many instances were shown where operating costs were distinctly lessened by grounding and the advantages gained in lowered hazard to life and property were pointed out.

In 1909 only one town—Julesburg—undertook grounding; in 1910 thirty-four made trial of such connections, and in 1911 out of 103 cities served by electric-light companies fifty-four had grounded secondary protection and fourteen cities and towns required such connections by ordinance.

Wherever water-works systems are available connection is made to them by a conductor not smaller than No. 4 B. & S. gage, at least one connection being used to the block. This method is followed in Denver, where every new or rewiring installation is required by ordinance to have the neutral wire connected thoroughly to the conduit through a lug provided on the service cabinet and both thoroughly grounded to the main water-service pipes outside the water meter in the few buildings having metered water service.

The grounding in Denver has been followed by less personal injuries, less fires, less transformer losses and quicker detection of line troubles. So good has been the satisfaction that the Denver Gas & Electric Company is now engaged in providing all three-phase motor circuits with grounds on one leg and also on the motor frame.

In Akron, a small town in eastern Colorado, use is made of driven pipe ground on neutral and an arrester on each outer secondary. Mr. J. E. Rogers, of the Akron company,

says: "We consider grounded secondaries as a great protection from lightning," a sentiment which it was impossible to elicit in this territory three years ago.

The Central Colorado Power Company operates at altitudes of from 5000 ft. to 12,000 ft. a 100,000-volt transmission, 13,000-volt distribution, 440-volt, three-phase motor secondaries and 110-220-volt, singe-phase lighting secondaries. This company was the first to ground all final secondaries, and after two years' such operation it has not experienced a single loss of life or property. In very dry, rocky locations this company uses a number of driven pipes covering a considerable area.

In Leadville the peculiar condition is found that during early spring thaws persons on the damp surface ground have shunted the ground pipe driven into deeper frozen earth, thereby being subjected to severe shocks. This result is being avoided by installing considerable grounding surface just below the ground level, in addition to deeply driven pipe grounds.

In only two towns has experience apparently been that grounding has increased the transformer losses. This result may readily be due to a succession of storms of unusual severity about those towns, as the experience of the remaining fifty-two cities and towns is uniformly good. It is safe to expect that another year or two will see the conversion of practically all Colorado electric-light company managements to the use of grounding as a safeguard to life and property.

CONTRACTOR'S TRIBUTE TO ELECTRICITY.

The engineers of the Rochester Railway & Light Company are ever alert for new fields to conquer and do not let many opportunities slip through their fingers, as the illustrations published herewith show. Not content with securing an excellent day load from a contractor engaged in digging a diverting sewer as a part of the system to carry the sewage of Rochester to Lake Ontario, the company has evidently placed the contractor in such a happy frame of mind by the excellent service rendered that he is anxious to let everyone else know the advantages he enjoys in using electricity.

The construction of the diverting sewer is carried on 50

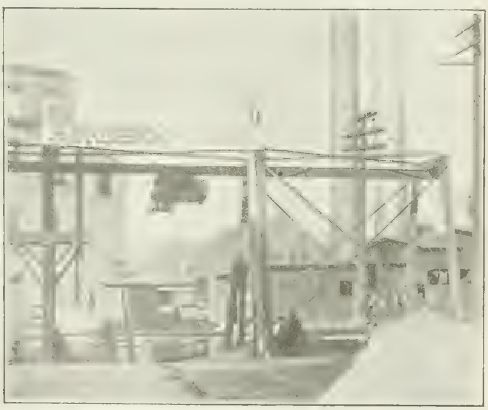


Fig. 1—Electric Hoists Used in Excavation Work in Rochester, N. Y.

ft. below street level and through solid limestone. The tunnel excavation is approximately 6 ft. x 8 ft. in section and 9000 ft. long. Every speck of the work on the contract is done by electricity. The holes for blasting are drilled by air from a 200-hp electrically driven compressor, located centrally on the contract just outside No. 3 station, off the Rochester Railway & Light Company. There are five traveling hoists of Sprague make, as shown in the engravings, in addition to two hoists rented by the Rochester company. The latter machines were described in these columns Nov. 18, 1909, and were built after designs of the engineers of the company, who desired an efficient but low-priced hoist that could be rented to contractors throughout the city. The company has five of these hoists in service practically 50 per cent of the time. The two in use on the diverting sewer are employed to bring up the spoil through the shafts. The latter, as well as the tunnels, are illuminated throughout by electricity. Contract work of this kind is exceptionally profitable inasmuch as it is long-hour summer business.

There is a large concrete bridge being built by the city over the Genesee River at Central Avenue, immediately ad-

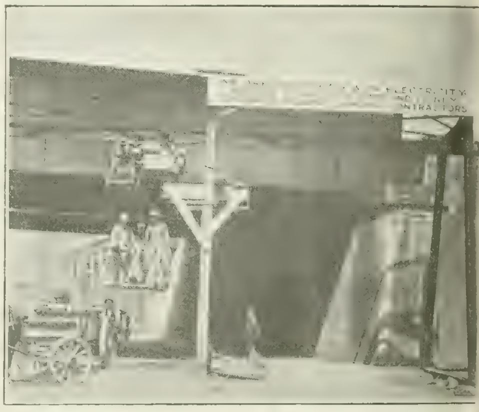


Fig. 2—Showing Contractors' Tribute to Electricity.

joining the New York Central Railroad, and all work c this contract is also done with electricity purchased fro the central-station company. Two rented hoists, two co crete mixers with charging elevators, the power equipme of which was adapted from steam to electric drive by tl engineers of the Rochester company, a centrifugal pump, circular band saw and other apparatus is connected. addition direct-current is being used to cut up the truss of the old steel bridge which is being replaced. The co tractor on the job is said to have expressed his regret tl he had not used electricity some time ago, and said it w the best thing he had yet run across. A concrete mix which had stood idle for four weeks was needed one mor ing for a batch of concrete. All the contractor had to was to send a man over to close the switch, and, as he sa he did not have to wait to make a fire and raise steam his boiler and then find that the equipment had got rust up and out of commission.

CENTRAL-STATION PUBLICITY IN CLEVELAN

In order to counteract the impression that is being ma by Newton D. Baker, candidate for Mayor of Clevela Ohio, to the effect that the Cleveland Electric Illuminat Company is paying enormous dividends to its stockhold newspaper space has been purchased and the company's setting out in clear, black type the actual facts. Mr. Ba is a pupil of the late Tom L. Johnson and, as such, se to have retained the desire to fight the Illuminating Co pany in politics and through suggestions of strong com tition. The small municipal plants that were taken o

with the annexation of two suburbs form the basis upon which Mr. Baker proposes to build competition, because of the fact that their records have been fair for the past year

The Illuminating Company's Profits

The advocates of the proposed municipal plant have charged that the Illuminating Company is making an excessive profit at the expense of the electric consumers of Cleveland. This profit it has been publicly stated amounts to twenty per cent a year.

The following figures for the year 1910 show how untrue that assertion is

Outstanding capital (Bonds and Stock) January 1st, 1911, - - $10,634,500.00

Net Earnings for the Year 1910 were - 843,428.00

From which there was paid to bondholders and stockholders, - 669,774.00

An amount equal to SIX AND THREE TENTHS PER CENT. (6 3-10) on the outstanding capital.

The outstanding capital on January 1st 1911 did not exceed the cost of the property at that date

The difference between the net earnings and the amount paid on outstanding [illegible] namely $173,654.00 represented the year's surplus which was set aside to [illegible] for contingencies

The Cleveland Electric Illuminating Company.

Fig. 1—Reproduction of Announcement in Newspapers.

cording to methods of the city officials in computing ex[illegible]. However, they are far from encouraging when

CAPITAL AND REAL VALUE

Every Dollar of the Illuminating Company's outstanding capital is represented by actual value in the property.

On January 1st, 1911, the Company's property was capitalized at $10,634,500. The valuation placed on it by the STATE TAX COMMISSION as of the same date is $11,375,000, on which sum we shall be required to pay taxes this year.

Thus, dividends and interest last year were earned on an investment below the appraised value of the property.

Since January 1st an additional $2,400,000 has been put into the property in order to build the new power house and extend the distribution system, making the present investment over $13,000,000.

There is not a public utility company in the United States which is more conservatively capitalized than this. Every bond and every share of stock represent a bona fide investment.

We make this statement, not to create sympathy for the investors we represent, but because the subject has a direct bearing on the proposal to have the city duplicate the present electric system with one of its own.

The cost of such duplication will exceed the Company's investment

In Wednesday's article we stated that the net earnings of this Company for the year 1910 were $843,428. This statement is correct.

The Cleveland Electric Illuminating Company

Fig. 2—Reproduction of Announcement in Newspapers.

reckoned on the business basis that is used by all concerns that have money invested. Accompanying are reproductions of the first two announcements printed.

Wiring and Illumination

TUNGSTEN OUTLINING WITH LOW-VOLTAGE ROTARY-CONVERTER SET.

The Union Electric Light & Power Company, of St. Louis, is arranging to outline its new office building at Twelfth and Locusts Streets with more than 1000 low-voltage tungsten lamps. To avoid the series-multiple connection of these lamps, with its consequent overloading of remaining units, in case some circuits suffer the loss of one or more lamps, the outline lighting will be carried out on a low-voltage, three-wire system, energy for which will be supplied by a rotary converter and step-down transformers. In addition to the outline lighting a number of signs will be operated from the same low-voltage source.

LONG-HOUR FLAMING ARCS FOR DECORATIVE LIGHTING.

The Citizens' Gas & Electric Company, of Council Bluffs, Iowa, is installing forty long-hour flaming-arc lamps for the spectacular lighting of the downtown section of Council Bluffs. The lamps are being hung on shepherd-crook posts at a height of 18 ft. above the street level and are arranged in staggered relation along the street at intervals of 70 ft. between lamps. The cost of operating the lamps is defrayed as part of the general city lighting, the Council Bluffs company receiving an annual income of $95 per lamp, from which is subtracted, however, a royalty of about $10 each.

VISUAL ACUITY AND LIGHT OF DIFFERENT COLORS

BY J. S. DOW.

The article by Mr. M. Luckiesh in the *Electrical World* for Aug. 10 raises a question of considerable interest in illuminating engineering and photometry. It has often been suggested that the "power of revealing detail" of a source might be utilized to compare heterochromatic lights. And whether or not we approve of this suggestion we are bound to admit that detail revelation is a very important factor in most lighting problems, so that if there exists any great difference between different illuminants in this respect it ought to be understood and appreciated.

The writer about the year 1908 carried out a series of experiments on this point along similar lines to those followed by Mr. Luckiesh. Some of these were published in the *Electrical World** and in *The Illuminating Engineer* (London)† during 1909. In these experiments one point was brought out which seems to have an important bearing on Mr. Luckiesh's experiments, namely, the distance away of the observer. Granted that owing to the chromatic aberration of the eye the most perfect definition should be secured by monochromatic light, the question remains, which color?

I believe that it is not possible to say that light of any particular color is invariably the best for all purposes. The question is a complicated one. The peculiarities of the retina and the intensity of illumination employed affect the problem, but the most important item in the author's experience is whether near or distant vision is employed. In

*July 15, 1909.
†April, 1909.

order to illustrate this point I reproduce a diagram presented in the articles referred to.

This illustrates the results of the want of achromatism of the eye. Assuming that yellow rays are brought to a focus on the retina the violet rays will be focused in front of it and the red rays behind it. Under normal circumstances, therefore, one might suppose that the eye would accommodate itself best to yellow light and that this color, besides yielding the greatest luminous efficiency, would also yield the most perfect definition. At medium distances, when the eye is neither being forced to accommodate for a very near object nor strained to accommodate for a very distant one, and for a truly normal eye, this might possibly be the case.

But suppose that the eye is forced to undertake very near vision, say, within the minimum distance of distinct vision of 10 in. A point is soon reached when the eye-lens is unequal to further effort and the luminous image tends to be formed *behind* the retina, so that one cannot see distinctly. Now it is clear that as this image recedes the red will fall behind the retina first, then the yellow and only afterwards the violet. Consequently, it may happen that

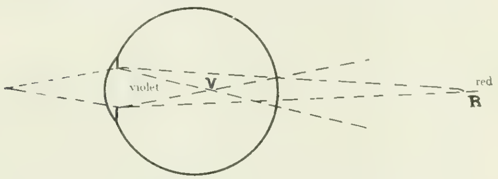


Diagram Showing Want of Achromatism of the Eye.

we can secure good definition by violet light when we have ceased to do so by light from other parts of the spectrum. This is exactly in accordance with the author's experience and that of some other people who have worked with him on this point. With a pure blue-violet light the eye can be brought to within a few inches of the object viewed without the strain of accommodation becoming noticeable. It is a fact that the green end of the spectrum is known to be excellent for securing good definition in microscope work. This is usually ascribed to certain physical phenomena connected with the optical laws of this instrument, but it has always seemed to me that the chromatic aberration of the eye might also be a potent factor.

This matter is a somewhat important one. The tendency of most people who have a difficulty in seeing fine work is to bring the eyes nearer and nearer, thus gradually straining the lens and leading to short sight. The defective vision of watchmakers and lace makers is well known. Is it possible that by using violet light the effort of accommodation and the consequences of such persistent near work might be mitigated?

Next picture what happens as the observer moves backward. A position is soon found when the eye can accommodate with perfect comfort for ordinary light—that is, mainly yellow light—and it might be presumed that in this case improved definition would be secured by using only this part of the spectrum. The red and violet ends naturally cannot be focused simultaneously with the yellow and only contribute a luminous haze. Some observers (including, I believe, Dr. Bell) find that, possibly owing to exceptionally good powers of accommodation, their eyes can adjust themselves either to red or blue, so that when a mixture of these lights is viewed they can actually see first a sharp blue object with a red haze and then a sharp red object with a blue haze.

As the distance becomes greater this effect becomes more pronounced, so that the eye oscillates between these two states. This experience, however, is not enjoyed by the author, whose eyes are slightly shortsighted. His experience is that at distances of upwards of 20 ft. it becomes more and more impossible for him to focus blue at all, while objects illuminated by red light appear more definite and sharp than even white ones would do. A glow-lamp filament seen through cobalt glass appears red with a luminous blue haze, and a line spectrum cast upon a screen appears to spread out like a fan at the blue end.

So far as the author's investigations have gone this is the general experience of people whose eyes are slightly myopic, and it can readily be understood why this should be so. Short sight means that with increasing distance a point is reached at which distant objects can no longer be clearly seen; their image is formed in front of the retina. A violet image is still further in front, so that it cannot be distinguished at all. But a *red* image might still be focused sharply and seen distinctly even when an object illuminated by white light is difficult to see.

It appears to be difficult to predict how the eyes of people wearing glasses are influenced, and this depends probably upon the success or otherwise in counteracting their optical peculiarities. When the writer exhibited an experiment illustrating the superior qualities of red rays for distant vision at a meeting of the Illuminating Engineering Society in London in 1909 the majority of the audience appeared to agree that the red light gave much the best definition. But there were also some who professed to be able to see either the blue or the red clearly, but not both together, and also a few others who could not detect much difference and thought they saw both the red and the blue equally well. There was no case of an individual declaring he saw blue best.

Bearing these facts in mind we can readily understand Mr. Luckiesh's experience that the addition of light of an unsuitable character may actually lead to objects being *less* clearly seen. It is obvious that if an eye is permanently unable to focus light of a particular kind no amount of this light, however great, would enable him to see properly All that happens is that the rays form a luminous haze and actually constitute an impediment to vision.

In view of these considerations I was led at the time my experiments were made to believe that acuteness of vision could not conveniently be made the basis of a method o measuring the luminous intensity of heterochromatic sources. Clearly one cannot make successful use of a method according to which the value of one light migh exceed the other, notwithstanding the fact that its illuminating power was thousands of times greater. In short the power of revealing detail and the power of creating brightness are separate functions, and are better kept apart

This, of course, is not to say that acuteness of vision b different illuminants ought not to be tested. But like th so-called "penetrating power," the photographic action o light, or its influence in destroying bacteria, it demand special tests which should not be confused with photometry

As regards the best qualities of light for distinct vision the conclusion would seem to be that for very near wor the blue end of the spectrum would be found to be bes for moderate distances the central region and for distan objects the red end. It is conceivable that to some excep tional people the color of the light (so long as it were ap proximately monochromatic) would be indifferent. The however, would not suffer by following the above sugge tions, while short-sighted people who appear to find mo difficulty in focusing the blue end of the spectrum at distance would benefit.

The question as to how far it is desirable that a lig should be exactly monochromatic, or whether it might n be better to aim at producing a narrow band in the spe trum so as to allow the eye a little latitude in accommod tion, would also have to be considered. The band oug presumably not to be too broad, since this would mean th much of the light was indifferently focused and th definition was lost. On the other hand, restricting t wave-length of the light within too narrow limits mig

onceivably prove inconvenient because it might mean that .. slight fluctuation in the accommodation of the eye would .t once make the image indistinct.

COMBINATION LAMP-POST DRINKING FOUNTAINS AT DUBUQUE, IA.

At a number of street intersections in Dubuque, Ia., the city government has erected combination sanitary drink- ng fountains and lamp-posts of the type pictured here-

Combination Drinking Fountain and Tungsten-Lamp Post.

th. Eight of these combination fixtures have already n placed, six of which were made up by a local manu- turer, through the adaptation of existing cast-iron parts. e post carries a 150-watt tungsten lamp inclosed in a in. frosted globe, 8 ft. above the sidewalk. The fountain rranged for four outlets, two of which are equipped with tinuous-flow sanitary drinking cups. The post fountains nplete cost $80 each. The post lamps are maintained by e city as part of the street lighting and cost $10 a year r energy. The single lamps are switched on and off ght and morning by the policemen patroling these respec- ...

RECENT TELEPHONE PATENTS.

REPEATING CIRCUIT.

Ever since the discovery of the principle of the micro- one telephone repeater there has been a struggle to adapt to operation in two directions. For operation in one rection only, that is, for transmitting one-half a con- rsation, the apparatus is ideally simple. As soon, how- er, as two repeating elements are combined to form a mplete conversation circuit the trouble begins. This rises in the neutral interference and singing of the com- nation. Most attempts to overcome this have been mere rcuit arrangements based upon so associating the ap- ratus that the interference would be eliminated through fferential action. Mr. C. E. Lanning, of Boston, brings rth an entirely different idea. He adheres to the old mple one-way principle, but arranges a switching relay r reversing its relation to the line automatically, with a eversal of the origination of transmission. The control elay operates in response to the received transmission through the repulsive action of a varying field caused by the voice current upon a copper block or other similar means. Other suggested arrangements comprise two repeaters at opposite poles, but one of which is in transmitting connection at a time.

SWITCHBOARD CIRCUITS.

There are to-day several types of switchboard-circuit systems for common-battery working in which the cord circuit is practically free from relays. Such systems were, however, not common at the date of invention of a patent granted to H. P. Claussen, of Chicago. In this system, which is of the three-wire type, all relays are associated with the various jack circuits, while the supervisory lamps are wired to the plug sleeves and to ground. The relays serve to supply battery connection to the jack sleeve and thus to the plug sleeve wherever the conditions demand the glowing of the lamp. The Stromberg-Carlson Telephone Manufacturing Company is assigned this patent.

Mr. A. H. Dyson, of Chicago, has obtained two patents for a trunking system, in which provision is made for the "A" or outgoing operator to control the connection. In other words, complete disconnection and supervision are provided. The trunks are adapted to operate in connection with two of the commercial switchboard circuits. These patents are also assigned to the Stromberg company.

SELECTIVE SIGNALING.

Most selective-signaling systems which depend upon the use of currents of different frequency are of the harmonic type. Each bell is therefore tuned to respond to a certain frequency, vibration being set up in a bell only when the native vibration period of its moving system accords with the frequency of the current. In the system herein under consideration selection is accomplished by electrical tuning. The bell windings are so arranged and proportioned that none but the specified frequency will produce any effect. This is accomplished by using two windings, one connected to each limb of the line, and by adding condensers and coils in such manner that neutralizing effects will be obtained from any frequency save the one corresponding to that of the bell.

FLEXIBLE MOUTHPIECE.

Mr. G. A. Duryee, of New York City, has patented a yielding-transmitter mouthpiece that no sound of the voice may escape and be overheard. The mouthpiece is mounted within a tube which is shaped to fit the face. The mouthpiece is shaped to fit the lips and it is permitted a forward and back motion, being positioned normally by tension springs.

COMPOSITE SYSTEM.

A patent granted to C. L. Bopp, of Meers, S. D., describes a composite system for two simultaneous telegraph circuits and one telephone. One of the telegraph circuits uses pulverized relays subject to high-potential condenser kicks.

LETTER TO THE EDITOR.

Value and Depreciation.

To the Editor of Electrical World:

SIR:—I have read with interest the discussion on depreciation in your issue of Aug. 5 by Mr. H. G. D. Nutting and also the criticism by Mr. W. A. Del Mar in the issue of Sept. 23. It seems to the writer that both the gentlemen are a little mixed up on the economic laws of value, price and money.

The value of a commodity can only be measured by the efforts which society makes in its production; or, in other words, the value of a commodity can only be measured by the quantity of labor necessary to produce it.

The price of a commodity is determined by its value and the unknown ratio of supply and demand. The conditions may be discussed from the following formula which I will attempt to give:

Let V = value, S = supply, d = demand and p = price. Then

$$p = V\frac{f(d)}{f(S)}$$

Now

$$d < S \quad p < V$$
$$d = S \quad p = V$$
$$d > S \quad p > V$$

But in the long run the average of $\frac{f(d)}{f(S)}$ is unity, therefore, in the long run the average price is equal to the value. There would have been no objection to Mr. Nutting's method in using dollars as a measure of value if it were not for the fact that money standards (the most common of which is gold) are also commodities and their value varies with the conditions of their production.

Brooklyn, N. Y. BENJAMIN HOLLAND.

Three-Wire Balancers.

To the Editor of Electrical World:

SIR:—The article by Mr. George T. Hanchett on "Three-Wire Balancers," which appeared in your issue of Sept. 9, explains very clearly the action of balancer coils and analyzes the flow of current in the various paths. The writer had occasion at one time to take up a study of this question and used a three-element oscillograph in order to obtain evidence regarding the distribution of the currents.

Two of the vibrators of the instrument were connected in series with the balancer coil, one vibrator being at each end of the coil, while the third vibrator was connected across the terminals of the coil so as to show the pressures impressed on it. The accompanying curves do not show the exact time phase of the currents and pressures, as the beams of light were not focused on the same point of the film.

The conditions existing with balanced load on the three-wire system are indicated by the curves in Fig. 1. The only current flowing in the balancer coil is a small exciting current, which is alternating in character, as shown by curves *a* and *b*. The pressure impressed on the coil is of the sine form, as shown by curve *c*.

When the load on the system becomes unbalanced a direct current is superposed on the alternating exciting current in the balancer coil, thus giving a resultant pulsating direct-current, as shown by curves *a* and *b*, Fig. 2, the pressure

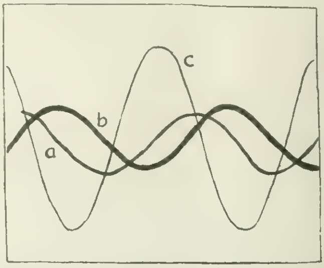


Fig. 1—Tracing from Oscillograph Record with Balanced Load

curve being represented by *c*, as before. The curves were obtained from balancer coils with an air core and of smal current capacity, and therefore the effect of the exciting current is very much greater than it would be with balancei coils used in commercial work.

It is true that the neutral point cannot be shifted by shifting the point at which the neutral is connected to one end of the balancing coil, but the pulsating emf obtained between the neutral and either outside wire will have an

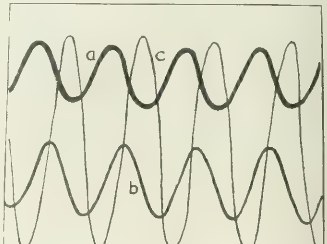


Fig. 2—Tracing from Oscillograph Record with Unbalanced Loa

effective value somewhat greater than half the total pre sure between the outside line wires, though the averag value will be just one-half.

Scranton, Pa. A. R. DENNINGTON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Homopolar Turbo-Generator.—An illustrated description of a 50-kw, 100-volt, direct-current homopolar turbo-generator at the present Olympia Electrical Exposition in London. Fig. 1 shows a section (not to scale) through the machine on the center line. The magnetic circuit is double, *aa* and *bb* being the two portions, each of which forms one end pole. Each pole extends completely round the armature with no change of sign. There is thus no iron loss. *R* is the rotating part or armature; *M* is the fixed part or frame. *EE'* are the exciting coils, which are placed directly [illegible]d each air-gap, so that the leakage is reduced to a [illegible]ble figure. The smallness of the gap is limited only [illegible]anical considerations, consequently the field copper [illegible]all. The conductors *C*, in which the volts are [illegible] in micanite tubes in tunnels in the armature, central pole, and are connected at each end to slip rings *D*, from which the current is collected. T rotor has a strong steel shaft *S* and a high-permeabil steel core *P*. On this are mounted the slip rings *D* and a the rings *GG* forming the end poles. In the diagram t center pole of the rotor is shown solid with the core a the end poles are solid rings. While this is not necess electrically, it is sometimes convenient mechanically build these up of laminations. Bolts *B* pass from one e of the rotor to the other and are insulated by mica tut like the armature conductors, and hold the slip-rings a pole-rings solidly in position. There are mica washers tween the rings; thus, mica is the only insulating mate used in the rotor. The rotor has a periphery of gr strength, and it is claimed that the construction adop renders the machine mechanically sound. The frame *M* f the machine consists of three castings, a large one co prising the central pole and the yokes and two smaller o s

forming the end poles and carrying the bearing brackets. The frame carries stationary conductors, which connect the armature conductors in series. The slip-rings are grooved and in the grooves lie the brushes *AA* (Fig. 2), which con-

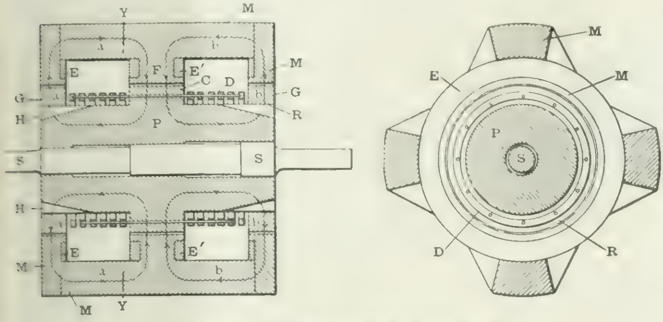


Fig. 1—Sections Through Homopolar Generator.

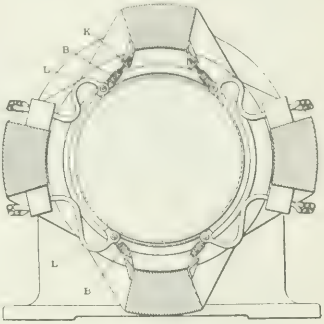


Fig 2—View of Erushes.

of a flexible copper core wound with an armoring. e latter, though slightly diminishing the flexibility, both tects the core from wear and is found by experience to ke a better contact with the slip-ring than any other n of brush. The brush is held in place round the ring springs *BB*, the tension of which is regulated by the w and nut *K*, while the current is led away by the ible leads *L* to the stationary conductors. Appended the leading dimensions and particulars of the machine, which it will be seen that it is of compact size. The tage of the distance between bearings is pointed and ıld lead to freedom from vibration troubles. The hine gives 50 kw at 100 volts, 500 amp, 3500 r.p.m.—plement to Lond. *Electrician*, Sept. 22.

th between bearings, inches	29.5
rame, inches	28.25
[illegible]	28.0
[illegible]	[illegible]
eral velocity, feet per minute	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

ectifier.—An illustrated description of a vibrating recti- of British make for charging small batteries from al-ating-current mains. The apparatus consists essen-y of a transformer with a vibrating contact. A stray gnetic field of the transformer operates the armature contact system of the rectifier at the zero points of the rnating-current curve, producing a rectified current his system of operating the vibratory contacts by the sformer field perfectly synchronous working can be ısted by mechanical means, such as small brakes, springs, without the use of auxiliary apparatus. The efficiency oad and on open circuit corresponds to that of trans-mers of similar output. The unidirectional current pro-d is suitable for charging accumulators, for lamps and er non-inductive applications, and with the addition of lensers it can also be used for inductive loads such as ıll motors, etc.—Lond. *Elec. Eng'ing*, Sept. 21.

Alternators.—J. Rezelman.—The author has formerly wn the existence of secondary currents induced by the ernal coils of an alternator. In the present article the thor gives an investigation of these currents and their fects.—*La Lumière Elec.*, Sept. 23.

Lamps and Lighting.

Specific Consumption of 0.8 Watt per Hefner Candle-Power.—The larger osram lamps ("osram intensive lamps" of from 100 cp to 1000 cp, which are competing with arc lamps) are now being built for lower specific power consumption, namely, 0.8 watt per hefner candle-power. This consumption is claimed for lamps for 100 volts to 160 volts with outputs of 200 cp, or 400 cp, or 600 cp, or 1000 cp, while lamps for 200 volts to 260 volts with an output of 200 cp, 400 cp, 600 cp or 1000 cp are made for a specific consumption of 1 watt per hefner. The prices of these lamps have also been reduced (the cost of a 200-hefner-cp lamp being now $1.88, of a 600-cp lamp $4, of a 1000-cp lamp $5.50), and tables are given showing what savings can be obtained if arc lamps are replaced by osram incandescent lamps. Four 110-volt lamps were tested in the Reischsanstalt, the test beginning with a consumption of from 0.83 watt to 0.87 watt per hefner candle of mean candle-power in a plane perpendicular to the axis of the lamp. The lamps were tested for 1000 hours. In all of them the candle-power decreased somewhat, the average being 8 per cent in 1000 hours. The record for one of the lamps is as follows, the voltage being maintained constant at 110.5:

Hours	Amperes.	Mean Hefner Candle-Power in a Plane Perpendicular to Axis of Lamp.	Specific Consumption in Watts per Hefner Candle-Power.
0.2	3.16	410	[illegible]
100	3.21	407	0.87
200	3.21	402	0.88
400	3.19	[illegible]	[illegible]
600	[illegible]	[illegible]	0.89
[illegible]	[illegible]	[illegible]	0.88
1000	[illegible]	[illegible]	[illegible]

(While it is not stated, it is known that a ductile tungsten filament is now being used in the osram lamp.)—From a bulletin of Deutsche Gasglühlicht A. G. (German Welsbach Company), Berlin.

Portable Photometer.—An illustrated description of a simple portable photometer made by a British company under the name "luxometer." The principle is similar to that of the Trotter photometer, but the parts are differently arranged. A screen illuminated by a standard lamp within the instrument is viewed at an angle which can be varied till the effect balances that of a fixed external screen illuminated by the source to be photometered, and the result is read off directly from the pointer attached to the head by which the internal screen is rotated. The compactness of the apparatus is illustrated in Fig. 3, which shows the complete outfit, including the luxometer *C* itself, the battery *S* supplying energy to the standard lamp and the daylight attachment *B*, the use of which is mentioned below. The weight is only 1.75 lb. When in use the instrument is held in the hand, no stand or other support being required. Candle-power as well as illumination measurements can readily be made and the surface bright-

ness or intrinsic brilliancy of any surface can be instantly measured by viewing it through the instrument instead of the fixed screen *A*. For this purpose a simple attachment can be provided, whereby what is spoken of as the "win-

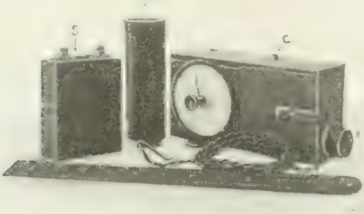


Fig. 3—Luxometer Outfit Complete.

dow efficiency" of a room can be determined. Merely to state that the illumination observed in a certain room lit by daylight is so many ft.-candles is meaningless, depending, as it does, entirely upon the state of the sky. By means of this attachment, on the other hand, a definite figure can be obtained for the ratio of the actual illumination at any particular point in the room to the daylight illumination outside. The value of the daylight outside is for this purpose measured by attaching the daylight tube, which is so proportioned that the illumination from one-thousandth part of the hemisphere of the sky reaches the instrument, the instrument being pointed at the clear sky. In order to simplify the adjustment a yellow-tinted external screen is provided and should be used in place of the white screen when daylight observations are being made. By this means the color of the daylight illumination is reduced to something near that of the standard lamp inside the instrument, so that an accurate balance is easily obtained.—Lond. *Elec. Eng'ing*, Sept. 21.

White Light from Mercury Arc.—E. DARMOIS AND M. LEBLANC, JR.—A critical discussion of the different methods for improving the spectrum of the mercury arc so as to superpose red rays on it. If this is done by means of an incandescent lamp the efficiency is decreased. The use of amalgam tubes has not passed the laboratory stage. On the other hand, the use of fluorescent screens seems a satisfactory solution of the problem. A fluorescent screen may be considered as a light transformer; excited by certain radiations it emits rays which are transformed toward the red part of the spectrum. The problem involved was to get a suitable fluorescent substance, and this has been solved by Dr. Peter Cooper Hewitt.—*La Lumière Elec.*, Sept. 23.

Ultra-Violet Rays from Mercury-Arc Lamps.—V. HENRI.—The author has studied the variation of the ultra-violet radiation from a mercury-vapor lamp with the conditions of cooling of the tube. He finds that the ultra-violet radiation is the more intense the higher the temperature of the luminous tube. In principle if the tube is cooled with water ultra-violet radiation is only one-fourteenth as strong as in the case of the lamp being lighted in free air, while consuming the same number of watts. The ultra-violet light efficiency of a lamp seems to depend not on the number of watts consumed, but on the potential drop in the luminous tube. As to the constancy of the ultra-violet light radiation during life, it seems that for the purposes of photographic and other applications of ultra-violet rays the mercury-vapor quartz lamp is a rather constant source of rays, and the radiation depends on the voltage, the amperes and the length of the tube.—*Comptes Rendus*, Aug. 14; *La Lumière Elec.*, Sept. 23.

Hygienic Effects of Gas and Electric Light.—K. SCHLESINGER.—The first part of an article in which the author first refutes the arguments of gas engineers concerning the superior hygienic properties of gas over electric light. The criterion must be the effect of gas and electric light on the condition of the air in the room, and in this respect the carbon-dioxide content in the air is really of smaller importance than the temperature and humidity in the air. While the temperature increases much more rapidly with gas than with electric light, gas light increases humidity and electric light decreases humidity. The decrease of humidity due to electric light may be considered as compensation for the small increase of temperature due to it while gas light has two serious disadvantages together, a high increase of temperature and also an increase of humidity. The paper is to be concluded.—*Elek. Zeit.* Sept. 21.

Metallic-Filament Lamp.—A note on a recent British patent (24,637, Sept. 14, 1911) of the Westinghouse Metall faden Glühlampenfabrik G. m. b. H. (Austria). After the decarbonizing process filaments containing traces of carbon are purified in hermetically sealed vessels, in which a high degree of exhaustion is produced by a vacuum pump. The vessel is heated to a temperature of from 1200 deg. C to 1300 deg. C. until all the carbon is eliminated.—Lond. *Elec. Eng'ing*, Sept. 21.

Supporting Wires for Metallic Filaments.—A note on recent British patent (23,404, Sept. 14, 1911) of A. Monc The supporting wires are made of thin nickel or carbo and are covered with a layer of chromium compound, whic is then heated to incandescence by a current and decom posed into an oxide of chromium.—Lond. *Elec. Eng'in* Sept. 21.

Power-House Lighting.—C. E. CLEWELL.—An article o the best methods of power-house lighting so that all par of the machines may be readily seen with as few shadow as possible. The author discusses the arrangement of tl lighting system of a certain power house, with speci reference to the use of 250-watt tungsten lamps in tl engine-room.—*Elec. Journal*, September.

Light Production.—R. A. HOUSTON.—In a continuatic of his long illustrated serial on the principles of light pr duction the author discusses flames.—Lond. *Electricia* Sept. 22.

Generation, Transmission and Distribution.

Homo-polar Gyrostat.—An illustrated description of exhibit at the present Olympia Electric Exposition in Lo don. Electric driving of gyrostats at high speeds becom very simple if the gyrostat wheel is made the rotor of homopolar motor, a couple of slip-rings being then t only electrical connection. There are two ways of doi this. In the first the gyrostat wheel is absolutely simp without any insulation; it is indicated at *A* in Fig. 4. T stationary poles *C* are produced in the casing by two a nular windings *B*. Current is led in and out of the flywh by flexible cord brushes *E*, which lie in the grooves *D*.

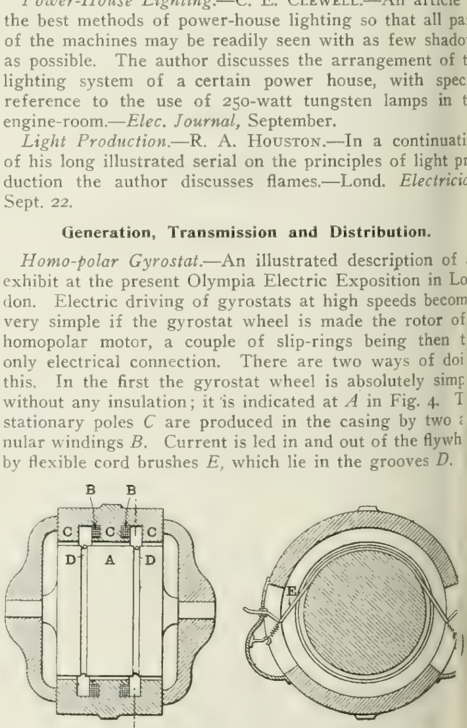
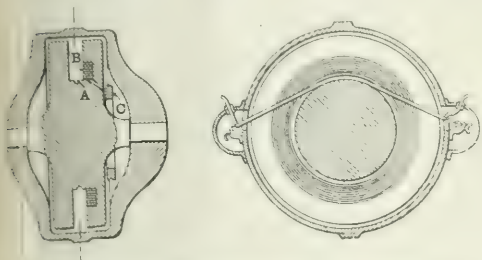


Fig. 4—Gyrostat with a Simple Flywheel.

preferred, one brush may bear on the periphery of the wheel and the other on the shaft or transmission. In g 5 the arrangement is such that the flywheel carries e magnetizing coil *B* and the current to this is supplied a

b[illegible]sh running in the groove A (one end of the coil being e[illegible]thed to the wheel) and a second brush running on a slip-ri[illegible]g C, to which the other end of the coil is connected. T[illegible] coil is preferably wound as a volute with flat copper st[illegible]p, the broad faces of the strip being in contact so that th[illegible] centrifugal force has no tendency to cut insulation or t[illegible]orce any part of the coil on sideways. The flywheel is sh[illegible]wn as in one piece, but it is preferably built up of dif-



[illegible]—Gyrostat with Flywheel Carrying a Magnetizing Coil.

[illegible]t qualities of steel, that of high-tensile strength being [illegible] where strength is important, whereas a ring of high-p[illegible]neability iron is used where necessary for the magnetic ci[illegible]cuit. The outer casing shown in Fig. 5 is fitted to en-a[illegible] a vacuum to be obtained; it has no electrical use, so [illegible]e whole motor revolves, excepting only the brushes. [illegible]. *Electrician*, Sept. 22.

[illegible] Starting Currents on Motor Circuits.—J. W [illegible] —An article in which the author gives in two diagrams th[illegible] records of power consumption of two cotton mills dr[illegible]en by squirrel-cage induction motors. They show that th[illegible] current during the starting periods does not materially [illegible] the current drawn from the line for normal opera-[illegible] The author shows why this must be so, at least if the [illegible]nt motors have a rating of 10 per cent each of the [illegible]quipment of the mill. The worst conditions in start-[illegible]e, of course, with the last motors. But even if the [illegible]wo motors, each demanding 25 per cent to 35 per cent [illegible] normal operating current for the mill, were to be st[illegible]ted at the same instant the total current required would o[illegible] slightly exceed the total current demanded to operate th[illegible] mill under normal conditions. The author's final con-cl[illegible]ion is that the prejudice in the minds of many electric-s[illegible]ply companies against the use of squirrel-cage motors [illegible]count of starting difficulties is largely unfounded.—[illegible] *Journal*, September.

Installations, Systems and Appliances.

[illegible] Heating and Cooking Apparatus.—A. Stein-[illegible]—The conclusion of his paper illustrated by numer-[illegible]agrams. Details are given of the construction of va[illegible]ous electric-heating and cooking apparatus. A distinc-ti[illegible] is made between designs using tubes and plates as he[illegible]ing elements, and the difference between direct and in-[illegible] heating is also emphasized.—*Elek. Zeit.*, Sept. 21.

Wires, Wiring and Conduits.

[illegible]ensible Steel Mast.—An illustrated description of an [illegible]sible steel mast of novel design, invented by A. Sie-[illegible] A four-sided hollow mast is formed of four flexible [illegible] strips (Fig. 6). The edges of these strips have teeth [illegible] them in such a way that the teeth of one strip inter-[illegible] with the recesses of the adjoining one, so as to join the [illegible] strips at their edges. The teeth project to some ex-te[illegible]. This makes up a hollow column, and it remains to br[illegible]e it. For this purpose thin sheet-steel brace plates [illegible] placed at frequent intervals. The mechanism for r[illegible]ng or expanding a mast of this kind is seen in Fig. 7, i[illegible]trating a four-sided section. The steel strips are [illegible]nd upon the drums AA and on two corresponding drums placed in the front and rear. A second set of drums B is mounted below to feed out the strip and guide it properly. These latter drums have projecting teeth around the center, which engage in holes in the steel band. A chain drive connects both drums and the lower or feeding rollers are driven by a hand crank or in other cases by an electric motor. As the four steel bands pass up through the guide plate D they become interlocked and form the

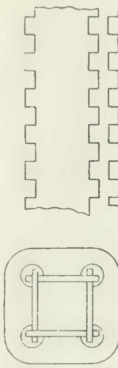


Fig. 6—Toothed Strip and Brass Plates.

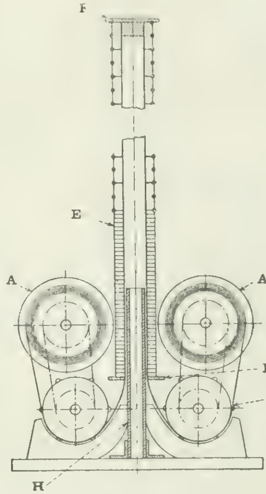


Fig. 7—Gear for Raising Mast.

steel tube. Upon the guide plate is a pile of section disks E. The top head of the mast F carries the first of a set of links which go to join all the section plates. When the head F rises in the first place it picks up the first section disk by means of the first four links placed on the four sides, so that the disk is automatically fitted around the column. As the mast continues to rise the second disk is taken along in the same way; the result is that the section disks are situated all along the mast, their spacing depending on the length of the link, which is determined according to circumstances.—Lond. *Electrician*, Sept. 22.

Electrophysics and Magnetism.

Homogeneous Röntgen Radiation.— C. A. Sadler.—An account of an experimental investigation of the transformation of the energy of homogeneous Röntgen radiation into energy of corpuscular radiation. Perhaps the most interesting result is that a very close connection exists between the emission of corpuscular radiation and the production of Röntgen radiation of the homogeneous type in the case of the group of elements Cr—Ag. This is in entire agreement with the supposition advanced by various investigators that the production of Röntgen radiation is always accompanied by the emission of negative corpuscles. *Phil. Mag.*, September.

Disintegration Products of Uranium.—G. N. Antonoff. —An account of an experimental investigation; the chief results are summed up as follows: A product called UrY with a period of 1.5 days is always present in small quantities in uranium. It emits soft beta rays with an absorption coefficient $\mu = 300\ (\mathrm{cm})^{-1}$ and probably also some alpha rays. The experimental results indicate that UrY is a lateral disintegration product of uranium and is produced in small quantity compared with UrX.—*Phil Mag.*, September.

Transient Phenomena in Overhead Lines and Cables.—K. W. Wagner.—A mathematical paper in which the author describes a method for experimentally investigating the transient electromagnetic phenomena in overhead lines

and cables. The method is essentially based on replacing the circuit under test by another circuit in which the transient phenomena occur in an otherwise identical way, but at so much less speed that they can be studied by the oscillograph. Applications of this method to the plotting of current and emf curves show agreement between theory and experiment.—*Elek. Zeit.*, Sept. 7, 14, 21.

Units, Measurements and Instruments.

Insulation-Resistance Tests.—W. A. Toppin.—The author thinks that the present tendency in the design of insulation-resistance testing sets is to render them less efficient than the apparatus manufactured several years ago. The use of small batteries to obtain the required testing pressure has become obsolete and a small permanent-magnet, hand-driven generator is now universally used. These used to be powerful little machines contained in a separate box from the ohmmeter, but in order to produce a lighter and cheaper apparatus the generator is now being put in the same case as the ohmmeter. Therefore, the weight of the generator was reduced and it became less powerful. The author gives comparative curves of the pressures obtained with two similar machines made by the same firm, one ten years ago and the other recently. There is a marked contrast between the pressures obtained when testing low-insulation resistances, the pressures with the recent machine being much lower. The author emphasizes that although there is a greater need for high pressure when testing doubtful wiring or plant it is just in these cases that the modern testing set fails. When testing lighting installations with a large number of points or motors with complicated switch gear it is not often that a result of more than 500,000 ohms is obtained, and thus the pressure at which the test is made is too low to be of much value.—Lond. *Elec. Review*, Sept. 22.

Telegraphy, Telephony and Signals.

Wireless Telephone Transmitter.—W. Dubilier.—An illustrated description of an improved wireless-telephone transmitter in which much heavier currents can be used than in the usual type of transmitter. It is a combination of a double-diaphragm transmitter with the principle of controlling the diaphragm by magnetic means instead of by the voice direct. The construction is shown in Fig. 8.

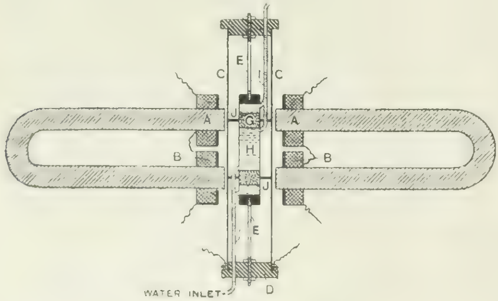


Fig. 8—Section of Transmitter.

The transmitter complete consists of the magnets *A, A*, wound with the 2-ohm windings *B, B* and placed opposite to each other with the diaphragm and carbon-containing cup between. The diaphragms are approximately 5 in. in diameter and 1/28 in. thick. The ebonite disk *D* is used to mount the diaphragms on and is drilled with large-sized holes so as to prevent "air packing" or talking against one another. A cross-section view of the carbon-containing cup is shown in Fig. 9. It resembles three brass rings placed within one another, forming three independent containing portions. Water circulates through the chambers *F* and *H* by means of the inlet and outlet tubes *I*, and the middle chamber *G* is used to retain the carbon granul To make contact with the granular mass use is made circular rings of platinum, *J, J*, which are first soldered the diaphragms *C, C*. The platinum rings are drills wi small holes round the entire circumference, so as to all a free circulation of air, and through one of these holes t small inlet and outlet tubes are run. The contact is ma in the center of the granular mass. A mica disk is used retain the granules in the chamber. A local transmitter connected in series with a set of dry cells and the windi

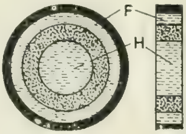


Fig. 9—Cross-Section of Carbon-Containing Cup.

B. Leads are taken from the diaphragms to the aerial c cuit. When the transmitter is spoken into the current fl ing round the windings varies the magnetic pull of magnets in the usual manner and the diaphragms *C, C* set in vibration to the same proportion. The maxim vibration should be figured as the resultant of the t that is, for the sake of illustration, consider that the ma mum vibration of each diaphragm is 1/16 in., the re would be equivalent to ⅛ in., for each diaphragm wo oppositely in the same proportion. In actual practice transmitter (although difficult to construct or adjust) gi the desired results and comes near to being the ideal tr mitter for heavy currents. This transmitter has also b used successfully as a telephonic relay.—Lond. *Electric* Sept. 22.

Miscellaneous.

Insulating Compound.—A note on a recent British pa (176, Sept. 14, 1911) of the British Thomson-Hou Company (General Electric Company of this country). drying oil, such as linseed oil, is heated with waste ru until a temperature is reached at which an exothermic action takes place, when a cement is produced. After c ing this can be thinned by mixing it with asbestos sulphur, then pressing it and finally vulcanizing the c pressed mass.—Lond. *Elec. Eng'ing*, Sept. 21.

Book Reviews.

The Propagation of Electric Currents in Telep and Telegraph Conductors. By J. A. Fleming. York: D. Van Nostrand Company. 316 pages illus. Price, $3.

This volume will be welcomed by students of con porary physics as well as by engineers of telephone changes and telegraph companies. The general phenor due to the transmission of electric impulses over air and submerged cables are described in several chapte which the presentation of the subject is clear and prehensive. Many chapters are devoted to the theor such transmission and no excuse is given for the intr tion from the start of vector analysis, Fourier's the and differential equations. It is rightly assumed th student who has not at least the mathematical equip which these imply had better leave the theory alone.

Frequent reference is made to the papers of Dr. nelly, of Harvard, on the propagation of electric cur along telephone cables and considerable space is giv the masterly investigation of Professor Pupin, of Colu on the properties of loaded cables. On page 47 a li works on modern electric theory is given from which of Sir Oliver Lodge are omitted; possibly because the are so well known as not to need mention.

HENDRICKS' COMMERCIAL REGISTER. Twentieth annual edition. New York: Samuel E. Hendricks Company. 1419 pages. Price, $10.

The twentieth annual edition of this invaluable commercial directory is enlarged over the previous edition by twenty-seven pages, or, allowing for matter omitted from the new edition, contains 124 pages of new matter, including the additional classification index pages, representing over [illegible] new classifications. The total number of classifications is now over 45,000, corresponding to 350,000 names and addresses in every branch of mechanical and electrical engineering and kindred professions and trades.

ELECTRIC TRACTION AND TRANSMISSION ENGINEERING. By Samuel Sheldon and Erich Hausmann. New York: D. Van Nostrand Company, 1911. 307 pages, 127 illus. Price, $2.50.

The purport of this work is stated in the preface to be to present a perspective view of the design of a complete railway installation, from the cars to the power station, as also to indicate the nature and sequence of the various entailed problems and to suggest methods for their solution. Many who will use this handbook otherwise than as a textbook will probably regret that answers are not given to the numerical questions appended to each chapter.

New Apparatus and Appliances

EXHIBITS AT THE ELECTRICAL EXPOSITION OF 1911.

A news account is published elsewhere in this issue of features of the Electrical Exposition of 1911 which is being held in the new Grand Central Palace, Lexington Avenue, New York City, Oct. 11 to 21 inclusive. We append herewith brief notes on some of the most interesting exhibits at the show.

CAMPBELL ELECTRIC COMPANY, Lynn, Mass., shows a complete line of electromedical apparatus, as well as transformers, ozone generators, transformers for bell-ringing circuits and thermo flashers and time switches.

EDISON STORAGE BATTERY COMPANY, Orange, N. J., has a complete exhibit of its various sized cells, in addition to a small generating outfit and battery for resident service.

ELECTRIC CONTROLLER & MANUFACTURING COMPANY, Cleveland, Ohio, makes a display of automatic motor starters and controllers. The apparatus is shown in operation in connection with a motor-driven pump.

ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has an interesting exhibit of its various types of cells. The company also is demonstrating apparatus for gas-car illumination, for railway lighting and signaling and for vehicles.

ELECTRICAL TESTING LABORATORIES, New York, are demonstrating methods used in analyzing and testing papers. Included in the display are machines for bursting strength, weight per ream, ash-weighing scales, etc.

FEDERAL SIGN SYSTEM, ELECTRIC, Chicago, Ill., has a display of Federal vacuum cleaners, Willis straight-line wattmeter and a number of sample signs.

GENERAL ELECTRIC COMPANY has an unusually large display of motors, arc lamps, theatrical lamps and a variety of household appliances.

GENERAL VEHICLE COMPANY, Long Island City, is making exhibit of a 2000-lb standard express-type body wagon and a 700-lb. standard wagon, in addition to a charging set for commercial vehicle work.

GOULD STORAGE BATTERY COMPANY, New York, exhibits [illegible] as well as complete batteries of a type used in the crosstown railway lines in New York City.

HASKINS GLASS COMPANY, Wheeling, W. Va., has arranged a display of "Lucida" reflectors, "Linticular" reflectors and a line of cut glassware. The company also manufactures insulators for high-tension work.

HABIRSHAW WIRE COMPANY, New York, exhibits panels containing sample rubber-covered wire and heavy conduit cables.

THE HOLOPHANE COMPANY, Newark, Ohio, has a tastefully arranged booth in which it displays glassware for residence, commercial and industrial lighting. Reflectors of glass and steel are shown in a great number of varieties.

HUGHES ELECTRIC HEATING COMPANY, Chicago, Ill., is making a demonstration of its ranges, ovens, warmers and toasters. The devices are in all sizes, from a single heating unit to a range suitable for hotels and restaurants.

HURLEY MACHINE COMPANY, Chicago, has a working exhibit of laundry machines of many types, all of which are driven by motors.

JEFFERSON GLASS COMPANY, Follanbee, W. Va., displays a full line of "Luceo" illuminating glassware, including indirect lighting dishes.

KINETIC ENGINEERING COMPANY, Philadelphia, Pa., shows two types of blowers, one for pipe-organ attachment and the other for piano attachment.

NATIONAL ELECTRIC LAMP ASSOCIATION, Cleveland, Ohio, features a 3000-watt cluster, consisting of six 500-watt, frosted, drawn-wire tungsten lamps hung beneath an 8-ft. steel reflector. Samples of its complete lines of lamps are shown in bases.

THE OPALUX COMPANY, New York, manufacturer of glassware designed to kill dazzling lighting effects, has a line of wide, medium and narrow reflectors on exhibition.

PYRENE MANUFACTURING COMPANY, New York, demonstrates the efficiency of its fire-extinguishing compound and also its insulating qualities. Small electric arcs are extinguished and bare-copper conductor feeding lamps are immersed in the liquid.

ST. JOHN CORPORATION, New York, distributor of the Rollinson electrical specialties, has a display of transformers for bell-ringing and other low-voltage circuits, in addition to a line of meters, load boxes or testing sets.

SHELTON ELECTRIC COMPANY, New York, is demonstrating its well-known lines of vibrators, hair dryers and therapeutic machines.

SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., has a complete line of its heating devices, including flatirons, stoves, toasters, pads, etc., on exhibition.

WATSON-STILLMAN COMPANY, New York, shows a turbine pump for use in loft buildings and apartment houses. Tanks of water are used in connection with the demonstration of the pump and of the tank switches.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, as well as WESTINGHOUSE LAMP COMPANY, show a complete line of their products. The manufacturing company features a line of improved direct-current motors with various forms of control apparatus, in addition to a line of meters; while the lamp company has a complete display of its tungsten lamps.

WESTON ELECTRICAL INSTRUMENT COMPANY, Newark, N. J., has a rather complete line of standard instruments on display. These include instruments of precision as well as those intended for switchboard and portable use.

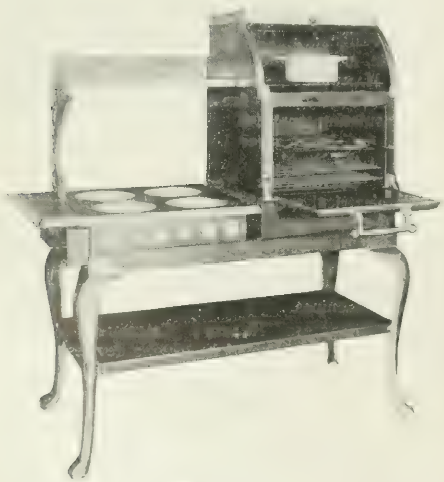
A TWO-VOLT DRY BATTERY.

A new dry cell recently developed and marketed by the Efficiency Electric Company, 4524 Lincoln Avenue, Chicago, is declared by the manufacturer to be the only two-volt dry battery made, besides embodying unusual features of long life and complete recuperation after apparent exhaustion. In energy output one of these cells is claimed to be the equal of eight of the average dry batteries. In a test reported by the makers one of the Star dry cells rang a bell continuously for eight weeks, being allowed only four-minute intervals for recuperation every two weeks. After another short rest, it is said, the same battery will be capable of ringing the bell for another period of six weeks or more. As a primary cell for furnishing energy to small lamps one of these batteries connected to a 2-volt, 2-cp tungsten lamp is said to have kept the lamp alight for an initial continuous period of 24 hours, followed by two similar 24-hour periods after the cell had been allowed to rest. The cells are made in three sizes—4 in. x 2 in., 6 in. x 2.5 in. and 8 in. x 4 in.

NEW ELECTRIC STOVE.

The Hughes Electric Heating Company, of 226 West Superior Street, Chicago, is making a new electric cookstove of the type shown in the illustration. This stove stands 60 in. high over all and is 52 in. wide and 21 in. deep. It has four "griddle" heaters and an oven 18 in. x 18 in. x 12 in. Above this oven is a warming closet. As shown in the illustration, there is also a large lower shelf, which is a useful adjunct.

The stove is substantially built of blue steel with nickel-plated trimmings. It is provided with three-position snap switches, so that the heat for each burner may be either



Electric Stove.

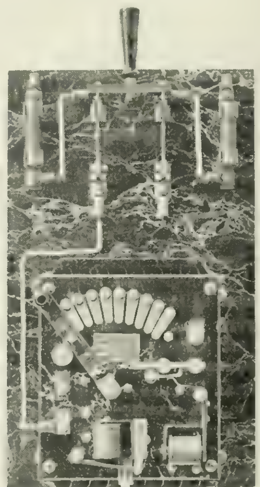
high heat, medium heat or low heat. The high-heat consumption for each burner is 880 watts, the medium heat 440 watts and the low heat 220 watts. Two heating units are provided for the oven, one located at the top and the other at the bottom, each consuming the same amount of electricity and controlled in the same way as the "griddle" burners. The oven is well insulated and will bake or keep food hot long after the supply of energy is turned off.

By the use of two heating units and the three-position switches nine different heat combinations can be effected for the oven. Baking ovens require a temperature of from 250 deg. F. to 450 deg. F., depending upon the nature of the work to be done. With the electric stove the time required for baking is about the same as with gas or coal, but the heat is utilized more efficiently, and there is no appreciable increase in the temperature of the air in the room where the oven is in operation. Of course, the electric stove is perfectly clean and odorless and in the highest degree convenient. The use of a stove of this kind means naturally a desirable addition to the day load of the central station.

UNIVERSAL DIRECT-CURRENT SPEED REGULATOR.

The illustration shows a universal speed regulator for motors with underload and overload release, designed for direct-current service and made by the Independent Electric Manufacturing Company, of Milwaukee. This device is available for regulating the speed of direct-current motors operating printing presses, ventilating fans and all kinds of machinery. It is made in several sizes and voltages and is fireproof. The frame is constructed of angle iron, and in the type illustrated the box is made of gray-iron castings and the face panel of marbleized slate. The switch and fuses are mounted on the panel, the device being complete for motor installation without wiring.

One interesting feature of this speed regulator is a device invented by Mr. W. H. Gaulke, general manager of the company. This feature consists of a horizontal ratchet bar which holds the contact lever squarely on each contact. The ratchet bar is connected to the lever by means of a



Direct-Current Speed Regulator.

link. Notches on the bar correspond with the various positions of the lever, insuring perfect alignment over each contact segment and preventing halfway positions of the lever in operation. A pawl engages the notched bar, holding the lever firmly in place at each position. When worn the horizontal ratchet bar may be replaced quickly and easily at nominal cost and it is not necessary to replace the entire lever.

Industrial and Commercial News

THE WEEK IN TRADE.

HESITATION is again noticeable in the attitude toward new business commitments, and buying continues in small amounts for early delivery. Weather conditions have helped some branches of trade and advancement of the season has expanded coal and retail lines. large volume of inquiries for steel has followed the luction of prices and orders for cars, rails and bridge equipt in fair amounts are expected shortly. Prices in the iron market are wavering and show signs of becoming r, and orders are not coming in as rapidly as is desired. tual output in the iron and steel trades is fairly large as pared with last year, but the income from this tonnage is in the same proportion, on account of the low prices at h contracts were placed. The last fortnightly report on cars showed a total of 50,038 as compared with 64,283 in previous statement. Another favorable statement was the ernment condition report, issued this week, which indicated rovement in many of the crops. Traffic returns are irreg- and but few of the roads are showing substantial increase eceipts. The Supreme Court convened on Monday and be in session until June. Conditions in the Southwest reported as fairly satisfactory and steady progress is being le in that part of the country. There are many encourag- features in the trade situation, such as the large trade nce of the country, the prevalence of cheap money and excellent harvest outlook, but, while these factors are rec- ed, immediate growth to former activity cannot be cted. Improvement in sentiment, if not in actual volume of ness, is being made each week and will be reflected in re transactions. Business failures for the week ended as reported by *Bradstreet's*, were 201, as compared 248 in the previous week, 192 in the corresponding week 10, 203 in 1909, 256 in 1908 and 1 2 in 1907.

THE COPPER MARKET.

DECREASE in deliveries and production and increase in surplus stocks as compared with August were shown in the September report of the Copper Producers' Asation which was issued on Monday of this week. Cop- stocks in the United States increased 7,453,355 lb. ng the month and production dropped to 115,588,950 lb. as ared with 125,493,667 lb. in August. Total consumption only 108,135,595 lb., a falling off of over 21,000,000 lb. as pared with deliveries of 129,791,034 lb. in the month pre-

andard Copper.	Bid.	Asked.	Settling Price.
	11.75	11.85	.....
er	11.75	11.85	11.80
r	11.75	11.85	11.80
mber	11.75	11.85	11.80
	11.75	11.85	11.80

London market, October 10, was as follows:

	Noon. £ s d	Closing £ s d
copper, spot	54 10 0	55 6 3
copper, futures	54 6 3	55 2 6

fluctuations for this year

	Highest.	Lowest.
	12.35c	11.57½c
spot	£57 10 0	£53 7 6
futures	58 2 6	54 0 0
cted	61 10 0	57 5 0

ing. Domestic deliveries were 57,311,584 lb. as compared 59,936,364 lb. in August and export deliveries dropped from 55,660 lb. to 50,824,011 lb., which is the smallest total thus in the current year with the exception of 45,000,000 lb. February. Stocks on hand Oct. 1 were 140,894,856 lb. as nst 133,441,501 lb. on Sept. 1. No particular significance is ched to the smaller production, since 4,000,000 lb. of the 00,000-lb. decrease is attributed to one less working day September than in August, 3,000,000 lb. to operating diflties and the remaining 3,000,000 lb. to smaller shipments the Lakes. Domestic deliveries, while showing a small dease, were at the daily rate of 1,910,386 lb., which shows a ing decline when compared with the rate of 1,933,398 lb. per day in August. The 19,000,000-lb. drop in export deliveries is the controlling factor in the report and industrial disturbances abroad were the chief cause of this decrease. The week in the copper trade has been dull and prices have continued to show a downward tendency. A slightly better tone has appeared in the export market, and exports for the month, including Oct. 10, aggregate 5075 tons. The daily call on the Metal Exchange, Oct. 10, quoted copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

General Electric Orders.—Among orders recently received by the General Electric Company, Schenectady, N. Y., are the following: From the Metropolitan West Side Electric Railway Company, of Chicago, Ill., for two 2000-kw, 600-volt rotaries, six 700-kw, 9000-450-volt transformers, two 20,000-cu. ft. blower sets and a switchboard; from the Fairmont & Clarksburg Traction Company, of Fairmont, W. Va., for three 300-kw, 1200-600 volt rotary converters, nine 110-kva transformers and a switchboard for Clarksburg, W. Va.; from the City & County Contract Company, of New York City, for one gasoline-electric equipment for construction car and control equipment, for the New York, Westchester & Boston Railway Company; from the Des Moines City Railway Company, of Des Moines, Ia., for a switchboard; from the Lewiston, Augusta & Waterville Street Railway Company, of Lewiston, Maine, for one 300-kw, two-unit motor-generator set and a switchboard; from the Waldameer Construction Company, of Erie, Pa., for one GE-205, four-motor car equipment with controller for the Erie & Suburban Railway Company; from the Pacific Electric Railway Company, of Los Angeles, Cal., for one motor-generator set, one 17-kw, 500-125-volt exciter and three core-type transformers; and from the Delaware & Hudson Company, of Albany, N. Y., for one gas-electric motor car.

New Boston Edison Buildings.—The Edison Electric Illuminating Company of Boston has purchased the athletic field formerly used by Boston College, comprising 367,134 sq. ft., fronting on Massachusetts Avenue, near Everett Square, Dorchester. The property is assessed for $111,100. In addition the Edison company has bought 88,700 sq. ft. of land adjoining, making a total tract of ten acres, on which it is proposed to erect several buildings to cost about $500,000. The growing needs of the construction and operating departments demand larger facilities and it is planned to erect a complete service depot, embracing a stable, garage, machine shop, storerooms, and general construction and operating offices for the departments having this work in charge. Part of the property will be laid out for tennis courts and a baseball diamond for the use of employees. The library now in the Boylston Street building will be removed to the new plant. At the annual meeting of the company, to be held next Tuesday, the stockholders will vote on the proposal to fund the new extension.

Garwood Electric Company.—The Garwood Electric Company, of Garwood, N. J., for which Charles N. Fowler, Jr., of Elizabeth, N. J., has been appointed receiver in chancery, is not only completing its unfilled orders, but is also taking new business, the assets of the company being, it is stated, largely in excess of its liabilities. All of the branch offices of the company are soliciting business, as usual, and reorganization plans are now being considered.

Brooklyn Edison Contract.—The Bush Terminal Company, which operates an extensive system of model loft buildings on the Brooklyn waterfront, has renewed its contract with the Edison Electric Illuminating Company of Brooklyn for a period of five years. Over 4000 hp is now being supplied from the mains of the central-station company to this customer.

Holtzer-Cabot Electric Company.—Fire caused over $200,000 damage to a four-story factory building and contents belonging to the Holtzer-Cabot Electric Company at Brookline, Mass., last week. Nearly all the loss was covered by insurance.

Allis-Chalmers Company.—Following new low prices in Allis-Chalmers preferred stock and 5 per cent bonds in the New York market early this week, Vice-president Nichols issued an official statement on the company's affairs in which he said: "For some time past the volume of new business with our company—the same as with other concerns of whom we have any knowledge—has been unsatisfactory. Our product is not one of necessity in the sense of being one that is daily consumed by the population. It consists of heavy machinery, power plants, etc., for which, as new enterprises are now being held in abeyance, a market must be found among industrial and other going concerns who themselves are now operating far below capacity, with consequently little incentive or courage to increase their capital expenditures. There seems to be no immediate prospect of revival. We are undertaking to operate the manufacturing plants of the company and to conduct its business affairs to meet the best interests of the security holders. Our company has current assets greatly in excess of its current liabilities. Our semi-annual audit is now in progress by our regular auditors, whose figures are not yet available. It has been decided by the board of directors to change the ending of our fiscal year from June 30 to Dec. 31, so that hereafter the closing of the books will correspond to the periods of statements now required to be made annually to state and federal authorities." The annual report of the company will be made public within a short time.

United Missouri River Power Company.—On application of the United States Mortgage & Trust Company, a receiver has been appointed for the United Missouri River Power Company, which was mentioned in these columns Sept. 30 in connection with non-payment of interest on $1,850,000 of its 6 per cent gold notes. The company was incorporated in February, 1906, in New Jersey, as a consolidation of the Missouri River Power Company and the Helena Transmission Company; this brought under one control two large water powers on the Missouri River, aggregating some 18,000 hp, and an auxiliary steam station of 6000 hp in Butte. The lines of the company extend to Butte, Helena and Anaconda. In January, 1910, the Capital City Power Company, which owned a third water-power on the Missouri River with a capacity of 25,000 hp., was acquired by the United Missouri River company. The authorized capital stock of the company is $12,500,000, of which $10,000,000 is outstanding, and $1,500,000 7 per cent cumulative preferred, of which $1,375,000 is outstanding. S. T. Hauser is president of the company and W. B. Gower is its secretary. It has a New York office at 20 Exchange Place.

Underpaid Postage on Foreign Letters.—A recent issue of the *Bulletin* of the Berlin, Germany, American Association of Commerce and Trade prints the following communication from a member of that body: After the introduction of the 2-cent rate of postage to Germany by German steamers, all Americans in Germany hoped underpaid mail matter would cease. Unfortunately they did not reckon with American mailing clerks, or rather mailing boys! Lately complaints have been universal on the part of American firms in Germany of underpaid letters. Americans are in most respects practical business men; why are they not in the matter of prepaying postage? Letters might just as well be sent wholly unpaid, as nothing is gained by part payment. Extra postage is getting to be a regular, although wholly unnecessary, item in the expense account of American firms in Germany. The sums paid out for extra postage by any one firm in a year would feed a moderate-sized family for that length of time!

Sedalia Light & Traction Company.—Announcement is made that a decree of foreclosure of the Sedalia Light & Traction Company has been entered and that sale under the decree is expected to take place in the near future. The property will probably be bid in by the bondholders' committee and in that case any bondholders who do not deposit their bonds with the committee will receive only their pro rata share of the amount bid by the committee, less expenses and receivers' obligations. Undeposited bonds will be received by the committee at the New York Trust Company until Oct. 16, after which time they will be received only at the discretion of the committee, on such terms as it may direct. Over $500,000 par value out of the total issue of $749,000 is now represented by the committee.

General Motors Truck Company.—The General Motors Truck Company has been formed to market the commercial automobiles made by the General Motors Company. The Rapid-Reliance Company, of Illinois, with an office at 2241 South Wabash Avenue, Chicago, is agent for the General Motors Truck Company, which has its headquarters in Detroit. A line of commercial cars comprehensive enough to cover every business requirement will be made eventually. The nucleus of this line will be formed by the "Rapid," which is built with capacities of from ½ ton to 3 tons and the "Reliance," with capacities of from 2½ tons to 5 tons.

American Electric Fuse Company.—On Nov. 1 the factory, plant and business of the American Electric Fuse Company, of Muskegon, Mich., bankrupt, will be offered for sale to the highest bidder at the plant in Muskegon by Paul S. Moon, trustee in bankruptcy. Sealed bids will be received for the complete plant or for one or more of the three divisions; that is, (1) telephone and electrical supplies, (2) wire and insulation equipments, and (3) rheostats and current controllers. The wire business is carried on in a separate building, and if this is sold separately the building and equipment will be included.

"Conta" Flaming-Arc Lamps.—The Regina Electricitäts Gesellschaft, G. M. B. H., of Cologne, Germany, manufacturer of the "Conta" flaming-arc lamp and the "Iota" tungsten lamp, wishes to dispose of its American patent. Its exhibit at the Turin Exposition, at which 130 "Conta" flaming-arc lamps were installed on a 6300-volt, three-phase circuit, was awarded to Grand Prix and a Diplome d'Honneur. A Grand Prix was also received at Marseilles in 190- and at Brussels in 1910. The General Electric Company of London has acquired the British patents.

Goulds Manufacturing Company.—Business of the Gould Manufacturing Company, of Seneca Falls, N. Y., manufacturer of pumps, is running at only a slightly lower rate than last year's, which was the largest in the history of the company. A representative says: "This year's business in hand pumps and small machinery is the biggest we have ever had while our business in large power pumps and heavy machinery is slightly lower than it was last year. As has been the case for several years past, our export business is good and is showing a steady increase."

Westinghouse Foreign Business.—It is stated that during the past five months the foreign interests of the Westinghouse Electric & Manufacturing Company have done a much better business than in any corresponding period in the history of the company. Domestic business is showing a falling off, and it is expected that the annual report of the company will show between 9 per cent and 10 per cent on the common stock after meeting preferred requirements. After payment of per cent preferred dividends last year, 12.3 per cent was shown on the common stock.

Wireless Commissions Were Large.—In the answer filed in the Supreme Court in the suit against George H. Parker, former director and Western agent of the United Wireless Telegraph Company, for selling his own stock instead of treasury stock, it was stated that gross commissions in two years from the sale of some 85,000 shares amounted to $1,315,9-. After payments to sub-agents and general expenses Parker's share was, he said, $200,000.

Toledo Railways Change Rumored.—Advices from Toledo contain rumors that Albion E. Lang, president of the Toledo Railways & Light Company, will resign prior to January 1, 1912. It is stated that Mr. Lang accepted the post with the intention of serving during franchise negotiations between the company and the city of Toledo, and that the rumored action is due to the prolonging of these matters.

Dominion Light, Heat & Power Company Sold.—The Canadian Light & Power Company has purchased the Dominion Light, Heat & Power Company's plant at Montreal and will make use of the company's franchise and power station to still further increase its business in that city.

Aluminum Notes and Prices.—The aluminum market, as of Oct. 10, is reported firm, with ingots for remelting quoted at 20@22 cents spot No. 1, the base for large ingots. Rods and wire are held at 21 cents and sheets at 33 cents.

Sale of Winnipeg Electric Railway Halted.—Advices from Winnipeg state that the special committee appointed to consider the purchase of the Winnipeg Electric Railway by the city has voted against the proposition.

Financial.

THE WEEK IN WALL STREET.

RREGULARITY has characterized prices on the New York list since last report, and in comparison to the activity of the past few weeks the market has been exceedingly quiet. ...akness appeared last Friday after the President's remarks ...anti-trust laws and the downward movement extended ... trading on Monday. Pressure on Reading in the early ...nsactions brought losses in this issue, in marked contrast ... advances in Louisville & Nashville shares, and bonds of the ...lantic Coast Line later in the day. The Department of Agri...ure issued its report on the grain crops on Monday, and

NEW YORK.

	Oct. 3	Oct. 10.	Shares Sold.		Oct. 3	Oct. 10	Shares Sold
[illegible]	6*	3	2,900	Int. Met., pf.	42	4[illegible]	13,650
[illegible], pf	16 *	12[illegible]	900	Mackay Cos.	82[illegible]*	85*	400
Cop....	49[illegible]	49[illegible]	70,330	Mackay, C., pf.	72[illegible]*	7[illegible]	100
[illegible]. T....	33⅞*	33[illegible]*	———	Man. Elev....	132*	132*	———
[illegible]oco....	35[illegible]*	34[illegible]	820	Met. St. Ry..	15*	15*	———
[illegible] pfd	[illegible]	105*	300	N.Y.&N.J. Tel.	13[illegible]	139 *	———
Tel. & C.	80[illegible]*	80[illegible]*	———	Steel, com....	60[illegible]	5[illegible]	919,700
T. & T..	13[illegible]	134[illegible]	8,624	Steel, pfd..	10[illegible]	10[illegible]	10,257
R. T.....	73¼	74[illegible]	5,000	W. U. T..	77[illegible]	79[illegible]	29,900
Elec...	148½	149½	1,400	West'h, com..	62¾*	61¼	300
Met....	15	14⅞	11,600	West'h, pfd..	110½*	115	100

PHILADELPHIA.

	Oct. 3.	Oct. 10		Oct. 3.	Oct. 10
Rys	44	44 *	Phila. R. T..	21[illegible]	21¾
[illegible] A	11⅝	11¾	Phila. Elec..	16¾	16⅜*
[illegible] B'ty ..	51	51¼	Phila. Trac..........	82¾	83
[illegible] B'ty, pf	[illegible]	30*	Union Trac	49¾	49½

CHICAGO.

	Oct. 3.	Oct. 10		Oct. 3.	Oct. 10
City Ry.	186*	186*	Com. Edison..	134	135[illegible]
[illegible] Rys.	24*	24*	Chi. Subway......	2¼	1¾
[illegible] Rys., pf.	89[illegible]	89½*	Chi. Telephone......	120	120
Rs., Ser. 1....	92*	92*	Nat'l Car..........	101*	101*
Rs., Ser. 2...	27*	27*	Nat'l Car, pf.......	118½*	118 *

BOSTON.

	Oct. 3.	Oct. 10			Oct. 3.	Oct. 10
[illegible] & T........	133⅝	134⅝		Mex. Tel....	3*	3*
Tel...........	149[illegible]*	149⅞		Mex. Tel., pf........	6*	6*
[illegible]...........	280*	285		N. E. Tel..........	143¼*	146
[illegible]ec..	148½	149½	1,400	W. T. & T.........	18*	19
E. Ry.........	19	19⅜		W. T. & T., pf.....	95*	95[illegible]
E. Ry., pf....	89¾	92				

...t price quoted.
...es sold for the week Oct. 2 to Oct. 7.

...e its estimated yields are under records of former years ...have promise of harvests well up to the average. A large ...ree of interest was shown in the weekly statement of the I...perial Bank of Germany, which indicated recovery from t... large demand incurred by September requirements and a...proach of normal conditions. Tuesday's market was strik...ingly inert, and the range of price changes was the narrowest f... a considerable length of time. Many of the usually active s...cks did not figure in the trading until near the close, and t...al sales were only 254,043 shares. Selling of cotton options ...a new low prices and the statement of unfilled orders on the b...oks of the Steel Corporation were incidents of the day. T...e steel report showed a slight decrease, bookings on Sept. 3... being 3,611,000 tons as compared with the 3,696,000 tons ...e August statement, but, in spite of this, the showing was ...r than had been expected. Excepting for small advances ...is foreign discount rates have shown little change. Loans ...eing made from New York to German banks in heavier ...e and shipments to Southern centers for crop financ...s becoming more pronounced. The record of withdrawals ...eek has been much larger than usual. Rates in the money ...t Oct. 10 were: Call, 2¼@2⅜ per cent; ninety days, ...3¾ per cent. The quotations in the tables are those at ...lose Oct. 10.

FINANCIAL NOTES.

...nnual Report of Boston Edison Company.—As fore...cted in these columns Aug. 19, the report of the Edison E...ctric Illuminating Company of Boston for the year end...in June 30, 1911, shows very satisfactory growth in all branches o... the company. Gross earnings, as previously reported, were $...,257,914 and expenses, not including depreciation, were $2,-2...,276, leaving net earnings of $3,014,637, which compares with $2,602,228 for the preceding year. Miscellaneous income was $78,271, making a total net income of $3,092,909. Taxes were $608,595, as compared with $546,508 in the previous year, and after deduction of this item, and $179,316 for interest, there was left a balance of $2,304,997 available for dividends, which is equivalent to 14.73 per cent on the $15,603,700 capital stock outstanding and compares with $1,909,145 in the previous year. Dividends were $1,867,035, leaving a surplus of $437,962 as against $413,548 in the year ended June 30, 1910. The total connected load on June 30, 1911, in 50-watt equivalents was 2,773,838, which compares with 2,408,926 on the corresponding date in the previous year. President Charles L. Edgar, in his report to the stockholders, says in part: "As no new properties were absorbed during the past year, the report shows the increase which your company obtained through its regular growth. This is by far the largest in its history and, with the exception of last year, is more than double that of any previous year. There have been very few changes in the property of your company during the year just past. The growth of the business in the newer Back Bay district has necessitated enlarging the Scotia Street substation, and the adjoining lot of land, referred to in the report for 1908, has been used, and there has been erected thereon a three-story addition, covering approximately 2700 sq. ft. of land. The new steam turbo-generator referred to in last year's report has been installed and is just about being put into operation. It is, at the moment, the largest steam turbine in the world. During the year the stock authorized by the board of Gas & Electric Light Commissioners for the purchase of the electric property of the Lexington company has been issued, 424 shares having been sold at auction for $119,952. The 177 shares left over from the previous issue have also been sold, so that there is not, at the present time, any stock in the treasury authorized and unissued. Although the growth of your company during the past year has been satisfactory, there does not seem to be any immediate need for new capital, and it is probable that no steps toward an additional issue of stock will be taken for some months."

Oakland Railways.—Banking houses are offering $2,500,-000 collateral trust, 6 per cent, four-year gold notes of the Oakland Railways, which is a merger of the Oakland Traction Key Route and other companies operating 230 miles of electric railways along the entire east shore of San Francisco Bay. The cities and towns of Oakland, Alameda, Berkeley, San Leando, Richmond and others lie within this area. The notes are dated Sept. 1, 1911, and are due Sept. 1, 1951. The collateral to be deposited as security for the issue consists of $3,-391,000 of underlying bonds of more than two-thirds of the capital stock of all the underlying companies; of $2,500,000 demand guaranty notes of underlying companies, and the direct guaranty of these companies is indorsed on the notes. Gross earnings in the twelve months ended June 30, 1911, were $4,414,416, operating expenses, including taxes, were $3,017,662, leaving net earnings of $1,396,754. Interest on bonds now outstanding was $858,349, leaving a surplus applicable to interest on notes of $538,405, or over three and one-half the $150,000 required.

Spokane & Inland Empire Electric Railroad Company.—Total revenues of the Spokane & Inland Railway Company from transportation in the year ended June 30, 1911, were $1,669,638, which is a decrease of $93,976 from last year's returns. Operating expenses were $1,194,578, which represents an increase of $112,410 as compared with those in the previous year. Net operating revenue was $745,060, representing a decrease of $206,388 for the year. Carl R. Gray, president of the company, says in the report that, while the street-railway system in Spokane shows an increase over the returns in the previous year, decreases on the interurban lines in northern Idaho and eastern Washington were shown.

Montreal Tramway Bonds.—New York and Chicago banking interests have purchased $10,000,000 first and refunding mortgage 5 per cent bonds of the Montreal Tramways Company. The proceeds of these bonds will furnish the company with funds for use in connection with the purchase of the property of the Montreal Street Railway Company and for retirement of certain bonds of this company. The sale of these bonds represents the largest block of bonds sold by Canadian corporations, with the exception of Canadian railroads. The purchasers will offer them for sale within a short time.

Western Union's Year.—The full pamphlet report of the Western Union Telegraph Company for the year ended June 30, 1911, shows that the company earned 5.38 per cent on its $99,817,100 capital stock, as compared with 5.49 per cent on the same amount in the previous year. Gross telegraph earnings were $34,714,810, as compared with $31,788,246, and miscellaneous earnings were $763,983, as against $965,865. Total earnings were $35,478,793, as compared with $32,754,111 in 1910. Expenses and taxes, including rental of leased lines, reconstruction, repairs, etc., were $30,053,631, as against $26,614,303. Net earnings were $5,425,161, as compared with $6,139,808. Other income in 1911 was $1,680,196, and was $1,135,092 in 1910, making total net incomes of $7,105,357 and $7,274,900, respectively. Interest charges were $1,733,389, as compared with $1,687,830, leaving a surplus of $5,371,968 available for dividends, as compared with $5,587,070 in the previous year. Dividends in 1911 and 1910 were $2,991,304 and $2,989,696, respectively, leaving balances after all deductions of $2,380,663 in 1911 and $2,597,374 in 1910. In his report to the stockholders President Theodore N. Vail says, in part: "The large increase in gross is more than offset by the increase in the expenses of $3,167,853—13.14 per cent—causing a decrease of $148,880 in the net revenue. Of this increase in expenses $2,369,434 was for salaries and wages, an increase in this item of 21.18 per cent over last year. While your company has had a great past, and cannot fail to have as great a future, present conditions, resulting from a long period of unsettled business and labor conditions and of economies and retrenchment, are, from a conservative standpoint, far from satisfactory."

National Light & Power Company.—The National Light & Power Company has been incorporated under the laws of New Jersey with an initial capital stock of $500,000, and with Judson H. Boughton as president and W. C. Morehead as secretary and treasurer. The corporation will be a holding and engineering company for gas, electric, street railway and hydroelectric properties, with the home office in St. Louis in the same quarters as the National Light & Improvement Company, which syndicate is now in the process of dissolution. Judson H. Boughton, president, has been identified with the National Light & Improvement Company as secretary and treasurer, president of the Waco, Texas, Citizens' Railway Company, vice-president and general manager of the gas and electric properties at Waco and Ft. Worth, and also associated with the various other interests of the National Light & Improvement Company's properties. W. C. Morehead has been an official in the subsidiary corporations of the National Light & Improvement Company, with headquarters at Waco and Ft. Worth, but he will now remove to St. Louis and take up the duties of secretary and treasurer of the new parent organization.

American Telephone & Telegraph Company.—The report of the American Telephone & Telegraph Company for the twelve months ended June 30, 1911, as filed with the Massachusetts Highway Commission, shows gross income of $17,344,680 as compared with $16,503,890 in the corresponding period of the previous year. Operating expenses were $8,004,562, comparing with $8,446,731, and net income was $9,340,118 as compared with $8,057,159. Other income was $24,127,177, comparing with $24,017,390, making a total net income of $33,467,295, which is an increase over the $32,074,547 in the preceding period. Charges were $6,386,314 and left a surplus of $27,080,981, which compares with $26,285,440 and represents 9.83 per cent earned on $275,435,325 stock outstanding, as compared with 10.1 per cent on $259,846,200 stock in the corresponding period last year. Dividend requirements were $21,194,025, as compared with $19,747,337, and left a surplus of $5,886,956, which compares with $6,528,103 last year. The report of the company for the third quarter will appear in next week's issue.

Nashville Railway & Light Company.—The report of the Nashville Railway & Light Company for August shows gross earnings of $154,254 comparing with $146,038 in August, 1910. Expenses and taxes were $93,471 as compared with $87,748, and net earnings were $60,783 as compared with $58,290. Charges, depreciation and preferred dividends were $148,969, leaving a surplus for the month of $11,814, which compares with $10,115 in August of the previous year. In the eight months ended Aug. 31 gross earnings of the company were $1,261,044 as compared with $1,178,540 in the corresponding period last year. Expenses and taxes were $751,476 as compared with $688,471, leaving net earnings for the period of $509,567, as against $490,068 in the eight months ended Augu[st] 31, 1910. Charges, depreciation and preferred dividends wer[e] $390,097, which left a surplus for the eight months of $119,47[…] which compares favorably with $102,574 in the correspondin[g] eight months of 1910.

Bids Wanted on North Carolina Utility Bonds.—Seale[d] bids will be received by the clerk of the board of commi[s]sioners of the town of Wilson, N. C., until Jan. 1, 1912, f[or] the purchase of $74,000 5 per cent coupon bonds, known [as] "Refunding electric-light and water-works bonds of the tow[n] of Wilson." These bonds will mature twenty years after da[te] of issue and interest will be payable semi-annually at the off[ice] of the treasurer of the town of Wilson or at some bank [in] New York City at the option of the purchaser. Each pr[o]posal must be accompanied by a certified check for $1,000, pa[y]able to the order of the treasurer of the town of Wilson [as] guarantee of good faith and to be forfeited to the town [in] the event of failure of the successful bidder to comply wi[th] bid within ten days from opening of same. For further i[n]formation address Theodore A. Hinnant, clerk board of co[m]missioners.

September Business of Western Electric Company.—[An] increase of 12 per cent. as compared with September, 19[10] was made in the volume of sales of the Western Elect[ric] Company last month. This gain was particularly notewort[hy] not only in view of the dullness in the preceding four mont[hs] but because it was also the largest gain in any one month t[his] year, and made the largest September showing in the histo[ry] of the company. In the eight months ending Aug. 31 [the] gross business of the Western Electric Company was ab[out] 4 per cent in excess of that in the corresponding period l[ast] year and gross business for the year, as previously stated [in] these columns, is expected to reach $66,000,000. From pres[ent] indications the company expects to be able to occupy o[ver] 200,000 sq. ft. of new floor space at the Hawthorne plant [by] January 1. A new merchandise building is included am[ong] other additions at this plant.

DIVIDENDS.

Columbus Railway Company, quarterly, preferred, 1¼ [per] cent, payable Nov. 1.

Eastern Consolidated Electric Company, semi-annual, 2 [per] cent, payable Nov. 1.

Edison Electric Illuminating Company of Boston, quarte[rly], 2 per cent, payable Nov. 1.

Milwaukee Electric Railway & Light Company, quarte[rly] preferred, 1½ per cent, payable Oct. 31.

Westinghouse Electric & Manufacturing Company, quarte[rly] preferred, 1¾ per cent, payable Oct. 16.

West Penn Traction Company, quarterly, preferred, ½ [per] cent, payable Oct. 16.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	N Sur
BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.					
August, 1911........	$89,545	$42,647	$46,898	$30,152	[illegible]
August, 1910........	81,376	40,236	41,140	30,222	[illegible]
COLUMBUS ELECTRIC COMPANY.					
August, 1911........	$39,573	$21,272	$18,301	$10,414	[illegible]
August, 1910........	39,328	16,540	22,788	17,887	[illegible]
DALLAS ELECTRIC CORPORATION.					
August, 1911........	$129,851	$83,884	$45,967	$25,518	[illegible]
August, 1910........	118,257	82,637	35,620	25,659	[illegible]
EL PASO ELECTRIC COMPANY.					
August, 1911........	$50,588	$30,428	$20,160	$8,343	[illegible]
August, 1910........	46,897	30,730	16,167	8,215	[illegible]
GALVESTON-HOUSTON ELECTRIC COMPANY.					
August, 1911........	$142,326	$76,197	$66,129	$25,200	[illegible]
August, 1910........	124,764	65,932	58,832	25,965	[illegible]
NASHVILLE RAILWAY & LIGHT COMPANY.					
August, 1911........	$154,254	$93,471	$60,783	$48,969	[illegible]
August, 1910........	146,038	87,748	58,290	48,175	[illegible]
NORTHERN TEXAS ELECTRIC COMPANY.					
August, 1911........	$135,529	$69,585	$65,944	$26,009	[illegible]
August, 1910........	119,813	63,953	55,860	20,300	[illegible]
PUGET SOUND ELECTRIC RAILWAY.					
August, 1911........	$155,665	$96,661	$59,004	$51,879	[illegible]
August, 1910........	173,988	100,168	73,820	52,145	[illegible]
SAVANNAH ELECTRIC COMPANY.					
August, 1911........	$58,680	$40,331	$18,349	$18,342	[illegible]
August, 1910........	56,870	37,680	18,190	18,182	[illegible]
SEATTLE ELECTRIC COMPANY.					
August, 1911........	$448,863	$230,443	$208,420	$116,260	[illegible]
August, 1910........	479,573	258,749	220,824	110,081	[illegible]
SIERRA PACIFIC ELECTRIC COMPANY.					
August, 1911........	$51,140	$17,375	$33,765	$4,345	[illegible]
August, 1910........	45,636	14,206	31,430	6,029	[illegible]

General News

Construction News.

PHOENIX, ARIZ.—Contracts have been awarded by the Salt River Valley Water Users' Association for the South Side Consolidated power ... as follows: To Mario Brothers, of Philadelphia, Pa., for two traveling cranes; for 26 miles of copper wire and 17 miles of galvanized ... wire to John Roebling's Sons Company, Trenton, N. J.; ... F. Kierulff Company, of Los Angeles, Cal., for 100 steel poles for ...er lines; to the Wesco Supply Company for 1200 ft. galvanized guy ... 225 telephone insulators, 25 copper splicing sleeves and 30 clamps, ... the Pierson Roebling Company for 350 insulators.

...DARVILLE, CAL.—Plans are being considered by the Modoc ... Irrigation Company for the erection of a hydroelectric power ... Goshead Lake.

FOREST, CAL.—Plans are being considered for utilizing electricity ... operate the North Fork mine. Surveys are being made for trans... line and estimates of cost are being prepared.

...AKEPORT, CAL.—Surveys have nearly been completed by the Clear ... Railroad Company for its proposed electric railway from Hope... Lakeport, a distance of 44 miles.

...NG BEACH, CAL.—The Pacific Telephone & Telegraph Company ...een granted permission by the City Council for pole line and ...rground conduit work in certain sections of the city in which its ...ise has lapsed, pending the decision on similar cases in neighboring ...

...NG BEACH, CAL.—The Southern California Edison Company has ...itted a bid offering to supply electricity for the city pumping ...ns at 1 cent per kw-hour between midnight and 6 a. m.; 1⅓ cents ...kw-hour between 6 a. m. and 5 p. m.; 2 cents per kw-hour between ... and 9 a. m., and 1⅓ cents between 9 p. m. and midnight.

...S ANGELES, CAL.—The Los Angeles Railway Company contem...s the construction of an electric railway through Elysian Park.

...S ANGELES, CAL.—Property owners on East Third Street, from ...ngeles Street to Santa Fe Avenue, have filed a petition with the ... Council asking for the removal of the present overhead wires, and ...stablishment of a conduit district. All power companies in the ...ill be affected.

...S ANGELES, CAL.—The Pacific Electric Railway Company is re...d to be planning the construction of a four-track line between Los ...es and Santa Monica, building two additional tracks along its ...nt route. The company also proposes to make improvements to ...stem at Monrovia.

...S ANGELES, CAL.—The finance committee of the City Council is ...ed to be considering plans for the distributing system for the proposed ...pal electric power plant to be operated in connection with the Owens ... aqueduct. It is proposed to issue $6,000.000 in bonds for the ...pal electric power plant to be operated in connection with the Ownes ... the Los Angeles Gas & Electric Company and the Southern Cali... Edison Company, whose combined systems are valued at $8,500,000. ...e the companies refuse to sell the city is planning to lay its own ...ts parallel to those of the three companies. The city will have a ...s of 150,000 hp from the Owens River aqueduct plants.

...RTINEZ, CAL.—Maps and permits showing the route to be taken ... the water front by the Great Western Power Company have been ... with the county clerk. Franchises along the water front from ... to Martinez, grant the company rights over many lines and ...ivilege of establishing a plant at Martinez.

...SADENA, CAL.—The City Council has appropriated $1,500 for ...rchase of equipment for the municipal electric-light plant. C. W. ...r is manager.

...NDSBURG, CAL.—The Southern Sierra Power Company has ...enced work on the erection of a transmission line to the Rands... mining district.

...HMOND, CAL.—The Castro Point & Terminal Railway Company, ...tly organized, proposes to construct and operate an electric rail... from Richmond to Winehaven.

...N BERNARDINO, CAL.—The offer of the Pacific Electric Railway ...any to build an electric railway in the northwest section of the ...r a bonus of $18,000, has been accepted by the property owners ...e district.

...N DIEGO, CAL.—The electric division of the San Diego Southern ...ay, between San Diego and National City, will be rebuilt.

...N FRANCISCO, CAL.—The California Terminal Company, recently ...porated at San Francisco, Cal., proposes to construct an electric ...ay from San Rafael to Sacramento, a distance of 95 miles. C. W. ...isk is interested in the company.

...N FRANCISCO, CAL.—A special meeting of the stockholders of ... Pacific Gas & Electric Company has been called for Oct. 23, to vote on the proposition of creating a new mortgage under which the company can issue bonds from time to time to an amount not exceeding $150,000,000 and to increase the common stock to an amount to enable it to comply with the California statute under which no corporation may have outstanding indebtedness in excess of its subscribed capital stock. The proceeds will be used for refunding or retiring existing issues of the companies and its subsidiaries, amounting to about $67,000,000. The remainder will be reserved for extensions and improvements, etc.

VALLEJO, CAL.—The Vallejo Electric Light & Power Company is reported to be preparing to extend its transmission lines to the O'Hara tract to furnish electricity for lamps and motors in that vicinity.

MONTROSE, COL.—The Federal Light & Traction Company has petitioned the City Council for a twenty-year extension of its franchise to permit the extension of its lighting service to the towns of Ouray, Ridgeway, Olath, Delta, Hotchkiss, Paonia and Cedar Edge.

PUTNAM, CONN.—The State Legislature has granted an amendment to the charter of the Putnam Light & Power Company, giving the company permission to furnish electricity in the town of Woodstock, and also allowing it take over the rights of the Pomfret Club.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 17 to furnish at the navy yard, Brooklyn, N. Y., supplies as follows: Schedule 3943—Electric conduit and fittings. Schedule 3944—Electrical supplies. Schedule 3954—Hoist controllers. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—An agreement has been reached between the Potomac Electric Power Company and the Commissioners of the District of Columbia, whereby the District of Columbia will save approximately $10.000 on its lighting contract. The company has been furnishing 700-cp lamps in many cases instead of 1000-cp lamps as contracted for and has agreed to reduce the rate from $85 to $80 each per year from October, 1909, to March, 1911. Announcement has been made that 750 new incandescent lamps are being erected around the White House and along Massachusetts Avenue as far as Union Station. It is also stated that orders have been given for 240 lamps for Potomac Park.

JACKSONVILLE, FLA.—The Postal Telegraph Company, it is said, will comply with the city ordinance requiring wires on Bay Street to be placed underground, at once, instead of waiting the maximum period of five years fixed by the ordinance. The cost of the work is estimated at from $25,000 to $30,000.

BAXLEY, GA.—At an election to be held Oct. 19 the proposition to issue bonds to erect an electric-light plant will be submitted to a vote of the people.

JACKSON, GA.—The City Council has entered into a contract with the Central Georgia Power Company to supply the city of Jackson with energy to the amount of 600 hp. A transmission line will be erected from the power plant to Jackson, work on which will begin at once.

ASSUMPTION, ILL.—It is reported that S. A. Shafer, superintendent of the local coal mine, has been granted a franchise to operate an electric-light system in Assumption. Electricity will be supplied from a generator at the mine. The erection of a distributing system is all that will be required. The Consolidated Electric & Manufacturing Company operates an electric plant in the city.

BEARDSTOWN, ILL.—The Beardstown Electric Light & Power Company is reported to have rejected the proposition of the City Council to enter into a contract for lighting the streets of the city under the terms of which the company was to supply arc lamps with all-night service at $4.50 each per month; $3.25 per lamp for midnight service and $1 each per month for 60-cp tungsten lamps. The Council is contemplating the installation of a municipal electric plant.

CHICAGO, ILL.—Sealed proposals will be received by the city of Chicago, Room 406, City Hall, Chicago, Ill., until Oct. 19, for furnishing and installing at the water-works shops, 2304 South Ashland Avenue, one 72-in. vertical motor-driven boring and turning mill, according to specifications on file at the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

DEPUE, ILL.—The Spring Valley Lighting Company, of Spring Valley, Ill., is negotiating with the Village Board for a franchise to supply electricity in Depue and a contract for street lighting. It is proposed to erect a transmission line from the Spring Valley plant to this village. The company now supplies electrical service in Cherry, Dalzell and Marquette. The company is reported to be contemplating extending its system to Grandville and Mark.

DIXON, ILL.—The City Council has agreed to pay for electricity for ornamental street lamps in the business district, provided the merchants will pay for the installation. It is proposed to erect forty-eight or more lamp standards.

DIXON, ILL.—The franchise of the Central Union Telephone Company has expired and the company has been notified that it must re-

...ve its poles and wires from the business district. It is expected that the wires will be placed underground.

EL PASO, ILL.—The City Council has granted E. H. Gray a twenty-year franchise to operate an electric-light plant in El Paso. The franchise provides for a twenty-four service and all-night street lighting service and a maximum rate of 12 cents per kw-hour for electricity for lamps with a discount of 10 per cent for prompt payment. The present street lighting contract of the El Paso Light & Power Company, of which Mr. Gray is manager, has been extended to June 1, 1913. The same number of lamps will be used, except that tungsten lamps will be substituted for the carbon lamps now in use. Tungsten lamps will be supplied at the rate of $17 each per year and arc lamps at $75 each per annum. The company will pump the city as at present, but has an option of installing an electric motor at its own expense and supplying electricity to operate the pumps at 4 cents per kw-hour.

FARMINGTON, ILL.—The City Council is contemplating the installation of an ornamental lighting system on McKinney Street. It is proposed to replace the present arc lamps with tungsten lamps.

LA SALLE, ILL.—Preparations are being made by the Chicago, Ottawa & Peoria Railway Company to increase the output of its power plant and place a portable substation on the eastern division.

LOCKPORT, ILL.—Owing to trouble at the local water-pumping station the City Council has decided to engage an electrical expert to make an investigation of conditions there and submit a report of same.

MACOMB, ILL.—The City Council has granted the Western Telephone Company a new franchise to operate in the city. The company will place its wires underground and make extensive improvements to its system.

MASCOUTAH, ILL.—The city of Mascoutah has purchased the electric plant of the Mascoutah Lighting Company for $9,000, to be owned and operated by the municipality. The citizens recently voted to issue bonds to the amount of $12,000 to take over the plant.

NEWMAN, ILL.—The electric plant of the Newman Electric Light Company was destroyed by fire on Oct. 3, causing a loss of about $18,000. A new generator just received but not installed was also destroyed.

PANA, ILL.—The Commercial Club has reported to the Council that the merchants have agreed to install fifty ornamental lamps, the cost not to exceed $50 each. An ordinance will be asked from the Council requiring all poles and wires to be removed from the business streets and all wires placed underground. The city, it is understood, will supply electricity and maintain the lamps after they are erected. Ornamental lamp standards, each carrying five lamps, will be installed.

PEORIA, ILL.—The Peoria Railway Company has applied to the Village Board of Averyville, a suburb of the city, for a twenty-year franchise. The company has at present a franchise, which has six years to run, but if granted a new franchise the old will be repealed. The Peoria Northern Railway Company has also asked for a fifty-year franchise to operate an interurban road through the village. If both are granted, the McKinley interests, which control both lines, contemplate extensive improvements, involving an expenditure of $60,000. The interurban project is said to be the first step toward the building of an electric railway between Peoria and Chillicothe and ultimately to Bureau Junction, connecting with the Chicago, Ottawa & Peoria Railway, giving the McKinley interests a through line from Ottawa to St. Louis, Mo.

SAYBROOK, ILL.—The Gibson City Electric Light & Power Company, of Gibson City, Ill., is planning to extend its transmission line to Saybrook, where the company has secured a franchise. The company agrees to sell electricity for business purposes at 10 cents per kw-hour and for domestic use at 12 cents per kw-hour. Especial attention will be paid to the development of the heat, light and power business.

EVANSVILLE, IND.—Arrangements have been made by the Evansville & Chrisney Railway Company for the construction of its proposed railway to connect Lynnville and Chrisney with Evansville. Substantial subsidies have been voted to aid in construction of the road. Contracts for construction of the railway will probably be awarded in the near future.

HOBART, IND.—Preparations are being made by the Gary, Hobart & Eastern Traction Company for the construction of its proposed railway between Gary and Hobart.

INDIANAPOLIS, IND.—It is expected that a contract will soon be awarded by the Indianapolis, Chicago & Meridian Railway Company for the construction of its proposed railway to connect Indianapolis, Sheridan, Gary, Hammond and Warsaw. M. J. Mooreland is secretary.

VINCENNES, IND.—The Board of Trade, it is reported, is planning to form a company to build a street railway to South Vincennes, a factory suburb. The Vincennes Traction Company, it is said, has refused to extend its lines to the addition.

ELLIOTT, IA.—Funds to the amount of $4,000 have been raised for the purpose of erecting a transmission line to supply electricity in Elliott and the farmers between Elliott and Griswold.

FARLEY, IA.—The construction of an electric railway to connect Farley, Garnaville and Luxemburg is under consideration. S. G. Durant, of Omaha, Neb., and associates are interested in the project.

MONTICELLO, IA.—The dam of the Monticello Electric Company was carried away recently by the flood in the Maqauketa River.

TOPEKA, KAN.—The Brown Telephone Company, of Abilene, t[illegible] Concordia Telephone Company, of Concordia, the Solomon Valley Tel[illegible] phone Company, of Beloit, and the Smith & Flint Telephone Company, [illegible] Minneapolis, have been consolidated under the name of the United Tel[illegible] phone Company. The new company is capitalized at $500,000 and w[illegible] take over all the Bell Telephone Company toll lines in that part [illegible] Kansas.

BOWLING GREEN, KY.—The Isbell-Chapman Electric Company h[illegible] filed amendments to its charter changing its name to the William [illegible] Isbell Electrical Company.

LONDON, KY.—Bids will be received at the office of the Supervisi[illegible] Architect, Washington, D. C., until Oct. 25 for a gas engine, electr[illegible] generator, etc., for post office at London, Ky., in accordance with pla[illegible] and specifications, copies of which may be obtained at the above offi[illegible] James Knox Taylor is supervising architect.

LOUISVILLE, KY.—The Kentucky Electric Company has award[illegible] a contract to the Robins Belt Conveying Company, of Cleveland, Oh[illegible] for conveying machinery and to the Orten-Steinbrenner Company, [illegible] Chicago, Ill., for crusher and crane for its coal-handling and crushi[illegible] plant.

LOUISVILLE, KY.—With a view of utilizing the water power [illegible] the falls of the Ohio River Mayor Head has authorized Assistant C[illegible] Engineer Parsons to begin work of making a survey of the propo[illegible] power canal immediately. The route suggested for the canal begins a[illegible] point near the old waterworks pumping station, extending in a [illegible] circle to Beargrass Creek, through the creek bed to the south side [illegible] the race track, thence west to the river.

LOUISVILLE, KY.—Mayor W. O. Head is reported to be c[illegible] sidering a bond issue for the purpose of purchasing the privately ow[illegible] shares of the Louisville Gas Company, which controls the Louisv[illegible] Lighting Company. These amount to 26,750 shares, the remainder be[illegible] held by the city. H. M. Byllesby & Company, of Chicago, Ill., [illegible] sidered purchasing the controlling interest in the company, but [illegible] deal was blocked, owing to the refusal of the city to sell its holdi[illegible]

NEWPORT, KY.—The City Council recently entered into a cont[illegible] with the Union Light, Heat & Power Company for the installatior[illegible] 300 additional electric arc lamps in the city. At present there are [illegible] 150 lamps.

ORANGEBURG, KY.—Plans are being considered for the inst[illegible] tion of an electric-light plant in this town. Orangeburg has n[illegible] post office and is located near Maysville.

PRESTONBURG, KY.—The Prestonburg Electric Light Compan[illegible] is reported, has increased its capital stock from $6,000 to $10,000.

NEW ORLEANS, LA.—The New Orleans Railway & Light Com[illegible] has installed three new turbines, each rated at 1000 kw, at its ce[illegible] station at Market and South Peters Streets.

FREDERICK, MD.—The installation of an ornamental lighting [illegible] tem on Market Street is under consideration. The property owners [illegible] pose to erect and maintain the system.

HAGERSTOWN, MD.—The Hagerstown & Clearspring Railway [illegible] pany, which proposes to build an electric railway from Hagers[illegible] through Cearfoss and Greencastle to Mercersburg, has awarded co[illegible] for 1200 tons of steel rails. The company has secured a right-o[illegible] along a portion of the Hagerstown-Cearfoos Turnpike. Rights-o[illegible] between Greencastle and Mercersburg have already been secured. [illegible] announced that $100,000 has been subscribed toward the constr[illegible] of the road. L. N. Downs is president of the company.

BEVERLY, MASS.—Bids are being received by Charles T. Ma[illegible] Boston, Mass., mill engineer and architect, for construction of [illegible] buildings for the Beverly Gas & Electric Company, as follows: [illegible] story garage, 86 ft. x 52 ft.; two-story generator house, 60 ft. [illegible] ft.; two-story purifier house and one-story meter house. Mill [illegible] struction will be used.

BOSTON, MASS.—The Edison Electric Illuminating Compa[illegible] Boston has purchased a large site on Massachusetts Avenue, near E[illegible] Everett Square, Dorchester, on which it proposes to erect several [illegible] ings at a cost of about $500,000, to provide for the growing needs [illegible] construction and operating departments.

COHASSET, MASS.—The Selectmen of Cohasset have engage[illegible] fessor Clifford, instructor in electrical engineering in Harvard C[illegible] to make investigations and report on the electric-light wiring sys[illegible] the town. Electrical service is supplied by the Electric Light & [illegible] Company, of Abington and Rockland, which purchases energy fr[illegible] Edison Electric Illuminating Company, of Brockton, Mass.

DEERFIELD, MASS.—The Meadown Mills property, located [illegible] distance below the Stillwater Bridge, has been acquired by Alexa[illegible] Patterson, of Conway. It is proposed to construct a dam and [illegible] hydroelectric plant at this site.

GREENFIELD, MASS.—It is announced that the Greenfield [illegible] Light & Power Company intends to begin operations on the site [illegible] dam near Stillwater Bridge, on the Deerfield River.

PLAINVILLE, MASS.—A special town meeting will soon be [illegible] submit the proposition to authorize the Selectmen to enter into [illegible] tract with the Foxboro Electric Light Company to light the st[illegible] of the town for a period of three years.

SOUTH HADLEY FALLS, MASS.—The South Hadley Fal[illegible] Electric Light Company has applied to the Massachusetts Gas & [illegible]

... Commissioners for permission to extend its transmission lines to town of Granby to supply electricity for lamps.

WORCESTER, MASS.—The Worcester Electric Light Company has ... that it will erect several cluster posts of the type ... the Worcester Merchants' Association has ... to have ... for lighting the principal streets of the city. The company is ...ting the lamps as an experiment.

GRAND RAPIDS, MICH.—The Grand Rapids Company will ... electricity for operating its system from the Grand Rapids-Muskegon Power Company. The present equipment in the power house at ... Street and Ellsworth Avenue will be discarded and a rotary con...

MARQUETTE, MICH.—The Gogebic & Iron County Railway & Light ... planning to erect ... electric plant at the Montreal ... at Saxon. The proposed plant will supply electricity to its prop... in Marquette and vicinity. The company will begin work at once ... extension from Bessemer to Marquette.

...PUBLIC, MICH.—The Cleveland Cliffs Iron Company is building a ...electric plant on the Carp River, near Marquette. The proposed ... will develop about 8000 hp. The power station will be located at ...ot of the hill known as Mount Mesnard. The water will be con... to the power house through a pipe line 22,000 ft. long and 26 in. ...meter. The power station will be 88 ft. x 48 ft., and will be ...ed with two generating units of 4000 hp each. The transmission ...ill be 10 miles in length and will be connected with an auxiliary ...station and distributing plant already in service at the Maas Mine, ...gaunee. The latter plant is also connected with a power plant at ...nceton mine in the Swanzy district and with the Cleveland Cliff ...operties in the Ishpeming and North Lake fields. The transmis... ...stem will cover a territory of about 40 miles. There will be a ... circuit over the entire line. The wires will be carried on steel ... The plant will involve an expenditure of more than $1,000,000.

...GUS FALLS, MINN.—It is reported that S. O. Bridson, of ... County, N. D., is negotiating with the Otter Tail Power ...ty, of Fergus Falls, for energy to operate a street railway which ...oses to build from the insane hospital to this city, through the ... district to the Northern Pacific Railroad station. If a fran... is granted, it is said, work will begin on constructon of the ... the spring.

...NEAPOLIS, MINN.—The Council committee recommends an ap...tion by the board of tax levy for 100 ornamental lamps to be ... on Washington, Nicollett and Hennepin Avenues. The cost ... amps is estimated at about $10,000.

...PAUL, MINN.—The St. Paul Promotion Company, which has ...ganizing the Southern Electric Railway, or Lake Pepin Line, has ...ated with the Interurban Construction Company of Hastings. ...uthern Electric Railway was to have extended from St. Paul ... Hastings and Red Wing to Lake City. The Interurban Con... Company, of Hastings, meanwhile has commenced work on a ... from St. Paul through Hastings to Rochester, Minn. Both ... will be used by the new company, which is to be known as the ...an Construction Company.

...ERICKTOWN, MO.—C. L. Gates, of Waverly, Ill., is reported ... purchased the controlling interest in the Fredericktown Electric ... Manufacturing Company. Earl Gates, formerly manager of the ... plant at Palmyra, Ill., will have charge of the local plant.

...CO, MO.—The North Missouri Central Railway Company, it is ... has been reorganized and arrangements made whereby the road ... Jefferson City and Columbia will be built by P. M. Johnson, of ... This is part of the project to build an electric railway from ...n City to Mexico, via Columbia, 63 miles in length, and a branch ...m Columbia to Moberly, a distance of 39 miles.

...OSEPH, MO.—The promoters of the Kansas City, Clay County ...seph Railway Company have been granted a franchise by the ...n County court to build and operate an electric railway over ...

...A, MONT.—It is reported that a receiver has been appointed ... the United Missouri River Power Company at the request of the ... Mortgage & Trust Company, of New York, N. Y., which ... bonds to the amount of $12,000,000 of the company. The power ...any owns power plants at Canyon Ferry, Hauser Lake and uncom...pled hydroelectric plants on the Missouri River.

...SSOULA, MONT.—The Flathead Telephone Company, recently ...incorporated, proposes to construct and operate telephone, telegraph, ...electric-light and railway systems and also water-power plants in Mis... and Flathead Counties. A. H. Stevens, of Hamilton; V. H. ...son and F. C. Wilhelm, of Missoula, are interested in the company.

...RRY, MONT.—Application has been made to the Town Council ... H. P... for a franchise to install an electric-light system in ... A special election will be held to submit the proposition to the ...

...EENE, N. H.—The Keene Gas & Electric Company has applied to the Public Service Commission for permission to erect a high-tension transmission line from the power house of the Connecticut River Power Company in Hinsdale to its power house in Keene.

...IZABETH, N. J.—Plans have been completed by the Broad Street Improvement Association for the installation of new arc lamps on Broad Street. The plans call for the erection of seventy-two lamps at a cost of $80 each per year, of which the association will pay $60 of the cost, the remaining $20 will be paid by the city. The total cost of the system will amount to $5,760 per annum.

ROSWELL, N. M.—The Berrendo Irrigation Company, which is developing a tract of about 14,000 acres near Roswell, has entered into a contract with the Roswell Light & Gas Company to supply electricity for operating the irrigating pumping plants. The company has erected 45 miles of transmission lines through the property and will extend the lines until the entire tract is covered. The contract limits the charge for electrical service to $1.25 per acre ft. and provides for a reduction for the service in proportion to the number of irrigators on the land and the amount used. The pumping plants are situated on shallow wells, the lift being from five to thirty-five feet. All of the pumps are of the 6-in. centrifugal type, each operated by a 25-hp motor, direct connected. The Roswell Light & Gas Company is planning to increase the output of its plant to 1500 hp. Two new 750-hp producer gas engines will be installed. The new plant will be built to provide for the installation of a second unit as needed.

AMSTERDAM, N. Y.—As a result of a hearing held recently by the Public Service Commission, Second District, on the application of the Edison Electric Light & Power Company, of Amsterdam, N. Y., for authority to exercise franchises for the erection of transmission lines, etc., for the distribution of electricity for lamps and motors in the village of Akin and the towns of Amsterdam, Mohawk and Florida, Montgomery County, Commissioner Sague, who conducted the hearing, announced that he would recommend granting the petition of the company. At present the localities which the company proposes to enter are without electrical service.

CORTLAND, N. Y.—Bids will be received until Oct. 24 by Dr. Andrew S. Draper, commissioner of education, State Normal College, Albany, N. Y., for electric wiring and fixtures at the State Normal School, Cortland, N. Y. Franklin B. Ware, of Albany, N. Y., is State Architect.

DUNDEE, N. Y.—Edward L. Bailey, owner of the local electric-light plant, has submitted a proposition to the Board of Village Trustees offering to sell the property to the village. The proposition submitted calls for payment by the town of $150 per month to Evelyn H. Bailey for the balance of her natural life, or should she not survive twenty years from the time the agreement is made, the village is to pay her heirs or executors the above-stated sum until the twenty years have passed. According to the offer made the village would be required to pay at least $36,000 for the plant. It is stated that the trustees do not approve of the purchase of the plant.

LESTERSHIRE, N. Y.—Plans are being considered for the installation of an ornamental lighting system on Main Street. Estimates for cost of same have been submitted by the Binghamton Light, Heat & Power Company, which furnishes the street-lighting service in Lestershire. It is proposed to use cluster lamps erected on ornamental standards.

LONG ISLAND CITY, N. Y.—The New York & North Shore Railroad Company has applied to the Public Service Commission for permission to issue bonds to the amount of $1,500,000 and capital stock to the amount of $771,764, the proceeds to be used for improvements to its system.

NELLISTON, N. Y.—The Fort Plain Gas & Electric Light, Heat & Power Company has been granted authority by the Public Service Commission, Second District, to lease its plant in the village of Nelliston to the Mohawk Hydroelectric Company, of Ephratah, N. Y., until May, 1921, with the option of renewal for a period of ten years thereafter. The Mohawk Hydroelectric Company is authorized to exercise a franchise granted by the village of Nelliston on Dec. 20, 1910, to supply electricity for lamps and motors in this village. The Mohawk company is also authorized to exercise its franchise granted by the Town Boards of Ephratah and Palatine to erect transmission lines in these towns. The company has also been granted permission to issue bonds to the amount of $56,000 to provide funds for the erection of transmission lines and purchase of equipment necessary to operate under the franchises mentioned.

NEW YORK, N. Y.—Bids will be received by George McAneny, borough president, City Hall, New York, N. Y., until Oct. 23 for furnishing and installing electric lighting and power fixtures and wiring in the city court building, located in the City Hall Park. Blank forms and specifications may be obtained at the office of the auditor, office of the Commissioner of Public Works, 13 Park Row, New York, N. Y.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, borough of Manhattan, New York, until Oct. 17 for furnishing and installing pumps erecting coal railway and pipe-fitting work, etc., for power house, Metropolitan Hospital, Blackwells Island, New York. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

NEW YORK, N. Y.—Bids will be received by the State Commission in Lunacy, 53 Lancaster Street, Albany, N. Y., until Oct. 25 for a new generator and engine at the Manhattan State Hospital, Ward's Island, N. Y., plans and specification for which may be seen and blank forms of proposals obtained at the Manhattan State Hospital, Ward's Island, N. Y., at the office of the State Commission in Lunacy, 1 Madison Avenue.

New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany, N. Y. Copies of plans and specification may be obtained on [illegible] the State Architect. T. E. McGarr is secretary of State Commission in Lunacy.

NYACK, N. Y.—The Rockland Light & Power Company has submitted a proposition to the Board of Water Commissioners to supply electricity to operate the West Nyack pumping station.

NYACK, N. Y.—The contract submitted by the Rockland Light & Power Company, covering the Pearl River lighting district, for a period of five years has been approved by the Town Board.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to build an extension of its transmission lines from the terminal at Sodus to a point 7 miles east, where a connection will be made with the Northern Wayne Electric Light & Power Company.

ROCHESTER, N. Y.—Sealed proposals will be received by the State Commission in Lunacy, 53 Lancaster Street, Albany, N. Y., until Oct. 25 for rewiring old buildings at the Rochester State Hospital, Rochester, N. Y. Drawings and specifications may be seen and blank forms of proposals obtained at the Rochester State Hospital, Rochester, N. Y., and at the office of the State Architect, Albany, N. Y. Complete sets of plans and specifications may be obtained at the office of Franklin B. Ware, State Architect, Albany, N. Y. T. E. McGarr is secretary of State Commission in Lunacy.

WARREN, N. Y.—The Warren Light & Power Company has filed a notice with the Secretary of State of an increase in capital stock from $200,000 to $500,000. Improvements are being made to the local power house and new machinery installed. The company is a subsidiary of the United Service Company, of Scranton, Pa.

DURHAM, N. C.—The Southern Power Company has completed its transmission line from Rocky Creek to Durham and will be ready to supply electricity here as soon as the mills are ready for the service. The line is about 175 miles long.

DEVILS LAKE, N. D.—The Northern Telephone Company is reported to have secured an option on the property of the Devils Lake Improvement Company, including the local telephone, light and water systems.

DEVILS LAKE, N. D.—At an election to be held Nov. 6 the proposition to issue bonds to the amount of $33,000, the proceeds to be used for the installation of a municipal electric-light plant, will be submitted to a vote.

FARGO, N. D.—It is reported that H. M. Byllesby & Company, of Chicago, Ill., are contemplating extending the Fargo & Moorhead Street Railway to Dilworth.

KENTON, OHIO.—The Kenton Gas & Electric Company has announced that it will build a new plant as soon as possible. The City Council recently notified the company that it must furnish better service or surrender a franchise extension.

LIMA, OHIO.—It is reported that all bids received on Sept. 15 for water-tube boilers of 1600 hp in 200-hp units; six engines, six generators, an eleven-panel switchboard, pumps and pipe were rejected by George E. Whitney, Sec. of Comn. Revised plans and specifications will be ready about Oct. 16.

WOOSTER, OHIO.—Proposals will be received by Charles E. Thorne, director of the Ohio Agriculture Experiment Station, Wooster, Ohio, until Oct. 27 for the construction of an addition to the power house at the Ohio Agriculture Experiment Station. Plans and specifications may be seen at the office of the director of the experiment station.

GROVE, OKLA.—The City Council is reported to have engaged the Western Engineering Company, of Oklahoma City, Okla., to prepare plans for an electric-light plant and water-works system, to cost approximately $35,000.

OCHELATA, OKLA.—Plans are being prepared by the Western Engineering Company, of Oklahoma City, Okla., for the installation of an electric-light plant and water-works system in Ochelata, to cost approximately $15,000.

PONCA CITY, OKLA.—At an election to be held Oct. 31 a proposition to issue $30,000 in bonds, the proceeds to be used for the construction of a municipal electric-light plant, will be submitted to a vote of the people.

DUFUR, ORE.—The installation of a municipal electric-light plant in Dufur is reported to be under consideration.

ELGIN, ORE.—The Eastern Oregon Co-operative Telephone Association, recently organized, and which is to be owned and operated by the business men and farmers of Union County, is planning to install a telephone system in this district immediately. William Parks is president and J. A. Masterson, treasurer.

MEDFORD, ORE.—The contract for installing a cluster-lamp system on Main Stret has been awarded to the Southern Oregon Electric Company, at $37 for each standard and 28 cents a running foot for wiring. The standards are to be of concrete, each carrying three lamps. The system is to be installed by the property owners and to be maintained by the city.

PORTLAND, ORE.—Plans are being considered for the installation of ornamental cluster street-lighting system on Grand Avenue for fifteen blocks.

PORTLAND, ORE.—The Deschutes Rimrock Power Company, recently organized with a capital stock of $1,000,000, is contemplating the development of water-power along the Deschutes River. The company proposes to construct its power plants near the mouth of the river, where they will not conflict with the government's operations on the Deschutes River. The company owns large tracts of land east of the Deschutes River and directly south of the Columbia River, which will be developed and platted out into small farms. It is understood that preliminary plans for construction of the plants have been prepared. It is estimated that 75,000 hp can be developed. It is said that bonds to the amount of $9,000,000 for the company have been underwritten by a London syndicate. M. A. Moody, of The Dalles, Ore., and LeRoy Park, of Portland, Ore., are interested in the project.

SALEM, ORE.—The city has abandoned its suit against the Portland, Eugene & Eastern Railway Company for revocation of the company's franchise for failure to carry out the terms of the franchise. The company agrees to make the improvements asked and to relinquish fran chises on streets unoccupied.

SPRINGFIELD, ORE.—The Oregon Power Company is contemplating extensions and improvements to the local water-works system, involving an expenditure of about $15,000. The work will include changing the source of supply and rebuilding pipe line leading from the reservoir on the butte back of the city. The company is also contemplating the installation of complete filtering system.

THE DALLES, ORE.—The Skamania Light & Power Company, o Stevenson, Wash., has submitted a proposition to the City Council offer ing to supply electricity in The Dalles at a much less rate than is now charged by the Pacific Power & Light Company. Should the city ac cept the proposition, the city would build its own distributing system purchasing energy from the Skamania company to operate same. Th Skamania company is operating a plant at Stevenson, Wash., and is nov installing a hydroelectric power plant on Wind River, which will increas its output to 5000 hp. S. Samson, of Stevenson, Wash., is president o the company and F. Vandovort, chief engineer.

WOODVILLE, ORE.—Bids will be received by the town of Wooc ville, Ore., until Oct. 27 for $10,000 electric-light and water-work bonds.

PANAMA.—Sealed proposals will be received at the office of th General Purchasing Officer, Isthmian Canal Commission, Washingtoı D. C., until Nov. 14 for chain fenders for all locks, including ste hawse-pipe castings, cylinders, sheaves, eyebars, structural work, opera ing valves, pipings and fittings, mechanism for starting and stoppin pumps, etc. Blanks and general information relating to this circul (No. 649) may be obtained from the above office or the offices of tl assistant purchasing agents, 24 State Street, New York, N. Y.; 6 Whitney-Central Building, New Orleans, La., and 1086 North Poi Street, San Francisco, Cal.

ALLENTOWN, PA.—The Lehigh Valley Transit Company has pu chased the property of the Montgomery Traction Company, which op rates an electric railway from Norristown to Lansdale, and has miles of track. The Montgomery company is capitalized at $250,0 and has a bonded indebtedness of same amount. This purchase giv the Lehigh Valley Transit Company the last link for its proposed hig speed line from Sixty-ninth and Market Streets, Philadelphia, to De ware Water Gap, a distance of about 100 miles. The property will rebuilt on a high-speed basis from Norristown to North Wales or La dale.

EASTON, PA.—Arrangements have been made by the Northampt Traction Company to purchase energy from the Eastern Pennsylva Power Company to operate its system.

ETNA, PA.—The Borough Council has awarded the contract for construction of the power house to Walker & Curley. The building v be 34 ft. x 85 ft., and 22 ft. high.

HOPE, R. I.—The village of Hope has awarded a contract to Narragansett Electric Lighting Company, of Providence, R. I., for installation of a street-lighting system in Hope. The contract calls the erection of twenty-five lamps in certain sections of the village.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Comp has announced a reduction in the price of electricity for incandesc lamps from 12 cents to 10 cents per kw-hour, to take effect after Oct. This is the second reduction made by the company within sixteen mon

COLUMBIA, S. C.—The Columbia Electric Street Railway, Light Power Company has applied to the City Council for a franchise to cha and extend some of its tracks in Columbia.

GREENVILLE, S. C.—Arrangements are being made for the ini equipment of machinery to test the method to be used by the Clay Linen Mills of Greenville. The company expects later to erect bu ings for a 7000-spindle plant, to be operated by electricity. Raven McDavid is president.

CHAMBERLAIN, S. D.—Negotiations have been closed by Guy Pratt, of Omaha, Neb., general manager of the Nebraska Teleph Company, for the purchase of all telephone lines running out of Ch berlain and including the local exchange. The Bell Company has purchased several other lines west of the Missouri River, among t being the Western Telephone Company, Dallas; the Trotter line, w extends from Stuart through Norfolk to Gregory, and the Ch line in northern Nebraska, which gives the company almost com control of the telephone business west of the Missouri River in S Dakota as well as northwestern Nebraska.

RAPID CITY, S. D.—Plans are being considered by local business men for the construction of an electric railway from Rapid City to Butte, Newell County, a distance of 47 miles. The proposed railway would cost approximately $500,000.

TABOR, S. D.—An electric-light plant has been installed by a local firm of sufficient output to supply electricity for lighting its own place of business and several other business houses in Tabor. It is expected that the system will be extended to provide the entire town with electricity for lamps.

ALAMO, TENN.—B. W. Chapman, it is reported, is interested in a project to install an electric plant in Alamo.

CHATTANOOGA, TENN.—The Tennessee River Power Company, which is constructing a hydroelectric power plant at Hales Bar, 15 miles from Chattanooga, expects to have it completed early in the summer of 1912. The power house is 354 ft. long and 60 ft. wide, of steel and concrete construction.

LONSDALE, TENN.—The City Council has decided to increase the number of electric lamps in the southern part of the city. The Knoxville Railway & Light Company furnishes electrical service in this city.

BASTROP, TEX.—The City Council is reported to have entered into contract with the Bastrop Water & Light Company whereby improvements will be made to the street-lighting system. It is proposed to place 500-cp lamps in part of the business district of the city and ...p lamps in the residence section.

CARRIZO SPRINGS, TEX.—It is reported that the new electric ... in Carrizo Springs has been completed. It is proposed to light the ... by electricity. Arrangements are now being made to install the street-lighting system.

CUERO, TEX.—The Cuero Electric Light Company is installing additional machinery in its power house at the dam on the Guadalupe River to provide for the increasing demands for electrical service.

EL PASO, TEX.—The El Paso Gas & Electric Company has filed ... to its charter increasing its capital stock from $545,000 to ...

MENARD, TEX.—The city is reported to have awarded a contract to ... an electric-light plant and water-works system in Menard to ...ke & Burge, of Chicago, Ill.

MEXIA, TEX.—It is reported that plans are being considered for installation of a new engine and generator in the local power plant.

MISSION, TEX.—Samuel Robertson, acting for the San Benito ...urban Railway Company, is reported to have contracted to build interurban railway from Mission to Monte Cristo, a distance of ...

ORANGE, TEX.—Arrangements are being made by the Yellow Pine ...r Mill Company for the erection of the new transmission line between the power plant and paper mill.

SAN ANTONIO, TEX.—The San Antonio Gas & Electric Company has ...anced a reduction in the price of electricity for lamps to take effect ...ice. Under the new schedule the rates are as follows: For the ... 25 kw-hours the price is 14 cents per kw-hour; for the next 75 ...urs 8 cents per kw-hour; 6 cents for the next 900 kw-hours, and 5 ... for all over 1000 kw-hours. For power 5 cents per kw-hour for the ... 500 kw-hours; 4 cents for the next 500 kw-hours, and 3 cents for ...ver 1000 kw-hours. The reduction was voluntary on part of the ...ny.

WACO, TEX.—The City Commissioners have awarded the Waco ... & Electric Company a contract for the installation of 100 additional arc lamps in the city.

NORFOLK, VA.—Announcement has been made by the officials of the ...ia Passenger & Power Company that improvements will be made ... local system, involving an expenditure of about $1,000,000. The ...sed improvements will include the erection of new steel car barns, ...st $125,000; new rolling stock, $50,000; and about $200,000 for ...vements to tracks and the erection of new terminals at Ocean ... and Willoughby Bend.

RICHMOND, VA.—The Virginia Railway & Power Company has ...ized an expenditure of $1,100,000 for improvements and extensions to its system in Richmond, of which $700,000 will be used for construction of power house at the foot of Twelfth Street and additional ...ission lines. The building will be 150 ft. by 120 ft., of concrete or ... construction. The equipment will include eight 600-hp boilers, ...w turbine, condenser, switchboard, transformers, rotaries, coal and ...ndling equipment and two stacks 250 ft. x 12 ft. Provision will ...de for trebling the output of the plant as needed. The remaining ...00 will be used for replacing tracks on Broad, Main and other ...s and electric welding of rails throughout the city. William North... president of the company.

BLAINE, WASH.—Preparations are being made by the British Co... Electric Company to erect a transmission line from Cloverdale, B. ... to Blaine.

BURLINGTON, WASH.—The Bellingham & Skagit Interurban Railway Company has been granted a franchise to construct and operate an electric railway in Burlington. The Stone & Webster Engineering Corporation are said to be interested in this company.

ELLENSBURG, WASH.—Plans are being considered by the Ellensburg Woolen Mills for the erection of two buildings. The installation of a heating and power plant is also contemplated. J. F. McAfee is superintendent.

HUSUM, WASH.—The Pacific Power & Light Company has applied for a franchise to erect a transmission line from Husum to Underwood.

OXBOW, WASH.—Work will soon begin on the construction of an electric railway from Oxbow to Lake Burien. W. H. Coughlin, of Seattle, Wash., is interested in the project.

PASCO, WASH.—The City Council has awarded a contract to the National Harvester Company, of Spokane, Wash., for the installation of an ornamental street-lighting system in the business section and part of the residential portion of the city. The contract calls for 86 lamp standards, each carrying three lamps.

SEATTLE, WASH.—The Board of Public Works has instructed City Engineer R. H. Thomson to prepare plans for the Seattle-Renton municipal electric railway, the cost of which is estimated at about $800,000.

SEATTLE, WASH.—Application has been made to the Board of County Commissioners by Roy W. Comegys for a franchise to erect transmission lines for the distribution of electricity in certain sections of the county.

SNOHOMISH, WASH.—Plans are being considered for the installation of a new street-lighting system in Snohomish. Several propositions have been submitted by the Everett Gas Company, owner of the local system. The company recommends the installation of thirty-five magnetite luminous arc lamps, at a cost of $72 each per year.

TACOMA, WASH.—The Griffin Wheel Company has awarded a contract to the Evans-Dickson Company for the installation of an electric-lighting system at its plant.

VANCOUVER, WASH.—Application has been made to the City Council by the Skamania Light & Power Company for a franchise in Vancouver to supply electricity for lamps and motors. S. Sampson, of Stevenson, Wash., is president of the company.

ELLENBORO, W. VA.—Work has commenced on the construction of the new power house of the American Undercurrent Company at Lumberton. O. E. Longdorf, of Pittsburgh, is president of the company.

FOLLANSBEE, W. VA.—The Steubenville & East Liverpool Railway & Light Company has extended its system to Follansbee and is now supplying electricity for lighting the residences in the town. The company has a contract for street lighting here and will soon begin work on installation of same.

KIMBALL, W. VA.—The Town Council has granted I. Tobin a franchise to install an electric-light plant and water-works system in Kimball. The franchise also gives him the right to operate street car lines in the town. At present the King Coal Company supplies electricity in the town.

LA CROSSE, WIS.—Part of the large dam of the La Crosse Water Power Company, located at Hatfield, on Black River, 5 miles above Black River Falls, was carried away by the flood on Oct. 6, causing great damage to the $2,000,000 power plant of the company and practically destroying the village of Black River Falls. The dam was 110 ft. thick at the bottom, 50 ft. thick at the top and 30 ft. high, and cost $500,000.

MILWAUKEE, WIS.—Bids for the construction of an electric-light plant adjoining the garbage incinerator have been received by Public Works Commissioner Harry E. Briggs. The plant will use waste steam to generate electricity.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has applied for a franchise to extend its Farwell Avenue line from Mineral Springs Road to Marion Street. It is proposed to reach the newly built lake bluff territory.

STOUGHTON, WIS.—The contract for the construction of the new power house for the municipal electric plant has been awarded to George W. Becker, of Stoughton. The installation of two 125-hp water-wheels, with governor and controlling machinery, is nearly completed. The work was done by the Power Engineering Company, which also has the contract for placing the generator and exciter in position.

INNISFAIL, ALTA., CAN.—A by-law authorizing the Council to appropriate $15,000 for the construction of an electric-light plant in Innisfail will be submitted to the ratepayers.

KAMLOOPS, B. C., CAN.—The proposition to expend $223,000 to secure hydroelectric power from the Barrier River is reported to be under consideration.

PRINCE RUPERT, B. C., CAN.—William Mahlor Davis, of Prince Rupert, chief engineer, will have charge of the construction of the proposed municipal electric-light plant and water-works system for Prince Rupert, for which a by-law appropriating $550,000 was recently passed. Ernest A. Woods is city clerk.

VANCOUVER, B. C., CAN.—The Western Canada Power Company has been granted permission to deliver electricity to the amount of 5000 kw-hours per annum to the Whatcom Railway & Light Company, at Sumas, Wash. The license was granted by the Inland Revenue Department, at Ottawa, and is for a period of one year.

WINNIPEG, MAN., CAN.—The new municipal power plant, located at Point du Bois, 70 miles from Winnipeg, has been placed in operation and now supplies 60,000 hp. The cost of the plant was about $5,000,000. Steps have been taken to double the output of the plant when needed.

HALIFAX, N. S., CAN.—The Nova Scotia Car Works, it is reported, is contemplating enlarging its power plant. The equipment to be installed will include one 600-hp Corliss engine for direct connection to electric generator, three 200-hp return tubular boilers with self-supporting steel smoke stack 5 ft. in diameter, 90 ft. high, feedwater heater, piping, etc. The Robb Engineering Company will have charge of the work.

LINDSAY, ONT., CAN.—At an election held recently the ratepayers voted in favor of the by-law granting the Electrical Power Company, Ltd., a franchise to supply electricity in Lindsay. Two bylaws were submitted to the people, one to give the franchise and the other to purchase the local plant to be owned and operated by the municipality.

MONTREAL, QUE., CAN.—The property of the Montreal Street Railway Company has been transferred to the Montreal Tramways Company, which was recently organized with a capital stock of $20,000,000 for the purpose of taking over the Montreal Street Railway Company, the Montreal Park Island Company, the Montreal Terminal Railway and the Public Service Corporation. Announcement has been made that the Montreal Tramways Company has sold $10,000,000 in bonds to provide funds in connection with taking over the property of the Montreal Street Railway Company and for retirement of part of the latter company's bonds.

PACHUCA, MEX.—The West Mexican Mines Company, operating the Rosario mine, is contemplating the installation of a new air compressor and electric hoisting machinery.

New Industrial Companies.

THE ACKLEY BRAKE & SUPPLY COMPANY, of New York, N. Y. has been incorporated by Griffin S. Ackley, John C. Raymond, both of Hudson Terminal Building, New York, N. Y., and Helen T. Ackley, of Elmwood Avenue and Anderson Place, New York, N. Y.

THE BAILEY ELECTRICAL SUPPLY COMPANY, of New York, N. Y., has been incorporated by Siegel & Siegel, Isadore Steinberg, Leon Portnow and Anna Bailey. The company is capitalized at $5,000.

THE BOSTON SMOKELESS DRAFT INDUCER & ECONOMIZER COMPANY, of Boston, Mass., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing draft inducers. G. A. Cooley, of Melrose Highlands, Mass., is president, and M. B. Gay, of Portland, Maine, treasurer.

THE DENISON SALES COMPANY, of Providence, R. I., has been incorporated with a capital stock of $10,000 to manufacture and distribute electrical and mechanical appliances, automatic musical instruments, etc. The officers are: William Henry Doris, president; Clyde Alwyn Bennett, vice-president and general manager, and Charles Carroll De Goey, 388 Blackstone Street, Providence, R. I., treasurer.

THE ELECTRICAL DEPARTMENT COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $10,000 by Frank L. Borden, B. E. Fanning, J. C. Rendler, Hans Grass and R. W. Stephens.

THE ELECTRIC SCORE BOARD COMPANY, of Boston, Mass., has filed articles of incorporation with a capital stock of $100,000. The incorporators are: George E. Baird, Frank C. Baird, John E. Donahue and Frederick B. Osborne. The company proposes to manufacture electrical appliances.

New Incorporations.

CADIZ, OHIO.—The Cadiz Traction Company has been granted a charter with a capital stock of $10,000 to construct and operate an electric railway in Cadiz. The incorporators are: Robert P. Scott, B. W. Rowland, C. S. Scott, R. C. Pittus and Thomas Scott.

CINCINNATI, OHIO.—Articles of incorporation have been filed for the Great Miami River Electric Company by Edward Schlesinger, Walter C. Taylor, James B. O'Donnell, E. P. Lamping and R. C. Cronin, all of Cincinnati, Ohio. The company is capitalized at $10,000 and proposes to build dams along the Great Miami River to furnish power to generate electricity and build canals, locks and raceways. The company will operate in Hamilton, Butler, Montgomery, Shelby and Warren Counties.

NEW WASHINGTON, OHIO.—Articles of incorporation have been filed for the Cranberry Home Telephone Company with a capital stock of $10,000 by W. A. High, J. H. Donaldson, A. G. Lederer, O. L. Green and John H. Sharp.

Personal.

MR. ROBERT W. ROLLINS, manager of the Hartford (Conn.) Electric Light Company, has been appointed general manager of the Worcester (Mass.) Electric Light Company.

MR. H. KENT McCAY has resigned as president of the McCay Engineering Company, of Baltimore, to accept the post of chief engineer of the city of Baltimore. Mr. McCay will act as consulting engineer of the engineering company.

MR. A. L. NICHOLS has resigned as superintendent and chief electrician of the municipal light plant, Independence, Kan. Mr. J. M. Kent, of Kansas City, Mo., has been appointed consulting engineer to aid in conducting the lighting business in Independence.

MR. F. B. CHAPMAN, who was with the National Carbon Company, and formerly represented Machado & Roller, on the 1st of October joined the commercial staff of the Bryant Electric Company. Mr. Chapman will represent that company in New York State and New England.

MR. E. HEINEKE, chief electrician for the American Smelting & Refining Company at Santa Barbara, State of Chihuahua, Mexico, who is returning from a vacation abroad to his former home in Alsace-Lorraine Germany, will spend several weeks in Chicago investigating American shop and repair methods.

MR. A. MILLER BELFIELD, a patent attorney of Chicago, gave a talk on some of the interesting business customs observed during a recent trip abroad at the noon luncheon of the Purdue Alumni Association of Chicago, Oct. 5. Mr. Belfield was an 1892 graduate of the electrical school of Purdue.

MR. F. W. WILLCOX, of the Edison Lamp Works, who went abroad in the spring, will remain for some time with the British Thomson-Houston Company, London and Rugby, in connection with special work in the development and extension of the incandescent lamp business of that company. The address of Mr. Willcox is 83 Cannon Street, London, E. C.

MR. MASON B. STARRING, formerly president of the Northwestern Elevated and Chicago & Oak Park Elevated Railways, Chicago, has been elected president of the United Railways Investment Company, of New York, which controls electric-railway lines in Pennsylvania and California. Mr. Starring's salary in his new position is reported to exceed $50,000 yearly.

MR. GARRETT T. SEELY, of Chicago, formerly manager of the South Side Elevated Railroad Company, has been made assistant general manager of the Metropolitan West Side Elevated Railway Company, the Northwestern Elevated Railroad Company and the South Side Company, the change growing out of the association of the companies in the Chicago Elevated Railways.

MR. R. HANSCHKE, JR., graduate of A. & M. College of Texas and the University of Hanover, Germany, has been appointed Eastern representative of the Charles L. Kiewert Co., Milwaukee, Wis., well-known importers of all kinds of flaming, searchlight and "Bi carbons, and Alba and Aurola flaming arc lamps. Mr. Hanschke's office address is 165 Greenwich Street, New York City.

MR. ALVIN J. FORBES, formerly superintendent and chief electrician of the Lytle Creek Power Company, San Bernardino, Cal., has been appointed superintendent of the Southern Sierra Power Company. He will be engaged in the construction of transmission lines throughout San Bernardino and Riverside Counties. His successor will be Mr. B. Himes, city electrician and electrical inspector, San Bernardino.

PROF. HAROLD B. SMITH, of Worcester Polytechnic Institute, married Sept. 28 to Miss Persis H. Smith at the home of the bride's parents in New York City. Professor and Mrs. Smith sailed Sept. 30 from New York by the North German Lloyd steam *Princess Irene* for an extended trip through Africa, Asia and Europe. The second year of Professor Smith's leave of absence from the Worcester Polytechnic will be spent in study in Zurich and Berlin.

MR. J. S. CODMAN, formerly associated with the Holophane Company with headquarters in Boston, has become financially interested in the manufacture of electric vehicles and will hereafter be identified with S. R. Bailey & Company, Amesbury, Mass. Mr. Codman, who has taken an active part in the development of illuminating engineering, has served as vice-president of the Illuminating Engineering Society and was recently elected a manager of the New England Section of the society.

MR. C. NESBIT DUFFY, comptroller of the Milwaukee Electric Railway & Light Company, is a man of varied activities, and among other things he is vice-president of the board of regents of Marquette University, Milwaukee. A public dinner was given at the Hotel Pfister on Oct. 1 in honor of Rev. Joseph Grimmelsman, S.J., president of the university, and Mr. Duffy introduced the toastmaster of the evening. Governor McGovern, President Van Hise of the University of Wisconsin and other distinguished guests were present.

MR. CHARLES S. DAVIS has resigned as general manager of the Marlboro (Mass.) Electric Company to become associated with the Westinghouse Lamp Company with headquarters at Bloomfield, N. J. Mr. Davis, who is a graduate of the Massachusetts Institute of Technology, has served as assistant electrician for the Boston & Maine Railroad, as master electrician of construction at the Charlestown Navy Yard, as engineer for the Holtzer-Cabot Electric Company and as a member of the executive board of the Marlboro Board of Trade.

MR. WILLIAM NEWELL, who has been appointed mechanical engineer of the Bureau of Factory Inspection of the Department of Labor of New York State, was formerly assistant superintendent of the Liability Department of the Fidelity & Casualty Company, of New York, and has made a special study of accident prevention. Mr. Newell graduated and received the degree of mechanical engineer from Columbia University in 1907 and is a member of the A. S. M. E. and the Industrial Safety As-

sociation. With Mr. F. E. Law, vice-president of the Fidelity Company, he is co-author of the book "The Prevention of Industrial Accidents."

MR. EDWARD W. LLOYD, general contract agent for the Commonwealth Edison Company, Chicago, was the victim of a painful accident on Sept. 30. In company with Mr. Peter Junkersfeld and two other gentlemen he was inspecting some electrical work in a building being remodeled. The four were standing on a temporary walk made of planks supported on the new steel framework when the plank supporting their weight broke in two without warning. Mr. Junkersfeld being nearest the end managed to grasp the framework and so escaped with slight injury, but the others were precipitated to the concrete floor, 15 feet beneath. Mr. Lloyd picked himself up and did not realize at the time that he was hurt much, but later he discovered that he was bruised severely about the body, with the possibility that some of his ribs were cracked. He has been confined to the house since, but at the last report was improving nicely, and it is probable that he will have recovered entirely by the time this is printed.

MR. P. T. GLIDDEN, general manager of the Louisville Lighting Company, who assumed his duties Oct. 2, was born in Massachusetts in 1869, and from early manhood has been identified with the electrical business. From 1889 to 189[illegible] he was with the Holtzer-Cabot Company of Boston, leaving the employ of that company to go with the Schaefler Electrical Company of that city, of which he became superintendent in the manufacture of incandescent lamps. Mr. Glidden joined the staff of the New York Edison Company in 1895, with which he remained for eight years, part of the time being in the operating department, but most of it in the commercial end of the business. In 1903 he was with the Ohio Brass Company, manufacturers of electrical supplies. The following year he became manager of the new business department of the [illegible]ton Light, Heat & Power Company. After a year and a half he was elected vice-president and general manager. While retaining the management of the Binghamton company he was made vice-president and general manager of the Eastern Pennsylvania Power Company, of Easton. He left this position to become general manager of the Louisville Lighting Company. Mr. A. M. Worthington, whom he succeeds, remains until Oct. 15, and will then go to California, where it is hoped that his health will greatly improve.

MR. HAROLD S. BUTTENHEIM, for several years secretary of the McGraw Publishing Company, and at present connected with the David Williams Company as second vice-president, is about to sever his connection with the latter company to take up another branch of publishing work. For some years past Mr. Buttenheim has been making a study of problems relating to municipal government and civic advance. With the rapid spread of the commission government idea, the growing activities of commercial organizations in civic work, and the increasing demand for better conditions in our cities generally, he believes the time has now come when a paper devoted to such subjects can be made a real success. These reasons led Mr. Buttenheim to purchase recently, with his brother Edgar J. (formerly circulation manager of the David Williams Company), the magazine called *The American City*, established in New York some two years ago and published at [illegible] Nassau Street. Mr. Harold S. Buttenheim will take the editorship of the paper, while the business management will be under his brother's direction. The progress of *The American City* is further assured by the addition to its staff of Mr. James H. Van Buren, who has resigned his position as eastern advertising representative of the *Municipal Journal and Engineer* to become advertising manager of *The American City*. Mr. Buttenheim's successor as manager of *Iron Age-Hardware* is Mr. Roy Soule, already well known to the hardware fraternity as the author of the "Assistant Manager" articles which have been a regular feature of *Iron Age-Hardware* for more than a year past.

Trade Publications.

CABLE SPECIALTIES.—W. N. Matthews & Brother, 219 North Second Street, St. Louis, have issued leaflets relating to various cable specialties, including rollers, clips, splicing joints and fault-finders. A special leaflet is devoted to the "Telefault" instrument for locating high resistance or leaks on short-circuits in cables. Boltless guy clamps which can be installed in two minutes are described in another leaflet.

TRANSFORMERS.—A new, handsome and comprehensive catalog on "High-Efficiency Transformers" has been issued by the Moloney Electric Company, of St. Louis and Windsor, Ont. Transformers for lighting and motor service of the single-phase and three-phase, subway and station types are illustrated and described, as well as instrument transformers, variable-voltage transformers and tungsten-sign-lamp transformers. Details of manufacture are fully discussed and the various methods of testing for core and copper loss are explained. Phase and bank connections are clearly shown by diagrams. Moloney transformers are made in sizes up to 5000 kw and for any voltage.

FUEL ECONOMIZERS.—"Economical Steam Power Plants" is the title of a 24-page pamphlet reprinted from the technical journals and issued by the Green Fuel Economizer Company, of Matteawan, N. Y. Four of the largest modern steam-power plants, viz., the Hudson & Manhattan Power Station in Hoboken, N. J., the 120,000-hp St. Denis plant near Paris, the plant of the Laclede Power Company, St. Louis, and the electric plant at Vitry-sur-Seine, are described. The pamphlet ends with a fifth paper on "Economizer Practice," discussing the theory of the lowest economical difference in temperature between the gases entering the chimney and the cold boiler-fed water. It is shown that whereas there is little economy in reducing the temperature of chimney-flue gases lower than 500 to 550° F. by means of boiler surface, the temperature of the same gases may be reduced to 200° F. or 250° F. quite profitably by means of economizer surface, because of the lower temperature of the contents of the economizer and the less costly nature of the economizer surface.

BUSINESS NOTES.

MR. JAMES R. DEANE, 528 McCormick Building, Michigan Avenue and Van Buren Street, Chicago, has taken the local agency for the "High Efficiency" transformers manufactured by the Moloney Electric Company, St. Louis, Mo.

THE TRIUMPH ELECTRIC COMPANY, of Cincinnati, Ohio, shipped last week a carload of equipment, including several large generators and motors, to Pekin, China. Inquiries and orders have also been received from India, Cuba and New Zealand. The company reports that during the past six months the sales have aggregated more than 50 per cent over the previous ten years' average.

SIGN PROJECTORS.—Indicating that the field for the sale of electrical advertising specialties is immense and has hardly begun to be developed, the Sanitary Specialty Company, of Louisville, which sells electrically operated devices of various kinds, reports that it has sold 350 sign projectors to retail merchants in that city. There was comparatively little publicity given the device, which made an instantaneous hit.

TRANSFORMERS FOR CHICAGO STREET LIGHTING.—The Delta-Star Electric Company, of Chicago, Ill., is delivering the first installation of Pittsburgh transformers on its contract closed with the Sanitary District for a large number of 12,000-volt, 250-kva units, to be used in the new street-lighting system. These transformers are of an improved type, having extremely high insulation strength and mechanical rigidity.

SWITCHBOARD METERS FOR UNITED STATES NAVY.—The Sangamo Electric Company, of Springfield, Ill., has recently shipped forty large-capacity, shunted-type, mercury-flotation, watt-hour meters to be installed on eight large battleships and cruisers including the *Connecticut*, *Montana*, *Tennessee*, *Florida* and *North Carolina*. These meters were ordered after a long service test on the battleship *North Dakota* and other vessels are to be equipped in the near future. Experience has shown that the mercury-flotation feature is of peculiar value in locations subject to vibrations or shocks, such as are encountered in battleship practice.

FIRE IN HOLTZER-CABOT WORKS.—The Brookline plant of the Holtzer-Cabot Electric Company was damaged by fire on the night of Oct. 6. The principal injury was to the offices and executive departments, the machinery wings being practically unharmed, except by water. The motor department is located in a separate building on Albany Street, Boston, and hence escaped damage. For the time being the company's headquarters and offices are located at 94 Washington Street, Brookline. The damaged workrooms are being rehabilitated, and the officers of the company state that orders will be cared for and deliveries made with slight delay.

RECENT LAMP BUSINESS OF THE BOSTON INCANDESCENT LAMP COMPANY.—The Boston Incandescent Lamp Company, manufacturers of refilled carbon incandescent lamps, reports that it has booked a larger volume of business during the month of September than during any previous month in its history. This company, which sells lamps at minimum prices for standard types and voltages in the carbon filament class, attributes its growing business to the fact that while there is a rapidly increasing demand for high-efficiency incandescents, there is, and perhaps always will be, a legitimate place for lamps of comparatively low efficiency at a very low price.

BAILEY ELECTRIC VEHICLE.—Messrs. S. R. Bailey & Company, of Amesbury, Mass., have made a two-passenger roadster electric automobile of very novel design and are at work on a four-passenger car of the same design. The cars have the center of gravity less than 18 in. from the ground, yet the road clearance is 10 in. The cars are built on graceful lines. They are designed especially for official work of public-service corporations. Their particular merit consists in their ability to cover distances of vaying length at a speed greater than hitherto attained. The space provided for battery equipment is unusually large and enables an equipment of elastic size to be used in the same car.

TRUMP TURBINES.—The Trump Manufacturing Company, Springfield, Ohio, has just been awarded a contract by the Northern Ohio Power Company, Cleveland, Ohio, for three horizontal water wheels, each unit directly connected to Westinghouse generators of 500-kw capacity, these turbines to operate under a head of 100 ft. The city of Rutherfordton, N. C., has awarded a contract for a pair of horizontal Trump turbines in steel casings, these turbines to be directly connected to Westinghouse generators. The turbines, which will develop 200 hp at 600 r.p.m. under a 53-ft. working head, are fed by a steel feeder pipe 36 in. in diameter approximately 100 ft. long. The speed of the wheels is controlled by a Woodward governor.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 3, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,004,557. RESISTANCE FURNACE; W. D. Coolidge, Schenectady, N. Y. App. filed Dec. 3, 1907. Inert gas is passed through a tungsten resistance tube.

1,004,556. SELECTIVE SIGNALING DEVICE; Edwin R. Gill, Yonkers, N. Y. App. filed Sept. 4, 1908. Electromagnetic device for telegraph and telephone work. (See No. 906,523.)

1,004,567. SELECTIVE SIGNALING SYSTEM; Edwin R. Gill, Yonkers, N. Y. App. filed March 28, 1910. Combined telephone and telegraph for train dispatching, etc. A metallic line with grounds.

1,004,571. PORTABLE SMOOTHING IRON; A. E. Hollingshead, Minneapolis, Minn. App. filed Dec. 5, 1910. An egg-shaped heating head.

1,004,599. ARMATURE FOR ELECTRIC GENERATORS; J. Splitdorf, New York. App. filed June 14, 1910. New form of head with curved ends and cross arms and windings.

1,004,608. ELECTRIC WATER-HEATING APPARATUS; J. G. Wallman, Oakland, Cal. App. filed August 25, 1910. A plurality of electrodes having concavo-convex surfaces are suspended in a boiler.

1,004,618. TROLLEY HEAD; J. J. Bennett, Pittsfield, Mass. App. filed Jan. 21, 1911. Removable wheel and shaft carried by a revolvable harp.

1,004,657. REFILLABLE FUSE; F. H. Kaiser and J. C. Clemens, Buffalo, N. Y. App. filed March 8, 1911. The fuse wire is held in sockets inside of a fiber tube.

1,004,673. PROCESS OF AND APPARATUS FOR MAKING CLAD METALS; J. F. Monnot, N. Y. App. filed Dec. 23, 1908. Electro deposited at a temperature above the melting point of the metal deposited.

1,004,681. LIGHTNING-ROD CABLE; E. H. Parker, New York. App. filed Dec. 23, 1910. Braided wires are twisted together.

1,004,740. ELECTRIC ALARM; P. A. Brown, Denver, Colo. App. filed Sept. 22, 1908. A number of cartridges are exploded successively.

1,004,748. WAVE DETECTOR; J. L. Creveling, New York. App. filed May 24, 1907. Adjustable electrode. Improvement on patent No. 761,450.

1,004,767. COMBINED TELEGRAPH, SIGNAL AND TELEPHONE SYSTEM; W. A. Froeckman, St. Louis, Mo. App. filed May 5, 1910. Arrangement to notify substations of a break and its location.

1,004,780. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed July 27, 1911. For reversing two compound-wound motors working in parallel.

1,004,785. TROLLEY ATTACHMENT; J. P. Henderson, Sharon, Pa. App. filed Nov. 29, 1909. Winding drum for retracting the pole and a magnetic release.

1,004,793. MANUFACTURE OF ELECTRODES FOR SECONDARY BATTERIES OR STORAGE CELLS; V. de Karavodine, Billancourt, France. App. filed Oct. 5, 1910. Lead sulphate is treated with ammonia and water and then electrolyzed in an alkaline bath.

1,004,795. ELECTRIC WELDING; L. S. Lachman, New York. App. filed Oct. 15, 1908. A countersink in one and a projection on the other piece are brought together for butt welding rods to larger bodies.

1,004,811. TROLLEY FROG AND CROSSING; R. E. Noble and L. E. Mitchell, Chicago, Ill. App. filed June 11, 1909. Clamp to hold the wire to the frog and an inclined guide for the trolley wheel.

1,004,825. ELECTRIC CONTROLLER; H. F. Stratton, Cleveland, O. App. filed April 6, 1911. A rheostat for controlling the field current of a motor for acceleration.

1,004,826. SYSTEM OF ELECTRICAL DISTRIBUTION; A. M. Taylor, Birmingham, Eng. App. filed Jan. 23, 1906. A private storage system to equalize a power load at the consumer's plant.

1,004,846. ELECTRICALLY-OPERATED ANNUNCIATOR; F. W. Bost and B. Gobel, China Grove, N. C. App. filed Oct. 19, 1909. Drop annunciator for burglar alarm.

1,004,860. SOLENOID WITH SHUNT; A. C. Eastwood, Cleveland, O. App. filed June 7, 1910. Motor control. Brake winding in series with a motor circuit and a shunt around the winding with a switch.

1,004,879. SIGNALING SYSTEM FOR MINES; E. M. Johnson, Hancock, Mich. App. filed Sept. 9, 1907. The signals transmitted from any level to the hoisting engineer are indicated at all of the other levels.

1,004,884. CURRENT COLLECTOR FOR ELECTRICALLY PROPELLED VEHICLES; W. Kohler, Bremen, Germany. App. filed March 17, 1910. For trackless trolleys with two superimposed overhead wires.

1,004,923. METHOD OF HEATING CARBON; W. A. Smith, Niagara Falls, N. Y. App. filed Dec. 20, 1910. The carbon or coke passes through a furnace parallel to the direction of current.

1,004,924. ELECTRIC-RESISTANCE FURNACE; W. A. Smith, Niagara Falls, N. Y. App. filed Dec. 20, 1910. A vertical shaft with one electrode in the upper end and the other axially arranged lower down so that the charge passes it.

1,004,943. ELECTRIC-PUMP GOVERNOR; W. V. Turner, Edgewood, Pa. App. filed Oct. 30, 1908. A switch is pneumatically operated by the same air pressure that causes the blow out.

1,004,946. JUNCTION BOX; J. Wares and J. W. Kippen, Pullman Sta., Ill. App. filed Aug. 18, 1910. Fire and water proof box with a distribution board.

1,004,956. ELECTRIC BED WARMER; J. Alden, Boise, Idaho. App. filed May 13, 1910. A casing containing an incandescent lamp.

1,004,962. TROLLEY HARP; J. T. Archer, Champaign, Ill. App. filed July 11, 1910. The harp is pivoted so as to be tiltable on the pole.

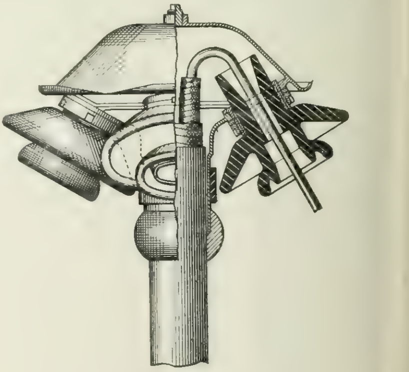
1,004,995. TELEPHONE INSTRUMENT; P. B. Clarke, Liverpool, Eng. App. filed Dec. 27, 1910. A tapered casing forming a mouthpiece.

1,005,002. TERMINAL FOR ELECTRICAL CABLES; C. W. Davis, Edgeworth, Pa. App. filed May 8, 1909. A divided casing with a central inlet and radial outlets.

1,005,003. TERMINAL STRUCTURE FOR ELECTRICAL CABLES; C. W. Davis, Edgeworth, Pa. App. filed July 1, 1909. A capped casing with an inlet and outlets with a petticoat.

1,005,004. MAIL-BOX ALARM; G. H. Diemer, Trinidad, Colo. App. filed Feb. 21, 1910. For rural free delivery boxes to give an alarm in the house.

1,005,007. METHOD OF TREATING MOLDS USED IN THE ART OF ELECTROTYPING; George E. Dunton, New York, N. Y.



1,005,002.—Terminal for Electrical Cables.

App. filed July 22, 1910. The mold is subjected to a grease solve before plating.

1,005,008. SELF-REGISTERING TARGET; M. St. C. Ellis, U. Navy. App. filed June 1, 1910. Segmental target with electric-s nal device. Improvement on No. 804,712.

1,005,023. ATTACHMENT PLUG; G. W. Goodridge, Bridgep Conn. App. filed July 16, 1910. Formed of porcelain buttons a metallic parts held together by a tubular rivet.

1,005,033. LIGHTNING ARRESTER; J. D. Hilliard, Jr., and C. Parsons, Glens Falls, N. Y. App. filed Aug. 22, 1906. A nor air gap is in series with an automatic break device shunted by secondary air gap.

1,005,060. TWO-STEP KNIFE SWITCH; W. Muirhead, Jr., N York. App. filed April 26, 1911. To shunt motor running fu when starting and maintain the circuit when changing to the r ning step.

1,005,084. ELECTRICAL CONTROLLER; J. G. P. Thomas, C wick, Eng. App. filed Feb. 3, 1910. The circuit controlling d rotates in a casing containing oil.

1,005,107. AUTOMATIC VOLTAGE REGULATOR; G. D'Eustac and P. von Lehoczky, Pittsburgh, Pa. App. filed Nov. 14, 1 For the feeding points of alternating-current circuits.

1,005,119. ATTACHMENT PLUG FOR ELECTRIC WIRES; W. Tregoning, Cleveland, O. App. filed Nov. 18, 1909. Two- porcelain connected by a screw and provided with a strain relie

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CONTENTS.

ENDING OF THE FEDERAL INCANDESCENT LAMP SUIT.

Elsewhere will be found a full abstract of the decree entered last week at Toledo, which closes the proceedings commenced last March at Cleveland when the federal government filed suit against incandescent lamp companies for alleged violation of the Sherman anti-trust law. As will be seen, the decree orders the dissolution of the National Electric Lamp Company, of which the entire stock is now held by the General Electric Company, and of its twenty subsidiary companies, the business of which must hereafter be conducted in the name of the General Electric Company; the defendants are enjoined from making agreements with manufacturers of lamp-making machinery and glassware which will prohibit the latter from making similar agreements with others; all parties to the suit are enjoined from entering into any combination or agreement fixing resale prices of lamps or imposing conditions having any bearing on such resale or discriminating in any manner against purchasers who do not buy ordinary carbon-filament lamps from the manufacturers also of other lamps covered or claimed to be covered by patents, such as graphitized and metallic-filament lamps; the practice is enjoined of imposing differentials in price between lamps which do not differ in quality and efficiency, and of allowing discounts based on aggregate purchases from different manufacturers or on aggregate purchases of different types of lamps, or making favorable prices having the purpose to drive rival manufacturers out of business. A prohibition which may have an important bearing on future litigation relating to trade combinations is an injunction restraining the General Electric Company from exercising an option to purchase the capital stock of a nominally independent lamp company, or from exercising any influence or control over that company by virtue of said option.

So far as relates to central stations and other consumers of incandescent lamps, the decision in the case appears to be quite sharply limited in effect to creating an open market for the ordinary carbon-filament lamp, in which trade competition alone will regulate prices. As that type of lamp, however, is now less used than the modern high-efficiency lamp and is rapidly becoming obsolete, the consumer will not be greatly benefited by its release from artificial price conditions. Although the jobber and dealer are frequently mentioned in the decree, it is not clear that they will greatly benefit. The open market for the old carbon-filament lamp will undoubtedly reduce the margin of profit which existed when its selling price was practically fixed by the lamp combination; and the licensors of the high-efficiency patented lamps, being also the largest sellers of such lamps to consumers, will be able virtually to fix within a narrow margin the price at which such lamps can be sold at a

living profit by licensees and dealers. In fact, the decree is more liberal in regard to the patent aspect of the case than some courts which have considered the relation of the patent monopoly to the public with respect to the right of the inventor to an absolutely unrestricted monopoly. It is expressly stated that the owner of a lawful patent may grant to another a license under such a patent upon terms and conditions fixed by the licensor, the single limitation of the decree being that the licensor shall not fix a resale price.

The decree is thus confined solely to the matter of combinations in restraint of trade, except in so far as it prohibits the fixing of a resale price of a patented article, and does not touch on the larger question brought forward in the Cleveland petition relating to the influence of patents on the commercial monopolization of an industry or a branch thereof. The decree, with perhaps the exception of the resale prohibition, is merely a restatement in concrete form of the general policy of the government, as recently developed, in the enforcement of the Sherman anti-trust law, and the Cleveland case was treated rather from this standpoint than with respect to the special industrial conditions involved. Perhaps it was wisest thus to narrow the cause upon which judgment was to be passed, owing to the extremely complicated nature of that part ignored, which would have involved an interpretation of the patent monopoly more far-reaching in effect than the simpler interpretation of the Sherman law in the light of recently established and strong precedents. In view, however, of the enormous commercial influence of patents in the electrical field at the present time, it is nevertheless to be regretted that the patent aspect of the case was not thoroughly gone into; for the Cleveland petition made allegations on the subject which are not set at rest by the decree, and introduced specifically a question relating to the status of foreign patents which some time will require an answer. It would have been far better for the electrical industry if the government had seen its way clear to dispose of the entire case as set forth in the Cleveland petition, instead of neglecting allegations which, made by the federal government and now on record, will eventually reappear in litigation. Of course, it is not within the province of a court to revise our present unsatisfactory patent system, which is a task for the legislative branch of the government. But such action would doubtless be much advanced by rulings in conspicuous cases that would reveal to the nation, and thereby to Congress, the great need of a drastic overhauling of a code now absolutely out of harmony with present-day industrial and commercial conditions.

AUGUST ELECTRICAL EXPORTS.

The great dullness of summer trade this year is reflected in the statistics of electrical exports for August, and beyond that remark they call for hardly any other comment. The exports of heavy electrical machinery were valued at $666,544 as compared with $708,160 in August, 1910, while the exports of electrical instruments were $725,145 as compared with $852,958. The total was $1,391,689 as against $1,561,118. It is obvious that electrical consumption and development wait upon the general tendencies of world trade, and are not likely to gain and grow where people feel poor or are preoccupied with fighting. The conditions of financial unrest and uncertainty appear to have general prevalence, but intrinsically the fact remains the same, namely, that the world at large is still very inadequately supplied with electrical apparatus.

HARMONIC ANALYSIS OF ALTERNATING-CURRENT WAVES.

It is remarkable how increasingly important become Fourier's wonderful theorem of harmonic analysis in th[e] progress of applied science. This theorem finds its use i[n] many different branches of engineering. In alternating current theory it is becoming more generally employe[d] every year. In fact, it is now so frequently employed tha[t] students often misapprehend it and suppose that irregula[r] wave-forms embody harmonics; whereas the Fourie[r] theorem states only that they behave as though they em bodied harmonics. The distinction from a practical stan[d] point may be trivial, but from a logical standpoint is pr[o] found. The effects of alternating current of complicate[d] wave-form can most easily be understood by analyzin[g] them into their Fourier components; that is, into an ass[o] ciation of a fundamental and a series of harmonic current[s]. In practice, all alternating-current waves are non-sinusoid[al]. Even so-called sinusoidal waves are actually only approx[i] mations to the true geometrical form, and, if a sufficient[ly] high degree of accuracy is called for, they too must be su[b] jected to Fourier analysis. Fortunately, however, f[or] most practical engineering purposes, this refinement can [be] neglected, and in most instances only the fundament[al] frequency needs to be considered.

When, for any purpose of investigation, the effects [of] the harmonics in alternating-current waves must be tak[en] into account, the first step is to find what the harmon[ics] are. This may be done by experimental analysis in t[he] laboratory, but it is ordinarily accomplished by securing [an] oscillographic record of the alternating wave of current [or] emf, to rectangular co-ordinates, and subjecting the [re]corded curve to Fourier analysis. Fourier analysis is [a] large subject, with an extended literature, and there is [at] least one book written exclusively on "The Production [and] Analysis of Alternating-Current Waves" (by Prof. Ernst Orlich, in German). In electrical engineering pr[ac]tice, however, two methods of Fourier analysis are in ge[n]eral use. One is the Runge method, and the other [the] Fischer-Hinnen method. Both are so called "sched[ule"] methods. That is, they both employ a certain sched[ule] prepared in advance, according to the number of harmo[nics] to be included, and the ordinates of the wave are meas[ured] at an assigned number of points, the said measured o[rdi]nates being then written on the schedule, which prescr[ibes] an arithmetical treatment of them leading to the evalua[tion] of the required harmonics' amplitudes. The Fischer-H[in]nen schedule can be made the swifter of the two in [any] ordinary case as far as the eleventh harmonic inclu[siv]e, since it calls only for the successive additions of set[s of] ordinates, whereas the Runge schedule calls for succes[sive]

dditions of sets of ordinates, with multiplication by proper ne-coefficients. Each method is inherently inaccurate, to ıe extent that it assumes that no other harmonics exist ve those included in the schedule. But the errors in- ılved in the Fischer-Hinnen method are apt to be greater an those involved in the Runge method.

The article by Messrs. C. A. Pierce and William Ander- n, published on page 1007 of this number, discusses the lative advantages of the two methods, and sums up in vor of the Runge method. It is obvious that it is useless pursue any method of Fourier analysis beyond the degree precision that the original wave outline will warrant. many cases the oscillographic wave record is not suffi- ently sharp and definite to enable the ordinates to be read th a precision greater than one part in thirty. Discrep- cies due to imperfections in ordinate reading lead to aggerated discrepancies in the evaluated amplitudes of e higher harmonics. In the rare cases where a fine and ite large-scale wave-record has been secured, and the est practicable degree of precision is called for in the sis, neither the Runge nor the Fischer-Hinnen method its best adaptation. Either the Slichter method with ecially ruled charts, as described in our columns on 15, 1909, or the Michelson harmonic analysis, is then ted.

P IC HYDROELECTRIC ENTERPRISES IN FRANCE.

are wont to think of our own country as somewhat minent in the matter of electric energy transmission, so indeed from many standpoints it is, yet few of us e how much of actual enterprise has been shown else- Switzerland is full of power-transmission lines so is northern Italy, but the large number of hydro- c installations that have been made in France is sing to those who have not followed this develop- The ordinary American traveler thinks of France r from being a country of abundant water-powers. es not fully realize the mountainous character of portions of France nor the industry of its people in ng out water-powers in locations and of capacities here remain unutilized. A recent muster-roll of h public hydroelectric stations has been made by our contemporary, *La Revue Electrique*, and it is alto- surprising, not only in extent, but in character. It own that in the four great river basins of France were at last accounts no less than 857 public hydro- c installations. Of these the Rhone Valley, of course, holds the first place in number and in importance, e Garonne Valley is not far behind, and those of the and Loire add considerably to the total.

m an economic standpoint the plants of the Seine y are particularly interesting, since these are in a ively flat country where the average fall is small and e utilization of small powers has perhaps been pushed er than elsewhere. There are 149 public hydroelectric r plants established on the Seine and its tributaries, t two-thirds of them for strictly local use and the re- der furnishing energy to several localities. An exami- n of the roster of plants upon these particular water- sheds reveals a very curious and interesting state of affairs. Its most extraordinary feature is the thoroughness with which powers of so trivial a size that they would hardly be seriously considered here have been harnessed and put to good use. The general topography of the country is strongly in evidence when one examines the available heads employed in these several plants. Only four of the entire number show a head of over 10 m and these are all small, considerably under 100 hp. The utilization of falls of between 1 m and 2 m is common, and the average head seems from a rough survey of the data to be not over 3 m. Most of the installations, too, are of small size, only two of the list rising to the dignity of 200 hydraulic hp and not a few running under 10 hp, yet they are all put to service and worked for what they are worth with characteristic French industry. As might be expected from the small amount of power, the transmissions are generally short, 12 miles being the longest, and the voltages employed are consequently low, in a very large number of instances not exceeding 250 volts. A single 15,000-volt installation marks the maximum pressure employed. Almost the whole of the plants recorded, therefore, belong to the type of small plants, chiefly for local lighting and industries employing motors, and serve communities of very small population. They are, however, a striking example of making the most of small opportunities. Wherever a little fall exists it is promptly utilized either for local affairs or for reinforcing a small existing central station. Apparently none is too low or too small to escape careful scrutiny with a view of utilization.

Considering the number of plants and their communal ownership, one instinctively wonders why the union of individual powers into a network is so rarely attempted, as has become the custom in this country. A study of the situation, however, tells the story. There are, for instance, in the Department of the Marne twenty-one such hydroelectric plants. Only one of the number reaches 100 hp and the rest range between 3 hp and 45 hp; twelve of the number, including the single 100-hp plant, are operating on heads of less than 2 m. The chance for combined action, considering the small size of the individual equipments, is obviously hardly worth considering, yet all the plants are serving a useful purpose for their several communities. A situation like this is certainly a lesson in economics which the inhabitants of rural districts in our own country may well take to heart. Fancy a little New England village of 200 or 300 inhabitants taking advantage of a 6-ft. fall yielding 20 hp or 25 hp for the establishment of a town plant; yet this is precisely the thing which many a small commune in rural France has done, to say nothing of similar plants established entirely for private use. There is nothing in these little powers to encourage the promoter, and no profits to accrue save those derived from operation with rigid economy, yet they serve a most useful purpose and may be made to pay a fair return on the cash actually spent. If the whole truth were known, it would probably be found that not a few of these little French plants are almost automatic in their arrangement and are administered with a rudimentary simplicity that we find it difficult to imagine; yet they accomplish their purpose and teach a lesson in resourcefulness and economy that should not pass unheeded.

Cleveland Incandescent Lamp Case.

On Oct. 12 Judge John M. Killits, of the United States Circuit Court, sitting at Toledo, Ohio, handed down a decree disposing of the federal suit entered in the United States Circuit Court at Cleveland on March 3 against thirty-five electrical and other manufacturing companies on the charge of engaging in "unlawful contracts, combinations and conspiracies to restrain the trade and commerce among and between the several states and territories of the United States in incandescent lamps and to monopolize the same." A full account of the charges then filed is given in the issue of the *Electrical World* for March 9.

An answer in the suit was filed June 5, which consisted of a denial in detail of the allegations made, and included a statement that since the filing of the suit the General Electric Company, which owned 75.2 per cent of the stock of the National Electric Lamp Company, had closed an option and purchased the remainder of the stock, which had been held by the National Electric Lamp Company under an agreement that the entire management and control of that company should be vested in and exercised by the party holding the minority interest.

The decision of Judge Killits is in the form of a decree, and represents an agreement arrived at between Attorney-General Wickersham and the defendant corporations. The decree dismisses the complaint against the Kentucky Electrical Company, and does not mention the complaints against the Libbey Glass Company, Phoenix Glass Company, York Electric Machine Company and Dyer Machine Company, which had been charged with making agreements with the defendant lamp companies to give to them better prices and terms on glass bulbs, lamp bases and lamp-making machinery than to their competitors, the additional charge being that these companies were controlled by the incandescent lamp corporations. It is understood that the government dropped its case against these manufacturers.

The preamble of the decree cites that the defendants, by leave of the court, withdraw their answers to the suit and state in open court, through their counsel, that it is not their desire or intention to violate the provisions of the act under which they are indicted; that it is their desire and intention to comply with the statutes of the United States referring to agreements, combinations or conspiracies in restraint of trade; that their previous action in the premises was in the belief that it was not in violation of the law, and that it is not their desire or intention to operate under or make or carry on such contracts or practices as are condemned by Congress, as now construed by the court. The court then proceeded to give the terms of the decree, the entry of which was not opposed by the defendants, with the preliminary statement that it finds that the defendants are and have been engaged in unlawful agreements and combinations in restraint of trade, and that the doing of the several acts and things set forth in the petition and to be enjoined are unlawful.

The decree states that the General Electric Company is now the owner of the entire capital stock of the National Electric Lamp Company, and at the time of the filing of the suit was the owner of the majority of such stock; that the National Electric Lamp Company is in turn the owner of the entire capital stock of the subsidiary companies mentioned in the suit; that such stock ownership has been concealed from the general public and the trade; and that, notwithstanding such stock ownership, the General Electric Company, the National Electric Lamp Company and the latter's subsidiary companies are pretending to be separate, distinct, independent and competing companies in the business of manufacturing, dealing in and selling incandescent electric lamps, whereas no such independence or competition exists or has existed; and that the General Electric Company has heretofore been largely engaged in carrying on an incandescent lamp business indirectly through said companies. It is therefore ordered that the National Elec tric Lamp Company and all of its subsidiary companies b each and all of them dissolved, and the General Electri Company is enjoined from hereafter conducting, exceptin in its own name, the business heretofore or hereafter car ried on by it in incandescent lamps of any and every de scription. It is further ordered that all factories, plant and all manufacturing and selling departments operate and owned by the General Electric Company for th manufacture and sale of incandescent lamps shall be mad known to the general public and trade as the property an business of that company; provided that the General Ele tric Company is not prohibited using the trade names c incandescent lamps lawfully manufactured or sold by i including the trade names now employed by the Nation Electric Lamp Company and its subsidiaries, if it acquir such trade names and the business of manufacturing lam to which the same are applied, but such names shall known as the property of the General Electric Company.

The decree names the following as the companies su sidiary to the National Electric Lamp Company: Americ Electric Lamp Company, Banner Electric Company, Br liant Electric Company, Bryan-Marsh Company, Bucke Electric Company, Colonial Electric Company, Columl Incandescent Lamp Company, General Incandescent La Company, Economy Electric Company, Fostoria Incand cent Lamp Company, Independent Incandescent Lamp Co pany, Munder Electric Company, New York & Ohio Co pany, Shelby Electric Company, Standard Electrical Ma facturing Company, Sterling Electrical Manufacturi Company, Sunbeam Incandescent Lamp Company, Fosto Bulb & Bottle Company, Providence Gas Burner Comp and Warren Electric & Specialty Company.

The General Electric Company, together with the abo mentioned defendants and the Westinghouse Electric Manufacturing Company, Westinghouse Lamp Compa Aetna Electric Company, Capital Electric Company, Fra lin Electric Manufacturing Company, Liberty Electr Manufacturing Company and Gilmore Electric Comp is enjoined from making or carrying out, directly or directly, any contracts with any manufacturer of la making machinery or with any manufacturer of bulbs tubing for incandescent lamps whereby such manufact is bound not to sell his goods to others than the said fendants or any of them or to sell to the said defend or any of them at other and different prices and term payment than those to which they severally may sel other purchasers.

All of the defendants above noted are enjoined f fixing by combination, or any other act between any or more of them, or between any of them and others, price at which any incandescent electric lamp of any tern, character or type, whether made or sold under le patent, license or otherwise, shall be sold either at wh sale or retail; provided that any of the defendants law owning patents may grant to another defendant o others, or may receive, proper manufacturing lic under such patents, or under any patents lawfully ow by any of the defendants or others, upon terms and c tions fixed by the licensors; provided further that any licensor is prohibited from requiring or imposing upo licensees the fixing of the wholesale price to be obse by the licensee vendees; and the purchasers of such l from either the licensor or licensee or from the vende either the licensor or licensee, whether at wholesale o re-tail, shall not be in any manner restricted as to the ice at which such lamps shall be sold to the public or to any dealer or consumer.

The defendants are enjoined from maintaining, by a ee-ment, differentials between lamps which do not in act differ in quality or efficiency and from allowing disc nts based on aggregate purchases from different man ac-turers.

The defendants are enjoined from making or enforcing ;y agreement with dealers, jobbers and consumers who ly from the said defendants either tantalum, tungsten, aphitized-filament or ordinary carbon-filament lamps, hereby such dealers, jobbers and consumers are compelled purchase all of their ordinary carbon-filament lamps om said defendants as a condition to the purchase of d other type or types of lamps; and they are enjoined om discriminating against any dealer, jobber or consumer siring to purchase tantalum, tungsten and graphitized-filament lamps because of the fact that the latter purchases dinary carbon-filament lamps from others, and from discriminating against any dealer, jobber or consumer desiring purchase any one or more of the above-mentioned types lamps because of the fact that he purchases any other the said lamps from other manufacturers of or dealers i them.

The defendants are enjoined from making discounts bsed on the quantity of lamps purchased by any dealer, jobber or consumer, from making such discounts on the bsis of the total quantity of tungsten, tantalum, graphitzd-filament or ordinary carbon-filament lamps, or the tal quantity of ordinary carbon-filament lamps or any r more of other types of lamps sold, and are en- l from making any discounts based on the total quntity of any two or more types of lamps sold, when the rult is to combine or aggregate discounts on both an unpented lamp and a lamp patented or claimed to be patente and the defendants are enjoined from utilizing any pents which they may have or claim to have, or which thy may hereafter acquire or claim to have acquired, as ameans of controlling the manufacture or sale of any type o types of lamps which are not protected by lawful

e defendants are enjoined from offering or making favorable prices or terms of sale for incandescent ic lamps to the customers of any rival manufacturer they at the same time offer to their established trade, were the purpose is to drive out of business such rival maufacturer or otherwise unlawfully to restrict the trade a commerce of the United States in incandescent electric laps; provided that no defendant is restricted from makin any price for incandescent electric lamps to meet or to ete with prices previously made by any other de- nt or by any rival manufacturer; and provided, er, that nothing in the decree shall be taken in any t to restrict fair, free and open competition in the f the lamps.

decree enjoins the defendants in suit who are li- es, namely, the Westinghouse Electric & Manufactur- ompany and others above mentioned, from operating any license contracts or agreements so far as such cts or agreements provide that prices and terms of f incandescent electric lamps shall be fixed other- han by the licensor, or containing provisions fixing rice at which any purchaser or any vendee from a facturer shall sell incandescent electric lamps.

e General Electric Company is enjoined from exercis- s option to purchase the capital stock of the defendant klin Electric Manufacturing Company or from exer- g or attempting to exercise any influence or control that company by virtue of its option.

e decree reserves to the court jurisdiction in the case the purpose of enforcing its provisions and also for rpose of modifying any of its injunctive provisions any defendant upon the joint application of the at- y-general and such defendant.

is ordered that the defendants be given a period of nity days from Oct. 12 for compliance with the terms of th decree; but they are given a delay of six months from an after that date for compliance with the terms relating to e dissolution of the National Electric Lamp Company an its subsidiary companies.

On the day when the decree of Judge Killits was filed Attorney-General Wickersham made the following statement:

"The decree entered to-day by the Circuit Court of the United States for the Northern District of Ohio against the General Electric Company and about thirty or more defendants is the outcome of a suit which the government brought about six months ago to break up a combination in restraint of interstate trade and commerce in incandescent lamps.

"It appeared that the combination controlled practically 97 per cent of the electric lamp business of the country and that it was regulating by agreement prices at which all lamps were sold. The larger part of the business was done through the General Electric Company by means of its ownership of the National Electric Lamp Company, which, in turn, controlled a number of subsidiary companies, though all of these were pretending to operate as independent and competing concerns. The balance of the business was done through the Westinghouse Electric Manufacturing Company, the Westinghouse Lamp Company and a number of smaller companies named in the petition.

"The defendants by this combination not only controlled the prices at which lamps were sold by the manufacturers, but even the prices at which they were resold by jobbers and dealers, and then controlled not only the prices at which lamps covered by patents were sold, but the price at which unpatented lamps were sold, and they were enabled by the enormous power thus secured over the market to require practically all purchasers of lamps to buy unpatented lamps from members of the combination as a condition to the right to purchase patented lamps.

"In addition to this the defendants engaged in the combination had resorted to many practices contrary to fair trade in order to crush and destroy independent rivals.

"All the defendants duly filed their answers to the petition of the government, but later, after the government was prepared to present its testimony and after the decisions of the Supreme Court in the Standard Oil and Tobacco cases, the defendants in this case indicated a desire to submit to a decree. After full consideration and many conferences extending throughout the summer a decree satisfactory to the government was obtained. Accordingly, by leave of the court, the answers of the defendants have been withdrawn and the decree aforesaid entered to-day.

"By this decree the contracts and combinations entered into by all the defendants are declared to be unlawful under the Anti-Trust act, and they are severally enjoined from entering into or performing any agreements or arrangements of any nature by which the prices of incandescent electric lamps of any type or description, whether patented or unpatented, are to be sold, either at wholesale or retail.

"In addition to this general injunction there are certain specific things accomplished by the decree which are of far-reaching importance to the freedom of competition in interstate commerce, and which it is believed will establish precedents of genuine value to the government in any like cases that may arise. Among these are the following:

"First: The National Electric Lamp Company and all its subsidiary companies are ordered to be dissolved and the General Electric Company is forbidden hereafter to conduct any business in the manufacture or sale of electric lamps except in its own name.

"Second: The practice of fixing the resale price on any style of lamp, whether patented or unpatented, is hereafter forbidden, and when once a lamp has been manufactured by the owner of a patent or his licensee and sold to a wholesale or retail dealer the price at which such dealer sells to another or to the public is open to free competition.

"Third: The method by which competition in unpatented

articles has been suppressed through the use of a patented article is declared to be unlawful, and is forbidden. The manner in which this was done is fully explained in the government's bill. But, in brief, it may be stated that the practice consisted in a system of contracts with dealers, jobbers and consumers by which they were compelled to agree to purchase from the defendants all their supply of carbon lamps on which the patent had expired as a condition to the right to purchase certain lamps known to the trade as tungsten, tantalum and metalized-filament lamps, which are still claimed to be patented. By means of aggregating discounts on lamps claimed to be patented with discounts on lamps not patented, another weapon was used to suppress competition in unpatented lamps. Both these practices had the effect of continuing a monopoly on an article long after the patent had expired by tying up its sale with a patented article which the trade required.

"Fourth: The General Electric Company and each and all of the defendants engaged in the manufacture of electric lamps are enjoined from entering into or carrying out certain contracts which it has been the practice to make in the past, by which the manufacturers of bulbs, tubing and other parts necessary to a completed lamp were bound not to sell the article manufactured by them to anybody except the defendants save upon unequal conditions. The result of this part of the decree is that independent manufacturers of electric lamps will hereafter be enabled to secure the parts necessary to such manufacture without the unfair and unnatural restraint which has heretofore existed.

"Fifth: All parties to the combination are enjoined from hereafter seeking to injure the business or secure the trade of rival manufacturers by offering and making terms or prices for incandescent lamps to the customers of such rival manufacturers more favorable than they make to their established trade, though nothing in the decree is to be taken in any respect as a restraint upon fair, free and open competition.

"It may be proper to add that the investigation out of which this suit arose also disclosed eleven other patent pools of a similar nature by which the prices of various electrical devices and supplies were fixed and to which some of these defendants were parties. But since the institution of this suit all these pools have been voluntarily dissolved.

"It may further be said that the investigation also disclosed a general trade and patent agreement between the General Electric Company and the Westinghouse Electric & Manufacturing Company, the two largest electrical concerns in the country, covering substantially their whole business; but this agreement, since the institution of the government's suit, has expired by limitation and has not been, and it is believed will not be, renewed."

Vice-president B. G. Tremaine, of the National Electric Lamp Company, stated that the decree would not affect the operation of any of the plants included in the order of dissolution. The General Electric Company, he said, had purchased the stock of the National Electric Lamp Company. The latter and its subsidiaries will be dissolved, but they are all the property of the General Electric Company and Mr. Tremaine believes they can be operated by it without violating the Sherman anti-trust law. Instead of being run separately and under different names, the companies can make it plain on all their stationery and many other ways that they are owned by the General Electric Company and that everything connected with them is under its control.

The Bryan-Marsh Company in a circular letter to its customers states that there will necessarily be some changes brought about on account of the decree, but that these changes will in no way affect the personnel of the company, which will continue to render the same service, and whose methods of conducting its business will not undergo any change.

American Institute of Electrical Engineers Affairs.

At a meeting on Oct. 13 of the board of directors of th American Institute of Electrical Engineers a resolution wa adopted providing for a Pacific Coast meeting of the Insti tute at Portland, Ore., in the month of April, 1912. Upo the report of the board of examiners eighty-six associat were elected, forty-four students enrolled and seven a sociates transferred to the grade of member. A universit branch was authorized at the Oklahoma Agricultural an Mechanical College, Stillwater, Okla., and another at Yal University.

The law committee reported its interpretation of tl provisions of the constitution providing for second nom nees on the directors' ticket of nominees and gave the opi ion that the request of two members of the board for tl naming of a second nominee operated of itself, witho further ballot, to put the name of such nominee upon tl directors' ticket. The president announced the appointme of Mr. W. D. Weaver to serve as a member of the Edis medal committee for five years and also informed tl board that the following members had been appointed the United States national committee of the Internation Electrotechnical Commission: Mr. C. O. Mailloux, pre dent; Dr. Arthur E. Kennelly, secretary; Messrs. Comfo A. Adams, Louis Bell, John J. Carty, Carl Hering, Jol W. Howell, John W. Lieb, Jr., Ralph D. Mershon, Edwa B. Rosa, Charles F. Scott, Clayton H. Sharp, Samuel Sh don, Charles P. Steinmetz and Samuel W. Stratton.

The committee appointed at the August meeting of t board to welcome and entertain Mr. S. Z. de Ferra president of the Institution of Electrical Engineers of Gr Britain, visiting the United States, reported that it h given a luncheon in honor of the distinguished guest whi in addition to Mr. de Ferranti and the other guests honor, was attended by nine past-presidents and fifteen ficers of the Institute.

On the invitation of the International Society for Te ing Materials, the president was authorized to appoin delegate to represent the Institute at the sixth congress that society, to be held in September, 1912. The secret was instructed to publish with the standardization rules the Institute the decisions of the International Electrote nical Commission at Turin in regard to standard symbolo the direction for indicating advancement of phase in grap diagrams of alternating-current quantities, and a résu of the principles of the rating of electrical machinery the leading foreign countries.

A resolution was adopted providing for a committee electrophysics as a standing technical committee of Institute and the appointment on the committee of the sa number of members as are appointed on the other techn committees of the Institute.

In view of the resolution proposed and carried with m applause at the International Electrical Congress at Tu complimenting the American Institute of Electrical E neers on its practice of inserting in its publications metric equivalent value in parentheses after each exp sion of values in English measures, and also in view of request of the congress that the technical societies of countries in which the metric system is not yet officia invited to follow the example of the American Institut Electrical Engineers, the board adopted a resolution structing the editing committee to regard as standard p tice and to continue the insertion of metric equival and to include in its "Suggestions to Authors" the req that the authors themselves, as far as possible, make metric insertions in order to facilitate the work of the editing committee. It was also resolved that the Inst adopt the standard international symbology decided on by the International Electrotechnical Commission and that the editing committee be requested to include in its "Sug gestions to Authors" the request that, as far as possible,

the authors of all papers also adopt this symbology; and hat the Institute adopt as the standard direction for expressing advancement of phase in graphic diagrams of alternating-current quantities the counter-clockwise direction tandardized by the International Electrotechnical Commission, and that the editing committee be requested to ask the uthors of Institute papers, as far as possible, to use this standard direction in diagrams prepared for publication n the Institute transactions.

The meeting closed with the adoption of a resolution, offered by Past-president Jackson, expressing the appreciation of the board of directors of the distinguished services of President Dunn, Chairman Mailloux, Secretary Kennelly, Dr. Sharp and of the president of the International Commission, Dr. Elihu Thomson, and their associated American delegates to the International Electrical ngress at Turin, in representing the Institute with grat-ng enhancement of its reputation and dignity in the ctions and meetings of the congress and of the International Electrotechnical Commission.

Annual Rejuvenation of the Sons of Jove.

Between three and four hundred delegates from all over country were in attendance at the annual rejuvenation the Sons of Jove at Denver, Col., this week. The reign- Jupiter of the order, Mr. J. F. Dostal, formerly of ver and now of Colorado Springs, had arranged an orate entertainment program for the delegates. On t. 16 there was a smoker at the Colorado Traffic Club and annual rejuvenation was held on Oct. 17 at El Jebel nple, when over one hundred candidates were initiated. e rejuvenation was preceded by a parade in which the nbers wore the garb of the order. In honor of the venation the streets were a blaze of red light and cial electrical floats of elaborate design formed a fea- The business sessions were held in the Brown ace Hotel, where a banquet was held on Oct. 18 as the cluding function of the convention. At the business sion in the morning Mr. R. W. Jaynes, of Pittsburgh, was elected Jupiter for the coming year.

Convention of Railway Signal Engineers.

he sixteenth annual convention of the Railway Signal ociation was held at the Hotel Antlers, Colorado ings, Col., Oct. 10, 11 and 12. There were over 500 strations and the papers and committee reports were ted and bound for the meeting. The latter comprised pages and had been so carefully prepared by the ors and committeemen that they went through without h discussion or objection. The reports of the committees on wires and cables, electric signaling for electric ways and on storage batteries were especially inter- ng. The committee on storage batteries devoted its rs to the preparation of specifications for portable cells he all-lead type designed to be transported to central rging stations for recharging and to be used for operatg electric-motor signals, control and line circuits, etc. e batteries contain from two to six cells and have pacities ranging from 40 amp-hours to 100 amp-hours. e report of the committee on wires and cables emaces specifications for lead-covered cable for circuits of o volts or less; specifications for underground, braided les for circuits of 660 volts or less; specifications for l-covered cables for 2200-volt service; specifications for pper-clad steel bond wires, and specifications for 30 r cent conductivity of hard-drawn, copper-clad, steel e wire. Mechanical, chemical and electrical tests of ber insulation are required which are more stringent than those specified in the National Electrical Code. The insulation must show an analysis not less than 30 per cent nor more than 33 per cent of pure Upriver fine, dry Para rubber of best quality; not more than 4 per cent of solid, waxy hydrocarbons consisting of refined paraffine or pure ozokerite; not more than 0.7 per cent of free sulphur; not more than 2.5 per cent total sulphur. There must be freedom from all foreign matter, and the mineral matter shall be such as will not have a deleterious effect on the insulation.

The attendance of electrical manufacturers and their representatives was unusually large. The entertainment features were more numerous than at other meetings, probably due to the many attractions around Colorado Springs. Trips were made to Pike's Peak, the Garden of the Gods, Cheyenne Canyon and Cripple Creek. The annual baseball game of East vs. West was attended by the entire delegation.

The newly elected officers are Mr. C. C. Anthony, Pennsylvania Railroad Company, Philadelphia, Pa., president; Messrs. B. H. Mann, Missouri Pacific Railway, and F. P. Patenall, Baltimore & Ohio Railroad, vice-presidents, and Mr. C. C. Rosenberg, secretary-treasurer. Quebec, Canada, was selected as the place for the next annual meeting, which will be held in September, 1912.

Officials of the American Electric Railway Association.

The last business meetings of the thirtieth annual convention of the American Electric Railway Association were held on Oct. 13 at Atlantic City, N. J. The entertainment features of the convention lasted until that date and were concluded by an interesting aviation exhibit.

Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, was elected president of the association for the ensuing year. The other officials of the parent association are as follows: First vice-president,

PRESIDENT-ELECT T. N. M'CARTER.

Gen. George H. Harries, Chicago, Ill.; second vice-president, Mr. Charles N. Black, United Railroads of San Francisco; third vice-president, Mr. C. Loomis Allen, Syracuse (N. Y.) Rapid Transit Railway; fourth vice-president, Mr. Charles L. Henry, Indianapolis & Cincinnati Traction Company; secretary and treasurer, Mr. H. C. Donecker.

The new officials of the allied American Electric Railway Engineering Association are as follows: President, Mr. E. O. Ackerman, Columbus (Ohio) Railway & Light Com-

pany; first vice-president, Mr. Martin Schreiber, Public Service Railway, Newark, N. J.; second vice-president, Mr. L. P. Crecelius, Cleveland (Ohio) Railway; third vice-president, Mr. John Lindall, Boston (Mass.) Elevated Railway; secretary-treasurer, Mr. Norman Litchfield, Interborough Rapid Transit Company, New York.

The report of the committee on education was presented by Prof. H. H. Norris before the American Association on Oct. 10. The committee invited five companies last year to co-operate in an actual experiment with employees. Each company was asked to contribute a reasonable sum of money and five young men with whom the committee could conduct its experiment. The committee, Professor Norris said, believed that if a young man could be stimulated to investigate further than the actual demands of his job required he could be led to undergo a process of self-education. The committee enrolled twenty-seven students last year, and it recommends that the experiment be continued another year and that the number of students enrolled be increased to 100. It was also recommended that each student be expected to pay $5 as evidence of his appreciation of the work, and that each company be expected to pay not to exceed $35 for each student enrolled. The total expenditures for the period of the experiment averaged $22 per student.

Mr. Horace W. Flashman, who acted as instructor for the committee, stated in an appendix to the report of the committee that 227 letters were written to the boys. The students were encouraged to ask questions regarding their daily work. To the first one or two problems the answers were brief and hesitating, the boys feeling that they were walking through unfamiliar fields. At the close of the course in practically all cases the answers, although on more difficult subjects, were extended and complete.

Organization of the Gas, Electric and Railway Association of Oklahoma.

As a result of a meeting of parties interested called by Prof. Harold V. Bozell, director of the school of electrical engineering at the University of Oklahoma, on Oct. 6, the Gas, Electric and Railway Association was formed, with the following officers: President, Mr. Noel R. Gascho, manager of the Alva Light & Power Company; vice-president, Mr. Fred. W. Caldwell, manager of the Shawnee Gas & Electric Company; secretary-treasurer, Prof. Harold V. Bozell, Norman; directors, Messrs. Galen Crow, manager of the Guthrie Light & Power Company, and Paul M. Galloway, manager of the Tulsa Gas & Electric Company, each for one year; V. H. Francis, manager of the Kingfisher Municipal Electric Light & Water Plant, and L. A. Pritchett, manager of the Marlow Municipal Electric Light Plant, each for two years.

During the sitting of the committee appointed to make recommendations as to the scope of the organization, and to present a constitution and accompanying by-laws, there was a general discussion regarding the defects of the Public Utilities Association and the benefits from the proposed organization to be derived by both privately-owned and municipal-owned plants. During its existence the public of the State seemed to have an idea that the former society was some sort of political organization, or at least an organization to fight the laws and commissions, etc., which came into being at the time of statehood. The central stations had to overcome great difficulties at the time, on account of the numerous regulations they had to conform to at once, and when the managers got together in the old association and talked over these matters they were unhappily reported as combining against the public. Mr. V. H. Francis, of the Kingfisher municipal plant, showed very clearly how the proposed association could help the municipal plants and explained some of the troubles that the municipal manager has that the private manager knows nothing of. The question as to how the State organizations might be able to reach the commissioners and councilmen of different cities where there is municipal ownership was discussed and the sentiment of the municipal managers present seemed to be that in times of disagreement with superiors over matters of engineering facts and proper management they would be helped very much by the fact that their views would often be backed by acts of the association which would have much weight with the city fathers. The question of the good the society would be able to do in the way of prevention of "foo legislation" and the enactment of good legislation wa brought up by Professor Bozell, who cited some instance of legislation in neighboring States which, if enacted, woul have caused some sorts of business to be a joke. Th point was brought out that this influence on legislatio would be—and could exist in no other way—only the fur nishing of facts to the legislators concerning the effect certain proposed laws would have if enacted and that th association would countenance no one bringing influence t bear to have legislation "favorable to interests" enactec The purpose of the association would be the promotio of the interests of the members through social and scien tific lines and to help, in case laws were proposed in whic the association was interested, to see that these laws wer based on facts.

According to the constitution and by-laws adopted, pro vision is made for three classes of members, namely, Clas A, Class B and associates. The first is open to manage and directors of companies; the second to other employee of the same; the third to any one interested in the ga electric or railway business or skilled therein, incluc ing the commercial men. Only the first-class membe may hold office and vote. There is provision for advanc ment from Class B and associate membership to membe ship in Class A. An annual meeting is provided for.

There was present at the meeting—which was called the Auditorium of the State Fair Grounds at Oklahon City—a very good representation of managers of plan from all over the State, municipal as well as private inte ests being represented. Almost all of the large towns the State were represented. All of the commercial men that part of the country who knew of the meeting we present. The annual meetings will be held alternately the east and west sides of the State—that is, one meeti will be held in what was Indian Territory and the next what was the Territory of Oklahoma.

Following the election of officers the newly elected pre dent delivered an address under the title "Co-operation, N Combination," which he said should be the object of t organization. He claimed that the regulation of pub utilities has come to stay and it is to the advantage of parties for the regulated companies to co-operate with t corporation commission. Co-operation should not o exist between the association and the commission but me ber companies and individuals should lend the commissi every assistance possible in ascertaining the facts relati to the business. The commission is the same as a court justice, being as much the court of the defendant as of t plaintiff; it is just as much the commission of the pul utilities as it is of the public. It was not created to w hardships on any class or any line of business, but to that all parties concerned are treated fairly. So long as n of high standing and with honesty of purpose are elec to these important positions neither the public nor public utility companies have anything to fear.

It is common knowledge among the member compan that certain plants operated by municipalities which can t pay ordinary operating expenses give lower rates than o privately owned plants elsewhere furnishing similar s vice. Customers of the latter plants hear of the low r

tes and wonder why a private company cannot furnish the service at as low a rate as a municipality. They keep talking this over among themselves, aided by the demagogue politician, until they have worked up a fearful case of robbery and graft. Then they are prejudiced and the privately owned plant might sell service at actual cost, or below cost for that matter, yet in their minds the graft would still exist. This state of affairs should be gone into by the commission and the municipalities should be shown where they are operating at a loss and be required to bring the rates up where they belong so as to pay expenses, interest on the bonds, provide for depreciation, etc. The municipalities engaged in furnishing lighting service to their inhabitants should be required to keep their accounts and make reports in detail to the commissions as to income, expenses and earnings, just as is done with privately owned companies. The majority of the municipal plants would be glad of this sort of help from the commission. They would like to be placed on a paying basis, so that when a machine is burned out, transformers are lost by lightning, or the interest on their bonds falls due, they would not have to borrow from some other city funds or vote bonds to meet these items.

proper co-operation adverse legislation can be pre-l and at the same time legislation of a just and neces- haracter can be enacted, such as giving the commis- power to issue "indeterminate permits" during satis- service and giving it power to decide whether a nity can best be served by two public utility com- s in competition or served by one under State regu- —further, before a competitive utility can build r plant in the same community, it must secure a t. Thus the commission is protective as well as tory.

Denver Electrical Show.

second annual electrical show given under the aus- of the Colorado Electric Club was opened in the rium in Denver on Oct. 14. Coincident with this exposition there was the annual convention of the mated Sons of Jove in honor of which red predomi- in the color scheme of the street illumination which l a feature of the show week. An electric parade up of 350 electrically propelled vehicles preceded rmal opening and the platoon of police forming the for the parade headed the procession in electric

y innovations were made in the street illumination. mblem of the Sons of Jove was featured prominently nt of a number of the hotels and the portiere and r effects used in decorating the streets last year were n place on the thoroughfares leading to the Auditor- Within the Auditorium the booth arrangement was the same as last year as was also the illumination. The tain sunset which was the main feature of spectacular t at the previous show was replaced by electrical s performed by Miss H. Wallack. The electrical s used in connection with the dances were gorgeous. rs were placed around the stage on which the dances given and the floor was of thick, clear glass through colored light was diffused.

freaks of high-frequency currents were repeated ear, the demonstrator being Prof. H. T. Plumb, for- of Purdue University, who also delivered lectures g the exhibition. The entire experimental equipment Colorado State School of Mines was on exhibition e section devoted to the high-frequency experiments. of the latest improvements and developments in elec- machinery and appliances were shown during the The department devoted to the heavier exhibits, as mining and milling machinery and irrigation pumps, was unusually complete. Under the rules of the club soliciting or selling of exhibited or other articles was forbidden and nothing was offered for sale but refreshments. The membership committee of the N. E. L. A. had a booth at the show and efforts were made to increase the membership, the campaign being carried on among the manufacturers eligible for Class D membership.

Assert Electrolysis Damages Pipes and Building Structures in Chicago.

The office of L. G. McGann, commissioner of public works of Chicago, has served notice on the surface, elevated and subway electric railways of Chicago, citing instances where it is believed electrolytic damage has been caused or is now under way as the result of stray return currents from the rails. The communications are based upon reports of an investigation recently made by Mr. Raymond Palmer, a consulting engineer, who was engaged by the city to make a survey of electrolytic conditions in the downtown section and on the South Side. The report gives examples of damage caused to underground pipes, mains, buildings and bridge structures, and suggests remedies in the form of adequate return paths for the railway currents. The bridges at Clark, Wells, Dearborn and Van Buren Streets are said to have been already affected by the stray return current. According to the report, the electrolytic damage is caused by the returns from the elevated railways (which are carried on steel structures generally supposed to afford ample return path) and by the 250-volt electrified tracks of the freight tunnels of the Illinois Tunnel Company, 40 ft. below the street level, as well as by the 600-volt surface-road trolley returns.

Electrical Co-operation.

At the meeting of the Electric Club of Chicago on Oct. 11 Mr. Philip S. Dodd, secretary of the Commercial Section of the National Electric Light Association, spoke on the subject of electrical co-operation. He mentioned three agencies that may be employed to this end. One is the Sons of Jove, which is a powerful social organization which could do certain valuable work for the development of the industry as a whole. Another agency is the Commercial Section of the N. E. L. A. This body is active in promoting electrical co-operation. It has circulated 10,000 copies of its book entitled "Data on Electric Signs" and 40,000 copies of the publication entitled "Electrical Equipment of the Home." In preparing and distributing the latter book jobbers, contractors and manufacturers have co-operated with the N. E. L. A. The third agency of co-operation mentioned by Mr. Dodd is the "people's electrical page" in daily newspapers in certain cities. This co-operative advertising page is now published in seven different cities and in three of these the page is published in two different papers. This co-operative daily newspaper advertising is proving of direct value to the advertisers and also it forms the entering wedge for real co-operation among the various electrical interests. There should be a good opportunity for such advertising in Chicago.

Mr. H. L. Rogers, business manager of the Chicago *Daily News*, spoke from the viewpoint of a daily newspaper advertising man. He thinks that it will pay electrical people to advertise in the daily newspapers things of general interest. Mr. Dodd's plan appeals to the speaker as a good one. Mr. Rogers expressed the hope that his hearers would not be frightened by the expense, and said that there were several stores on State Street that spent more than $100,000 a year for advertising in a single paper.

Mr. H. H. Cudmore, of Cleveland, said that the experience of that city with co-operative newspaper advertising had been very favorable. A page is run weekly in a morning paper and there is also a page once a week in an evening paper. The central portion is occupied by electrical news and "reading matter," with the remaining space taken up by advertisements. Mr. Cudmore recommended that the same idea be adopted in Chicago and that the Electric Club take it up. Mr. A. A. Gray made a plea for organized effort in electrical development, and spoke in favor of co-operative electrical advertising in daily newspapers.

The matter of establishing daily newspaper service of this character in Chicago under the auspices of the Electric Club was referred to the board of managers, which was instructed to report to the club at a subsequent meeting.

Patents and Monopolies.

Mr. Charles A. Brown, a prominent member of the patent bar of Chicago, delivered an address on the relation of patents to pooling agreements before the Electric Club of Chicago at the weekly luncheon of Oct. 11. Mr. Brown has spoken on this important subject before, and in the issue of the *Electrical World* for March 23, 1911, page 708, there appeared an abstract of his scholarly review of the situation as delivered on a previous occasion. His speech before the Electric Club covered much the same ground. In concluding Mr. Brown said that the test of legality in this matter may be obtained, perhaps, by an examination of the question whether the patent under which the combination is effected is a valid one, with claims covering all the devices licensed under the combination. If that is the case the combination is very likely to be held to be a legal one. A feature of the situation is that Congress may wipe out the entire patent system if it wishes to do so. The people may desire to clip the wings of corporations depending on patent monopoly by this means. It would be lamentable, however, to abolish patent protection entirely, as such protection is an incentive to invention.

Mr. A. D. Curtis asked if there had been any recent change in the attitude of Congress toward design patents. Mr. Brown answered that there is a tendency among some Congressmen to attack the patent system at almost every session, but there has been no radical change in the patent laws for a long time.

Mr. Donald M. Carter, a patent lawyer, said that a patent monopoly is different from other forms of monopoly in that it is virtually a contract between the government and an inventor. The people do not realize this fact and therefore do not do justice to patent monopoly, confounding it with odious monopolies of other descriptions. The government cannot lessen the value of a patent and live up to the terms of its contract. If the facts were fully understood it might be possible to get legislation that would protect inventors and at the same time prevent patents from being used for wrongful purposes.

Mr. F. P. Vose asked for information about the German patent system and Mr. Brown said that there were many points of similarity between patent practice in Germany and the United States. It is believed, however, that, speaking generally, Germany is not opposed to trade combination. A vote of thanks was extended to Mr. Brown for his instructive address.

October Meeting of A. I. E. E.

At a meeting of the American Institute of Electrical Engineers held in New York on Oct. 13 Mr. B. G. Lamme presented a paper entitled "A Theory of Commutation and Its Application to Interpole Machines." The author called attention to apparent contradiction of facts in the usu mathematical assumptions made in treating the problem commutation. According to the usual theory, during tl commutation of the coil the local magnetic flux due to tl coil is assumed to be reversed, although it is apparent th in the zone in which the commutation occurs certain of tl magnetic fluxes may be assumed to be practically consta in value and direction during the entire period of coi mutation. The author described a method of dealing wi the problem of commutation based upon considering t armature flux as a whole as set up by the armature amper turns. The theory is based upon the broad principle of t revolving conductors cutting across the stationary armatu field set up by the armature winding, and thereby gener ing an electromotive force in the short-circuited coils whi is proportional to the product of the revolutions, the fl which is cut and the number of turns in series. The usı reactance voltage due to the reversal of the local flux in individual coil is not considered, although its equival appears under another form.

The author stated that the field distortion has practica nothing to do with the problem. The distorted field m netism is simply a resultant of the no-load main fi flux combined with that due to the armature winding, the fore the two components of the distorted full-load field the no-load main field, which is fixed in space and is usu practically constant, and the armature field, which is a fixed in space, but varies with the load. If the brushes set in a certain position with respect to the no-load fi then as this component of the resultant full-load fiel practically fixed in space and in value it has no variable fluence on the commutating conditions. The true vari element which does affect the commutation is the armat flux, and it is this flux which is the basis of the auth theory of commutation. In the case of the inter machine a small pole is placed midway between two jacent main poles for the purpose of setting up a l magnetic flux under which the armature coil is commuta The resultant magnetic flux and electromotive forces be assumed as made up of two components which ca considered singly. One of these components is that w would be obtained with an armature magnetomotive f alone acting along the various flux paths, including the terpole, and the other would be that which would be tained with the interpole magnetomotive force alone, armature magnetomotive force being absent. When two components are superimposed the interpolar flux du the armature magnetomotive force is in direct oppos to that due to the interpole magnetomotive force, therefore only the electromotive force due to their di ence is effective. The interpole magnetomotive force be considered as consisting of neutralizing ampere-t which are effective in overcoming the armature mag motive force, plus magnetizing ampere-turns, which duce the resultant interpole field.

When the different armature electromotive forces ar termined for the whole period of commutation and superimposed the resultant electromotive force indi the flux distribution required under the interpole. author gives equations for representing the various ele motive forces and fluxes required. According to author's treatment the exact balance between the inte and armature magnetomotive forces gives the best c tion. He remarks that from certain standpoints this tion is the correct one, but in practice usually a slight e of the interpole strength, or over-compensation by the interpole, is advantageous. The method described has een applied to a large number of direct-current machine including high-speed generators, turbo-generators, d current railway motors, moderate-speed and low-speec erators of all ratings, industrial motors of various d including adjustable-speed motors and machines with as many interpoles as main poles. The agreement be een

he calculated results and test data has been found to be ery close.

In his introductory remarks President Gano Dunn outned certain work accomplished by the International Elecrotechnical Commission at the International Congress of urin. He called attention to the fact that the International Electrotechnical Commission has suggested that an nternational congress be held at San Francisco in 1915. s a result of the work of this commission the English ave agreed to substitute I for C as the symbol for current, nd the Germans have agreed to substitute R for W as the mbol for resistance, so that in the future Ohm's law will e expressed by the symbols I, E and R, which have been n common use in America for a number of years. The mmission has recommended that in the graphical repreentation of alternating-current quantities the counterockwise direction of rotation is to be employed. This ethod is in conformity to the former usage in France, aly, Sweden, Norway, Russia and Japan, and it correonds with the usage of about one-half of the writers in ermany and the United States. The plan adopted by the rican Institute of Electrical Engineers of putting ic equivalents of English measures in parentheses r the expressions of value was indorsed, and all tech- societies in all countries have been asked to follow xample of the A. I. E. E. in this respect.

ie discussion on Mr. Lamme's paper was opened by Mr. . T. Erben, of Schenectady, N. Y. He remarked that ugh the formulas take into account many things that requently neglected in commutation formulas, yet they n be applied only when constants are inserted from exrience. He stated that if a turbo-generator running at out 2000 r.p.m. when not provided with compensating ings will carry from 700 to 800 per cent normal load ut flashing over, then when it is fitted with compeng windings it will carry probably ten or twelve times al load without flashing. Photographs taken at the ent of short-circuit indicate that gas is thrown out l of the brush. This gas is of very high electrical convity, so that the arc follows the gas and is carried d the machine with the gas as a conductor. That the ction of gas is an important element in commutation own by the fact that the overload which a machine carry is reduced by probably 50 per cent when one- of the brushes are removed from the commutator. ugh there exists a general impression that the prob- of the direct-current machine are very simple, the is that commutation is one of the most complex prob- that electrical engineers have to handle.

George L. Hoxie, of New York, stated that the t-current generator is really an alternating-current ine, and involves all of the problems of the latter ine, and in addition thereto the problem of obtaining nuous current from coils in which an alternating elective force is produced. He claimed that it is not er to consider separately the magnetic fluxes produced fferent magnetomotive forces acting upon a common etic material, on account of the variation in reluctance s material. Under load conditions the armature cur- superimpose their magnetomotive forces upon the ctomotive force of the field current, the resulting ctomotive forces producing a resultant flux which is the geometrical sum of the fluxes that would be pro- l by the two magnetomotive forces acting separately. ss the machine is arranged with a strong magnetic and liberal air-gap and operated with saturation in the tips, pole faces and armature teeth, there will be great distortion and bad commutation. So far as concerns nutation, it is desirable that during the time the coil is t-circuited by a brush it should have generated within f an electromotive force opposed to the current that particular coil carried a moment earlier. Moreover, electromotive force should be of sufficient value to bring the initial current to zero and produce a new current equal in value and opposite in direction. Dr. Hoxie called attention to the work of Prof. Harris J. Ryan, who designed and patented a pole-face winding some twenty-one or twenty-two years ago. He expressed the opinion that such a pole-face winding or some modification of it may again be employed for obtaining improved commutation conditions.

Mr. H. M. Hobart, of Schenectady, claimed that it is advantageous to have as large a neutral commutating zone as possible, which result can be obtained by employing a fairly small pole arc with a considerable distance between pole tips. The introduction of the interpole has tempted designers to decrease the number of commutator segments, with results which have not always been satisfactory. With a fair value of average voltage between the commutator segments the enormous armature reaction which the use of interpoles renders possible causes the maximum voltage between segments to reach in cases even five times the average voltage. The result in such cases may be a maximum electromotive force of perhaps 60 volts between adjacent segments. A voltage of such a high value is very apt to result in trouble at the commutator. There are many aspects of commutation that cannot be worked out theoretically. For example, although commutation formulas ordinarily neglect the fact, it is known that the grooving out of the mica between commutator segments results in a saving of from 5 per cent to 10 per cent, and possibly up to 15 per cent. Improvements of the same general nature, which are usually ignored in theoretical considerations, can be obtained by employing improved types of brush holders and by certain mechanical changes, including the rigidity of the commutator.

Prof. Malcolm MacLaren, of Princeton, N. J., discussed in detail the effect of employing fractional-pitch windings with interpole machines, and claimed that the effect of a variation in the pitch of the winding is small, provided account is taken of the neutralization of the armature magnetomotive force in the chorded zone. He expressed the belief that the method of analysis proposed by Mr. Lamme is applicable more strictly to interpole machines where the interpole flux is neutralized and fractional-pitch windings are used, than it is to non-interpole machines using full-pitch windings.

Prof. Comfort A. Adams, of Cambridge, Mass., showed the conditions under which the author's assumption of a stationary commutating flux through which the armature coils move is applicable in practical machines. He stated that the assumption is absolutely legitimate in the limiting case when the number of slots and number of segments under the brush are very great. With a small number of armature slots and armature segments there is a variation in time and space in the distribution of the magnetomotive force throughout the commutating zone, so that it is incorrect to consider the fluxes as stationary throughout this zone. In any case, however, it is proper to consider that a flux varying in value travels with the core, as is done according to the usual method of calculation of the local armature reactance. Although there are certain objections to the use of the short air-gap, yet in so far as the interpole machine is concerned the length of the air-gap has no influence on the commutation. Prof. Adams mentioned the fact that the air-gap in a certain machine had been decreased from its normal value of a little over 0.125 in, down to 0.02 in. with absolutely good performance so far as commutation was concerned.

Prof. C. F. Scott, of New Haven, Conn., said that the paper possesses an element of much value, in that the method of analysis depends upon physical relations rather than upon mathematical representation. The author has considered the problem of commutation as one relating to the cutting of a stationary magnetic field by moving conductors, rather than the performance of a conductor sta-

tionary with respect to the armature core around which the flux varies. He commended the paper as being an excellent example of the physical rather than the mathematical method of handling engineering and design problems.

Mr. James Burke, of Erie, Pa., called attention to the desirability of employing full-pitch rather than fractional-pitch windings with commutating-pole machines. In machines with commutating poles the coil throw is sometimes decreased to as low as 70 per cent pole-pitch. An armature thus wound does not operate as well with the interpole field construction as does an armature provided with full-pitch windings. Although not often taken into consideration in commutating formulas, the width of the mica is an important element in commutation. In the ordinary machine the mica has a width of about 1/32 in. In special cases the width has been increased to ⅜ in., with the result that machines which would not otherwise have operated have given excellent service. In certain cases if the usual theoretical criterion of commutation is applied the machines would seem to be impossible of operation, yet on account of the use of extra-wide segments such machines are found with commutators in perfect condition after continuous service for many years. Another point of considerable importance is the number of commutator bars per slot. The performance of a machine equipped with interpoles varies largely with the number of coils and commutator bars per slot, although this fact is frequently neglected in commutation theory.

Mr. C. E. Wilson, of Pittsburgh, displayed a number of charts showing the performance of coils and brushes under commutation. The curves indicated that a machine should be slightly over-compensated in order to minimize the current density under the leading brush-tip. The curves also indicated that certain machines which are fully compensated at, say, one-half load are under-compensated at overload on account of saturation in the interpole circuit.

Progress of Construction Work for Keokuk Water-Power Development.

Advantage may be taken of the fact that a large party of St. Louis engineers and electrical men inspected on Oct. 14 the hydroelectric plant in process of construction for the Mississippi River Power Company on the Mississippi River at Keokuk, Ia., to give a brief account of the progress of the work as exhibited on that date. The plant has now reached a stage when its magnitude impresses the most casual observer, while the admirable efficiency of the

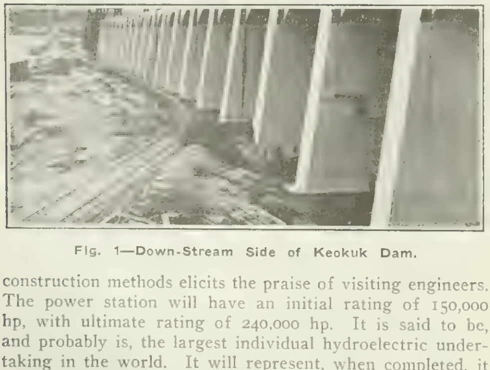

Fig. 1—Down-Stream Side of Keokuk Dam.

construction methods elicits the praise of visiting engineers. The power station will have an initial rating of 150,000 hp, with ultimate rating of 240,000 hp. It is said to be, and probably is, the largest individual hydroelectric undertaking in the world. It will represent, when completed, it is reported, an expenditure of $17,000,000.

St. Louis, distant about 140 miles from Keokuk in a straight line, is greatly interested in the development, for the electric-service and electric-railway interests of the city have contracted to take 60,000 hp. The inspection party of Oct. 14 was made up of members of the St. Louis League of Electrical Interests and the Engineers' Club of St. Louis. It consisted of sixty-three gentlemen, among whom were a number of engineers of prominence, including Mr. H. H. Humphrey, president of the League of Electrical Interests, and several officers of the Union

Fig. 2—Present Appearance of Keokuk Dam from Up-Stream Sic

Electric Light & Power Company, of St. Louis, as Mr. I Spoehrer, secretary; Mr. John Hunter, chief engineer; M S. B. Way, electrical engineer, and Mr. F. D. Beardsl commercial engineer. The party traveled on a night tra and spent all day in Keokuk, where it was taken in char by the Mississippi River Power Company, represented Mr. Hugh L. Cooper, vice-president and chief engineer the company. The visitors spent the forenoon inspecti the work on the dam, which extends out from the Illin side of the river, and the afternoon at the power-ho site, which is on the Iowa side. The engineers were ent tained both at luncheon and at dinner at the Rivervi Club and the Hotel Keokuk by the Mississippi River Pov Company and, with delightful weather, their visit v highly instructive and enjoyable.

In a brief news account of the status of the work, s as this, it is not necessary to attempt a general descript of the Keokuk water-power development. A number articles on the subject have appeared in the *Electr. World*. In the issue of Feb. 10, 1910, page 337, there an interesting account of the history of the enterprise. illustrated advance description was given in the issue May 19, 1910, page 1287, and as late as Aug. 5, 1911, p 331, there was an illustrated progress report. A n ber of other references to the work have appeared fi time to time. So rapidly has construction been advan however, that the work represents quite a different app

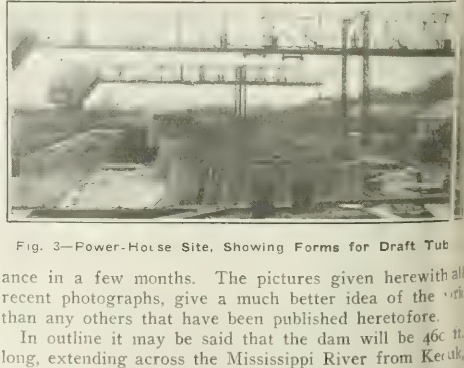

Fig. 3—Power-House Site, Showing Forms for Draft Tub

ance in a few months. The pictures given herewith all recent photographs, give a much better idea of the rk than any others that have been published heretofore.

In outline it may be said that the dam will be 46c ft. long, extending across the Mississippi River from Keuk, Ia., to Hamilton, Ill. At this point the bed of the ver is solid rock, and the adjoining bluffs furnish stone a quality suitable for crushing as an ingredient of concrete.

The conditions are, therefore, very favorable. The dam proper is 46 ft. high above the average level of the river bed. It will consist of 119 monolithic concrete arches supported on concrete piers. Seventy of these arches have now been built and Fig. 1 gives a good idea of the structure from the down-stream side. Fig. 2 is a recent picture of the dam from the up-stream side, showing, at the arch on the extreme right, some of the steel forms for piers and arches in position. At right angles to the main portion of the dam, near the Iowa shore, is the power house, which is an integral part of the dam and will be 1700 ft. long. The dam will furnish a head of from 21 ft. to 35 ft., and this head and the immense volume of water available will be used to operate an initial installation of fifteen 10,000-hp hydroelectric units consisting of vertical-shaft turbine water-wheels and alternating-current generators.

Below each arch in the main portion of the dam there will be a spillway of concrete, with a massive steel controlling gate above it. The arches are 36 ft., center to center, and 30 ft. wide in the clear. The width of the dam is 43 ft. at the bottom and 36 ft. at the top. The foundations of the piers are anchored 3 ft. in bed-rock. The visitors were shown how a cofferdam is built on the up-stream side of the dam; how the water is pumped out, the rock drilled for foundation excavations and the concrete footings put in; how the steel forms are built up on these foundations by bridge workers and how the concrete is poured by means of steam locomotives hauling one large

Fig. 4—View of Power-House Site, Showing Discharge Openings from Turbine Draft Tubes.

bucket from the mixing mill on shore, the buckets being handled and dumped at the end of their journey by a cantilever crane running out on the completed structure with a 50-ft. overhang; and, finally, how the whole cycle of operations is repeated as the work progresses, the cofferdam being removed and the water being allowed to run over the finished arches until the spillway construction is begun. Communication between the men in charge of the pouring of concrete and the crane operator controlling bucket travel is maintained by telephone.

The concrete used in the spillway section is of 1:3:5 mixture. There are large stone-crushing and mixing plants on both sides of the river, those on the Illinois side being used for the straightaway section and those on the Iowa division being used for the power-house site and the controlling works for the government canal for navigation. Incidentally the building of the dam will improve navigation at the Des Moines Rapids of the Mississippi River, as the present canal, with its three locks, will be replaced by a larger canal and a single lockage into the broad, deep lake that will be created. Likewise, it may be remarked that it is believed that the raising in level of the river above the dam will be observed as far north as Burlington, Ia., miles away, as the river winds. The present depth of the river at Keokuk is about 6 ft., reading, perhaps, 10 ft. in spots. For a number of miles the level of the present tracks of the Chicago, Burlington & Quincy Railroad, on the west side of the river, will be under the new water level, and a part of the work is the relocating of these tracks. Many acres of land will be flooded, of course, and have been purchased or condemned.

Construction work is done largely by compressed air, although electricity is generated for lighting. There is a temporary power plant on each side of the river. On the power-house site the workmen are engaged in blasting out the wheel pit and erecting the massive concrete construction surrounding the draft tubes for the turbine water-wheels. This work is being done in the bed of the river, the water being diverted by a well-built cofferdam. The draft-tube construction is particularly impressive and interesting. There will be fifteen draft tubes for turbines in the initial installation. Each will be 18 ft. in diameter at the top and will curve down and flare out to enormous discharge openings 20 ft. high and 42 ft. wide. These openings will be beneath the level of the water below the dam, the river acting as a tailrace. Fig. 3 is a view showing the work on the power-house site. The wooden forms for the tops of several of the draft tubes are plainly shown, as well as two of the large cantilever cranes used in construction work. Fig. 4 is another view of the draft-tube construction, but this picture is intended particularly to show the great openings of the discharge chambers.

Contracts have been awarded for turbine water-wheels made by the I. P. Morris Company, of Philadelphia, and the Wellman-Seaver-Morgan Company, of Cleveland, and for vertical-shaft generators made by the General Electric Company. The 10,000-hp turbines will be mounted directly above the draft tubes and will be surmounted by the 7500-kw generators. The latter will turn at 56 r.p.m. and will generate three-phase, 25-cycle alternating current at 6600 volts. The power house will be, when complete, 1700 ft. long, with twenty-four, or possibly thirty, generating units. It will be 123 ft. wide and 133 ft. high. Transmission to St. Louis will be effected at 100,000 volts.

About 500 men are now employed in the construction work and the company maintains a clubhouse for the officers and a hospital for the men. The work is being carried on rapidly, but without confusion or bustle, and it is now expected that the initial generating equipment will be ready for service in July, 1913. The Stone & Webster interests are prominent in the Mississippi River Power Company and will probably operate the plant when it is completed.

Panama Canal Electric Towing Locomotives.

The official weekly publication of the Isthmian Canal Commission, *The Canal Record,* which is printed at Ancon, gives an account of the electric locomotives which will tow ships through the locks. Specifications have been sent to Washington in order that bids may be asked for the forty locomotives that will be required for the locks at Gatun, Pedro Miguel and Miraflores. The system of towing outlined in the specifications is the invention of Mr. Edward Schildhauer, of the canal engineering staff, and a patent has been applied for, the government having the right to use the patent without remuneration. Two bids will be called for, one for one locomotive for test purposes and the other for the remaining thirty-nine, in case the first is satisfactory.

The system of towing provides for the passing through the locks of a ship at the rate of 2 miles an hour, the vessel being held steady between four lines of taut hawsers. A ship will come to a full stop in the forebay of the locks, where four hawsers will be attached to it, two forward on either side and two aft. At their other ends these hawsers will be attached to the windlasses of four towing locomotives operating on the lock walls, two forward towing and two aft being towed by their hawsers, thus holding the ship steady. The locomotives will run on a level, excepting where they pass from one lock to an-

other, where they will climb heavy grades. Between the lower and intermediate locks at Gatun, for example, there is a difference in elevation of 29 ft. 7 in., and, in order to save concrete, this ascent is made in the shortest feasible distance. The horizontal distance from the point of tangency on the lower lock wall to the point of contact on the wall of the intermediate lock is 106½ ft. The vertical curve has a radius of 100 ft. and the maximum grade is one on two.

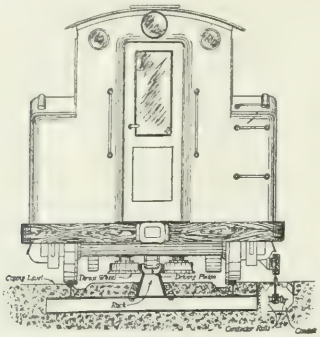

Fig. 1—End View of Electric Locomotive.

There will be two systems of tracks, one for towing and the other for the return of the locomotives when not towing. The only cross-overs between the tracks will be at each end of the locks, and there will be no switches in the rack road. The tracks will be of the 5-ft. Panama railroad gage, laid with 90-lb. Bessemer steel rail on Carnegie steel ties, each tie anchored into the concrete by a bolt on the side farthest from the lock chamber. On the center wall there will be two towing tracks with one return track between them, and on each side wall a towing and return track. The towing tracks will have a center rack throughout, and the locomotive, while towing, will always operate on this rack. On the return tracks, at the incline between locks, they will also operate on racks, but elsewhere they will run by friction. The racks will be of cast steel, so formed that lubricant will not drop upon the concrete and that water will not be held in the interstices, this latter precaution being taken against the breeding of mosquitoes. The distance from center to center of adjoining teeth is 3.13 in. After hauling the ship through the last gates and into the forebay, the locomotives will coil their cables and return to await another ship, or will take hold of a vessel going in the opposite direction and tow it through.

Each locomotive will consist of three parts, as shown by the drawings reproduced on this page—two tractors and between them, a windlass. The windlass will not be mounted upon a truck, but will be supported by two arms extending on each side from either end and resting on bearings immediately over the adjacent wheels of the tractors. The ends of the arms will be equipped with rollers to permit free horizontal movement of the members when the locomotive is rounding a horizontal curve. The windlass is joined to the tractors by a drawbar and trunnion which have the effect of a universal joint and permit free movement of the parts when the locomotive is on a vertical curve.

TRACTORS.

The tractors will be alike in every particular, each consisting of a four-wheel truck upon which are mounted a motor and a control apparatus. They will run as rack or friction locomotives at the will of the operator, and the whole locomotive can be controlled from either cab.

While towing, and on the inclines between the locks, the tractor will run as a rack locomotive. Motion is communicated from the motor to the rack pinions by means of a system of gear reduction in which there are no clutches. There is absolutely no means of disconnecting this train of gears, and, as a result, the rack pinions are in motion only when the motors are. A solenoid brake, which closes upon a brake wheel whenever the current is cut off from the motors, provides against accident in case the current should be cut off while the locomotive is on one of the inclines. In such an event the locomotive would come to a stop instantly and be held there until the brake should be released. The rack pinions are of quill construction and are so mounted upon the back axle of each truck that the rack pinion will run free from the motor when the locomotive is on the return track and traveling by friction.

For traveling by friction the tractors will be fitted with jaw clutches, which will connect the traction motors with the driving wheels. These clutches will be operated by solenoids. The locomotive, when operating by friction, will move at a rate of 5 miles an hour.

The electrical equipment for each tractor will consist of one traction motor with control apparatus. The motor will have a full speed torque of 840 lb. at 1 ft. radius, full load speed, at no less than 470 revolutions per minute, and will be capable of developing not less than [illegible] per cent greater torque for a period of one minute. Alternating current will be used with the effect that synchronous speed will be maintained on all the locomotives in a t[illegible] The motor will be three-phase, induction, totally inclosed, moisture-proof, high torque, or mill type, 25 cycles per second, with 220 volts between lines. The motors on the tractors of each locomotive will be operated in parallel and controlled by resistance in the secondary circuit, accomplished by contactors in the primary and secondary

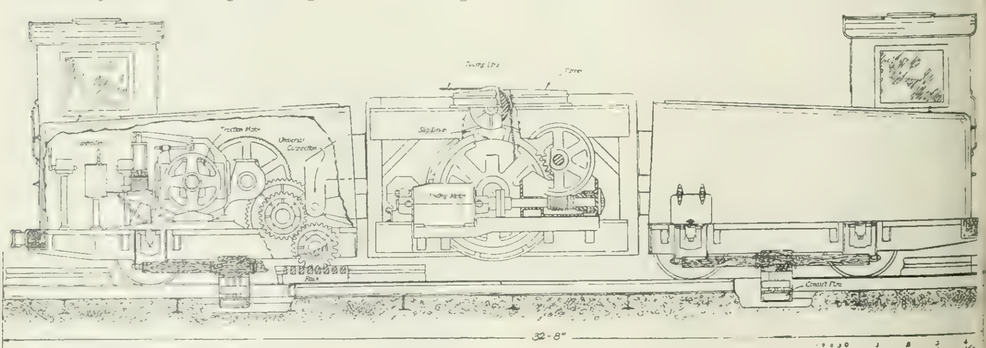

Fig. 2—Side View of Electric Locomotive.

rcuits operated by master controllers, one in each cab. iere will be not less than seven energy points in each rection, and between these and the braking position there ll be a coasting point, so that when energy is turned off om either forward or reverse direction there will be ailable a coasting point before the braking position is ached. The master controllers will be of the drum type, e for each tractor.

Energy will be collected by each tractor by means of a pw carrying two contact shoes, each operating on a sepa- e contact rail carried in an open conduit, one for each of to phases, while the third phase will be carried by both t ck rails. The maximum load that will be thrown upon t traction motors will occur when the locomotive is as- cding the inclines between the locks, and this will be gater than the load of towing a ship. Inasmuch as vight is not required for tractive effort, the whole loco- ntive will be of as light construction as possible, the esti- ted weight being 70,000 lb.

WINDLASS.

e third part of the locomotive will be a windlass for g in or paying out the towline, and motors to drive it The drum will be 18 in. in diameter. A friction clutch w provide against its ever sustaining a pull of more than 2 oo lb. Two speeds are provided for, one for coil- i in the line under load at a rate of 10 ft. a minute a the other for coiling it when not under load, at a rate o ft. per minute. Rotary switches in the cabs of each r will control the movement of the windlass.

ere will be two motors, one for operating the wind- nder load, and one for the rapid coiling of the haw- The windlass motor will have a full-speed torque of b. at 1 ft. radius, will be capable of 50 per cent r torque for one minute, and will have a full load of not less than 630 revolutions per minute. The g motor will have 30 lb. torque at 1 ft. radius, able of exerting 50 per cent greater torque for one , and will have a full load speed of 630 revolutions inute. These motors will be of the squirrel-cage out otherwise will have the same classification as the s in the tractors.

towing line will pass through a sheave in a revolv- rret, which will permit it to rotate easily in a hori- plane, so that the line load may always be directly guiding sheave. The tow line will be of plow steel composed of six strands of thirty-seven wires each, ve a hemp center and will be 1 in. in diameter. The must have a tensile strength of not less than 225,000 r square inch and the hawser must have an ulti- breaking strength of not less than 70,000 lb. will be a 4-ft. loop at the ship end, and the length line from the center of this loop to the drum of the ss will be 215 ft.

the machinery, for both windlass and tractors, will be l in a steel casing. The housing of the windlass will st of a steel frame covered with 3/16-in. steel plate. top sheeting must be capable of standing a strain of 65 b. per square foot and the upper side edges of the g must be capable of sustaining a concentrated load ooo lb., which may be placed upon it when the ne is used to warp a vessel up to the lock wall, when e is at right angles to the locomotive and the chock ship is considerably below the locomotive.

Electrical Machinery and Transformers.

previously noted in these columns, the Turin Interna- tio l Electrical Congress included eight sections for the dis ssion of technical subjects. Below are given abstracts of e seven papers presented in Section I, which dealt wit electrical machinery and transformers.

MECHANICAL AND ELECTRICAL CHARACTERISTICS OF LARGE, HIGH-SPEED GENERATORS.

In the introducton to a résumé of the present state of the art of high-speed generator design, Dr. Hans Behn-Eschenburg traced some of the most important epochs up to the time of the Paris Exposition, and then he contrasted practice at that time with present practice. At Paris the largest generator was a 3000-kw, 83-r.p.m., 6000-volt machine, and the general opinion at that time was that low-speed practice had come to stay. The success of the turbine forced the electrical designers to abandon that type and to develop an entirely new kind of machine.

Most improvement in the electrical practice has been in the extreme refinement of the details and in the use of superior materials. By using a larger number of small slots, by laminating and properly shaping the pole shoes, by subdividing the conductors, by employing effective damper windings, by locating the field and armature windings so as to get minimum leakage, and by using sheet steel with low specific losses, it has been possible to increase the effectiveness of the material, thereby increasing the specific output without increasing the losses. The result is that the output per unit weight at a given speed has in some instances been doubled within the last five years. The cylindrical form of revolving field structure, first employed by Mr. C. E. L. Brown in 1901, has been developed until now it constitutes one of the most important features of modern construction. With this type of field structure it is comparatively easy to attain any output from 100 to 20,000 kw for 25 and 50 cycles, with two, four or six poles. The number of ampere-turns per pole can be as high as 80,000. Moreover, the uniform distribution of the windings over the surface promotes efficient ventilation and reduces the difficulties of balancing.

In two-pole machines of output from 100 kw up the cylindrical structure is cheaper than that with projecting poles, but for four, six and eight-pole machines the latter has the advantage. However, when the output reaches 1000 or 2000 kw per pole, the cylindrical form comes to its own.

In direct-current, high-speed machines the limit set by commutating has been raised to about 16 volts per bar by using commutating poles and compensating windings. The commutating-pole machine was described in full by Menges in 1884, and yet there was no machine of this type shown at the Paris Exposition, all development along this line having taken place in the last eight years. Nevertheless, the size of direct-current generators is still limited by peripheral speed and the surface of the commutator.

Following the general discussion, the author gave data and formulas for determining the principal mechanical and electrical dimensions of high-speed alternating-current and direct-current generators, as well as formulas and rules for estimating the ventilation, heating and losses. These instructions are followed by actual examples, one being a 4000-kw, 3000-r.p.m., two-pole machine, and the other a 12,500-kva, 1500-r.p.m., four-pole machine.

The author concluded by giving data on a number of modern machines, which tend to show that the upper speed limit from the point of view of economy has been exceeded and that the best economical results for machines between 500 and 15,000 kva are attained at about 1000 r.p.m. With the direct-current machine, aside from the fact that the highest speeds are impossible of attainment, actual practice was indicated in the tables showing that the economical speed lies far below the range of turbine speeds. The design of gear reduction has been greatly improved, and their employment in this connection offers a way out of the difficulty.

Dr. Behn-Eschenburg's paper was discussed by Dr. S. P. Thompson, Prof. C. Feldmann and Messrs. E. Brunswick and C. Carli.

…ENERATORS, CONVERTERS AND RECTIFIERS.

A report by Dr. S. P. Thompson related to that class of dynamo-electric machinery the object of which is to change electrical energy from one form into another form. The author showed that there is a transition of construction from type to type, and described briefly the following principal types: Motor-generators with two field-magnet systems and two armatures, motor-generators with one magnet and two armatures, motor-generators with one magnet and one armature having two independent windings, synchronous converters, cascade converters, revolving-field converters, rectifiers, frequency changers, phase shifters and auto-converters.

Attention was called to the fact that modern opinion favors the use of synchronous converters rather than motor-generator sets, the objections initially urged against the converters having been largely overcome. The cascade converter, which consists of a combined induction motor and synchronous converter mechanically arranged as one machine and electrically connected in series, is now usually built as a twelve-phase machine in the rotor part, and is provided with commutating poles on the field magnet.

Particular attention was paid to the so-called auto-converter, which is the most recent type of machine developed for the purpose indicated. It resembles in many respects the well-known split-pole synchronous converter, but differs therefrom in that it may be employed for converting from direct current of one voltage to direct current of another voltage. The field magnet is constructed with twice as many polar projections as there are poles in the windings of the armature, the magnet poles being arranged in pairs of the same polarity. The machines may be arranged for use as step-down, direct-current converters, as voltage regulators, to convert from variable current at constant voltage to constant current within a limited range, or as synchronous converters, affording regulation of the continuous voltage without affecting the power factor on the alternating-current side. According to the last-mentioned arrangement the machine is the ordinary split-pole synchronous converter. When used as a purely direct-current machine it is provided with two separately insulated sets of brushes, one set being arranged for one voltage and the other set for an entirely different voltage. The electromotive force produced between one set of brushes can be varied independently of the electromotive force between the other set, on account of the splitting up of the resultant magnetic fields. By proper excitation of the coils placed on the separate magnetic circuits, the machine can be arranged to operate as a variable-speed generator, which will furnish an approximately constant voltage at one pair of brushes, independent of the speed of rotation.

Dr. Thompson's report was discussed by Messrs. Brunswick, Routen and Mouchard.

SOME CHARACTERISTICS OF THE CASCADE CONVERTER.

The cascade converter was discussed and compared with the synchronous converter and the motor-generator in a paper by Mr. H. S. Hallo, which in the absence of the author was read by Prof. Clarence Feldmann. This type of machine was invented in 1902 and now there is in operation an aggregate rating of 150,000 kw. In efficiency it approaches closely the synchronous converter. For instance, comparing machines of 1000 kw and 50 cycles, the efficiencies are as follows: Synchronous converter alone, 95.2 per cent; synchronous converter with transformer, 93.5 per cent; cascade converter, 92.5 per cent; motor-generator, 89.5 per cent. On the score of price the cascade converter again stands between the motor-generator and the synchronous converter, it being but slightly more expensive than the synchronous converter.

With respect to regulation, the cascade converter surpasses the synchronous converter, but is not as good as the motor-generator. In order to keep down the wattless current in the stator winding which would be caus by regulation of the direct emf, the leakage reactance the alternating-current side is made great by closing tl slots. By suitably dimensioning the wedges used to clo the slots the reactance can be made to decrease with i creasing load on account of the saturation of the wedg and in this way a machine can be so designed as to strongly over-compounded and yet operate at unity pow factor between three-fourths load and full load.

The cascade converter is less susceptible to hunting th the synchronous converter. It also has a distinct adva tage over the synchronous converter and the synchron motor-generator in starting, since it can be started fr the alternating side almost as easily as an induction mot The synchronous motor-generator naturally has the b power-factor characteristics; however, the cascade c verter is better in this respect than the synchronous c verter.

In natural commutation qualities the synchronous c verter has the advantage, but it is not at all well adap to the use of commutating poles. The cascade conver while not quite so good as the synchronous converter. better than the direct-current generator in its inher commutation, and lends itself readily to the use of c mutating poles. The author also shows that series bo ers used with synchronous converters react unfavora upon commutation and render the use of commuta poles even less effective than they would otherwise The cascade machine gives the same emf regulation w out a series booster.

Mr. Hallo's paper was discussed by Messrs. Brunsw Sarli and Eichel.

FREQUENCY TRANSFORMATION.

A paper on frequency transformers, by M. Paul Bu was, in the absence of the author, read by Mr. E. Br wick. The author classifies the uses of frequency tr formers and briefly reviews the present state of the in each group.

The first group includes transformations from one stant frequency to another such as are necessary v systems of different frequencies are operated in conjun with one another. The usual method here employed i synchronous motor-generator set, although the indu motor-synchronous generator set is also used. I pointed out that these two kinds of machines cann operated in parallel, since in such event the synchro set will carry all the load.

Another method which has been used is based o fact that an induction motor with its primary conn to a source of given frequency and its rotor driven b other motor will produce a secondary emf, the freq of which is determined by the speed of the rotor. driving the rotor with a synchronous motor having r volving armature connected in parallel with the seco of the induction machine and provided with a comm to furnish the excitation, there is had the machine inv by Le Blanc and Arnold.

The Le Blanc-Arnold method requires two entirel arate machines. The author, in collaboration wit Boucherot, developed a method by which two elect separate machines utilize the same magnetic circuit is, one rotor and one stator serve for two separate el circuits which may be designed to deliver differen quencies. In use as a frequency converter one stator ing is connected to the primary circuit of one freq while the other stator winding is connected to the seco circuit, which has a different frequency. The roto be wound for direct-current excitation, in which ca machine is synchronous and may be used to regula power factor of the line, or in special cases the rot be of the squirrel-cage type, thus rendering the m hin asynchronous.

The second group covers the transformation of variable frequencies to a constant frequency. For instance, the secondary current of a variable speed induction motor, if transformed to the proper frequency, may be returned to the line instead of wasted in rheostats. The Scherbius polyphase commutating machine connected to the secondary of a variable-speed induction motor and coupled to an asynchronous generator may be used to accomplish this purpose. The machine of the author and M. Boucherot is also well adapted to this kind of a transformation.

The third group comprises transformations from constant to variable frequency, such as might be utilized in controlling the speed of an induction motor for traction purposes. This might be accomplished by driving a machine having a direct-current winding connected to the line through slip rings and to the induction motor through a commutator which delivers a frequency variable with the speed and an emf variable with the position of the brushes. No practical work has been done in this line.

The fourth group consists of transformations of relatively small amounts of energy from normal to relatively high frequencies such as are used in wireless-telegraph work. In this connection several static converters are described.

ELECTROMAGNETIC PHENOMENA RESULTING FROM SHORT-CIRCUIT OF AN ALTERNATOR.

M. P. Boucherot gave a succinct but comprehensive theoretical treatment of short-circuit phenomena in alternators. In the body of the paper he handled the subject from the physical standpoint and with very little mathematics, the rigorous mathematical development of the equations being given in an appendix. In the first section of the paper the author defined the various inductance coefficients which must be dealt with in studying the phenomena and established the relations between them. He then took up the polyphase short-circuit first developed equations for representing the currents in the exciting and in the armature windings and the emf generated in the exciting or field winding. These equations have been checked by oscillographic tests.

In discussing the remedies the author pointed out that it is as desirable to increase the self-inductance of the field winding as it is that of the armature winding. However, where external inductance is used it should be confined only to the main circuit, because external inductance in the excitation circuit will require extra emf to overcome the ohmic drop in the reactor winding, and therefore in case of a short-circuit, relatively very large emfs will be generated in this circuit and may easily puncture the insulation. The use of reactors in the main leads does not involve similar danger, but it does require a considerable quadrature emf, which may call for an increase of from 15 to 30 per cent above normal.

The effects of short-circuit in one phase and of short-circuits within the windings of the generator itself were also taken up. The most important phenomena in these cases are the high emfs generated in the windings of the alternator. For example, in the case of a short-circuit in one phase, the maximum emf generated in the other phases may attain from ten to twenty times the normal value provided the iron is not saturated and that reactors are not used. Attention is also called to the fact that an internal short-circuit may subject the windings of the field circuit to emfs in the thousands of volts even when no appreciable external current is produced.

M. Boucherot's paper was discussed by Messrs. Feldmann, [illegible]vick, Thompson, Sarli and Holleux.

COMMUTATOR MOTOR FOR ROLLING MILLS.

MR. Legouëz reviewed some of Latour's work on commutator motors, dealing especially with those that employ what is known as squirrel-cage commutation. The author gave a general definition of this type of machine and described several of these motors that have been built and put into successful operation. He proposed to use a compound Latour motor in connection with a flywheel for driving rolling mills. The compound motor described is a series alternating-current polyphase commutator motor with each pair of adjacent brushes shunted by a circuit containing a fixed emf and an adjustable impedance. When the impedance is zero the motor has pure shunt characteristics, and when it is infinite—that is, when the circuit is open—the motor has series characteristics. The fixed emf can be produced by a polyphase transformer, which should preferably be provided with a rotor and stator to permit regulation of the phase. The impedance is an inductive resistance arranged to permit regulation.

This system gives a total range of speed adjustment of about 15 per cent above and below normal at full load. It also gives a good efficiency and power-factor at all operating speeds. As little energy is handled by the shunt circuits and therefore the auxiliary devices are relatively small, the losses are quite insignificant as compared with the rheostatic losses in an ordinary induction motor-flywheel outfit provided with automatically variable resistors in the secondary.

The operation of the set is as follows: When the mill begins work the motor, having a shunt characteristic, develops its full power without an appreciable drop in speed; but when the power reaches a predetermined limit the impedance is automatically increased, which allows the motor to slow down, thus permitting the flywheel to do part of the work. As soon as the load falls off the impedance is cut out and the speed rises again, storing energy in the flywheel, which is now ready for another cycle of operation.

The paper was discussed by M. Sarli.

VARIABLE SPEED THREE-PHASE MOTORS.

The problem of economically regulating the speed of three-phase motors with special reference to rolling-mill operation was dealt with in a paper by Mr. C. Sarli.

After briefly referring to the Görges three-phase commutator motor the author described the Winter-Eichberg system of regulating the speed of a three-phase commutator motor by impressing an adjustable emf across the brushes. He next described briefly the series motor and its mode of speed regulation, and then he took up the double commutator motor of Brown-Boveri, which is in reality a combination of two Déry single-phase commutator motors. In concluding the discussion of the commutator motors he mentioned the methods of compensating the power-factor in the first two systems.

In the second part of the paper the author describes three cascade systems that have recently come into practical use. These systems all utilize energy from the main motor in a second and variable speed machine which returns it either to the shaft of the main motor as mechanical energy or to the line as electrical energy. Three methods are distinguished accordingly as (1) the second machine is a commutator motor coupled directly to the main motor; (2) the second machine is a direct-current motor to which the energy of slip is transferred by means of a converter; (3) the second machine is a commutator motor coupled to an asynchronous generator that feeds the slip energy back into the line.

In conclusion the author compared the various systems, showing that the commutator motors are used for low and medium powers, while for large outputs such as are required in rolling mills the cascade arrangements are better adapted. He then gives performance data and characteristics of some actual installations and refers to the use of heavy flywheels with such cascade groups.

The paper was discussed by Messrs. Legouëz, Palestrino and Finzi.

Regulation of Public Utilities.

At the annual convention of the League of American Municipalities held in Atlanta, Mr. Arthur S. Huey, vice-president of H. M. Byllesby & Company, Chicago, delivered on Oct. 5 a clear-cut address entitled "Regulation of Public Utilities." Mr. Huey explained the dignity of conducting public-utility operations and said that there were probably 20,000 executives engaged in the operation of privately owned utility corporations in the United States. A number of people have referred to this body of men collectively as "corporation robbers." The speaker remarked that the gentlemen referred to like this term about as well, probably, as his hearers enjoy the phrase "a bunch of cheap politicians." Many public-utility operators believe themselves to be honest men trying to conduct a legitimate business in a decent and progressive way.

Public utilities in the United States have been developed, financed and made useful almost entirely by private initiative and private capital. Much has gone into this development besides money. The best years, the best energies, the most earnest thought of many men have been devoted to this development, together with shattered hopes, broken hearts and wrecked fortunes. There is a human side as well as a so-called "heartless-corporation" side to all of this endeavor.

The privately owned utilities of the country have a reasonable right to fair treatment based upon calm, intelligent study of the facts in each case. Operators of utilities have induced thousands of persons to place their capital in this service. "In our consciences," said Mr. Huey, "the integrity of this capital is synonymous with our honor, and we will defend it to the last extremity of lawful effort."

But there is no good reason why public officials and public-utility corporations should not work together in harmony, intelligence and for the common good. Public utilities are most efficiently and economically conducted as monopolies, but nevertheless no monopoly, however beneficent, should be permitted to exist without legal safeguards to protect the public. The speaker then went on to comment on the establishment of state public-service commissions and showed that on the part of the utilities there has been during the last few years a much keener realization of obligations due the public and customer than was formerly the case.

Private ownership of utilities means the employment of ability and capital at a wage, and if this wage is above the average of interest rates the service company is stimulated just as much as good wages stimulate the employee. This theory was recognized recently by the public-service commission in Wisconsin in permitting a utility organization to derive an annual profit of 12 per cent as a reward for excellence of service.

Comparatively few realize that there is intense competition now waging among American communities. The city which lags behind in doing the things which are incumbent upon municipal governments loses in the contest for industries, population and commerce. There never was a time when greater necessity existed for employing public funds in the most useful ways that will bring the greatest and the quickest returns. Under these circumstances it is not good business judgment for cities to bond themselves to place capital in electric, gas, telephone and street-railway companies when private capital is already interested and is willing to do the work for reasonable compensation. The operation of water-works, however, is properly a municipal function, as the vital necessity transcends its cost.

To-day there are fourteen states with utility commissions possessing powers of regulation over organizations supplying electricity, gas, transportation, telephone and water service. Twenty-seven states have commissions exercising control of varied degree over one or more classes of utilities, steam railroads included. The speaker then went on to point out a few general principles which must obtain regulation is to prove a permanent and beneficial featu of civic life.

It is a mistake to consider the lowering of rates as tl principal object of utility regulation. The true function to ascertain and maintain equitable relations. Fair rat must be based on all elements entering into the cost service, including interest and depreciation on the val of the property.

While the profits or income of the promoter and operat are secondary to the interests of the public and the owne nevertheless the service is important and should be li erally rewarded.

A public utility should be placed beyond the possibili of a strike, and some provision should be made to cov this requirement. This regulation should provide f strict neutrality in the conflict between unionism and nc unionism.

In conclusion, Mr. Huey heartily commended a sugg tion originating with Mr. J. C. Michael, formerly corpo tion counsel for St. Paul, Minn., suggesting that an int change of representatives among the various organizati of municipal officers and the various organizations of u ity managers would be of mutual value. Speaking for National Electric Light Association, of which Mr. Hu is second vice-president, the speaker extended an invitat to the League of American Municipalities to send as ma delegates as it desired to the Seattle convention of n year. He assured his hearers that the N. E. L. A. wo heartily welcome such representatives and extend to th every facility for hearing papers and discussions. F thermore, the association would be glad if some rep sentative of the league would accept a place on the p gram of papers.

President McCarter of New Jersey Public Service C poration on Public Service Regulation.

Mr. Thomas N. McCarter, president of the Public S ice Corporation of New Jersey, recently discussed at le before the Board of Public Utility Commissioners of N Jersey questions relating in general to state regulation in detail to the electric and gas rates of the subsid companies of the corporation. Mr. McCarter was form strongly opposed to public utility legislation, but he since stated publicly that he has come to regard such le lation, as Governor Wilson says it is regarded in Wiscon as a protection and not as a menace. Mr. McCarter offe on behalf of the corporation, to make reduction in rates gas and electric service.

Taking up the subject of rates, Mr. McCarter added the policy had been to lower rates in all branches of business as rapidly as was possible, and in addition the so far as its gas and electric business is concerned, to es tablish an absolute uniformity of rate for its comme business, and this is now true in both branches of its ness throughout the broad territory served, except th two of the divisions the gas rate is $1 flat, whereas in other four the rate is $1.10 with 10 cents a thousand is count for payment within a certain number of days. from this, absolute uniformity exists. After years of sideration of the matter Mr. McCarter is satisfied tha his plan of uniformity is of great advantage to the peop of the State. Technically it may be open to some obje on, but it has been of great assistance in the developme of the smaller suburban places whose prosperity is so er-woven with that of the larger cities. The rates put nto effect have only been possible by the centralizing o sta-tions and long-distance distribution. This policy has iow been the settled practice for so long that to attempt a adi-cal departure from it would cause great confusion an dis-

tisfaction. The policy in this respect has been wise and ould be continued, even though in its technical and eoretical aspects it may in some instances militate against e people of the larger cities to the benefit of the people in e large number of smaller municipalities.

The next question which presented itself was whether the tual capitalization of the Public Service Corporation was · which the board must recognize in the proceeding. Mr. McCarter insisted that it was. All these iderlying companies, both gas and electric, upon iich obligations of rental or otherwise have been sumed by the gas or electric company were, with ly one substantial exception, results of mergers or conidations expressly authorized by and made in compliance th the so-called merger or consolidation act of New Jer-. The stocks of the old companies were thus by direct thority converted into stocks and bonds of the new comny, the practice generally followed being to provide sufficnt bonds in the new consolidated company to take up the derlying bonds at maturity or before of the constituent mpanies, as well as to provide a quota of bonds for future ancial needs. Thus, in effect and in law, the contracting mpanies to the various consolidation agreements fixed t value of their respective properties in the new capitaltion, and provided as well for future improvements. In arly all these cases the bonds retained for future impvements have long since been sold for value and the used in betterments. In addition thereto, there has spent upon these properties the respective investment gas and electric companies. These values, thus long xed, are in point of law at this late day immune from by the rate-making power or otherwise, and said thus fixed must now be taken to have been the value properties, physical and franchise, tangible and intle, entering into the respective agreements of merger nsolidation, and the State is now estopped from atg this capitalization. This legal proposition is based decision of the Supreme Court of the United States New York Consolidated Gas case. Precisely a r state of affairs exists in New Jersey. The stocks of derlying companies have been issued from twelve to years. They have become scattered far and wide s in New York, have been traded in freely and widely faith of their legality. The State through its rateg power cannot be now heard to attack it. Mr. Mcr regards this matter as settled for all time by the n in the leading case quoted. However, if the con- that as a matter of law the validity of these securinot now be questioned is not controlling, then he inith equal vigor, that they *should not* be questioned by ard in the exercise of its discretion. The proposition radical is to ignore these existing securities and the nts and obligations in reference thereto, and to make reproduction valuation of the property actually enin the gas and electric business, as the case may be, en to fix an annual return which will be permitted that value thus ascertained.

ming for purposes of argument that the value, as y the radical, will be much less than the existing ization, and that the board should allow a reduced return upon that valuation, the blow would fall, in rst instance, upon those who have since put in large f money, and all—including the radicals—agree that estment of money in these enterprises should be enged, and those who make it should receive a fair ren their investment. Secondly, the blow would fall those who over a long period of years have invested, d faith, in these various underlying stocks; but the ould not be here. Many of the largest corporations, iduciary or benevolent character, have, in good faith, ed large sums in these securities, or made loans upon me as collateral. Mr. McCarter declared that there a bank or trust company chartered by the State—except savings banks—that would not be seriously affected by any such unfortunate situation. In short, a state of financial panic would ensue.

Continuing, Mr. McCarter directed attention to the impracticability of making a complete physical valuation of the gas and electric properties within any reasonable time; to the uselessness of any such appraisement when completed, and therefore to the advisability of arriving at some equitable solution of this problem quickly.

The complications that would exist in valuing gas and electric properties located in some 193 municipalities, large and small, must be apparent. Assuming that the value as ascertained is less than the capitalized value, the knowledge acquired would be purely academic unless made the basis of action that would lead to financial ruin. There is another aspect of the matter. Having arrived at such a fair valuation of the property, gas and electric, devoted to the public use as would stand the test of review by the courts, the next duty of the board would be to determine the fair rate of return to be allowed thereon. Mr. McCarter contended that not less than 8 per cent on such valuation is just and reasonable. That was the deliberate judgment of the Wisconsin commission in the Madison case, and that, after years of reflection, is his judgment as to the minimum amount to be allowed on a well-established property, if it is to meet the requirements for betterments and extensions that will be put upon it by an increased public demand.

The proposition for decreases in rates made by Mr. McCarter is as follows:

That a schedule of rates be fixed by the board, effective for five years from Jan. 1, 1912, on a basis that will recognize the obligations of the gas and electric companies as to their respective underlying securities, and will enable the gas and electric companies to pay annually a dividend of 8 per cent on their actual capital as it will exist from year to year, over the five-year period, after deducting proper reserves for maintenance, and after further providing a moderate fund for that portion of capital expenditure which business prudence demands should not be capitalized.

Based on a careful estimate of the prospective business of both companies for the next five years, the proposition contemplates, in the case of the gas company, the putting into operation of a uniform flat rate of $1 as of Jan. 1, 1912, and on Jan. 1, 1914, the reduction of this base rate to 95 cents and on Jan. 1, 1916, the further reduction of this base rate to 90 cents. In the case of the electric company it contemplates as of Jan. 1, 1912, the adoption of the same schedule of discounts from the base rate put into effect by the New York Edison Company. The present Public Service rate steps down 1 cent for every 500 kw-hours of monthly consumption for the first five steps; the New York rate steps down 1 cent for every 250 kw-hours of monthly consumption for the first four steps. In the fourth year of the period, or on Jan. 1, 1915, the base rate is further reduced from 10 cents to 9 cents, thus combining the first two steps of the existing schedule.

There will be at the end of five years, if the prognostications as to business are reasonably accurate, a surplus over the 8 per cent dividend and reserves in the electric company of approximately $1,650,000, or an average of $330,000 a year—a sum quite inadequately. In the judgement of Mr. McCarter the electric rate should not be reduced at all. The additional earnings which would result therefrom should be used as rapidly as possible to bury wires, relieving so much the more rapidly the congested sections of the cities from overhead electrical constructions for the transmission of energy for commercial purposes.

The subject of a proper reserve for purposes of depreciation, permanent renewals, obsolescence, unforeseen catastrophes and what-not is one that has been forcing itself to the front and engaging the attention of all thoughtful men conversant with public utilities. The fact is it has become a practical necessity for companies to consider the

subject. All intelligent bankers now require it as a prerequisite to the purchase of securities. The corporation has for years given this subject a most thorough consideration, and at the time of the first large sale of the general mortgage bonds to bankers the subject was thoroughly considered by the bankers, their experts, Messrs. Stone & Webster, and by officials of the corporation, and an agreement was reached providing for the gradual accumulation of such a reserve, starting in a small way, but with as large an amount as the company at that time was able to bear and still do its duty to the public and to its stockholders, but increasing annually. For the year 1912 the sum to be placed in the reserve is $600,000, for 1913 it is $800,000, for 1914 it is $1,000,000, and it increases from then on, proportionately with the earnings, up to $1,500,000. In addition to this, commencing in 1913, the corporation is obliged to establish a sinking fund, amounting to $209,500 annually, for the retirement of general-mortgage bonds.

Mr. McCarter would feel justified in appealing to the board for protection by raising rates against any action by any other arm of the State government, the effect of which was to make impossible the results herein outlined, such as, for example, any new form of taxation largely in excess of that now in force.

Estimates of the earnings of the Public Service Electric Company for the next five years show gross earnings of $7,649,873 in 1912. And the increases are figured at 12 per cent in 1912, 11 per cent in 1913 and 10 per cent annually for the rest of the period. The operating ratio is computed at 46 per cent. The decreases expected from reduction are deducted from the net earnings in the estimate.

The corporation is now paying dividends at the rate of 6 per cent per annum. Mr. McCarter added that it has been the frank hope of the management that the earnings for 1912 would justify placing the corporation upon a 7 per cent basis, and in 1913 upon an 8 per cent basis, there to remain at least for the early future. Using the results shown as a basis, it is apparent that if this plan be adopted, these expectations will not be realized, and all that the corporation can hope to do is to continue its 6 per cent dividend in 1912 and the first half of 1913, and thereafter during the period probably pay a 7 per cent dividend, accumulating, in addition thereto, a surplus that in the later years might justify an 8 per cent dividend.

In conclusion, Mr. McCarter stated that a great opportunity is here presented for a just and honorable settlement of what otherwise might turn out to be the most dangerous and perplexing problem that has been injected into the public affairs of New Jersey since the days of the civil war. The corporation has still left available for improvement $20,000,000 of bonds. Its supply of bonds will then be exhausted. Future funds for the development of these great properties can come only from three sources—the expenditure of the reserve for construction purposes, the investment of further surplus earnings, and additional issues of stock. As the municipalities grow larger and larger the amount of money annually needed for improvements will increase. It has averaged over $6,000,000 a year since the formation of the corporation.

Discussing the claim that the corporation is active in politics, Mr. McCarter added that just as long as approximately 10 per cent of the bills introduced into the Legislature at Trenton directly affect the business of the corporation just so long will the corporation not only be justified but required to defend itself from such attacks by any legitimate means within its power. Two-thirds of the bills have no excuse for their existence other than an attempt on the part of the introducer to pander to popular clamor or to blackmail the corporation. The board could perform no better work than helping to take the corporation out of politics, and in no way could that work be better started than by a permanent adjustment of the matters under discussion.

The Kansas Workmen's Compensation Act.

The new workmen's compensation act recently passed b[y] the Kansas Legislature represents almost a complete re[-] versal of the usual legal principles under which an injur[ed] employee may seek redress by civil suit for damages. T[he] new law recognizes only the paramount fact that the em[-] ployee injured has lost a part or all of his earning pow[er] as a sacrifice to the industry in which he is engaged, a[nd] then proceeds to fix definite amounts for damages due hi[m] or his dependents, based on the extent of his injury a[nd] his former earning power. The relations defined are [so] simple as to be calculable even without pencil and pap[er] and under these definite provisions the employee is a[s-] sured the full amount of the damages paid, without t[he] usual heavy legal and court fees which so often absorb t[he] major part of the amount deserved by the injured man.

In explaining the provisions of the act before the Kans[as] Electrical Association at Independence, Sept. 21, M[r.] Charles Kerr, representative from the Sixth State Distri[ct] and, with Mr. H. E. Gauss, of the State Senate, jo[int] author of the bill, presented figures to show that of $25[0,-] 000 expended on workmen's damage suits during a rec[ent] year in the Kansas courts only 16 per cent actually reac[hed] the injured men on whose behalf the cases were broug[ht,] the rest going for insurance, legal expenses, court f[ees,] etc. Data taken from 11,000 accident cases, said Mr. K[err,] also show that the injured workmen were actually rec[om-] pensed by only 20 per cent of the losses they sustai[ned] through their injuries. The new law is designed to reli[eve] both employer and employee of the heavy tolls thus char[ged] for this inequitable distribution of benefits from inj[ury] suits, in which only the smallest part of the money s[pent] by the employers really reaches the employees.

The provisions of the new law apply specifically, am[ong] other subjects, to all "electrical work" connected with [the] construction, installation, operation, alteration, remova[l or] repair of wires, cables, switchboards or apparatus [used] for the transmission of electrical energy, and to wor[k in] electric-lighting plants, electric-power plants, water-po[wer] plants, steam-heating plants, artificial-gas plants and st[reet] and interurban electric railways.

Where the workman dies as a result of his inju[ry,] leaving others who are wholly dependent on his earn[ings,] the latter are by the new statute entitled to an am[ount] three times his annual rate of average wages, but not [less] than $1200 or more than $3600. If these dependents r[eside] abroad the award is limited to $750. In case the dep[end-] ents did not rely wholly for support upon the man k[illed] they are entitled to receive an amount as above pr[opor-] tional to their sustained loss. If the decedent ha[s no] dependents the employer is required to pay only a re[ason-] able amount for medical attendance and burial, not ex[ceed-] ing $100.

Where the injury results in total incapacity for [work] the injured man is entitled to payment—during the [period] of his incapacity after the second week, but for a p[eriod] not exceeding ten years in all—of an amount equal [to 50] per cent of his daily earnings, but not more than $2. [nor] less than $1 per day. In case of partial disabilit[y the] allowance ranges from 50 per cent down to 25 per ce[nt of] the former wages. In the case of persons under 21 [years] of age receiving less than $10 weekly the limiting [com-] pensation prescribed is 75 per cent of the former wag[es].

The above rates of workmen's compensation apply [only] when the injury received occurred in the regular cou[rse] of work of the employee and are rendered void, of c[ourse,] if it is shown that he deliberately intended the i[njury,] willfully failed to use guards or precautions provid[ed by] the employer, or was intoxicated at the time of the [acci-] dent. Contingent fees of attorneys for services an[d pro-] ceedings under the compensation act must be in [every] case subject to the approval of the court having ju[risdic-]

tion. The insertion of this clause has the purpose of preventing any extortionate rates of contingent fees under the act.

The general provisions of the Kansas law apply only to employers having five or more employees in their service and who have elected before the accident to come within the provisions of the law. Such election on the employer's part to come within the terms of the new law is binding upon him for the period of a year, and also thereafter without further act on his part, unless he has filed sixty-day notice withdrawing his election. All employees entitled to come within the protection of the act are presumed to have done so without specific election on their part. They may, however, withdraw from the provisions of the act if they desire, after giving notice to their employer. Where such withdrawal is made, however, as a condition of employment the contract between employer and workman becomes void. In case an employer who has elected not to come under the provisions of the law is afterward sued by an injured workman his customary legal defenses of assumed risk, fellow-servant act and contributory negligence are removed by the terms of the new statute.

California Public Utility Constitutional Amendments.

As a result of a special election Oct. 10, held for the purpose of voting upon twenty-three amendments to the State ...stitution, two amendments relating to public utilities ...re adopted. One of these authorizes the Legislature to ...arge the powers of the State Railroad Commission and ...end its jurisdiction to include all public service corpor...ns, while the other extends the power of municipalities ...r building utilities.

...he first mentioned declares that every private corpora... and every individual or association of individuals ...ning or operating any commercial railroad, interurban ...ilroad, street railway, canal, pipe line, plant or any equip...ent relating to such, for the transportation of passengers ...r freight, or for the transmission of telephone or tele...raph messages, or for the production, generation, trans...ission, delivery or furnishing of heat, light, water or ...wer, and every common carrier, is a public utility, subject ...ontrol and regulation by the railroad commission. The ...mmission shall have the power to supervise and regulate ...l public utilities and to fix the rates to be charged for ...e commodities furnished or for services rendered. The ...ght of the Legislature to confer powers upon the Railroad ...mmission respecting public utilities is declared to be ...enary and to be unlimited by any provisions of the con...tution.

...ll powers now vested in boards of supervisors or ...icipal councils or other governing bodies of the coun... cities and towns, or in any commission created by ... and existing at this time, shall cease so far as such ...rs shall conflict with those conferred upon the State ...ilroad Commission; provided, however, that at an elec...n to be held pursuant to laws a majority of the qualified ...ctors may vote to retain such powers, and until such ...ction the said powers shall continue unimpaired. If the ...te should not prove favorable to retention the powers ...ome vested in the railroad commission, or a vote may ... taken expressly for the purpose of surrendering such ...wers to the railroad commission, with provision that the ...wer may be reinvested by a vote of the counties, cities ...c towns.

...y the second constitutional amendment any municipal ...poration may establish and operate public works for ...plying its inhabitants with light, water, power, heat, ...nsportation, telephone service or other means of com...nication. Such works may be acquired by original con...ction or by the purchase of existing works, including franchises. Persons or corporations may establish and operate works under the regulations prescribed by the municipality on condition that the municipal government shall have the right to regulate the charges thereof. A municipal corporation may furnish service to inhabitants outside its boundaries; provided that it shall not furnish any service to the inhabitants of any other municipality owning or operating similar works without the consent of such municipality expressed by ordinance.

By another constitutional amendment the Railroad Commission is increased from three to five members, to be appointed by the Governor, instead of being elective, as heretofore. The term is extended from four to six years. Members of the commission may be removed from office for just cause by a two-thirds vote of the Legislature.

By a Senate constitutional amendment the Legislature may create and enforce a liability on the part of all employers to compensate their employees for any injury incurred in the course of their employment, irrespective of the fault of either party. Settlement of any dispute under this legislation may be by arbitration or by an industrial accident board, by the courts, or by all of these agencies, at the discretion of the Legislature, anything in the constitution to the contrary notwithstanding.

New York Commission News.

The Public Service Commission, Second District, has received a complaint from Charles Berger, of New York City, a subscriber of the New York Telephone Company, directed against that company, asking that the commission make an order directing and requiring the telephone company to adjust the rates charged for local messages in excess of those included in the yearly rate on the basis of allowing any unused messages to apply as a credit to any succeeding year of such contract. He states that during the year 1910 he used about 650 messages, during the year 1909 about 400 messages and during the year 1908 about 225 messages, while up to Oct. 1 this year he has used about 825 messages, for which the company is charging him $4 per month plus 5 cents for each local message. He alleges that it is unreasonable for the company to charge him for excess local calls above the 600 for this year, when during the years 1908 and 1909 he used only about half of the 600 calls allowed under his contract each year, and also that it is unreasonable to charge him $4 per month in addition to the 5 cents for each message that he has been charged with since the 600 local messages were used. The telephone company has been required to answer the complaint within twenty days.

CURRENT NEWS AND NOTES.

Los Angeles A. I. E. E. Section.—The Los Angeles Section of the American Institute of Electrical Engineers opened the season of 1911-12 with an informal dinner on Oct. 17, at which Dr. J. A. B. Scherer, president of Throop Polytechnic Institute, Pasadena, delivered an address on "Technical Education from the Practical Standpoint."

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Deep-Waterways Convention.—The sixth annual convention of the Lakes-to-the-Gulf Deep-Waterways Association was held in Chicago on Oct. 12, 13 and 14. The association reaffirmed its demand for a 14-ft. waterway in the Illinois River and Mississippi River, connecting Lake Michigan and the Gulf of Mexico. Politics was tabooed, and there was no action on water-power possibilities, which, in Illinois, are affected by politics.

Nobel Prize for Edison.—It is reported that the Nobel prize for physics of about $40,000 will this year be awarded to Mr. Thomas A. Edison. The prize in previous years has gone to Röntgen, Lorenz and Zeeman, the Curies and Becquerel, Rayleigh, Lenard, J. J. Thomson, Michelson, Lippman, Marconi and Braun, and Van der Waals.

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New York Companies' Section, N. E. L. A.—The first meeting of the season of the New York Companies' Section of the N. E. L. A. was held in the Edison auditorium, Oct. 16. The meeting was given over to discussion on contest papers dealing with the technical, accounting and commercial sides of the recent N. E. L. A. convention in New York.

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Annual Banquet of Commonwealth Edison Section, N. E. L. A.—The annual banquet of the Commonwealth Edison Company Section of the National Electric Light Association will be held at the Sherman House, Chicago, on the evening of Nov. 1. At that time announcement will be made of the result of the spirited election for officers of the section that has been in progress.

* * *

Commercial Vehicles in Denver.—According to the *Denver Municipal Facts,* Denver possesses more power trucks per capita than several other leading cities where such figures are available. Denver has one truck to every 1800 inhabitants, Philadelphia one to 3000, Cleveland one to 5000, Seattle one to 3000, Los Angeles one to 4400, San Francisco one to 5200 and Oakland one to 2500.

* * *

Valparaiso (Ind.) Company to Purchase Electricity at Wholesale.—The Valparaiso Lighting Company, of Valparaiso, Ind., belonging to the Kelsey-Brewer Syndicate, of Grand Rapids, Mich., will shut down its plant and buy electrical energy at wholesale from the Northern Indiana Gas & Electric Company, which operates throughout an extensive area along the southern shore of Lake Michigan.

* * *

Comparison of Voltmeters and Ammeters.—The Bureau of Standards, Washington, has issued as reprint No. 163 a paper which recently appeared in the *Bulletin* of the bureau, giving a comparison of American direct-current switchboard voltmeters and ammeters. The comparison is under eight heads, namely, accuracy of calibration, effect of stray fields, damping, mechanical balance of moving parts, resistance and power consumption, zero shift, insulators resistance, temperature coefficient and ruggedness of moving system. One section of the paper deals with details of construction.

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Explosion of Blow-off Tank in Power House.—A blow-off tank used for the blowing out of boilers exploded in the power house of the Metropolitan West Side Elevated Railway Company on Throop Street, Chicago, at 12:40 a. m. on Oct. 9. Three of the boilers had been blown out and the power-house attendants were blowing out a fourth when the accident occurred. The blow-out tank was made of iron and had a connection to the sewer and also a vent to relieve the pressure. It was ruptured by the explosion, which also blew down a portion of the side wall of that portion of the building and a section of the tile roof which was about it. The damage was not great, being estimated at $2,000. None of the boilers, engines, generators or other machinery was injured. There was some damage to the adjacent elevated-railway structure, but traffic was not interrupted seriously, for, fortunately, the trouble occurred at the time when travel is light. The cause of the accident is not known, as after the explosion the vent was tested and found unobstructed. The power house in question supplies about two-thirds of the energy required for the system, the remainder being purchased from the Commonwealth Edison Company.

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Probably No Chicago Electrical Show Next Year.—It is reported that there may be no electrical show in Chicago next year. Beginning in 1906 the Electrical Trades Exposition Company has given an electrical show every January in the Coliseum. These exhibitions have been largely attended and very interesting, with spectacular lighting effects. As the number of electrical shows throughout the country has increased, however, electrical manufacturers and dealers have protested against the increasing expense. At the 1911 Chicago show a profit-sharing plan was announced, but it appears not to have been successful, and in consequence of the disaffection of many former exhibitors it is probable that the 1912 show will be omitted. There has been no official announcement on the subject, however.

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Northern Indiana Gas & Electric Company's Extension.—The Northern Indiana Gas & Electric Company is planning to erect a new substation at the corner of Sheffield Avenue and Hanover Street, in Hammond, Ind. The company has arranged to purchase the surplus energy of the Chicago, Lake Shore & South Bend Railway Company operating between Chicago and South Bend, Ind., which has a large generating station at Michigan City, Ind., 35 miles east of Hammond. The new substation is designed to utilize this supply of energy. Electricity will be received at 33,000 volts from an overhead transmission line and reduced to 6600 volts in the substation. While the railway is operated single-phase, the electricity sold to the central station company will be three-phase, 60-cycle. Three 750 kw transformers will be installed, and the substation will also be equipped with high-tension switching apparatus and tub-regulating transformers. From Hammond the Northern Indiana Gas & Electric Company transmits electricity for general commercial purposes to East Chicago, Indiana Harbor and Whiting, as well as in the city of Hammond itself. The area covered is devoted largely to manufacturing purposes, and the industries gathered here are expanding rapidly both in number and extent. Mr. W. I Ray is general manager of the company.

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Philadelphia Electric Company Section.—The active work of the Philadelphia Electric Company Section for the season was inaugurated on Sept. 25, with the meeting of the Commercial Department Branch. Mr. R. L. Lloyd read a paper on "Refrigeration from the Commercial Standpoint." On Oct. 5 the Accounting Department Branch gave close attention to a paper entitled "The Accounting System of the Philadelphia Electric Company," by Mr. Frank A. Birch. The Meter Department Branch held a meeting Oct. 6, when a paper on Fort Wayne and Westinghouse meters was presented by Mr. W. H. Donley. The formation of an Engineering Department Branch is anticipated, with others to follow. The October meeting of the Section was held Oct. 13. All branches, as well as members not yet identified with any departmental branch, attended. The membership committee reported a total membership of 533. Chairman Sproule made the announcement that Past-president Wm. C. L. Eglin had donated a handsome gold watch to be awarded as a prize for the best paper presented at any department branch meeting of the section by a Class "B" member of the N. E. L. A. President John Gilchrist of the N. E. L. A., Mr. R. S. Orr, president of the Pennsylvania Electric Association; Mr. Wm. C. L. Eglin and Mr. A. R. Granger addressed the meeting.

EXPOSITION OF NEW INVENTIONS.—What is said to have ... "first international exposition of new inventions" ...as held at the Coliseum, St. Louis, during the week ended ...ept. 6. Several electrical devices were shown.

* * *

W...ELESS SPANS THE PACIFIC.—For the first time in the ...sto... of wireless transmission communication was estab...she... Oct. 5 between the San Francisco operator at Hill ...res and the Hokushu station, Japan, 6000 miles distant. ...okusu is the most northern wireless station of Japan.

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BULGARIAN INTERNATIONAL EXPOSITION.—An interna...ona... exposition will be held in Sofia, Bulgaria, next sum...er ...ring the months of June, July and August. Full ...articulars concerning the exposition may be obtained upon ...pplication to the organization committee, 5 Alexander ...

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ELECTRIC SIGNS IN PARIS.—The prefect of the Depart...ent of the Seine has decided to put a stop to the constant ... in illuminated street signs, which are transform... ...rincipal boulevards of Paris into thoroughfares, ...ing streets in an ordinary inartistic American ...ty." Henceforth a heavy fine will be imposed on all ...gns of this description.

* * *

MODERN POLE LINES.—The consumption of poles for tele...one, telegraph, steam and electric railway and light and ...mpanies during 1910 fell little short of 4,000,000 ... the 3,870,694 poles purchased during 1910, 2,831,-... ...2 per cent, were reported by telephone and tele... ...panies; 733,092, or 18.9 per cent, by electric rail... ...t and power companies, and 305,792, or 7.9 per ... steam railroad companies. In 1909 the total pur... ...re 3,737,740 poles compared with 3,249,154 in 1908 ... 268 in 1907. Cedar wood supplied the largest pro... ...aving contributed 62.8 per cent for 1910, against ...3 per cent in 1909 and 64.2 per cent in 1907. In 1910 ...per cent of the total purchases reported were subjected ...some sort of preservative treatment to increase their ...

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... SUBWAY PROJECT.—The local transportation ... of the City Council of Chicago does not ... in the Mayor's proposal that the proposed pas...way shall be built by a subway commission ... to the Mayor. The committee has amended the ... offered by the Mayor in such a manner that, if ...led ordinance is adopted, the members of the ...mmission shall be appointed "by and with the ...nd confirmation" of the City Council and shall ...ir plans and specifications to the City Council ...n to the Mayor. The Mayor says that the oppo...me of the aldermen to his plan is only a cloak ...tion to a subway of any description. A refer...e on the question of whether Chicago shall build ...wn passenger subway has been suggested.

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...L ENGINEERING AT UNIVERSITY OF MINNESOTA. ...ear course in electrical engineering has now been ...n for three years at the University of Minne... ...is giving good satisfaction. The work of all en... students is uniform during the first year, but in ... year the civil engineering course begins differ... by substituting geology and surveying for the ... of the course in electrical and mechanical engi... In the third year the electrical and mechanical ...gin to diverge, one taking up applied electricity ... ther fuel analysis. After the successful comple... ...e first four years of work, the degree of bachelor ... in engineering is conferred. The work of the ... is more definitely specialized, leading to the de... ...ivil, electrical or mechanical engineer. A considerable number of students take only the more general work of the four years, and do not qualify as engineers.

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MOTOR-DRIVEN BLOCK SIGNALS.—Extensive applications of electricity to block signaling on the Harriman lines in the Far West have been utilized by the management as a means of stimulating passenger traffic through the display of full-sized working safety-signal equipments at many important stations and city ticket offices. The signal equipments are shown with glass fronts, behind which the motor-driving mechanism and control apparatus can be seen in full operation, and the standard movements and lantern colors are indicated during the day and at night correspondingly. In a typical home and distant-signal exhibit at Salt Lake City the company points out that in the calendar year 1910 the Union Pacific and Oregon Short Line railroads carried 49,491,000 passengers without fatal injury to any. The manner of working is outlined and the protection against collision, broken rails, misplaced switches and faulty clearance on sidings or switches is emphasized. The value of electricity in protecting train movements, as shown by these exhibits, is keenly appreciated by the public.

* * *

CONVENTION OF RAILWAY ELECTRICAL ENGINEERS.—The fourth annual convention of the Association of Railway Electrical Engineers will be held in Chicago at the La Salle Hotel from Nov. 7 to 10. There will be morning and afternoon sessions on each of the four days indicated. Among the papers to be presented are the following: *Insulation,* by Mr. K. R. Stranberg; *The Light for Safety,* by Mr. F. R. Fortune, and *Industrial Trucks for Railway Service,* by Mr. T. V. Buckwalter. There will be reports of committees on "Data and Information," "Car Ventilation," "Standards," "Improvements," "Shop Practice," "Specifications," and "Accounts and Reports." The entertainment features include a dance, a theater party and an automobile tour. Space has been provided for twenty-nine exhibits by manufacturers. The officers of the Association of Railway Electrical Engineers are: President, Mr. J. R. Sloan; vice-president, Mr. F. R. Frost; secretary-treasurer, Mr. J. Andreucetti. The exhibits and entertainment are in charge of the Railway Electrical Supply Manufacturers' Association, of which Mr. H. A. Moore is president and Mr. J. Scribner secretary.

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NEW YORK SECTION, I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society held on Oct. 12 brief reviews and discussions were given of the papers presented at the Chicago convention by Messrs. A. J. Marshall, H. E. Ives, S. W. Ashe, G. H. Stickney, N. Macbeth, L. B. Marks, A. S. McAllister and E. L. Elliott. Abstracts of the papers and the discussion thereon at Chicago appeared in our issues dated Sept. 30 and Oct. 7. In commenting on the paper entitled "The Analysis of Performance and Cost Data in Illuminating Engineering," Mr. Macbeth claimed that it would be unwise to permit the representatives of manufacturers to submit papers containing performance and cost data relating to commercial types of lamps, because the data thus submitted would subsequently be published as having received the official indorsement of the Illuminating Engineering Society. In commenting on the paper entitled "The Effectiveness of Light as Influenced by Systems and Surroundings," Mr. Marks expressed the opinion that the observations recorded in the paper did not justify the conclusions drawn by the author relative to the advantages of the indirect over the direct system of lighting. Dr. Ives pointed out that the author failed to take account of the variables and constants in the problem so that his observations could not be classed as investigations. Moreover, the visual acuity method of determining the illumination with a printed page as the test object is subject to variation by different observers throughout a range of several hundred per cent.

Mexican Technical School.—The Mexican government will establish a school of electrical science and telegraphy in the Government Building in Calle de Chiquis. Mexico City. Correspondence instruction is to be maintained in connection with the school.

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Central-Station Service in Europe.—The annual kw-hour output of the principal electric-lighting company in Paris is little more than twice that of Scranton, Pa., and Brussels, Belgium, with a population of 750,000, has an output about equal to that of Marion, Ind.

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Rewiring of Colorado Capitol.—The Colorado Legislature has authorized the complete rewiring in conduit of the Colorado Capitol at Denver. This work will cost about $40,000. The $10,000 available this year is being placed in the rewiring of the basement and the attic, following the recommendation of Mr. W. J. Canada, electrical engineer of the Rocky Mountain Fire Underwriters' Association.

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Institute of Operating Engineers.—The educational committee of the Institute of Operating Engineers is now working on the lesson papers to be used in the various studies by those who intend to follow the courses of the institute. The institute courses have recently been adopted in Armour and Lewis Institutes, of Chicago, and Y. M. C. A. classes in New York City, Buffalo and Denver.

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Another Screw Standard.—The Society of Automobile Engineers has announced the details of a new screw standard devised by a committee of the society, which supplants a standard adopted in 1906 by the Association of Licensed Automobile Manufacturers. While screw standards are thus increasing in this country, the metric screw standard has finally supplanted all others on the continent of Europe.

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Diesel Marine Engines.—The British Admiralty has placed an order for a Diesel engine of 6000 hp for a warship and another for a torpedo-boat destroyer, the latter to have a horse-power of 1000. An English firm of shipowners has ordered a Diesel marine engine for a 6000-ton vessel, and a Hamburg line freight vessel now under construction will have a Diesel marine engine. Two vessels of the German Woermann Line are powered with Diesel engines, which have been working satisfactorily for some time. This type of engine is also being applied to a new type of submarine vessels.

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Electrolysis in Chicago.—The commissioner of public works of Chicago has notified the elevated and surface railways of Chicago to take measures to stop the leakage of electricity from their structures and rail returns, as it is asserted that electrolytic corrosion caused by such escaping current causes damage to the city's water mains and bridges. The complaint is based on a report by Mr. Ray Palmer, a consulting engineer retained by the city to make an investigation of the electrolysis problem, as related in an article in the *Electrical World* of Aug. 19, 1911, page 431, entitled "Electrolysis Situation in Chicago."

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Electrical Equipment of Chicago & Northwestern Terminal.—G. Neiler, the engineer who designed the electrical and mechanical equipment of the new passenger terminal of the Chicago & Northwestern Railway in Chicago, read, in abstract, a comprehensive paper describing the installation before the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers on Sept. 27. This is the third of three long and profusely illustrated papers describing various engineering features of the termi[nal] read before the Western Society within the la[st] [fe]w weeks. The electrical and mechanical equipment, [w]hich cost about $1,500,000, is very elaborate and complet[e], containing many special applications of great interest. [It was] described in two articles published in the *Electrical* [World] of Aug. 19 and Aug. 26 last. Mr. Neiler made th[e inter]esting statement that the exhaust-steam turbo-ge[nerator] (which supplements main generating units havin[g] condensing reciprocating engines) produces el[ectrical] energy at less than 0.1 cent per kw-hour. Messrs. [ ] Seely (who presided), A. Bement, F. J. Ravlin an[d] Fowle took part in a brief discussion.

* * *

Privacy of Telegraphic Communication.—Mr. [ ] B. Lowe, a prominent broker, and four other m[en have] been arrested in Salt Lake City on charges of [ ] stock quotations and stock information from the [ ] New York wires of E. F. Hutton & Company, broke[rs]. [The] arrests were the result of a long search directed by [ ] Brothers, local representatives of E. F. Hutton & C[ompany], as to the source from which the Lowe brokerage [ ] obtained information which supposedly only [ ] Brothers should know. Expert wiremen in con[nection] with Pinkerton detectives ascertained that it was ca[ ] megaphone and vibrators from the sounders in [ ] Brothers' office and then transmitted over private [ ] San Francisco under supervision of Moss & Com[ ] independent brokerage firm of that place. As th[ ] no actual electrical connections to the wires of E. [F. Hut]ton & Company, the men could not be charged w[ith] tapping, but are held under bail on charges of rea[ ] using information from telegraphic messages not a[ ] to them, this being punishable in Utah by from o[ ] years' imprisonment or a fine of $1,000. Represent[ ] all of the firms involved aver that widespread inve[ ] will be held. Undoubtedly the result will be wa[ ] with great interest by the telegraph and teleph[one com]panies.

* * *

Cincinnati Central-Station Tax Valuati[on].—[The] Ohio State Tax Commission granted another [ ] to the Union Gas & Electric Company of Cincinn[ati] final valuation of $15,000,000 placed on its pr[ ] which Vice-president R. W. White made the argu[ ] the company had been placed at a great disadv[antage] the backward spirit in Cincinnati, which makes [ ] impossible to sell gas and electrical energy at [ ] The conservative German element was blamed f[or] a grea[t] part of this, and the assertion was made that the [ ] sells only about half as much gas per meter as [ ] city in the county. The company has more adve[ ]tions to meet, he said, than any other compa[ny] United States and perhaps in the world. It had [ ]ing $140,000 a year as taxes, but the new valuat[ion] require it to pay $190,000. Federal and state ex[ ] will increase this materially. In addition the Pub[lic] Commission is likely to require extensions wher[e] not profitable, and it is possible that the electrical [ ] have to be abandoned and a new one built beca[use] impossibility of securing canal water for the c[ ] Judge R. M. Ditty, chairman of the commission, [st]ated th[at] this body has nothing to do with the amount of [m]oney th[at] is paid in taxes, as that lies wholly with the [l]ocal ta[x] officials, but that it is its duty to place the ful[l v]aluatio[n] upon all public utility properties. He indicate[d] that th[e] valuation in this case is really too low if any [mi]stake ha[s] been made. He also said that the commission [h]as spe[nt] more time upon this company and given it a m[or]e carefu[l] investigation and consideration than any other [o]ne in t[he] State. He promised, however, to hear further [a]rgumen[t] and examine further data in order to satisfy b[oth] sides [of] the controversy.

A KANSAS NATURAL-GAS-DRIVEN STATION.

...ctricity for Power Competes Successfully with Natural Gas in Independence, Kan.

...ns Built 500-hp Gas Engine.—Jacket Water-Cooling ...wer.—Forty Electric Pleasure Vehicles in Town of 12,000 Inhabitants.

T...E history of the application of gas engines to drive central-station lighting plants in the Southwest has hardly yet become one of uneventful satisfaction. ... rest is still felt in stations of this kind operating ... gas which have proved really thorough and ... successes after several years of operation. A ... small station of the kind is that of the Inde... Electric Company, at Independence, Kan., a ...nt which contains three different types of gas ... includes several ideas of novelty in its arrange...

...aust and cooling tower for the jacket and pis...ing water.

... respects as well, besides its internal-combustion ...ation, is the Independence central-station situa... worthy interest among similar towns of 12,000 ... In spite of cheap natural gas a number of the ...ries are operated from the lines of the electric ...hose connected load in motors is larger than its ...ting peak. But perhaps most notable of all is ... of electric pleasure vehicles in use in Inde... where nearly forty cars provide a desirable off...ng load for the plant.

GAS-ENGINE EQUIPMENT.

... engine equipment of the Independence plant ... 500-kw horizontal, twin-tandem, double-acting ...rch engine driving a 2300-volt, 60-cycle, three-...nator made by the Electric Machinery Company, ...polis; a Snow twin-tandem, double-acting, hori...ne driving a 200-kw General Electric alternator ... m., and a 100-hp Westinghouse vertical three-...gine belted to a 75-kw General Electric alter... ...e small Westinghouse engine is the original ... the station, but is now reserved for auxiliary ... se of breakdown of the other two units. The 200-kw Snow engine set is employed on Sunday, when the large engine is shut down for general overhauling and inspection. Under the present schedule of operation the 500-kw Strait engine, the principal unit of the station, is thus run continuously from 4 o'clock Sunday evening until 8 o'clock the following Sunday morning, and has been carrying out this program without interruption during the eighteen months it has been in service. Except for its periodical Sunday rests this engine has been shut down only five times, for a total of nine hours, during the period of its service.

The performance of the Independence plant has been watched with much interest by other Kansas plant operators, who feel a state pride in the fact that this large 500-kw engine was built on Kansas soil at Kansas City, Kan., and although it was the first gas engine which its designer, Mr. H. O. Hem, had ever built, it started up eagerly when first turned over in the Independence plant, and has been run without interruption since. As already noted, the unit is of the horizontal twin-tandem, double-acting type, with cylinders 16 in. by 30 in., and is direct-connected to drive its alternator and a 64,000-lb., 12-ft. flywheel at 150 r.p.m.. The exciter is belt-driven.

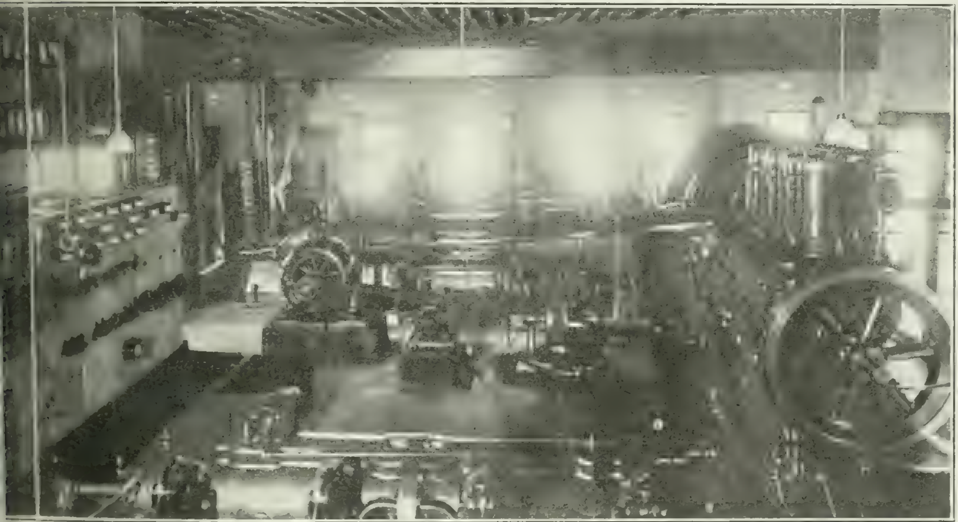

Fig. 1—Interior of Gas-Engine Station of Independence Electric Company, Independence, Kan.

ENGINE DETAILS.

Several unique features of design characterize this engine. The fuel mixture is separately supplied to each end of each cylinder, thus enabling any cylinder to be cut off if desired and insuring short passages between the throttles and cylinders, so that a governor action of the valves is at once effective in regulating the gas entering the cylinders. Lubricating oil is fed under pressure to the cylinders and exhaust valves, the lubricating ports being so positioned that the oil flows down both sides of the wearing surfaces. The speed of the engine is controlled by a high-speed centrifugal governor, which develops a controlling thrust of 500 lb. with 3 per cent variation in speed. This governor acts through a system of rods to control the mixing valves for each cylinder. These mixing valves are constructed with exposed spanner-wrench grips so that with the aid of an indicator stamped on the steel any valve can be set to any desired aperture without dismantling the valve or shutting down the engine. Each cylinder is also ignited on opposite sides to insure rapid and effective combustion of

the charge. The eight igniters are controlled from a timing commutator, with adjustable rocker arm, mounted on the half-speed lay-shaft. The ignition energy is taken from the exciter.

The lay-shafts are further unique in being each driven

Fig. 2—500-kw Horizontal, Twin-Tandem, Double-Acting Gas-Engine Unit.

through two pairs of bevel gears and an intermediate shaft set at an angle of about 20 deg. with the lay-shafts themselves. By the arrangement of this peculiar drive, for which special gear teeth were required, the lay-shaft is not only dropped several inches below the engine-shaft center-line, but is also brought in much closer to cylinder casings, so that the shaft and its eccentrics are out of the way. As the lay-shaft is below the piston center-line and the guides have been cast with specially large openings it is possible to reach the bolts inside, as well as to remove the interior cylinder heads through these guide openings. The cylinders are also cast with split jackets so as to be easily accessible.

The manufacturers had assured the Independence Electric Company that even the exhaust valves might be removed and changed with the engine running without affecting its operation or load. Recently a spring broke in one of the valves, and although this did not require the dismantling of the valve, the entire exhaust-valve mechanism was removed and restored by four men working three hours, the engine meanwhile carrying its load unaffected. Before this experiment was tried it had been the intention to purchase a duplicate of the present unit for use in case of shut-down, but after finding that the exhaust valves might be thus replaced with the engine running the intended purchase of auxiliary equipment was confined to an extra exhaust valve. Ample circulation of water is permitted through the exhaust valves, so that even the paint remains unscorched on these valves after nearly two years' operation. The hand-valves controlling the various circulating-water lines are all grouped together at the head ends of the cylinders, together with the discharge pipes, so that the temperature and volume of any circulation can be determined conveniently while manipulating the corresponding valve.

TESTS AND EFFICIENCIES.

Under the average operating conditions of the Independence plant during a thirty-day test, including periods of light as well as full loading, a kw-hour was produced for every 20 cu. ft. of gas taken by the engines. This natural gas, which comes from the Oklahoma fields, has a fuel value of about 950 lb.-Fahr. heat units per cubic foot. Under conditions of half to 60 per cent load at the time of another test the engine produced a hp-hour on 11.75 cu. ft. of gas. These results were taken from tests made at the local plant, during the course of which the indicator card reproduced herewith (Fig. 4) was made.

The Snow engine, which is now used for Sunday service and during emergencies, has recently been equipped with a set of mixing valves similar to those on the 500-kw engine. The cylinders of the Snow unit are 14 in. by 21 in., while those of the Westinghouse vertical three-cylinder unit measure 13 in. by 14 in.

Compressed air for starting up the engines is furnished by a 5-hp motor driving a Sterling compressor pump. The motor, like all the other station equipment, is of the alternating-current type. The gas supply lines for the e is piped in at high pressure to reducing valves and g eters, which lower its pressure from 3.5 lb. per squa in to that equivalent to 3 in. or 4 in. of water colum gas used in the plant is measured by a pair of arranged in parallel in the supply line in the station.

The exhaust gases from the engines are led outsi building to a muffler pit 8 ft. square and 8 ft. deep, c over with loose boards and earth. As they leave the these gases are partially cooled by introducing i pipe just enough water to absorb most of the heat i vaporized into steam. From the muffler pit sever pipes extend up the side of the plant wall, opening atmosphere, although all but one of these lin ordinarily kept closed. From the muffler another pip in diameter, is led up and into the cooling tower jacket water, inducing a draft which is effective ducing several degrees lower temperature of the leaving the tower.

JACKET WATER-COOLING SYSTEM.

The cooling tower is a frame structure 45 ft. h 14 ft. square, sheathed with pressed steel and painte Surmounted by a row of electric lamps beneath it cornice, its appearance is not objectionable by day Inside the tower at 6-in. distances are hung sheets mesh netting 14 ft. wide and 28 ft. long. As the poured over these it breaks up into thin sheets, span interstices, and thus presents nearly 10,000 sq. ft. of surface to the upward ascending air currents. Be temperature of the water itself additional up-draf duced by the exhaust line from the muffler pit, th which is said to cause 8 deg. Fahr. difference in temperature of the water. The Independence plant from the very low humidity which, even on hot d vails in the southeastern section of Kansas, m sometimes possible to cool the circulation water 96 deg. when the atsmosphere itself is 104 deg.

The circulation water leaves the engine cylinc temperature of about 140 deg. and is discharged in well, 4 ft. by 6 ft. in area and 4 ft. deep, just alon muffler pit. From this hot-well one of two 4-in. ce pumps, driven by a 15-hp General Electric inducti

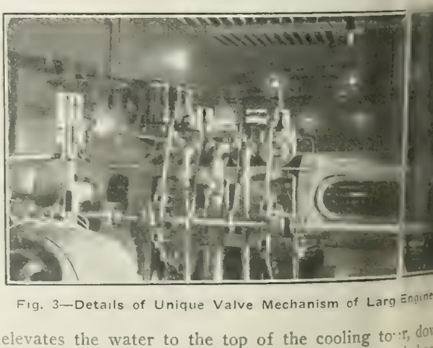

Fig. 3—Details of Unique Valve Mechanism of Larg Engine.

elevates the water to the top of the cooling tower, down which it trickles to the basin at its base. From this basin the other centrifugal pump of the pair then aga elevates the water to the 20-ft. storage tank, from which the engine jacket circulating system is supplied.

The switchboard for the plant comprises the three generator panels, three line panels and two rectifier panels for :he magnetite-arc lamps used to light Independence's streets. The constant-current transformers are mounted on a gallery behind the switchboard. A hand-operated travel-

Fig. 4—Indicator Card Taken from 500-kw Gas Engine.

g crane is installed over the 500-kw engine. This latter nit is also equipped with an automatic safety stop, which revents any tendency to overspeeding by at once opening :e ignition circuit. In a hole drilled in the 20-in. by 21-in. ace of the 12-ft., 32-ton flywheel, a steel rod suspended by spring is mounted. Should the flywheel reach a speed bove six revolutions above its normal rate of 150 r.p.m. the ntrifugal force developed causes this rod to protrude out f the hole, striking and opening a switch in the ignition rcuit. This safety stop is tested regularly every Sunday orning when the engine is ready to be shut down by lding the governor and allowing the stop to break the nition, in this way stopping the engine.

USES OF ELECTRIC ENERGY.

t the present time the Independence Electric Company 800 kw of connected motor load. Among its larger ver" customers are the local brickyard, planing mill, hine shops and local repair shops. The Coffeyville rified Brick & Tile Company has 200 hp connected load 220-volt, three-phase motors in daily use. A 40-hp motor s its auger mixer, two others operate the dry-pans, a

F 5—Cooling-Tower Muffler Pit and Exhaust and Water Circulating System.

p motor runs the bucket crane, a 15-hp motor drives epress machine, and a 10-hp motor is installed in the shed.

nother unique motor application on the company's lines n electric road roller, energized through a portable transformer from the 2300-volt, single-phase distribution lines. The roller weighs nearly 8 tons and is operated at a cost less than the maintenance of a steam roller. The machine was designed and built in Independence.

Forty electric pleasure vehicles in a town of 12,000, not exclusively a residence suburb, is an unusually high per-capita ratio and one that is probably unequaled by any other late-frontier settlement in the West. The contributing causes to this unusual development in Independence have been its 35 miles of paved streets, a numerous class of wealthy residents and satisfactory central-station service. Two public garages do an electric-vehicle charging and stabling business, and several private rectifier sets are installed. The latter obtain battery-charging service at 8 cents per kw-hour.

Mr. W. R. Murrow is secretary and general manager of the Independence Electric Company. Mr. J. Hill is engineer of the plant and Mr. C. Hill is chief electrician.

HYDROELECTRIC CENTRAL STATION AT SKAGWAY, ALASKA.

Operation by High-Head Pelton Wheel in Summer and Steam Turbine in Winter.

SKAGWAY, Alaska, situated 1000 miles north of Seattle, is reached by steamers through the famous "inside passage" and a narrow mountain inlet, called Lynn Canal. This town is the terminus of the White Pass & Yukon Railroad, which gives a daily service over the White Pass to White Horse, the head of navigation on the Yukon River. At the time of the rush of gold seekers in 1898 and 1899 the town had a population of 5000, but at the present time the population is about 800.

Skagway, being located in a valley surrounded by high snow-clad mountains, is ideally situated for the utilization of hydraulic power and good use is made of the power available. The Home Power Company, which has a modern hydraulic and steam electric plant in the town, procures water-power from the lakes and wood for fuel from the mountain sides.

At an elevation of 500 ft. above the valley is Lake

Fig. 1—Power Plant of the Home Power Company, Skagway, Alaska.

Dewey, a beautiful body of water ¾ mile in length and 700 ft. in width. A dam about 700 ft. long was installed at one end, a shorter dam was placed at the other end, thereby increasing the size of the lake. Nearly 3000 ft. in elevation is Upper Lake Dewey, 1800 ft. in length by 800 ft. in

width, the water from it flowing in a succession of falls down the mountainside into the lower lake. No attempt is made to store any large body of water in these lakes, but use is made of the supply from melting snows and glaciers, this being sufficient throughout most of the year for power purposes and the town's use; late in the winter only enough

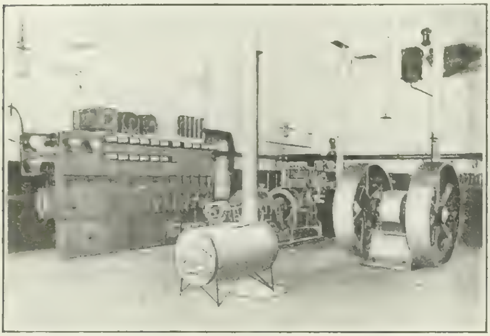

Fig. 2—Steam-Generating Equipment and Switchboard.

water for the town's use and the requirements for condensing purposes in the plant is available.

Two years ago the plant's water-power unit consisted of a Tutthill waterwheel directly connected to a 100-kw Stanley alternator, but since that time more modern machinery has been installed to meet the increasing demands.

The Stanley alternator was superseded by a General Electric 125-kw, 2300-volt, two-phase, revolving-field generator running at 900 r.p.m. and a 5-kw, 125-volt exciter belted from the generator shaft and running at 2000 r.p.m.

A Pelton waterwheel was also installed. This is now used almost continuously. There are two rows of buckets on the wheel shaft, the water supply being controlled by two hand-operated needle nozzles. A General Electric 250-kw, 2300-volt, two-phase, revolving-field generator is connected by flexible coupling to the waterwheel shaft, which runs at 600 r.p.m. A 15-kw, 125-volt exciter is belted from the generator shaft. The speed of the unit is main-

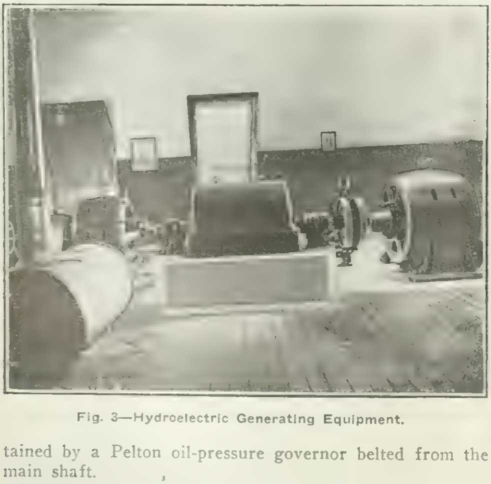

Fig. 3—Hydroelectric Generating Equipment.

tained by a Pelton oil-pressure governor belted from the main shaft.

Water is furnished from the lower lake reservoir by a 12-in. steel pipe line, giving a pressure of 215 lb. per square inch being delivered to both waterwheels. From about Dec. 15 to April 15, owing to a scarcity of the water supply, the plant is operated by steam power. The steam equipment is quite complete. It consists of one Curtis steam-turbine set of 100-kw rating running at 3600 r.p.m. and furnishing 2300-volt, two-phase service. The turbine exhausts into a jet condenser. A Snow single-cylinder air pump, running condensing, maintains a vacuum of from 24 in. to 26 in. The injector water is furnished by a 2-in. line at 60 lb. pressure. The air pump discharges into a hot-well.

A tandem-compound Ideal engine is belted to the 125-kw generator, the waterwheel being disconnected therefrom for this purpose. This engine exhausts into a Blake barometric condenser which is supplied with ejector water by a 3-in. line at 60 lb. pressure. This condenser discharges into the hot-well. The boilers consist of two B. & W. water-tube boilers, each having a steam drum 42 in. in diameter and 20 ft. in length and seventy-two 4-in. tubes. Each furnace is 7 ft. x 5 ft. in size and wood is used as fuel. The wood is purchased at $5.50 per cord delivered to the boiler-room on cars, each containing one cord. A gage pressure of 160 lb. is maintained, the safety valves being set at 165 lb. From five to seven cords of wood are burned on a twenty-four-hour run. Only one boiler is used, the other being kept in readiness.

Either of the two Snow duplex pumps are used for feeding water to the boiler from the hot-well through two closed heaters. A Hoppes purifier has been installed, bu owing to the good quality of the feed water it is not used The Ideal engine is supplied with steam from the boile header by a 6-in. line and the steam turbines by a 3-in. line

The switchboard contains eight black-slate panels as fol lows: Three machine panels, with two-phase oil switche and field-circuit switch and rheostat; two exciter panel with exciter switch and rheostat; two panels with o switches for motor-service lines, and one panel with tw single-phase oil switches for lighting circuits.

The switchboard is equipped with direct-current an meters and voltmeters; alternating-current ammeters, vol meters, synchronous indicator and watt-hour meters c motor and lighting-service circuits. All distributin switches are provided with trip coils and time-limit relay All of the wiring from the machines to the switchboard placed in conduit.

Recently a new set of 2300-volt busbars has been i stalled with an oil switch as a circuit between this set a the older set of busbars. By this arrangement one u may be operated on the motor-service lines, another one lighting circuits. Although this mode of operating is n an economical one it is necessary to give good lighti service in spite of the fluctuating motor load on the sy tem. A voltage regulator is used in connection with the go ernor when motor service is furnished, but this does r always provide good lighting service when the motor mands are heavy.

The White Pass & Yukon Railway formerly had its o steam station and also furnished some energy for comm cial lighting, but it now purchases all of its energy fr the Home Power Company. The railway shops equipped with two-phase, 220-volt motors to run lath air compressor, pumps, etc.

With the exception of about three months in the su mer, when the natural light exists throughout the nig the streets are lighted artificially by seventy 16-cp multi carbon lamps. A series-tungsten system is being plan d for the future. All energy for lighting is delivered y transformers with 110-volt secondary emf, both car n and tungsten lamps being used. A day lighting servic is maintained from motor-service lines to a number of c sumers, but the main lighting circuits are in service ly at night, the street-lighting energy being obtained from e same circuits.

The Tuthill waterwheel unit having no governor is ed only on the lighting load, but the Pelton unit is run n-

antly, except on Sunday when no motors are run, and it rries all the load in the summer months.

A low-pressure water main is used in the station for the eration of a waterwheel to which are belted two 0.5-hp, o-volt generators. These furnish energy for operating e telegraph and telephone lines of the railway company. small Racine steam engine is provided for use when cessary in place of the waterwheel.

A large percentage of the customers have meters and a te of 10 cents per kw-hour is charged. Flat-rate cusmers are charged $1 per month for each 16-cp lamp. ergy for traction power and lighting is sold to the railad company at 2.5 cents per kw-hour. A rate of $1.25 per nth for each 16-cp street lamp is given to the town. In winter time when the lighting circuits are in service about eighteen hours a day the output on them is about o kw-hours, but in the summer months when the circuits e in service for only about twelve hours a day with no eet lamps in use the output is about 375 kw-hours. The tor load for ten hours, in the day time, is about 250 -hours for the whole year. Motor service is usually rnished only in the daytime.

The manager of the company is Mr. Charles Nye, the cretary is Mr. L. A. Harrison and the station is in charge Mr. Gordon Swan, who is chief engineer for the com-. Though this electric station is situated in the North and often is the cause of surprise to visitors, it e to meet any demands made upon it for motor or ng service.

UROPEAN APPARATUS AND PROCESSES FOR THE MANUFACTURE OF ELECTROLYTIC HYPOCHLORITE.

A Promising Source of Central-Station Income from Laundries and Fabric-Cleaning Works.

By John B. C. Kershaw.

ALTHOUGH the time has not yet arrived when one-half the world lives by "taking in the washing" of the other half, a larger proportion of the popula- of cities is engaged in cleaning, bleaching and laundry ations than is generally recognized, and the last census s show that in the United States this proportion of pulation is rapidly increasing. Laundries and the so- l dry-cleaning works multiply and increase in size astonishing rapidity. The up-to-date central-station ger should find, therefore, among these laundries and eaning works (many of large size) a profitable and l outlet for electric energy. Altogether apart from estion of equipping these works with electric motors ice of hand or steam-driven machines, there is the bility of installing electrolytic bleaching apparatus will enable cleaner and whiter goods to be produced with ordinary bleaching agents, without any great in- in the cost of treatment, and with less destructive s upon the fabric.

e practical use of electrolysis to produce bleaching itions dates from 1890, when a Frenchman named Her- introduced his process at a wood-pulp factory at nfors in Sweden. Since that date a very large num- f cells for producing hypochlorite by the electrolysis rine have been patented and tried experimentally. In writer's monograph upon the "Electrochemical and trometallurgical Industries of England," published in 7 by Knapp, of Halle (as Vol. 28 of the German series Applied Electrochemistry), information will be found ting to the electrolyzers of Watt-Hermite, Vogelsang, ins and Woolf, and the practical trials that had been de with these in the years 1890-1905 in the United Kingdom. These early attempts to apply electrolytic hypochlorite to various bleaching or deodorizing purposes failed, chiefly owing to defects in the apparatus, and it is only within the last few years that success has been attained in producing a satisfactory apparatus and a fairly stable bleaching fluid at a reasonable cost. For the sodium hypochlorite produced by the electrolysis of brine it is claimed that its efficiency as a bleaching agent is much higher than that of calcium hypochlorite (the active agent of "bleach" or "chloride of lime"), while its destructive action in weakening the fiber of the goods is less. As regards the superior bleaching efficiency of the electrolytic solution, Drs. Kind, Weindel and Fraas have investigated the somewhat exaggerated claims made on its behalf and find that:

(1) Using equal amounts of chlorine, and working under similar conditions, the electrolytic bleaching liquor gives the better bleaching effect.

(2) If the bleaching effect be stopped at the same degree of whiteness the use of electrolytic liquor enables a saving of 5 per cent of chlorine to be made when working with alkaline liquor.

(3) The presence of an excess of bleaching liquor does not alter these comparative results.

(4) Increase of alkalinity diminishes the rate of bleaching but increases the final effectiveness of the bleach in the case of both electrolytic and "bleaching-powder" solutions.

In the light of these conclusions central-station managers have a good case to present when urging the adoption of electrolytic methods of preparing the bleaching solutions required by laundries and cleaning works. The chemistry of the electrolytic hypochlorite process and the details of construction of three forms of apparatus which have received practical trial in Europe are dealt with below.

THEORY OF THE ELECTROLYTIC HYPOCHLORITE CELL.

The electrolysis of solutions of chlorides always produces chlorine at the anode, and the hydrate of the base (sodium, potassium or magnesium) at the cathode. In the electrolytic alkali processes the aim of the inventor has been to effect removal of these products before they can react one with the other. In the electrolytic bleaching processes the chlorine and the caustic hydrate are allowed to react in order that the chemical changes represented by the following equations may occur:

$$3\,NaOH + 3\,Cl = 3\,NaOCl + 3\,HCl. \qquad (1)$$

Sodium hydrate and chlorine yield sodium hypochlorite and hydrochloric acid.

$$3\,NaOH + 3\,HCl = 3\,NaCl + 3\,H_2O. \qquad (2)$$

Sodium hydrate and hydrochloric acid yield sodium chloride and water.

If the temperature be allowed to rise above a certain point a further action will occur and chlorate will be produced. It is therefore necessary in all electrolytic bleaching and disinfecting processes to pay great attention to the circulation and to the temperature, as chlorates are useless for bleaching purposes.

THE SIEMENS ELECTROLYZER.

The Siemens form of hypochlorite cell is based on the patents of Dr. Karl Kellner, of Vienna, one of the early workers in applied electrochemistry. The following description is taken from an article in the *Chemical Trade Journal*, March 27, 1909:

"The Siemens 'bleaching electrolyzer' consists of a flat tank of substantial construction divided into sections by vertical glass plates. By this means a series of decomposition cells is formed; these are 'pitched' in such a manner that the solution of salt or bleaching lye must flow horizontally in a zig-zag path from cell to cell, subjected in each cell to the action of the electric current. This arrangement permits making bleaching electrolyzers for connection to any continuous-current supply at any voltage, but it is advisable not to use more than 150 volts.

"The electrodes are constructed of platinum-iridium wire net and are arranged horizontally, one above the other, in such a manner that the anode or positive electrode lies below the cathode or negative electrode. This arrangement [illegible] layers of fluid to be formed in the electrolyte

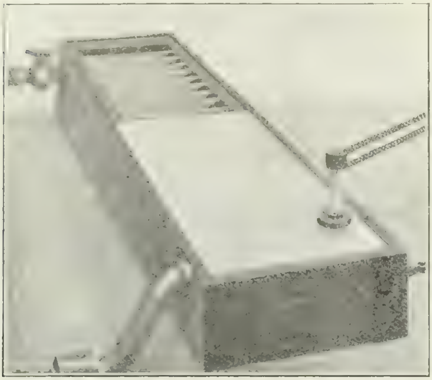

Fig. 1—Kellner's Electrolyzer.

and effects the most efficient utilization of the electrical energy. The electrodes are so arranged that no internal electrical connections of any kind are necessary. This is a great practical advantage, as connections to electrodes are well known to give considerable trouble. The Siemens electrolyzer has only two electric terminals, designed as a result of special experience, which are built into the apparatus in such a manner that it is impossible for them to be attacked by electrolytic action. The electrodes are so arranged that they can be taken out of the electrolyzer at any time for purposes of adjustment and replaced quickly. Fig. 1 shows a working model of this form of electrolyzer.

"The fitting up and working of a modern electrolytic bleaching apparatus of the Siemens type is extremely simple. The necessary quantity of salt is first dissolved in water, the solution being allowed to clarify in a second vessel. For this purpose wooden vats or tanks of brickwork, etc., are used, or the existing tanks employed for dissolving chloride of lime are generally suitable. The clear solution of salt passes into a cooling vessel, whence it is forced continuously through the electrolytic apparatus by means of a small centrifugal pump. In the course of this circulation the solution of salt is gradually decomposed by the electric current, and the bleaching lye in passing through the above-mentioned cooling vessel is kept cool by means of coils of lead pipes through which water is passed and is thus maintained at the low temperature necessary for a good output. The circulation continues to take place until the desired concentration of active chlorine has been attained. This type of cell has attained extended use in Germany and Austria in laundries and chemical cleaning works."

HASS AND OETTEL ELECTROLYZER.

The Haas and Oettel electrolyzer is distinguished from that of Kellner by the use of carbon as electrode material and by the application of the hydrogen gas liberated at the cathode to effect automatic circulation of the liquid in the vessel containing the mixed brine and hypochlorite solutions. The following description is taken from an article by F. Reuss, which appeared in the issue of the London *Electrical Review*, April 15, 1910:

"The electrolyzer consists of a rectangular stoneware box divided by the carbons into some thirty compartments, each chamber having a hole at the bottom and another at the side about 2 in. from the top. The first and last carbons in these form respectively the anode and the cathode of t apparatus.

"The electrolyzer is placed in a stoneware tank measu ing about 6 ft. long, 4 ft. wide and 3 ft. deep, and this filled with brine holding about 15 per cent of common s in solution. As soon as the circuit is completed a live effervescence commences in the cells, due to the evoluti of hydrogen, raising the level of the liquid inside the ele trolyzer and causing it to overflow through the openings the sides, while it is replaced by fresh liquor enteri through the holes in the bottom of the cell.

"As the passage of the current produces heat, the te perature is kept down by passing cold water through co placed on both sides of the electrolyzer. The circulation entirely automatic and is very effective.

"Continuous current is employed. Using about 80 a and 110 volts, ten hours is required to complete the electr ysis of 10.5 kg of chlorine, the equivalent of about 66 of bleaching powder."

A very large number of Haas and Oettel electrolyz are now in use for laundry purposes in England and Am ica, as well as on many of the steamship lines. The wri has also inspected an installation which is giving satisf tion at a large dyeing and cleaning works in the vicinity Liverpool. Fig. 2 shows a working installation of t electrolyzer.

THE HERMITE ELECTROLYZER.

An improved form of the Hermite hypochlorite cell been in use since 1905 by the sanitary authorities at Pop London, for manufacture of a disinfecting fluid, and though the writer has no definite knowledge that this has been applied in laundry and bleaching work, it will useful to include a description of it in this article. A n ture of sodium and magnesium chloride is used as the e trolyte, sodium hydrate as a preservative being added to solution as it leaves the cell. The description is taken fr a paper by C. V. Biggs read before the Faraday Society London, November, 1906:

"The system adopted at Poplar is to mix a certain qu tity of fluid in an elevated tank and then to allow this f to flow through four double troughs or cells, placed above the other, so that the liquid descends continuously gravity. Each trough is divided laterally by a parti and in each of the two divisions five distinct 'eleme

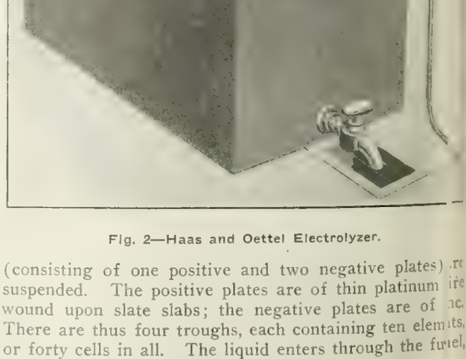

Fig. 2—Haas and Oettel Electrolyzer.

(consisting of one positive and two negative plates) are suspended. The positive plates are of thin platinum wire wound upon slate slabs; the negative plates are of zinc. There are thus four troughs, each containing ten elements, or forty cells in all. The liquid enters through the funnel,

…asses along the front division of the top trough, back …hrough the division behind, over a weir and into a sub-…ivision, from which it is drawn off by the bent-glass tube …ischarging into the second funnel. It then passes along …he front division, back through the division behind, over …he weir into the pocket of the second trough and so on to …he final bent tube, which discharges it into a carboy. A …ottle arranged at the right-hand side of the tier of cells …upplies the sodium hydroxide used as a preservative, which …ows drop by drop into the carboy as it is filling and serves …o neutralize free hypochlorous acid. As the liquid passes …hrough the troughs it is subjected to the action of a cur-…ent of 15 amp at 230 volts, which is 5.6 volts per cell."

COSTS AND CONCLUSIONS.

It is unnecessary in this article to examine in a detailed …anner the various conflicting data that have been pub-…shed concerning the comparative costs of bleaching with …ectrolytic hypochlorite and with ordinary bleaching pow-…er. Independent and unbiased investigators admit that …e electrical hypochlorite solution is the more expensive of …e two. The present writer in the discussion upon Mr …iggs' paper on the Hermite cell, read before the Faraday …ociety in 1906, made the following statement:

"For certain purposes hypochlorite of soda is much to be …referred to hypochlorite of lime, the active agent in ordi-…ary bleaching powder, and in these cases the higher cost … the former, even when produced by the electrolysis of …ine, is unlikely to retard its utilization as soon as a cheap, …liable and durable electrolytic cell for producing it is …aced upon the market. The Hermite cell and process in … original form did not fulfil these conditions, and the … judgment must be passed upon many of the patented …esses which have since been brought before the public."

…e cells described above, however, appear to fulfil the …ired conditions as cheap, reliable and durable cells for …roduction of sodium hypochlorite solutions from brine …ectrolysis. As the operation of these cells does not …re skilled attention and can be rendered intermittent …ell-known devices, they are eminently suited for in-…tion in laundries and bleach works.

…HE SEPARATION OF AN ALTERNATING-CURRENT WAVE INTO ITS HARMONIC COMPONENTS.

…mparison of Fischer-Hinnen and Runge Methods and Simplified Means of Applying the Latter.

By C. A. Pierce and William Anderson.

THERE are many different analytical and graphical methods for separating a periodic alternating wave into its harmonic components. Few of these can be c…lered usable, however, if the wave is at all complex a… accurate results are desired. One of the methods that … been used a great deal was devised by Mr. J. Fischer-Hinnen.[1] Another one was devised by Mr. C. Runge.[2] The p…pose of this article is to compare the two methods, to call a…ntion to the superior accuracy and greater brevity of the l…er and to give a new table, constructed according to R…ge, for the accurate analysis of an alternating-current w…e which contains more than the first two or three lower h…nics.

…ccording to Fourier, any periodic alternating wave can b… expressed by the trigonometric series,

$$e = A_1 \sin\theta + A_2 \sin 2\theta + A_3 \sin 3\theta + \ldots \qquad (1)$$
$$+ \tfrac{1}{2} B_0 + B_1 \cos\theta + B_2 \cos 2\theta + B_3 \cos 3\theta + \ldots$$

…o express an alternating-current wave by means of this series it is necessary to determine the constants $\frac{1}{2} B_0$, A_1, B_1, etc. The constant $\frac{1}{2} B_0$ can be made equal to zero by drawing the axis of the complex wave so that the positive and negative loops are equal. The terms containing the coefficients with the even subscripts vanish in the case of alternating-current waves in which the negative loops are repetitions of the positive loops, the ordinates being negative instead of positive. With these simplifications, equation (1) reduces to

$$e = A_1 \sin\theta + A_3 \sin 3\theta + A_5 \sin 5\theta + \ldots$$
$$+ B_1 \cos\theta + B_3 \cos 3\theta + B_5 \cos 5\theta + \ldots \qquad (2)$$

Runge's method, as originally published, considered the most general case corresponding to equation (1). Fischer-Hinnen's method was developed for the case where the axis is drawn symmetrically with respect to the positive and negative loops, that is, the constant term, $\frac{1}{2} B_0$, is eliminated from equation (1). Either method can be simplified so as to apply to equation (2) and the computations are more than halved thereby. Since practically all alternating-current waves can be accurately expressed by equation (2), which means that even harmonics are not present, the discussion to follow will consider this case alone.

The method of Fischer-Hinnen consists in determining separately, from ordinates measured on the complex wave, the components of each harmonic beginning with the third. The sine components of all of the harmonics above the first are combined with a certain ordinate of the complex wave to get the sine component of the first harmonic, and the cosine component of the first harmonic is obtained in a similar manner. The method would be ideal for determining any one harmonic directly were it not necessary to add a correction to the sine and cosine components of that harmonic whenever harmonics of three, five, etc., times the frequency of the desired harmonic are present. The higher harmonics are frequently of no practical importance, but there is no sure way of finding this out without determining their value.

The necessity of carrying alternating-current wave analyses to include harmonics higher than the third and fifth becomes greater as electrical engineering advances. This is especially true wherever capacity and resonance are predominant. It is true in the laboratory, where complex waves are frequently built up by means of alternators directly coupled together.

In cases such as those above the method of Fischer-Hinnen fails to be satisfactory in five ways:

a. No harmonic is exactly determined if harmonics of three, five, etc., times its frequency are present unless corrections are made which necessitate the determination of these higher harmonics.

b. The first harmonic components cannot be determined exactly unless all of the higher harmonics are known. The neglect of any component introduces an error into the corresponding component of the first harmonic equal to the component neglected.

c. The errors discussed under *a* and *b* affect the phase relations as well as the amplitudes of the harmonic components.

d. There is no easy way of ascertaining when all of the harmonics have been obtained.

e. To determine, even approximately, a wave that is at all complex necessitates the measuring of a great many different ordinates on the complex wave.

As an illustration of the last item it is necessary to measure twenty-six different ordinates to determine the first, third, fifth and seventh harmonics, assuming no higher harmonics; ninety-eight different ordinates to determine the odd harmonics up to and including the fifteenth harmonic, and about 518 different ordinates to determine the first eighteen odd harmonics under the same conditions. In an article on the flux distribution in an alternator[3] the analyses

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[1] …ektrotechnische Zeitschrift, p. 396, Vol. 22, 1901. See also P. M. L…n, *Electric Journal*, p. 386, Vol. 5, 1908.

[2] …schrift für Mathematik und Physik, p. 443, Vol. 48, …903. See also S. P. Thompson, *Proc.* Physical Society of London, p. 443, Vol. 19, 19…

[3] … Adams, *Trans.* A. I. E. E., Vol. 28, Part II, … 1909.

made by this method were carried to include the nineteenth harmonic, which made it necessary to determine about 166 different ordinates on each wave. In one instance the analysis was extended to include the twenty-seventh harmonic, which took about 310 different ordinates.

Whenever it is necessary to determine more than one or two harmonics in a complex wave the nine or eighteen

SINE COMPONENTS.

	1	35	3	33	5	31	7	29	9	27	11	25	13	23	15	21	17
Sin 5 deg.	S_1				S		S				$-S_{13}$		$-S_{11}$				S_{17}
10		S				$-S_{14}$		S_{13}				$-S_{10}$		S_{14}			
15	S		S_1'		S_{15}		S				S_3		$-S_3$		S_5'		$-S_{16}$
20		S_4				$-S_8$		$-S_{16}$				S_{16}		$+S_8$			
25	S_5				S		S_{11}				S_7		S_{17}				S_{13}
30		S		S_2'		S		$-S$				$-S_6$		S_6		S_2'	
35	S_7				S		S				S_{17}		$-S$				$-S_{11}$
40		S				S_{16}		S_4				S_4		$-S_{16}$			
45	S		S'		S		S		S_1''		S		$-S_9$		$-S_3'$		S_9
50		S				S		S_{14}				S_{14}		S_2			
55	S_{11}				S		$-S_{17}$				S_1		S_{13}				$-S_7$
60		S		S_4'		$-S_{12}$		S_1				$-S_{12}$		S_{12}		$-S_4'$	
65	S				S_1		$-S_7$				S_{11}		S_1				S_5
70		S_{14}				S_1		S_2				S_2		$-S_{10}$			
75	S		S'		S		S				S_{15}		$-S_{15}$		S_1'		$-S_3$
80		S				S_4		$-S_8$				S_8		$-S_4$			
" 85	S_{17}				$-S_{11}$		S_{13}				$-S_5$		S_7				S_1
" 90		S		S'		S_{18}		$-S_{18}$		S_2''		S_{18}		S_{18}		S_6'	
I. Sum 1st Cols																	
II. Sum 2nd Cols																	
I.−II.																	
I.+II.																	
$\frac{1}{18}$(I.−II.)	A		A		A_5		A_7		A_9		A_{11}		A_{13}		A_{15}		A_{17}
$\frac{1}{18}$(I.+II.)	A		A		A_{31}		A_{29}		A_{27}		A_{25}		A_{23}		A_{21}		A_{19}

odd harmonic method after Runge is much shorter. In his original article two tables are given, one for all harmonics up to and including the fifth, and the other for all harmonics up to and including the seventeenth. Prof. S. P. Thompson gives a table for all odd harmonics up to and including the eleventh harmonic.

and 180 deg., 5 and 185 deg., 10 and 190 deg., and 15 an 195 deg. The resulting equations were:

By Runge's method.[4]

$e = 100.0 \sin \theta + 30.0 \sin 3\theta + 10.0 \sin 5\theta$
$= 100.0 \sin \theta + 30.0 \sin 3\theta + 17.3 \sin (5\theta + 29.9)$
$= 100.0 \sin \theta + 30.0 \sin 3\theta + 26.5 \sin (5\theta + 19.1)$
$= 100.0 \sin \theta + 30.0 \sin 3\theta + 30.0 \sin 5\theta$

By Fischer-Hinnen's method,[4]

$e = 90.0 \sin \theta + 30.0 \sin 3\theta + 20.0 \sin 5\theta$
$= 92.6 \sin \theta + 30.0 \sin (3\theta - 12) + 20.0 \sin (5\theta -$
$= 98.7 \sin \theta + 30.0 \sin (3\theta - 19) + 20.0 \sin (5\theta - 31$
$= 105.4 \sin \theta + 30.0 \sin (3\theta - 14.1)$
$+ 20.0 \sin (5\theta - 23$

COSINE COMPONENTS.

	1	35	3	33	5	31	7	29	9	27	11	25	13	23	15	21	17
Sin 5 deg.		d_{17}				d_{11}		$-d_{13}$				d_5		$-d_7$			
10	d				$-d_4$		d_8				d_8		$-d_4$				d_{16}
15		d_{15}		d_5'		d_3		$-d_3$				$-d_{15}$		$-d_{15}$		d_1'	
20	d				$-d_{10}$		d				$-d_2$		d_{10}				$-d_{14}$
25		d_1				d_{17}		$-d_7$				$-d_{11}$		d_1			
30	d_{12}		d_4'		d_{12}		d				d_{12}		d_{12}		d_4'		d_{12}
35		d_1				$-d$		$-d_{17}$				d_1		$-d_{13}$			
40	d				d		$-d_{14}$				d_{14}		$-d_2$				$-d_{10}$
45		d		d_3'		$-d_9$		d_9		d_1''		$-d_9$		$-d_9$		$-d_3'$	
50	d				d_{16}		$-d_4$				$-d_4$		d_{16}				d_8
55		d				d_{13}		d_1				$-d_{17}$		d_5			
60	d		d_2'		$-d_6$		$-d_6$				d_6		d_6		$-d_2'$		$-d_6$
65		d				d_1		d_{11}				d_7		d_{17}			
70	d				$-d_8$		$-d_{16}$				$-d_{16}$		$-d_8$				d_4
75		d		d_1'		d_1		$-d_{15}$				$-d_3$		$-d_3$		d_5'	
80					d_{14}		d_{10}				$-d_{10}$		$-d_{14}$				$-d_2$
85		d_1				$-d_7$		$-d_5$				d_{13}		d_{11}			
" 90 "	d_0		d'		d_0		d_0		d_0''		d_0		d_0		d_0'		d_0
I. Sum 1st Cols....																	
II. Sum 2nd Cols..																	
I.+II.																	
I.−II.																	
$\frac{1}{18}$(I.+II.)	B_1		B		B_5		B_7		B_9		B_{11}		B_{13}		B_{15}		B_{17}
$\frac{1}{18}$(I.−II.)	B		B		B_{31}		B_{29}		B_{27}		B_{25}		B_{23}		B_{21}		B_{19}

In order to illustrate the errors introduced by determining too few harmonics a complex wave was built up from the equation

$$e = 100 \sin \theta - 30 \sin 3\theta + 20 \sin 5\theta + 10 \sin 7\theta,$$

and the wave was analyzed first by Runge's five-harmonic method and then by Fischer-Hinnen's method determining only the first three odd harmonics. The wave was analyzed four times by each method, using the part between $\theta = 0$

If other higher harmonics had been neglected c er changes would have been made in the resulting equat s.

[4]The sine and cosine components are here combined, as is custom n this work. Equation (2) can be written,

$$e = C_1 \sin (\theta + \Phi_1) + C_3 \sin (3\theta + \Phi_3) + \text{etc.},$$

where $C_n = \sqrt{A^2 n + B^2 n}$ and $\Phi_n = tan^{-1}\frac{B_n}{A_n}$.

In using the latter equation, care must be exercised to locate in the proper quadrant.

ıe authors have found that it is seldom safe to use a table ving less than the first nine odd harmonics, and it is fre-ıently necessary to use a table for the first eighteen odd rmonics. This is not so very laborious by Runge's scheme ıce it is necessary to compute only the harmonics desired. ıe nine odd harmonic scheme is not reproduced here ıce it can be deduced easily from the eighteen odd har- scheme, or it can be deduced from Runge's original ticle, or the table can be built up easily from the equa-ıns,[6]

$$A_m = \frac{2}{n+1} \sum_{k=0}^{k=n} y_k \sin k \left(m \frac{\pi}{n+1} \right) \qquad (3)$$

$$B_m = \frac{2}{n+1} \sum_{k=0}^{k=n} y_k \cos k \left(m \frac{\pi}{n+1} \right) \qquad (4)$$

ıere m stands for any harmonic component, as the first, t rd, etc., $n+1$ is the number of ordinates taken on a l wave and $\frac{\pi}{n+1}$ is the distance between ordinates. A t le for any number of odd harmonics can be built up by nans of these equations.

To analyze a wave by means of the eighteen odd har-nnic scheme, which is given below, draw the Θ-axis s that the positive and negative loops are equal and meas-u the ordinates over a half wave at 5-deg. intervals. The first point of the half wave may be taken anywhere on either loop.[6] Let the ordinates, as measured in order, be represented by $y_0, y_1, y_2 \ldots y_{35}$. Write down the ordinates with their proper sign as indicated below and perform the indicated operations, which are all algebraic, i.e., $s_1 = y_1 + y_{35}$, $d_1 = y_1 - y_{35}$, $s_{18} = y_{18}$, $d_0 = y_0$, etc.

$$\begin{array}{rl} & y_0 \; y_1 \; y_2 \ldots\ldots\ldots\ldots\ldots\ldots y_{17} \; y_{18} \\ & \quad\;\; y_{35} \; y_{34} \ldots\ldots\ldots\ldots\ldots\ldots y_{19} \\ \hline \text{Adding} & \quad\;\; s_1 \; s_2 \ldots\ldots\ldots\ldots\ldots\ldots s_{17} \; s_{18} \\ \text{Subtracting} & d_0 \; d_1 \; d_2 \ldots\ldots\ldots\ldots\ldots\ldots d_{17} \end{array}$$

$$\begin{array}{ll} s_1' = s_1 + s_{11} - s_{13} & d_0' = d_0 - d_{12} \\ s_2' = s_2 + s_{10} - s_{14} & d_1' = d_1 - d_{11} - d_{13} \\ s_3' = s_3 + s_9 - s_{15} & d_2' = d_2 - d_{10} - d_{14} \\ s_4' = s_4 + s_8 - s_{16} & d_3' = d_3 - d_9 - d_{15} \\ s_5' = s_5 + s_7 - s_{17} & d_4' = d_4 - d_8 - d_{16} \\ s_6' = s_6 - s_{18} & d_5' = d_5 - d_7 - d_{17} \\ s_1'' = s_1' + s_3' - s_5' & d_1'' = d_1' - d_3' - d_5' \\ s_2'' = s_2' - s_6' & d_0'' = d_0' - d_4' \end{array}$$

In using the table each sum or difference from above is to be multiplied by the sine of the angle indicated and written down in the table with its proper sign. Thus, S_1 in the table stands for the produce of $s_1 \times \sin 5$ deg. and d_{17} stands for $d_{17} \times 5$ deg., etc.

By means of this scheme the computations for any of the components can be omitted without introducing any error into the remaining components. For instance, if only the first five harmonics are desired the computations for all above the ninth may be omitted, decreasing the work by nearly half without decreasing the high accuracy of the harmonics obtained.

Central Station

Management, Policies and Commercial Methods

A LUMBER-ELECTRIC-LIGHTING-ICE PLANT.

ectricity and ice are the by-products of the power plant o a stave mill at Livermore, Ky., operated by the Smith C perage Company, of Louisville. The requirements of tl stave plant are not sufficient to absorb all of the power p duced, so that the company has installed an electric li it plant, as well as machinery for making ice. It has re ntly filed an amendment to its charter providing that it m engage in the new business.

STREET LIGHTING AT PANA, ILL.

he Commercial Club of Pana, Ill., will ask the City C ncil to pass an ordinance to cause the removal of all p s and wires from the business streets to the alleys, the p s to be of uniform height and the service wires to be tr sferred from the street fronts of buildings to the rear. In ddition, the club has subscribed for 50 five-lamp orna-m tal curb-lighting posts, to cost not exceeding $50 each. T lamps on these posts will be supplied from underground ts. The city will furnish the energy and maintain the s after the latter are installed.

GASOLINE COMPETITION.

ıe Salida (Col.) Electric Light, Power & Utility Compa has replaced five gasoline-lighting systems by tungsten ele ric lamps in the past three months, only three gasoline sy ems now remaining in that city. As a result the insurance charges have been lessened. An unusual feature is that all wiring in connection with these new electrical installations has been done in conduit and metal molding. The total number of rewiring installations completed in the past three months is twenty-two, twenty of which were followed by reductions in fire-insurance rates.

CENTRAL-STATION SERVICE REPLACES LARGE INDIANAPOLIS ISOLATED PLANT.

The Merchants' Heat & Lighting Company of Indianapolis has taken over the supply of electrical energy and steam heat for the Century Building, a large local block occupied by publishers, manufacturers and other power users, which was formerly served by an isolated plant. Several years ago, when the Merchants' company was small and new to the Indianapolis field, it purchased a part of its electrical supply from this same isolated plant, to tide its customers' service over peak periods. With its present new 10,000-kw turbine plant on West Washington Street, however, the acquisition of the former isolated-plant load has made scarcely a ripple in the operation of the system.

GARAGE TO BE OPENED BY INDIANAPOLIS CENTRAL-STATION INTERESTS.

A garage capable of stabling 200 cars will be opened shortly at 320 North Delaware Street, Indianapolis, by the Merchants' Auto Company, whose president, Mr. E.

[5] ompare Fourier's "Series" and "Spherical Harmonics," by Byerly, p. 30.

[6] Thompson introduced the restriction of using a half wave from a zero ordinate to the next zero ordinate, which simplifies the scheme scarcely at all and the restriction sometimes becomes very inconvenient.

Darrow, is general manager of the Merchants' Heat & Light Company of Indianapolis. Harvey Stout, the latter company's attorney, will be general manager of the garage company, and Roy J. Wensley, formerly of the central station's engineering department, will be superintendent.

The new garage will stable and charge electric trucks and pleasure cars, making a specialty of the expert care and supervision of battery-driven vehicles, facilities for which have heretofore been lacking in Indianapolis, in spite of the large number of electric cars in use there.

A LARGE CENTRAL-STATION COTTON MILL FOR THE WEST.

Although cotton is the chief crop of most of the Southern and Southwestern States, and the principal market for the cotton goods is now in the West, all of this material must be twice shipped half way across the country to reach the mills which are along the Atlantic seaboard.

The long-hour demand of the cotton mill gives the business such an excellent load-factor that central-station managers in the West should not be slow to encourage the installation of cotton mills on their lines. Such business would be advantageous to the seller of electricity and profitable to the cotton-goods manufacturers, who would thus be enabled to save freight both ways.

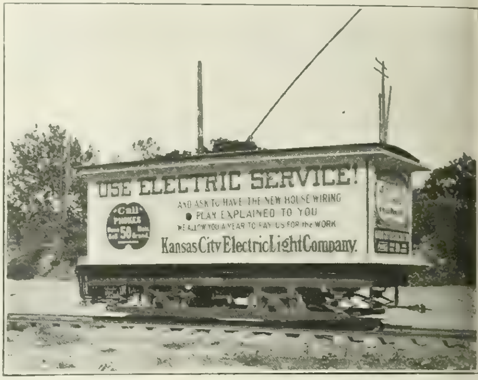
One of the first large cotton mills to grasp this economic situation is now being installed by the Kansas City Cotton Mills Company, at Kansas City, Mo. The mill will contain 50,000 spindles and will be driven by forty-three three-phase, 440-volt motors, aggregating 525 hp. Energy has been contracted for from the Kansas City Electric Light Company.

EXPANSION OF ELECTRIC POWER AT SALT LAKE CITY.

During the past three years the electric-power earnings of the Utah Light & Railway Company, of Salt Lake City, have increased at the rate of 35 per cent to 40 per cent per year. In June, 1909, the company's connected power load was 8738 hp; in August, 1910, this had increased to 13,600 hp, and at present the total rating of electric motors supplied with current from the company's system is 17,000 hp. Eight solicitors are at work in both lighting and power fields, two men being specially assigned to power applications to the exclusion of practically all other work. The company's commercial department was reorganized about three years ago and placed in immediate charge of Mr. B. W. Mendenhall as general agent. With the exception of steam auxiliary service, which is operated only during emergencies, all the output of the company is derived from hydroelectric stations of its own, supplemented by the purchase of about 3000 kw from the Telluride Power Company's system. The new steam plant at Jordan River, Salt Lake City, recently described in these columns, is now practically completed and is available for regular operation as a stand-by installation. Provision is being made in this plant for the control of the entire transmission and distribution system from a switching benchboard and remote-control oil-switch installation located on the premises.

ELECTRIC CAR PROVES SUCCESSFUL HOUSE-WIRING ADVERTISEMENT.

One of the most effective forms of advertising used by the Kansas City Electric Light Company during its present house-wiring campaign, according to Mr. C. F. Farley, contract agent, has been the equipment of a single-truck street car with signs, brilliant tungsten lighting and an electric piano, for operation after dark through streets in the sections where the house-wiring solicitors have been working. Since this car was put into service, two months



Electric Car Used for Advertising Purposes.

ago, the number of contracts coming in, it is declared, has been doubled.

Two sides and the rear of a single-truck car have been built up with light wood signboards framed by reflector troughs containing thirty 100-watt tungsten lamps. "Use Electric Service" and "Increase the Value of Your Home" are the catch phrases of the signs now used, the legend being changed from time to time at a cost of about $25. The signs are well painted in red and gold, on a white background, and the whole appearance is far from crude. In front the car is equipped with a powerful interurban type arc headlight and, to attract the attention of the ear as well as the eye, inside the cab is an equally powerful electric player piano. The movement of this phenomenon down a quiet residence street, with its headlight and many tungstens flashing and its piano playing, does not fail to attract its share of attention.

NEW SUBSTATION FOR KANSAS CITY ELECTRIC LIGHT COMPANY.

The Kansas City Electric Light Company has just completed the construction of its new Substation K, which was

Substation K of Kansas City Electric Light Company.

designed and built under the supervision of its regular engineering staff. This building, the exterior of which

..dies unusual architectural dignity and beauty, is of brick, ..eel and concrete and measures 133 ft. x 40 ft. in floor ..lan. It is located at Fortieth and State Streets and stands .. the state line dividing Kansas City, Mo., from Kansas ..ty, Kan., in the midst of a residential district.

..he substation will house the frequency changing and ..istributing equipment of the electric-light company, be..des the first of several 100-kw rotary-converter sets of the ..reet-railway company, which leases part of the substation ..uilding. Twenty-five-cycle, 6600-volt energy is received ..om the generating station and converted into 2300-volt, ..-cycle primary energy for lighting and 600-volt direct ..rrent for railway use. The bus structure in the basement .. all of molded concrete and also serves as a pressure ..amber for the air-blast transformers supplying the rotary ..nverter. The station also contains space for constant-..rrent transformers and rectifier sets. At the end of the ..ilding a spur track from the street railway is extended .. the station, providing storage for a special work car .. needed and also permitting heavy machinery to be ..ught inside on the cars, whence it can be picked up by .. 25-ton, hand-controlled, motor-driven crane and de..ted at any point in the station.

..Mr. A. N. Richardson is general superintendent of the ..nsas City Electric Light Company.

..XPRESS DELIVERY WITH ELECTRIC TRUCKS AT INDIANAPOLIS.

..he Adams Express Company delivers from 60,000 to ..00 packages monthly to addresses in its Indianapolis ..itory, using electric trucks exclusively after experience ..h both horse-drawn and gasoline vehicles. The 22 ..ks of the company average 11,000 to 15,000 total miles ..area traversed by both paved and unpaved streets. All ..he trucks are equipped with the new Edison nickel-iron ..age batteries.

..e company maintains a modern garage in South Il..is Street, two squares from its express delivery depot. ..rging plugs and storage space are provided for the nine-.. one-ton and three-ton trucks. With the exception ..wo one-ton Landsen cars all of the trucks are of Gen.. Vehicle Company manufacture, 1906 model, the date ..he first installation. At first the earlier type E Edison ..s were used, but two years ago these were replaced by .. type A cells, and after continuous use, according to .. A. F. Jones, local agent for the company, these cells .. no visible evidence of depreciation. At the rear of the ..ge storage space there is a machine shop with lathe, ..ll, etc., and also a workroom where all minor repairs ..e made without recourse to outside help. Two day men ..d three night men are employed at the garage, a skilled ..ectrician and machinist being included in the number.

All trucks are charged nightly, the cells being kept nor..ally in fully-charged condition except for occasional and ..earranged discharges once a week or so. Distilled water ..added to the alkaline solution every second night, one of ..e two rows of cars being filled each evening. Once a ..nth chains are washed in gasoline and boiled in graphite. ..arging is done by ammeters on the switchboard, no ..struments being provided on the trucks themselves.

The one-ton trucks in Indianapolis service make 12 to .. miles per day, chiefly averaging runs of about 25 miles. ..e average used for daily charge is 17 kw-hours, includ..g resistance losses in the charging panels. A careful ..cord of the performance and cost of each truck is kept .. the local office, an analysis of unit costs per day's run ..d per package delivered being made each month. In ..und figures, the cost of energy has averaged about 45 ..nts per truck per day, while the cost of supplies reaches 37 cents. Garage labor and expenses run about 75 cents per truck per day, and the drivers' wages divided by the total number of trucks, including one or two extra wagons, amount to $2 or more per day. For its truck operators the Adams company pays the same wage scale as is received by the drivers of the other companies' horse-drawn wagons, but gets the pick of the men since the electric vehicles are, of course, more pleasant to handle.

In general, the use of the electric trucks has proved a great economy of expense, time and trouble over horse or gasoline-truck delivery. The electrics can go further and faster, and can work more continuously than is possible for a horse-drawn wagon. The loads per trip are, of course, also heavier. The one-ton trucks sometimes start out with loads of 3000 to 3500 lb., and the larger wagons have carried five tons without apparent effort. Snow, ice and mud make no trouble for the Adams trucks, and during several days of the last winter these wagons continued on duty through 14 in. of snow and mud, while other local delivery services were suspended. A gasoline truck was in service at the Indianapolis Adams delivery for a time, but proved to be the cause of so much expense, time and trouble to keep it in operative repair that it had to be abandoned. But no qualifications are made concerning the success of electric trucks with nickel-iron batteries in the Indianapolis delivery service.

DECORATIVE LIGHTING IN SPRINGFIELD, ILL., DURING STATE FAIR.

The week of the annual State Fair at Springfield, Ill., is one of much business activity and great bustle and merriment. The electrical men of Springfield are not behind other business men in rising to the occasion. The Springfield Light, Heat & Power Company, of which Mr. Warren Partridge is general superintendent, supplied the electricity for the street lighting decorations illustrated herewith. For twenty-two blocks arches were erected over business streets and on some of the prominent corners there were intersect-

Fig. 1—Decorative Lighting in Springfield, Ill., During State Fair.

ing arches as shown in Fig. 1. In each block five festoons of lamps were strung across the street. Each festoon consisted of twenty lamps. In addition there were longitudinal lines of lamps along each side of the streets containing fifty lamps to a block, so that the total number of lamps to the block was 200, or a total of 4400 in all. Eight-cp carbon lamps were used. Energy for this special lighting was supplied by the company's 220-volt direct-current mains.

Fig. 2 shows the special lighting of the court house. The dome of this building was outlined in 8-cp incandescent lamps and in all there were 800 lamps on the building. In the grounds surrounding the court house in connection with

the evening carnival there were installed fifteen arc lamps, fifty-one 16-cp lamps and thirty-six 32-cp lamps.

Although the State Fair itself was not open in the evening, a considerable use of electricity was made in the grounds. In the various buildings and around the fair

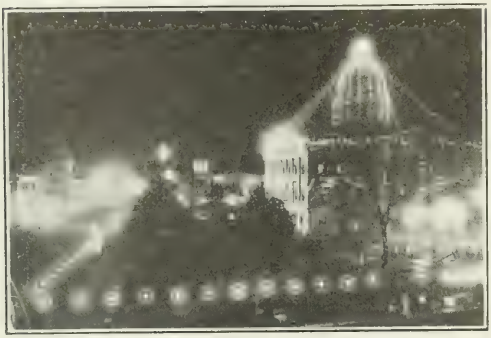


Fig. 2—Decorative Lighting of Court House at Springfield, Ill.

grounds there were placed eighty-four arc lamps. These were carried on constant-current tub transformers located on the grounds and fed from 2300-volt single-phase alternating-current circuits. In addition, the State Fair authorities maintain a permanent equipment of their own and from this source were supplied thirteen flaming-arc lamps in the Dome Building, six flaming arcs in the Exposition Building and five flaming arcs in the Coliseum. In addition to the arc lighting, there were about 800 16-cp lamps used for miscellaneous building lighting at the State Fair grounds. A number of the private exhibitors used electric lighting decorations and this service demanded about 1000 16-cp lamps, thirty arc lamps and about 50 hp in motors.

OPERATING ELECTRIC VEHICLES ON A BASIS OF SPECIFIC-GRAVITY RECORDS.

To encourage the proper and satisfactory use of electric vehicles by its customers, the Commonwealth Edison Company, Chicago, has mailed out to its private garage consumers blank record forms, one of which is reproduced herewith.

An interesting feature of this card, which includes columns for setting down the hours and rate of charging, energy consumption, specific gravity, miles run, etc., is the entire absence of any space for recording the voltmeter readings at the beginning and end of the charging operation, although in the past the battery voltage has generally been considered one of the most important elements of the cells' history and has usually been the principal factor in governing their charge and discharge.

As is well known, however, the voltage indicated by a battery is at best only inferential of the energy yet remaining in the plates, and although this method is generally used as a convenient index to indicate the condition of the cells many cases of battery abuse are on record whose cause can be traced to the fact that voltmeter readings alone were relied on by inexperienced persons for indication of when to cease charging. In other cases, where complaints have been made by garage owners that their charging costs were running unduly heavy, the Commonwealth company has dispatched its battery experts to the spot only to discover that in the effort to bring a given battery up to its prescribed end-of-charge voltage the attendant was putting about twice as many kw-hours into the cells as they properly needed—not only wasting energy and casting unfair reflections on the cost of running the car, but also working damage to the plates.

The real index to the condition of charge in a batter is, of course, the specific gravity of the sulphuric-acid elec trolyte. As the cell is discharged the specific gravity fall: ranging from 1.280 in a fully charged condition down t 1.160 when the cells are about exhausted. It is by thi

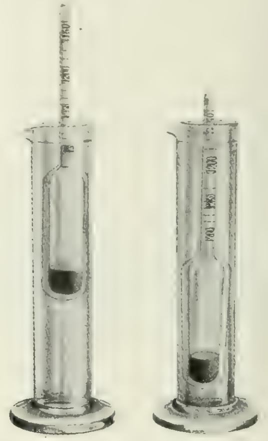
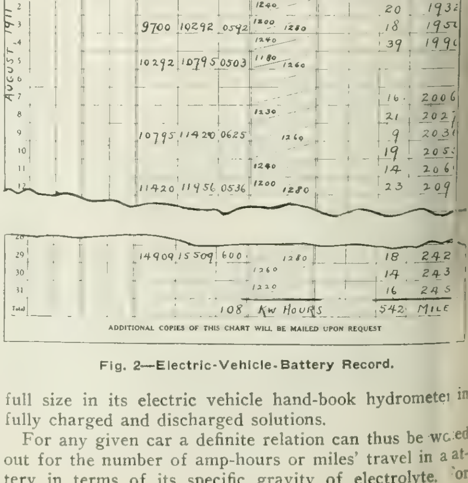


Fig. 1—Hydrometers in Electrolytes from Fully Charged a Discharged Batteries.

record of specific gravity that the Commonwealth co pany is now urging its customers to be governed, alo with records of the kw-hour input into their batteries a the miles of car travel. The proper time for starting a stopping the charge is definitely fixed by the reading the hydrometer, and to show the simplicity and convenie of using this instrument in electrolyte withdrawn from of the cells by means of a syringe the company illustra



Compliments of

COMMONWEALTH EDISON COMPANY

~~139 Adams Street,~~ Telephone Randolph 1280 Chicago, Ill.
120 West Adams Street,

Electric Vehicle Battery Record of

Address

Make of Vehicle No. of Cells

Date	Start Time	Start Amp's	Finish Time	Finish Amp's	Start Watt Meter Reading	Finish Watt Meter Reading	Kilo Watt Hours	Gravity Start	Gravity Finish	Amp Hour Meter Disch	Amp Hour Meter Charge	Miles Run	Remarks Odomete
1												12	1911
2								1240				20	193
3					9700	10292	0592	1200	1280			18	195
4								1240				39	199
5					10292	10795	0503	1180	1260				
6													
7												16	2006
8								1230				21	202
9					10795	11420	0625		1260			9	203
10												19	205
11								1240				14	206
12					11420	11956	0536	1200	1280			23	209
29					14909	15509	600		1280			18	242
30								1260				14	243
31								1220				16	245
Total							108	Kw Hours				542	Mile

AUGUST 1911

ADDITIONAL COPIES OF THIS CHART WILL BE MAILED UPON REQUEST

Fig. 2—Electric-Vehicle-Battery Record.

full size in its electric vehicle hand-book hydrometer in fully charged and discharged solutions.

For any given car a definite relation can thus be worked out for the number of amp-hours or miles' travel in a battery in terms of its specific gravity of electrolyte. For

example, a certain pleasure car which will run 72 miles on good streets when charged to a density of 1.280 can be positively relied upon to go 60 miles when the gravity has fallen to 1.260, 42 miles at 1.240, 36 miles at 1.220, 24 miles at 1.200 and 12 miles at 1.180, becoming fully exhausted at 1.160.

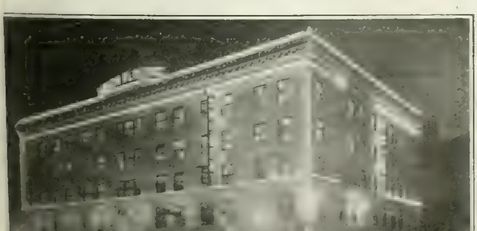
In suggesting the use of its new record cards, the Commonwealth company, according to Mr. Roderick Macrae, of its electric vehicle department, does not urge that all of the columns provided necessarily be filled. Even the time of starting and finishing the charge, together with the current rates in amperes, may be omitted, as in the accompanying specimen card. As most cars are not provided with amp-hour meters, the columns relating to electricity input and output must also be dispensed with in the majority of cases. The really important data to be recorded, however, are the energy input, the specific gravity at the end and beginning of the charge, and the number of miles accomplished.

The card in the illustration gives the record of a pleasure icle operated entirely with respect to the specific gravity its battery, the latter's condition having determined the ecessity for giving a charge or cutting off a charge under vay. During the month of August, for which the record ows figures, this car ran 542 miles, at a total switchard consumption of 108 kw-hours. This performance, 5 es per kw-hour, is considered a good average for a car this kind. As the rate for battery-charging energy un- the Commonwealth Edison Company's schedule varies m 7 cents to as low as 3 cents per kw-hour, it becomes ient that the operation of an electric automobile is in sense the expensive luxury prospective customers somees fear.

Wiring and Illumination

ENTRAL-STATION OFFICE-BUILDING ILLUMINATION.

One of the central-station companies that utilize decorae lighting for the purpose of advertising both the locan of their offices and the brilliance of electric light the Union Electric Light & Power Company, of St. Louis. is company removed its general offices a short time ago



Illumination of Office of Union Electric Company, St. Louis.

a building on the corner of Twelfth and Locust Streets, l the accompanying photograph represents the appearce of this building at night. It will be noticed that the lding is made prominent by outline lighting consisting lines of incandescent lamps. In addition there are two ctric signs bearing the words, "Union Electric," one a of sign and the other a vertical sign slightly projecting on the other side of the building. A conspicuous feature of the spectacular illumination of this building is a row of ten flaming-arc lamps which are suspended on the level of the second floor of the building. A portion of the building made so conspicuous is utilized as a theater, and there is an electric sign for this theater and also a row of incandescent lamps around the sidewalk canopy at the theater entrance. The fact that the building is visited by large numbers of theatergoers at night makes the electric-light advertising of the Union Electric Light & Power Company particularly valuable.

BACKYARD CONCRETE POLE LINES FOR SUBURBAN DISTRICTS.

The substitution of backyard pole lines for pole lines on the streets, although not very widely adopted, is still not unknown to central-station men, descriptions of some of the systems, notably that in Brooklyn and also that in Rochester, having appeared in these columns. In theory, at least, the backyard system does not differ materially

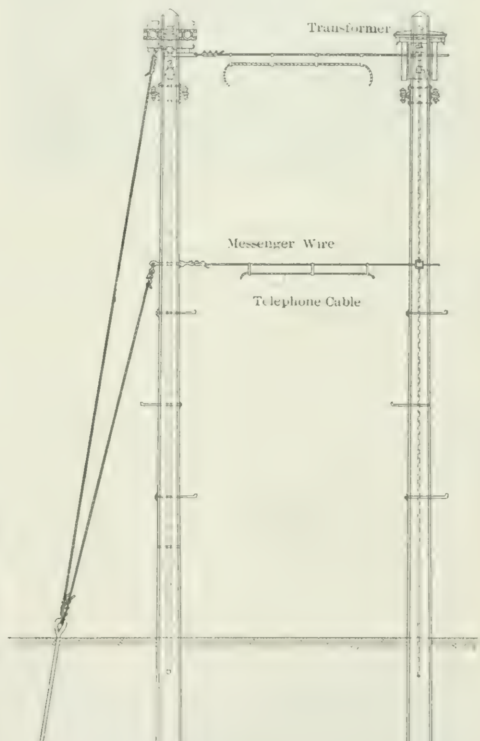


Fig. 1—Details of Terminal and Intermediate Concrete Poles.

from the alley system used in those cities possessing alleys between streets, in that it serves to keep poles from disfiguring the front views of houses and from interfering with the natural growth of trees. The system also possesses an added advantage when properly installed in that it wards off the danger of a public clamor for underground conduit in sections where the expense would be out of all propor-

tion to the income possible from the connected load existing or liable to exist for a great while to come. In suburban sections graced with expensive dwellings and well-kept grounds a pole line, no matter how well installed, is sure

Fig. 1—Intermediate Concrete Pole in Backyard.

to jar the sensibilities of some of the residents, and in such localities very little difficulty should be experienced in obtaining a right-of-way through backyards for lighting and telephone circuits.

The illustrations presented herewith show a high-grade

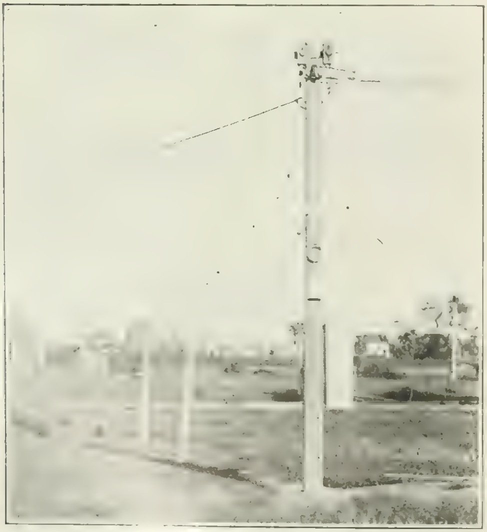


Fig. 2—Intermediate Concrete Pole.

backyard system in the Borough of Brooklyn installed by the Edison Electric Illuminating Company, of that city, and used jointly by it and the Bell Telephone Company. The detail construction of both the terminal and the intermediate concrete poles is shown in Fig. 2. The poles are made in the Parkville yard of the company and specially made cast-iron templates are employed for the molds. Each pole is 23 ft. high and sits from 5 ft. to 6 ft. in the ground. At the base of the terminal pole there is a box from which the primary underground cable is drawn through 1½-in. iron pipe through the center of the concrete pole and out at the top through the primary fuse boxes to the next pole on messenger wire. The primary cable is connected to a transformer at the next pole and a secondary is then run on brackets to the various customers.

At about 7 ft. from the top of the pole eye bolts are installed on which the messenger wire that supports the telephone cable is fastened. Through the center of the intermediate poles there is a ⅜-in. iron pipe through which the ground wires of the transformer and the cable armor are run. There are also installed near the tops of the intermediate poles two Philadelphia brackets which act as pull offs for the service cable. The sketch shows the pole equipped with steps for climbing; but the latest practice o the company is to do away with these as shown in the photographs, as it has been found to be more convenient to worl from ladders. The Edison Electric Illuminating Compan is experimenting with concrete poles, but the ones her described have been very successfully used and are mad of a mixture of three parts clean sand, five parts broke stone and one part cement. The mixture is poured rathe wet and ¾-in. ridge bar is employed for reinforcemen The poles shown have a base about 9 in. square and a to 6 in. square, the corners being chamfered.

RECENT TELEPHONE PATENTS.

PARTY-LINE SYSTEM.

One of the well-recognized types of selective party li is that employing a sectional line which is built up fro station to station until the desired one is reached.

Such systems have heretofore required that at lea one side of the line be looped into each station and whe some of the stations are off the general direction of t line considerable extra wire is required in looping in a out. It is with the idea of obviating this expense that M S. A. Souther, of Chicago, has produced the system f which a patent has been granted him. According to l plan the main line and branch lines are arranged as thou separate lines, and the branch lines are bridged to t main line through the contacts of a relay. The re has its winding included in the sectional side of the ma line beyond the point of attachment of the correspond branch. The stations on the branches are arranged in series as though farther out than the last main-line s tion and the nearer branches are later than those fart out. Whenever any relay is pulled up its correspond branch is cut off; therefore, whenever a branch line been passed, the branch is cut off each time current is s out to build up sections beyond it. When the last ma line station is passed the end of this line is left open the outermost branch relay fails to respond to current pulses, which now become effective to build up the bra h from station to station to the desired one or to an o n end. If the latter, the stations of the next branch be n to respond, etc. The Homer Roberts Telephone Comp y has been assigned this patent.

SWITCHBOARD CIRCUIT SYSTEM.

In systems where there is a line relay to close e calling-lamp circuit and a cut-off relay to put out is lamp, the cut-off relay usually removes the line-relay il from circuit. However, because of its inductance, e coil of the line relay is likely to generate a very dec d and disagreeable click. This is overcome in the arra e ment of circuit invented and patented by Mr. C. S. Vn-

...n, of Chicago, in his recent patent. He cuts off the ...mp circuit only, the operating winding of the line relay ...g left in the line but inductively neutralized by a ...d opposing winding, which is closed through front ...tacts of the cut-off relay. This patent is assigned to ... Kellogg Switchboard & Supply Company.

SUBSCRIBER STATION DEVICES.

Mr. R. E. Southwick, of Los Angeles, has invented a ...sk stand in which all the apparatus of the set is mounted. ...e induction coil and condenser are mounted in the base. ...false cover to the base or to the transmitter serves as ...gong and the ringer is mounted in such position that its ...pper strikes this cover.

Mr. C. W. McKibben, of Beaumont, Tex., has arranged a circuit for use on high impedance lines where a high-...wered transmitter is used. An adjustable coil is in ...ies with the receiver, but shunted through a switch. ...n talking the switch is opened, the shunt removed and ...de tone is thus cut down.

An auxiliary ear-piece attachment forms the subject of ... patent issued to Mr. C. H. Gatchell, of Boston. The e...-piece with a flexible sound-conducting tube for the ...l ear is mounted upon a flat plate. The plate clamps ... the receiver ear-cap with the end of the auxiliary ...l passage registering with the sound aperture in the ...er cap. The idea is to produce an apparatus to con-... received sound to both ears, which may be applied ...ut removing the regular receiver cap.

AUTOMATIC-MANUAL TRUNKING.

Automatic systems require the maintenance of special conditions in the circuit for an appreciable length of time ...ler to clear a connection. Where a manual switch-... and automatic are connected together it is advis-... to establish the disconnect condition automatically at ...mpletion of a call in order not to delay the operator ...ave any one hung up. The accomplishing of this ... object of an invention of Mr. A. R. Kahl, of Roch-... N. Y. He arranges a slow-acting circuit in order ...ain the time interval. This is done by retarding the ...rgization of the circuit-control relay by the use of ...nces and by connecting two or more relays in series ...at one must fall back to release another, the last ...ing the control circuit. This patent is assigned to ...Stromberg-Carlson Company.

Letters to the Editor.

Rating Motors in Kilowatts.

...Editor of Electrical World:

...—I have noted with great interest the fact that the ...ational Electrical Technical Commission at its Turin ...ng adopted the proposals of the Brussels conference, ...by the output of electric motors is defined as the ...nical power at the shafts, and is to be expressed in ...ational watts. It is with mingled feelings of pleasure ...oubt that I revolve this proposal in my mind, inasmuch ...was responsible for carrying exactly this scheme into ...ce now nearly twenty years ago. It had been sug-... by the International Congress of 1884 as a natural ...suitable rating for motors, inasmuch as the kilowatt is ...as good a mechanical unit in principle as the horse-...r and has the very considerable advantage of being ...ctely related to the absolute system, forming, in fact, the connecting link between the mechanical and electrical branches of that system. At that time, however, kilowatts were not as familiar as they are now, and I am not aware that anything practical was done in the way of carrying the suggestion into effect until 1893. At that time I was directing the building of the first three-phase generators and induction motors turned out by the General Electric Company at its Lynn works, and decided that inasmuch as the kilowatt rating for motors was a perfectly logical one and we then had the opportunity of using it on a totally new piece of apparatus in no way tied up by precedents in motor practice, it would be an opportune time to break away from the horse-power and get the rating on to a proper scientific basis. So we tried it with the first line of commercial three-phase motors, including machines of 1-kw, 3-kw, 5-kw, 10-kw and 15-kw mechanical output. If I mistake not, a few of these early motors are running yet, bearing the kilowatt rating on the name plate.

I am bound to say, however, that this well-intended innovation did not seem to fill any long-felt want, and it was soon found wise to abandon it. The trouble came from the fervid protest of the commercial organization. In the first place it was justly charged that the ordinary customer for motors had very little notion as to what kilowatt output meant, and could not be easily persuaded that this was not a new form of bunco game. Second, the kilowatt rating was, of course, numerically smaller than the horse-power rating of the same machine, and the man on the street not unnaturally thought of the machine in horse-power rather than in kilowatts. In those days, when it was no easy matter to sell three-phase motors in the face of the direct-current competition at best, the handicap of a totally unfamiliar rating was a thing not to be taken lightly, nor, indeed, is the argument against a change to a new unit giving a smaller numerical designation one that is entirely without force even to-day. I have a very strong suspicion that if the hefner were bigger than the international candle, instead of smaller, it would be less tenaciously held as a practical unit of light.

Kilowatts are so familiar at the present time to the ordinary public that I fancy an attempt to carry out the resolution of the Turin conference will be more successful than it was nearly twenty years ago. It is certainly a desirable change to make, because the horse-power is at best an empirical quantity derived from ancient and by no means reliable experiments, and moreover, the French *cheval-à-vapeur* is not quite the same as the English horse-power, so that the passage to a definite international unit founded on the scientific system of measurements ought to have a good chance of practical success. It will be particularly desirable as enforcing once for all the use of the watt as both an electrical and a mechanical unit, which, particularly from the standpoint of the student, is a highly desirable thing. Let it here be written, however, that in 1893 the General Electric Company gave the plan a fair trial and only abandoned it for commercial reasons, which it is to be hoped will be found less pressing now than then.

Boston, Mass. LOUIS BELL.

Automatic Block Signals for Electric Railways.

To the Editor of Electrical World:

SIR:—A paragraph appeared in your issue of Sept. 23 under the above heading which says: "At a recent meeting of the Illinois Electric Railway Association Mr. H. E. Chubbuck, of the Illinois Traction System, called attention to the remarkably few failures of the automatic block signals on that system. During August, with ninety-four signals installed, making 143,904 movements, there were but thirty-eight failures; signal operation was 99.97 per cent perfect."

Before commenting on the above excellent, but somewhat misleading, statement permit me to call attention to a few well-established historical facts on this subject, from an original source, which may be of interest and are probably new to many of your readers.

The writer originated the closed-rail circuit system of automatic electric signaling and received basic patents covering the same in the United States and France in 1872, and in that year I installed the system, putting it in practical operation under trains in a closed-rail circuit block about a mile in length on the Philadelphia & Erie Railroad, thus demonstrating its operativeness and utility. I was the sole owner of this system for eight or nine years after inventing, patenting and demonstrating the same. During this time I made many installations on various railroads in different States, embodying block signaling, including overlapping, front and rear, and station-approach signaling, also including drawbridge and switch connections and operations, in one instance connecting six switches in a single block, the derangement of any one of which would instantly show the danger block signal. In short, in the early seventies I had developed and perfected the system, including rail bonding, so that it performed every function which it performs to-day, and as perfectly and reliably. In fact, in those early days I established, by experiment and continuous use, basic data that are now used, such as resistance, wire gage and strength of current necessary to get best results.

It may be of interest, also, to note that about 1880 or 1881 Mr. George Westinghouse and his associates acquired control of the Robinson basic signal patents and interests by purchase, and immediately reorganized under the name of the Union Switch & Signal Company, which thereafter had the sole control of this system until the expiration of the Robinson patents, when it became public property. It may be here added that the company which Robinson organized and originally owned for the exploitation of his signal system was called the Union Electric Signal Company, and in the reorganization under the name of the Union Switch & Signal Company the terms "Union" and "Signal" were derived from the Robinson company.

Perhaps the most important and interesting point, however, to which I wish to here call attention is that during the whole time I owned and controlled this system I never knew of a single instance of the signals failing to operate exactly as originally intended; and of the tens of thousands of these automatic block signals installed since then, I have never known of a single authentic instance of one of them failing to operate precisely as it was originally designed to operate.

In this connection it may be pointed out that the one radically unique and most important feature of this closed-rail circuit system, not found in any other system before or since its inception, is that every signal not only performs its normal functions for the automatic control of trains, but it also acts as an absolute check upon its own operation. Thus, if by any means its source of current supply is interrupted, mechanically or otherwise, the signal instantly goes to danger for lack of operative current, thus indicating its own derangement through some cause outside of itself. This, of course, is not a failure, but one of the chief and distinguishing excellences of the system. It blocks trains instantly which otherwise might meet with collisions and wrecks and incalculable loss of life and property, as would inevitably be the case in the New York subway, for instance.

To illustrate, a year or two ago, just after a torrential rainstorm, every signal on both tracks in the New York subway between the New York City Hall and Borough Hall in Brooklyn went to danger, stopping every train between these points. The general manager of the Interborough Railway Company, operating the subway, was quoted as explaining the immense blockade of the subway resulting by saying that it was owing to the failure of the signals. Investigation, however, showed that the trunk-line conductors feeding the signal system were carried from the power house in Brooklyn to the subway through an unsealed or improperly protected conduit, and the heavy rain flooded the conduit, thus cutting off operative curren from the signals. Thus each individual signal between th points named, in the adjacent boroughs, pointed out wit unerring certainty not only the exact location of the trou ble but the responsibility for the blunder or negligenc which caused this unnecessary blockade. Could signal e ficiency be greater than this?

In this connection it may be pointed out that withou this automatic signal system it is more than doubtful if tl New York subway could transport in safety 20 per cer of its present enormous passenger traffic.

As already indicated, some people carelessly speak of tl signals as "failing" when, as a matter of fact, they a working perfectly and unerringly pointing to the fact th somebody has neglected his duty or something has o curred entirely outside of the signals to arrest, temporaril their operative functions, thus giving specific notice th while responsible for their own perfect action they decli all responsibility for outside errors or actions by othe over whom they have no control, but who, so far as t working signal system is concerned, are mere unwelcor interlopers.

Mr. Chubbuck explains the cause of the thirty-eight leged failures of the signals in 143,904 movements ninety-four signals on his road in August as follov Twenty-four were caused by electrical storms which burr out fuses and in two cases broke the line wires; n so-called failures were due to shutting off the supply electrical energy in the transmission system; two w caused by grounded lightning arresters, and three w due to other causes. Thus, in this case, the so-called 99 per cent perfect clearly becomes 100 per cent perfect. A this, in the last analysis, is the percentage of perfect wo ing which this system has attained and maintained c stantly during more than the last thirty-five years.

For the benefit of those specially interested, I add following references to sources of information on the velopment of railway electric signaling: Robinson's b patents on electric signaling: United States, No. 130,(Aug. 20, 1872; closed rail circuit. British, No. 2,280, A 30, 1871; aut. electro-pneumatic; now in general use; covers electro-mechanical. French, No. 94,993, Feb. 1872; covers closed circuit and subject matter of the B ish patent. Third annual report of the Block Signal Train-Control Board, dated Nov. 22, 1910, pages 177 178. Court decisions: Union Switch & Signal Comp vs. Reading R. R. Company and the Hall Signal Comp 96 F. R., 761; 37 C. C. A., 580.

Brooklyn, N. Y. Wm. Robinso

The Small State Electrical Association.

To the Editor of Electrical World:

Sir:—At the usual small state electrical or public ut convention the program is a dull and prosy thing, dis sion largely or wholly lacking, and the meetings a l In many such organizations the duty of preparing anc livering papers falls too often on those who are si accessible or willing, rather than on the men who are qualified to treat the subjects discussed. Some mem when called upon for such papers, overlook the brief pertinent points with which they might benefit their lows and, instead, involve themselves in an unequal s gle to comprehend the whole development of their jects from the dawn of Eocene life to the future pro perfection of the art. At a recent state convention a p on the organization of a power plant staff started the Declaration of 1776, reverted to the discover of cuneiform characters on building brick, discovered ra day's experiments in induction, discussed absolute th nal efficiency and entropy, and thus continued in solemn

[t]h through nearly forty pages of closely typewritten mat[te]r. The convention was held at a summer resort, the [pa]per was brought up twice at the regular meetings and [re]ad each time for a spell by a heroic secretary, while the [to]rtured members fidgeted or drowsed and then, finally, [ha]lf-read, it was voted over to the limbo of unfinished [bu]siness. Almost every small convention in which the [of]ficers are inexperienced in handling association matters [ca]n show several examples of such long academic papers, [s]o full of the well known and the platitudinous as to con[ce]al effectually whatever points of originality they contain. [Af]ter thus exhausting the patience of the audience it is [lit]tle wonder that such papers provoke no lively discus[sio]n—the feature that should be the most valuable part of [th]e sessions. For, instead of discussion by those really [qu]alified to give new angles and viewpoints of the subject, [th]e air of the convention, after such a long-drawn effort, [i]s so surcharged with the frantic idea of going on with the [ne]xt paper in order not to fall behind the already belated [sc]hedule that anyone who even risks asking a question is [me]t with frowns of impatience.

[T]he means of improving these conditions in the small [co]nventions is not difficult, for the present dissatisfaction [ha]s sprung rather from the failure of presidents and secre[tar]ies to see to it that those on the program know what is [ex]pected of them. One solution is to limit the papers to [a l]ength that can be presented in ten or fifteen minutes. [An]other, and perhaps the better, would be to give the [aut]hors free rein in their preparation of papers to be [prin]ted in the society's *Transactions*, but limit them to [a f]ive or seven-minute discussion of the principal points [brou]ght out. The papers should invariably be printed in [adva]nce and distributed among the members, or at least [eno]ugh of those known to be especially interested in the [sub]ject, to enable them to discuss it with proper informa[tio]n. With seven minutes allowed for the author's review [of th]e main points and twenty-three more set aside for [gener]al vital discussion by those interested, whose patience [wou]ld not be taxed as at present, the meetings would be[come] interesting and the usual conditions of slack attend[ance] would improve. The average convention is held at a good deal of expense to the interests which support it, and certainly those in attendance should profit to the fullest amount possible.

Discussion and informal meeting among themselves, central-station men will certainly admit, are worth far more to them than the printed program. Too few operators in the same state and near-by towns know each other by sight or name, although they may have many common business and technical problems in which mutual advice would be of the greatest value. The increasing use of label badges helps to acquaint members of the convention with each other, but during the discussions and other business, as each man rises to speak, he should be required to give his name and town, or if these are known to the presiding officer the latter should acknowledge his taking the floor with a clear enunciation so that every member can hear. The value and interest of the discussion are greatly increased when the identity of the speaker is known.

In the running of such a state association there can be no doubt that the most important official is the secretary. The position of president is chiefly honorary and ever-changing in these organizations. But the secretary is properly a permanent officer whose work on behalf of the society is done throughout the year and whose preparation of the programs can make or mar the meeting as later carried out. In the choice of a secretary the greatest care should be exerted. The experience of the most successful state associations shows that the secretary should himself be a central-station man of personal force, as well as familiar with plant subjects and the operators of his state. Such a secretary can grasp the real needs of the body and industry, put on foot and carry out valuable special inquiries, investigations, etc., and also attract prospective members into the body. To compensate such a man for time and attention distracted from his regular business, he should be voted an attractive salary from the association treasury, and experience has shown that this payment is one of the best investments that the small association can make.

Cincinnati, Ohio. CHARLES L. MORGAN.

Digest of Current Electrical Literature

[A]BSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

[Syn]chronous and Non-Synchronous Reactance.—J. RE[...]AN.—The first part of a highly mathematical article. [The re]action of the rotor of a synchronous alternator with [respec]t to the stator is in part of a polyphase nature. The [article] deals with the reactance under various conditions of [...] etc., of the various possible combinations of single-[phase] and polyphase stators and rotors; the polyphase [stator] with single-phase rotor is in particular interesting. [...] machines with non-salient poles are considered.—[Lo]n[do]n *Electrician,* Sept. 29.

[Ind]uction Motors.—A note on a recent British patent [...]83, Sept. 21, 1911) of the British Thomson-Houston [Compa]ny and J. Martin. To increase the range of speed [varia]tion the stator is provided with a three-phase winding [whic]h can be connected for two or four poles. The rotor [is fit]ted with a six-phase winding and can operate as a [sing]le winding for one number of poles or as two distinct [thre]e-phase windings for double the number of poles. The [spee]d of the motor is controlled by a six-phase star resist[a]n[ce] connected to the slip rings.—Lond. *Elec. Eng'ing* Se[pt.] 28.

Lamps and Lighting.

[Me]tallic-Filament Lamp Tests.—A. TURPAIN AND H. NICOLEAN.—The authors formerly made an extensive series of tests of various types of metallic-filament lamps in order to select the best lamp for the municipal service of the city of Poitiers in France. They selected the osram lamp in 1909, and this has since proved very satisfactory. Thus in a hotel in Poitiers the yearly lighting cost was reduced from $187 in 1908 to $119 in 1910, the latter price including the purchase price of new lamps ($34); at a school in Poitiers the lighting cost was reduced from $135 in 1908 to $75 in 1910. In both cases the number of lamps was greater in 1910 than in 1908. The authors have again made an extended series of modern metallic-filament lamps, and they give the results in tables and diagrams. They tested with direct current the following lamps: Osram, canello, Z, osmine and alphalia, and with alternating current the following lamps: Osram, canello, osmine and alphalia. The most noteworthy result is the reduced life with alternating current, as compared with direct current; only the 50-cp osram lamps and the 25-cp alphalia lamps had a life of over 1000 hours (the osram over 2000 hours). This result is attributed by the authors to the considerable voltage fluctuations of the alternating-current system of Poitiers, due to the many motors supplied with energy from this network.

Furthermore, there are the vibrations of the filaments.

due to the alternations, which can be observed with the naked eye. In spite of the shortened life the employment of metallic-filament lamps is very economical even with alternating current.—*La Revue Elec.*, Aug. 25.

Technical Spectro-Photometer.—J. Thovert.—The author described at the recent meeting of the International

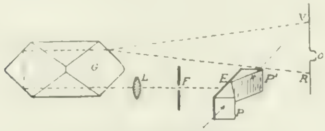


Fig. 1—Spectro-Photometer.

Photometric Commission in Zurich a simple arrangement by which an ordinary photometer can be used to measure relative intensities in the different colors of the spectrum. As shown in Fig. 1, the prisms P and P' reflect the light from the two sources to be compared on to the photometer screen E. Between this screen and the eye-piece are placed a slot F, an objective L and a pentahedric prism G. The image of the slot F, in which the two illuminations are seen side by side, is dispersed by its passage through the prism, so that it is spread over the whole width VR. The eyepiece O can be shifted through the whole range of color from V to R, and any particular color can be measured according to its position. The field is observed as two adjacent zones, the brightness of which can be made equal by moving the photometer between the sources of light in the usual way. Owing to the low values of illumination obtained it becomes difficult to make observations with wave-lengths of less than 0.5 μ.—*The Illumin. Eng.* (London), September.

Light Production.—R. A. Houston.—In a continuation of his long serial on "studies in light production" the author deals with the Welsbach mantle and selective radiation.—London *Electrician*, Sept. 29.

Generation, Transmission and Distribution.

French Hydroelectric Stations.—The number of hydroelectric stations in the four large river districts in France is as follows:

District of Seine River	149	plants
District of Loire River	114	"
District of Rhone River	343	"
District of Garonne River	251	"
Total	857	plants

H. Bresson gives statistical tables on the history, ownership and engineering equipment of the 149 plants of the Seine district. J. Boulanger gives sketches, with maps, of the distribution of energy in the Côte-d'Or and of the transmission and distribution systems of the Grosne Electric Company.—*La Revue Elec.*, Aug. 25.

High-Pressure Steam Pipes.—J. Guillaume and A. Turin.—The first parts of a long article, profusely illustrated by diagrams and tables, giving practical notes and data for the design of high-pressure steam lines.—*La Revue Elec.*, Aug. 11 and 25, Sept. 8.

Traction.

Public Service Railway of New Jersey.—A very full, detailed article, covering eighty-four full pages of text and profusely and beautifully illustrated by forty-eight full-page plates, besides illustrations in the text. After a general introduction special chapters are devoted to the corporation and its organization; office buildings; way department; energy generation (the total output in 1910 of the generating stations being 288,740,147 kw-hours, of which the railway company used 150,108,893 kw-hours, and the remainder, or 138,631,254 kw-hours, was used for lighting and motor service); overhead construction; rolling stock; maintenance of car equipment; transportation department purchase and storeroom departments; accounting depart ment; claims department.—Convention Number *Electr. Railway Journal*, Oct. 7.

Electric Locomotives for Shunting Purposes.—A. Marshall.—A paper read before the Cleveland Instituti of Engineers. Shunting is taken to include: (1) Th handling of heavy goods and mineral traffic in yards an sidings, as now done by steam locomotives; (2) the hau age of minerals below ground, as now done by stationa engines and horses, with particular reference to Clevela iron-stone mines. Although shunting covers a wide fie the following specifications for an electric system a thought to meet all demands: System direct-current, 5 volts, negative side earthed, track rails as negative co ductor; one, two or four series-wound motors per locom tive; series-parallel control work with resistances. Exce in some special cases (in mines) the locomotives can be be supplied with energy by means of overhead conducto Compared with the steam locomotive the electric locomoti has the following advantages: It loses no time on the ro coaling, watering, etc.; it accelerates more quickly; it quires no shed for boiler cleaning, etc.; it needs fewer pairs and renewals. The steam-engine designer is co fronted with a serious problem when he has to produce engine of more than about 26 tons. In the electric locon tive each axle is independently driven and sizes up to tons can be built with a rigid wheel-base not exceeding 6 the whole of the engine weight being available for adhesi Figures are given for the actual cost per ton-mile w steam-operated shunting locomotives and for the estima saving with electric operation. Perhaps the most strik fact brought out in the paper is the indication it gives the very small amount of useful work performed by ste engines in shunting operations. For instance, in the c of the Newport works the equivalent of the full amount useful work done by the seven steam locomotives dur the busiest twenty-four hours of the week, including t required to move themselves about, can be given out any one of the comparatively small generators (1.250 k at the waste-heat power stations at these same works twenty minutes. In addition to the saving on fuel ther a further large saving on locomotive repairs and renew As regards the ease of operation and simplicity, too m cannot be said in favor of the electrical machine. A ther advantage of the electric locomotive is that the dr has a clear view of his work fore and aft, and thus more readily avoid collision, and, what is more import accident to workmen. At night, too, very much more w can be done by the aid of the powerful headlamps which each engine is fitted, while the dangers incident shunting operations are reduced. There is also somet to be gained by reducing the output of smoke and st in busy yards and thickly populated districts. Some r are added on installations in mines where special conditi may necessitate special provisions.—London *Electri* Sept. 29.

Volt-Hour Meters for Tramways.—A volt-hour met mentioned in a paper by R. G. and J. G. Cunliffe be the (British) Municipal Tramways Association. The meter is in principle a direct-current motor in its sim form, having a moving armature of a special and si design, and it is designed so that the speed of the arm is proportional to the voltage. The meter is arrang read in volt-hours; thus, at the end of one hour the av voltage of the circuit during that hour is indicated di on the dial. Special applications of this meter are on tramway sections where it is desired to keep a con check of the average voltage, and in connection with way systems using ampere-hour meters on the cars, w when used alone may give misleading results. The meter has neither pen nor paper; it can be used eithe stationary position or upon a car and has the advantage

recording directly upon a dial.—London *Electrician*, Sept. 29.

Swiss Single-Phase Road.—S. Q. HAYES.—An illustrated description of a narrow-gage, single-phase road connecting Locarno, on Lake Maggiore, with Pontebrella and Bignasco, in the Valle Maggia of Switzerland. The operating emf is 5000 volts, except in Locarno, where 800 volts is used. Each truck has two 40-hp single-phase series motors.—*Elec. Journal,* September.

Wires, Wiring and Conduits.

Electric Conductivity of Commercial Copper.—F. A. WOLFF AND J. H. DELLINGER.—The authors review the various standard values in use for the resistivity and temperature-resistance coefficient of copper and describe the means of making precise measurements of the conductivity of wire samples. The resistivities are given for eighty-nine samples of commercial copper from fourteen important refiners and wire manufacturers in this and other countries. The mean for annealed wire is: Resistivity in ohms per meter-gram at 20 deg. C. = 0.15292; per cent conductivity = 100.07. (Per cent conductivity is computed on the basis of 100 per cent conductivity corresponding to the standard resistivity, 0.153022 ohm per meter-gram at 20 deg. C.). The mean result of data furnished by a large wire manufacturing company, representing tests on more than 100,000,000 lb. of copper, is also given; for example, for annealed samples: Resistivity in ohms per meter-gram at 20 deg. C. = 0.15263; per cent conductivity = 100.25. It is concluded that the best value to be assumed for the resistivity of annealed copper in the preparation of wire tables and in the expression of per cent conductivity, etc., is the previously used standard value, namely, 0.153022 ohm per meter-gram at 20 deg. C. The conductivity of hard-drawn No. 12 B. & S. wires was found to be less than the conductivity of annealed wires by a mean value of 2.7 per cent. The difference between the conductivity of annealed and hard-drawn wires increases as the diameter of the wire decreases. The lowest resistivity and highest conductivity found for a hard-drawn wire were: Resistivity in ohms per meter-gram at 20 deg. C. = 0.15386; per cent conductivity = 99.46; and for annealed wire were, resistivity in ohms per meter-gram at 20 deg. C. = 0.15045; per cent conductivity = 101.71. Representative mean values for commercial hard-drawn aluminum were obtained as follows: Resistivity in ohms per meter-gram at 20 deg. C. = 0.0763; resistivity in micro-ohms per centimeter cube at 20 deg. C. = 2.828; density = 2.70. The advantages of the expression of resistivity in ohms per meter-gram are stated. The desirability of an international standard of copper conductivity is urged.—*Bull. Bureau of Standards,* February.

Temperature-Resistance Coefficient of Copper.—J. H. DELLINGER.—An account of an extended investigation which shows that for representative samples of the copper at present furnished for electrical use the conductivity and temperature-resistance coefficient are proportional to a high degree of accuracy for differences in physical condition and to a fair accuracy for differences in chemical composition of samples. This relation may be put in the following very convenient form for reducing the results of resistivity measurements to a standard temperature: The change of the resistivity per degree C. of a sample of copper is 0.000598 ohm per meter-gram, or 0.00681 micro-ohm per centimeter cube. The distortions caused by bending and winding a wire are shown to produce no material change in the temperature-resistance coefficient; so that the temperature rise in machines and instruments may be calculated from measurements of the resistance of the windings with greater confidence than heretofore. The measurement of temperature-resistance coefficient is shown to present an advantageous substitute for the direct measurement of conductivity in a number of cases. A discussion is given of the mathematical relations between the different methods of expressing the temperature-resistance coefficient. In an appendix results of tests of the Reichsanstalt are given which confirm the author's results.—*Bull. Bureau of Standards,* Vol. 7, No. 1.

Effects of Bends on Inductance.—R. P. JACKSON.—An article on the effects of bends and loops on the inductance of a conductor. Bends and loops should be avoided because a crooked line cannot be the shortest one between the points. But the effect of bends and loops on the inductance is not as marked as is often supposed. No matter how crooked and intricate the path afforded by a conductor, so long as one loop does not lie over another its impedance cannot be greater and is, in fact, somewhat less than the same conductor stretched out straight. It is true, however, that such a tortuous path has greater impedance than one following an approximately straight line between the terminal points. The reason for this is explained. Bends, loops and corners are harmful only because they involve more length of conductor and not because such loops and bends in themselves increase the inductance. This is not the case, however, if one loop overlaps another. In this case the inductance increases in general as the square of the number of turns. Sharp points are bad, whether at bends of the conductor or elsewhere, but for reasons due to the static rather than the magnetic field.—*Elec. Journal,* September.

Calculation of Aluminum Lines.—G. BARON.—The author calculates the sag which must be given to aluminum wires to make sure that the tension never becomes greater than the maximum tension permitted by the German Association of Electrical Engineers, namely, 9 kg per square millimeter (12,800 lb. per square inch). The most unfavorable conditions assumed by the author relate to an additional load of ice of 15 grams per meter length and square millimeter surface (6½ lb. per foot length and square inch surface) at a temperature of — 5 deg. C. (+ 23 deg. F.). The general formulas for the solution of the problem are given and used to calculate a numerical table for convenient use.—*Bull. techn. de l'Assoc. de l'Inst. Elec. de Grénoble,* March, 1911; abstracted in *La Revue Elec.,* Aug. 11.

Automatic Protection of High-Tension Cables.—H. BIRRENBACH AND M. HÖCHSTÄDTER.—An English translation of their German paper recently abstracted in the Digest, in which the authors describe a new automatic protecting device for high-tension cable networks and mains invented by Mr. Höchstädter. Particulars of the installation at Cologne are given and the results of tests are also referred to.—Lond. *Electrician,* Sept. 29.

Electrophysics and Magnetism.

Production of Helium from Radium.—B. B. BOLTWOOD AND E. RUTHERFORD.—An account of a careful experimental investigation, the chief results of which are summed up as follows: The rate of production of helium by a radium salt has been accurately measured and has been found to be equal to approximately 0.107 cu. mm of helium per day per gram of radium (element), which is equivalent to 156 cu. mm of helium per year per gram of radium in equilibrium with its first disintegration products, the emanation, radium *A* and radium *C*. The rate of production, 158 cu. mm of helium per year, calculated by Rutherford and Geiger from the results of their experiments on the number of particles emitted by radium, is in excellent agreement with the rate of production which has been found. The amount of helium by the disintegration of a known quantity of radium emanation has also been measured and has been found to correspond with the amount to be expected from theory. The production of helium by polonium and from a preparation containing radio-lead has also been observed.—*Philos. Mag.,* October.

Alternating-Current Spark-Gaps.—W. WEICKER.—An illustrated translation of a German paper recently abstracted in the Digest in which the author examines the

methods of measuring alternate-current voltages by means of spark-gaps and shows the various influences that must be taken into account for purposes of correction. He defines the "initial voltage" and the "limiting voltage of brush discharge" and shows how these are affected by the nature of the electrodes, by the length of the spark-gap, by moisture, atmospheric pressure, ultra-violet light and other disturbing influences.—Lond. *Electrician*, Sept. 22.

Electrochemistry and Batteries.

Electrode Control in Electric Furnaces.—E. Ragonot.—An illustrated description of the automatic system of electrode control in use at the Keller-Leleux electric furnace plant in Livet, France. The Routin automatic regulator is employed, the arrangement being shown in Fig. 2. *F* is the Keller electric furnace, with one terminal of the

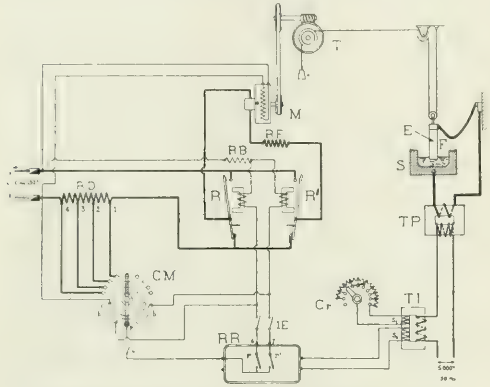


Fig. 2—Diagram of Connections of Control System.

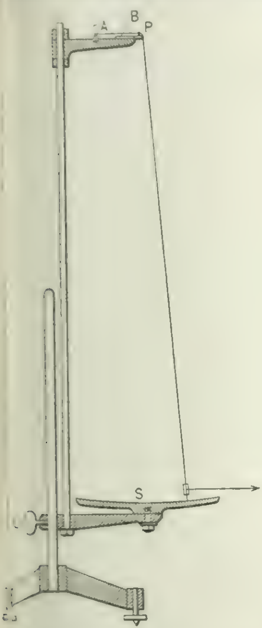
electricity supply in the bottom of the crucible *S* and the other terminal in form of a movable electrode *E* at the top. *E* is suspended by means of a chain, one end of which runs over the endless screw axle *T* as shown in the illustration. This axle is driven by belt from the motor *M* and the electrode *E* is thus raised or lowered. The 5000-volt alternating-current supply which feeds energy to the furnace *F* through the intermediary of the transformer *TP* is shown at the right-hand bottom corner of the diagram. An auxiliary 150-volt, direct-current supply is shown at the left hand of the diagram; it feeds energy to the motor *M* which raises or lowers the electrodes. This motor *M* is shunt-excited (the excitation current being taken from the 150-volt supply just mentioned). In normal operation (that is, with the connections as shown in the diagram) the armature of the motor *M* will receive no current, being short-circuited through the resistor *RF*. It is only when either the relay *R* or the relay *R'* has been acted upon by the electromagnet device that the armature of the motor *M* will be connected in one or the other way to the 150-volt direct-current supply system and will begin to rotate in one or the other direction, thus raising or lowering the electrode *E*. The electromagnetic device which operates the relays *R* and *R'* can be actuated either by hand by means of the commutator *CM* or automatically by means of the Routin regulator *RR*. The relays *rr'* in the latter would be too weak to actuate directly the motor *M* for raising or lowering the electrodes; they, therefore, serve only to actuate the main relays *RR'*. The primary of the transformer *TI* is in series with the primary of the furnace transformer *TP*. The transformer *TI* has two secondary windings, one of which s_2 supplies the current for actuating the relays *rr'*, while the other s_1 is an auxiliary winding, short-circuited through the resistor of adjustable resistance *Cr* for the following purpose. In electric furnace plants it is necessary to be abl to vary the load within rather wide limits, correspondin to primary currents between 40 amp and 100 amp. Fo any load the current must be maintained constant with a accuracy of 2 per cent. In order to accomplish this, with out changing the primary winding, use is made of th rheostat *Cr*, which permits adjustment of the load of th secondary winding s_1. For operation by hand the com mutator *CM* is used, which permits starting the motor *M* in one or the other direction and also permits regulatio of the speed by short-circuiting a greater or smaller pa of the resistor *RD* in the circuit of the armature. Th interrupter *i* (at the side of the commutator *CM*) permi one to cut the regulator out if desired.—*La Revue Elec* Sept. 8.

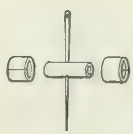
Units, Measurements and Instruments.

Resistor of Variable Low Resistance.—J. H. Dellinge—A description of a very simple resistor of variable lo resistance, the operation of which depends on the fact th mercury has approximately sixty times the resistivity copper. The apparatus consists simply of a tube of th glass (thick glass may be broken by scratching of t copper wire), or of porcelain or hard rubber, with slight enlargement at the upper end to receive the me cury when displaced by the descending copper wire. amalgamated copper wire of slightly smaller diameter th the internal diameter of the tube is lightly gripped eit by a cork placed in the top of the tube or by a pair springs faced with insulating material. A length of 15 is convenient. A 1-ohm range is obtained by using a t of about 0.4 mm diameter and any other range down 0.01 ohm is obtained by tubes up to 4 mm diameter. the first of these mercury resistors of variable resista a flexible lead wire was connected to the upper end of copper wire, and to prevent opening the circuit when wire was wholly withdrawn from the mercury a w shunt was connected across the terminals. An impro ment in the arrangement is to connect simply to the and the bottom of the mercury column. Thus there nothing whatever connected to the plunging copper w which functionates simply by short-circuiting the merc A simple and valuable modification is the use of two these resistors in series by the employment of a g U-tube of which the diameter of one leg is $\sqrt{10}$ times other. Thus a pair of resistors of variable resistanc the ranges 0.1 ohm and 0.01 ohm are conveniently tained. The use of the U-tube eliminates the difficult sealing the lower end. A scale may readily be atta and when the instrument has been calibrated the re ances of its settings are known. The instrument sh not usually be employed for exact quantitative work, h ever, as it has a large temperature-resistance coeffic The mercury resistor of variable resistance has been p plied to facilitate adjusting to a balance the auxiliary arms of the Thomson bridge, in the comparison of resistance standards, and its use materially increases speed of working. It is especially valuable in the m urement of the resistance of wire samples for determ tion of the conductivity, since the magnitude of the arms may be very different for every sample meas The application of this device to alternating-current b work has been productive of good results. The prec of determination of low values of inductance may b creased by the use of ratio arms of lower resistance. has been made convenient by the use of the mercur sistor. It was found that, fortunately for altern current work, this resistor has practically non-va inductance (at any rate for modern frequencies). is evident if the copper wire is of practically the diameter as the mercury column, as the geometry c circuit is not changed by varying the resistance. this instrument is a complementary apparatus to the

riable inductance. The total change of inductance of ıe of these "mercury variables" 15 cm long, about 1.5 mm ternal diameter of tube, 1 mm diameter of copper wire, ıd a range of 0.05 ohm, was 6×10^{-9} henry, or 6 cm.—*ıysical Review,* September.

Measuring the Torque of Electrical Instruments.—P. G. ..NEW.—An illustrated description of an instrument ıich while specifically designed for the determination of ıe torque of electrical measuring instruments is gen-·ally applicable to the measurement of small horizontal rces. It operates on the pendulum principle, as shown Fig. 3, the essential feature being the use of a scale *S*





... 3—Device for Measuring Torque. Fig. 4—Details of Bob.

... concave spherical surface turned from a brass cast- ... a radius of curvature of 1 m. The bob, which is ...rted from an adjustable arm, is so arranged that the ... of support *P* is at the center of curvature of the ...ical scale. A silk fiber used for suspension is wound ... friction pin *A* for convenience in adjusting its length. ... fiber passes through a V-shaped notch in the end of ...ss strip *B*, which is capable of a small horizontal ...tment to aid in the initial centering. The whole is ...ted on an ordinary clamp stand, the tripod being ... with leveling screws. The clamp *C* allows the scale ... bob to be lowered as a unit for convenience in apply-... an instrument. The graduations of the scale con-... 153 concentric circles, the distance between succes-... circles being approximately 1 mm. The diameter of ... scale is 30 cm. Since the horizontal deflecting force ...s as the tangent of the angle of displacement, it is ...ssary, in order that the instrument should be direct ...ing, that the circles be so spaced as to indicate the tangents of the angles of deflection directly. The bob consists of a small hollow brass cylinder with a fine sewing needle passed through it perpendicular to the axis, as shown in Fig. 4. The silk fiber by which the horizontal force to be measured is transmitted to the bob is attached to the needle and passes out along the axis of the hollow cylinder. The point of attachment is made at the center of mass of the bob, which, for convenience, is marked by a ...le scratch. The mass of the bob alone is adjusted to 0.5 gram, but in order to change the range concentric cylinders, each cut in halves, are made to fit snugly over the inner cylinders, as is indicated in Fig. 4. These extra cylinders make the total mass 1 gram, 2 grams, 5 grams, 10 grams and 20 grams respectively, giving a range of 40 to 1 for full-scale deflection. In measuring the torque of the deflection instrument—for example, a voltmeter—the horizontal thread is fastened to the pointer at a convenient distance from the pivot, the whole pendulum system adjusted to the proper height and the voltmeter moved horizontally until the desired deflection is produced. In this case torque = arm $\times$ weight $\times$ 0.001 $\times$ reading in divisions. In the case of a watt-hour meter it is necessary only to attach the thread to the edge of the disk, apply current and voltage to the meter and allow the thread to wind upon the disk as far as it will—*Bull. Bureau of Standards,* Vol. 7, No. 1.

High-Frequency Alternating Currents in Linear Conductors.—H. W. Edwards.—An account of an experimental investigation of the distribution of current and the variation of resistance in linear conductors of square and rectangular cross-section when carrying alternating currents of high frequency. Alternating currents were produced by the discharge of a condenser through an inductive resistor, with sufficient uniformity of current to render possible their use in precise measurements. A description is given of an ammeter suitable for the measurement of the intensity of alternating currents. The frequency of alternating currents was measured by a photographic spark counter for any frequency up to 750,000 per second. By checking Maxwell's formula for the virtual resistance of cylindrical wires it is shown that the damping of the oscillating currents used is small enough to be neglected. The ratio of the virtual to the direct-current resistance for copper wires of square and rectangular cross-section was measured by the use of a differential thermometer and these observed values were checked by approximate formulas within certain limits. For the two square cross-sectioned wires tested this limit was for frequencies above 150,000 and for the two rectangular cross-sectioned wires the limit was about 150,000. Formulas are developed by certain assumptions in the general theory, which give approximate methods of calculating the ratio of the virtual to the direct-current resistance. The validity of these assumptions is based upon experimental results. In the development of the expression from which the ratio of resistances is calculated there occurs an expression for current intensity at any point of the cross-section of the conductor. This expression is used to calculate, for some particular cases, the distribution of current intensity within the cross-section.—*Physical Review,* September.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—A note on a recent British patent (20,441, Sept. 21, 1911) of the Marconi Wireless Telegraphy Company and Mr. J. H. Round. To reduce the effects of powerful atmospheric discharges a variable conductor and a receiver in the form of a Fleming valve, both of the unidirectional type, are connected in opposition and in parallel as shunts to the receiving circuit. The variable conductor operates only when acted upon by powerful oscillations, so that when the circuits are in tune signals can be received as long as they are not strong enough to affect the conductor; but, on a discharge taking place, the two valves become equally operative, and, being in opposition, no sound is produced. The filaments of the valves are rendered incandescent by current from two batteries, one in each circuit, adjusted by resistances. Potentiometers are also provided for varying the voltage across the valves, so that the sensitiveness of the conductor of variable conductance can be adjusted.—Lond. *Elec. Eng'ing,* Sept. 28.

Book Review.

ÖKONOMISCHE ERZEUGUNG UND VERWERTUNG ELEKTRISCHER ENERGIE. By Adolf Prasch. Vienna: Joseph Eberle & Company. 276 pages, 134 illus. Price, 3.80 marks.

This little book is Part I of the sixth volume in a uniform series of books on engineering subjects. It covers the general theory of electromagnetism, the production of electromotive force, the characteristics of direct-current and alternating-current generators and motors, tra formers and storage batteries, the performance of pri movers obtaining energy from steam, water, gas or oil; operation of arc lamps, mercury-vapor lamps, incandesc lamps, Nernst lamps, switches, rheostats, fuses, lightn arresters, meters, transmission lines and cables. The tr ment is brief and to the point, the physical relati being outlined without resort to mathematical proof formularization. The material is arranged for ready ref ence, and as such should prove of value, although the b contains almost no operating data or design details.

New Apparatus and Appliances

ELECTRICAL APPARATUS AT BREWERS' EXPOSITION.

Electrical machinery is found to be efficient and convenient by brewers as well as by other manufacturers. At the American Exposition of Brewing Machinery, Materials and Products, held at the Coliseum, Chicago, from Oct. 12 to Oct. 21, and said to be the first exhibit of the kind held in the United States, there were several exhibits of electrical interest. A conspicuous feature was a well-made model of a modern brewery, operated by electricity and provided with miniature electric lamps. A large proportion of the machines in the various exhibits were shown in operation, electric motors being utilized for the purpose. There were twenty-one General Electric motors in service for this purpose and also a number of Westinghouse, Crocker-Wheeler, Fort Wayne, Roth and other motors.

The General Electric Company made an exhibit showing an electric beer-vat drier. This is an electric-heating device especially designed for brewers' use during the vat-varnishing season. A new General Electric machine shown in this exhibit was an ozonator designed for use on direct-current circuits. Direct-current and alternating-current motors were also exhibited.

Allis-Chalmers Company exhibited two motors, a 7½-hp induction type K motor and a 5-hp direct-current machine. A 10-kva transformer was included in the exhibit.

Charles L. Kiewert Company, of Milwaukee, had an exhibit beneath two Alba flaming-arc lamps made in Germany and for which this company is the American agent.

Electric Storage Battery Company displayed a few Ironclad Exide cells.

H. W. Johns-Manville Company had a characteristic exhibit including fuses and electrical specialties.

Fairbanks, Morse & Company, Chicago, had a display consisting of direct-current and alternating-current motors.

The Schneible Company, of Buffalo, made a machinery exhibit including electric centrifugal pumps and electric gas compressors.

Cutler-Hammer motor controllers were rather conspicuous in connection with a number of the motors in service in exhibits.

The Terry Steam Turbine Company, of Hartford, Conn., displayed a small single-stage steam turbine directly coupled by a horizontal shaft to a 15-kw generator. A turbine wheel showing the method of blading was also exhibited.

Vilter Manufacturing Company, Milwaukee, exhibited a large horizontal compressor for refrigerating work, as well as other machinery of this character. A vertical compressor made by this company was operated in the basement.

The York Manufacturing Company, York, Pa., exhibited several refrigerating machines, both horizontal and vertical, of the single-acting and double-acting type. This company also had a vertical machine in service in the basement. This compressor was driven by a 15-hp motor and used the purpose of cooling beer.

The General Vehicle Company, Long Island City. played a 3½-ton electric chassis for heavy commercial s ice. A 5-ton electric brewery truck was also shown.

The Hohmann & Maurer division of the Taylor Ins ment Companies, Rochester, N. Y., had an exhibit of perature-indicating instruments of particular interest. novelty was a mercury thermometer so connected as t dicate by electrical means at a distance the tempera where the thermometer is placed. For instance, the e neer of a power plant connected with a meat-packing es lishment can ascertain by the use of this device the perature of the chill room at any time by pressing a bu on a wall indicator and noting the light flashed up u glass-covered openings corresponding to the scale on thermometer tube.

ELECTRICAL EXHIBITS AT ILLINOIS STATE FA

Increasing attention is paid to the state fairs by m facturers of electrical apparatus. At the recent Illi State Fair in Springfield, which attracted a large att ance, there were several exhibitors who showed elect machinery or appliances. The General Electric Com was one of these. This company has already exhibite the Wisconsin and Iowa state fairs this year, and it to exhibit also at the Oklahoma, Texas, Mississ Georgia and other state fairs. Its display at Spring was shown in a tent and included a gasoline-engine, di connected electric-lighting set, the dynamo of which rated at 3 kw and wound for 110 volts. The gas engi this unit is of the four-cylinder type. In parallel this machine was a single-cylinder gas-engine-driven and the two were operated in parallel with excellent lation. There was also a considerable display of he and cooking devices of interest to residents of rural tricts, including an electric range.

The International Harvester Company of America a large exhibit in a tent. It included two 25-hp. cylinder gas engines made by the exhibitor and belt 16-kw Fort Wayne direct-current, 110-volt dyn These dynamos furnished energy to about 1100 inca cent electric lamps, arranged in festoons in the int of the tent and also placed on posts. These lamps ra from 2-cp carbons to 40-watt tungstens. A 5-hp el motor operated a line of gas engines of different sizes and an exhibit of twine-making machinery was driven 7.5-hp motor. A 5-hp motor operated an exhib o spreaders, while 4-hp machines were used to demon ate in action a number of corn pickers, hay loaders and corn shellers.

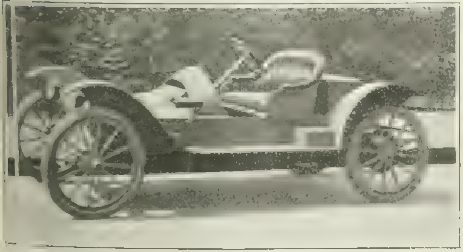
In a separate tent the International Harvester Co any

[ex]hibited its "power-house on the farm." This consisted [of] a 6-hp gas engine belted to a line shaft, from which a [...]w, 30-volt, Fort Wayne direct-current motor was driven. [Fr]om this line shaft were also operated corn shellers, feed [gr]inders, an emery wheel, a washing machine, a churn, [cre]am separators, a grindstone and a pump. The installa[tio]n included a sixteen-cell storage battery of National [ce]lls, made by the United States Light & Heating Company. [A f]eature of this little power plant was a small switch[bo]ard panel made by the Cutler-Hammer Manufacturing [Co]mpany, containing a voltmeter and an ammeter, with an [in]genious arrangement of switches so designed that the [ou]tgoing circuits could be fed either from the dynamo or [th]e battery by one movement of the switch handle. The [sw]itchboard is also provided with a low-voltage cut-out of [th]e lever type.

[F]airbanks, Morse & Company exhibited a low-voltage [fa]rm-lighting plant, consisting of a gas engine driving a s[m]all dynamo, from which was charged a sixteen-cell stor[ag]e battery made by the Electric Storage Battery Company. [Th]e exhibit was lighted by thirty-six 20-watt Mazda lamps, a[n]d electricity was also supplied for a low-voltage fan and a [w]ashing machine. The dynamo is rated at 28 amp at [... vo]lts. A neat switchboard panel completed the exhibit. [A] large number of gas and oil engines were exhibited, [...Th]e Root & Van Dervoort Engineering Company, of [...] Moline, Ill., exhibited a gasoline engine driving a [dynam]o, from which its exhibit was lighted and which also [serve]d to supply energy for an electric sign. The Colum[bus E]ngine Company, of Detroit, Mich., showed some in[teresti]ng examples of kerosene engines. The American [Elect]ric Company, of Chicago, showed a number of elec[tric] and telephone specialties, and Joseph Barnett & [Comp]any, of Riverside, Ia., exhibited their copper-cable [light]ing rods and fixtures.

H[I]GH-SPEED, LONG-RANGE ELECTRIC PASSENGER VEHICLE.

[In] the accompanying illustration is shown an electric [vehic]le designed for the severe duty of covering 80 miles [in fou]r hours running time under ordinary conditions of [count]ry roads. The established fact that the car maintained [an av]erage running speed of 20 miles per hour for 244 [miles] between Boston and New York shows that it can [perfo]rm the service satisfactorily. Moreover, six cars,



Electric Roadster.

[duplic]ates, of the one here illustrated, have been ordered by [the E]dison Electric Illuminating Company of Boston to re[place] gasoline passenger cars used by heads of departments. [Bei]ng designed for business service and ease of riding [the c]ar differs essentially from all other electric or gasoline [cars]. The wind resistance has been minimized. The body [is] very low with a low center of gravity, but it is suspended from the upper side of the springs. The frame is buil[t] of wood strongly braced with steel.

In the spring suspension lies the secret of the car's easy riding qualities. The chassis is supported on a three-point suspension. There are the conventional full elliptic springs in the rear, and in the front there is mounted a cross spring from which the upper part of the body is suspended. The action of the front spring and axle is such that the car is capable of traveling over the worst of roads at high speed without discomfort to passengers.

The car is equipped with Edison storage battery, the battery and motor being proportioned according to the mileage and speed required. The standard equipment consists of fifty cells of the A-6 type, from which the travel obtained is between 80 and 120 miles at a speed of 20 miles per hour.

Use is made of a speed controller placed on the top of the steering wheel in the location occupied by the throttle on a gasoline car. There are eight forward and four reverse speeds; the reversing switch is operated by a pedal.

The car is one that should prove especially useful for public service corporations on account of its great mileage, high speed, easy riding and simple operation. It has been placed on the market by S. R. Bailey & Company, Amesbury, Mass.

CHICAGO FALL AUTOMOBILE OPENING.

From Oct. 7 to 14 the Chicago Automobile Trade Association gave a "fall opening" on Automobile Row; that is, Michigan Avenue from Twelfth Street to Twenty-eighth Street. Nearly all the members of the association took part in the opening, decorating their stores in gala attire and setting forth their cars and accessories in the most attractive shape, making particularly prominent the new models and devices of the fall season. During the evening free demonstration cars were run along the street and on Oct. 9, which was "fire-prevention day" in Chicago, in memory of the great Chicago fire of forty years ago, the automobilists combined with other bodies and the city authorities in a civic celebration.

While most of the exhibits shown in the stores and on the street related to gasoline cars, there were nevertheless a number of electric machines which figured in the "opening," including those made by the Anderson Electric Company, Baker Electric Company, Borland Electric Company, Flanders Manufacturing Company, Hupp-Yeats Corporation, C. P. Kimball & Company, Ohio Electric Vehicle Company, The Rauch & Lang Carriage Company, Studebaker Corporation, Waverley Company and Woods Electric Automobile Company. In addition there were several members of the association who called attention to electrical accessories to the automobile trade. Among these were the Hessler Storage Battery Company, Dolly Electric Company, Vesta Accumulator Company, Winter Battery Company and Witherby Igniter Company.

Electrical street decorations were a prominent feature of the opening. Between Twelfth Street and Twenty-eighth Street, a distance of about two miles, Michigan Avenue was spanned with eighty-six festoons, each supporting forty 16-cp incandescent electric lamps. These festoons were in turn supported from span wires attached to buildings. They were suspended from the span wires by two vertical wires and by this means the festoon was divided into three portions of about equal length.

In addition, at street corners or at equivalent intervals in the cases of long blocks, ornamental wooden posts were erected. There were sixty-four of these posts in all and each was surmounted by a 16-in. opal glass globe containing a 250-watt tungsten lamp. Each post also supported from corner brackets four ornamental colored lanterns in imitation art glass and each of these lanterns inclosed a 16-cp carbon lamp. Mr. Homer E. Niesz was the contractor for the electrical decorations and also for supplying electricity to the lamps during the week of the "opening."

A NEW PLUG AND RECEPTACLE.

The increasing use of portable electric translating devices, such as small motors, lamps, batteries, etc., has developed a demand for a plug and receptable which more nearly conforms to modern requirements than the older

Plug and Receptacle.

form of devices, and to meet this need the Delta-Star Electric Company, Chicago, is placing on the market the device illustrated herewith.

In general, the considerations involved in the design of plugs and receptacles are to provide means for carrying the rated current of the device without excessive drop or heating and carry such overloads as may be encountered in actual practice, and the insulation of all live parts for maximum potential in a permanent manner, both electrically and mechanically. These features have been embodied by the designers in the present type.

The receptacle consists of an iron shell containing two flat contacts mounted in a fireproof insulating body impervious to moisture, acids or oils. This material has high insulation and mechanical strength, rendering impossible short-circuiting between the terminals. The receptacle can be mounted on a horizontal, vertical or angular position, as desired. The plug consists of a metal shell containing two flat contacts imbedded in insulating material, and so designed that they lock into the receptacle contacts, thus preventing accidental opening of the circuit. All parts are made with dies, insuring interchangeability, which is a very essential feature in railroad service.

SMALL BATTERY CHARGING AND TRANSFER PANEL.

The panel shown in the accompanying illustration, which has been recently placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee, is for use with battery systems where two batteries are employed, one of which is a reserve battery under charge, while the other is on the working line. Duplicate batteries arranged in this manner are used on circuits for electric clocks, railway signals, electric bells in schools and other buildings, the batteries being alternated as the working battery becomes discharged. This panel allows the transfer of batteries without interrupting the working circuit, which is very important in many cases. On an electric-clock system the contact by the master clock might occur when circuit is open and cause the secondary clocks to be fifteen to twenty seconds slow.

The charging rate can be varied without disturbing the working circuit, each of the contact buttons, shown at top and bottom of the accompanying illustration of the panel, forming a resistance step. These panels are ordinarily made for use on 110-volt direct-current circuits. A snap switch is provided for stopping the charge when the desired maximum voltage is reached. One fuse of each the charging and the working circuit has additional terminals on front of the panel, so that an ammeter can be conveniently cut in on either circuit without interrupting the circuit. Automatic means for cutting out the battery wher charged and transferring batteries on the working circuit when either reaches a minimum voltage can also be provided if desired.

Battery-Charging Panel.

DIFFUSING GLASSWARE FOR INCANDESCENT LAMPS.

The Haskins Glass Company, Wheeling, W. Va., ha brought out what is termed "Lucida" glass, possessing de sirable illuminating qualities. The glass is translucent i that it entirely hides the form of the radiant and appea uniformly illuminated throughout its surface. Moreove the glass possesses a large degree of reflecting power s that when properly shaped it affords an excellent diffusir reflector. It has a low coefficient of absorption with hig diffusive power besides having a pearly lustre yielding shimmering effect by transmitted light. The curves sho that the distribution of light is such that there is neith a bright spot directly underneath the reflector nor wi distribution dissipating the light over a wide area. Bo the outer surface and the inner surface of the glasswa have their natural glaze unroughened by acid or sand blas ing so that it can be readily cleaned.

The peculiar nature of the "Lucida" glassware adap it equally to all styles of finish and design; it harmoniz with bronze, iron, brass, gilt or silver metal work and c be treated in any "period" or style of decorative art aft the manner of sculptured alabaster or in the simpl motives characteristic of the glass-blower's art. It is m le up in the following shapes: Bowl type, flat or flared t e, semi-flared type, mission bell type, two-piece ball g e type, and in hemispheres.

Fig. 1—Diffusing Reflector.

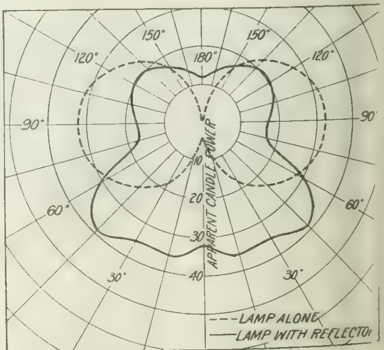


Fig. 2—Distribution from 40-Watt Lamp with Reflec r.

Industrial and Commercial News

The Week in Trade.

WHILE demand for immediate necessities furnishes the chief source of new business at present, buoyancy has been imparted to the buying movement by the prevlence of low prices. Attracted by these, consumers are placing rders on a broader scale for replenishing stocks, though most f the contracts are for early delivery. Price reductions have reatly broadened operations in the steel trade, and both inuries and orders are being received in encouraging volume. n some branches of the trade, notably structural steel and ipe, mills are working at a high rate of capacity. The broader emand for steel from shipyards and builders is an indicaion of expansion throughout the country. Conditions in the ig-iron market are still unsatisfactory. In addition to lack f demand, producers are showing little disposition to close rm contracts at the low prices now quoted. Aside from cattering orders for small amounts, there have been few feaires of interest in the pig-iron market during the week. Price visions on cotton goods have had a beneficial effect and ers in dry-goods and textile lines are showing a wider inst in contracts for the future.

Acceptance of the plan for disintegration of the American acco Company, filed on Monday, in compliance with the ree of the United State Supreme Court, will furnish a needed le to business interests at large, in that it helps to point the way to meet the requirements of anti-trust laws and eve the business tension. Trade as a whole indicates that dying influences are making headway and that confidence eing established. Growth of new enterprises and of plans utilization of idle capital is becoming more pronounced. ness failures for the week ended October 12, as reported *Bradstreet's*, were 212, as compared with 201 last week, 233 e corresponding week in 1910, 220 in 1909, 244 in 1908, and [illegible] 1907.

The Copper Market.

FROM present indications the October report of the Copper Producers' Association will be even less favorable to producers than was the case in September. A heavy dease has taken place in both foreign and domestic consump-, and as output shows no signs of curtailment a large inse in surplus stocks is expected. In anticipation of this r showing consuming interests are not responding to the

[illegible] Copper.	Bid.	Asked.	Settling Price.
[illegible]	[illegible]	[illegible]	....
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible] market, Oct. 17, was as [illegible]

	Noon.	Closing.
	£ s d	£ s d
[illegible]	[illegible]	[illegible]
[illegible] futures	[illegible]	[illegible]

[illegible] fluctuations for this year:

	Highest.	Lowest.
[illegible]	12.35	11.87
[illegible] spot	£57 10 0	[illegible]
[illegible] futures	[illegible]	[illegible]
[illegible]	[illegible]	57 5 0

sent scale of copper prices, holding to the belief that the l of the market will force them still lower. With electronow bringing from 12.10 cents to 12.20 cents cash, and e copper quoted at 12¼ to 12⅜ cents cash for October and vember delivery, earlier predictions for 12-cent copper bere the end of the year seem probable of fulfilment. Purases are in very small lots for both domestic and foreign rests. Inquiry from abroad, while encouraging, does not roach in volume that of the first half of the year. Standard pper in New York is very dull, and deviation from the posins cited in the table has been slight. Statistics of operations the copper trade show that 1,078,909,598 lb. of copper were duced in the United States in the past nine months and that s total is .3 per cent less than in the corresponding period t year. Shipments to domestic consumers in this time aggrete 511,515,058 lb., or 11.3 per cent under the total in the same months of the previous year. Exports in the past nine months amounted to 548,529,887 lb., or 9 per cent in excess of the showing in the preceding year. Total deliveries in the period were 1,060,044,937 lb. and this was 1.4 per cent under the deliveries in the corresponding period of 1910. In the current month, including October 17, exports aggregate 9619 tons. The daily call on the Metal Exchange October 17 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

Montreal Tramways Makes Proposal for Acquisition of Street Railway Company.—Samuel T. Mains, secretary of the Montreal Tramways Company, has sent a notice to stockholders of the Montreal Street Railway Company in which he offers to exchange the stock of the latter for cash, debenture stock and ordinary stock of the Montreal Tramways Company, in accordance with an agreement recently entered into with the street railway company for acquisition of its property. The notice calls attention to this agreement and states that among other considerations on the part of the tramways company it has agreed to pay and deliver to shareholders of the Montreal Street Railway Company, on completion of transfer to it, $438.75 in cash, $800 in 5 per cent debenture stocks, and $100 in ordinary shares of the tramways company, for each five shares of the street railway stock held by any street railway stockholder as shown by the registry of the company. Fractional certificates will be issued to holders who do not own five shares or an exact multiple of five shares. The notice says further that at the meeting of the street railway shareholders at which the agreement for acquisition of the property was approved a number of shareholders requested that the tramways company deliver $1,250 in 5 per cent debenture bonds and $100 in ordinary shares, against each five shares of street railway stock, to those holders who preferred not to take cash, and this request, according to the circular, will be acceded to by the tramways company. Funds for acquisition of the property will be obtained from proceeds of the $10,000,000 first and refunding 5 per cent bonds sold to American banks, as mentioned in the last issue.

Underpaid Letters.—The United States Consul-General at Tientsin, China, in a late report says that his office still receives letters from the United States with 2-cent stamps affixed and on which the consular officer must pay 6 cents when they are delivered. He mentions this fact for the reason that many American firms appear to pay no attention whatever to affixing the proper amount of postage on their foreign letters. A somewhat general canvass of the leading import firms of Tientsin reveals the fact that the receipt of underpaid letters from the United States is so common that the firms generally refuse to accept them unless the envelope shows the address of some American firm with whom they are in communication.

Contracts Awarded for New York Skyscraper Equipment.—Messrs. Mailloux & Knox, of New York City, designers of the electrical equipment for the fifty-five story Woolworth building, now in course of erection at Broadway, Park Place and Barclay Street, New York City, have awarded a contract to the Providence Engineering Works for tandem-compound engines, aggregating 2300 hp, for this building, and to the Babcock & Wilcox Company for the boilers. The elevators will be furnished by the Otis Elevator Company. Awards for the generators and switchboards will be announced later.

New Screw and Bolt Factory to Be Electrically Operated.—The Gary Screw & Bolt Company, which is building a new factory at East Gary, Ind., now nearing completion, has entered into contract with the Northern Indiana Gas & Electric Company of Hammond, Ind., for 750 kw of electrical energy which will be used to operate the machinery in the factory, as electric drive will be employed throughout. The energy will be supplied to the factory as 440-volt alternating current.

La Crosse Dam Will Be Rebuilt.—Under charge of W. J. Ferris, president of the La Crosse Water Power Company, the portions of the dam at Hatfield wrecked Oct. 6, as described in the previous issue, will be rebuilt as rapidly as possible. The cost of repairs is estimated at $100,000.

Philadelphians Will Investigate City Lighting Contract.—With reference to rumors that an investigation is to be made of the contract with the Philadelphia Electric Company for lighting the city, Logan M. Bullett, of the Citizens' Committee, stated as follows: "This is one of the matters we have had under consideration almost from the time of formation of the committee, and in due time we expect to ask an investigation of the subject. We have all the necessary data respecting the prices paid by the cities of Philadelphia, Baltimore, Chicago and elsewhere for municipal electric lighting and are prepared to place our information in the hands of the Catlin commission."

Idaho Properties Sold to Pittsburgh Interests.—J. S. and W. S. Kuhn, of Pittsburgh, who are interested in irrigation work in Southern Idaho, have purchased the holdings of the Boise & Interurban Railway of Boise, which operates between Boise and Caldwell, and the transaction involved the transfer of between $2,000,000 and $3,000,000 in securities. Negotiations for purchase by the same interests of the Boise Railroad Company, Ltd., and the Boise Valley Railway Company are expected.

Will Extend Lines in Northwest.—Preparations are being made by engineers representing the Pacific Power & Light Company for surveys of the territory between Wallula and The Dalles, where high-tension transmission lines will be erected for supplying energy in this section. The line will be about 130 miles in length and its cost will approximate $375,000.

American Capitalists to Operate Canadian Traction.—Negotiations are said to be in progress for a merger of the Brantford (Ont.) Street Railway and Grand Valley lines into an electric system, with a view to extension from Toronto to Detroit. American capitalists are interested in the project.

Aluminum Notes and Prices.—The aluminum market as of October 17, is reported quiet, with ingots for remelting quoted at 20@22 cents spot No. 1, the base for large ingots. Rods and wire are held at 31 cents and sheets at 33 cents.

Financial.

The Week in Wall Street.

DISCUSSION of the plan for reorganization of the American Tobacco Company has occupied Wall Street throughout the week. Business interests in general are awaiting presentation of a method whose acceptance as conforming to anti-trust laws will relieve uncertainty and assist revival of trade, but in spite of this desire for advancement considerable opposition has been offered to the present plan on the ground that it does not provide for restoration of competitive conditions. Even if the plan proves satisfactory to the Supreme Court, there is likelihood of another period of uncertainty before ratification by that body takes place. Public interest in the market is still very light, and professional trading is easily recognized in the transactions. Profit-taking sales at the opening on Monday, with selling centering on United States Steel, lowered prices rather generally, though recovery toward the close showed gains in the majority of issues. The market was equally irregular on Tuesday, though the volume of sales was smaller than on the previous day. Revival of the rumor of a government suit against the Steel Corporation took place during the day, but was denied by representatives of the Attorney-General in a statement to the effect that no suit had been filed against the company. There is a great deal of speculation on this matter, however, and many in financial quarters are expecting to hear of a suit after the return of the President to Washington. Advance in sterling exchange rates to a figure that was not only the highest figure for the year but was in excess of gold export rates a short time ago was made on Tuesday. In view of the abundance of idle money and the condition of general business, American bankers are finding satisfactory outlets for their funds in foreign money markets. Rates in the money market Oct. 17 were: Call, 2⅜@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in this table are those at the close Oct. 17.

NEW YORK.

	Oct. 10.	Oct. 17.	Shares Sold.		Oct. 10.	Oct. 17.	Shares Sold.
All. Ch.	3	2½	9,445	Int. Met., pf.	45	44[illegible]	1,600
All. Ch. pf.	12½	10	2,565	Mackay Cos.	85*	85*	300
Amal. Cop.	49[illegible]	51[illegible]	31,300	Mackay, C., pf.	72½	72½	400
Am. D. T.	33[illegible]*	33[illegible]	——	Man. Elev.	132*	134½*	100
Am. [illegible]	34[illegible]	35	800	Met. St. Ry.	15*	15*	——
Am. Loco. pf.	105*	104*	500	N.Y.&N.J.Tel.	139½*	139½*	——
Am. Tel. & C.	80[illegible]*	78*	25	Steel, com.	59	59[illegible]	378,500
Am. T. & T.	134[illegible]	135[illegible]	5,385	Steel, pfd.	109	109[illegible]	4,530
B. R. T.	74[illegible]	75	9,200	W. U. T.	79¾	78[illegible]	5,200
Gen. Elec.	14[illegible]	15[illegible]	4,150	West'h, com.	61[illegible]	65½	2,075
Int. Met.	14[illegible]	14¾	1,800	West'h, pfd.	115	115*	200

PHILADELPHIA.

	Oct. 10.	Oct. 17.		Oct. 10.	Oct. 17.
Am. Rys.	44	43½*	Phila. R. T.	21[illegible]	23¼
[illegible]	11[illegible]	11¾	Phila. Elec.	16⅜*	16¼
[illegible] St. Bt'y.	51[illegible]	52[illegible]*	Phila. Trac.	83	83½
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	49[illegible]	51⅛

CHICAGO.

	Oct. 10.	Oct. 17.		Oct. 10.	Oct. 17.
Chi. City Ry.	186*	186*	Com. Edison	135[illegible]	128⅜
Chi. Elev. Rys.	[illegible]*	27	Chi. Subway	1¾	1½
Chi. Elev. Rys., pf.	[illegible]	90*	Chi. Telephone	120	119½*
Chi. Rs., Ser. 1	92*	92*	Nat'l Car	101*	101*
Chi. Rs., Ser. 2	27*	27*	Nat'l Car, pf.	118½*	118½*

BOSTON.

	Oct. 10.	Oct. 17.		Oct. 10.	Oct. 17.
Am. T. & T.	[illegible]	135⅜	Mex. Tel.	3*	4*
Cum. Tel.	[illegible]	[illegible]	Mex. Tel., pf.	6*	6*
Edison	285	284	N. E. Tel.	146	146
Gen. Elec.	[illegible]	[illegible]	W. T. & T.	19	19½
Mass. E. Ry.	[illegible]	[illegible]	W. T. & T., pf.	95[illegible]	95½*
Mass. E. Ry., pf.	92	[illegible]			

*Last price quoted.
Shares sold for the week Oct. 9 to Oct. 14.

Financial Notes.

Commonwealth Power, Railway & Light Company.—Owing to dullness in business in Grand Rapids, Mich., and the increase in the wages of its employees, the Commonwealth Power, Railway & Light Company, operating in that section, did not make as favorable a showing in the month of August, 1911, as it did last year. While gross earnings increased nearly $18,000, or 4¼ per cent, as compared with those in August, 1910, net earnings decreased about $11,500, or 4¼ per cent, and the surplus over charges for the month represented a falling off of $15,500, or more than 30½ per cent as compared with the record in the same month in the previous year. The eight months ended Aug. 31, 1911, however, show improvement over those in the corresponding period last year. Gross earnings were $3,507,170, an increase of 7.35 per cent, and net earnings were $1,661,590, an increase of 4.70 per cent, in spite of an increase of 9.86 per cent in operating expenses. Charges were $1,021,509, an increase of 3.26 per cent, leaving net profits of $640,081, representing a gain of 7.07 per cent. Preferred stock dividends amounted to $240,123, an increase of 0.12 per cent, and the surplus was $399,958, which was 11.72 per cent in excess of that in the corresponding period last year

Kings County (N. Y.) Electric Light & Power Company.—Gross earnings of the Kings County Electric Light & Power Company in September were $377,816, representing an increase of $24,926 as compared with those in September, 1910. Operating expenses were $195,735, an increase of $13,792, a little over half the gain in gross returns. Net earnings were $182,081, showing an increase of $11,134. Bond discount was $1,689 and depreciation was $46,621, or $2,472 in excess of the item in September, 1910. Fixed charges were $70,547, an increase of $7,370, leaving a surplus of $63,224, which, in spite of the increase in charges, was $1,292 in excess of the surplus in the corresponding month last year. Gross earnings in the nine months ended Sept. 30 were $3,443,532, an increase of $297,[illegible] and operating expenses were $1,733,327, an increase of $213,[illegible] Net earnings were $1,710,205, which was an increase of $83,[illegible] over net earnings in the first nine months of 1910. Bond discount was $15,202, and depreciation charges were $417,948, an increase of $42,522. These deductions left a balance of $1,277,055 an increase of $40,996, which was offset by fixed charges of $593,139, an increase of $50,243 over those in this period in 1910. The surplus was $683,926, which represents a decrease of $9,247.

American Telephone & Telegraph Company.—Total revenue of the American Telephone & Telegraph Company for the quarter ended September 30, 1911, was $9,094,370, as compared with $8,714,616 for the corresponding quarter last year, and the balance after dividends was $1,345,735, as compared with $1383220. Expenses in the period were $890,743 as compared with $884,416, deduction of which left net revenue of $8,203,626, which compares with $7,830,199 in 1910. Interest

[illegible]s were $1,401,539, as compared with $1,249,941, leaving a [illegible]us available for dividends of $6,862,088, as against $6,580,-[illegible] last year. Dividends amounted to $5,516,353, as compared [illegible] $5,197,035 in the corresponding quarter of 1910.

[illegible]nited Railways & Electric Company.—[illegible] Maryland Public Service Commission has received the annual report of [illegible]a[illegible]ings of the United Railways & Electric Company for the [illegible]ar ended June 30, 1911. The report conforms in every [illegible] the requirements of the commission, and is the second [illegible]nual document prepared under the new form as prescribed by the Public Service Commission act. In the report the U[illegible]ed Railways places the gross earnings of the road for the tw[illegible]e months at $7,851,290, as compared with $7,456,783 for the previous year, or a gain of $394,506 for 1911. Operating [illegible]x[illegible]nses for the year were $3,655,063, as compared with $3,421,-[illegible] 1910, making a gain of $233,260 for the fiscal year just [illegible]. Operating net revenues were $4,196,226, as compared [illegible] $4,034,980 for the preceding fiscal year, the increase for [illegible]ing $161,245. Miscellaneous income for the twelve [illegible], including interest on deposits, income from securities [illegible] as well as other income, amounted to $15,311, as against [illegible] for the previous twelve months, making the gross in-[illegible]f the company for the year, less operating expenses, [illegible]37, as compared with $4,043,717, an increase of $167,-[illegible] for 1911. The taxes of the company, including payme[illegible] on real and personal property, on capital stock, etc., am[illegible]nted to $731,957. Deductions of interest on the corporatio[illegible] funded and floating debt, together with other deductions, am[illegible]nted to $2,852,934 for the twelve months, which deducted fro[illegible] the gross income of the property, less operating expenses, giv[illegible] a net income of $1,358,602 for the year. During the year [illegible]raordinary expenses of the company were $864,048, as [illegible]ted with $1,013,413 for 1910. In addition $60,000 was ap-[illegible] the sinking fund of the Maryland Electric Railway [illegible]y's 5 per cent bonds. Dividends of 2 per cent on $53,000 [illegible]ompany's preferred stock amounted to $1,060, and in-[illegible]n $13,947,000 income bonds totaled $278,940. The [illegible] surplus for the year, as given in the report to the [illegible] Service Commission, totaled $154,554, as against $271,364 [illegible]r. At the beginning of the fiscal year the company had [illegible] $652,331, which added to the $154,554 gives a [illegible]rplus of $806,885, as compared with $734,771 for 1910. [illegible] the fiscal year the company paid to the Mayor and [illegible]uncil the balance of the assessment tax for the years [illegible]08 and 1909 and on the corporation's capital stock for [illegible]rs 1908 and 1909, which, together with other deductions, [illegible] a final surplus of $773,490 for the year, as contrasted [illegible] for 1910.

[illegible]shington, Baltimore & Annapolis Electric Railway.—[illegible] of the Washington, Baltimore & Annapolis Electric [illegible] Company have issued a statement of earnings for Sep-[illegible] which shows that the total income for the month was [illegible] as compared with $8,423 in September, 1910. Gross [illegible]g revenue was $67,261, as compared with $68,659, or a [illegible]e of $1,387. Operating expenses for the month were [illegible] as against $29,217, this being an increase of $852 as com-[illegible]ith September of last year. The net operating revenue [illegible] month amounted to $37,191, as compared with [illegible]n September, 1910, representing a decrease of $2,250. [illegible]neous income totaled $226, as compared with $120 for [illegible]er of 1910, or a gain of $105. Gross income for the [illegible]vas $37,417, as against $39,563, or a decrease of $2,145. [illegible] taxes, etc., for the month amounted to $21,587, as [illegible] $31,139 for the corresponding month of the previous [illegible]l deduction of this item from the gross income of the [illegible] left a surplus of $15,830 for the month, or an in-[illegible]f $7,405. The percentage of operating expenses to [illegible]erating revenue was 44.70 per cent, as compared with [illegible]r cent for September of 1910. The gross operating [illegible] of the company for the six months of the new fiscal [illegible] began April 1, is placed at $377,128, as against [illegible] for the corresponding period in 1910, a gain of $7,674 [illegible]s year; operating expenses were $174,710, as compared with $176,587 for 1910, a decrease of $1,856, while the gross income for the six months was $203,527, as against $193,456 in 1910, an increase of $10,171 for this year's operation. The interest charges and taxes for the period totaled $133,502, as against $185,612 for 1910, a reduction of $52,110. The surplus for the six months is placed at $70,025, which compares with [illegible] for the previous year, an increase of $62,281. After the [illegible]nization plan was put into effect Washington, Baltimore & Annapolis officials thought that their company, with a good year, would be able to close the fiscal year with a surplus of $100,000. From the statement issued last week, showing a surplus of over $70,000 at the end of the first six months of the new fiscal year, it is seen that the company is more than meeting this expectation.

New England Telephone & Telegraph Company.—The noteworthy feature of the report of the New England Telephone & Telegraph Company for the year ended June 30, 1911, as filed with the Massachusetts Highway Commission, is the large increase in expenses. From a total income of $13,400,000 only $2,888,000, or about 20 per cent, was available for dividends, representing 7.37 per cent on $39,178,100 capital stock whereas in the previous year, with a total income of $12,525,000, the amount saved for dividends was $3,525,000 or nearly 30 per cent, representing 9 per cent on the same amount of capital stock. Much of the increase in expenses, it is stated, is due to physical alterations to the properties of the company and not to the reductions in rates previously noted in these columns. While the decrease in gross income from this source is expected to reach $600,000 ultimately, it is confidently believed that this amount will be speedily regained by the revenue from new business induced by lower rates. Another item affecting the expense account this year was a general increase in wages. In spite of the heavy operating costs which this company has had to meet this year no difficulty has been experienced in meeting the dividend requirements, which, as mentioned in the *Electrical World*, July 1, were increased from 6 per cent to 7 per cent in June of this year. After payment of this a small balance was left. The stockholders of the company now total about 4,000 and the average holding, not including the 228,866 shares owned by the American Telephone & Telegraph Company, is 40 shares.

Earnings of Chicago Elevateds.—The reports of the Metropolitan West Side Elevated and the South Side Elevated companies for the year ended June 30, 1911, have been filed with the Illinois Railroad and Warehouse Commission. Gross earnings of the former were $3,180,327, as compared with $2,991,368 last year, and operating expenses were $2,773,964, as compared with $2,567,145. The surplus available for dividends decreased from $424,223 in 1910 to $406,363 in 1911. After charges and dividends, the balance was $145,126. Gross earnings of the South Side Elevated were $2,419,922, as compared with $2,348,135 last year and operating expenses were $2,065,-169, as compared with $2,046,250 in 1910. Net profits were $354,753, as compared with $301,885 in the previous year, and after payment of charges and depreciation the surplus was $74,550.

DIVIDENDS.

American District Telegraph Company of New Jersey, quarterly, 1 per cent, payable Oct. 28.

Connecticut Railway & Light Company, quarterly preferred and common, 1 per cent, payable Nov. 15.

Guanajuato Power & Electric Company, quarterly preferred, 1½ per cent, payable Nov. 1.

Havana Electric Railway Company, quarterly, preferred and common, payable Nov. 11.

Houghton County Electric Light Company, semi-annual preferred, 75 cents per share; common, 62½ cents per share, both payable Nov. 1.

Lowell Electric Light Corporation, quarterly, $2 per share, payable Nov. 1.

REPORTS OF EARNINGS.

Period	Gross Earnings	Operating Expenses	Net Earnings.	Fixed Charges.	Net Surplus
AMERICAN TELEPHONE & TELEGRAPH COMPANY.					
9m., Sept., '11.	$27,297,994	$2,673,204	$24,624,789	$4,207,423	$20,417,366
9m., Sept., '10.	26,310,511	2,578,901	23,731,609	3,836,296	19,895,313
KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.					
Sept., 1911....	$377,816	$195,735	$182,080	$118,856	$63,224
Sept., 1910....	352,889	181,942	170,947	109,015	61,932
9m., Sept., '11.	3,443,533	1,733,328	1,710,205	1,026,280	683,925
9m., Sept., '10.	3,146,503	1,519,816	1,626,687	933,514	693,173
METROPOLITAN WEST SIDE ELEVATED RAILROAD COMPANY.					
Yr., June, '11.	$3,180,327	$2,773,964	$406,363	......	......
Yr., June, '10.	2,991,368	2,567,145	424,223	......	......
OREGON ELECTRIC RAILWAY COMPANY.					
Yr., June, '11.	$616,[illegible]	$[illegible]3,512	$267,404	$100,000	$167,40[illegible]
Yr., June, '10.	474,867	274,120	191,239	100,000	91,239
RUTLAND (VT.) RAILWAY, LIGHT & POWER COMPANY.					
Yr., Sept., '11.	$309,198	$164 121	$145,076	$90,995	$54,081
Yr., Sept., '10.	270,197	139,732	130,464	84,651	45,807
SOUTH SIDE ELEVATED RAILROAD COMPANY.					
Yr., Sept., '11.	$2,419,922	$2,065,169	$354,753	......	......
Yr., Sept., '10.	2,348,135	2,046,250	301,885	......	......

General News

Construction News.

DECATUR, ALA.—The City Council is considering the question of issuing bonds to the amount of $50,000 for the construction of a municipal electric-light plant.

TROY, ALA.—The Pea River Power Company has awarded a contract for the construction of a dam across the Pea River at Elba. It is expected that 2000 hp will be developed for transmission by electricity to the towns of Troy, Dothan, Elba and others. Charles Henderson, of Troy, is said to be financing the enterprise.

PHOENIX, ARIZ.—The Salt River Valley Electric Railway Company, recently incorporated, has applied for a franchise for an electric railway in Phoenix. If granted a franchise the company proposes to extend its system to Scottdale, a distance of 11 mile. F. M. Winter is interested in the company.

TUCSON, ARIZ.—Plans are being considered for the erection of a central electric power plant for the Hart Ranch, near Shawnrita, to supply electricity for a pumping system. Dietrich & Goetz, of Tucson, Ariz., are engineers.

ARKADELPHIA, ARK.—The Southwestern Telegraph & Telephone Company has purchased nine local exchanges of the North Arkansas Telephone Company, giving the Southwestern company a toll line along the Missouri & North Arkansas Railway into Eureka Springs and northwest Arkansas territory. The exchanges are located at Arkadelphia, Malvern, Lonoke, Searcy, Heber Springs, Leslie, Marshall, Conway and Morrillton.

BAKERSFIELD, CAL.—Preparations are being made by the San Joaquin Light & Power Company to erect a transmission line from Bakersfield to the Weed Patch Company's property, a distance of 17 miles. The San Joaquin company will supply electricity for a number of power plants to be installed in that vicinity.

DIXON, CAL.—Arrangements are being made by the Pacific Gas & Electric Company for rewiring the residence portion of the city for the purpose of establishing a twenty-four-hour service. Flat rates will be discarded and meters installed throuhout the entire system.

GRIMES, CAL.—The Pacific Gas & Electric Company is making arrangements to extend its transmission line from Knight's Landing to Howell Point to supply electricity for operating pumps for irrigation purposes.

HAWTHORNE, CAL.—The Southern California Edison Company has been awarded a contract by the Board of Supervisors of Los Angeles County for the installation of seventy-five street lamps in Hawthorne.

LOS ANGELES, CAL.—The Pacific Light & Power Company has taken out a permit to build an addition to the transformer house at its Hollywood substation.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has placed an order with the General Electric Company for one motor-generator set, one 17-kw, 500-125-volt exciter and three 450-15,000:13,500-2250-volt core-type transformers.

MARYSVILLE, CAL.—The installation of an ornamental street-lighting system on D Street has been assured by contributions from business firms and property owners amounting to $5,000. The committee is now collecting funds for installing arches at Third and E Streets and also at Third and C Streets. It is planned to light the entire business district with arches.

MODESTO, CAL.—The Sierra & San Francisco Power Company has taken over the property of the La Grange Water & Power Company in Modesto. It is said that the transformers and other equipment of the Sierra company will be transferred to the Oakdale station of the company. The Sierra company will remove its offices and equipment to the office of the La Grange company.

ONTARIO, CAL.—An agreement has been entered into between the Ontario Power Company and the Southern California Edison Company whereby the Edison company is to furnish the local company with electricity in case of emergencies or when extra heavy demands are being made upon it and the Ontario company is to supply the Edison company with its surplus. The new arrangements will prevent the necessity of enlarging the steam plant for emergencies. The steam plant will not be discarded but will be used when needed.

PORTERVILLE, CAL.—The Tulare County Power Company expects to be ready to deliver energy to its patrons not later than April, 1912. This company is a co-operative concern and each share of stock carries with it an agreement from the company to deliver 1 hp of electricity annually. The substation from which the electrical energy will be distributed in the orange district will be located near Strathmore, work on which will begin in the near future. A site has been secured in Tulare for a station which will supply electricity in the dairy district, and where a steam auxiliary plant will be located.

ROSEVILLE, CAL.—A committee has been appointed to negotiate the Pacific Gas & Electric Company for the purchase of the local elec light plant.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has plied to the Board of City Trustees for franchises to extend its sys into the annexed districts.

SAN BERNARDINO, CAL.—The Southern Sierras Power Com has awarded the contract for the construction of a one-story p house, 66 ft. x 67 ft., in San Bernardino, to Hoyt Brothers, Monad Block, San Francisco, Cal., for $20,000. The work includes the f dations for the machinery, which will be installed by C. C. M Company, of San Francisco, Cal., to cost about $150,000.

SAN FRANCISCO, CAL.—The contract for furnishing and insta steam turbines, generators and main switchboard in power house laundry building in the Hall of Justice has been awarded to Fred C. Roberts & Company, of San Francisco, Cal., for $23,198.

SAN FRANCISCO, CAL.—The Western Power Company has fil certificate with the Secretary of State at Trenton, N. J., showin increase in capital stock from $18,000,000 to $20,670,000. E. E. Ha is president of the company and H. P. Wilson secretary.

SAN FRANCISCO, CAL.—Plans and specifications are being pre by the Bureau of Engineering as follows: (a) For construction o alarm and telephone central building; (b) for furnishing and inst lateral and miscellaneous ducts and setting box standards; (c) for nishing and installing telephone cable and appurtenances; (d) for nishing and installing telephone equipment and batteries; (e) for fu ing and installing telephone boxes and standards; (f) for furnishin installing gasoline engine and electric generator with auxiliaries; (g furnishing and installing motor-generator set with switchboards.

STOCKTON, CAL.—The Sierra & San Francisco Power Compan commenced the construction of a transmission line from Mante Stockton. The company has notified the city authorities that it build a distributing system in Stockton, with underground condu the business district. An auxiliary steam generating plant wi erected. H. Jackson is assistant manager.

TULARE, CAL.—The Tulare County Power Company is report have awarded the contract for the construction of a 3000-hp stean bine plant for irrigation purposes to the Hunt-Mirk Company, o Francisco, Cal.

DENVER, COL.—The Denver City Tramways Company is pla to build an extension along Colorado Boulevard and Twenty-ninth nue, in Denver.

LAMAR, COL.—The plant and holdings of the Lamar Light, H Power Company have been purchased by the Associated Engineers' pany, of Colorado City, Col. The new company, it is said, will extensive improvements to the property. T. L. Wilkinson, of D Col., is president of the Associated Engineers' Company and E. C Deist, of Colorado Springs, secretary.

PUEBLO, COL.—The Pueblo & Suburban Traction & Lighting pany will soon place contracts for laying about 6 miles of track a concrete bridges.

TRINIDAD, COL.—The Trinidad Electric Transmission, Rail Gas Company contemplates the purchase of two 2000-kw turbines, 1000-kw transformers, coal-handling machinery, boilers with a rat 1000 hp and stokers for its power plant in Trinidad, and also reb about 19 miles of track in the near future.

NEW HAVEN, CONN.—The Shore Line Electric Railway Co has awarded the contract for the construction of an extension b Ivorytown and Deep River to the Cavanaugh-McCaffrey Comp Boston, Mass. It is expected that the railway will be extended t ter as soon as the right-of-way is secured.

SAYBROOK, CONN.—At a town meeting held recently the voted to instruct the Selectmen to enter into a contract with the Light & Power Company to light the streets of the town for a pe five years, the cost not to exceed $1,050 per annum.

AUBURNDALE, FLA.—The city is reported to be contemplat installation of a light, water and ice plant and a telephone exchan

BROOKSVILLE, FLA.—It is reported that the proposition to a franchise to Mr. Fuller, of Umatilla, to construct an elect light plant and water-works system in Brooksville, will be submitte to vote.

JACKSONVILLE, FLA.—Contracts have been awarded by the Board of Bond Trustees as follows: To the H. W. Clark Company, fur nishing meter box tops; to the Allen Contracting Company, for moving condensers to the new power plant; for new switchboard, to the Electric Company; for boiler, brick and flue work, to the Ru Engineering Company, and to the Allis-Chalmers Company, for wiring generator.

MADISON, FLA.—The Town Council has made arrangements for the

urchase of the local electric-light plant, owned by the Madison Electric Power Company. The proposition offered by the Council and accepted by the company calls for payment of $30,000 for the plant payable at the end of twenty years, with interest at 6 per cent payable yearly.

ST. AUGUSTINE, FLA.—The plant and holdings of the St. Johns Light & Power Company were sold at auction on Oct. 3 to the Inter City Securities Company at $180,000. The plant will be operated as at present and B. F. Dyson, receiver, will be in charge until the company is reorganized.

ATHENS, GA.—Owing to the low water in the Oconee River the hydroelectric power plants which supply electricity for the street railways and lighting in Athens are closed down. The large steam plant of the Athens Railway & Electric Company is in full operation for the first time [illegible] years.

SOUTH BOISE, IDAHO.—The Board of Village Trustees has granted the Great Shoshone & Twin Falls Water Power Company a franchise to [illegible] electricity in South Boise for a period of forty-one years.

ABINGDON, ILL.—The Abingdon Electric Company, of Abingdon, Ill., [illegible] franchise to supply electricity in Prairie City. The Prairie City municipal electric-light plant was recently destroyed by fire, and since that time that city has been without electrical service. The [illegible] company will erect a [illegible] transmission line from [Abin]gdon to Prairie City, a distance of 14 miles. Electricity will be fur[nish]ed by the company in St. Augustine and also probably to the farm[ers] along the line. In addition to erecting the line the company will in[stall] a new [illegible] engine and a generator in the local plant. The pro[pose]d addition will involve an expenditure of about $10,000.

[illegible], ILL.—The [illegible] Mutual Telephone Company has pur[chase]d a site on which it proposes to erect an exchange building.

[C]HICAGO, ILL.—Plans for the proposed municipal tuberculosis sani[tariu]m to be erected at North Fortieth Street, between Bryn Mawr and [illegible] Avenues, Chicago, Ill., provide for an administration building [illegible]r house, dining room and service building, three infirmary build[ings], [illegible] nurses' homes and ten open-air cottages with a capacity of [illegible]ty patients each. The cost of the buildings is estimated at $818,323.

[C]HILLICOTHE, ILL.—A committee has been appointed by the [illegible] Men's Association to take charge of installing an ornamental [lighti]ng system in Chillicothe.

[C]HILLICOTHE, ILL.—The People's Telephone Company has sold [its s]ystem to E. S. Sterrett, C. A. Camp, of Henry, Ill., and C. B. [illegible]lle, of Joliet, Ill. A franchise has been granted the new owners in the city of Chillicothe and the village of North Chillicothe. It [is] said that the plant will be entirely overhauled and the wires [placed] underground. A new building will be erected at Third and Pine [Stre]ets and a new switchboard and central-station equipment and new [illegible] installed.

[E]LGIN, ILL.—The Commercial Club is interested in the proposition [to in]stall an ornamental street-lighting system in the business district in [illegible]

[G]ALVA, ILL.—The Commercial Club is considering plans for the in[stall]ation of an ornamental street-lighting system in the business dis[trict]. It is proposed to erect ornamental standards with cluster lamps. [The] establishment of a municipal electric-light plant is reported to be [under consideration].

[illegible], ILL.—The question of substituting ornamental lamp [stand]ards for the present arc lamps is under consideration.

[JACK]SONVILLE, ILL.—The Jacksonville Railway & Light Com[pany] is installing a 500-hp McIntosh-Seymour engine in its power house [illegible]

[M]ATTOON, ILL.—The Chamber of Commerce is planning a cam[paign] to extend the ornamental street lighting system recently in[aug]urated throughout the entire business district.

[M]ORRISON, ILL.—The question of building an interurban railway [from] Rock Island to Albany, through Morrison, Sterling and Polo [to] Rock Ford, is under consideration. M. T. McCaskey, of Chicago, Ill., [is interes]ted in the project.

[MOU]NT VERNON, ILL.—The Citizens' Gas, Electric & Heating [Com]pany is contemplating extensive improvements and extensions to its [plan]t, including increasing the capacity of its reservoir from 30,000,000 [to [illegible]],000,000 gal., by raising its dam 2 ft. A new engine and generator [will be] installed. F. M. Sinsabaugh is manager.

[P]AXTON, ILL.—The Consumers' Electric Light, Heat & Power Com[pany] is reported to have submitted a proposition to install an electric [pla]nt in Paxton, to cost about $75,000. The company asks for a thirty-[yea]r franchise and a ten-year contract for street lighting.

PEORIA, ILL.—The village of Averyville has granted the franchises [aske]d for by the Peoria City Railway Company and the Peoria & North[ern] Railway Company. Work will start at once, it is reported, on the [propo]sed improvements, which will involve an expenditure of about [illegible].

PETERSBURG, ILL.—The Central Union Telephone Company and [the] Petersburg Telephone Company has been consolidated under the name [of t]he People's Telephone & Telegraph Company, of Menard County. [Th]e new company will be capitalized at $100,000. The incorporators and [offic]ers are: H. H. Colby, of Petersburg, president; George H. Rottger, [of] Springfield, secretary, and D. W. Frackelton, of Petersburg, treasurer.

TUSCOLA, ILL.—The Douglass County Telephone Company has secured the Jarmen Building and will install a modern exchange.

ANDERSON, IND.—The Indiana Service Company, which recently filed articles of incorporation with the Secretary of State, in addition to furnishing electrical service in several cities and townships will also supply gas and water service. C. W. Hooven, one of the incorporators, is president of the Anderson Gas Company, and also controls the natural gas plant at Shelbyville, Elwoods and Anderson. Artificial gas will be generated and piped to various cities. Rushville, Connersville, Batesville, Tipton and Noblesville are included in the plans of the Indiana Service Company. Howard L. Olds and John T. Bacon now control the light and water service at Newcastle and Rushville.

BRAZIL, IND.—The City Council has granted the Retail Merchants' Association permission to install cluster lamps on eight blocks on Main Street.

CANNELTON, IND.—At an election held recently in Cannelton, Troy and Tell City, in Perry County, the voters approved of a subsidy of 2 per cent to aid the Vincennes & Cannelton Traction line. The proposed railway has been surveyed into Cannelton from Vincennes via Petersburg, Huntingburg and Ferdinand. Work must begin on construction of the road within ninety days.

ELWOOD, IND.—Preparations are being made for the installation of an ornamental street-lighting system in the business district. The present plan calls for the erection of five-lamp standards on each of the four corners of Main and Anderson and Main and Sixteenth Streets and the remainder of the standards will carry three lamps and will be set 60 ft. apart. The merchants and property owners will pay for the installation of the system.

GARY, IND.—The Indianapolis, Chicago & Meridian Railway Company has been granted a fifty-year franchise to operate a street railway on Seventeenth Avenue and a cross street route with a western terminus at the Hammond boundary.

INDIANAPOLIS, IND.—The American Traction & Power Company, a Delaware corporation, will open an office in the Aetna Building, Indianapolis, Ind. The company is a holding corporation for electric railways and power plants now in course of construction in Mississippi and Kentucky. H. C. Brubaker is president of the company and G. K. Bruce secretary.

KENTLAND, IND.—R. W. Howard, who has been granted a franchise to supply electricity in Kentland, will also supply electrical service in Brook, Goodland and Sheldon. A twenty-four-hour service will be furnished. Work has begun on construction of the plant.

MONTEZUMA, IND.—At a special election held recently the citizens voted to build an entire new electric-light and power plant. The proposition submitted was to repair the old plant or build a new one.

PORTLAND, IND.—Subsidies of $5,000 each were voted by Monroe and Wabash Townships to aid in the extension of the Fort Wayne and Springfield Traction line south of Portland.

COLUMBUS JUNCTION, IA.—The City Council has called a special election to be held Nov. 4 to vote on the proposition to grant a franchise to E. M. Miller, of Greeley, Col., and R. D. Parks, of Lake Crystal, Minn., to install an electric-light plant in Columbus Junction.

DES MOINES, IA.—An order has been placed by the Des Moines City Railway Company with the General Electric Company for a switchboard for its plant at Des Moines.

DES MOINES, IA.—The State Board of Agriculture, it is reported, has found that it can secure electricity cheaper from the local company for use at the Iowa State Fair than to use the electric plant which was installed three years ago.

HAMPTON, IA.—At an election held recently the proposition to renew the franchise of the Hampton Electric Light & Power Company was defeated. The present franchise has five years to run.

MANCHESTER, IA.—The City Council has granted Joseph Huntchinson an electric-light and power franchise for a period of twenty-five years. Under the terms of the franchise the plant must be in operation prior to Oct. 1, 1912. Mr. Hutchinson owns the Quaker mill property, north of the city.

NASHUA, IA.—The Nashua Power Company, recently incorporated with a capital stock of $21,000, will erect and operate an electric plant in Nashua. G. T. Greeley, G. C. Hoover, W. A. Granger, W. F. Getsch and J. W. K[illegible] are interested in the company.

OELWEIN, IA.—Orders have been placed by the Oelwein Light, Heat & Power Company for a new generator for its power house. The company is increasing the output of its plant to supply electricity to operate the piano factory of Gamble Robinson and other manufacturing establishments. R. W. Sanders, of Chicago, Ill., is president of the company.

POCAHONTAS, IA.—Sealed bids wlil be received by George Schneiders, city clerk, until Oct. 27 for furnishing material and installation of a complete electric-light plant for the city of Pocahontas. Bids will be received on the entire plant and on various portions thereof. Alternate bids are requested on a gas-producer plant, high and low-speed steam plants and oil-engine equipment. The work will include brick or concrete power house, steam, gas-producer or oil-engine plant, 40-kw or 50-kw generator, pole line and wiring and all accessories. Plans and specifications are on file and may be seen at the office of the city clerk, Pocahontas, Ia., and at the office of the Oscar Claussen Engineering Company, 514 German National Bank, St. Paul, Minn., where copies of plans and

[illegible] the company. A charge will be made for the reproduction of the plans.

HUTCHINSON, KAN.—Preparations are being made by the United Water, Gas & Electric Company for the erection of a high-tension transmission line from Hutchinson to Nickerson to supply electricity in the latter city. The company will also supply electrical service to farmhouses along the line.

LAWRENCE, KAN.—The County Commissioners have decided to purchase a portable electric-light plant for the new County Home. It is stated that a small plant can be purchased for about $1,000. The gas engine which operates the generating plant will be used for pumping water.

NEWTON, KAN.—The local electric-light plant, owned by the Newton Electric Light & Power Company, has been purchased by the Kansas Gas & Electric Company. It is understood that the power plant will be closed down and energy for operating the system will be supplied from the power plant of the Kansas company in Wichita. A new substation will be erected which will supply electricity for local consumption in Newton and for operating the Arkansas Valley Interurban Railway. The company's lines are now within 6 miles of Newton. The present plant will be held for emergencies. The price paid for the plant and holdings is said to be about $125,000. The Kansas Gas & Electric Company will issue bonds to the amount of $204,000 for the purchase of and improvements to the property. James D. Newton, present manager, will remain in charge of the plant.

SYRACUSE, KAN.—The contract for installing the proposed municipal water and light system in Syracuse has been awarded to the J. S. Worley Engineering Company, of Kansas City, Mo., at $35,800.

HICKMAN, KY.—The Kentucky Southwestern Railway, Light & Power Company is making a preliminary survey for its proposed electric railway between Paducah, Ky., and Union City, Tenn.

LOUISVILLE, KY.—The stockholders of the Louisville & Nashville Railroad Company have voted to establish a telephone and telegraph service along the line of the railroad. The new wires will also handle public business. The telegraph service has been furnished by the Western Union Telegraph Company since 1884.

WHITESBURG, KY.—The installation of an electric-light plant in Whitesburg is under consideration. Jasper Bowens, of Polly, is interested in the project.

ALEXANDRIA, LA.—Orders have been placed by the electric-light committee for a 500-kw turbo-generator, to cost $10,396.

GLIDDEN, LA.—The installation of a municipal electric-light plant in Glidden is reported to be under consideration.

HOMER, LA.—The City Council has purchased the local electric-light plant, owned by Edward Sawyer, for $5,750. It is proposed to operate the plant in connection with the water-works system.

MONROE, LA.—At an election held recently the citizens voted to extend the water, light and sewerage systems in different parts of the city.

NEW ORLEANS, LA.—Proposals will be received by F. S. Shields, secretary, at the office of the Sewerage and Water Board, 508 City Hall Annex, New Orleans, La., until Nov. 7, 1911, for furnishing and installing the following machinery: One 6000-kw horizontal, high-pressure, condensing steam turbine and alternating-current unit; one 150-kw rotary converter with stationary transformers and one seven-panel switchboard. Specifications and blank form of proposals may be obtained upon application at the office of the board. George G. Earl is superintendent.

BANGOR, MAINE.—The Bangor Railway & Light Company is planning to replace its wooden dam at Veazie, Maine, with a stone and concrete structure. The Bangor Power Company, a subsidiary of the Bangor Railway & Electric Company, has built a temporary dam at Gilman's Falls, on the Stillwater branch of the Penobscot River, and is now building a concrete structure, which will complete the original project of the Bodwell Water Power Company at that point. The Bangor Railway & Light Company is now developing about 12,000 hp and with improvements under way or projected expects to increase its output by 10,000 to 15,000 hp.

LIVERMORE FALLS, MAINE.—Plans are being prepared by the Livermore Falls Light & Power Company for improvements to the street-lighting system in Livermore Falls. It is proposed to replace the present street lamps with 40-cp tungsten lamps.

NORWAY, MAINE.—The Norway & Paris Street Railway Company has awarded a contract to C. E. Hoxie & Company, of Augusta, Maine, for the construction of a new concrete dam at the outlet of Pennesseewassee Lake, in Norway.

PORTLAND, MAINE.—Sealed proposals will be received by the City Hall Building Commission, Portland, Maine, until Nov. 9 for lighting fixtures for the Portland city hall. Plans and specifications may be seen at the office of Carrere & Hastings, 225 Fifth Avenue, New York, N. Y., or John Calvin Stevens and John Howard Stevens, 187 Middle Street, Portland, Maine.

PRESQUE ISLE, MAINE.—The Aroostook Valley Railroad Company is reported to have secured permission from the New Brunswick provincial government for the construction of the St. John Valley Railroad along the St. John River from St. John to Grand Falls and St. Leonards. The proposed railway is to have a subsidy from the Canadian government.

BALTIMORE, MD.—The Subway Commission, it is reported, has petitioned the Board of Estimate for approval of plans calling for an additional appropriation of $1,000,000 to continue the construction of the subway system. Raleigh C. Thomas, electrical engineer of the commission, states that the Electrical Commission is planning to continue work on the underground conduit system during the coming year by extending trunk, lateral and distributing lines in practically all sections of the city.

MIDDLETOWN, MD.—The Frederick Gas & Electric Company, of Frederick, Md., is reported to have submitted a proposition to the Council offering to extend its electric transmission lines from Braddock Heights to Middletown.

BROOKVILLE, MASS.—The Randolph & Holbrook Electric Light Company, of Randolph, is installing a street-lighting system in Brookville. About 100 lamps will be erected.

GARDNER, MASS.—With a view of installing electricity in homes where a small number of lamps are required the Gardner Electric Light Company has submitted a proposition offering to install four 20-cp tungsten lamps at the rate of $1 per month. The company will wire the house at cost. Any one wishing more than four lamps may have them at the same rate, 25 cents apiece. In order to prevent trouble an excess indicator will be put in, which will cause all lamps to flash if more than four are used at one time.

LEOMINSTER, MASS.—The Selectmen and the special lighting committee have signed a contract with the Leominster Electric Light & Power Company for street lighting for a period of five years, under the terms of which the company agrees to replace the present arc lamps with tungsten lamps of 100 cp, of which there are 85. The moonlight schedule is to be abolished and all lamps will burn all night and every night. The company agrees to supply 100-cp tungsten lamps at $32.5[illegible] each per year; 80-cp tungsten lamps at $28.50 each and 60-cp tungsten lamps at $28.50 per lamp per year with all-night service. The 60-c[illegible] lamps burning until 1 o'clock will cost $18.24 each per year, and th[illegible] 40-cp lamps $15 each per year on the same schedule.

PLAINVILLE, MASS.—At a special town meeting held Oct. 9 th[illegible] Selectmen were authorized to enter into a contract with the Foxbor[illegible] Electric Company, of Foxboro, Mass., for lighting the streets of th[illegible] town for a term of three years. The contract calls for the installatio[illegible] of seventy-five lamps.

SPRINGFIELD, MASS.—The Gilbert & Barker Manufacturing Com[illegible]pany, of Springfield, Mass., has awarded a contract to Fred Ley [illegible] Company, of this city, for the construction of its new plant for th[illegible] manufacture of gas engines, to be located at Union and Spring Avenue[illegible] West Springfield. The new plant will consist of nine buildings and wi[illegible] contain a floor area of about 80,000 sq. ft. The plans include the i[illegible]stallation of an electric-power plant.

MENOMINEE, MICH.—Preparations are being made by the Menom[illegible]nee & Marinette Light & Traction Company for increasing the output [illegible] its power plant in Menominee. New equipment will soon be purchas[illegible] by the company, including one 1000-hp water turbine, one 1100-kw, 22[illegible] volt, three-phase, 60-cycle generator, switchboard instruments and thr[illegible] 675-kw, 2200-33,000-volt transformers.

MINNEAPOLIS, MINN.—The Waveland Park Improvement Assoc[illegible]tion is considering plans for lighting the Waveland district. F. [illegible] Newell is secretary of the association.

MINNEAPOLIS, MINN.—Dr. P. M. Hall, city health commission[illegible] has commenced to advertise for private consumers to use electrical ener[illegible] generated by an electric plant to be installed to utilize waste stea[illegible] at the Minneapolis garbage crematory. There will be a surplus above t[illegible] amount needed to light the workhouse, city buildings and grounds [illegible] the vicinity and the city attorney has ruled that private customers m[illegible] be supplied.

MORRIS, MINN.—Plans have been prepared by Fairbanks, Mo[illegible] & Company, of St. Paul, Minn., and submitted to the town of Mor[illegible] for the installation of an electric-light plant, to cost approximately $1[illegible] 000. A committee has been appointed to consider the proposition.

ST. PAUL, MINN.—The St. Paul Southern Electric Railway C[illegible]pany has consolidated with the Interurban Construction Company, [illegible] Hastings, Minn., and has awarded the contract for the construction [illegible] the proposed railway to Mankato to the Hoy & Elzy Company.

NEWTON, MISS.—The municipal electric-light plant has been pla[illegible] in operation and is now supplying electricity for commercial and resid[illegible]tial lighting. As soon as the plant is entirely completed the street-lig[illegible]ing system will be turned on. It has been decided to use the meter [illegible]tem throughout the entire system. The Newton Oil & Manufacturing C[illegible]pany has sold out its electric system to the city.

ST. LOUIS, MO.—The Tower Grove-Manchester Association is [illegible]tating the question of installing a new lighting system on Manches[illegible] Avenue.

ST. LOUIS, MO.—Work has commenced on the construction o[illegible] large building for the Laclede Gas Light Company, at the corner [illegible] Eleventh and Olive Streets, to cost about $500,000.

ST. LOUIS, MO.—The Union Electric Light & Power Company [illegible] announced a new schedule of rates for electricity for resider[illegible] lighting to take effect from Oct. 20. Under the new schedule [illegible] maximum rate will be 11 cents per kw-hour and the minimum 6 c[illegible] per kw-hour.

WARRENSBURG, MO.—The City Council, it is reported, has decla[illegible]

...avor of municipal ownership of the electric light plant and water-works system. The franchises of the companies now operating in Warrburg will soon expire and a campaign for lower rates is on.

...RT SHAW, MONT.—The Sun River ... Company has been work on the construction of a telephone system between Willow Creek and Warm Springs. J. B. Bond is engineer.

...INNEMUCCA, NEV.—Work has been ... on the construction of the ... plant of the Winnemucca Water & Light Company. It is said that orders have already been placed for machinery for the pro...

...TON, N. H.—The Tilton Electric Company is planning to install a 50-hp engine in its power plant. The company is increasing the output of its plant to meet the increasing demands for electrical service in Tilton and Belmont.

...VER, N. J.—Subject to the approval of the ... Public Utility Commissioners a certificate has been filed with the Secretary of State consolidating the Bernards Electric Company, of Bernardsville, the Eastern Pennsylvania Power Company, of Dover, and the Warren County Power ... whose registered office is at Jersey City. The new company ... known as the Eastern Pennsylvania Power Company and will ... capitalized at $258,500, of which $157,000 will be given to the stockholders of the old Eastern Pennsylvania Power Company in exchange for ... present holdings. The Bernards Water Company stockholders are to receive ten shares of new stock for each five held by them and the ... of the Warren company is to be exchanged for an equal amount par value of stock in the new company. It is said that the new company proposes to erect a large power plant in the vicinity of Mount Pocono.

...RSEY CITY, N. J.—Plans are being considered for installing an ...ntal lighting system in the shopping district and placing the wires ... ground. It is proposed to erect brackets each carrying four lamps ... poles that carry the trolley wires. Under the terms of an agreement the Public Service Electric Company is to lay at least 2500 lin. ... conduits each year in any street or streets it chooses and 2500 ft. ... streets designated by the Street and Water Board.

...VILLE, N. J.—The City Council has passed an ordinance ... the question of issuing bonds for the erection of a municipal ... light and power plant to a vote of the people at the November ...

...GHAMTON, N. Y.—Sealed bids will be received by S. W. Murray, ...ry of Board of Contract and Supply, Binghamton, N. Y., until ... for the construction of an electrical conduit system and in...n of boulevard lamp-posts on Court Street. Plans and specifica... will be furnished on application to J. A. Giles, city engineer. A ... of $15 will be required, which will be refunded on return of ...

...HAMTON, N. Y.—The contract between the city of Binghamton and the Binghamton Light, Heat & Power Company, whereby the ...ures a three-year lighting contract under a new system that pro... for an equal distribution of lamps throughout the city has been ... Work will begin at once on erection of poles and wires. It is ...ed to have part of the system in operation within thirty days and ... the system by Jan. 1.

...EVA, N. Y.—Plans have been prepared by the Central New York ... Electric Company for enlarging its Geneva plant, calling for an ...ture of about $40,000. The work will include the installation of ... boiler.

...TON, N. Y.—The Board of Water and Light Commissioners is in ... market for a 100 or 150-kw, direct-current, 250-volt, direct-connected ...ven generating unit and balance set for three-wire system. E. R. ... is secretary.

...LE FALLS, N. Y.—The Utica Gas & Electric Company has sub... a proposal to the Board of Aldermen for street lighting, under ... of which the company offers to supply arc lamps at $82.13 each ... and incandescent lamps at $24 per year. Under the present ... the city pays $35 per year per lamp for arc lamps and $12 each ...ndescent lamps. The contract calls for 163 arc lamps and thir... ...andescent lamps. Owing to competition between the Utica Gas ... Company and the Hudson River Electric Power Company a... the city secured arc lamps for $35 per year and awarded a five... ...tract to the Utica Gas & Electric Company.

...ERVIS, N. Y.—Plans are being considered for utilizing the ...wer of Shohola Falls to generate electricity for transmission to ... The present plan is to build a dam on Shohola Brook at ..., which are about 7 miles from where the brook empties into the ... River. The power house would be located near the river and ... conveyed to it by means of a large pipe line. John G. Hillard and ... V. Hillard, who own the Shohola property, are said to be ... in the project.

...IA, N. C.—It is reported that extensions and improvements to the ... light and water-works systems are contemplated, involving an expenditure of about $20,000.

SHELBY, N. C.—Negotiations have been closed between the Board of Aldermen and the Shelby Light & Power Company, whereby the ... will take over the property of the Shelby Company, at $13,000. The plant will be owned and operated by the municipality.

FINLEY, N. D.—The Finley Light & Power Company has awarded a contract to the Battery Power Company, of Milwaukee, Wis., for the installation of an electric-light plant.

CINCINNATI, OHIO.—The Ohio Electric Railway Company has commenced work on the erection of its substation at Herr's crossing in Urbana.

COLUMBUS, OHIO.—Bids will be received by H. S. Holton, director of public service, until Oct. 27 for furnishing material and installing a cluster lamp-lighting system for part of the city in accordance with plans and specifications on file in office of the director of public works and the Department of Lighting, Dublin Avenue, from whom copies may be obtained. The specifications call for 866 ornamental standards.

DELAWARE, OHIO.—The proposition to purchase the plant of the Delaware Electric Light, Heat & Power Company, to be owned and operated by the municipality, will be submitted to a vote of the people at the regular election to be held Nov. 7. The company has submitted a proposition to the City Council offering to sell the plant to the city for $137,500.

SPRINGFIELD, OHIO.—The question of installing an electric plant in the new high school building or substituting a transformer is under consideration by the Board of Education. The cost of installing a transformer is estimated at $1,200, while an electric plant would cost from $6,000 to $7,000.

VAN WERT, OHIO.—The Van Wert Public Service Company has submitted a proposal to the City Council for street lighting, offering to furnish 100 street arc lamps at $70 each per year and $65 per year for each additional lamp, under a moonlight schedule, and $80 each per year under an all-night schedule. The company agrees to substitute two series tungsten incandescent lamps for one arc lamp where desired. The Trinidad Power & Transmission Company, which was recently granted a franchise by the City Council to erect an electric-light plant in this city, failed to submit a bid, the reason assigned, it is said, being that the Auglaize Power Company, which is now building a hydroelectric plant and dam at Defiance, will be able to supply electricity at a rate which could not be touched by local steam plants and that it would be foolhardy to risk the investment required for the installation of an electric plant.

AFTON, OKLA.—The proposition to issue $20,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant and water-works system, will be soon submitted to a vote.

BARTLESVILLE, OKLA.—The Bartlesville Interurban Railway Company is building a new power house in Bartlesville. The equipment will include a 500-kw Allis-Chalmers turbine set with type "C" condenser. The company expects to install a 400-hp Babcock & Wilcox boiler.

CUSTER CITY, OKLA.—The Western Engineering Company is preparing plans and specifications for water-works and electric-light plant for Custer City, Okla., to cost approximately $40,000.

FAIRLAND, OKLA.—L. D. Long, it is reported, is planning to install an electric-light plant in Fairland. It is understood that an order has already been placed for machinery.

GROVE, OKLA.—Plans and specifications are being prepared by the Western Engineering Company for an electric-light plant and water-works system for Grove, to cost $35,000.

HOWE, OKLA.—An election will be held Nov. 4 to vote on the proposition to grant a franchise to the Howe Electric Light & Power Company to install an electric-light plant in Howe.

PAULS VALLEY, OKLA.—The Oklahoma State Corporation Commission has directed the Washita Electric Power Company, of Pauls Valley, to install a steam power plant as an auxiliary to its water-power plant, in order to supply adequate electrical service at all times. The company has increased its rate for energy from 12 cents to 15 cents per kw-hour.

BAKER CITY, ORE.—The City Council has granted the petition of the Eagle Electric Power Company for a year's extension to its franchise. Under the terms of the franchise, as it now stands, the company must have its plant in operation by October, 1912.

BEND, ORE.—The Bend Water, Light & Power Company has been granted a franchise to extend its water and electric service in new additions to the city territory.

FLORENCE, ORE.—The proposition to grant a franchise to the Florence Electric Company to install an electric-light and power system and one to the Florence-Mapleton Independent Telephone Company for a telephone system in Florence will be submitted to a vote of the people.

PORTLAND, ORE.—The Southern Pacific Company is planning to equip its railway from Portland to McMinnville for electrical operation.

PORTLAND, ORE.—Preparations are being made by engineers of the Pacific Power & Light Company for making surveys for the erection of a high-tension transmission line between Wallola and The Dalles, for the purpose of supplying electricity in the territory between the two cities. The proposed line will be about 130 miles in length and will cost about $375,000. The company owns practically all the electric plants in the Columbia, Yakima and Walla Walla River valleys.

PORTLAND, ORE.—An ordinance has been introduced in the City Council to provide more street lamps for the suburbs of the city. The contract with the Portland Railway, Light & Power Company calls for arc lamps at $75 each per year, with underground service, and $56 each per year from overhead wires. It also provides that the company extend its lighting system 1200 ft. beyond lamps in use when the contract took effect without extra charge to the city. Beyond this, however, the company refuses to install extra lamps without extra compensation from the city in addition to the rate of maintenance. Several

[illegible] have been made beyond the 1200 ft. limit. [illegible] lighting service in certain parts of [illegible]. The Mount Hood Railway & Light Company, it is under[illegible] to furnish the service.

ST. HELENS, ORE.—Application has been made by Charles R. M[illegible] for a franchise for an electric railway in St. Helens.

WOODBURN, ORE.—Negotiations have been closed whereby the Northwestern Long-Distance Telephone Company takes over the local telephone system, owned and operated by Henry Chappelle, of Woodburn.

WOOLLEY, ORE.—The Bellingham & Skagitt Interurban Railway Company has applied for a franchise to erect an electric-light and power plant in Woolley.

LANCASTER, PA.—Announcement has been made of the consolidation of several illuminating and power companies under the name of the Edison Electric Company, of Lancaster, Pa. The company is capitalized at $1,500,000 and was formed by the merger of the Edison Electric Illuminating Company, of Lancaster; Columbia Light, Heat & Power Company, of Columbia; Lititz Electric Heat & Power Company, of Lititz; M[illegible], Penn [illegible] Township, Mount Joy Township, East and West Donegal Townships Electric Light Companies; East and West Lampeter Townships, Manor Township, Warwick Township and Lancaster Township Electric Companies, and Manheim Suburban Electric Company. The officers are: W. W. Greist, of Lancaster, president; George Bullock, of New York, N. Y., vice-president, and J. S. Grabill, Jr., secretary and treasurer.

LORETTO, PA.—It is reported that the management of St. Francis College has decided not to supply electricity to light the streets and residences of the borough of Loretto.

MALVERN, PA.—The Public Service Company of West Chester is erecting a new transmission line to Malvern and will soon supply electricity in this town. The company has purchased the plant and holdings of the Ridley Creek Supply Company in Malvern. The Ridley company had the contract for lighting the streets of the borough. The plant of the Ridley Creek company in Williston was not included in the purchase.

PITTSBURGH, PA.—Plans are being considered by the West Penn Railways Company for improvements and extensions to its system in western Pennsylvania, involving an expenditure of about $2,000,000. The new extensions will include one from Greenburg to New Alexandria, another from New Alexandria to Latrobe and a third to cover a district between West Newton and Scott Haven. Rights-of-way have been acquired for these extensions and surveys are being made.

PITTSBURGH, PA.—A meeting of the stockholders of the Pennsylvania Light & Power Company, of Pittsburgh, has been called for Oct. 26 to vote on the proposition to increase the capital stock from $650,000 to $1,000,000 to provide funds for extensions to its system. The company proposes to extend its transmission lines across the Ohio River into McKee's Rocks, where it obtained a franchise in September. Plans have also been completed for the installation of underground conduits over a considerable portion of the North Side, where the streets are being raised.

SHARON, PA.—The Lawrence Hydro-Electric Company, recently organized, has applied for a charter permitting it to construct a dam on Slippery Creek for the purpose of supplying power in Laurence, Mercer and Butler Counties.

SOMERSET, PA.—Preparations are being made by the Somerset Railway Company to begin work on the construction of its proposed railway between Somerset and Rockwood, a distance of 10 miles.

SUNBURY, PA.—Announcement has been made of the consolidation of the Sunbury Gas, Edison Illuminating, Sunbury Electric Light & Power, Northumberland Electric Illuminating and the United Light & Power Companies under the name of the Edison Electric Illuminating Company, of Sunbury. The company is capitalized at $250,000 and the officers are: George Scott Stewart, of Philadelphia, Pa., president; W. W. Hepburn, of Philadelphia, Pa., vice-president, and E. R. Tatnall, of Haverford, secretary and treasurer.

SIOUX FALLS, S. D.—Funds have been provided by the County Commissioners of the counties of Hughes, Sully and Stanley for preliminary investigations for developing the water-power of what is known as the Little Bend of the Missouri. It is estimated that a minimum of 35,000 hp can be developed. It is also proposed to utilize the water for irrigating purposes over a wide territory and also to use the power developed to lift the water to large reservoirs for irrigation purposes. Application will be made to Congress for permission to construct canals and dams and locks necessary.

WAVERLY, TENN.—At an election held recently the proposition to issue bonds to purchase the local electric-light plant, owned by the Waverly Electric Company, was carried.

GREENVILLE, TEX.—The building formerly used as a power house for the municipal electric-light plant was destroyed by fire on Oct. 6. A new generator valued at [illegible] was also destroyed.

SEGUIN, TEX.—Bids will be received by Rev. J. Romberg, care of C. H. Page & Brother, architects, Austin, Tex., until Nov. 2 for wiring the Lutheran College building and servants' building at Seguin, Tex.

WACO, TEX.—The City Commissioners are reported to have canceled a bond issue, voted some time ago, for the installation of municipal electric-light plant. It is said that a contract has been award to the Waco Gas & Electric Company for street lighting for a peri of ten years. The company, it is reported, has made a reduction of per cent in the price formerly paid for arc lamps.

YOAKUM, TEX.—The Creamery Dairy Company, it is report is contemplating the installation of an electric-light system at its pl in addition to a 125-ton ice plant.

CHATHAM, VA.—The Town Council is reported to have decided advertise for bids on a franchise to supply electricity in Chatham.

CLIFTON FORGE, VA.—The Clifton Forge Ice & Bottling Works reported to have awarded contracts for additional machinery, includ a 750-kw generating unit, condenser and water-tube boiler. W. Mathews is president of the company.

ROANOKE, VA.—Extensive improvements are contemplated by Roanoke Street Railway & Electric Company which will involve an penditure of about $235,000. Orders have been placed by the comp for a new steam turbine for its steam power plant on Walnut Aver which will increase the output by 3500 hp. The new turbine and eq ment will cost about $45,000; new car barns, $75,000; substation Mason's Creek, $15,000, and new track and street paving, $100,000.

SUFFOLK, VA.—The Southern Bell Telephone Company has ta over the plant and holdings of the Atlantic Coast Company, an inde dent system, which operates in several cities and towns in eastern ginia and eastern North Carolina.

CHELAN, WASH.—The Great Northern Railroad Company, it reported, is planning to erect a large hydroelectric plant on the C River gorge, near Chelan. H. M. Herzog, of Seattle, Wash., is gineer.

DUVALL, WASH.—Application has been made to the Board County Commissioners by John F. Miller, attorney, American I Building, Seattle, Wash., representing local capitalists, for a franc to operate an electric-light system and water-works system over county roads and streets in Duval. The cost of the proposed sy is estimated at about $500,000.

HANFORD, WASH.—The plant and holdings of the Hanford [illegible]ation & Power Company have been acquired by the Pacific Po Light Company, of Portland, Ore. The Hanford system will be rated in conjunction with its other properties. It is said that plan being considered for enlarging the Hanford plant at Priest Rapids. W. Talbot, of Portland, Ore., is president of the Pacific company.

MORGANTOWN, W. VA.—The Union Utilities Company is pla to install motor-driven pumps at its water-works pumping station in gantown.

POINT PLEASANT, W. VA.—It is reported that preparation being made for the erection of two additions to the local electric plant, one of which will provide space for additional electric gener machinery and the other for a cold-storage and ice plant. S Sutton, it is said, has been engaged to supervise the erection o buildings and the Bert L. Baldwin Company, of Cincinnati, Ohio have charge of the installation of machinery.

PRINCETON, W. VA.—The Appalachian Power Company has a trust deed in the office of the clerk of the county court in Pri and in Welch on all its properties in the sum of $25,000,000. The pany is capitalized at $25,000,000 and has recently purchased el light and power plants in addition to securing rights-of-way and chises which permit it to erect a system of dams to furnish hydroe power for coal plants, villages, cities and manufacturing industr Virginia and West Virginia.

WHEELING, W. VA.—Plans are being considered by the Wh Traction Company for the construction of an extension of its system Moundsville to Barton and St. Clairsville.

LA CROSSE, WIS.—Plans are being considered by the La Water Power Company to rebuild the wrecked portions of the and the upper dams at once, the cost of which is estimated at $100,000. W. J. Ferris, president of the company, will have cha the work.

MADISON, WIS.—Announcement has been made by State F E. M. Griffith that work has begun on the installation of a tel system to be used as a protection against forest fires in Wisconsi

MENESHA, WIS.—The City Council has passed an ordinance izing an issue of bonds to the amount of $40,000 for extensions electric-light plant and water-works system.

MILWAUKEE, WIS.—The Department of Public Works is rted to have awarded a contract for the installation of a steam oine, motor generator set, etc., in the municipal incinerator to the llis-Chalmers Company, of Milwaukee, Wis., for $12,617. Harry E. riggs is Commissioner of Public Works.

PRESCOTT, WIS.—The Prescott dam on Kinnickinnick Cre sev-eral miles from Prescott, which furnishes power for operating tl plant of the Clifton Light & Power Company, gave way on Oct. 6, using considerable damage to the power plant. It will cost several t usand dollars to rebuild the dam.

RANDOM LAKE, WIS.—It is reported that an electric-light int is being installed in Random Lake.

WINNIPEG, MAN., CAN.—The City Council has rejected th propo-

[ ]on to purchase the property of the Winnipeg Street Railway Com[pan]y for $24,000,000. The municipal power plant will soon be in full [op]eration and will compete with the company in supplying electricity for [ ] and motors.

[W]INNIPEG, MAN., CAN.—Tenders will be received by the city of [W]innipeg until Nov. 3 for furnishing incandescent carbon and tungsten-filament lamps according to specifications, copies of which may be obtained a[t the] office of the general manager of the Light and Power Department, [ ] Main Street, Winnipeg. M. Petersen is secretary of Board of Con[trol].

[S]YDNEY, N. S., CAN.—The Cape Breton Electric Company is in[stall]ing a 500-kw Allis-Chalmers turbo-generator set with auxiliaries at [the] power house in Sydney.

[B]RANTFORD, ONT., CAN.—Negotiations, it is reported, are under [wa]y for the consolidation of the Grand Valley Railway Company and the [ ] Street Railway Company, with a view of creating a system [of ele]ctric railways to extend from Toronto to Detroit. American capital[ists, i]t is said, are interested in the deal.

[L]ONDON, ONT., CAN.—Extensive improvements and extensions are c[ontempla]ted by the London Street Railway Company to its system, w[hich] will involve an expenditure of about $1,000,000.

[S]HERBROOKE, QUE., CAN.—The Sherbrooke Railway & Power Com[pan]y is building a new substation at Derby Line, Vt. It is understood [th]at equipment has been purchased for the station.

[D]AWSON, Y. T., CAN.—The second unit of the Granville Power [Comp]any's hydroelectric plant on the north fork of the Klondike River, [ ] from Dawson, has been completed. The plant now has an [ ] of 10,000 hp.

[S]ONORA, MEX.—C. W. Forbes, general manager of the Sonora [Teleph]one Company, is reported to be in San Francisco, Cal., taking [ ] the erection of a long-distance telephone line, to extend from [ ] to Hermosillo. The cost of the pole line alone is estimated at $[ ]

[ZI]MAPAN, HILDAGO, MEX.—Application has been made by Andrew [Mac]kenzie, of Mexico City, for a concession to erect a hydroelectric [ ] on the Tula River, near Zimapan.

New Industrial Companies.

[THE] AMERICAN TANAGRA ELECTRICAL COMPANY, of New Y[ork], N. Y., has been incorporated with a capital stock of $50,000 to [man]ufacture apparatus for theatrical effects. The incorporators are: S[ ]ekulsky, 414 Central Park West; Hugh Hastings, 26 West Twenty-[ ] Street, New York, N. Y., and William A. Boeckel, 467 Kosciusko S[treet], Brooklyn, N. Y.

[THE] BUSCH STORAGE BATTERY COMPANY, of New York, N[. Y.,] has been incorporated by Charles Busch, 611 East 181st Street; [ ] Heering, 25 West Sixty-fifth Street, and Oscar E. Noetling, 315 [Fi]fty-seventh Street, all of New York, N. Y. The company is capi[talized a]t $30,000 and proposes to manufacture storage batteries, etc.

[THE] CHRON-ELECTRIC COMPANY, of San Francisco, Cal., has [been inc]orporated with a capital stock of $25,000 by E. L., E. C. and [ ] Hueier.

[THE] HARBECH MOTORS COMPANY, of Chicago, Ill., has been in[corpor]ated by A. T. Ewing, E. S. Hartman and C. Bednor, of Chi[cago]. The company is capitalized at $50,000 and proposes to manu[facture] motors and hardware specialties.

[THE] HARRISBURG STAR BOILER COMPANY, of New York, N[. Y., h]as been incorporated with a capital stock of $12,500 to manu[facture] engines, boilers, etc. The incorporators are: James S. Bowdle a[nd Jam]es Otis, of Oswego, N. Y., and Gerald E. Otis, of Buffalo, N. Y.

[THE] HEATER MUFFLER COMPANY, of Elmira, N. Y., has been [granted] a charter to manufacture appliances for motors, engines, auto[mobiles], etc. The company is capitalized at $50,000. The incorporators ar[e:] Kinzie, L. D. Curran and A. G. Ingham, of Elmira, N. Y.

[THE] HENRY MANUFACTURING COMPANY, of New York, N. Y., [has been] incorporated with a capital stock of $100,000 to manufacture ma[chine] tools, engines, etc. The incorporators are: George L. Henry, [Wes]t 138th Street; William F. Mohr and Charles W. Caffry, 33 New [ ], all of New York, N. Y.

[THE] HUDSON EXPORT & IMPORT COMPANY, of New York, N[. Y., h]as been incorporated with a capital stock of $10,000 by Herman M[ ] Asher Golden and Meyer Levy, all of 91 Wall Street, New York, N[. Y.] The company proposes to manufacture and deal in machinery, en[gin]es, motors, etc.

[THE] KLING ELECTRIC COMPANY, of Peru, Ind., has been granted a [cha]rter with a capital stock of $5,000 for the purpose of dealing in ele[ctr]ical supplies. The incorporators are: Alpha H. Kling, Alpheus H. [K]ling and E. P. Kling.

[TH]E LOS ANGELES ELECTRICAL APPLIANCE COMPANY, of Lo[s] Angeles, Cal., has been chartered with a capital stock of $5,000. Th[e] directors are: Fred F. Ives, Ross C. Holmes and Edwin D. McKi[nn]ey.

[TH]E MOTOR SPECIALTIES COMPANY, of Oswego, N. Y., has bee[n] incorporated with a capital stock of $175,000 to manufacture motors, engines, motor vehicles, boats, etc. The incorporators are: Arthur Lovell, of Plainfield, N. J.; Howard H. Williams, 31 Nassau Street, New York, N. Y., and H. V. Walsh, 551a Lafayette Avenue, Brooklyn, N. Y.

THE F. E. NEWBERRY ELECTRIC COMPANY OF ILLINOIS, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by F. E. Newberry, B. H. Bendheim and Francis Adams, Jr. The company proposes to do a general electrical contracting, construction and engineering business.

THE RICHEY TELEPHONE APPLIANCE COMPANY, of Alexandria, Va., has been incorporated with a capital stock of $6,000 to manufacture telephone appliances. The officers are: R. L. Newhouser, president; C. V. Richey, vice-president, and D. A. Bear, secretary and treasurer, all of Washington, D. C.

THE S. R. MANUFACTURING COMPANY, of Schenectady, N. Y., has been incorporated with a capital stock of $50,000 to manufacture motors, engines, motor vehicles, etc. The incorporators are: Christian Steenstrup, Karl M. Rossi and Ralph J. Ury, all of Schenectady, N. Y.

THE S. & H. MANUFACTURING COMPANY, of New York, N. Y., has been incorporated by Charles H. Stirrup, 37 Ft. Greene Place, Brooklyn, N. Y.; Frank A. Stirrup, Westfield, N. J., and Vitalis Himmer, Jr., Bayonne, N. J. The company is capitalized at $10,000 and proposes to manufacture vacuum cleaners, etc.

THE TAYLOR-HUBBARD COMPANY, of Brooklyn, N. Y., has been granted a charter with a capital stock of $100,000 to do a general engineering and contracting business. The incorporators are: Richard D. Hubbard, 164 Maple Street, and Edwin Taylor, 775 St. John's Place, both of Brooklyn, N. Y.

THE UNITED STATES STOKER CORPORATION, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000. The company proposes to manufacture mechanical stokers for furnaces, etc. The incorporators are: James L. Robinson, 309 Lafayette Avenue. Brooklyn, N. Y.; Burgess Osterhout, Freeport, N. Y., and William B. Barker, 10 Dewey Avenue, New Rochelle, N. Y.

New Incorporations.

PHOENIX, ARIZ.—Articles of incorporation have been filed for the Thousand Springs Power Company, with a capital stock of $2,000,000 by F. M. Bancroft and J. J. Crippen. The head office of the company is located in Denver, Col.

LEPANTO, ARK.—The Lepanto Light & Telephone Company has filed articles of incorporation with a capital stock of $2,500. The incorporators are: H. S. Portis, G. S. Lee and D. D. Buck.

FAIRFIELD, CAL.—Articles of incorporation have been filed by the California Terminal Company with a capital stock of $50,000 by C. W. Conlisk, W. M. Rank and R. A. Morton. The company proposes to build an electric railway from San Rafael to Sacramento, passing through the counties of Main, Sonoma, Napa, Solano, Yolo and Sacramento, a distance of 95 miles.

DOVER, DEL.—The United Water & Guarantee Company has been granted a charter with a capital stock of $1,000,000. The company proposes to construct and operate electric-light and water-works systems. The incorporators are: J. M. Deeter, of Harrisburg, Pa.; A. Grant Richwine, W. Dale Sheaser, of Mechnicsburg, Pa., and Arley B. Magee, of Dover, Del.

WILMINGTON, DEL.—The American Traction & Power Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000 and the incorporators are: F. M. Shive, S. E. Roberson and Harry W. Davis, all of Wilmington.

DARIEN, GA.—The Choopee River Power & Manufacturing Company has been incorporated with a capital stock of $5,000 to generate and transmit electricity. The incorporators are: A de Sola Mendes and Wyatt de R. Barchy, of Darien, Ga.; Goodwin Thayler, Winslow H. Edwards and Charles K. Jewett, of East Hampton, Mass.; H. C. Beasley and E. C. Collins, of Reidsville, Ga.

TWIN FALLS, IDAHO.—The Twin Falls Railway Company has filed articles of incorporation with a capital stock of $500,000 for the purpose of building electric and steam railways in the vicinity of Twin Falls. The incorporators art: L. B. Perraine, of Twin Falls; Raymond McCune, E. S. Williams, D. B. Moorman, C. W. Smith and A. D. Stafford.

CHICAGO, ILL.—The Oak Hill Street Railway Company has been incorporated with capital stock of $20,000 to construct and operate street railways. The incorporators are: Charles Pullman, E. A. Isaacson, L. S. Watts and O. C. Petersen, 1201 Stock Exchange Building, Chicago, Ill.

CRESTON, IA.—The Creston, Winterset & Des Moines Railroad Company has been granted a charter to construct an electric railway from Creston to Des Moines, a distance of about 75 miles.

PRESQUE ISLE, MAINE.—The Westfield Light & Power Company has been incorporated with a capital stock of $10,000 by Lincoln R. Sinclair, Enoch B. Briggs and Thomas C. Bell, of Westfield, Maine.

CROSBY, MINN.—The Crosby Water, Light & Power Company has been organized for the purpose of constructing and operating an electric-light and power plant and furnishing water in the town of Crosby.

liam P. Harrison, Francis H. DeGroat and Grace Weiss, all of Duluth, Minn.

GLENDIVE, MONT.—The Glendive Heat, Light & Power Company has been incorporated with a capital stock of $100,000 by George H. Hollecker, N. Buttleman and others.

CAMDEN, N. J.—The International Gas & Electric Company has filed articles of incorporation with a capital stock of $1.000.000. The incorporators are: F. R. Hansell, of Philadelphia, Pa.; George H. B. Martin and S. C. Seymour, of Camden, N. J.

HUNTER, N. D.—The Hunter Light & Power Company has been incorporated to install and operate an electric-light plant by I. Moen, H. M. Weiser, Z. F. Hamilton and others.

CANEY, OKLA.—The Oklahoma Rural Telephone Company has been chartered with a capital stock of $10.000 by A. H. Utley, of Caney, Okla.; J. W. Craig, of McLester, Okla., and Z. J. DuPies, of Coalgate, Okla.

KEOTA, OKLA.—Articles of incorporation have been filed for the Keota Telephone Company with a capital stock of $5,000 by R. N. Robinson, R. A. Bonham and H. D. Price, all of Keota, Okla.

TALOGA, OKLA.—The Taloga, Putnam & Southern Railroad Company has been incorporated with a capital stock of $100,000 by Charles W. Musgrove, George W. Kouns, J. E. Rudle, of Taloga, Okla., and others.

HERMISTON, ORE.—The Hermiston Telephone & Electric Company has filed articles of incorporation with a capital stock of $7,000.

PORTLAND, ORE.—The Ewbank Power Transmission & Motor Company has been incorporated with a capital stock of $250,000 by H. B. Ewbank and G. Staples. The company proposes to develop water power and construct an electric railway system near Portland.

CLEARFIELD, PA.—The Pike Township Electric Company has been granted a charter with a capital stock of $5,000. The directors are: A. W. Bigler, of Clearfield, treasurer; W. I. Betts and W. F. Powell, both of Clearfield, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the following companies: Independent Electric Company, of North Fayette Township; Independent Electric Company, of Oakdale; Independent Electric Company, of McDonald, and Independent Electric Company, of Collier Township. Each company is capitalized at $5,000, and the directors are: Robert A. Scott, of Wilkinsburg, Pa., treasurer; A. H. Mercer, N. S., Pittsburgh, Pa., and M. Wilson Stewart, of McKeesport, Pa.

TRAPPE, PA.—The Trappe Electric Company has been granted a charter with a capital stock of $5,000. The directors are: Herbert H. Ganser, of Norristown, Pa., treasurer; Daniel A. Bertolette and Montgomery Evans, all of Norristown, Pa.

CAMDEN, S. C.—Articles of incorporation have been filed for the Camden Water & Light Company with a capital stock of $70,000 by H. G. Garrison, W. M. Shannon, of Camden, S. C.; Edward C. Brainard, of Chicago, Ill., and others.

LAURENS, S. C.—The Sullivan Power Company has been granted a charter with a capital stock of $30,000. The company proposes to build a dam across the Reedy River near Tumbling Shoals and erect a hydroelectric power plant. The incorporators are N. B. Dial and J. H. Sullivan, both of Laurens, S. C.

HUNTERSVILLE, W. VA.—The Allegheny Improvement Company has been incorporated with a capital stock of $25,000 by H. M. Lockridge, J. H. Doyle, of Huntersville, W. Va.; J. A. Viquesney, of Belington, W. Va.; T. S. McNeel and C. J. Richardson, of Marlington, W. Va. The company proposes to deal in real estate and timber, build dams in Knapp's Creek, erect electric-light plants, sawmills, etc., in Pocahontas County.

TORONTO, ONT., CAN.—Articles of incorporation have been filed for the Mexican Midland Light & Power Company, Ltd., by Emil Carl Boeckh, Alexander Stewart and Henry Kilgour, of Toronto, Ont., Can.; T. Makinson Saunders and F. J. Robinson, of London, Eng. The company is capitalized at $15,000,000 and has been granted authority to build and maintain a light, heat and power plant, with privileges to construct railways, acquire timber limits and negotiate for municipal and other franchises.

Personal.

WOODMANSEE, DAVIDSON & SESSIONS (Incorporated), consulting engineers, Chicago, have opened a branch in the Wells Building, Milwaukee, Wis.

MR. FRANK G. BOLLES, formerly with the Bullock and Allis-Chalmers Companies, has been appointed secretary of the Manufacturers' Association of Racine, Wis.

MR. J. B. WHARTON, formerly of the Wilkes-Barre (Pa.) Company, has succeeded Mr. Fred. E. Shornstein as manager of the Richmond (Ind.) Light, Heat & Power Company.

MR. H. C. ALVORD, formerly in the sales department of the Montreal Light, Heat & Power Company, has been appointed sales agent of the Metropolitan Electric Company of Reading, Pa.

MR. N. G. PHELPS, formerly of the Peoria (Ill.) Gas & Electri Company, has been appointed in charge of the commercial department o the Richmond (Ind.) Light, Heat & Power Company.

PROF. A. A. MICHELSON, of the department of physics of the Un versity of Chicago, has returned from the University of Goettingen, wher he has been exchange professor during the summer semester.

PROF. WILLIAM T. RYAN, of the University of Minnesota, has re turned to his educational duties, having spent the vacation period i special work in design in the Westinghouse works at East Pittsburgh.

MR. KINGSLEY GOULD MARTIN, son of Mr. T. C. Martin, w married Oct. 18 at St. Matthew's Church, New York, to Miss Kathari Moulton Thompson, daughter of Mr. and Mrs. Silas Lavater Thompso of New York City.

GEN. IRVING HALE, manager for the General Electric Company Denver, was stricken with apoplexy on Sept. 29 and was removed to h home in an unconscious condition. Under the care of physicians he so rallied and has shown gratifying progress toward recovery since then.

DEAN H. M. RAYMOND, of Armour Institute of Technology, Cl cago, addressed a joint meeting of the Armour Institute branch of t American Institute of Electrical Engineers and the Armour Institu branch of the American Society of Mechanical Engineers on Oct. 1 His subject was "A Few Hints to Engineering Students."

MR. C. F. KLEE has been appointed contract agent of the Merchan Heat & Light Company, of Indianapolis, succeeding Mr. R. MacLell who has joined the staff of the Appalachian Power Company at Po hontas, Va. Mr. B. D. Christian, formerly of Noblesville, Ind., has be appointed engineer of the contract department of the Merchants' compa

PROF. GEORGE D. SHEPARDSON has, after twenty years' service the faculty of the University of Minnesota, been granted a year's le of absence. Professor Shepardson during this period will make a study educational methods and engineering developments and pursue a spe course in the theory of the telephone at the Harvard Graduate School Applied Science.

MR. D. A. HEGARTY, manager of the New Orleans Railway Light Company, was appointed at the recent annual convention of Society of Municipal Improvements held at Grand Rapids, Mich., ch man of a committee to make a report on city lighting, to be presen at the convention of that association to be held at Dallas, Te November, 1912.

MR. ARTHUR V. WAINWRIGHT has been appointed general mana of the Central New York Gas & Electric Company, with headquarters Geneva, and will have charge of the properties of the company in Gen Seneca Falls, Waterloo, Phelps, Clyde, Newark, Palmyra and Lyons. Wainwright was previously connected with a system of electrical proper in North Carolina.

PROF. GUSTAVE GILLON, professor of electrical engineering the University of Louvain, Belgium, is on a visit to this country order to look up various matters relating to electric traction. This is second visit of Professor Gillon, who spent some weeks here ten y ago, during which he visited our important central-station plants. Hector Prud'homme accompanies Professor Gillon.

LIEUT. BENJAMIN D. FOULOIS, U. S. A., who has conducted periments for the War Department in relation to wireless signaling f aeroplanes, was recently operated on for appendicitis at an army hos in Washington. Lieutenant Foulois is an experienced aviator, being on the officers of the army selected to make a special study of aerial n gation. In addition, he has specialized on the possibilities of "wirel in connection with the operation of aeroplanes.

MR. FRANK M. TAIT, formerly secretary and general manager, been elected president of the Dayton (Ohio) Lighting Company to ceed Mr. E. P. Matthews, who remains a member of the board of d tors. Mr. Tait will continue to serve as general manager, but wil succeeded by Mr. Matthews as secretary. Mr. Tait, who is not thirty-eight years old, has served as secretary and treasurer and is first vice-president of the National Electric Light Association.

MR. GANO DUNN has just returned from abroad, where, as a r sentative of the United States government and as president of American Institute of Electrical Engineers, he has been attending International Electrical Congress at Turin and the meeting of the I national Electrotechnical Commission, the body that has been organiz bring about international uniformity of standards and practice in electrical industry. Mr. Dunn, who for many years was first vice- dent and chief engineer of the Crocker-Wheeler Company and who is president of the New York Electrical Society, has been elected a dir and a vice-president of J. G. White & Company, Inc.

MR. HENRY P. ERWIN, who has been made secretary of Edison Electric Illuminating Company of Brooklyn to fill the vac caused by the death of Mr. Jacob H. Evans, is a lawyer and has with the company for the past five months in the capacity of res counsel. Mr. Erwin is a native of Tennessee, and was grad from the academic course of Yale University in 1904, and from Yale Law School in 1907, and was attached to the staff of Di Attorney Jerome of New York City from 1907 to 1910. His ele to the secretaryship of the Kings County Electric Light & Power pany will take place at the directors' meeting to be held November.

MR. GEORGE C. CLARKE has resigned his position as re nt

[illegible] of the Pennsylvania [illegible] become chief engineer for the engineering contractors, Fraser, Brace Company, New York. Mr. Clarke is a graduate [illegible] College. During the past twelve years [illegible] engineering staff of the Pennsylvania Railroad Company [illegible] engaged in the roadbed reconstruction work on the lines east of Pittsburgh, the construction of the passenger station at Pittsburgh and the [illegible] work and electrification of the New York [illegible] Fraser, Brace & Company [illegible] Falls, Mass.

[illegible] Siemens & Halske [illegible] New York [illegible] will represent the Verband Deutscher Electrotechniker at a Helmholz celebration which [illegible] under the auspices of the [illegible] Dr. Franke is accompanied by Dr. [illegible] [illegible]pin department of the Siemens & Halske Company, well known for his [illegible] these gentlemen will [illegible] Dr. Paul R[illegible], chief of the electrical measuring department of the Siemens & Halske [illegible]. These gentlemen will, in company with Dr. K. G. Frank, American representative of their company, visit a number of the more important telephone installations in this country and also made a study of the effect of high-tension transmission lines on neighboring telephone [illegible] lines.

[illegible] *ORIN SWENSON* has been appointed [illegible] of the Kansas City Railway Terminal Company, and will [illegible] of the electrical work pertaining to the new terminal, including repair shops, coach yards, and all light and power required on the [illegible] way. Mr. Swenson was born in Chicago, August [illegible], after graduating from the [illegible] English High and Manual Training School in 1893, spent three years at the Armour Institute of Technology and two years at the University of Illinois, graduating from [illegible] institution in 1899 with his degree in electrical engineering. [illegible]ately after graduation, Mr. Swenson went into the electrical department of the Illinois Steel Company and in February, [illegible], became connected with the Commonwealth Edison Company of Chicago, his work [illegible] getting out estimates and the development of [illegible] wiring diagrams, following the building and construction work in the field, testing out and turning over the complete equipment to the [illegible] department. In 1905 he left the Commonwealth [illegible] the engineering department of the New York Central & Hudson River Railroad Company, where he remained until September, 1907, engaged in engineering construction and inspection for the electrical [illegible] New York Central Terminal, including detailed development of [illegible] and testing electrical equipment and superintending installation of electrical equipment at the Yonkers power station, [illegible] Bridge terminal, etc. Mr. Swenson was assistant electrical engineer [illegible] Detroit River Tunnel electrification from September, 1907, to 1911, at which time the engineering and construction work was [illegible] completed. Mr. Swenson is a brother of Bernard V. Swenson, [illegible] secretary of the American Electric Railway Association.

Trade Publications.

[illegible] CHUCK.—The D. & W. [illegible], Providence, R. I., [illegible]sued Circular No. 201, describing its magnetic chuck, which possesses a wide range of usefulness in holding pieces of iron on the [illegible]r, shaper and milling machine.

[illegible]LER-BEARING CAR JOURNALS.—Bulletin No. 26, issued by [illegible] Standard Roller Bearing Company, Philadelphia, Pa., contains tests, [illegible]nials and a description of the two general types of roller-bearing [illegible]rnals developed by the company for street and high-speed interurban railway service.

[illegible]ITCHBOARD GRAPHIC METERS.—The Westinghouse Electric [illegible]nufacturing Company has issued Circular No. 1131, describing [illegible] meters for switchboard service. The publication shows illustrations of the meters together with typical charts taken from same, indicating the various uses to which graphic meters may be put with advantage to the user.

[illegible] MOTORS.—The Westinghouse Electric & Manufacturing [illegible] has just issued the first number of a small monthly publication entitled *Small Motors*, which is devoted to practical applications of [illegible] motors, including views of motors in actual service, such as operating ice cream freezers, small lathes, washing machines, grinding wheels [illegible] numerous other household devices. One application shown is an [illegible]try to the furnace, to increase the draft, to increase the distribution of heated air by drawing it from the pipes and forcing it into the [illegible] to ventilate a steam-heated room, and in other ways to assist in [illegible] heating and ventilation of the home. Advice as to installation, operation and care of the motors is given in short practical talks. *Small [Motor]s* is distributed to central stations and dealers the first of every [illegible].

[illegible]ENT LAMP CATALOGS.—"The Fortress of Lamp Quality" [illegible] title of an illustrated booklet recently issued by the Shelby Electric Company, Shelby, Ohio, which describes in an attractive and in[illegible] [illegible] manufacturing facilities enjoyed by the manufacturers of Shelby lamps. The Shelby company has also issued a catalog covering types, prices and discounts on Shelby incandescent lamps of all classes in large, street-series and miniature styles. A vest-pocket compendium of commercial information on Peerless lamps has been prepared by the Warren Electric & Specialty Company giving ratings, voltage ranges, prices and discounts, with a small cut of each type listed. The Sterling Electrical Manufacturing Company, of Warren, Ohio, in its new loose-leaf catalog lists and describes not only the more common types of incandescent lamps, but also the spiral carbon-filament type and the Sterling single-unit fixtures and "Mazdafore" clusters for industrial lighting. The page is punched for binding, and additional sheets will be issued whenever changes in lamp data make it advisable.

ELECTRIC PLEASURE VEHICLES.—The Waverley 1912 Catalog embodies a new idea in catalog making. The earliest product of the Waverley factory was named after the Waverley novels, and the scheme of decoration for this year relates to incidents and characters from the [illegible] themselves and scenes associated with Abbotsford, the home of Sir Walter Scott, as the setting of the narrative. The outside cover displays in green and gold figures in medieval armor taken from the entrance hall at Abbotsford. The inner cover shows Scott's coat of arms under a three-color picture of the Waverley 1912 limousine in the garden at Abbotsford. Across the tops of all the inside pages runs a frieze in three colors and gold representing the tournament in "Ivanhoe." A portrait of Sir Walter backs up the title page, and in the wide margin on either side of the printed matter appear panel portraits of different Waverley characters. The two central pages of the catalog are devoted to a large four-color halftone of a Waverley car on the Abbotsford estate. The artist employed to illustrate the catalog was Frederick Richardson, the well-known book illustrator of Chicago. Besides the purely decorative pictures the catalog is well furnished with half-tone illustrations of Waverley cars, showing both interior and exterior views, those on pages 5, 7 and 9 being especially noteworthy, while the descriptive matter accompanying the pictures is unusually full and convincing.

BUSINESS NOTES.

AMERICAN DISTRICT STEAM COMPANY has moved its general offices from Lockport, N. Y., to its new works at North Tonawanda, N. Y.

THE HASKINS GLASS COMPANY has moved its Chicago office to the Marine Building, 136 West Lake Street, and placed in charge Mr. A. H. Krom, formerly of the Commonwealth Edison Company, of Chicago, who will act as branch manager.

PUTTING TELEGRAPH WIRES UNDERGROUND IN KANSAS CITY.—The Western Union Telegraph Company is making an extension of its underground construction in Kansas City. The contract for doing the work has been awarded to the Graner-Mahoney Contracting Company, of St. Louis.

CHICAGO ARC LIGHTING.—For controlling the arc circuits of the new Chicago street-lighting system, the Delta-Star Electric Company, of Chicago, has been awarded the contract for a new type of automatic oil circuit-breaker having a rating capacity of 15 amp at a voltage of 12,000. The contract for these switches was awarded by the Sanitary District.

STEEL TRANSMISSION STRUCTURES.—The Archbold-Brady Company, Syracuse, N. Y., has issued an attractive bulletin on its products for transmission lines, including transmission line supports and anchor structures, special river and railroad crossing structures, catenary bridges and cross catenary supporting poles. Brief descriptions of typical installations form part of the bulletin. The illustrations represent successful solutions of a variety of problems which involve fabricated steel structures of a different character from those ordinarily used in building, railroad or bridge work.

AN EXCELLENT ADVERTISING CARD.—The Bryant Electric Company, of Bridgeport, Conn., has issued a unique advertising card, which at the same time has a direct practical value. It is devoted to the Bryant interchangeable line of "New Wrinkle" sockets, switches and other wiring devices, and consists of a heavy base card 14 in. x 12 in., to which is attached a revolvable disk 10 in. in diameter. The various bases and caps which make up the line are printed on the base card and the shells on the disk. This permits each of the twenty shells to be brought against any one of the twenty-six caps and bases, and when this is done the catalogue or style number of every one of the 520 complete articles formed by the union of the two parts shows through a slot in the disk. On the reverse side of the heavy card is an index of catalogue numbers which includes standard package quantities and list prices. It will thus be seen that this card covers what it would require many pages of a catalogue to list properly and at the same time renders it possible to obtain in its entirety an illustration of every completed device, for examination to determine if it possesses the requisite features. As nothing identical seems ever to have been made before, a patent for the device has been applied for by Mr. Frank V. Burton, the Eastern sales manager of the company, who originated the device and produced it, and who also directs all of the company's publicity work.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 10, 1911.

[Prepared by [illegible] Allyn, 16 Exchange Place, New York.]

[illegible] INTERRUPTER; C. Aalborg, Wilkinsburg, Pa. [illegible] An oil-containing casing for the contacts [illegible] area.

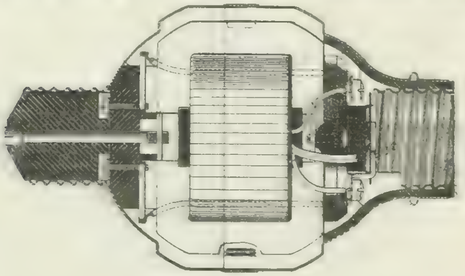
[illegible] LAMP AND SERIES CIRCUIT CUT-OUT; [illegible] Pa. App. filed Sept. 20, [illegible] Two [illegible] separated for insulation.

1,005,[illegible] CONDUIT; H. H. Balliett, Pittsburgh, Pa. App. [illegible] Inner and outer tubes and two intermediate helical coils.

1,005,163. TRANSFORMERS; F. Conrad, Swissvale, Pa. App. filed [illegible] In the form of a socket for tungsten lamps.

1,005,[illegible] ELECTRICALLY HEATED TRAY; F. L. Cromine, Detroit, Mich. App. filed May 8, 1911. Asbestos sheet and heat unit to set in a serving tray.

1,005,176. GUARD FOR TELEPHONE AND TELEGRAPH WIRES; C. J. Elliott, Oxnard, Cal. App. filed July 11, 1910. A guard surrounds each wire and is connected to an adjacent wire of different potential.



1,005,163.—Transformer.

1,005,192. BINDING POST; G. Garretson, San Diego, Cal. App. filed Jan. 17, 1911. A bolt with a notched head and a clamp nut.

1,005,194. TELEPHONE SYSTEM; T. W. Gleeson, Boston, and W. H. Gilman, Medford, Mass. App. filed Aug. 5, 1907. A "farmer's" party line to prevent interference and to insure release.

1,005,199. BATTERY CONNECTOR; J. H. Gugler, Milwaukee, Wis. App. filed Jan. 22, 1909. The carbon has a cavity filled with oil surrounding the binding post.

1,005,221. MOTOR CONTROL; J. D. Ihlder, New York. App. filed Oct. 11, 1905. Artificial power-consuming device to equalize load as in elevator work with alternating-current induction motors.

1,005,222. ELECTRODYNAMIC BRAKE CONTROL; J. D. Ihlder, New York. App. filed March 13, 1908. For automatic or push-button elevator systems with floor controllers.

1,005,237. ALTERNATING-CURRENT ELECTROMAGNETIC SWITCH; D. Larson, Yonkers, N. Y. App. filed Nov. 26, 1907. Mounted on a vertical baseboard; has a weighted armature.

1,005,252. VEHICLE-BRAKING SYSTEM; J. N. Mahoney, Wilkinsburg, Pa. App. filed March 25, 1907. Automatic fluid pressure system for trains to stop detached cars first and then stop the front cars so as to avoid collision.

1,005,253. REFILLABLE CARTRIDGE FUSE; E. B. Mallory, Wilkinsburg, Pa. App. filed June 17, 1911. Has disks for holding the knife-blade terminals in position.

1,005,283. SPRING BINDING POST; L. M. Neher, Milford, Ind. App. filed Feb. 11, 1908. A sheet-metal spring loop with overlapping perforated tongues for the wire.

1,005,293. REGULATION OF THE VOLTAGE OF ALTERNATING-CURRENT MACHINES; C. A. Parsons and Alexander H. Law, New Castle-Upon-Tyne, England. App. filed Sept. 16, 1910. A synchronously rotating inductor varies the reluctance of a magnetic circuit for automatically compounding loads of different power-factors.

1,005,307. OUTDOOR TRANSFORMER; K. C. Randall, Edgewood Park, Pa. App. filed Oct. 18, 1909. Double walls with ventilating passages to shield the tank from the sun.

1,005,316. CONTACT FINGER; E. E. Rose, Swissvale, Pa. App. filed Feb. 2, 1907. For drum-type controllers; means for adjusting the pressure and movement of the finger.

1,005,323. SPRING-FASTENING DEVICE; J. Schade, Jr., New York. App. filed June 22, 1908. A wire-receiving socket and a spring-engaging arm.

1,005,338. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed June 17, 1905. A rotating commutator for wireless signaling; a battery of condensers discharged through a circuit without a spark-gap.

1,005,350. CONTROLLER; H. A. Steen, Pittsburgh, Pa. App. filed July 8, 1909. Two control drums, a single operating handle and interconnections for governing either or both of two motors.

1,005,355. VARIABLE-SPEED, MOTOR-CONTROLLING APPARATUS; A. Sundh, Yonkers, N. Y. App. filed March 13, 1908. The acceleration of a motor is controlled by current from a generator running with the motor.

1,005,357. COOKING APPLIANCE; A. L. Sykes, Covington, Ky. App. filed May 16, 1910. An electric heater in the bottom of a shallow receptacle and with a deep cover.

1,005,360. ELECTRIC-HEATING DEVICE AND METHOD OF CONSTRUCTING THE SAME; H. R. Taylor, Wilkinsburg, Pa. App. filed Dec. 31, 1908. An insulated resistance element is held under pressure between two curved metal plates.

1,005,393. TELEPHONE SYSTEM; C. S. Winston and E. H. Rupe, Chicago, Ill. App. filed Dec. 19, 1904. Cord circuits are adapted for use with various types of lines, such as magneto common-battery signaling and common-battery talking lines.

1,005,395. FUEL HEATERS; M. J. Wohl and A. A. Low, New York. App. filed Oct. 17, 1907. A bent pipe between resistors for heating liquid fuel prior to carbureting for engines.

1,005,402. ELECTRIC SWITCH; A. A. Zeigler, Boston, Mass. App. filed Feb. 16, 1910. Integral connections between a binding post and a switch contact for railroad signaling, etc.

1,005,418. SIGNAL CONTACT; E. R. Cunningham, Des Moines, Ia. App. filed Sept. 3, 1910. For trolley roads. The contacts are carried by a housing over the trolley wire.

1,005,420. APPARATUS FOR CONTROLLING MOTORS; F. W. Darlington, Philadelphia, Pa. App. filed Dec. 14, 1909. Pneumatically controlled switches for a single car or number of cars.

1,005,445. ELECTRIC-CAR CONTROLLER; H. T. Maib and E. C. Rowe, Spokane, Wash. App. filed Dec. 22, 1910. A safety device to prevent the circuit-breaker from blowing out when the motors are reversed and the car is still going ahead.

1,005,471. ANTENNA; R. H. Rendahl, Liljeholmen, near Stockholm, Sweden. App. filed June 7, 1910. Thin metal tubes of large diameter held in a row.

1,005,475. THERMAL ELECTRICAL PROTECTOR; C. A. Rolf, Adrian, Mich. App. filed April 21, 1902. A number of solder-secured elements and a rotatable arm for resetting.

1,005,482. ELECTRIC SIGN AND METHOD FOR MAKING THE SAME; H. A. Schmidt, Chicago, Ill. App. filed Jan. 31, 1910. Crooke's tube is partly embedded in cement.

1,005,483. DEVICE FOR CUTTING SLEET FROM TROLLEY WIRES; E. Slingluff, Cincinnati, Ohio. App. filed April 29, 1910. A rotatable cutter is mounted above the usual trolley wheel.

1,005,506. TERMINAL CONNECTION OR COUPLING FOR ELECTRIC CONDUITS; W. S. Brown, New York, N. Y. App. filed Ma[illegible] 16, 1910. A cast socket and sheet-metal clamp strap.

1,005,517. FUSE; A. F. Daum, Pittsburgh, Pa. App. filed Nov. [illegible] 1910. A fuse strip under tension and with an indicator. Improvement on Patent No. 961,716.

1,005,521. CUT-OUT; H. W. Doughty and C. E. Beach, Binghamton, N. Y. App. filed Oct. 16, 1906. An insulating block with contact slides between two insulating blocks with terminals.

1,005,575. AUTOMATIC CIRCUIT-BREAKER; E. C. Raney, Crooksville, and C. E. Simmons, Steubenville, Ohio. App. filed Oct. [illegible] 1908. Self-opening and closing, for motor circuits.

1,005,612. ELECTRICAL VIBRATING DEVICE; H. N. Cupp, Ma[illegible] Pa. App. filed Sept. 7, 1910. Double solenoid for riveting hammers, etc.

1,005,628. METHOD OF MAKING COMPOUND METAL ARTICLES; H. W. Fisher, Pittsburgh, Pa. App. filed June 16, 1909. One metal at or above its melting point is electrodeposited upon another [illegible] an additional coating of the first then cast upon the deposited coating.

1,005,635. ALL-PORCELAIN ELECTRICAL LAMP SOCKET; E. [illegible] Freeman, Trenton, N. J. App. filed April 1, 1910. Two-part b[illegible] with snap switch inclosed.

1,005,638. MOTOR-CONTROL SYSTEM; H. E. Frost, Cleveland, O. App. filed Oct. 1, 1910. A master switch controls electromagnetic operated switches which control the motor.

1,005,649. APPARATUS FOR EXPLODING MINE CHARGES; [illegible] Krannichfeldt, Cologne, Germany. App. filed Feb. 19, 1907. A [illegible]ter-hand switch controls individually the local exploding switches.

1,005,671. ELECTROLYTIC DEVICE; W. B. Thorpe, Balham, London, Eng. App. filed Jan. 12, 1909. For recording meters, etc.; gas-t[illegible] joint; insulation.

1,005,672. ELECTROLYTIC APPARATUS; W. B. Thorpe, Bal[illegible] London, Eng. App. filed Aug. 18, 1909. Re-combining gas type meter, etc.; ignition device.

1,005,700. CONTROL SYSTEM FOR ELECTRIC MOTORS; F. [illegible] Fishback, New York, N. Y. App. filed Feb. 28, 1910. Some of [illegible] speed-controlling switches effect more than one motor speed.

1,005,714. CABLE DUPLEX SYSTEM; I. Kitsee, Philadelphia, [illegible] App. filed Dec. 22, 1908. For telegraphy; two transformers of di[illegible]ent ratios of transformation.

1,005,715. TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed [illegible] 19, 1908. Long-distance duplex telegraphy; a single key for [illegible]trolling a plurality of sources.

1,005,718. ARRANGEMENT OF ELECTRODES FOR THE ELECTROLYTIC REFINING OF METALS; F. M. Kohler, St. Petersb[illegible] Russia. App. filed Dec. 28, 1909. Anode plates and a frame [illegible] a container for the electrolyte and the cathode.

1,005,725. ELECTRIC FURNACE; G. Massip, Paris, France. [illegible] filed Sept. 23, 1910. The hearth is internally heated by the cu[illegible] so as to become a conductor and form one electrode.

1,005,754. ELECTRICAL WATER HEATER; M. H. Shoenberg, [illegible] Francisco, Cal. App. filed April 29, 1911. The water supply c[illegible] be cut off while current is on.

1,005,758. PROCESS AND APPARATUS FOR TESTING ELECTRIC METERS; E. M. Wilkins, Mexico City, Mexico. App. filed [illegible] 12, 1907. For comparing rotary registering meters, one of [illegible] has a mark upon a rotating part.

1,005,786. SPRING-FASTENING DEVICE; J. Schade, Jr., New [illegible] N. Y. App. filed June 22, 1908. Sheet-metal strip formed w[illegible] wire receiving socket in its stationary end and another socket [illegible] spring-arm end.

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CONTENTS.

EUROPEAN 110,000-VOLT PLANT.

We are glad to note in this issue the installation of the first European plant at voltage exceeding 100,000. Very long transmissions are not sufficiently numerous abroad to encourage the use of extreme voltages, yet this plant is well up to the present American limit, although as a matter of fact the distance of transmission at present is only about 35 miles. In a short time, however, this country will have advanced to the 140-000-volt limit, commencing with an installation in Michigan. The European plant is at Lauchhammer, Germany, and is particularly notable as being steam-driven, using coal at the mouth of the mines. The initial equipment consists of two 5000-kw turbo-generators, delivering energy at a voltage of 5000. The steam-producing plant is out of the ordinary from the standpoint of American practice in its use of simple double-flue boilers, a peculiarity due possibly to the nature of the fuel. They are, however, equipped with automatic stokers, economizers and superheaters, and are operated by artificial draft. The extraordinary voltage used for so short a transmission is due first to the fact that the ultimate energy will be some 20,000 kw, and second, to the question of standard accessory apparatus, including transformers. Any voltage over 65,000 required special design, and so having determined in the interest of economy to go above this figure they apparently decided to play the limit. From the generating plant the energy goes at 5000 volts to the switchhouse. Here duplicate busbars are provided, connected with the raising transformers, which themselves feed into duplicate 110,000-volt busbars. Disconnecting switches and oil switches are installed on both sides of the transformers and also on the outgoing high-tension transmission lines.

The transmission line itself presents some interesting peculiarities. It consists of a duplicate system of three-phase conductors carried on a single line of iron towers. Three cross-arms are provided, the one at the top of the tower being arranged to carry four wires with the outer ends of the cross-arms turned down so as to bring the outside wires on either side of the tower in position to form an equilateral triangle with the two others of the circuit, carried respectively on the upper cross-arm nearer the tower and at the end of the short lower cross-arm. All wires are carried on five-disk suspension insulators. There are thus two complete circuits, one on each side of the tower, 5.9 ft. between centers and completely transposed once a mile. At the extreme top of the tower is a 100,000 circ. mil steel cable grounded, and serving to help in anchoring the towers and to protect against lightning. In addition, the third and lowest cross-arm on each tower carries a bow-shaped guard under each one of the circuit wires, on which, if the insulator should break, the wires would be instantly grounded. In other respects the construction is

quite similar to that of our own high tension systems, and it is worth noting that an American automatic regulator presides over the voltage in the power house. To the American engineer decidedly the most interesting feature of the system is the tower line. It impresses one as being neater, lighter and probably cheaper than the ordinary American construction, and the arrangements for suspending and guarding the circuit wires are certainly excellent. The base is only about 27 in., so that the structure resembles a latticed pole rather than a typical tower, and is possessed therefore of a certain flexibility which is of use in case a wire breaks under extraordinary load.

A METHOD OF DETERMINING EQUIVALENT CONSTANT HEATING CURRENTS.

In the design and operation of railway motors it is important to be able to compute the equivalent constant current whose heating effect is equivalent to that of a variable-current régime imposed upon the machine in cycles of service operation. In order that the motors may not be overloaded their temperature elevation must be kept within certain assigned limits, and this in turn depends upon the I^2R losses integrated over the period of service. But the current I in the motor is necessarily very variable. Nevertheless, it goes through a certain regular cycle in the operation of a railway train. If a steady current can be found whose square will produce in the long run the same heating as the service régime, it becomes possible to test the motor with this equivalent current and to ascertain by experiment the temperature elevation produced. The computation of the equivalent heating current for a given curve of actual currents obtained from a recording-ammeter chart with rectangular co-ordinates of amperes against time is a very tedious and lengthy task. A much simpler and very practical method was described in a paper by Mr. C. O. Mailloux read before the International Electrical Congress of Turin.

The method of Mr. Mailloux consists in obtaining the record of variable currents in polar co-ordinates, the time being represented by the angle and the current strength by the variable-radius vector. Thus, for electric-railway service one complete revolution, or 360 deg., may be allotted to five minutes of time, after which a new polar chart must be started. There would thus be six such charts covered in a service run lasting thirty minutes. By means of an ordinary planimeter, and especially by means of a particular type of planimeter called the integraph, the sums of the areas of all the polar-current charts are then obtained mechanically and the mean-radius vector is quickly determined. In the particular process described this mean-radius vector is evaluated mechanically with practically no resort to arithmetic. The equivalent heating current follows immediately from this mean-radius vector. According to the data contained in the paper, the method can be applied in one-tenth of the time necessary for arriving at a result of like precision with ordinary rectangular co-ordinates of amperes and time. Moreover, the liability to mistakes is greatly reduced by the new process. The method is practically an extension of that originally introduced by Fleming for the determination of the virtual-current strength corresponding to a complex alternating-current wave-for[m]. Whereas, however, the Fleming method was confined to [a] single half-wave, or 180 deg. of rotation, the new method [is] extended to cover as many complete rotations or fractio[ns] of the same as may be necessary and the summation [of] successive rotations is very simply and elegantly conduct[ed].

EFFECT OF POWER-FACTOR ON SYNCHRONOUS CONVERTER RATING[.]

In the case of an ordinary direct-current generator [or] motor everyone who has had experience with such m[a]chines knows that their armatures become heated by [the] working armature currents under load and also that t[he] heating is normally uniform over all of the armature co[ils]. If an ordinary direct-current machine, under normal lo[ad], develops more heat in some particular coil or coils than [in] the others, it is evident that there is some defect in [the] machine, such as a short-circuited turn in the coil. [The] same is true in the case of an ordinary alternator. Wh[en]ever heat is developed in the armature winding by I^2R [it] is uniformly distributed through the winding. Neverth[e]less, an exception to this condition is presented in [the] armature of a converter, which is a sort of hybrid betw[een] a direct-current and an alternating-current machine. A c[on]verter also presents analogies to a revolving commuta[tor], so that its thermal behavior is relatively complex by c[om]parison with that of either a direct-current or an al[ter]nating-current generator.

The heating of converters has, however, received [much] attention, because it is this heating which assigns and limits the rating of such machines, assuming that the c[om]mutation can be kept satisfactorily free from sparking. [It] is well known that converters develop no appreciable to[rque] about their shafts beyond that due to friction, so that [the] normal mechanical stresses which they have to withs[tand] are due only to accelerations either in starting, stoppin[g or] responding to changes of frequency on the system [sup]plying them. Consequently they are not only very lig[ht in] weight for their output, compared with generators, b[ut if] their heating could be reduced they could be made to c[arry] still greater loads without the need of much mecha[nical] reinforcement.

Mr. Ralph D. Mershon published an early articl[e on] "The Output of Polyphase Generators and Rotary T[rans]formers" in our columns of June 15, 1895, dealing [with] the quantitative relations of the I^2R armature heati[ng in] these machines. Other contributions to the literatu[re of] the subject have been made at different times by Dr. S[tein]metz, Dr. McAllister and others. The heating of [con]verters has also been much studied and reported up[on in] Europe. Most of the discussions concerning the I^2R [he]ating of converter armatures under load have assume[d that] the machines were operated at unity power-factor and the average heating of the armature was sought for [com]parison with the average heating of the same ma[chine] receiving or delivering the same load current as mo[tor or] generator respectively. It has been repeatedly pointe[d out], as was shown in the above-mentioned Mershon arti[cle of] 1895, that six-phase converters had a greater outpu[t than] quarter-phase converters, and these in their turn [had] greater output than three-phase converters. Rel[ative]

w of the discussions have covered the conditions of heatg with reduced power-factor—that is, when the incoming ternating currents are not in phase with the generated nf in the armature. It is known that the heating is nsiderably increased under such conditions; or, to exess the same facts in another way, the current output a polyphase converter for a given permissible temrature elevation must be distinctly reduced if it has to erate at a reduced power-factor.

The I^2R heating of converter armatures is far from ing uniform. The coils at one end of each armature gment nearest to the taps become the most heated id attain a temperature elevation in excess of the ers. Theoretically this inequality might be reduced by king the turns in those coils of larger cross-section. The mplication in manufacture and repairs introduced by h an expedient has, however, never been held to repay advantage thereby obtainable. Consequently the outt of converters is apt to be kept below what might be ched with the average armature heating, owing to the parity of heat generation in the different coils and slots the armature. The article by Mr. Nicholas Stahl appring on page 1060 of this number discusses this inequality heating in the coils of converter armatures from a thematical standpoint. It shows that the heating of the el-coils or tap-coils is considerably greater than that of middle coils, even at unity power-factor, and that the d arity increases at one end-coil as the power-factor is duced, although it diminishes at the other end, the rear il receiving at 80 per cent power-factor much less g than the middle coils.

TI LIFE OF METALLIC-FILAMENT LAMPS.

interesting study of the life of tungsten lamps in service under commercial conditions was recently reported in one of our foreign contemporaries. The scene of the igation was Poitiers and the experiments were made e municipal plant in the interest of the municipality. amps were run both on direct current and alternating ent, four makes of lamp being tried out on the former three on the latter. The candle-powers were mostly moderate and four makes of 16-cp, 120-volt lamps included in the list. On direct current, in particular, results obtained with these low candle-power lamps somewhat remarkable. In a group of four 16-cp. 12 olt lamps, each by a different maker, one gave out at -four hours, but the other three endured to 1528 rs, 2300 hours and 4229 hours respectively. The lamp last mentioned had fallen to 11.3 cp at the end of its life, but held up to 80 per cent of its initial candle-power for hours. Meanwhile neither of the other specimens had aln off 20 per cent at the end of its life. The 25-cp s went rather better. One make failed at 646 hours, ner at 1045 hours, a third at 2500 hours and still anth at 2981 hours, all without falling off 20 per cent in e-power. The wattage of these small lamps seems to n the practice of Continental makers, very various, h to a certain extent accounts for idiosyncrasies in life although in the case of the 16-cp lamps it is interesting to note that the example of longest life was of singularl low specific consumption, dropping below 1.2 watts per candle only after some 2800 hours of service. The next size larger lamps, of 32 cp, did materially better. Of this size a sample of one make lasted 2228 hours, another 2422 hours, a third 2773 hours, and the fourth was still running after 2900 hours, having then fallen off just 30 per cent of the candle-power. On alternating current the results were astonishingly bad, no lamp of any make or size going materially beyond 2300 hours and most breaking short of 1000 hours. Only two, in fact, passed the latter figure, one a 50-cp lamp and the other a 25-cp lamp.

In discussing the cause of this extraordinary difference in life between direct current and alternating current, the investigators are disposed to regard it as due chiefly to the fact that the commercial network for alternating current is subject to rather bad regulation owing to the large number of motors on the service. This judgment as to the cause of the phenomenon is in all probability correct, since no experiments here have tended to show any material difference in life between tungsten lamps burning on direct current and alternating current. One curious and noteworthy fact in these tests is that with very few exceptions all the lamps tested were overrated in candle-power and in most cases also overrated in efficiency. We hear a good deal about the high efficiency at which the foreign makers run their tungsten lamps, but the indications of this impartial, if somewhat incomplete, test are that whatever may be done in the case of selected groups of lamps the commercial product is less accurately rated than our own. For instance, the 32-cp lamps tested ran from 1.2 initial watts to as high as 1.54 initial watts per candle and the 25-cp lamps from 1.29 watts to 1.55 watts in the tests on direct current, while on alternating current three lamps which started out at just over 1 watt per candle had all failed by the end of the first 400 hours. The long and short of the matter seems to be that the American users of tungsten lamps have little cause for anxiety over the life or the uniformity of the American product. A casual group of American tungsten lamps by various makers would certainly show as good results in life, and rather better in uniformity, than was secured in the Poitiers test.

The sole fact of special interest to American practice is the very creditable results that seem to have been reached with tungsten lamps as low as 16 cp. The test itself certainly shows, in spite of the small number of lamps investigated, that there is a reasonable expectation of life on a circuit of good regulation for these little lamps at voltage as high as 120. In other particulars the American user has certainly reason to be well satisfied with the quality of the present product as compared with the commercial foreign lamp, although some foreign-made tungsten lamps show consistently results that are quite comparable with those reached here. The active competition in manufacture of the metallic-filament lamps abroad does not seem yet to have led to the evolution of any noticeably superior product. It seems to be the old story of American engineers taking up a foreign product and putting it in first-class commercial shape so as to reach final results at least as good as the best attained abroad. The evolution thus carried on always takes time, as it has done in this case, but it seems to have arrived.

Final Disposition by Patent Office of Heany Tungsten Lamp Cases.

The period having expired during which appeal could be made, the United States Patent Office has made public the decision, rendered July 7, 1911, of Assistant Commissioner C. C. Billings in the Heany tungsten lamp cases. Three applications made by John A. Heany, of York, Pa., for patents on tungsten lamps were involved, and in the decision all were finally rejected on the ground of fraud. The final rejection of these applications dissolves interference with a number of pending tungsten lamp patent applications, which can now resume their routine course through the Patent Office.

The Heany applications thus finally rejected were the subject of a criminal suit in the Supreme Court of the District of Columbia, filed early in 1908 and reported at the time in these columns, in which Barton, an assistant patent examiner, Everding, a patent attorney, and Heany were indicted for conspiracy, forgery and the destruction of original pages of a patent application and the substitution therefor of new pages. Prior to the commencement of the trial Barton pleaded guilty; Everding and Heany were tried, the jury convicting the former and acquitting Heany. Both Barton and Everding were sentenced to the penitentiary for terms of three and two years, respectively.

The present proceedings were based upon charges filed by Principal Examiner A. F. McKinnan and by Kuzel, Just, Hanaman and von Bolton, inventors, who were involved in interference proceedings with Heany. The General Electric Company, as assignee, was also represented among the counsel pressing the charges. The applications involved were the original Heany application filed Dec. 29, 1904, on which a patent was issued Jan. 29, 1907; a divisional application filed Aug. 31, 1906, and another divisional application filed Nov. 19, 1906. The charges are that Everding and Barton, aided and abetted by Heany, removed from the files of the Patent Office two sheets of the specification of the original application, substituting therefor two other typewritten sheets containing, among other matters which were not in the application when filed, a reference to the use of paraffine as a binder and also a description of the use of metals in a state of colloidal suspension, instead of the powdered forms of the metal; and that thereafter Barton inserted, by means of a typewriter machine, on the sheets which had been fraudulently substituted, the words "pure chromium, molybdenum, thorium, manganese or alloys thereof," and elsewhere inserted the words "osmium, cerium, niobium, tantalum, vanadium or boron and silicon," and elsewhere after the word "hydrogen" inserted the words "or nitrogen"; that Barton, in behalf of Heany, fraudulently stamped an amendment and entered it on the examiner's register and upon the file wrapper as of a previous date, namely, Aug. 26, 1907. Charges are also made in connection with the application of Aug. 31, 1906, and Nov. 19, 1906. In the criminal proceedings against Barton and Everding it was charged that the fraudulent substitutions were based upon knowledge, provided by Barton, of the subject matter in patent applications relating to tungsten lamps which were filed by other inventors.

When the present proceedings were initially instituted, the defendant instituted proceedings in equity in the Supreme Court of the District of Columbia, asking for an injunction restraining the Commissioner of Patents from striking the patents of Heany from the files of the Patent Office or considering the charges of fraud made by Principal Examiner A. F. McKinnan, on the grounds that Heany's acquittal in the criminal trial barred further proceedings. The court granted a temporary injunction restraining the commissioner from proceeding in the case, which injunction was later reversed on appeal.

Commissioner Billings in his very able opinion states that, in view of the grave charges that have been preferr[ed] against the Heany applications, it is deemed expedient a[nd] proper to institute proceedings before the parties to t[he] interference should present their proofs upon the questi[on] of priority of invention, for the reason that if it should [be] found that the Heany applications had been fraudulent[ly] changed and modified, as alleged, and to be incapable [of] amendment, it is clear that Heany has no right to dema[nd] an interference with other applicants for a patent a[nd] has no status in such a proceeding. It is added that [it] would be a travesty and against all legal principles to pe[r]mit a party to an interference to remain a party there[to] should it be found that the very applications of that pa[rty] involved in the interference are fraudulent to such a deg[ree] that no valid patent could be based upon such applicatio[ns] or, in other words, that any patent or patents granted up[on] such applications would be invalid and void on the grou[nd] of fraud.

It is stated that in the injunction case the Court of A[p]peals held that the question as to whether Heany conni[ved] at and approved the attempted tampering with his appli[ca]tions in the Patent Office is not *res adjudicata*. That co[urt] also held that if the commissioner should find the alte[ra]tions in an application to have been made without [the] knowledge and consent of the applicant, he will per[mit] it to be corrected so as to restore it to its condition [as] originally filed. Should he, on the other hand, find tha[t it] was tampered with by connivance and approval of the [ap]plicant, he will enter an order rejecting the applicat[ion], leaving the applicant his right to appeal therefrom. [The] opinion goes fully into the question whether Heany c[on]nived at and approved of the alleged fraud, and the deci[sion] of Assistant Commissioner Billings is that Heany wa[s a] party to the fraud.

Counsel for Mr. Heany, while admitting as facts [the] testimony of Mr. Barton in the criminal suit giving de[tails] as to the fraudulent addition of new matter to the app[lica]tion of Mr. Heany, maintained that their client did not [have] any personal knowledge of such fraudulent action and [that] he should be permitted to correct his applications and th[ere]by receive the benefit of such prior invention as the a[ppli]cations in their original form disclosed. The assistant c[om]missioner, however, ruled that from the testimony g[iven] during the proceedings he was constrained to hold that [Mr.] Heany was not only privy to the frauds concerning [the] filing of his two divisional applications and the ori[ginal] application upon which the former are alleged to have [been] based, but was an active participant therein; and tha[t the] whole proceeding involving these three applications [is] permeated with falsehood and fraud on Mr. Heany's [part], that no valid patent can be granted on any of these ap[plica]tions. In the opinion it is stated that, of the three ori[ginal] sheets of the application of the 1904 or the parent ap[plica]tion, the only one now on file is the third sheet conta[ining] two and one-half claims and these cannot be rightly [used] as a foundation upon which a specification can be ere[cted]; therefore, the amendment to this application offering [new] sheets as identical with those removed is refused not [only] on the ground that the application is so permeated [with] fraud as to be in law no application, but also on the g[round] that there is nothing appearing in the evidence on wh[ich to] base a just and correct conclusion as to what the or[iginal] specification contained when filed.

Aside from the confession during the criminal tr[ial] of Mr. Barton, in the present proceedings other test[imony] was considered as to Mr. Heany's complicity in the [fr]aud, and it is stated that when Mr. Heany was called for [te]stimony he refused to answer interrogations. The opini[on] reviews the testimony offered for the purpose of showin[g] that Mr. Heany had invented a pure tungsten-filament inc[an]descent lamp prior to Dec. 29, 1904, and that there coul[d] have been no motive on his part, therefore, in perpetuati[ng] the frauds specified in the charges, and admitted by t[he] re-

ondents in their answers, to have been made in that appli- tion. In support of this contention, a witness, Mr. mon, produced a pocket notebook, a shop book of his ork, together with perfected lamps, which he testified ere made under Mr. Heany's direction between May, 03, and May, 1904; but Mr. Simon subsequently con- ssed that these lamps were not made until 1908 and 1909. ius, instead of showing that Mr. Heany was in possession the invention prior to December, 1909, it tended to show at if Mr. Heany was capable of thus manufacturing evi- ence he was equally capable of fraudulently altering the corded evidence that his application filed in the Patent ffice is supposed to furnish. Another witness, Mr. Urm- n, who produced notebooks and experiment sheets similar character to those of Mr. Simon, admitted that his books re not written until years after the dates they bear. It stated that, likewise, Mr. Heany's notebooks, experiment eets and other documentary evidence introduced by him e entitled to no weight as contemporaneous records, in ew of Mr. Heany's explanation as to how they were kept his laboratory, and his admission that they might have len made long after the occurrences or experiments to hich they are purported to relate. The experiment sheets one of the Heany exhibits were clearly shown to be lulent by the testimony of two witnesses.

iere was produced in evidence correspondence that took ace in 1904 between Mr. Heany and the General Electric mpany, which showed that an option was given to the ter company by Mr. Heany. This option, however, was l by the General Electric Company before it ex- red, for the reason that officials of that company were fied that Mr. Heany had produced nothing of value. correspondence tended to show, moreover, that not were Mr. Heany's efforts in 1904 to produce a success- ncandescent lamp failures, but that he was working composition instead of pure tungsten lamps. A wit- who worked for Mr. Heany from June to October, testified that in this period the only use made of tung- vas to add a small amount of it to the oxides of the metals in the production of electrodes for arc lamps, that Mr. Heany never explained or showed to him any sten incandescent-filament lamps. A lamp introduced vidence by Mr. Heany, alleged to have been made prior 905, and to contain a pure tungsten filament, when l in the presence of Assistant Commissioner Billings ng the taking of testimony, showed that the platinum ne white-hot, while the filament showed no light, there- owing it to be inoperative. In reply to an assertion he had exhibited to him a V-shaped tungsten-filament in the early part of 1904, Examiner McKinnan, of Patent Office, stated that such a lamp was not shown until 1907.

commenting on this line of testimony the opinion s that the evidence tends to show that Mr. Heany was ng on many lines during 1904, such as the develop- of insulated-wire machinery, miniature arc lamps, sition-filament incandescent lamps, and glowers sed of oxides in the nature of self-starting Nernst rs. The evidence fails, however, to show that Mr. y had developed a successful tungsten-filament in- scent lamp; and even if Mr. Heany did some work tungsten in 1904, and had some idea that it might be le to produce an incandescent lamp with a tungsten- nt, the evidence fails to show that he had a concep- of an operative tungsten-filament lamp or a success- method by which it might be produced at that time.

One exhibit consisted of written instructions on a printed sheet stated to have been given by Mr. Heany to his as- sistant prior to Dec. 8, 1904, but a witness, who was proprietor of a printing office in New York, testified, by evidence most convincing, that he did not print and deliver the printed sheet until July 26, 1905. Mr. Heany was en an opportunity to rebut this testimony, but refused to appear for further examination. The opinion states that several witnesses testified to boasts made by Mr. Heany as to his ability to influence the Patent Office, one testifying that Mr. Heany said that a man in the Patent Office had been keeping him posted on what was going on and also helped him prepare patent specifications; that Mr. Heany occasionally, in unguarded moments, boasted to employees that he was the only man who had succeeded in getting next to the Patent Office; that he often reiterated to his employees that they must understand that Barton's relations with him were "perfectly straight," but that Barton was so rash that he would ultimately get them all in trouble. The opinion also refers to testimony indicating that fraudulent specifications and claims were prepared at York, Pa., by Mr. Everding and Mr. Barton with Mr. Heany's knowledge; that Mr. Heany frequently came into the room where the typewriting was being done, and that Mr. Heany and Mr. Everding conversed during the dictation.

The formal decision of Assistant Commissioner Billings is that the parent application and the two divisional applications at issue are finally rejected, and patents thereon are finally refused on the ground that any patent granted in view of the established facts would be held in the courts to be null and void and of no effect on the ground of fraud. It is ordered that upon the termination of the proceedings each of these three applications shall be indorsed with the words "patent refused on the ground of fraud," and each of them shall hereafter be kept in the archives of the Patent Office separate from the other applications for patents.

The Incandescent Lamp Situation.

Following the decision of the United States Circuit Court in the incandescent lamp suit, which was fully reported in these columns last week, there is much very natural inquiry as to the ways and means by which the General Electric Company will adjust its lamp business to meet the mandate of the court. It is now known that the General Electric Company owns outright the National Electric Lamp Company and its twenty constituent companies. At the time that the government suit was begun last March the General Electric Company bore a dual relation to these companies. It owned a majority of the stock, but by contract full control rested with the minority stockholders, and it was the owner and licensor of certain patents under which the National company and its subsidiaries operated. After the government suit was instituted the General Electric Company found it expedient (in accordance with an option created by a previosly existing contract) to buy the minority interest in the National Electric Lamp Company. The decree entered on Oct. 21 was drawn in accordance with this condition.

No official public announcement has yet been made as to the way in which the General Electric Company will meet the situation, but by reliable authorities it is stated that every effort will be made to retain those features of the National organization which made it effective in the development of the lamp business. Messrs. Terry and Tremaine will have general supervision of these properties and the local executives will remain the same. The engineering, manufacturing and selling facilities will, it is stated, be continued practically unchanged, and the rivalry which has hitherto existed in development work, as well as in selling, between the National companies and the lamp department of the General Electric Company will be encouraged as much as possible. Also, the practice which has hitherto prevailed of giving all of the licensees full information as to the discoveries, progress and development made by each of them will be continued in the belief that this policy makes for more rapid and efficient progress in the art of lamp manufacture.

The fact that the General Electric Company is the owner of each of the twenty odd companies hitherto embraced in the National organization will be made clear by some such legend as "owned by the General Electric Company" in connection with the printing or writing of the name of each of the companies.

The details incident to the necessary recasting of the entire lamp organization are naturally enormous and the officers of the several companies have been in constant conference for several weeks working on the readjustment to conform to the new conditions. One of the most important questions to be worked out is the matter of future price contracts. Owing to the inhibition of any attempt to control the re-sale price of lamps all existing price contracts must be canceled and new arrangements made in their stead, and that work is now going forward as rapidly as possible.

Briefly, therefore, the situation, so far as information is now obtainable, may be summarized as follows: In so far as the form and legal relations of the General Electric Company to its subsidiaries in the lamp business were declared to be contrary to law they will be discarded. In so far as those features of research, manufacture and distribution which made the operations of the National companies economically efficient can be retained they will be retained.

Telephone Toll Lines as Common Carriers.

An important proceeding has been instituted before the Interstate Commerce Commission, which body is asked for a ruling on the question whether a telephone toll line company is a common carrier and also to formulate rules and regulations to govern the operation of and charges for telephone toll-line service. The application was made by the Home Telephone Company, of Clarksville, Tenn., which filed a complaint against the Cumberland Telephone & Telegraph Company, a subsidiary of the American Telephone & Telegraph Company. The Clarksville company formerly had a toll-line connection with the Long Distance Telephone & Telegraph Company, which was later taken over by the Alabama & Tennessee Telephone & Telegraph Company and finally sold to the Cumberland company. According to the complaint the Cumberland management immediately cut out its connections with the Home company and refused to render it toll-line service.

According to a law passed June 18, 1910, the Interstate Commerce Commission is given jurisdiction over telegraph, telephone and cable companies, but there has as yet been no ruling as to whether such jurisdiction includes the requirement that telegraph and telephone companies shall file tariffs with the commission before putting them into effect, as in the case of railroad companies. The counsel for the Home Telephone Company takes the position that, since railroads under the law relating to common carriers cannot refuse the use of their rails to other companies desiring them for interstate business, the Independent telephone companies can demand and secure the use of toll-line service in consideration of reasonable charges. It is pointed out that in Ohio the United States Court refused to enjoin one telephone company from making any toll-line connections with another telephone company, the judge ruling that, under the public policy of the State of Ohio, an exclusive contract such as that which the application for an injunction sought to establish could not be granted.

Census Electrical Data.

Additional advance thirteenth census (1907) data on the manufacture of electrical machinery and apparatus, supplementing the tentative report issued in September last and printed in our issue of Sept. 9 are contained in a statement just issued by Census Director Durand in response t[o] requests from leading technical journals and the princip[al] manufacturers. The matter was prepared under the direc[-]tion of Mr. William H. Steuart, chief statistician for manu[-]factures, Bureau of the Census. The figures are prelim[i-]nary and subject to such revision as may be necessary afte[r] further examination of the original reports.

	Number of Establishments Reporting	Number	Total Kilowatts.	Value
Dynamos:				
Direct current	75	13,882	414,222	$4,711,0[…]
Alternating current	28	2,909	991,728	8,370,0[…]
Dynamotors, motor-generators, boosters, rotary converters, and double current generators	29	2,291	295,079	3,155,0[…]
Transformers:				
50 kw and over	14	3,953	11,058,021	4,616,0[…]
Under 50 kw	31	72,776	577,408	4,185,0[…]
			Total horse-power	
Motors:				
Direct current for power	93	100,714	676,682	7,787,0[…]
Alternating current for power	45	143,409	1,006,995	10,519,0[…]
For automobiles	8	2,796	12,471	294,0[…]
For fans	32	199,113	178,033	2,451,0[…]
For electric elevators	22	4,988	63,585	1,189,0[…]
For railways and miscellaneous, including parts and supplies		53,710	795,652	9,847,0[…]
		Weight of Plates. (Pounds.)		
Storage batteries	68	23,119,331		$4,244,[…]
Parts and supplies				434,[…]
		Number		
Primary batteries:				
Liquid and testing	11	344,650		729,[…]
Dry	43	33,988,881		4,583,[…]
Parts and supplies	18			622,[…]
Arc lamps:				
Open	10	5,004		84,[…]
Inclosed	23	118,981		1,623,[…]
Incandescent lamps:				
Carbon filament	43	55,048,378		6,157,[…]
Tungsten	20	11,738,619		6,241,[…]
Gem, tantalum, glower and vacuum and vapor lamps				2,716,[…]
Decorative and miniature lamps, X-ray bulbs, vacuum tubes, etc.	16			601,[…]
Telegraphs:				
Intelligence	6	83,539		198,[…]
Police	17			1,127,[…]
Wireless apparatus	23			448,[…]
Switchboards and telegraph parts and supplies	15			185,[…]
Telephones:				
Transmitters	27	1,116,403		1,377,[…]
Receivers	31	1,063,309		1,135,[…]
Complete sets of instruments not included in transmitters and receivers	52	732,697		5,104,[…]
Interior systems complete without instruments	12	16,238		123,[…]
Central switchboards	27	36,272		2,399,[…]
Private exchange boards	11	2,252		370,[…]
Parts and supplies	48			3,752,[…]
Electric heating, cooking and welding apparatus (1)				1,003,[…]
Electrical measuring instruments:				
Station apparatus	21			1,639,[…]
Testing and scientific	37			547,[…]
Meters for consumers' circuits	15			5,614,[…]

(1) Twenty establishments reported the manufacture of electric hea[ters] including those for cars; thirteen, electric cooking stoves; and four, ele[ctric] welding apparatus.

Meter Committee of N. E. L. A.

The meter committee of the National Electric Light Association was in session at the Hotel La Salle, Chicago, on Oct. 19 and 20, Mr. A. J. Bushnell, chairman, presiding. The other members of the committee present were: Messrs. W. H. Fellows, Washington, D. C.; W. E. McCoy, New York; Frank A. Vaughn, Milwaukee, and W. L. Walsworth, Minneapolis. The first day's meeting was confined to the committee itself, but on the second day there was a conference with representatives of meter manufacturers, the latter including Messrs. F. G. Vaughn and F. P. Cox, General Electric Company; William Bradshaw, Westinghouse Electric & Manufacturing Company; Charles E. Hansell and A. G. Lucas, Duncan Electric Manufacturing Company; A. A. Serva and A. L. Pond, Ft. Wayne Electric Works; Chester E. Hall, Minerallac Electric Company; E. R. Anderson, Willis Electric Meter Company; H. W. Young, Sangamo Electric Company, and H. I. Shire, Columbia Meter Company. In addition there were two visitors of some note, Mr. John Nelson Cadby, of the Wisconsin Railroad Commission, and Mr. Ernest E. Sharp, of London, who is connected with Chamberlain & Hookham, meter makers, Birmingham, England. The latter happened to be visiting Chicago and attended the conference by invitation. Mr. A. G. Turnbull, foreman of meter repairs for the Commonwealth Edison Company, attended the meetings of the committee also.

Much important work has been mapped out by the meter committee, which will report at the Seattle convention of the N. E. L. A. next June. At the Chicago meetings there was a discussion of uniformity in the dial markings of meters, uniformity in meter connections and uniformity of design as affecting the price of watt-hour meters—all subjects of much interest to electric-service companies. The next meeting of the committee will be held early in December, probably, and Chicago is likely to be the meeting place. On the evening of Oct. 19 the committee took dinner at the Illinois Athletic Club and met President John F. Gilchrist, of the N. E. L. A., and some of the other [illegible] of the Commonwealth Edison Company.

Project to Develop Falls of Ohio River at Louisville Revived.

Mayor Head, of Louisville, Ky., has revived the project [illegible] harness the falls of the Ohio River at that point and the local Engineers and Architects' Club has appointed a committee to investigate the feasibility of the plan. At a session of the club Oct. 16 many engineers present scouted the possibility of utilizing the changing flow of the river, which varies 30 ft. in height. The average head available at the falls is about 12 ft., but this almost vanishes during times of flood, while at low water the small quantity flowing would be of little value for power purposes. The average flow of 8000 cu. ft. per second in the river has been variously estimated to be capable of delivering 6000 hp to 50,000 hp, and plans for a power canal around the city have been proposed by the advocates of the scheme. Others have computed the interest on the heavy construction costs involved for this low-head development to exceed the saving to be expected over a coal-burning plant. In any case, it is pointed out, on account of the stream variations, which make a hydroelectric plant inoperable during flood and low-water conditions, an auxiliary steam plant would be needed.

At the Engineers' Club meeting Mayor Head, Mr. M. W. Neff, of the Board of Public Works; City Engineer David Lynn and Major Lytle Brown, local United States engineer, advocated the development of the falls. Messrs. T. A. Leisen, Marshall Morris and J. T. Gathright opposed the plan. At the close of the meeting the club's president, Mr. G. Wilbur Smith, chief engineer for the Louisville Lighting Company, appointed a committee to investigate the water-power plan, naming Messrs. Marshall Morris, D. R. Lyman, T. A. Leisen and Carl Clem as its members.

Keokuk Water-Power Development.

Mr. Hugh L. Cooper, vice-president and chief engineer of the Mississippi River Power Company, which is erecting a great hydroelectric plant on the Mississippi River at Keokuk, Ia., lectured before the Western Society of Engineers in Chicago on Oct. 18 on "Water-Power Development of the Mississippi River at Keokuk." Mr. Cooper also spoke before the St. Louis League of Electrical Interests and the Engineers' Club of St. Louis on the same subject on the evening of Oct. 19. The lecturer's address was illustrated by a large number of lantern-slide pictures and was greatly enjoyed, the speaker's straightforward manner and occasional flashes of dry humor making his remarks especially interesting. The address was mainly devoted to the hydraulic features of the undertaking, and in view of the illustrated article describing the present condition of the work which was given in the *Electrical World* of Oct. 21 it will not be necessary to make an extended report. A few facts brought out by Mr. Cooper will be of interest, however, as supplementing previous accounts that have appeared in the *Electrical World* and also correcting one or two inaccuracies that have appeared in print.

In view of the recent failure, or partial failure, of dams in Pennsylvania and Wisconsin, it is important to know that very careful precautions have been taken in making the foundations for the main dam at Keokuk. At distances of 36 ft. test holes have been driven to a depth of 36 ft. in the bedrock of the river in the middle line of the 4600-ft. main dam. Compressed air is forced down one hole and if there is any indication of escaping air or mud in the adjoining hole further excavation is made to discover the cause. The rock in the bed of the river is excellent for foundation work, and in only one instance has a defect been discovered by the careful testing adopted. This was a stratum of 4 in. of clay about 4 ft. below the surface, and the excavation was carried down below this weak spot.

The entire development at Keokuk will cost about $25,000,000. The interest charged on the money secured to carry on the work is nearly $3,000 a day, so that the necessity for all reasonable haste is obvious and great pains have been taken to expedite the construction work as greatly as is consistent with safety. About 1500 men are now employed on the job. The damages paid for lands which will be overflowed by the lake created by the dam amount to about $2,000,000. This lake will have an area of nearly 100 sq. miles, but will be of small value as a storage reservoir, because the development is a low-head proposition and the greatest necessity is to maintain a uniform head of water so that the storage supply cannot be drawn upon to a very great extent. About $1,000,000 has been spent in equipment for construction work.

As has been previously stated, a contract has been entered into to supply 60,000 hp of electric energy to the public utilities of St. Louis, 140 miles away. This contract is very elaborate. The base rate made for electrical energy delivered in St. Louis is $18 a hp-year at 60 per cent load-factor. However, by an interesting provision, it is agreed that there shall be a revaluation every ten years, made by arbitrators, if necessary, to fix anew the rate for electrical energy according to the fluctuation in the market price for coal for the average of a term of two years before the date of revaluation. The base rate for coal is taken as $1.42 a ton. For each increase or decrease of 1 cent in the price of coal a corresponding increase or de-

crease of one-half of 1 per cent shall be made in the price of the hydroelectric energy. Thus, if in ten years the price of coal has gone up 20 cents a ton, the price of the energy delivered in St. Louis will be advanced 10 per cent, making it at that time $19.80 a hp-year. Similarly, a reduction in the price of coal will mean a reduction in the price of electricity under the St. Louis contract, which is for a term of ninety-nine years.

It is of interest to note that the 7500-kw generators, of which fifteen will form the initial installation, will be probably the largest hydroelectric units in existence using one runner in the turbine. The rotor of each of these units weighs about 500,000 lb.

Mr. Cooper concluded his Chicago lecture by inviting the members of the Western Society of Engineers to visit the plant at any time, but preferably some time next spring. In the discussion Mr. Lyman E. Cooley, the well-known civil engineer, told in an interesting manner of his early connection with the work. Mr. Cooley made a study of the situation ten years ago, and his preliminary plans for water-power development at the rapids at Keokuk have been followed in the main in the present development. Mr. Cooley paid a high compliment to Mr. Cooper for his work, not only as an engineer, but as a financier, in securing the funds for the project after arduous and long-continued effort. In referring to this financial side of the project, Mr. Cooper said that bankers seem to have a distrust of engineers' preliminary estimates of cost, and there seems to be some foundation for this apprehension. Mr. Cooper advises his hearers never to make any estimate for anybody unless as a last resort and after exhaustive study. Temporary or preliminary estimates of cost are apt to be misleading and should be avoided by the engineer.

Denver Convention of Sons of Jove.

As published last week, the ninth annual convention of the Rejuvenated Sons of Jove was held at Denver, Col., Oct. 16, 17, 18. There was a larger attendance than at any previous annual meeting, probably because of the stirring contest waged by Mr. Washington Devereux, of Philadelphia, and Mr. Robert L. Jaynes, of Pittsburgh, for the office of Jupiter.

There was a short skirmish when the meeting convened on the day of election, but Mr. Devereux proposed the name of Robert L. Jaynes for Jupiter and the election was made unanimous. Mr. Jaynes has been one of the most indefatigable workers in the order and his friends look forward to great achievements under his administration. Among other matters that came up was a suggestion from Past Jupiter J. Robert Crouse for a fund to be created by the Past Jupiters' Association. In the absence of Mr. Crouse this paper was presented by Mr. Philip S. Dodd. Another matter considered was the advisability of accepting advertising in the *Jovian Bulletin.* It was decided to try the plan of taking advertising for a year, although the meeting was very much divided on the subject, it being felt by some that the dignity of the order was at stake.

The tenth Jovian Congress will be made up as follows: Jupiter, Mr. Robert L. Jaynes, 1421, Pittsburgh; Neptune, Mr. H. E. Hobson, 56, Dallas; Vulcan, Mr. George H. Porter, 194, Chicago; Pluto, Mr. H. C. Biglin, 1095, Denver; Mercury, Mr. E. C. Bennett, 3932, St. Louis; Hercules, Mr. W. M. Stearns, 2703, Atlanta; Mars, Mr. H. H. Cudmore, 196, Cleveland; Apollo, Mr. W. J. Grambs, 447, Seattle, and Avrenim, Mr. C. M. Parr, 1788, Hartford.

The Denver Jovians did everything possible to make the visitors' stay pleasant, comfortable and interesting. On Monday evening a smoker was held at the Traffic Club, and on Tuesday the rejuvenation was held at El Jebel Temple, at which about 100 new members were initiated. The rejuvenation was preceded by a parade through the princip streets and the electrical effects were beautiful, the Pitt burgh and Philadelphia floats being particularly good, the cities being the contestants for the next annual meetin The contest was later decided in favor of Pittsburgh.

The attendance at the banquet on Wednesday evenir was 300, and addresses were made by Jupiter Jayne Past Jupiters Turner, Hobson, Kirkland and Dostal ar Mr. Washington Devereux. The two gentlemen last name were presented with loving cups.

Possible Combination of Elevated and Surface Railways in Chicago.

For some time a merger of the elevated and surfa street-railway systems of Chicago has been under di cussion. An important step in this direction came to lig on Oct. 23, when a letter addressed to the Mayor and Ci Council of the city of Chicago was made public at a mee ing of the City Council. This letter was signed by M Henry A. Blair, representing the Chicago Railways Co pany; Mr. Ira M. Cobe, representing the Chicago Ci Railway Company, the Southern Street Railway Compa and the Calumet & South Chicago Railway Company, a Mr. Samuel Insull, representing the Chicago Elevated Ra ways, recently combined, as already noted in this journ The letter of Messrs. Blair, Cobe and Insull was short b significant. It reads as follows:

"To the end that a comprehensive plan be formulate having for its purpose the permanent establishment a maintenance of the best possible transportation faciliti for the city of Chicago, the undersigned will be glad co-operate with your honorable body in an earnest endeav to work out a satisfactory solution of every phase of t transportation problem."

This letter was dated Oct. 21, 1911, and was transmitt to the City Council by the Mayor with the recommendati that it be referred to the local transportation committ which was done. The meaning of the communication, doubt, is that street-railway and elevated interests are p paring to "get together," but before doing so wish t sanction of the city authorities, which is probably ind pensable under the "traction settlement" ordinance of 19 under which the surface-railway companies are operati The proposed consolidation has also an important beari on the question of building a passenger railway subway Chicago. The interest of the Commonwealth Edison Co pany, of which Mr. Insull is president, in the situation an active one, owing to the intimate relation of the head that company with the elevated railways and also to fact that the electric-service company supplies a large p portion of the electrical energy used both by the surf and elevated railway companies of Chicago.

Artificial Illumination in Continental Europe.

Under the title "Random Notes on Light and Life Europe" Dr. Herbert E. Ives, of Cleveland, gave an teresting illustrated address before the Chicago Section the Illuminating Engineering Society on Oct. 19. Mr. F. Schuchardt, the new chairman of the section, presid for the first time. Dr. Ives discussed interior lighting the continent of Europe, considering both ancient modern times and basing his remarks on observations researches relating to a recent European tour. The fam structures of antiquity, such as the Parthenon and Pantheon, were probably lighted by daylight exclusiv in some cases by openings in the roofs. Pompeiian hous

ld no windows; the rooms were lighted from courtyards. eautiful oil lamps have been found in Pompeii, but they uld have been of little service for general illumination; rhaps they were carried about as lanterns are to-day. modern Europe the street lighting is fairly good, but terior illumination is very poor, as a rule. The speaker w only one example of modern illuminating glassware the Continent. Europe may be the home of art, but ere is more truly artistic lighting in this country than road, although that isn't saying much. In Venice the nals introduce an interesting problem in street lighting l reflections from the water; it is, in fact, as if the eets had mirrors for pavements; the lights are seen uble. In conclusion the lecturer said that modern illu- nating engineering has great fields to conquer on the ntinent of Europe.

Mr. J. R. Cravath inquired as to the practice of using ry high lamp-posts for high candle-power flaming-arc lps in Europe. He explained that powerful flaming arcs a to be used for a considerable amount of new electric set lighting in Chicago and that at last accounts the pns were to have these on posts only 20 ft. high. Many f l that this is a mistake for lamps of such high candle- pwer and distribution characteristics and that posts not ls than 30 ft. high should be used for these lamps. He a ed Dr. Ives as to the general illumination effect and a as to the appearance of such high posts as are used in Erope.

Dr. Ives answered that he had noted one place in Berlin were iron posts as high as 50 ft. have been used for fl ning-arc lamps with good effect. The illumination is sead over a large area and the lamps are above the ordi- range of vision.

F. A. Vaughn, of Milwaukee, inquired as to the lighting conditions in London. Dr. Ives reported here is considerable rivalry between different sections ndon and remarks applying to one section as to light- ight not apply to another. While a considerable ty of light is used on London streets in some locali- the lighting in London in general on the best streets up to that in this country, artistically, as compared he best streets here.

irman R. F. Schuchardt asked for a comparison of est streets of Berlin with the best lighted streets in go and also asked as to the reported supremacy of ermans in scientific investigations leading up to dis- es of new illuminants. Dr. Ives' answer in general hat in the scientific development of new illuminants ny is in the lead, but that, once they are developed, ermans do not make use of these illuminants intel- y. There are more high candle-power arcs in use han in the average American city. The Germans do e their new lamps either artistically or comfortably. re far behind Americans in the use of reflectors and ng mediums for the reduction of annoying glare. ific reflectors are rarely seen in Europe by the observer.

Electrical Show at Salt Lake City.

first annual electric show under the auspices of the ic Show Association of Utah was held in the Cen- lock, Salt Lake City, Oct. 2 to 7. Over 2000 incan- t lamps were used in the street decorations in the f festoons and streamers leading from Main Street show building, and a large electrically illuminated at the intersection of Main and Second South Streets ed the visitors. An electrically outlined kite was sus- l between two buildings, with a streamer of electric , representing the string, running from the kite to a key in front of the building. A large blue bell, made electric lamps, which was furnished by the Mountain States Telephone and Telegraph Company, was suspended over the street and attracted much attention.

The main auditorium has a floor area of 100 ft. by 160 ft., and in the rear of this auditorium is a lecture hall in which Professor Plumb gave lectures and experiments on high-frequency currents. Thirty-three booths, each having a floor area of 156 sq. ft., were suitably arranged in the main auditorium. The decorations of the building were almost entirely in white, supplemented by autumn leaves and potted plants to add a little color. The lighting of the auditorium was done by festoons and clusters of tungsten lamps.

The east one of the two large show windows was fitted up to show the old-fashioned and the modern home, and the west window was given over to a display of the signal equipment of the Utah National Guard, a feature of which was a wireless telegraph equipment.

The Utah Light and Railway Company had an electric kitchen, in which it was shown by actual cooking demonstrations that it is possible to cook entirely by electricity by means of the electric fireless cooker and a few supplementary pieces of apparatus, at no greater cost than with coal or gas. In another booth was shown the development of street lighting in Salt Lake City, by means of a series of lamps, including the first Brush arc lamp installed in 1886, and each successive type, up to the present luminous arc lamp. An automatic tool-grinder direct-connected to an electric motor illustrated the possibility of the application of electricity to industrial work. An Edison storage battery and rack were shown with various sizes and types of incandescent lamps connected to meters, by means of which the relative consumption and illumination from the various types could be illustrated to the visitors.

The Telluride Power Company showed a large map of the lines and power plants of its system, with photographs of stations, pipe lines and transformation lines, standard and commercial instruments, and an oscillograph so arranged as to show the wave-forms of the voice, and an open-core transformer.

The list of exhibitors included the Mountain States Telephone & Telegraph Company, Intermountain Electric Company, Westinghouse Electric & Manufacturing Company, Progress Company, Stewart-Gleeson Company, Western Electric Company, Fairbanks-Morse Company, Mine & Smelter Supply Company, Studebaker Brothers Company, Wagner Electric Manufacturing Company, Utah Electric Supply Company, University of Utah, General Electric Company, Capital Electric Company, E. H. Eardley.

Turin International Electrical Congress—II.

Construction, Central Stations, Switchboards and Distribution.

In Section II of the Turin International Electrical Congress eleven papers were presented, dealing with construction, central stations, switchboard and distribution. Abstracts of part of these papers follow.

TRANSMISSION AND DISTRIBUTING SYSTEMS.

The selection of the transmission and distributing voltage and the design of switchboards and substations in large electric installations, taking into account both economy in first cost and continuity of service, were discussed in detail in a well-illustrated paper by Mr. Philip Torchio, chief electrical engineer of the New York Edison Company. The subject was discussed under the two heads of long-distance transmission and the selection of distribution voltage. Concerning long-distance transmission, the author concluded that in large installations the selection of the transmission voltage will be primarily governed by the difference between the saving in costs of lines and transmission losses due to higher voltages and the corresponding extra cost

of apparatus at the stations and substations; this cost will necessarily increase with the number and decrease in size of substations, so that where primary transmission lines are to be tapped for distribution at many points the extra-high-tension voltages may become economically impracticable. He stated that extra-high-tension systems are at least as reliable as lower voltage systems and in respect to protection against transient surges and lightning they possess material points of superiority. In important installations it is advisable to employ extra-high-tension insulation for lines and apparatus, even on lower working voltage systems, in order to raise their factor of safety.

The author claimed that the selection of distributing voltage is governed by the following four considerations: First, the relative cost of cables, which depends on the average length of feeders on the main system, and also upon the posible use of step-up transformers for the long feeders. Second, the relative power and energy transmission losses. Third, high-speed large-power generators require low-voltage windings for high dielectric and mechanical factors of safety. Fourth, the greater reliability of lower voltage systems is more valuable to important distributing systems, because of the greater commercial losses they would sustain in case of even momentary interruptions of service.

Three appendices formed an important feature of the paper. The first of these contained illustrations and descriptions of extra-high-tension switching gear and apparatus and typical designs of stations and substations. The second covered the continuity of service as shown in abstracts taken from operating reports of high-tension systems. The third dealt with steam generating plants, hydroelectric power substations and local transforming and distributing substations. Other features of the paper, which was also presented before the Spring Lake convention of the Association of Edison Illuminating Companies, were noted on page 862 of our issue for Oct. 7.

UNDERGROUND CABLE CONNECTED TO OVERHEAD LINES.

Mr. J. Grosselin submitted a report on high-tension underground cables connected to overhead lines. Assuming high-tension to include only voltages above 25,000, he finds that there are very few such installations now in operation, the highest tensions employed on cables at present being 40,000 volts alternating and 50,000 volts direct, although the Lorraine Electricity Company is planning to install 3 km of three-conductor cables to operate at 65,000 volts.

The practice of the various countries as to the factor of safety allowed in factory and installation tests was given, and it was recommended that the factory tests for alternating voltages from 25,000 volts to 50,000 volts be determined by multiplying the normal working emf by 2 and adding 10,000, and that for tensions above 50,000 volts the factor 1.5 be used. For direct emfs a factor of 1.25 was recommended. The proper duration of the factory test was set at fifteen minutes. At the end of the report there is appended a table giving various interesting data on high-tension cables operated in different parts of the world.

Mr. Grosselin's report was discussed by Messrs. Jona, Torchio, Soleri, Delon, l'Hoest Gevaert, Lichtenstein and Dunn.

THE CONSTRUCTION AND USE OF CIRCUIT-BREAKERS.

The present state of the art of automatic circuit-breaker design and application was set forth in a long paper by Mr. E. Ragonot. All circuit-breakers were divided into two main classes, namely, air-break and oil-break contacts.

Under the head of air-break switches the author discussed present practice and construction of the following details: Contacts, terminals, closing and releasing mechanism, arc extinction, inverse time-limit attachments, remote control. With respect to contact surface he declared that it was wrong to specify the current density, since it is the potential drop that is important, and in this type of switcl he placed the upper limit of allowable drop across th contacts at 10 millivolts.

Early in the discussion of oil-switch design a sharp lin was drawn between American and European practice. Th American-type oil switch has the following distinguishin characteristics:

1. Two breaks per pole for the highest tensions.
2. Large range of motion of contacts (25 cm to 50 cm)
3. Small volume of oil.
4. Separate cells for even low tension.
5. Use of impregnated wood as insulating support to th movable armature.

On the other hand, the following characteristics serv to distinguish the Continental type:

1. Multiple breaks per pole (two to eight, according t the tension on the power).
2. Short range of motion (8 cm to 15 cm).
3. Large volume of oil.
4. Single cell for all poles of one switch for low ar medium tensions.
5. Extensive use of porcelain as insulator.

With regard to contacts of oil switches, the allowab drop was placed at from 25 millivolts to 30 millivolts.

Under the head of "dimensions of oil switches" tl author gives a digest of a report on the subject recent submitted by a committee of the German Society of E gineers. The latter part of the paper dealt with inver time-limit relays, their construction and operation, and t last section is devoted to a discussion of the probable futu of the oil switch. At the present time it is usual practi to overhaul a switch thoroughly after each operation und dead short-circuit, and if two such loads should be impos in quick succession it is doubtful if the largest switcl now made would be able to stand up and properly perfo their functions.

To improve the action of oil breakers in this respect author suggested the following expedients:

1. Quickest possible break.
2. A very large volume of oil.
3. High pressure on the oil.

He then follows this with descriptions of some of latest experiences of the various large companies.

PARALLEL OPERATION OF ELECTRIC STATIONS.

This subject was assigned to Mr. Nizzola, but on count of severe illness he was unable to prepare a pa

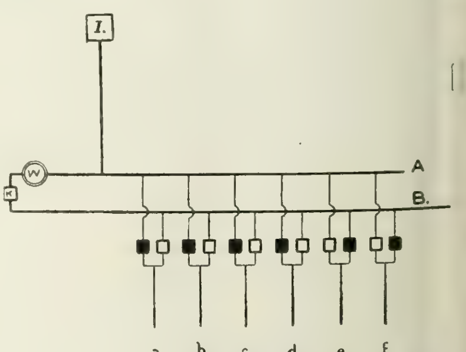


Diagram Showing Parallel Operation of Electric Statior

and, therefore, Mr. Guido Semenza gave a brief descri on of a method of parallel operation used by the Edison m- pany of Milan, the idea being to start a discussion o he subject. A schematic diagram of the connections for wo plants feeding six circuits is shown above. Plant is

connected to bus A and plant II to bus B, the two buses being tied together through a wattmeter and a circuit-breaker. The wattmeter is equipped with an alarm bell. Each distribution circuit is provided with connection to each bus.

In explanation of the system the author assumes plant I to be rated at 4000 kw, plant II at 2000 kw and the load on each circuit to be 1000 kw. Then under full-load conditions four circuits are connected to A and two to B, and if short-circuit occurs on lines e or f the breaker k will drop out and clear plant I from all trouble. Another condition which this arrangement meets very satisfactorily is the parallel operation of water-power and steam-power plants. For example, assume plant I to operate from water-power and plant II to operate from steam. During hours when the load is within the limits of plant I all circuits are connected to bus A and plant II is disconnected. When the load increases beyond the rating of plant I plant II is started and synchronized with I, the switch K being closed. The wattmeter indicates the amount of power supplied by plant II and the voltages can be so adjusted that the water-power plant will always operate at full load. When the load has increased sufficiently some of the lines are switched to bus B, the load being divided between the buses in proportion to the load it is desired to place on each station. The wattmeter enables the attendant to control the division of load and the circuit-breaker K prevents the spread of trouble from one plant to the other and thus limits the power behind a short-circuit.

The paper was discussed by Messrs. Torchio, Wyssling, [illegible] and Del Buono.

ELECTRICAL APPARATUS FOR 100,000-VOLT CIRCUITS.

A paper by Mr. Stephen Q. Hayes contained illustrations and descriptions of some of the recent designs of 100,000-volt apparatus, in order to show the commercial feasibility of high-voltage energy transmission. The apparatus described included transformers, terminals, circuit-breakers, lightning arresters, station arrangements and transmission lines. It was stated that self-cooling transformers are being built in ratings as high as 3500 kva. Artificially cooled transformers are built in ratings as high as 14,000 kva. Although there is no inherent limit to the size of the transformer, it is not ordinarily advisable to construct them in ratings larger than 10,000 kva on account of the difficulty of shipment.

The construction of transformers for 100,000 volts presents no great difficulty, except as regards the terminals. With the so-called condenser type of terminal the difficulties have been successfully overcome. In this terminal the rod or tube forming the conductor is surrounded by a number of concentric condensers of predetermined capacity, arranged in such a manner that they are in effect connected in a series, so that the fall of electrostatic potential from the inner one, forming the line conductor, to the outer one, which is grounded, is such as not to strain the insulating material locally beyond its dielectric strength.

The development of a bushing with its capacity distributed in such a way as to insure uniform potential grading through the mass of insulation has greatly facilitated the design of high-tension switching devices. One-hundred-thousand-volt circuit-breakers are built for both indoor and outdoor service. For outdoor service the leads of the contact type are covered with a series of porcelain insulators and the space between the bushing and the insulators is filled with a moisture-proof compound. The operating mechanism is covered by a metallic hood, and the pull rods connecting together the various poles of the breakers pass through pipes. Outdoor breakers of this design have been operated very satisfactorily on the lines of the Dominion Power & Transmission Company, near Hamilton, Ont.; the New York, Lockport & Ontario Power Company, near Niagara Falls, and the Southern Power Company in North Carolina.

The electrolytic type of lightning arrester has proved thoroughly reliable for 100,000-volt service. Where a somewhat cheaper form of lightning arrester is required for extremely high voltage on outdoor circuits it is possible to make use of a certain special arrangement, as has been done by the Southern Power Company. Instead of providing electrolytic cells placed in steel tanks, resistors are located in the circuit between the line and the horn gaps. The resistors are built up in the form of large columns having a large cross-section and great heat-absorbing capacity. Two columns are placed in series between each line and the ground connection. The resistors are made of a special mixture of concrete and red oxide of iron, and each column is divided up into a number of sections by expanded metal embedded in the cement. The edges of the expanded metal are riveted to sheet-metal eaves, which prevents water running down the sides of the concrete, thereby obviating variation in resistance due to the concrete becoming water-soaked. The arrester after having once been adjusted requires no attention and is so proportioned as to render it almost impossible for it to be seriously damaged by any discharge which can pass through it. The resistor column has a high resistance for low voltage and low resistance for high voltage.

Brief descriptions were given of apparatus built for potentials as high as 140,000 volts, which is the emf that will be used on a system to be installed in northern Michigan.

PRESENT LIMITS IN THE USE OF CABLES FOR ENERGY TRANSMISSION.

Mr. Elvio Soleri presented a paper dealing with the limits at present imposed upon the practical use of cables for long-distance transmission of electric energy.

To begin with, he gave a brief résumé of the present attainments in the art of cable manufacture and outlined the fundamental theories of cable calculations. In his investigation of the feasibility of using cables in long-distance energy transmission the author distinguishes three groups of limits, namely:

1. Limits imposed by manufacture.
2. Limits imposed by economy.
3. Limits imposed by safety of operation.

In the first group the author considered the emf and power that can be handled by three-phase and single-conductor cables, both for homogeneous and graded dielectric. He gave curves which served to determine the limits of section and emf.

The economic limits were studied by establishing relations between the price and power and emf of cables. The prices per kw-ampere were calculated for a series of cables of constant section and variable emf and for a series of constant emf and variable section.

In a special analysis of the use of aluminum in cables of very high tension the author gave some general results and some diagrams which permitted the determination of conditions under which this metal could be well adapted to cable construction.

Although long-distance transmission is usually cheaper with high-tension open lines, there were cited certain instances where cables might well be adopted. In studying the operation of cable lines it was shown that the capacity improved the efficiency of the line and that operation was more safe and reliable than with open wires.

The effect of capacity on economy formed the subject of a special study by the author, who, after giving the general relations, determined the losses in cable lines and open-wire lines and developed some simple formulas which express the laws of variation of these losses in terms of the constructive elements.

In conclusion the author stated that the present limits in the use of cables are far superior to the actual applications.

INVESTIGATIONS AND EXPERIENCES WITH HIGH-TENSION CABLES.

The results of a series of experiments carried on by the Siemens-Schuckert company in a system of high-tension cable manufacture were given by Dr. Leon Lichtenstein.

The chief object of these experiments was the determination of the losses of energy in single-conductor and three-conductor cables.

The first experiments were carried out upon 50-cycle, 700-volt, three-conductor, steel-armored cables, the conductors being in form of a sector and having an area of 310 sq. mm. The losses in excess of direct-current losses were as follows: 8 per cent in skin effect in the copper, 3 per cent in eddy currents in the lead cover and 8 per cent in eddy currents and hysteresis in the armor. Having foreseen that large single-conductor cables would leave very large losses in the copper and iron, some special tests were made upon a single-conductor cable having a section of 500 sq. mm and without armor. The diameter of the stranded copper conductor was 29.1 mm; the inside diameter of the lead sheath was 34.9 mm; the outside diameter of the cable was 40 mm. At 51 cycles per second the excess loss over direct-current losses was about 25 per cent and at 32.5 cycles it was about 10.2 per cent. It was practicably proportional to the square of the frequency and would therefore have been about 2.2 per cent at 15 cycles.

In consideration of the fact that high-tension systems employ single-conductor cables almost exclusively and that these cables often transmit large power over long distance, the great importance of the above results is apparent.

Following these tests the author made similar tests on single-conductor armored cables. These cables had a conductor section of from 35 sq. mm to 50 sq. mm with an insulation thickness of from 5 mm to 13 mm, and the armor was variously made of flat-steel strap, steel wire and copper wire. These experiments confirmed the author's expectations, since the hysteresis losses even at 15 cycles were so great as to limit seriously the use of this type of cable. For instance, it might be used for a short stretch, such as a river or a railroad crossing.

In conclusion the author called attention to a stretch of feeder cable between Bitterfeld and Dessau which has operated continuously for several months at 60,000 volts and 15 cycles.

GARBAGE DESTRUCTION AND ELECTRICAL ENERGY.

The destruction of garbage in connection with the production of electrical energy is the subject of a comprehensive report presented by Mr. Etienne de Fodor. Garbage destruction began in England, the first plant being constructed in 1870, and thereafter the practice spread very rapidly throughout the empire. The early plants were designed primarily to destroy garbage and little thought was given to any utilization of the heat thus liberated. In 1896 the city of Oldham built an electric power plant, 120 hp of which was derived from steam furnished by a garbage destructor. The first destructor plant that was designed expressly to enable the full utilization of the heat in the production of electrical energy was built in Shoreditch, London, and this plant was quickly followed by many more on the same order, and now there are 192 towns in England alone that have garbage destructor plants.

On the Continent the development of such plants has been slower, partly because the municipal authorities have often been prejudiced against them and partly because the heat value of the garbage is much less than in England.

The author discusses the variation of the quality of the garbage with the locality and the season of the year and gives actual figures from many different places.

Tests on thirty English plants are tabulated. These show an evaporation of water from 100 deg. C. to steam at 100 deg. C. of from 1.21 kg to 2.75 kg per kilogram of garbage, the average being 1.68 kg.

Similar tests from a number of different Continen plants show a general average of about 1 kg of steam p kilogram of garbage. Statistics covering the type of pla, the size, the electrical output and the uses to which electrical energy is put are tabulated from informat collected by the author from various English and C tinental plants for the year 1910.

The statistical data are followed by a résumé of wha at present considered best practice in garbage destruct and utilization. First of all, if high efficiency is to attained, arrangements should be made for storing garbage and feeding it to the destructors at a uniform r throughout the twenty-four hours. The electric ene would then be used to carry the peaks during periods maximum load and at other times it would charge a stor battery from which the auxiliary apparatus of the destru plant would be operated. The use of a storage batter also recommended to care for the variations in steam p duction due to the constant variations in the heating v of the garbage. In some places boilers fired with coal o are used to care for these fluctuations.

It appears that in the past insufficient attention has l given to economy in the utilization of the steam. Be engines should be used and less energy should be empl in the operation of the plant itself. In some plants energy consumed by the auxiliary devices constitute per cent of the gross output, while others require onl per cent. One instance is cited where by proper man ment the energy consumed in this way was reduced 31.5 per cent to 17.1 per cent.

Another important phase of the subject relates to utilization of the residue. This residue in the En plants often amounts to as much as 35 per cent of the weight of the garbage, and in certain instances it reach as much as 60 per cent. A number of plants been equipped with a crushing outfit for handling residue, the product being used in place of sand. well suited to concrete work, to the manufacture of and artificial stone, to the building of roads and in other places where sand or gravel is now used. parative tests on concrete made with this residue and gravel showed the residue to be fully as good as a some instances even better than gravel for concrete

In connection with the location of a destructor pl is interesting to note that there are no disagreeable whatever and that the location should be determin purely economical factors, such as the ease of coll garbage, etc.

The report concludes with a list of cities that hav bage destructor plants either in operation or under struction. The list is classified by countries. England the list with 192 plants; Australia, France, the U States and Germany come next with nine, eight, seve seven respectively; South Africa has six and South Ar four; sixteen other countries are listed with from three plants each.

The 1911 Meeting of the British Association fo the Advancement of Science.

The following is the conclusion of the report the Portsmouth meeting of the British Association f the Advancement of Science. Other portions of this por were printed in the issues of Sept. 23 and 30.

Practically the whole of the morning of Tuesday, Sept. was devoted to a discussion upon the relative me s of the "locomobile" type of superheated-steam engine ction gas engines and producers and Diesel engines, three apers being presented on the subject.

Mr. W. J. Marshall described the "locomobile" type of superheated-steam engine and related experiences w this

machine in ratings up to 500 hp. Tests reported showed a consumption of 1.21 lb. of coal per hp-hour by a 50-hp unit and a consumption of 1.24 lb. of coal per hp-hour by a 1?-hp unit. The author expressed the opinion that this type of engine is more than able to hold its own against the competition of the steam engine.

Mr. W. A. Tookey presented a series of figures showing the actual performances of suction-gas power plants of various types and ratings. In the majority of tests mentioned the actual coal consumption by a combined set of engine and producer working with anthracite is between 0.? lb. and 0.85 lb. per hp-hour. The units ranged in rating from 10 hp to 220 hp. The author expressed his belief that, in the near future, as in the years that have just passed, there is sure to be a great demand for the suction-gas engine and producer.

Mr. C. Day presented data tending to show that the "total works" cost of the kw-hour in stations where the plant rating does not exceed 1000 kw is 2.04 cents with steam engines, 2.08 cents with gas engines and 1.06 cents with Diesel oil engines. The average fuel consumption by Diesel oil engines in every-day service varies from 0.44 lb. per hp-hour at full load to 0.62 lb. per hp-hour at quarter-load.

There was a long discussion upon these three papers, the first speaker, Captain Sankey, calling special attention to the necessity for some definite pronouncement as to the meaning of "rated horse-power," a term used by all three authors, none of whom, however, gave a clear explanation of the method he adopted. The engineering standards committee some years ago had discussed this matter and decided, although it did not publish the recommendation, that the rated horse-power of gas engines, governing by missing explosions, should be 85 per cent of what the engine could possibly do.

Prof. W. E. Dalby expressed the opinion that the whole ... of small steam plants is the superheating of the ... and Mr. W. Y. Lewis asked whether it is possible ... ze the waste heat from Diesel engines in the same ... that waste heat from steam engines is used. If this were possible, then the Diesel engine would have a larger field for power production in factories where the waste steam is at present used for heating purposes.

... E. Kilburn Scott said that he would advocate the ... engine for any work that it could possibly perform and thought it was only a question of time before large Diesel engines would be built and displace the large steam-driven stations at present. One need only look round such ... as the Commonwealth station in Chicago to realize ... efficiency of steam. There there are six 20,000-kw units with a large number of boilers. It was impossible to make the boilers large enough, and that is the limitation. He therefore hoped that the makers of internal combustion engines would increase their factories and carry out researches which would result in the manufacture of large Diesel oil engines.

Mr. H. E. Wimperis predicted the development of an internal combustion engine using steam and gas, to which Captain Sankey replied that such a proposition is now actually under his consideration.

Mr. H. S. Russell said that the reason why the Diesel oil engine has such low fuel costs is the very much higher thermal efficiency of the engine and the absence of stand-by losses. He mentioned a case in which a 500-hp gas-driven generating plant, in connection with which the fuel costs were 1.4 cents per kw-hour, had been replaced by a Diesel plant where the fuel costs were only 0.06 cent per kw-hour, a result which he attributed to the absence of stand-by losses. The fact that such a large amount of exhaust steam is obtained from steam engines only demonstrates their inefficiency. The over-all thermal efficiency of a steam engine is not more than 11 per cent; with gas engines it is from 1 per cent to 20 per cent, and with oil engines it is 40 per cent. Consequently the heat available as exhaust is less. At the same time, by means of a properly constructed boiler, good use can be made of the exhaust heat from Diesel oil engines. On the question of the reliability of oil engines, he mentioned an electric generating station in which such an engine has run for four years for twenty-three and three-quarter hours per day, while another on a battleship has run for 800 hours on one journey without stopping. By the elimination of the producer house or the boiler house, as the case may be, wages with a Diesel engine are reduced by half.

Prof. E. W. Marchant having called attention to the fact that all the authors of the papers had left capital expenditure out of account the president mentioned that it would be useful to have some further information on the comparative cost of generating electricity by the three methods.

In reply Mr. Marshall said that the superheated-steam engine which he had described was rated on the basis of allowing a margin above what it was known the engine would do. Thus, a 140-hp to 180-hp engine had the same guaranteed fuel consumption over that range and was guaranteed equally economical at either load. It was also guaranteed to give 200 hp with reasonably economical results. With regard to the question of producing electric energy, there are no electrical works driven entirely by these engines in England, but this is not true in Germany. He complained of the comparison made by Mr. Day, as it is possible that it may include steam engines twenty-five years old. Mr. Day should have made his comparison with a specified type of steam plant. The same thing applies to wages, which are naturally more on older steam plants owing to the more rapid deterioration. These are not legitimate comparisons to put forward, and he made a similar complaint against Mr. Tookey's figures. Mr. Tookey, he said, is very proud of some results with fuel at $1.92 a ton, but the tables showed that 75 per cent of the examples given burned anthracite coal and he submitted that internal-combustion engine makers did not make their case good by giving examples of this sort.

Mr. Tookey said that, unlike the other two authors, he is not a manufacturer. He merely collected the figures from the owners of the plant and gave them for what they were worth. He made no apology or excuse for them. It is the usual plan for gas-engine makers to rate their engines upon the maximum power that can be hoped for from an engine of any particular size after a run of fifteen minutes, thirty minutes or sixty minutes. Personally, however, he adopted the plan of taking the piston displacement, multiplied by half the number of revolutions and divided by four, which represents the rated horse-power of the engine. As a matter of fact the makers' figures usually agreed with these within 10 per cent.

Mr. Charles Day said that his firm rated engines at that load at which it was suitable to work continuously and there were many of his engines in actual service giving continuously the rated loads. They had been known to go to 10 per cent above that for two or three hours. With regard to the suggestion that his comparative figures were unfair, he replied that he had taken the figures from stations in Great Britain of the size he had mentioned, irrespective of their age, although, as a matter of fact, there are very few old engines in electricity works. He had not picked out special cases to suit his argument.

Three papers were left over for the final meeting of Section G on Wednesday, Sept. 6, the first being by Mr. E. Kilburn Scott on "The Manufacture of Nitrogen Compounds by Electric Energy."

Mr. Scott stated that the principal products obtained from the electrical fixation of atmospheric nitrogen are nitrate of lime, containing 12¾ per cent nitrogen, and calcium cyanamide, containing 18 per cent nitrogen. He described the processes for making nitrate of lime as car-

ried out at Notodden and for calcium cyanamide as carried out at Odda, Norway. He mentioned that calcium cyanamide is made in the following countries : Italy, France, Switzerland, Dalmatia, United States, Canada, Mexico and Japan, while in Germany alone there are about half a dozen factories. In discussing the possibility of manufacturing nitrogen products in Great Britain the author said that much depends upon the cost of energy. At Notodden the energy costs $7.92 per kw-year, or 0.09 cent per kw-hour; at Odda, $7.20 per hp-year is paid for energy. The author claimed that the time is ripe for the establishment of many electrochemical and electrometallurgical processes which at present are only carried on abroad. Among these the manufacture of nitrate fertilizers, and especially nitrogen compounds for explosives, is very important, especially the explosives, for use in case war should cut off the outside supply.

After President Ramsay had expressed himself in accordance with Mr. Scott's view that the English coal supply was at present sufficiently cheap to make it worth while considering this question and that the future of the country lay in having chemical works in the neighborhood of the collieries, Dr. E. Erkhardt, who is connected with the Badische and Birkeland-Eyde, said he disagreed with Mr. Scott that it is opportune now to establish works in Great Britain for the manufacture of nitric acid from the air. He was partly responsible for the introduction of the Birkeland-Eyde process into England, but could not agree that the time is now ripe for its full development there. After having entered into negotiations for land and having studied prices for energy the conclusion come to was that it would be better to wait at least for several months. After having experimented for some time with a 3000-hp plant at Christiansand a decision had been come to that the work could be more cheaply carried out there than at Ludwigshafen, where coal would have to be used. Notodden works are earning money, and at Ruckhardt, in Norway, a 250,000-hp plant is being erected, the first half of which will doubtless be at work by next summer. In view of the present state of development of these processes it has not yet been decided to adopt one to the exclusion of the other. At present four-fifths of the equipment in this station is operating on the Schönherr process and one-fifth on the Birkeland-Eyde process, but as the result of further experiments it is quite possible that these proportions will be altered later on. In order to maintain the supply of materials for the manufacture of explosives in time of war the British navy would have to protect the Chili saltpeter fleet, and if this were not in its power it would not appear that the navy could do much for the food supply of the country, which is a much more serious problem. However, he thinks that the British Admiralty does not take this view, and for that reason does not see any prospect of the government taking up any of these processes.

Sir William White supported the views of the author of the paper that encouragement should be given to the establishment of factories as suggested, and Mr. H. E. Wimperis called attention to the fact that three years ago, after investigation, he had arrived at the figure of 1,000,000 hp continually going to waste in Great Britain from blast furnaces and coke ovens. At that time he suggested a development similar to that now put forward, but in the only district where this waste energy is made use of, namely, on the Tyneside, where it is being utilized for ordinary electric generating purposes.

Mr. Scott, in reply, again urged that England is lagging behind in metallurgical processes and considered it eminently a case for government action, especially from the point of view of explosives. He recalled the fact that the manufacture of carbide of calcium was started a few years ago in a factory specially erected next to the works of the Yorkshire Electric Power Company, but the trust that controlled the manufacture of carbide of calcium and had headquarters on the Continent came to the conclusion t t there were too many factories and shut the works down

A paper on the possibility of fixing a new standard f smoke emission from factory chimneys was next read Dr. J. S. Owens.

Dr. Owens described a telescopic apparatus for judg the density of smoke by comparison with a number graduated smoke glasses.

The proceedings of this section were concluded by paper by Mr. W. Y. Lewis, which described a new syst of continuous transport.

Mr. Lewis gave details of the Adkins-Lewis system rapid continuous transport. Use is made of a continuo revolving shaft extending throughout the whole length travel of the cars, which are driven by spiral threads the shaft. At the stations the pitch of the threads is s as to provide a low speed, but between stations the pitc from six to eight times as large and the speed corresp ingly higher. The author estimated that the total ene consumption per passenger-mile would be only one-eig of the amount required in operating the present system

A tribute to the system was paid by Capt. H. Riall S key, who has inspected the experimental equipment Ipswich and expressed his surprise at the small amoun power required and at the large amount of energy retu to the circuit by the retardation of the cars. He st that he had experienced no difficulty in getting on and the cars and that he could stand up easily while the was accelerating and decelerating at the rate of 4.5 ft. second per second. As an addition to his paper the au stated that in order to deal with traffic similar to that the District Railway, namely, 10,000 seats per hour, spiral shaft would need to have a diameter of 2 ft. efficiency of these spiral shafts was put at 90 per ce

Before Section A (mathematical and physical scie on Monday, Sept. 4, Prof. N. E. Dorsey read a short p on the work done at the Bureau of Standards on the a lute measurement of electric currents. Use was made balance of the type employed by Lord Rayleigh. Coil square cross-section are wound bifilarly on ename sulated wire upon brass forms. A novel feature of fixed coils is the provision in the forms and the back o windings of a channel through which water can be pun so as to maintain the coils at a constant temperature. this way the moving coil was surrounded by a do walled jacket maintained at a constant temperature by w circulation. All portions of the instrument have tested by means of a very sensitive astatic magneton and have been found to be good. The insulation of the has been excellent throughout the work.

On winding, the coils were carefully sealed with pa cloths and paraffin, and covered by a layer of softer thus protecting the windings from changes in atmosp humidity.

The distance between the two fixed coils was always that the sum of the forces which they exerted upor moving coil was a maximum. Under this condition a n mum force for a given current depends solely upon ratios of the diameter of the moving coil to those o fixed coils. Consequently the actual distance betwee fixed coils need not be measured. This has a great ad tage.

The ratios of the diameters of the coils were ascert by a modification of the electrical method used by Rayleigh. The settings of the coils and the needles adjusted by electrical methods and the variations in the diameters produced by variations in the temperature in the load carried were carefully studied experimen It has been found to be practicable to obtain such acc in the measurement of the ratio of the galvanometer stant of such coils that the mean variation from the of 10 or more shall amount to 2 in 1,000,000.

The correct adjustment of the coils was determined

cally, and an electrical method was devised for detecting d correcting any slight error that might exist in the acing or in the coaxiality of the fixed coils. The horizntality of the coils was tested by means of delicate jewels. While the earlier results were more erratic than the later s, they gave the same mean value. However, the condis under which they were obtained were much less satisry than those secured later, and consequently only the r values have been considered in obtaining the final nclusion.

These observations give the following mean value for e emf of the mean Weston normal cell (as defined at the shington conference) at 20 deg. C. in terms of the national ohm and the Bureau of Standards balance. ely, 1.01822 volts. This value differs from that obtained e National Physical Laboratory by 4 in 100,000. hether this represents a real difference in the results by the two balances or is an actual difference in the s of the reference coils used it is impossible at present ecide.

e instrument was designed by Prof. E. Rosa and the e work was done under his strict supervision.

scussion of Illumination by Pittsburgh Section, A. I. E. E.

e monthly meeting of the Pittsburgh Section of the rican Institute of Electrical Engineers was held in auditorium of the Engineers' Society of Western nnsylvania on Tuesday evening, Oct. 10.

The subject of the evening was "Industrial Illumination Applied Particularly to the Iron and Steel Industry."

e principal speaker of the evening was Mr. C. J. o, who had discussed the same subject before the ciation of Iron and Steel Electrical Engineers at its ention in New York City on Sept. 29, 1910, as menl in the *Electrical World* on Sept. 30.

e author covered the ground of steel-mill illumination ry thoroughly, outlining two methods by which illumition may be determined for any given installation. An eresting fact is that, though illumination was one of the practical applications of electricity in steel mills, yet ce along these lines has been very slow, probably the larger and more important motor-service prob- engrossing the attention of the engineers and pary to the inflexible units of illumination in use.

The 9.6-amp series-arc lamp is still in use in many mills. as series circuits are now being confined for sake of ety to outdoor work this type of lamp will undoubtedly on disappear. The lamp most widely used to-day in el-mill work is the standard inclosed-carbon arc of the 5 mp, 125-volt or 2.5-amp, 250-volt type. It has often n used indiscriminately for various purposes and has ved satisfactory, but owing to its comparatively low eciency is giving way gradually to the more efficient

The advent of the flame-arc lamp a few years ago, ugh having a short life, called the attention of engin rs to the importance of economy in illuminants. These h-power units were often misused in places requiring a ess intensity of illumination, but frequently found a pe for themselves in lighting large, high buildings or y ds, resulting economically because of the large area to lighted.

his lamp is now operated inclosed, the position of the etrodes have been changed from inclined to vertical, and its available as a long-burning lamp.

The multiplicity of types of illuminants now available for erent needs makes the problem of the illuminating engir a difficult one. A table was given showing the relati values in lumens per watt of the various types.

The author gave two methods of predetermining illumination results and advocated their joint use until more reliable data are available for steel-mill work.

The simplest one is the flux method, by which the number of lamps is determined by a formula expressed in terms of watts per lamp, area to be illuminated, intensity of illumination desired, total watts used, a depreciation factor and a constant.

The factor of depreciation must be added to take care of the depreciation in candle-power from its initial value which occurs in all forms of illuminants to a certain extent. The number of lamps having been determined, the units are placed with a view to uniform intensity at all points and as few shadows as possible. This method has the limitation that except when accompanied by rules for height and spacing it affords no guide to the uniformity of intensity, and hence the desirability of employing also the other method, thus preventing uneven intensity, shadows and glare.

The second, or point-by-point, method is based on the use of illumination curves and is a quite simple, although somewhat laborious, method of determining the height and candle-power for a given result. The illumination curve is calculated from a candle-power curve showing values every few degrees in a vertical plane through the center of the lamp. After obtaining the curve the illumination intensities thrown by the lamp on the plane to be illuminated are calculated by means of a formula involving the intensity, candle-power and distance of the source of light from the plane.

Experience with the point-by-point method soon enables one to become familiar with certain facts regarding the height of lamps and intensity of illumination.

It is advisable in calculating the illumination to lay out a floor plan of the building which can be scaled, showing machines so that shadows can be determined.

Satisfactory illumination does not always consist in an abundance of light. Too much light is often objectionable because it makes the less intensely illuminated spots too dark by contrast and the eye has difficulty in following the change. The following are given as prime requisites when laying out an illumination plan:

(1) Intensity.

(2) Freedom from shadows where they are objectionable.

(3) Freedom from glare.

Frequently in steel-mill work sufficient illumination is received from the molten metal to obviate the use of any other illuminant, though safety committees are now insisting on some lamps being placed at these points for safety of the workmen. Intensity of a desirable uniformity can generally be secured by spacing and by the use of a proper candle-power size for a given height of hanging.

Shadows are not always objectionable, as by their contrasts the outlines and details of an object are often brought out clearly. They do, however, often lower the efficiency of an installation and can be controlled to a large extent by the location and multiplication of the outlets.

In places where bad shadows are likely to ensue unless outlets are spaced closely it is much cheaper to multiply low-cost, low-candle-power units than high-cost, high-candle-power units.

Glare or dazzling light fatigues the eye and causes irritation and if continued will injure the eyesight. It may be obviated by hanging brilliant lamps high, by the use of diffusing glassware or shades, by making the illumination uniform and reducing the shadows.

The incandescent lamp, on account of its low cost, small units, ease of operation and other well known inherent advantages, finds a useful field of application in steel-mill work, particularly in high-studded shops where high-power units would cast objectionable shadows.

The electrical committee of the Carnegie Steel Company has selected the medium efficiency (of the three efficiency ratings) for tungsten lamps, basing its decision on the necessity of having a minimum variety of lamps and also on the fact that an average life of 1300 hours is being obtained at this efficiency in a number of its plants.

The various arc lamps, including the flame and luminous types, are being used extensively, each having its own field of application.

Mr. B. R. Shover, of the Carnegie Steel Company, who was elected president of the Association of Iron and Steel Engineers at the recent meeting in New York, discussed the paper at some length. He said that one particularly good thing about the paper was that it gave a reasonable method of computing the lighting values of the different types of illuminants. Previously the manufacturers have based their values, some on mean spherical candle-power, some on one particular zone; these being correct only when all of the light emitted was used, whereas some of the light is always wasted.

The only safe method is actually to lay out a plan of the building to be illuminated and use the flux method, or the point-by-point method, or a combination of the two, which will determine the number of lamps to be used. It should be borne in mind that illumination figured for one shape of building will not necessarily be correct for another one of the same area, as the different-shaped room will require a different number of lamps. Having determined the number of different types required, then it is only necessary to multiply this by the first cost and the operating expenses to find the cheapest method to use.

Estimates based solely on photometric curves are often unsatisfactory. If they are not correct the calculations are valueless. If they are accurate then the deductions can be relied on. The speaker made a vigorous plea for the manufacturers to furnish curves representing average conditions in every respect. The curves should not be taken from one lamp, one electrode or one plane, but with enough lamps, electrodes and through enough planes to get a good average result—one that could be relied on. For each constant-potential arc lamp there is one voltage at which it gives the best results. Any variation from this gives different illuminating results and, therefore, curves should be given that show results from an average operating voltage between limits of 10 per cent to 15 per cent on each side of normal. No lamp gives the same amount of light during its life, so that the average amount during its life or renewal of electrodes should be given instead of the initial value.

Curves should also be prepared, said Mr. Shover, showing light by taking into account what is termed "inherent depreciation," or that due to deposits on the inside of the globe, not that due to dirt on the outside. This is purely a laboratory problem and should be done by the manufacturers, and two of them are doing it. Such data should also be compiled from average results. "Acquired depreciation," or that due to accumulation of dirt on the outside, is due to the location of the lamp. This data should be prepared by the operators, as they are the ones properly situated to get such information. The inherent distribution is very materially affected by the shape of the globes and reflectors. The accumulation of dust also affects this; in some cases it actually assists by aiding the reflection, but in others, of course, it is a menace.

To sum up, then, the customer demands from the manufacturer: (1) Average light through 360 deg. and the authority for the test. (2) Rate of inherent depreciation. (3) Difference in light due to variation from normal terminal voltage.

Illuminating engineering is comparatively new and the value of the data accumulated has not been recognized before. It is now, however, distinctly the duty of the manufacturers to give the data freely and accurately. The user and the maker should see the importance of demar ing and giving respectively all accurate information p sible.

A paper prepared by Mr. C. B. Auel, assistant manag of works of the Westinghouse Electric & Manufacturi Company, was read by Mr. E. P. Van Kirk. Mr. A stated that previously the scope of the illuminating en neer was limited owing to his having only the open-a and the carbon-filament lamp, with a big gap betwe them, to choose from. Now, however, there is a lar assortment filling in the gap and the selection demar careful consideration.

The art of illumination has developed into a science a practically all that is now known has been learned in t last five years. The public is still unaware of the v amount of scientific knowledge that is being applied illumination.

The illuminating engineer seeks to find the best metl adapted to each case, bearing in mind the total econo to be derived, which after all is the most difficult to det mine.

An interesting point brought out by Mr. Auel was increase of efficiency in the workmen, expressed in minu per day gained, by having satisfactory illumination their work. An increase of two minutes per day per wo man in a large shop would soon pay for the investment good lighting.

A manufacturer would often spend thousands of doll for machine tools and then seriously limit the output failure to furnish proper illumination. The arrangem for controlling the lamps is often neglected, although i very important, particularly from an economical operat point of view. An efficiently designed illumination syst may be marred by injudicious arrangement of switcl thereby causing lamps to be lighted when they are needed. It is the duty of the illuminating engineer overcome this defect.

Campaign Against Proposed Municipal Plant in Cleveland.

An ordinance providing for the issue of $2,000,000 bo for the purpose of furnishing funds for the constructior a municipal electric lighting plant will be submitted to voters of the city of Cleveland on Nov. 7. The city ha present two small plants in outlying districts. These w constructed originally by small suburbs which were nexed afterward to the city of Cleveland. The gen proposition now is to abandon these plants and to c struct a new plant, presumably in some other part of city, to engage in street lighting and commercial busir

The proposed issue of bonds is one of the princ questions of the campaign which is now under way Cleveland. The Democratic candidate for mayor, Mr. N ton D. Baker, is strongly in favor of the proposal to i the bonds and construct a plant. The Republican candic Mr. Frank G. Hogen, has stated that if he is electec will make a careful investigation to determine the m of the question of extending the existing plants.

For the purpose of presenting the facts regarding situation to the public the Cleveland Electric Illumina Company has issued various circulars and is now pub ing a series of large advertisements in the daily newspa These advertisements will be continued during the rem ing days of the campaign. The circulars are distrib ed each night at the various political campaign meetings ld in tents in different parts of the city.

In the first newspaper advertisement addressed to he voters of Cleveland the company stated that the prop ed increase in public debt was not a political issue, was a question to be decided on the statements published in he

cumns of a newspaper committed to the project, was not a question whether the company could be injured by the bond issue, but that the question was whether the additional debt and the consequent increase in taxes would be a benefit or an injury to the residents of Cleveland.

In the second advertisement the company took up a charge that its profits were excessive. The following figures were quoted: Outstanding bonds and stock on Jan. 1, 1911, $10,634,500; net earnings for the year 1910, $843,-4…; paid to bondholders and stockholders, $669,774. This amount is equal to 6.3 per cent on the outstanding capital. The difference between the net earnings and the amount paid to security holders, $173,654, represented the year's surplus, which was set aside to provide for contingencies. The advertisement stated further that the outstanding capital on Jan. 1, 1911, did not exceed the cost of the prop… that date.

In the next advertisement the company took up the subject of "Capital and Real Value." Where its capitalization … 1, 1911, was $10,634,500, the value placed on the …y by the Tax Commission of Ohio on the same date … 1,375,000. Since Jan. 1 an additional $2,400,000 has … vested in a new power house and extensions of the distribution system. The advertisement adds that there is no a public-utility company in the United States which is capitalized more conservatively than this and that the cost of duplication by the city will exceed the company's investment.

In a discussion of its rates printed in another advertisement the company reproduced a bill which had been published previously by a newspaepr. The newspaper desired to show that the rates were excessive. The bill showed a total use of thirty-three units at an average rate of 6.8 …

The company then inquired why $2,000,000 was hit upon as the sum needed for the proposed municipal plant. It … that this sum would not build a municipal plant … t to supply even the downtown district.

… nother advertisement the company took up the claim … e cost of electricity in the proposed power house … be but 1 cent a unit. To show that the cost at the … house was only a very small part of the total cost … luction and distribution the company took up the … of the municipal water works, which showed that … lelivered to Cleveland homes cost over eight times … t cost to pump it at the station. In a subsequent … s of the operation of the water plant the company … that the cost to the consumers was eleven and one- … es the cost to the city at the pumping station.

… s emphasized in an advertisement published on Oct. … if the proposed plant was to supply all sections of … nd it would have to duplicate the present system of … veland Electric Illuminating Company and that that … ot be done without duplication of the investment of … pany. An advertisement published on Oct. 16 dis- … a charge made in a Cleveland newspaper in regard … cial operations of the company and stated that most … statements made were either false or misleading. … d that adequate protection was given to the people … the absolute regulation of the company by the … Service Commission of Ohio. Another advertise- … ated that the absence of the important personal fac- … unicipal operation results in waste and extravagance. … ntion was called in one advertisement to the present … f the city of Cleveland, which is so great that the … unable to increase the rate of pay of the police … r increase the number of police and is unable to give the school authorities the amount that they say is needed. It has also been shown that some of those who are in favor of the proposed bond issue have referred to the plant as an "experiment." On Oct. 22 an advertisement was published which discussed the subject of "corporation-baiting" and showed that the articles prepared by the company had been offered to one newspaper at its regular advertising rates and publication refused. This paper favors the plan to issue the bonds and construct the plant.

One of the circulars issued by the company stated that since April, 1912, the interest-bearing debt of Cleveland had increased more than 100 per cent. The tax rate, now $1.36, must be increased to over $1.41. Next year, to meet sinking fund and other interest charges, other bonds already authorized will raise the rate to $1.46. Interest and sinking fund requirements on $2,000,000 lighting-plant bonds would raise next year's rate to nearly $1.50, the limit of the law, leaving nothing for other improvements.

Another circular discussed the cost of electricity in the home and declared that the average price obtained for all electricity is 6½ cents per unit. It is stated that a larger percentage of homes in Cleveland have electricity than in any other large city in the United States.

A circular which was issued on Oct. 24 gave twenty-eight facts in relation to the situation. These dwelt in part with the record of loss of the small municipal plants at outlying suburban points, which were operated by the city after annexation of the communities in which they were located. It also showed that municipal light plants cannot be regulated or controlled. There is no provision in the Public Service Commission law of Ohio for the regulation by the commission of municipal plants of any character. Privately owned plants are subject to strict regulations.

National Civic Federation to Study Public Utility Regulation.

The executive committee of the department on regulation of interstate and municipal utilities of the National Civic Federation met in New York City on Oct. 25 and made provision for an exhaustive investigation of the problems of which this branch of the federation has cognizance. Mr. Emerson McMillan, of the American Light & Traction Company, acted as chairman of the meeting, which divided the work to be done among a number of sub-committees, which will respectively have cognizance of rates, control of service, control of capitalization, franchises, accounts and reports. A sub-committee was also appointed to draft a model bill. The general question to be studied is "What is adequate regulation of municipal utilities, railroads, telegraph and telephone companies, both interstate and intrastate?"

Among those connected, directly or indirectly, with the electrical industry who will take part in the work outlined, are the following: Messrs. Theodore N. Vail, president American Telephone & Telegraph Company; George B. Cortelyou, president Consolidated Gas Company, New York; Samuel Insull, president Commonwealth Edison Company, Chicago; James H. McGraw, president McGraw Publishing Company, New York; W. W. Freeman, general manager Brooklyn Edison Company; Charles L. Edgar, president Boston Edison Company; W. J. Clark, General Electric Company.

The organization of this department of the federation follows the comprehensive investigation into the relative merits of public and private operation of public utilities both in this country and in Europe made some time ago by a commission of the federation. That commission unanimously declared for adequate regulation by a competent authority, with power to require for all public utilities a uniform system of records and accounts, giving all financial data and all information concerning the quality of service and the cost thereof, which data should be published and distributed to the public like other official reports; and it also recommended that no stock or bonds for public utilities be issued without the approval of some competent public authority.

Public Service Commission News

NEW YORK COMMISSION.

A hearing took place on Monday, Oct. 23, before Commissioner Maltbie, of the Public Service Commission for the First District, on the complaint made against the New York Edison Company by various organizations of stationary engineers who protested in a petition filed with the commission against the low rates the company gave to large users of electricity. Counsel for the New York Edison Company stated that the rates specified in the petition were in accordance with the schedule of rates filed with and approved by the commission and denied the allegations that energy is sold in some cases at less than cost. Counsel for the complainants asked that the commission make a full investigation to determine the assets of the New York Edison Company in order to ascertain the fixed charges entering into total cost of production. He cited as a precedent the revaluation case of the Menominee & Marinette Light & Traction Company before the Wisconsin Public Service Commission which ordered an increase in rates to large power users and lowered those for residential and certain business lighting after exhaustive investigation. [*Electrical World*, Aug. 19, 1909.] The practice of the commission of affording every opportunity to a complainant to present his case and submit material evidence was outlined by the commissioner, after which counsel for the complainant asked for postponement in order to obtain evidence to substantiate certain information relative to the charges, which had been conveyed by hearsay. The case was adjourned until 2:30 p. m. Wednesday, Nov. 1.

The Public Service Commission for the First District of New York has authorized the Bronx Gas & Electric Company to issue $80,000 5 per cent bonds, payable July 1, 1961. These are secured by a mortgage filed July 1, 1910, under which $692,000 in bonds has been issued. About $90,000 bonds is outstanding under an old mortgage.

The Public Service Commission, Second District, has closed upon its records the complaint of the residents of the village of Warwick, Orange County, against the Warwick Valley Light & Power Company as to service and rates. As a result of negotiations conducted by the commission, a new schedule of rates acceptable to complainants has been adopted by the company, effective Oct. 1, 1911.

OHIO COMMISSION.

The Ohio Public Service Commission has stated that no consolidations of telephone companies will be permitted until the valuations of the properties involved are listed, confirmed by official inquiry and approved by the commission. Attorneys for some of the companies have contended that the commission has no authority to make appraisements where there is an agreement for the exchange of business between the companies proposing arrangements that do not amount to absolute elimination of competition. This refers to cases where either the Bell or Independent interests purchase local exchanges and enter into an agreement to give the other company the long-distance business. The commission holds that in the event that absolute authority to appraise properties is not given by the new law it is empowered specifically to approve or disapprove of the consolidations or mergers. This amounts to authority to force the companies to yield where valuations are demanded by the commission.

MARYLAND COMMISSION NEWS.

The Maryland Public Service Commission has granted to the Highland Telephone Company, of Hartford County, Maryland, permission to sell its property in Pennsylvania to the Delta Telephone Company for $30,000. The price originally agreed upon was $34,000, but at the suggestion of the commission it was reduced to the figure stated.

Chairman Ambler last week stated at a public hearing upon telephone rates that the commission had about made up its mind that the unlimited telephone will have to g At the hearing Mr. H. W. Rowland said that he had fi telephones in different sections and had a different contr for each one. Mr. Francis I. Mooney registered a co plaint about permitting the telephone company to act the arbiter when a subscriber claimed that he had made as many calls as the company claimed he had, and suggested that the Public Service Commission act as biter. If the company is not willing to do this the co mission should insist upon some mechanical system wh will measure the calls. Mr. Benjamin E. Hartogensis co plained of the charge of $2.50 for moving his telepho saying that the time put in by the men and the mate used were not worth more than 50 cents, or $1 at the m the workmen remaining in his office only fifteen minu He also expressed himself as in favor of measured serv and contended that the price of $6 a year for an extens station is exorbitant. Mr. E. D. Loane, Jr., said that if telephone company had paid Messrs. Jackson for gett up the report it could not have been more favorable the company. He contended that the report should g the details of the financing of the company. Mr. W. Dorsey said that he had a hard time getting an unlim 'phone and when he did get it he was charged $5 mileage, which he did not pay, and the company threatens to discontinue the service.

First Vice-president F. H. Bethell of the Chesapeak Potomac Company, at the request of Chairman Ambler sumed the rôle of explainer and recited in detail n of the methods pursued by his corporation in the con of its business. A considerable portion of Mr. Betl discourse had to do with the coin-box 'phones in us the district served by the Wolfe and Gilmore exchar He told of the company's devices for recording calls the methods adopted to insure accuracy, including refer to the adjustment bureau, which hears complaints adjusts differences. With respect to the coin-box 'ph Mr. Bethell, after saying that they had been installe an experiment after the big fire of 1904, asserted tha experiment had not been especially successful. The age use of these 'phones, he said, amounts to somet over one message a day and the annual revenue de therefrom averages about $15 each. All told there about 6300 coin-box telephones in use in the city and Bethell was strongly of the opinion that the con would not be justified in increasing the number. He that it required an average of four seconds to sec connection over an ordinary telephone, while the coi telephones usually require about seven seconds to con a connection. Their use is an additional expense t company, as operators can handle fewer lines. Rep to the allegation that the company in many inst charges for more calls than are used, Mr. Bethell that, with its device for keeping tally, the probabiliti that the company, on the whole, loses something lik per cent of its calls and that there is far more danger operator forgetting to charge a call altogether than is of the call being charged for a second time.

The Consolidated Gas, Electric Light & Power pany, of Baltimore, submitted last week to the comm a compilation of the inventories of its physical pr as requested. Piled up the documentary evidence e 2 ft. in height. In complying with the request Public Service Commission the company's officials wr that they could not have furnished the mass of da had the company not begun the work voluntarily over year ago. The letter goes on to say that the company pr it to be the intention of the commission to consi the value of the property and investments in so far a such value may be a factor in determining the fairness the company's rates for service. Such a valuation cons two divisions—the physical and the intangible, or going value of the property. The physical value is th de-

cribed, while in the going value are included the cost of organization and the cost of developing the business. New public-service plants, it was stated, have seldom in the past yielded a return on the investment during the early years of operation. The history of the gas industry and of the electric industry shows clearly that such properties have not reached a position of profit-earning until many years after their construction. During the earlier years a large amount of money is required for development purposes. When a corporation is earning less than its operating expenses, interest and depreciation a deficit results and the stockholders are forced to make sacrifices to meet such conditions. These deficits, together with the discounts on the issue of certificates, constitute a large part of the cost ... ilding up the business. A public-service corporation ... tled by law and equity to a reasonable return upon its investment. If the rates fail to produce sufficient revenue the investor is not receiving that return to which he is entitled. If he has received a reasonable return each year on his investment from the beginning of the enterprise, he has received that to which he was justly entitled and the value of the property is represented by the actual amount he has invested in it. If, on the other hand, the investor has failed to receive each year that amount which ... tutes a fair return, he should be permitted to charge ... sufficiently high to reimburse him for early losses. ... uch losses should be considered as costs of developing the business and their addition to the physical value of the property should be permitted. Such additions, together with the organization expenses and discounts on the sale of securities, should equitably constitute the going ... ngible value of the public-service company's prop- ... The company asks that it be permitted to give any ... r information bearing on the issues involved in the ... of the investigation. Attention was called to the ... at inventories submitted in the electric division in- ... he property of the Baltimore Electric Company and ... land Park Electric & Water Company. A separate physical valuation is being prepared of the Baltimore Electric Company based upon the property as it existed at the ... f the lease, together with all the amounts expended ... t between that time and June 30, 1911.

CANADIAN HYDROELECTRIC COMMISSION.

... Adam Beck, chairman of the Toronto Hydroelectric ... ssion, has issued a statement showing that, while the ... stimated cost of building transmission lines for the ... ssion was $4,006,927, the actual cost was $3,921,167, ... ng all interest charges up to Nov. 1. At present ... eight municipalities are supplied with electrical en- ... contracts aggregating 33,000 hp. It is estimated ... 470 hp of this total will be used in 1912, which will ... a revenue to the commission of $463,828.

CURRENT NEWS AND NOTES.

... TRIC LIGHT MARKS CENTER OF UNITED STATES POPU- ... —The Showers Manufacturing Company, Bloom- ... Ind., upon whose grounds the center of population ... United States is located according to the last census, ... ected to mark the point a steel flagstaff 75 ft. high, ... he end of which is mounted a 120-cp electric lamp.

* * *

... ONAL DISTRICT HEATING ASSOCIATION.—A meeting will be held Nov. 8 at the Cadillac Hotel, Detroit, Mich., by the executive committee of the National District Heating Association, in order to fix the time and place of the fourth annual convention of the association and to arrange for the program. Mr. D. L. Gaskill, Greenfield, Ohio, is secretary of the association.

STURGIS (MICH.) MUNICIPAL PLANT.—The town of Sturgis, Mich, held a public celebration on the completion of its municipal hydroelectric plant. The dam on the St. Joseph River and the big lighting plant will cost, it is estimated, $250,000. It is proposed to transmit electrical energy to neighboring towns for electric light and power purposes.

* * *

VON HELMHOLTZ BUST PRESENTATION.—An excellent bronze bust of Helmholtz having been presented to the American Institute of Electrical Engineers by Mr. Edward D. Adams, a public acknowledgment of this valuable gift to the historical collection of the Institute will be a feature of the Institute meeting in New York Nov. 10, 1911. It is expected that Mr. Edward D. Adams, the donor, will be present at this meeting and arrangements have also been made for an address in behalf of the Verband Deutscher Electrotechniker by Dr. Adolf Franke, who is at present in this country, and who was a student under Von Helmholtz.

* * *

MILWAUKEE SECTION OF N. E. L. A.—A successful and enthusiastic meeting of the Milwaukee Company Section of the National Electric Light Association, composed of employees of the Milwaukee Electric Railway & Light Company, was held in the Public Service Building in that city on Oct. 19. Mr. O. M. Rau, the chairman of the section, presided, and nearly all of the 125 members were present. Mr. Egbert Douglas, commercial engineer of the company, read a carefully prepared and exhaustive paper entitled "Some Considerations Involved in Selling Light and Power." The paper provoked a lively discussion, those taking part being Messrs. C. N. Duffy, C. Boose, Theodore Wisendanger, D. MacNaughton, J. M. Bolton and the author of the paper.

* * *

TELEPHONE RATE REDUCTION OVERRULED IN LOS ANGELES.—The suit begun a year ago by the Pacific States Telephone & Telegraph Company against the city of Los Angeles to prevent the enforcement of the rate reduction ordered by the City Council on May 31, 1910, has been dismissed by agreement. Acting on the advice of experts, the city attorney decided that it was impossible to defend the reduced rates as affording a proper return on investment. Accordingly the city attorney and the company's attorneys agreed to a dismissal, as in the meantime the Board of Public Utilities of Los Angeles had recommended the old rates, which the City Council accepted finally. The stipulation settling the suit provides that the city shall pay $950 costs and also orders the payment to the company of the impounded money held up during litigation, being $44,000, representing the difference between the old rates and those which the City Council attempted to enforce.

* * *

MONSTER RAILROAD TERMINAL PROPOSED IN CHICAGO.—A project is under discussion by which thirteen of the trunk railroads entering Chicago, or nearly half of the total number, may unite in building a great freight and passenger terminal station on both sides of Twelfth Street between State Street and Clark Street. The frontage of the proposed passenger station forming a portion of this terminal would be 750 ft. long on the south side of Twelfth Street. The use of the new terminal would mean the abandonment of the present Polk Street and La Salle Street terminals. The plan also contemplates the movement of freight trains on the level of the ground by means of electric locomotives. Passenger traffic will be handled on an upper level. The railroads which may possibly unite in this proposal are the Chicago & Western Indiana, Santa Fé, Erie, Wabash, Grand Trunk, Monon, Chesapeake & Ohio, Rock Island, Lake Shore, Chicago & Eastern Illinois, Nickel Plate, Chicago & Southern and the "Soo" Line.

CHICAGO A. I. E. E. SECTION.—At a meeting held on Oct. 18 Messrs. J. G. Wray and Ralph H. Rice were elected members of the executive committee of the Chicago Section of the American Institute of Electrical Engineers. The other members of the committee are Mr. W. L. Abbott, Mr. W. B. Jackson, Prof. John D. Nies and Mr. Fay Woodmansee.

* * *

SEATTLE N. E. L. A. CONVENTION.—The armory in Seattle has been engaged for the annual convention next year of the National Electric Light Association. An exhibition will be made in connection with the convention. The executive committee has decided to limit the sessions to three days; also to limit, as far as practicable, the entertainment features.

* * *

RESUSCITATION FROM ELECTRIC SHOCK.—The Austrian-Hungarian Society of Electrical Engineers has adopted a code of rules for resuscitation from electric shock, employing the Sylvester method of artificial respiration, according to which the patient is operated upon face upward. Dr. Jellinck, of Vienna, the eminent authority on electrical physiology, was consulted in the preparation of the rules.

* * *

GIRLS' CLUB OF COMMONWEALTH EDISON COMPANY.—A girls' club has been organized among the girls employed by the Commonwealth Edison Company, Chicago. Of the ninety-five employees of the company of the gentler sex, seventy-seven signed the roll at the first meeting of the new club. Semi-monthly meetings are held, and musical and literary programs are given. Miss Creed is president of the club and Miss Spears is secretary.

* * *

PHILADELPHIA SECTION, I. E. S.—A meeting of the Philadelphia Section of the Illuminating Engineering Society was held at 1000 Chestnut Street on Oct. 20, 1911, at which time Mr. Sidney W. Ashe, presented a paper entitled "The Training of Commercial Men in the Fundamentals of Illumination." The paper was illustrated with experiments and lantern slides. The author described the methods of instruction employed with college graduates at the Harrison lamp works of the General Electric Company.

* * *

NEW YORK ELECTRICAL SOCIETY.—During the present week, on Oct. 27, Major George O. Squier, of the United States Signal Corps, lectured before the New York Electrical Society on electric waves directed by wires for intercommunication purposes. The lecture dealt with the simultaneous transmission of wireless and wire intercommunications by means of the same equipment, United States patents for which were dedicated by Major Squier to the citizens of the United States. The lecture was illustrated by lantern slides.

* * *

RAILWAY ELECTRICAL ENGINEERS' CONVENTION.—Those in charge of the preparations for the annual convention of the Association of Railway Electrical Engineers, which will be held in the Hotel La Salle, Chicago, on Nov. 6 to 10, are confident that the convention will be the largest and best ever held by the association. The Railway Electric Supply Manufacturers' Association, an auxiliary body, is especially active in arranging for the entertainment of the visitors and for an exhibit of machinery and appliances which it is hoped to make particularly full and valuable.

* * *

TELHARMONIC MUSIC IN NEW YORK.—In our issue for Jan. 5, 1911, appeared a brief note relating to the application by the New York Cahill Telharmonic Company for a franchise to distribute music electrically throughout New York City. Our issue for April 28, 1910, contained an illustrated article in which were described the details of the improved Cahill telharmonic equipment. This latter equipment has been moved from Holyoke, Mass., to New York City, and has been tested with highly satisfactory results in its new location at 535 West Fifty-sixth Street. It will be placed in actual commercial service in the near future.

* * *

LOUISVILLE & NASHVILLE RAILROAD ENTERS TELEGRAPH FIELD.—At a meeting of the board of directors of the Louisville & Nashville Railroad in New York City a short time ago it was decided that they would not continue the contract with the Western Union Telegraph Company, but would construct telephone and telegraph lines of their own. The Louisville & Nashville Railroad has used the lines of the Western Union since 1884, and the last contract expired Aug. 17, 1911. The new lines will not only be used for railroad purposes, but also for commercial messages. The railroad operates 4500 miles of line through the Western and Southern States, covering the territory from Louisville to Florida and St. Louis.

* * *

VICE-PRESIDENT SHERMAN ON CONSERVATION AT HYDROELECTRIC-PLANT OPENING.—Vice-president James S. Sherman delivered the principal speech at the opening of the new municipal water-power plant at Sturgis, Mich., Oct. 12, which was celebrated by an assembly of 10,000 people. The Sturgis plant, which contains several features of novelty, was designed by Prof. Gardner S. Williams, of Ann Arbor, Mich., and has been described in the *Electrical World* of Aug. 25, 1910. Vice-president Sherman advocated the best use of the hidden forces of nature for the advancement of mankind, urging that they be made to supply comforts and conveniences and to lighten the burden of the present generation. Coming generations, he said, will be entirely capable of discovering their own solution of fuel and energy sources to take the place of exhausted natural resources.

* * *

BALTIMORE A. I. E. E. SECTION.—The Baltimore Section of the American Institute of Electrical Engineers has decided to hold two classes of meetings during the coming year. The first class will be more or less of a formal nature, and prominent engineers will be invited to read papers of interest as during the meetings of the past year. Interested non-members will also be invited to attend these meetings, of which there will be not more than four during the course of the year. The second class of meetings will be less formal and will be limited to the members of the section. It is proposed that at these meetings the regular routine business of the section will be conducted, papers of interest published by the Institute will be discussed informally by the members, and light refreshments, including "smokers," will be furnished. The first public meeting was held on Oct. 20 in the Physical Laboratory of the Johns Hopkins University, the subject for discussion being "The Cost of Industrial Power."

* * *

HARRISON STREET STATION, CHICAGO, NOW A SUBSTATION.—After a career of about twenty years as a generating station the Harrison Street station of the Commonwealth Edison Company, in Chicago, has been relegated to the rank of a substation. This station was put in service about the year 1892 and its erection was one of the first achievements of Mr. Samuel Insull when he became president of the old Chicago Edison Company. When built the station was considered one of the finest in the country, but at the present time its entire output rating is not as large as that of a single unit in the new Northwest station, which will soon be put into commission. With the great Fisk Street, Quarry Street and Northwest generating stations in service the Harrison Street plant will not be needed for the generation of electricity, and so the once famous plant drops into the "has-been" class—a significant commentary on the rapid development of electrical engineering and the expansion of electric service from central stations.

THE FIRST 110,000-VOLT INSTALLATION IN EUROPE.

[De]tails of Lauchhammer Transmission System for the Supply of Electric Power to Rolling Mills.

S[te]am Generating Plant Located at Coal Mines.—Duplicate Conductors Installed on Single-Tower Line.—Slender Tower Construction.

By KURT PERLEWITZ.

THE first 110,000-volt transmission system in Germany is now being installed and will be ready for operation in November. It is being built for the Lauchhammer Aktiengesellschaft, which owns large iron works at Lauchhammer, Gröditz, Riesa and Burghammer and also large coal mines at Lauchhammer. On account of enlargements of these works in recent years and the building of electrically operated rolling mills the present power supply was found insufficient and it was decided to build a large generating station from which all the works were furnished with electrical energy through high-tension transmission. Fuel for the generating station is to be obtained from the coal mines at Lauchhammer.

Besides the demand of approximately 6600 kw from its own works the plant is to furnish energy for a large portion of the province, containing four towns, 658 villages and 4 large estates, the demand of which is at the present time approximately 6000 kw. According to the estimates there will be connected immediately more than 116,000 incandescent lamps and over 21,500 hp in motors. The ultimate demand being calculated to aggregate about 20,000 kw, it was decided to transmit the energy at a tension of 110,000 volts. The distance of hardly 35 miles did not require such a high voltage, but the large load to be carried and the fluctuation of voltage to be expected through the rolling-mill load would have made a lower voltage uneconomical. The selection of the voltage was also influenced by the question of insulators, transformers and switch gear, which had to be of special design for any tension over 65,000 volts. Therefore, it would make little difference in regard to cost of apparatus and appliances whether an 85,000-volt or a 110,000-volt system was decided upon, while with the latter voltage it would make a considerable saving in cost of copper. A pressure of 65,000 volts requires a conductor of 0.186 sq. in. cross-section, while 85,000 volts and 110,000 volts only require a copper cross-section of 0.11 sq. in. and 0.065 sq. in., respectively.

GENERATING STATION.

The plant at Lauchhammer, shown in Fig. 1, consists of boiler-room, engine-room and switchroom. The dimensions in this and other illustrations are all given in millimeters. The boiler equipment will consist of eighteen double-flue boilers, of which only twelve are installed at present. Each boiler will have 1600 sq. ft. of heating surface and be provided with superheaters. Use will be made of automatic stokers, for which the Lauchhammer coal is particularly well adapted.

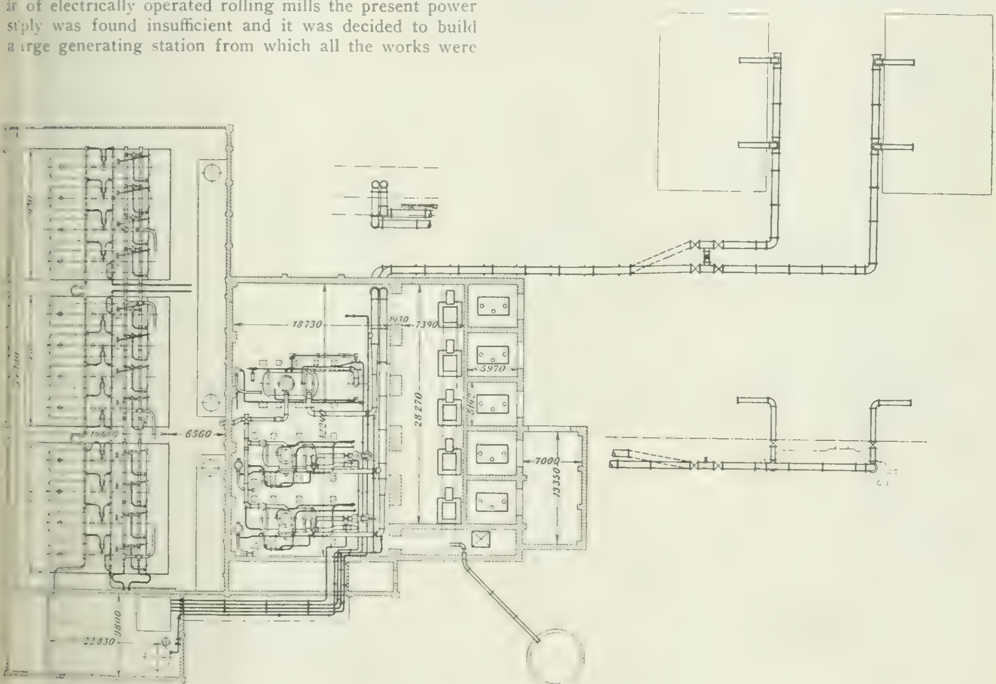


Fig. 1—Plan of Generating Station at Lauchhammer.

The feed water is heated in economizers. Instead of smokestacks the Schwalbach suction-draft system is used. Each group of four boilers forms one unit and each unit is provided with one 50-hp motor for the fans. The generating equipment will consist of four turbo-generators, of which three are being installed. Each generator is a three-phase machine designed for 5000-kw output at a power-factor of 0.8 and an emf of from 4740 volts to 5500 volts. Two of these sets were made by the Allgemeine Electricitäts-Gesellschaft and one set by the Maschinenfabrik Augsburg-Nürnberg, together with the Siemens-Schuckertwerke.

From the generators the energy is transmitted through cables to the 5000-volt main busbars in the switch house. The busbars are in duplicate and are provided with dis-

connecting switches so that one set can be cut out without causing disturbance. There are joined to these buses two T-connected transformers with a secondary emf of 1450 volts, at which voltage about 1000 kw will be delivered at

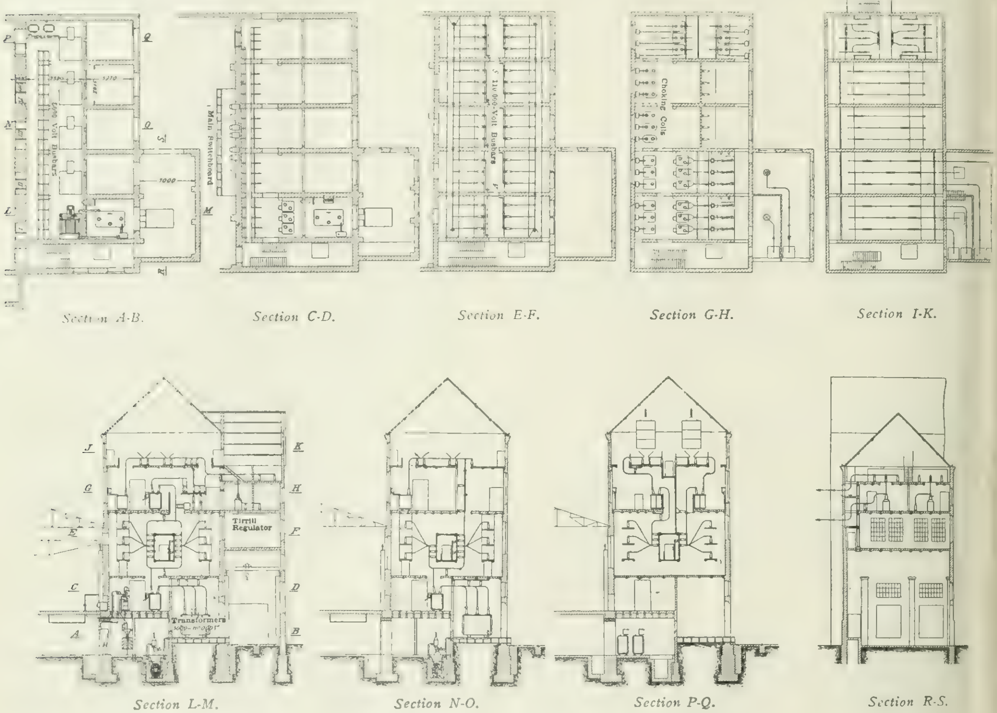


Fig. 2—Elevations and Sections of Switch House at Lauchhammer.

the Lauchhammer works. Connected to these buses are also four 6250-kva, three-phase transformers from which the energy is delivered to 110,000-volt busbars, which are also furnished in duplicate. On both sides of the transformers are installed disconnecting switches and oil switches, the latter being electrically operated and controlled from a central switch panel. In the outgoing high-

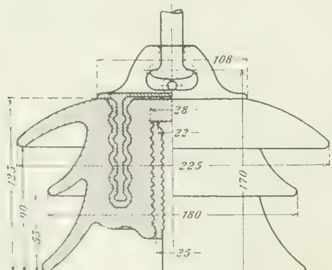


Fig. 3—Suspension-Insulator Unit.

tension lines are installed disconnecting switches, oil switches, choke coils and lightning arresters, as illustrated in Fig. 2. The switch gear and transformers were made by the Siemens-Schuckertwerke.

TRANSMISSION LINE.

The conductors, which are installed in duplicate, are carried on one line of iron towers set in concrete foundations The one-line system of towers was adopted on account of the difficulty of securing rights of way for two separa tower lines. The towers are of steel lattice-girder co struction.

Each conductor is of seven-strand, hard-drawn, el trolytic copper of approximately 83,000-circ. mil cro section. The spans are from 500 ft. to 650 ft. and t height varies from 60 ft. to 65 ft. A noteworthy featu is the span across the River Elbe, which has a length nearly 900 ft., the height of the towers being 140 ft. a 120 ft. For this span various kinds of conductors w considered, such as stranded steel cables, copper wire w steel core, bronze wire and others, but careful calculati showed that pure electrolytic, seven-strand, 140,000-c mil copper cable would prove best for carrying the ma mum load of ice and snow, the calculation being based a factor of safety of five. Five-unit suspension insulat made by the Porsellanfabrik Kahla, in Helmsdorf, are u

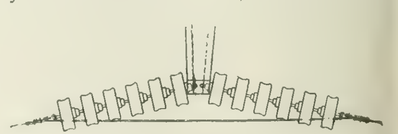


Fig. 4—Strain Insulator on Curve of Transmission Line.

on all intermediate towers. At crossings of streets, ways, rivers and certain other places use is made of 6-unit strain insulators made by Rosenthal, in Selb, Bav a. All conductors are carried on one pole line and each et

f three conductors forms an equilateral triangle, the sides f which are 5.9 ft. For this purpose the upper cross-arm s bent, as shown in the accompanying illustration. Under ach conductor is a ground connection in the shape of a ow supported on cross-arms, as shown in Fig. 7. This ow serves the purpose of catching and grounding the onductor in case the insulator should break. At the top f the tower is a 100,000-circ. mil steel ground wire, erving the double purpose of anchoring the intermediate owers and protecting the line against lightning. There strain insulators have been used, as shown in Fig. 6. In regard to the protection of the stations against high-frequency disturbances advantage was taken of the experiences gained at similar installations in America. Ground resistances are installed in all outgoing lines and between busbars, choke coils and horn-gap lightning arresters. Static dischargers are connected at the neutral point of the high-tension winding of the instrument transformers. The voltage regulation of the system is effected by Tirrill regulators in the main station and also by regulating trans-

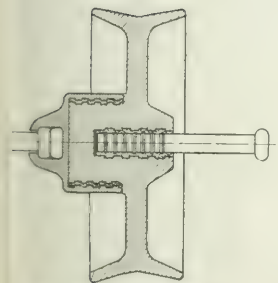


Fig. 5—Strain Insulator.

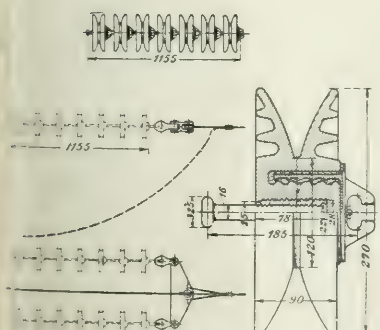


Fig. 6—Strain Insulator Used at Crossing of River Elbe.

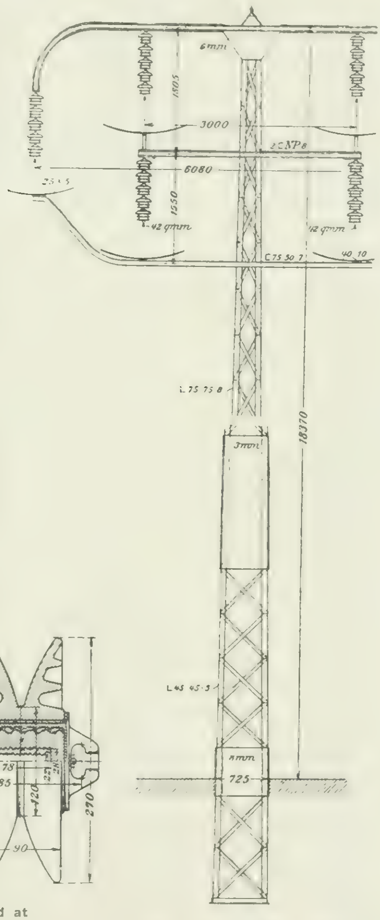


Fig. 7—Intermediate Tower.

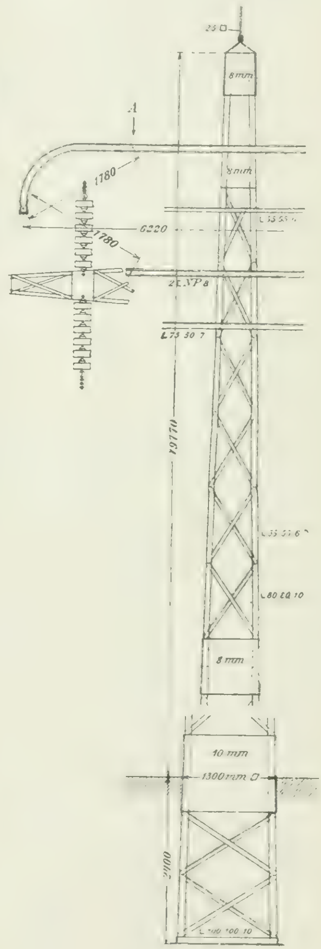


Fig. 8—Straight Tower.

: thus two systems of grounded connections at each tower. I: order to prevent inductive disturbances the wires are : pletely transposed once in every mile, or altogether : thirty times. This arrangement not only eliminates : inductive effects on neighboring telephone lines, but : prevents mutual induction and electrolytic influence of : two parallel circuits. It will be noticed that, by the bow-: ed form at the upper cross-arm the conductors are ing symmetrically, and inequality in the self-induction of th phases is thus prevented. This arrangement was devi d by Professor Ulbricht.

t the crossing of the River Elbe two double sets of formers on the 15,000-volt side in the main transformer station, which allow a variation of 750 volts.

SUBSTATIONS.

The substation at Gröditz, the arrangement of which is shown in Figs. 9 and 10, comprises an installation of three 3000-kva transformers and two 7000-kva transformers, the former stepping down the emf from 110,000 volts to 15,000 volts and the latter stepping down from 110,000 volts to 60,000 volts. Besides being connected through the 110,000-volt line the substations at Gröditz and Riesa are also connected through a 60,000-volt line covering the districts served by these stations.

The stations are so arranged that any of the two can furnish energy for the whole district in case of a breakdown of the other. This arrangement also eliminates reserve transformers. The consumers are served from five

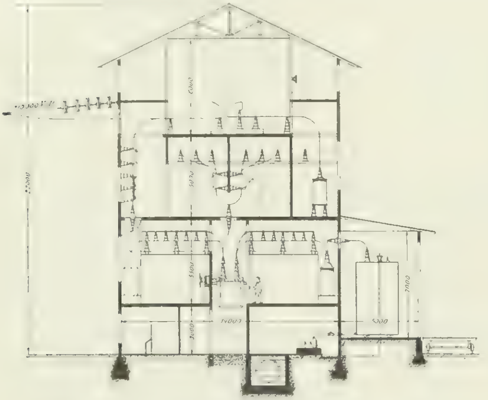


Fig. 9—Section of Substation at Gröditz.

transformer stations on this line, each distributing energy at 15,000 volts.

The design of the installation was made by Mr. E. G.

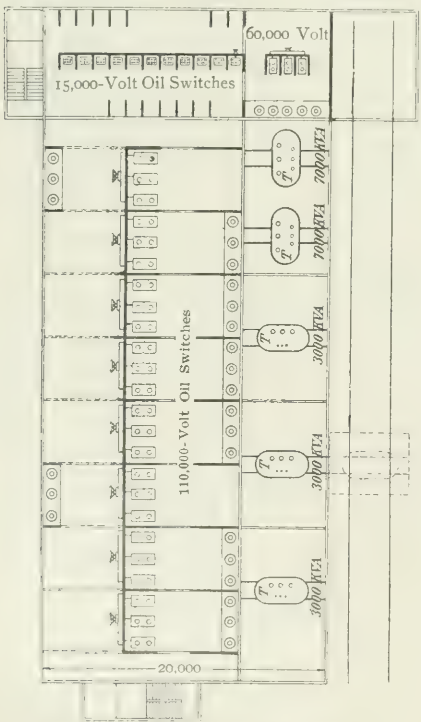


Fig. 10—Plan of Substation at Groditz.

Fishinger, Dresden, who also supervised the construction work. The illustrations accompanying the present article have been reproduced from an article by Mr. Fishinger which appeared in the *Elektrotechnische Zeitschrift.*

THE HEATING OF SYNCHRONOUS CONVERTERS.

The Effect of Power-Factor on the Average and or the Maximum Heating.

By NICHOLAS STAHL.

FOR commercial reasons modern synchronous converter are built with coils of uniform section. The armatur copper loss is, however, very unequally distributec the coils nearest the taps to the collector rings having t withstand far more than the average. Consequently, as a added margin of safety, many manufacturers build thei machines to carry without injury the maximum current established in the tap coils, assuming, with the justificatio of experience, that even the best ventilated machines ar not able to equalize to any considerable extent the he generated by conduction along the copper or through th insulating walls.

It is also well known that the variations in local heatir increase markedly with the decrease of the power-fact below 100 per cent, which fact becomes of importan in connection with the subject of compounding by seri field current and reactance in the alternating-current ci cuit, since, with reasonable values of these quantities, well as of ohmic drop, an attempt even to hold up the vo

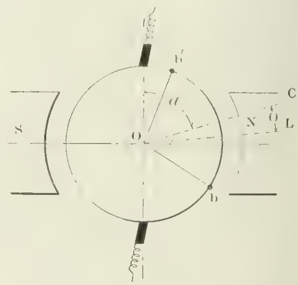


Fig. 1—Diagram Showing Meaning of Angles.

age to normal will involve a decided departure of t power-factor (leading) from 100 per cent, with a cor quent excess heating in all the coils, and in the tap c s particularly.

The question of unequal heating is of importance als n connection with the type of machine which is self-start g from the alternating-current end, in view of the star g requirement of from one to one and one-half times nor al kilovolt-ampere input at a very low power-factor.

The curves given below afford a ready answer not to the question of ratings of a machine used with diffe nt numbers of slip-rings (phases)—say, three or six—bu the query as to why it is not advisable to start a six-ph se machine, arranged with the low-tension sides of the tr s- formers in double-delta, as a three-phase machine, in o er to save switches and more operations for the attendant.

The theory on which the curves are based is as foll s:

Let p be the number of phases (or, rather, the numbe of rings).

E_p the effective alternating emf between rings.

I_p the effective alternating current in any arm ure path.

E_o the commutator voltage.

I_o the direct current in any armature path.

Cos θ the power-factor.

η the efficiency at full load.

Then for the equality of input and output with ord ary parallel windings with two armature paths from a lush set,

$$\eta p E_p I_p \cos\theta = 2 E_o I_o$$

The ratio between E_p and E_0 is easily shown to be

$$E_p = \frac{E_0}{\sqrt{2}} \sin\frac{\pi}{p} \qquad (2)$$

substituting in (1),

$$I_p = \frac{I_0 2\sqrt{2}}{\eta p \sin\frac{\pi}{p} \cdot \cos\theta} \qquad (3)$$

…e maximum value of the alternating current in any … will be:

$$I_p \max = \frac{I_0 4}{\eta p \sin\frac{\pi}{p} \cdot \cos\theta} \qquad (4)$$

… in Fig. 1 α represents the angle between the mid coil … phase winding (that is, coils lying between two ad…t collector rings) and the diameter of commutation …med on the neutral point), and θ is the angle of lag …rrent behind impressed emf, then it will be clear that …oil bb' will have the maximum alternating current …gh it when the line OL passes through the middle of a …—that is when $\alpha + \theta = 90$ deg. Assuming, as here…e, that the field form is sinusoidal, we have for the …taneous value of the alternating current

$$i = \frac{I_0 4 \sin(\alpha - \theta)}{\eta p \sin\frac{\pi}{p} \cdot \cos\theta} \qquad (5)$$

… is, the current (alternating) in any bar between b …$'$, and the total current, considering the reversal of …irect current on passing a brush, and that the direct …nt and alternating current first oppose each other, …

$$\text{instantaneous current} = I_0 - \frac{I_0 4 \sin(\alpha - \theta)}{\eta p \sin\frac{\pi}{p} \cdot \cos\theta} \qquad (6)$$

…verage heating for a given bar β deg. from the cen… bb' is (6) integrated over half a cycle, from β to … or

$$\int \left(1 - \frac{4\sin[\alpha - \theta]}{\eta p \sin\frac{\pi}{p} \cdot \cos\theta}\right)^2 d\alpha$$

$$\int \left[1 - \frac{4(\sin\alpha - \cos\alpha\tan\theta)}{\eta p \sin\frac{\pi}{p}}\right]^2 d\alpha$$

$$\int \left[\ldots \frac{16\sin^2\alpha}{\eta^2 p^2 \sin^2\frac{\pi}{p}} \ldots \frac{16\cos^2\alpha\tan^2\theta}{\eta^2 p^2 \sin^2\frac{\pi}{p}} - \frac{8\sin\alpha}{\eta p \sin\frac{\pi}{p}} - \frac{8\cos\alpha\tan\theta}{\eta p \sin\frac{\pi}{p}} - \frac{16\sin\alpha\cos\alpha\tan\theta}{\eta p \sin\frac{\pi}{p}}\right] d\alpha$$

$$= I_0\left[1 + \frac{8}{\eta^2 p^2 \sin^2\frac{\pi}{p}} + \frac{8\tan^2\theta}{\eta^2 p^2 \sin^2\frac{\pi}{p}} - \frac{16\cos\beta}{\pi\eta p \sin\frac{\pi}{p}} + \frac{16\sin\beta\,.\tan\theta}{\pi\eta p \sin\frac{\pi}{p}}\right] \qquad (7)$$

…e expression in brackets gives the ratio of the heat…g of a converter coil to that of the same coil in a direct-…rrent generator, disregarding the question of the effi…ciency of the latter; to include this it is only necessary to …ltiply its value into the bracket, so that for a converter o… say, 95 per cent efficiency at full load and a generator o… perhaps 92 per cent, the consideration of efficiencies leads to some 3 per cent variation in the ratio of respective heatings.

The last term in the brackets, $\frac{16\sin\beta\,.\tan\theta}{\pi\eta p\sin\frac{\pi}{p}}$, brings out the point often forgotten that at power-factors differing from unity the heating even in the tap coils will not be the same at opposite ends of a phase winding, being greater by twice the value of this term for the front tap-coil with respect to physical rotation, when $\sin\beta$ is positive, and the wattless current lagging; or, with respect to a tap leading to the collector ring it is the after-coil; with a leading wattless current the conditions reverse. A lagging wattless current shifts forward with respect to rotation the coil having the least heating and vice versa.

The average heating for the entire winding is found by integrating (7) through the entire extent of the phase and gives

$$\frac{p}{2\pi}\,.\,I_0\int_{-\frac{\pi}{p}}^{\frac{\pi}{p}}\left[1 + \frac{8}{\eta^2 p^2 \sin^2\frac{\pi}{p}} + \frac{8\tan^2\theta}{\eta^2 p^2 \sin^2\frac{\pi}{p}} - \frac{16\cos\beta}{\pi\eta p \sin\frac{\pi}{p}} + \frac{16\sin\beta\tan\theta}{\pi\eta p \sin\frac{\pi}{p}}\right] d\beta$$

$$= I_0\left[1 + \frac{8}{\eta^2 p^2 \sin^2\frac{\pi}{p}} + \frac{8\tan^2\theta}{\eta^2 p^2 \sin^2\frac{\pi}{p}} - \frac{2\,.\,16\,.\,2\sin\frac{\pi}{p}}{2\pi\,.\,\pi\eta p\sin\frac{\pi}{p}}\right]$$

$$= I_0\left[1 + \frac{8}{\eta^2 p^2 \sin^2\frac{\pi}{p}} + \frac{8\tan^2\theta}{\eta^2 p^2 \sin^2\frac{\pi}{p}} - \frac{16}{\pi^2\eta}\right] \qquad (8)$$

For three-phase, two-phase (four-ring) and six-phase converters equation (7) reduces as follows:

Relative coil heating (three-phase) = 1 +

$$\frac{32}{27\eta^2} + \frac{32\tan^2\theta}{27\eta^2} - \frac{32\cos\beta}{\pi\eta 3\sqrt{3}} + \frac{32\sin\beta\tan\theta}{\pi\eta 3\sqrt{3}} \qquad (9)$$

Relative coil heating (two-phase) = 1 +

$$\frac{1}{\eta^2} + \frac{\tan^2\theta}{\eta^2} - \frac{8\cos\beta}{\pi\eta\sqrt{2}} + \frac{8\sin\beta\tan\theta}{\pi\eta\sqrt{2}} \qquad (10)$$

Relative coil heating (six-phase) = 1 +

$$\frac{8}{9\eta^2} + \frac{8\tan^2\theta}{9\eta^2} - \frac{16\cos\beta}{\pi\eta 3} + \frac{16\sin\beta\tan\theta}{\pi\eta 3} \qquad (11)$$

The corresponding average heating ratios are:

$$\text{three-phase} = 1 + \frac{32}{27\eta^2} - \frac{16}{\pi^2\eta} + \frac{32\tan^2\theta}{27\eta^2} \qquad (12)$$

$$\text{two-phase} = 1 + \frac{1}{\eta^2} - \frac{16}{\pi^2\eta} + \frac{\tan^2\theta}{\eta^2} \qquad (13)$$

$$\text{six-phase} = 1 + \frac{8}{9\eta^2} - \frac{16}{\pi^2\eta} + \frac{8\tan^2\theta}{9\eta^2} \qquad (14)$$

Assuming an efficiency of 100 per cent, the last three equations simplify to:

$$\text{three-phase} = 0.565 + 1.185\tan^2\theta \qquad (12')$$

$$\text{two-phase} = 0.38 + \tan^2\theta \qquad (13')$$

$$\text{six-phase} = 0.268 + 0.888\tan^2\theta \qquad (14')$$

Since the ratings for equal heatings are proportional to the currents, the reciprocals of the square roots of (12′), (13′), (14′) allow a ready determination, as indicated in Fig. 2.

It will be observed that one-half the rating shown for a given power-factor will represent within 2 or 3 per cent the per cent load that may be carried with the same *total* heating allowed at normal full load and unity power-factor. How far this must be modified when the allowable heating in a tap coil is considered is indicated by the accompanying curves, which show the heatings for the

front and back tap coils, the middle and the average coils, Figs. 3, 4 and 5 representing respectively the performances of three-ring, four-ring and six-ring converters, 100 per cent efficiency being assumed. In equations (7) to (14) the efficiency factor has been included, but it may be noted that approximate purposes will be served if the heatings for 100 per cent efficiency are divided by the square of the efficiency factor for any particular machine.

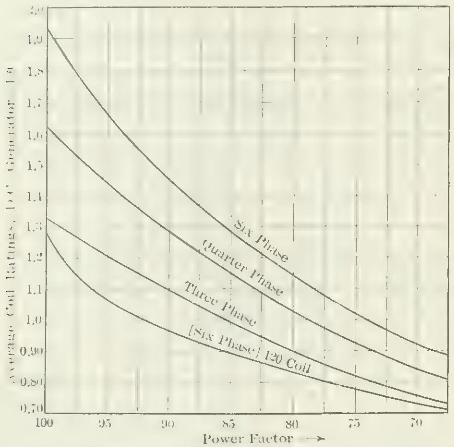


Fig. 2—Ratings of Three-Ring, Four-Ring and Six-Ring Converters for Equal Average Heating.

Inquiry is frequently made regarding the performance of both three-phase and six-phase synchronous converters when one of the transformers fails or is cut out of service for any reason. In the case of the three-phase or of the six-phase machines when the transformers of the latter are connected in double delta it is sufficient to remark that the load which may be carried is limited by the outputs of the two transformers left in open delta, or "V." Should these be operated to give normal full-load current on the low-tension side, the transformer will be carrying an overload of 15.5 per cent, and the synchronous converter will, of course, be operating at only two-thirds of its rated output, with corresponding heating. There are no unbalanced currents in the converter armature.

However, the case is different with a six-phase converter for which the transformers are diametrically connected, since after cutting out one the machine may be regarded as operating on a two-phase (four-ring) circuit; but with the phases distorted so as to have 120 deg. between one pair of phase wires and 60 deg. between the next succeeding two. Under these conditions the currents in the converter armature will be very considerably unbalanced, with a consequent increase of heating, which will, however, be that neither of a three-phase nor of a four-phase machine, and the permissible output of the converter will depend upon whether it is to be based on the maximum heating of any particular coil or on the average heating of the coils.

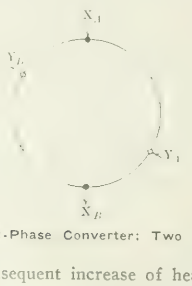


Fig. 3—Six-Phase Converter; Two Idle Taps.

In Fig. 2 are shown the ratings as calculated from the average heating of the converter based on the 120-de[g.] coil. The results given below will enable rapid calcul[a]tion in the case of the front and rear tap-coils and middle coils of the winding.

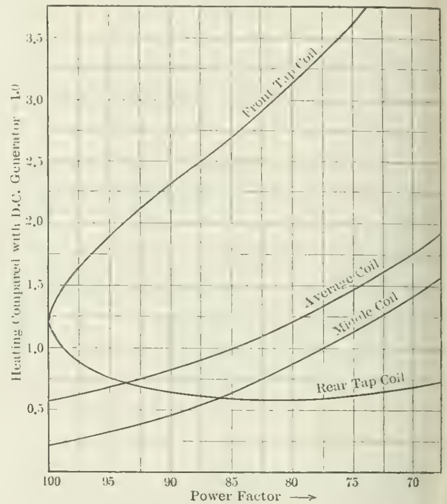


Fig. 4—Distribution of Heating in Coils of Three-Phase Converter.

If I represents half the effective full-load current i[n] given transformer, the heating in the long coil (l) is [de]termined by the maximum current which can flow dur[ing] half a cycle, which is ascertained as follows: The [in]stantaneous current in the winding will be the vector s[um] of the currents flowing from the two active transform[ers] having currents, for unity power-factor, of

$$i_x' = I_x\ (\max) \sin \alpha$$

and

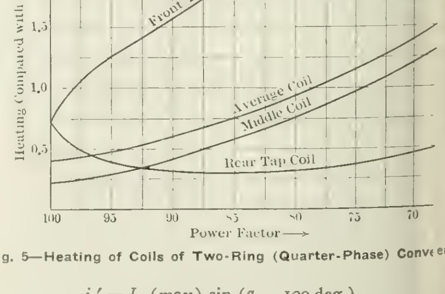


Fig. 5—Heating of Coils of Two-Ring (Quarter-Phase) Conver[ter].

$$i_y' = I_y\ (\max) \sin (\alpha - 120 \text{ deg.})$$
$$= I_x\ (\max) \sin (\alpha - 120 \text{ deg.})$$

In Fig. 3 X_A and Y_A are the points of attachment o[f t]he transformer windings of like polarity and sequence; [wh]en

I_a (max) enters at X_A, current at Y_A will be negative (incidentally equal to $-\frac{I_b\,(\max)}{2}$; hence the current leaves (physically) Y_A, so the vector sum producing the instantaneous current in the coil is (I indicates maximum current):

$$i' = I\sin\alpha - I\sin(\alpha - 120\text{ deg.})$$
$$= I(\sin\alpha - \sin\alpha\cos 120\text{ deg.} + \cos\alpha\sin 120\text{ deg.})$$
$$= I\left(\frac{3}{2}\sin\alpha - \frac{\sqrt{3}}{2}\cos\alpha\right) \qquad (15)$$

Now I is also half the maximum value of the current in an armature path for ordinary six-phase operation, since the line current, which is equal to the full effective current of a transformer, $2I$, is the vector difference of the currents in two adjacent sections of an armature 60 electrical space and time degrees apart; hence, $I_{line} = 2I_{arm}\sin 30 = I_{arm} = 2I$. Now for six-phase $I_s\,(\max) = \frac{4}{3}I_o$.

Hence $I = \frac{I_s\,(max)}{2} = \frac{2}{3}I_o$, $i'_1 = \frac{I_o}{\sqrt{3}}(\sqrt{3}\sin\alpha - \cos\alpha)$

With unity power-factor the maximum value of i_1 will occur when the center of the phase winding is opposite the center of the pole, so α is measured from the commutation center if on the neutral.

With a power-factor $\cos\theta$ (lagging) the maximum value of the current will be represented by an instantaneous value of

$$i'_1 = \frac{I_o}{\sqrt{3}}\cdot\frac{\sqrt{3}\sin[\alpha+\theta] - \cos[\alpha+\theta]}{\cos\theta}$$
$$= \frac{I_o}{\sqrt{3}}(\sqrt{3}\sin\alpha + \sqrt{3}\cos\alpha\tan\theta - \cos\alpha - \sin\alpha\tan\theta)$$
$$= \frac{I_o}{\sqrt{3}}(\sin\alpha[\sqrt{3} - \tan\theta] - \cos\alpha[1 - \sqrt{3}\tan\theta])$$

The total instantaneous current, considering the reverse direction of the direct current, is

$$i_1 = I_o\left\{1 - \frac{\sin\alpha}{\sqrt{3}}[\sqrt{3} - \tan\theta] + \frac{\cos\alpha}{\sqrt{3}}[1 - \sqrt{3}\tan\theta]\right\} \qquad (16)$$

The instantaneous heating will be the square of this, and the average heating for a half (or whole) cycle for a given conductor distant β deg. from the center of the coil is

$$\frac{I_o^2}{\pi}\int_{\beta}^{\pi+\beta}\left\{1 - \frac{\sin\alpha}{\sqrt{3}}[\sqrt{3} - \tan\theta] - \frac{\cos\alpha}{\sqrt{3}}[1 - \sqrt{3}\tan\theta]\right\}^2 d\beta \qquad (17)$$

$$= \frac{I_o^2}{\pi}\int_{\beta}^{\pi+\beta}\left\{1 + \frac{\sin^2\alpha}{3}[\sqrt{3} - \tan\theta]^2 + \frac{\cos^2\alpha}{3}[1 - \sqrt{3}\tan\theta]^2 - \frac{2\sin\theta}{\sqrt{3}}[\sqrt{3} - \tan\theta]\right.$$
$$- \frac{2\cos\alpha}{\sqrt{3}}[1 - \sqrt{3}\tan\theta]$$
$$\left. + \frac{2}{3}\sin\alpha\cos\alpha[\sqrt{3} - \tan\theta][1 - \sqrt{3}\tan\theta]\right\} d\beta$$
$$= I_o^2\left\{\frac{5}{3} + \frac{2}{3}\tan^2\theta - \frac{4}{\sqrt{3}\pi}\cos\beta[\sqrt{3} - \tan\theta]\right.$$
$$\left. - \frac{4}{\sqrt{3}\pi}\sin\beta[1 - \sqrt{3}\tan\theta]\right\} \qquad (18)$$

The ratio of the heating of a bar to what it would be when operating as a direct-current generator is the term in brackets.

When the power-factor is unity, $\cos\theta = 1$ and $\tan\theta = 0$, and equation (18) becomes

$$I_o^2\left\{\frac{5}{3} - \frac{4\cos\beta}{\pi} - \frac{4\sin\beta}{\sqrt{3}\pi}\right\}$$

The ratio of the permissible output ratings to that of the machine as a direct-current generator equals $\frac{1}{\sqrt{\frac{5}{3}}} = 77.5$ per cent for a front tap-coil for which $\beta = 60$ deg.

The corresponding heating of the front tap-coil for a six-phase machine is 0.418, and the ratio of the permissible output ratings on this basis is $\sqrt{\frac{0.418}{1.666}} = 50$ per cent.

Similarly, the short (60-deg.) coil has instantaneous alternating current.

$$i_s' = I\sin\alpha + I\sin(\alpha - 120\text{ deg.}) = \frac{I_o}{3}(\sin\alpha - \sqrt{3}\cos\alpha) \qquad (19)$$

and at power-factor $= \cos\theta$

$$i_s' = \frac{I_o}{3}(\sin\alpha[1 + \sqrt{3}\tan\theta] - \cos\alpha[\sqrt{3} - \tan\theta])$$

and the total instantaneous current is

$$i_s = I_o\left\{1 - \frac{\sin\alpha}{3}[1 + \sqrt{3}\tan\theta] + \frac{\cos\alpha}{3}[\sqrt{3} - \tan\theta]\right\}$$

which, by the same reasoning as the foregoing, leads to a total heating of

$$I_o^2\left\{\frac{11}{9} + \frac{2\tan^2\theta}{9} - \frac{4\cos\beta}{3\pi}[1 - \sqrt{3}\tan\theta]\right.$$
$$\left. - \frac{4\sin\beta}{3\pi}[\sqrt{3} - \tan\theta]\right\} \qquad (20)$$

At unity power-factor this becomes

$$I_o^2\left\{\frac{11}{9} - \frac{4\cos\beta}{3\pi} - \frac{4\sin\beta}{\sqrt{3}\pi}\right\}$$

and the heating for a front-tap coil $= 0.487$, giving a rating compared with a six-phase machine of $\sqrt{\frac{0.418}{0.487}} = 92.5$ per cent.

The total average heating for the 120-deg. winding is

$$\frac{3}{2\pi}I_o^2\int_{-\frac{\pi}{3}}^{\frac{\pi}{3}}\left\{\frac{5}{3} + \frac{2}{3}\tan^2\theta - \frac{4\cos\beta}{\sqrt{3}\pi}[\sqrt{3} - \tan\theta] + \frac{4\sin\beta}{\sqrt{3}\pi}[1 + \sqrt{3}\tan\theta]\right\} d\beta$$
$$= I_o^2\left\{\frac{5}{3} + \frac{2}{3}\tan^2\theta - \frac{6}{\pi}[\sqrt{3} - \tan\theta]\right\} \qquad (21)$$
$$= I_o^2\{0.62 + 0.607\tan\theta + 0.666\tan^2\theta\}$$

and at unity power-factor $= 0.62\,I_o^2$.

The permissible rating compared to that of a six-phase machine $= 65.7$ per cent.

The values of the average heating for various power-factors have also been plotted in Fig. 2 for comparison with the values for machines with symmetrical phases. It is curious to note that the rating actually falls below that of a three-phase machine.

It is interesting in this connection to follow the rapid drop in rating for a very slight change in the power-factor from unity even for average coil conditions. For example, at 95 per cent power-factor the six-ring, four-ring, three-ring and unbalanced-phase machines show respectively only 86 per cent, 87.5 per cent, 91 per cent and 85 per cent of their permissible ratings at unity power-factor.

This tendency is accentuated if it be considered that the ratings depend solely upon the front-tap coil heatings, the corresponding figures at 95 per cent power-factor being

for six-ring, four-ring and three-ring machines 72 per cent, 76 per cent and 79.4 per cent respectively. The more rapid fall of rating of machines of the higher number of phases points to the importance of unity power-factor operation on the maintenance of their relative initial rating advantage. The curves indicate also the rapid

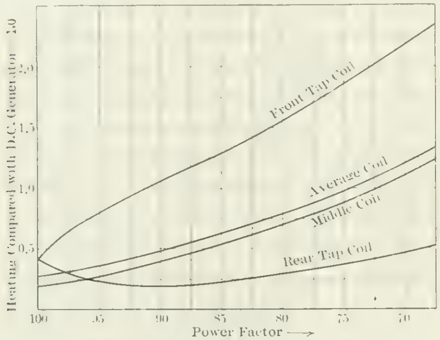


Fig. 6—Heating of Coils of Six-Phase Converter.

approach of all the machines to the same low ratings as the power-factor becomes very bad.

It is interesting to note the power-factors at which the rear tap-coils have the same heating as the middle and average coils. For the middle coils six-ring, four-ring and three-ring machines show power-factors of 96.5 per cent, 92.4 per cent and 86.5 per cent respectively, while for the average coil the figures are 98.2 per cent, 96.5 per cent and 93.7 per cent.

It was stated at the beginning that modern machines are designed to withstand the worst heating in any given coil, and the rapid overheating of these coils at poor power-factors lends emphasis to the insistence of the manufacturers that converters should be operated at or very near 100 per cent power-factor when fully loaded. This contention is strengthened in the case of compounded converters using reactance in the alternating-current circuit of from 15 per cent to 25 per cent with supply line of about 10 per cent reactance to secure flat compounding, for then it

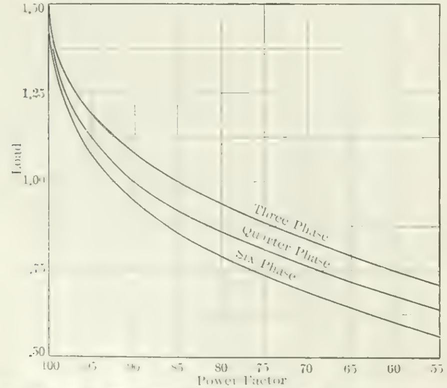


Fig. 7—Loads on Three-Ring, Four-Ring and Six-Ring Converters for Heating Equivalent to 150 per Cent Load, 100 per Cent Power-Factor.

is common practice to secure 100 per cent power-factor at not more than full load, and very frequently at 75 per cent or even 50 per cent of full load. With the latter figures given, the machines of the principal makers in this country would have power-factors ranging from 98 per cent to 95 per cent. If the heating due to this cause is added to that produced by the overload (which varies as the square o the overload) there would be for a six-phase machine a 50 per cent overload and 95 per cent power-factor a tota heating in a rear tap-coil (since the wattless current i now leading) of $\frac{0.8}{0.418} \times (1.5)^2 = 4.72$ times that at full loa and unity power-factor; for a three-phase machine th figure would be 3.56, the four-ring machine having a intermediate value. It is clear that the machine is in n danger at low loads even at very poor power-factors.

Since it is common practice at present to operate con verters for periods of two hours or more at 150 per cen load, Fig. 7 has been plotted to show the loads which ma be carried at various power-factors with the same hea ing in the front tap-coils as exists at 150 per cent load ar unity power-factor.

Had the curves been made on the basis of the averaj heating the slopes would not have been so abrupt, b would have indicated the same tendency. This latter cur may serve as an additional check on the safety of such m chines as are arranged for unity power-factor adjustment high loads and correspondingly low power-factors at low loads, and, properly interpreted, may serve as a clew to t heating when unity power-factor is secured at lower th 150 per cent loads.

It is hoped that the foregoing may present some new recall some forgotten facts regarding the amount of loc heating that may be expected under various conditions.

REGENERATIVE CONTROL FROM A COMMERCI VIEWPOINT.

Monetary Saving to Be Expected When Install Initially or Substituting Regenerative for Standard Apparatus.

By J. Gustaf V. Lang.

In previous articles[1] fairly reliable conclusions have b reached with reference to the average saving in ene consumption that a regenerative equipment will eff to the first cost of such an equipment compared wit standard one and, finally, to the comparative cost of pairs and maintenance of the two kinds of equipments. the basis of these conclusions it is a comparatively e matter to study the commercial importance of regenera under different conditions.

Only in the case where a traction company buys energy at a fixed rate is the full value directly evid When the traction company itself generates energy cost of energy as a rule is not figured in such a way the company could sell to outsiders at that rate and m a reasonable profit. Still, the manufacture of electric ergy is really an undertaking by itself and all the inte depreciation and a certain amount of overhead cha should be given due consideration in arriving at the ene cost figure. If an energy cost figure arrived at in way is used as the basis, the full value of the energy sa is easy to gage under any circumstances. If this is done it becomes a next to impossible task to value the in fluence an energy saving would have in all the diffe directions. Some would be more easily recognized u e certain circumstances than others.

Take, for instance, the case of a new installation: he whole power plant, transmission lines, feeders, numbe of substations, etc., would be reduced in proportion to he saving. This would mean a reduction in first cost nd thus in interest and depreciation. There would be a reduc-

[1] ELECTRICAL WORLD, March 30, Aug. 12, Aug. 26 and Sept. 16, 1911

-n in coal, water and labor; the proportion of the reduc-
-n in labor would naturally depend on the size of the
ndertaking. If the cost of energy in the case of the
stallation of standard equipments had been figured as if
e generating plant was a separate undertaking to earn
reasonable profit on the investment, and the energy saving
the adoption of regeneration equipments were figured
-h that energy cost as a basis, the saving in investment
-l have received due credit in the energy cost saving.
-e same thing is true in case of an existing plant. A
-ing in energy consumption would show a direct saving
-y in coal and water, but indirectly there is a consider-
- greater saving. This is evident from the fact that
-e is a surplus of energy in the same proportion as the
-ng, which surplus could be sold for other purposes and
- bring a revenue which would be considerably larger
-n the direct saving in coal and water. Where this sur-
- cannot be disposed of the saving is equivalent to an
-ease in the power plant which sooner or later is likely
-e of corresponding value for extensions and develop-
-t of service. Even if this value does not show returns
-ediately, it is there and it is likely to add to the profits
-y now and then, when on special occasions extra heavy
-c has to be handled. Besides the saving in coal and
-r and its handling there is also in most cases a sav-
-n wear and tear on machinery, in oil, waste, etc.

estimating the cost of energy, inclusive of everything,
-t is given to the potential surplus equipment of the
-m and it is no more than right that this should have
credit. It may be argued that this surplus cannot
-tilized for some time and should therefore not be
-ted. Against this argument stands the perfectly logi-
-rgument that the selling price of the energy would be
-l on the investment values when the existing power sta-
was built, but that, when the point is reached where
-ddition had to be built, this addition in all likelihood
-d cost in proportion a great deal more and conse-
-tly the saving by avoiding such an addition by the
-luction of regenerative control would be considerably
-ter and make up for the difference between the esti-
-l and the actual saving during the time when the sur-
could not be utilized to the full advantage.

-hen the energy cost is determined on the basis sug-
-d the average cost will be somewhere between 1 cent
2 cents a kw-hour. At Norwich the cost was claimed to
5 cents and it is a question whether interest, deprecia-
and a reasonable proportion of the overhead expenses
included in this value since it differs so greatly from
-harge made at Blackburn, where the energy was sup-
by the Corporation power plant and the street-rail-
-ment was made to pay 3 cents a kw-hour.

-ce the maintenance figures arrived at in the previous
-le were based on conditions at Norwich it may be as
to take the Norwich conditions as an example in
-mining the commercial value of regeneration. The
-ge travel per car per year was 31,600 miles, corre-
-ling to an average speed of 5.5 miles per hour, sixteen
- a day, for 360 days. The average energy consump-
was 1.2 kw-hours per car-mile. The total energy ex-
-ture per car per year was thus 38,000 kw-hours. A
-g of 25 per cent would amount to 9500 kw-hours,
at a price of 1.5 cents would have a value of $142.50
-ar per year.

NEW INSTALLATION.

-nsidering a new installation of motor equipments the
-ional cost of installation over and above that called for
the standard equipment has been found to be $405 per
-. On this amount would have to be paid interest, at
6 per cent, which would mean a yearly charge of $24.30
-inst the saving of $142.50 in energy and $13 in mainte-
-nce. The depreciation would also have to be calculated
-n an equally greater investment, and thus the yearly con-
-bution to the sinking fund would be increased by 4 per
cent (if that were the rate of equipment depreciation) on $405; thus $16.20 should be charged against the saving. The balance then takes the following form:

	Credit	Debit
Saving in energy	$142.50	
Saving in maintenance	13.00	
Interest at 6 per cent on $405....		$24.30
Depreciation at 4 per cent on $405		16.20
Total.	$155.50	$40.50
Balance...		$115.00

Thus, after paying for the necessary complications, each car still earns $115 net, which represents the commercial monetary value of regeneration under the assumption of a new installation where the conditions would approximate those at Norwich. The average conditions in America call for heavier cars, higher average speeds with consequent larger motor equipments, higher average mileage per year and a decidedly higher energy consumption per car-mile. Since the brake-shoe maintenance under such conditions increases more than in proportion whereas the motor and controller maintenance increases only slightly, the saving in total maintenance will be considerably greater than in the above example. A commercial energy consumption is around 3 kw-hours per car-mile. The yearly saving in energy per car would then run up to 23,000 kw-hours and more, according to the yearly mileage. Even if the value should be somewhat less than 1.5 cents per kw-hour, figuring in interest, depreciation and overhead expenses of the generating plants and substations, the monetary value of the saving would run up to at least twice that given in the above-mentioned balance. The additional cost of the regenerative equipment over the standard would not be increased very much; certainly 50 per cent would be a safe assumption. Conditions representing more closely the average in this country would consequently modify the balance in favor of regeneration and it would take on approximately the following form:

Saving in energy....	$250.00	
Saving in maintenance	25.00	
Interest on additional cost		$[illegible]7.50
Depreciation........		25.00
	$[illegible]	$62.50
Balance.....................................		$252.50

Under average conditions a net saving of $250 per car per annum would be the result of the installation of regenerative instead of standard equipments. Such a saving is in itself well worth consideration, but that is not by any means the only advantage. There are indirect savings which might easily run up to quite a considerable amount. The saving of energy by economical handling of the standard equipment has been recognized, and different methods have been devised to induce the motormen to endeavor to decrease the energy consumption. This result is accomplished in some places by the installation of coasting clocks and a bonus system with its direct expense and additional clerical work. All the different tests described in previous articles and several others besides show conclusively that as far as net efficiency is concerned the regenerative equipment is almost independent of the personal element of the driver. All of the expense to induce economical handling of standard equipments would thus be saved.

The regenerative equipment also eliminates to a great extent the habit that a good many motormen have of applying the brakes before the supply of energy is cut off. It saves the constant banging of controllers "on and off"

in congested traffic. It is often sufficient for the motorman to step back one, two or more notches as may be found necessary. The motorman is enabled to "feel his way," and there is no unnecessary movement of the controller. Moreover, regeneration makes the car practically secure from runaway accidents on down grades as the regenerative braking is automatically "non-skidding."

With the control in one hand instead of two the chances for accidents are considerably lessened, for the motorman has only one thing to think about, one thing to do.

Regeneration also brings with it an advantage the importance of which is increasing as the necessity for very frequent service is becoming felt on rapid-transit lines. In order to cut down the time between stations to the minimum the train should accelerate at the maximum rate allowable without discomfort to the passengers until such a time as, retarding at the maximum rate, the vehicle will be brought to a stop at the next point. If the equipment is not capable of such a high speed as this would necessitate, the next best plan would be to accelerate at the maximum rate to the maximum speed of which the equipment is capable and then run at the maximum speed constantly until a point from which, braking at the maximum rate, the vehicle will be stopped at the desired place. This means that all of the kinetic energy has to be wasted at the brakes; the more these conditions are approached the more inefficient is the standard equipment as compared with the regenerative.

Since, according to present practice, a considerable amount of coasting is being done, it follows that with a regenerative equipment a decidedly higher schedule speed can be maintained without any greater net energy expenditure, so that, besides the saving in energy over the standard equipment, the regenerative equipment is inherently capable of improving the service, the value of which capability it is difficult to express in dollars and cents.

On underground roads the regenerative equipment should be of special value in eliminating almost entirely the dust caused by the brakes and also the heat caused by the dissipation of kinetic and potential energy at the brakes

SUBSTITUTION.

The commercial value of the substitution of regenerative equipments in place of existing standard equipment depends on circumstances to a considerable degree. There may be conditions, such as the urgent necessity of extension or of improved service without corresponding increase in equipment of the generating station, under which a substitution of equipments would be unusually valuable since an extension of the generating station would thereby be avoided. There might be other conditions, such as the extension of a line where the feeders are too small and where by the use of regenerative equipment the old feeders will be of ample size. Many other possibilities exist whereby the value of such substitution would be enhanced. However, it may suffice to take under consideration only an ordinary case.

In a previous article the cost of substitution of a regenerative equipment of the size used at Norwich was found to be $1,446. A very important question arises here, namely, what part of the new investment should be charged against the saving in energy and maintenance brought about by the substitution? The old equipments had depreciated to a certain extent before they were scrapped and to that extent they should have contributed to a sinking fund for the ultimate replacement of the worn-out equipments. The sinking fund should, therefore, contribute to the cost of substitution to the extent of the value of the depreciation or by the amount to which a yearly 4 per cent contribution on the original cost of the old equipment would have accumulated if placed at compound interest up to the time of the substitution.

Say that the cost of the old equipment was $1,100 and that $44 had to be set aside yearly at 4 per cent interest representing the depreciation, and that the old equipme had been in use eight years, the sinking fund would amou to $405, and thus the present value of the depreciat equipment to be replaced is in reality $405 less than original cost, and hence only $1,041 should be consider a new investment, interest on which would be chargeal against the saving.

The balance for the substitution of a regenerative equi ment in place of an eight-year-old standard would th be as follows, using the same figures as to yearly ener consumption, cost of energy, etc., as existed at Norwich:

Saving in energy	$142.50	
Saving in maintenance	13.00	
Interest at 6 per cent on $1,041		$62
Depreciation at 4 per cent on $405		16
	$155.50	$78
Balance		$76

For the reasons stated in the case of a new installati these figures, if modified to correspond to average con tions in this country, would change the balance to appro mately the following form:

Saving in energy	$290.00	
Saving in maintenance	26.00	
Interest		$9[illegible]
Depreciation		2[illegible]
	$316.00	$118
Balance		$19[illegible]

Thus in case the old equipment has been in use for ei years the substitution would have a commercial value favor of it of $200 per car per annum in addition to many other advantages touched upon above.

Do not the above figures indicate that regeneratior worth while? Would not many a time $200 per car annum make the difference between success and failure a traction enterprise? And would not $200 per car annum quite handsomely increase the net profits of th enterprises fortunate enough to earn any? Then should regeneration be allowed to lie dormant?

DOUBLING CAPACITY OF EARLY TURBINE PLA AT DUBUQUE, IOWA.

Several interesting considerations are involved machinery additions now being made to the steam-tur plant of the Union Electric Company of Dubuque, Io This station was completed in 1904 and was planned six 500-kw vertical turbine-generators, four of which installed. The company is now more than doubling plant capacity, however, by the installation of a 250 six-stage horizontal Curtis turbine, set in the space prov for the two 500-kw machines. The consumption guarar for the new unit, approximating 16 lb. of steam per hour, show such a significant gain over the perform of the older and smaller machines that the same b er equipment will be ample to supply all of the expected mercial-load development of the next year. This incr will be rapid, as the Union company is taking on sev new large industrial consumers, notable among them new factory of the Brunswick-Balke-Collender Compan

The experience at the Dubuque station also points some of the objections to building too well for the fu As above noted, it was originally intended to inst:

ıture fifth and sixth 500-kw vertical turbine in this plant, ıd foundations for these units were placed at the time the ant was built. To accommodate the new 2500-kw hori-ntal unit it has therefore been necessary to cut away ıese foundations, whose reinforced-concrete construction akes this a laborious process.

To supply 500-volt direct-current for the city railway a 2300-volt synchronous motor-generator set, running 514 r.p.m., is also being placed. While the interpole-nerator element is rated at only 750 kw, a nominal 1130-v motor has been chosen to drive it, so that the leading ırrent taken by this unit when operating with over-excited fields will help to improve the station power plant. The plant is located at a point nearly opposite the center of the railway and lighting load. The position occupied by Dubuque at the foot of the river bluffs makes the city area very long and narrow in outline, and the generating station is about 3000 ft. east of the center of gravity of this area.

Mr. L. D. Mathes is general manager of the Dubuque Electric Company, Mr. H. G. Gorr is superintendent, and Mr. R. P. Vivian is chief engineer. Sargent & Lundy, Chicago, are supervising the installation of the new turbine apparatus, and Woodmansee, Davidson & Sessions have charge of the motor-generator and switchboard additions.

Central Station
Management, Policies and Commercial Methods

CENTRAL STATION MONTHLY FOR CINCINNATI.

Beginning with November the Cincinnati Union Gas & ..tric Company will issue a monthly publication of in-..st to its present and prospective customers. Although e embryo magazine is yet without a name, in size it will about the same as the New York *Edison Monthly,* and ll contain forty-eight pages. The initial issue will be ..o, among the gas and electric customers of the com-.., all of whose gas consumers are considered good ..trical "prospects."

THRESHING BY MEANS OF ELECTRICITY.

..twithstanding the great advancement effected through ..agency of the steam threshing machine, the applica-.. of motors to these machines has demonstrated that ..tricity is much more efficient and economical than steam .. this purpose. On a Miami Valley farm owned by ..iam Stroop a motor-driven threshing machine was ..rimented with in connection with a crop of winter ..ey. There were 34 acres of barley, averaging 50 ..els an acre, and the average amount of grain threshed .. hour while the machine was in operation was 150 ..els. The total yield of the crop was 1700 bushels. ..team-driven engine with a 33-in. Peerless separator .. brought to the farm to do the work, but, inasmuch .. Mr. Stroop had been using an electric motor about his .. buildings for cutting and grinding feed, sawing ..l, etc., it was suggested that the motor be employed ..ead of the engine. Mr. Stroop's farm is connected .. the high-tension lines of the Dayton Light & Power ..pany, Dayton, Ohio, and the motor, which is shifted to ..us position as desired, is rated at 15 hp. A test was .. while the motor was operating the threshing outfit, ..ı demonstrated that it was drawing 20.5 kw. The ..l consumption of energy during the process of thresh-.. the 1700 bushels of barley was 220 kw-hours.

ADVERTISING CLIMATE BY ELECTRICITY.

..lectricity appears to have found a new sphere of use-..ness in the exhibit room of the Los Angeles (Cal.) ..mber of Commerce, in connection with the advertising .. climatic advantages in southern California. In order .. impress the tourist with the moderate temperature ..nges found in the lower portion of the State, a bulletin ..rd has been fitted with a thermometric scale, the steps .. 10 deg. Fahr. being emphasized by 2-cp incandescent ..ps. On the left side of the thermometric scale is an adjustable hand pointer carrying nine miniature incandescent lamps of about ¼-cp rating each, with red bulbs, and on the other side is a corresponding hand pointer equipped with blue lamps. Above the scale an electrically illuminated sign descants upon the charms of climate at San Diego, the highest temperature for the preceding day and the lowest temperature reading for the current date being shown by the electrically lighted hands below. The bulletin is about 7 ft. high by 30 in. wide and, in electrically emphasizing the point that San Diego has the shortest thermometer in the United States, it attracts much notice. The lamps are supplied by local central-station energy.

SUCCESSFUL HOUSE-WIRING CAMPAIGN IN WICHITA, KAN.

During a recent sixty-day house-wiring campaign conducted by the Kansas Gas & Electric Company 400 new contracts were closed. In the course of the campaign, which actually comprised only fifty-two working days, advertisements were carried in the local papers describing three special house-wiring propositions, for which the company arranged with the local contractors. The customer signed an agreement in favor of the company, promising to pay the amount in twelve equal instalments, without interest. These installations were estimated at the lowest possible rates and the company paid the contractors cash as soon as the consumer accepted the wiring and signed the agreement in favor of the company. In addition to the 400 contracts closed at least 100 other prospective customers were stirred to the point of applying for service.

Four salesmen were employed for forty-five days and three for the entire campaign. For each 100 contracts closed by a salesman the company paid a bonus of $25. At a conservative estimate this campaign will increase the company's gross income about $7,200 per year, or an average of about $18 per year per customer, not counting revenue on appliances sold.

The campaign has increased the appliance output very materially, the sales including 154 irons, ten washing machines, four vacuum cleaners, nineteen toasters, two percolators, three curling irons, one shaving mug and two sewing-machine motors; in addition there were placed on trial ninety-eight irons, six washing machines, two vacuum cleaners and six toasters. The record has been 90 per cent of sales on all trial orders.

Figuring advertising, soliciting and all expenses of securing the forty new contracts and selling and placing on trial the appliances, it cost the company $3.12 for each new customer. The campaign was in charge of Mr. Malcolm A. Smith, sales agent. Mr. H. S. Sladen is manager of the company.

MAKING MONEY OUT OF A BRICK WALL.

The value of an exposed brick wall surface as a means of central-station publicity is illustrated unusually well in the case of the Pacific Gas & Electric Company and its affiliated organization, the San Francisco Gas & Electric Company, occupying a modern office building near the center of the city's business area. The south wall of the building faces a vacant lot bordering on Sutter and Powell Streets, and recently the company's officers decided to turn the space to account for the purpose of acquainting the public with the magnitude and resources of the generating and distributing systems, the latter covering an area of 32,431 sq. miles and representing probably the largest single transmission enterprise in the world. The wall of the building is now occupied with a map of California showing in colors all important localities and physical features of the State, transmission lines, railways and waterways, and bearing the legend that the map illustrates the largest distribution system existing for electric light and power service. Above the map are four signs stating that the organizations are pioneers in hydroelectric development in California; that mining, manufacturing, irrigation, reclamation, transportation and all other industries are furnished with energy at the lowest rates; that power experts are at the service of the public without cost, and that the organization now employs 3500 people, operates fourteen power houses, eighteen gas plants and supplies 235,000 consumers in 209 cities and towns. Statistics are given below the map of the area served and the population tributary to the system, and near the ground are given the decreasing prices of gas for the last eleven years The map and supplementary signs occupy seven stories and are about 50 ft. wide. Officers of the commercial department state that the success attained by thus utilizing this otherwise barren wall has been little short of remarkable.

NEW SCHEDULE OF RATES FOR ST. LOUIS.

Effective on the first meter reading after Oct. 20, the Union Electric Light & Power Company, of St. Louis, announces a radical revision in rates for electrical energy. The new primary rate for residence lighting is 11 cents a kw-hour, instead of 12 cents, and in addition there is a secondary rate of 6 cents a kw-hour for all energy used in excess of that paid for at the primary rate.

This announcement of the new rates of the company, made Oct. 15, follows the decision of the Public Service Commission of St. Louis that the central-station rate for electrical energy in that city shall be a flat rate of 9½ cents. The company declares that its new rates of 11 cents and 6 cents will work out lower for the average residence than a flat rate of 9½ cents, and the commission's ruling will be contested in the courts.

"ACTIVE ROOM" PLAN OF RESIDENCE CHARGING.

In residences the primary rate of 11 cents applies to the first 4 kw-hours consumed per month for each of the first four "active rooms" of the house or apartment. All rooms except three bedrooms, bathrooms, basement, garret, closets and porches shall be counted as "active." The primary rate of 11 cents also applies to the first 2½ kw-hours consumed each month for each of the "active rooms," in addition to the first four. The secondary charge of 6 cents a kw-hour applies for all energy used in excess of that paid for at the primary rate in all rooms which are counted as "active." The monthly minimum shall be $1, and a discount of 5 per cent is allowed for prompt payment.

An average eight-room house may consist of a living room, dining-room, reception hall, kitchen and four bedrooms. The old rate, based on a consumption of 35 kw-hours per month at 12 cents, would be $4.20; deducting 5 per cent leaves $3.99 as the net monthly bill, or at the rat of 11.4 cents per kw-hour. The new rate for such a hous it is asserted, would be something like this:

First 4 kw-hours for first four active rooms, 16 kw-hours at 11 cents..	$1.7
One active room, first 2½ kw-hours at 11 cents....................	.
Excess 16½ kw hours at 6 cents........................	.
Total	$3
Less 5 per cent..	.
	$2

Thus the average net rate for the 35 kw-hours consum under the new system of charging would be 8.2 cents. is expected that the establishment of the low seconda rate will make attractive the use of electrical convenienc such as toasters, flatirons, radiators, electric cooki devices, etc.

COMMERCIAL LIGHTING.

For commercial lighting the new schedule provides for demand charge (paid in equal monthly instalments) $42 a year for each kilowatt of demand of the first 20 k $30 a year for each kilowatt of the next 40 kw, and $24 year for each kilowatt of demand in excess of 60 kw. addition there is an energy charge of 5 cents a kw-hour f the first 1000 kw-hours used during the month, 3 cents f the next 5000 kw-hours and 1½ cents a kw-hour for energy consumed in the month in excess of 6000 kw-hou

"Demand charge" is defined as a charge for the co sumer's greatest requirement of energy for any continuo period of 15 minutes. "Energy charge" is defined as charge for electricity consumed as shown by the mete The maximum rate of charge for service during any mo in an installation having a demand of less than 30 kw sh be not greater than 11 cents a kw-hour, with a minim bill of $1. Both for commercial lighting and in residen the rates given include free lamp renewals of stand carbon lamps. In commercial lighting a deduction of cent per kw-hour is optional in the case of customers h ing demands of 30 kw and more who desire to furn their own lamp renewals.

INDUSTRIAL SERVICE.

In the case of power service the rates given for c mercial lighting apply with a deduction of ½ cent a l hour where the service is used for the operation of mot and where the demand is 30 kw or more. The dem upon which the monthly demand charge is based shall ne be less than 75 per cent of the maximum demand occurr at any time during previous months of the contract un which service is furnished. An alternative power r which may be selected at the option of the customer, is p vided as follows: 10 cents a kw-hour for the first 100 ho during the month, 8 cents for the next 100 kw-hour cents for the next 100 kw-hours, 4 cents for the next kw-hours, and 3 cents a kw-hour for all energy used excess of 600 kw-hours during the month.

DETERMINATION OF DEMAND.

In the application of the rates the consumers' dem shall be determined by assessment or measurement follows:

Commercial Lighting Service.—(1) In installations 2 kw connected or less demand shall be determined as per cent of all display lighting; 100 per cent of the first watts connected, plus 66⅔ per cent of the connected l d. in addition to the first 300 watts of the entire illuminat exclusive of display lighting, except where tests indi the demand to be larger than that computed on this b (2) In installations greater than 2 kw connected the mand shall be measured.

Motor Service.—The demand of the consumer using company's service for motors shall be determined as maximum rate at which energy is used for any contin period of 15 minutes as shown by watt-hour meter.

The rates given apply on yearly contract. For sumers obtaining service for a period of less than a

ie charge for such electric service shall be 11 cents a w-hour, with minimum monthly bill of $1. In this case e consumer shall pay the cost of connection and disconection and installation and removal of meters. In case ie consumer's gross bill for the period is $50 or more the ieter charge and connection and disconnection charge hall be refunded when service is discontinued. The disunt for prompt payment is 5 per cent on the first $25 of ll bills; on amounts in excess of that the discount is 1 er cent.

UNIQUE PLAN OF CINCINNATI'S NEW RATE SCHEDULE.

The new schedule of rates for electric service from the ues of the Union Gas & Electric Company, of Cincinnati, hich went into effect Oct. 15, embodies a number of er advanced points in central-station relations with public.

the first place, the printed schedules of the company, statements of all conditions, riders, etc., and general rmation to customers, are arranged in booklet form, which is bound the customer's duplicate of his cont, the original being kept by the company. This thirty-page schedule booklet is of standard document size, by 9 in., so that it can be filed if desired. With a gle motion in this way the company places in permanent in the consumer's hands both its contract and rule , inviting the fullest study of its rates to all its cusrs and insuring that the rule book will be preserved the care given the contract.

rvice under the new rate schedule is divided into eight es, lettered A to H, limiting which are fourteen stand-"riders" or clauses, which are noted down and agreed the contract blank and fully explained on the following pages of the booklet.

general the new Cincinnati schedule involves a small sion downward of the former rates. A monthly "maince and inspection charge" of $1 per kilowatt of light-demand and 75 cents per horse-power of motor de-l is now made with the approval of the Public Service mission, this charge being waived when the monthly based on the kw-hours consumed, exceeds its amount. residence lighting 70 per cent and for business houses er cent of the connected load is taken as the demand. motor demand ratio ranges from 90 per cent under to 55 per cent over 100 hp, all elevator motors being iated at 60 per cent of their rating. Five per cent unt on all bills is allowed for payment within five days ite rendered.

chedule A, relating to residence lighting, is based eny on the equivalent hours' use of the maximum de-l, and involves a graduated number of successive steps, ding a premium to the long-hour user. It is expressed illows:

[illegible]	[illegible]	40	[illegible]	60	[illegible]	120	[illegible]	180	210	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	9.25	[illegible]	[illegible]	7.00	[illegible]	5.80	5.50	5.29	5.12	5.00	4.90

en cents per kw-hour is charged for all below thirty rs' use of the maximum, and in application inter-iate quantities are found by interpolation. For the of the accounting staff tables have been worked out, ng those intermediate figures directly. Bills showing ty hours' use of the maximum are allowed 10 per cent ount, plus a discount of one-tenth of 1 per cent for h dollar in excess of $10. Small motors, domestic heat-appliances, etc., are not considered in estimating the ximum-demand element of the bill.

Schedule B applies to commercial lighting. Starting at 10 cents the rate reduces to 4.9 cents, as under Schedule A. Where the total consumption exceeds 1500 kw-hours in any month the charge will be made on the basis of the wholesale schedule, E.

Schedule C relates to patroled advertising lighting, including lamp renewals, etc., the signs being illuminated from dusk to midnight every night in the year.

RATES IN CENTS PER LAMP PER MONTH.

Number of Lamps in Installation.	[illegible] C.P. LAMPS. Regular Rates.		FLASHER [illegible] RATE. Lamps dark from 25% to 40% of lighting period.		Lamps dark for 50% and over lighting period.		[illegible] C.P. LAMPS. Regular Rates.	FLASHER [illegible] RATE. Lamps dark from 25% to 40% lighting period.	Lamps dark for 50% and over lighting period.
	Car.	Tung.	Car.	Tung.	Car.	Tung.	[illegible]	Carbon.	Carbon.
[illegible]– 50	26	22	23	20	18	18	18	[illegible]	[illegible]
51– 100	26	20	23	19	18	18	[illegible]	[illegible]	[illegible]
101– 200	23	19	20	17	16	16	16	14	[illegible]
201– 300	20	17	17	16	14	14	[illegible]	[illegible]	[illegible]
301– 400	18	16	15	14	12	12	12	[illegible]	[illegible]
401– 500	17	[illegible]	14	[illegible]	11	11	[illegible]	[illegible]	[illegible]
501– 800	16	12	13	11	10	10	[illegible]	[illegible]	[illegible]
801–1000	15	10	13	9½	10	[illegible]	[illegible]	[illegible]	[illegible]
1001–2000	14	9½	12	9	9½	8½	[illegible]	[illegible]	[illegible]
Over 2000	13	9	11	8½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Under Schedule D the company installs and operates private tungsten curb-posts, $7 for each post having five 60-watt lamps, or $6.25 for each post containing one 250-watt lamp, being the monthly rate for dusk-to-midnight service. Series arc lamps operated all night long cost $5 per month in the underground district and $5 in the overhead section.

In arranging Schedules E and H for wholesale lighting and motor service a premium has been placed upon long-hour use rather than quantity consumed. The published wholesale lighting schedule ranges from the ordinance rate of 10 cents down to 1.88 cents per kw-hour for a consumption of 50,000 kw-hours used during 300 hours' equivalent. Schedule H similarly ranges from 9.02 cents for 1000 kw-hours at thirty hours' use down to 1.50 cents per kw-hour for 50,000 kw-hours at 300 hours' use.

Schedule F, for retail "power" (consumption under 1500 kw per month), is as follows, with the same discounts as Schedules A and B:

[illegible] hours' use of maximum demand....	30	40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cents per kw.-hour	10.00	9.00	[illegible]	[illegible]	[illegible]	6.33	5.50	5.00	4.67	4.43	4.25	[illegible]

Schedule G, for private garages, allows the "power" rate with a demand factor of 60 per cent of the capacity of outlets. For public garages a further discount of 10 per cent is allowed for off-peak restrictions during the winter months.

The standard "riders," which are noted on the contract and agreed to, relate to matters of auxiliary service, with and without off-peak restrictions; summer service; annual cut-out; service not including winter months; fans; temporary service; termination by sale or lease; old and new buildings; receiverships; weekly payment; tenant's own meters; total consumption of several meters and lighting from power circuits. In arranging this schedule and its limitations by "riders," which can be referred to easily by number, the effort has been to make clear to each cus-

tomer interested what any other customer pays for his service.

The closing pages of the booklet include the local electrical regulations and information for customers on matters of equipment, complaints, meter reading, wiring, etc., with examples applying the new schedules.

Mr. Rollin W. White has been acting president of the Cincinnati Union Gas & Electric Company, and Mr. J. W. Lyon is commercial manager of the electrical department.

Wiring and Illumination

A RECORD RUN OF A RECTIFIER TUBE.

One of the rectifier tubes in the Louisville (Ky.) magnetite street-lighting service recently brought to a close its extraordinary life of 7176 hours and 23 minutes in actual operation. This tube was started May 30, 1909, and taken out of service Feb. 17, 1911. During these 627 days the arc circuits were in operation 7919 hours, but, as the rectifiers are given a preliminary run of fifteen minutes each day, this particular tube was in use a total of 7176 hours. The rectifier tubes in service at Louisville ordinarily average lives of 700 hours to 800 hours each, being guaranteed for 500 hours. Louisville's equipment of magnetite arc lamps was the first large installation put into service. Nearly 2600 of these 4-amp lamps are in use there, supplied by rectifier outfits of the air-cooled type originally furnished.

COST OF LAMP CLEANING IN A LARGE ESTABLISHMENT.

A large office and mercantile establishment having many hundreds of artificial lighting units of various types has among other systems one of indirect lighting using units consisting of tungsten lamps of the 150-watt size in one-piece corrugated mirror reflectors. The cost of cleaning these lamps and reflectors in the ordinary routine of the place is 2.6 cents per unit.

Tests made on an office lighted in this way showed the reduction of 72 per cent in illumination due to dirt on lamps and reflectors after four months without cleaning. From these figures it is easily to be estimated that at any ordinary cost of electrical energy cleaning once a month would be justified by the saving in light involved. This test was made in offices located in a residence and manufacturing district of a large Western city and represents neither the very worst nor the very best condition encountered in cities where soft coal is extensively used. If more large concerns would carefully analyze the cost of cleaning and the cost of light lost by dirt on lamps and reflectors it is very probable that more frequent cleaning than is now common would be the rule.

EFFECT OF REFLECTION FROM FLOORS.

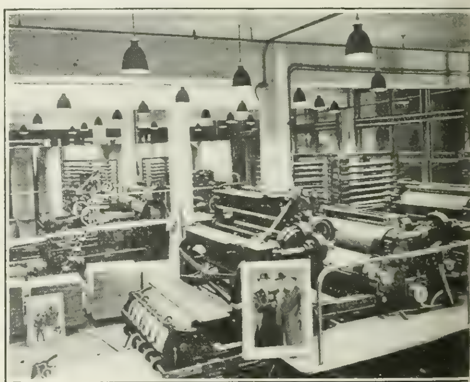
By J. R. Cravath.

The important effect of reflection from ceilings and walls is now fully recognized in illumination design, but the effect of reflection from the floors is commonly ignored. That such reflection is an important factor was plainly shown by the results of tests presented to the convention of the Illuminating Engineering Society in 1908 by Messrs. V. R. Lansingh and T. W. Rolph. The tests recorded in that paper, however, proved that the color of the floor has less effect on the illumination of a given horizontal plane than has the color of the ceiling or walls. This might be expected from a theoretical consideration of the subject.

Probably the reason that reflection from floors and differences in illumination effect with floors of different colors has been generally ignored is that it is frequently difficult to know in advance what the color of the floor will be in actual use. In many cases even if the floor is light in color at the start it will soon become darker with use, and hence a dark floor is assumed initially.

The writer has in mind a certain large ballroom in Chicago where the effect is totally different when the light natural finish of the wood on the ballroom floor is covered with dark canvas. This room is used at times as an audience room, and the dark floor cover is laid for such occasions. With the light floor the illumination of faces is remarkably good. With the dark floor covering there is a decided decrease in the illumination from below, and faces appear much darker. The walls are poor reflectors.

Another interesting case of reflection from below is to be found in dining-rooms which are lighted with a heavy art-glass dome over the table, there being no other source of light. It has been frequently noticed that such rooms appear very well lighted when there is a white tablecloth



Illumination of Ceiling by Reflection.

on the table, but the illumination of the room is much le[ss] when the cloth is removed.

The most striking illustration of the effect of reflecti[on] from below on the illumination of a room which has co[me] under the writer's notice is illustrated in the accompanyi[ng] photograph of a section of the printing department [of] Sears, Roebuck & Company's plant in Chicago. In th[is] case all of the lighting is by opaque reflectors of the de[ep] beehive type, each consisting of one piece of corrugat[ed] mirrored glass. The remarkable thing about this install[a]tion is the amount of light on the ceiling, in spite of t[he] fact that opaque reflectors are used. The photograph w[as] taken by artificial light and has not been retouched. T[he] illumination of the ceiling is, of course, obtained by [re]flection from the light-colored floors and from the lar[ge] quantities of paper stacked up about the presses. T[he] effect is altogether much more cheerful than one wo[uld] expect for an installation where all the light is obtain[ed] from deep opaque reflectors.

The physical efficiency of an installation of this kind [is] very high because the light on the working plane [is] obtained principally from the lamps themselves and fr[om] very efficient reflectors. On account of the high efficie[ncy] of such installations they will always find considerable u[se], especially in places where there is considerable dirt, as [in] various industrial establishments. As far as the shad[ing] of the lamps from the eye is concerned these deep reflect[ors] go about as far as is practicable with any direct system [of]

[li]ghting. As to efficiency and shading of lamps, therefore, [a]n installation of this kind is good. The chief objection [to] it is the fact that most of the light at any given point is [re]ceived from one light source. This means poor diffu[sio]n and unidirectional light, which cannot fail to result in [mo]re annoying glare from the paper and polished metal [o]f the presses than with a system where the diffusion of [li]ght is better and light is received from many directions [at] any given point.

The system under discussion was selected by the em[pl]oyees as the most satisfactory after trying several sys[te]ms. Under the conditions of the trial, however, it would [be] difficult to say how much the judgment of the employees [wa]s influenced by the higher intensity of illumination [ob]tained with this system as compared with the others. [Ho]wever, the watt consumption of the present system is [le]ss than those of the others tried in competition with it, [w]hich gave better diffusion. The annoyance caused to [wo]rkmen by glare from paper and presses is doubtless less [th]an would be caused by glare from papers and desks in [ge]neral office work.

In the installation illustrated the lamps are 12 ft. 7 in. [ab]ove the floor and the ceiling is 16 ft. high. The ceilings [an]d walls are white, except that the walls are painted black [to] a distance of 6 ft. above the floor. The bays are 16 ft. [by] 20 ft., and each bay contains five lamps, one in the center [of] the bay and one in the center of each of the four [qu]arters of the bay. No measurements have been made [of] the efficiency to determine the percentage of lumens gen[er]ated which reached the working plane. It is known, [ho]wever, that the illumination is from 3.5 ft.-candles to [?] ft.-candles.

[D]ECORATIVE STREET LIGHTING AT HAMILTON, OHIO.

[H]amilton, Ohio, is still congratulating its merchants on t[he] acquisition of a handsome new downtown decorative l[ig]hting scheme installed by the city and operated at the e[x]pense of the adjacent tenants and business houses. [Ab]out sixty of the posts are installed, most of them on

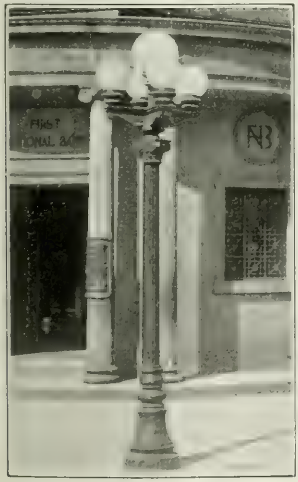


Fig. 1—Type of Tungsten Post Used at Hamilton, Ohio.

[H]i[g]h Street, the main business thoroughfare. The stand[a]r[ds] are of Corinthian design, and each carries five 60-watt [t]ungstens inclosed in frosted globes, all lamps turned up[w]ard and at a height of about 10 ft. from the sidewalk, securing a very even distribution on the street surface. The cost of installing the standards, about $80 each, was defrayed out of the city funds, and for the operation of the lamps the abutting property owners or tenants are

Fig. 2—Tungsten Standards at Hamilton, Ohio.

assessed $1 per front foot per year. This amount is collected by the municipal lighting plant in twelve monthly payments. The local Commercial Club has been behind the project of Hamilton's decorative lighting and has secured the co-operation of the merchants. Later it is probable that the operation of the downtown lighting will be taken over by the city as part of the regular street light

Fig. 3—Night View of Hamilton Decorative Lighting.

ing. This decorative lighting, together with a large part of the local commercial and residence lighting, is done by the Hamilton municipal plant, of which Mr. J. O'Toole is superintendent.

RECENT TELEPHONE PATENTS.

SAFETY CROSSING.

Where high-tension energy-transmission wires cross telephone or similar lines some special safety measure must be provided to prevent accidental contact. Special cradles have been used to a large extent, the cradles being hung parallel to and beneath the uppermost of the lines. Mr. C. J. Elliott, of Oxnard, Ontario, Canada, has devised and patented a different sort of protective means for those cases where the transmission wires are above. He provides a metallic ring to surround each high-tension wire. This ring is supported from the cross-arm at some distance out along the span. Each ring is connected to a wire at a different potential from the one it surrounds. If any wire break and slacken it comes in contact with its ring and burns off, the dead section thus formed dropping to the ground.

PRIVATE EXCHANGE SYSTEM.

Mr. A. D. T. Libbey, of Elyria, Ohio, has patented a combined intercommunicating and private exchange system, his patent being assigned to the Dean Electric Company. A key set is provided for each station and by this means any station may select and call any other. One key at each station is connected to a central office line and one station is chosen and equipped as a call-receiving station. This station is provided with a switch which enables the trunk or exchange line to be held while a call is being extended to the desired station. The answering of the desired station automatically releases the holding switch.

SWITCHBOARD CIRCUIT.

A switchboard with a universal cord circuit forms the subject of a patent granted to Messrs. C. S. Winston and E. H. Rupe, of Chicago. It is intended to terminate both magneto local-battery and common-battery lines upon this switchboard and the cord circuit is automatically adapted to suit whichever type of line it happens to be associated with. The Kellogg Switchboard & Supply Company has obtained this patent through assignment.

MOUTHPIECE.

A mouthpiece for transmitters patented by Mr. P. B. Clarke, of Liverpool, England, is designed to contact with the face of the user to prevent the escape of sound. The edge of the mouthpiece is shaped specially and carries a flexible strip. The walls of the mouthpiece are double, the intervening space being filled with fibrous material, a non-conductor of sound.

SELECTIVE RINGER.

A ringer for selective signaling is described in Mr. H. L. Johnson's patent. A ringer of the usual polarized type is provided with a third core parallel to the main cores. This carries a pole-piece in position to affect the polarity of the main cores. It carries an attachment to the yoke of the magnet and a magnetizing coil. This coil is connected either to the same side of the line as the ringer or to the opposite side, as the case may be, and by applying direct current to the line simultaneously with the alternating ringing current the auxiliary pole either opposes or assists the ringer action in a manner to permit selection.

METHOD OF WIRING.

With automatic apparatus each set of trunks between the various selectors must be of sufficiently large number to provide for the busiest moment. Thus the first trunks of a group are continuously busy, while the last are engaged only at rare intervals. To right this and to reduce the total number of trunks the selectors of any stage may be divided into groups and then the trunks may be connected to different groups in different sequence, some trunks skipping some groups altogether. Mr. E. A. Gray, of Boston, has patented this wiring system and assigned his patent to the American Telephone & Telegraph Company.

Letters to the Editor.

The Central Station and the Electric Vehicle.

To the Editor of Electrical World:

Sir:—From the editorial in your issue of Oct. 14 commenting on the recent convention of the Electric Vehicle Association of America I am very sorry to get the impression that there seems to exist an idea that in some mysterious way, and not altogether to their own interest, the central stations of the country are being expected to "pull the chestnuts" from the fire for the benefit of other industries interested in the present and future of the electric vehicle. The *Electrical World* is the beacon light of the electrical interests of the country, and whoever else may have a misconception on this subject, it is particularly to be deplored in that periodical.

It is perfectly true that just at present the central st tions are showing a very extraordinary and very able tivity in introducing and spreading the use of the elect vehicle. This is true, partly, because the introduction the electric vehicle means a more continuous profit to t central station than to anyone else at interest.

A recent authentic report states that if electric ener were used to deliver all the railway freight now deliver by teams in Boston 76,500 kw-hours a day would be quired; at 5 cents a kw-hour this would mean an increas revenue of over $1,100,000 a year to the source of ene supply for service at least 60 per cent of which is rende during the off-peak period. It would be very hard to f any proportionate beneficiary in any other division of dustries interested in the electrical vehicle.

Another excellent reason why the central station ou to be, and is (much to the credit of its foresight), in forefront of the work of introduction of the elect vehicle is that of all the allied interests it is best situa to meet the conditions as they are at this particular ment. For practical purposes the engineering probl are solved. The progress of introduction depends on conversion of the teamster and team owner. The strong local electric-vehicle interest that comes in contact v this class is the central station, and frequently, and usu in a judicial attitude. And don't imagine for a mon that the other electric-vehicle interests have not borne t share of the burden. It is extremely doubtful if the cen stations, with all their power, could have been of conspicuous service until the last three or four years. problems to be solved were not the kind to which could conveniently and profitably set their hands. It n no political economist, or even an experienced busi man, to know that every electric-vehicle manufacturer manufacturer of storage batteries or motors, who had foresight and courage to attack the problem during last fifteen years has been absolutely compelled to s every cent he could rake and scrape together and e foot-pound of effort he could spare, to do that missio work which would alone tend to precipitate the ger introduction of his product in time to justify his att at all.

Your reference to the sore need of operating dat hard to account for. Of reliable operating data the information by the ream. Successive collectors and pilers of operating data have been successfully and w fully confirming each other for at least five or six y and will continue to do so as long as each successiv trant into the work is perfectly satisfied that he is pioneer."

It is true that at the convention there were "bl given and "blows" taken between the representativ the manufacturers and the representatives of the ce stations, but it didn't take a keen observer to see tha majority of them were more than half in the spir banter. It took no experienced eye to see that the vention as a whole was not interested in the always search for scapegoats for the past.

Now, the Electric Vehicle Association of America extraordinarily harmonious organization; the co-ope therein is as fine as in any trade association I have been acquainted with. The sole reason why the c stations appear to-day to be bearing the brunt o battle is because the nature of the fight makes it turn"; they are the most qualified to make the gr headway at this particular moment, but this does not any relaxation of effort on the part of others—in fac they cannot relax and live.

Cleveland, Ohio. Hayden Ea s.

[The lack of harmony on which we commented is ural in the first stages of co-operation of commercial in ests as diverse as those concerned in exploiting the ectric vehicle, and will, we hope, in time give way to team

vrk." As to operating data, our remarks referred more p'ticularly to the lack of published data of an authoritive nature readily available for reference, and relating n only to the electric vehicle, but also to the comparative c t of horse transportation. We quite agree with our c respondent that the progress of introduction of the ectric vehicle depends on the conversion of the team oner, but such conversion will in turn depend largely on comparative showings of costs based on data that will [illegible] disinterested.—Ed.]

Vual Acuity as Affected by Pupillary Contraction.

[illegible] of *Electrical World*:

[S]IR:—In the article by M. Luckiesh in your issue of A[illegible] 19, on "Monochromatic Light and Visual Acuity," th author states that he attempted to make his investigati practical, and it is therefore unfortunate that an acuity co[m]parison between the mercury-vapor tube and the tu[n]gsten lamp was not made, as this was what prompted [B]ell's article in the issue of May 11, to which Mr. [Luck]iesh refers. Such an investigation, however, would ha[ve] necessitated employing heterochrome photometry, w[hi]ch Mr. Luckiesh tried to avoid, simplifying his conclusi[on]s. One factor relating to Bell's and Luckiesh's con[clusi]ons is whether the pupil has any bearing on acuity of vi[sio]n.

[Thi]s was called to the attention of Dr. Bell by the writer [in the] issue of June 8, and the following week he replied [that an] artificial pupil was used. Luckiesh, likewise, made [simulta]neous measurements with both eyes. Also observa[tions t]aken with a lens of the pupil indicated no change, [from w]hich he concluded:

[illegible] shows that pupillary contraction is not the ex-[illegible]

[Conc]erning these conclusions that the size of the pupil [has no] bearing on acuity, the writer would like to see fur[ther ev]idence offered before the statement is accepted as a [scienti]fic fact. Many investigators believed that the pupil [has so]me bearing on acuity, as shown by attempts to [elimina]te the pupil as a factor. The practice has been to [vary] the diameter of the pupil with atropine, pilocarpin, [etc. I]n a paper presented before the Boston Section of the [Illumin]ating Engineering Society and printed in the *Trans[actions]* of May, 1909, the writer said:

"[Ha]mmelsheim made a study of the relation of the size [of the] pupil to visual acuity. He varied the diameter of [the pu]pil with homatropin, atropine and pilocarpin. He [found] that the absolute size of the smallest visual angle [increa]ses if the opening of the pupil or of the diaphragm [befo]re it becomes less."

[There] would, therefore, be an objection to using an arti[ficial p]upil, although maybe the use of myotics or mydri[atics m]ight have indirectly produced the results noted.

[We] also find the following from Cobb, in the Johns [Hopkin]s lectures, Vol. II, page 551:

"[Fur]ther, other factors, such as small errors in refrac[tion,] changes in the pupil, will outweigh large changes [in ligh]t intensity. A small diaphragm (say, about 2 mm. [in diamet]er) put before the eye, although at the same time [cuttin]g down the brightness of the retinal image, will [often] increase the distinctness of vision."

[Refe]rring again to the Boston paper:

"[Ha]mmelsheim refers also to Klein, in Paris, 1873, who [also s]tudied the influence of the narrowing of the pupil on acu[ity] of vision."

Shiemer[1] states:

"[Th]e influence of the width of the pupil is extremely [great] with the smaller illuminations. From one meter-candle up keenness increases with narrower pupil. From 50 to 200 candles the difference increases very little."

Messrs. André, Broca and F. Laporte[2] state:

"The contraction of the pupil depends on the intrinsic brightness of the luminous source. The mercury vapor arc, which has a low intrinsic brightness, does not follow the above rule, but causes a very sharp contraction of the pupil."

We find the following in Tscherning[3], which supports Mr. Luckiesh:

"It is not alone the light which strikes the retina of a particular eye, but also that which enters the other eye, which causes contraction (referring to movements of pupil). The pupils are equal in size, even if one eye is exposed to a much stronger light than the other."

This statement, however, should not be construed as implying that Tscherning did not believe that the size of the pupil had any bearing on acuteness of vision, for we also find the following[4]:

"Visual acuity depends directly on the illumination of the chart, but it is quite difficult to determine the relation in a general way, because there are so many different factors which affect it. Thus, the relation must depend on the pupillary size, on the manner in which the pupil contracts under the influence of light, etc."

Where an attempt is made to eliminate the pupil from affecting acuity measurements by using mydriatics and myotics the effect on the accommodation of the eye is such that it probably affects the results. Norris and Oliver[5] state as follows (page 31):

From Snellen.—"If there has been permanent tension of accommodation it gives way under the influence of the mydriatic, and the farthest point of distinct vision moves farther from the eye than it would in simple relation without the aid of such substances." (Page 587.)

"Unlike that of the mydriatics, the action of the myotics does not render the pupil immobile. During the period of diminution of the action of the myotic the range of accommodation is absolutely increased, the influence on the near point being greater at that time than on the far point." 'Objects also appear more strongly illuminated to the atropinized eye than to the fellow eye." (Page 41.)

"To the eye to which the myotic has been applied objects appear much less brightly illuminated than to the other eye."

Regarding readings taken with both eyes simultaneously with a view to eliminating the effect of the pupil, we could conceive of a case where an individual's eyes had been corrected with glasses, both eyes having the same measure of optical perfection, but it is difficult to conceive of how the eyes would possess the same individual fatigue simultaneously, and fatigue plays an important part in our acuity, as can be proved experimentally. With regard to measuring the diameter of the pupil, Luckiesh states that he observed no change. This indicates to the writer a repetition of his early measurements, in which a lens, a mirror and a glass scale were used. It was found that it was difficult to note any decided change in the size of the pupil. Later on apparatus was used, developed by D. H. Rice, the writer's associate at that time. A pair of cross-hairs was used in conjunction with a small concave mirror having a radius of curvature of 2 in. One of the cross-hairs was fixed[6], the other movable. Any movement of the movable cross-hair was magnified by means of a simple lever passing over a scale. A clear image of the pupil resulted, whose variation in size was readily measured. A difficult thing to determine was what criterion to use as the proper size of the pupil to measure, as it kept changing

[1][illegible] zur Physiologie [illegible]

[2][illegible] Société Internationale des Electriciens, June, 1908.
[3]Tscherning, "Physiologic Optics," p. 212.
[4]Tscherning, "Physiologic Optics," pp. 214, 215.
[5]Norris and Oliver, "System of Diseases of the Eye," Vol. 11, p. 31.
[6][illegible] Feb. 25, 1909, [illegible]

continually. Tscherning[7] attributes this movement to action of blood vessels, for he says:

"On examining the pupil with magnifying glasses we observe rhythmic contractions which at least in part correspond to the systole and which are due to the fact that the vessels are continually filling with blood."

It would be quite difficult to use this apparatus and make acuity measurements at the same time unless the test type was made in the form of a lantern slide, as used by Dow[8], and readings of acuity and size of pupil taken simultaneously.

Concerning the use of the flicker photometer, to which Mr. Luckiesh refers, in view of the proof presented by Dr. Woodworth[9], of Columbia University, before the Illuminating Engineering Society, in which three relat brightness curves were shown superimposed, obtained three different optical methods, one of which was a flicl measurement, it is hard to see the need of any furtl proof.

In discussing Mr. Millar's paper on "Heterochroma Photometry"[10] in 1909, before the Illuminating Engine ing Society, the writer called attention to the desirabil of having such proof, and it is interesting two years la to notice this proof forthcoming.

Harrison, N. J. S. W. Ash

[7]Tscherning, "Physiologie Optics," pp. 214, 215.
[8]*Ill. Eng. London*, April, 1909, Vol. II, No. 4, p. 234
[9]*Trans.* Ill. Eng. Society, May, 1911, p. 459.
[10]*Trans.* Ill Eng. Society, Vol. IV, 1909, p. 782

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Polyphase Commutator Motors for Regulating Induction Motors.—A. SCHERBIUS.—An article on the system of Brown, Boveri & Company for regulating the speed of an induction motor by cascade connection of the induction motor and a polyphase commutator motor. The commutator motor has a compensation winding on its stator. Either shunt or series excitation is used as in direct-current machines. The emf's produced are proportional to, and in time-phase with, the fluxes. In the cascade connection the rotor of the induction motor must have a slip emf equal and opposite to the emf impressed on it from the commutator motor—that is, the speed of the induction motor must drop by a corresponding amount. By changing the excitation at will it is possible to provide any number of steps for the speed regulation. Further phase compensation is at once possible. Any number of combinations of the excitation winding may be made and the phase difference between excitation current and rotary emf may thus be adjusted. This is possible with shunt, series or compound excitation. The commutator machine absorbs the energy for regulation as electrical energy and transforms it into mechanical energy, which may be utilized in any number of ways. The total efficiency is therefore quite good. The design of the commutator machine is facilitated by the low frequency. This system may be used to advantage for regulating the use of induction motors for ventilators, blowers, pumps, rolling mills, etc. A special application is the use of the cascade system in connection with a flywheel for equalizing the load in three-phase networks containing winding motors, rolling-mill motors or traction motors with a quickly fluctuating power consumption. The motor is connected at any point in parallel with the network and equalizes the load fluctuations by means of the flywheel. The regulation of the set is accomplished by special relays. The largest commutator machine at present under construction by Brown, Boveri & Company has a rating of 900 kva.—*Elek. Zeit.*, Sept. 14.

Lamps and Lighting.

Gas and Electric Lighting.—K. SCHLESINGER.—The conclusion of his article on the comparative hygienic effects of gas and electric lamps. In the first part he had shown that gas lamps increase the temperature and the humidity, which are both serious hygienic disadvantages, while the electric lamps overcome the small disadvantage of a slight increase of temperature by the advantage of a reduction of humidity. In the present instalment he shows that gas lamps produce obnoxious gaseous products in considerable quantities. Moreover, the ventilating effect of a gas flame, which has been emphasized by gas engineers as a great advantage, is so small that it cannot even remove any considerable fraction of the combustion productions of flame itself. It certainly cannot improve the air, as been claimed by gas engineers. Finally, gas of the qua now used does have less odor than formerly and theref there is a greater danger of poisoning. The author believes that the use of gas may have a detrimental ef on the nervous system.—*Elek. Zeit.*, Sept. 28.

Automatic Transformer Switch for Low-Voltage Me lic-Filament Lamps.—An illustrated description of an hibit at the present Olympia Electrical Exhibition London. It is an automatic transformer switch for us connection with 25-volt or 50-volt installations conne

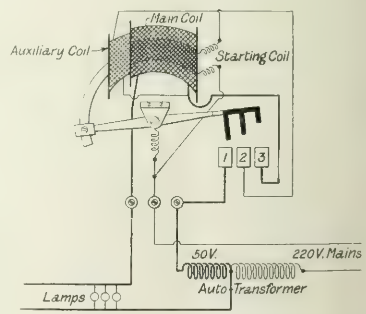


Fig. 1—Diagram of Automatic Transformer Switch.

to 200-220-volt mains through auto-transformers. W no lamps are on, the main circuit of the auto-transfo is open at the mercury cup (see Fig. 1). As soon as lamp is switched on a circuit is established through the marked starting coil and the "auxiliary" coil and "m coil in series and the core is sucked into the coil, ma contacts 1 and 2. This connects the auto-transform the mains at contact 1 and also short-circuits the sta coil at contacts 1 and 2. When a few more lamps a circuit, bringing the current up to 2.2 amp, the core been sucked in further and contact 3 is made, short-ci ing the "auxiliary" coil and leaving only the main o taining coil in circuit. The object of successively s circuiting the first two coils is to diminish the voltage When the lamps are all switched off the arm fal b gravity and the auto-transformer is out of circuit.—up plement to Lond. *Elec. Eng'ing*, Oct. 5.

Leading-In Wires.—A note on a recent British pent (1210, Sept. 28, 1911) of Mr. C. H. Weber. A proces for connecting filaments to the leading-in wires consis in

…dering or welding with the aid of sulphide metal compounds, such as sulphide of tungsten or molybdenum. These can be decomposed at a very low temperature and the fusing operation can take place in the open air instead of in hydrogen.—Lond. *Elec. Eng'ing*, Oct. 5.

…-Phase Incandescent Lamp.—A note on a recent British patent (17,480, Sept. 28, 1911) of Mr. W. G. Huskeeper. In preparing filaments for incandescent lamps the continual heating and cooling that takes place when single-phase currents are used causes the material to break. According to this invention use is made of two-phase currents, so that the current of one phase traverses one-half of the filament while the current from the second phase simultaneously passes through the second half. Since the currents differ 90 deg. in time-phase, one portion of the filament is hottest when the other is coolest, so that expansion and contraction of the parts take place together and the length of the filament remains constant. An autotransformer and lamps are provided in each phase-circuit to regulate the current.—Lond. *Elec. Eng'ing*, Oct. 5.

…ment in Mercury Tubes.—J. H. VINCENT.—A long …ated account of an extended investigation of the …ing luminous effects in mercury tubes: (1) Per… illumination in which a mercury arc increases and …ses in length rhythmically. (2) Periodic illumina… which the arc is intermittent. (3) Persistent illumination in which the arc is of constant length. These are called the necklace, fan and ribbon effects respectively to indicate the appearance observed on viewing the arc in a revolving mirror, the axis of rotation of which is parallel to the tube in which the arc occurs. The author also deals with the emission of a faint bluish-green light from a sphere containing liquid mercury and its vapor and adds …bservations on the phosphorescence of fused quartz. …s. *Mag.*, October.

Generation, Transmission and Distribution.

…ation of Load of Central Stations.—C. SCHMIDT. …athematical paper on load fluctuations due to the …t requirements of different classes of consumers. …thor shows how far the different classes of con… take the energy at more or less different hours …r more or less long periods. He then gives some …ions based on the laws of probability for the …ions of load caused in single branches and dis… …f a distribution network, for the voltage fluctuations … produced, and for the resulting excess of cost of … distribution.—*Elek. Zeit.*, Sept. 14.

…ric Lighting in Strassburg.—A. LOEWE.—An article …ing the excellent results which have been obtained in …rg, Germany, in a systematic campaign for ex… …g central-station service. Upon the advent of the …n lamp the 15-cp unit was adopted to supersede the …r carbon-filament units. The central station pays …t of wiring and installing the first four lamps for …nsumer, the wiring being done by local contractors. …st lamps are installed free of charge to the consumer …ist four consumers in the same house make applica… …the station. For the instalment of the second, third …rth lamps a monthly charge of 6 cents per lamp is …r the first six years. The expense of installing …han four lamps is not paid by the central station. …t of the wiring switches, fuses and meter board …s is charged per month. Each consumer must sign a contract that he will use for six years electrical energy to the amount of at least $4.50 per year. Electric lighting has become very popular with this system and has been introduced even into the smallest houses of workingmen. In January, 1910, the receipts of the central station for lighting were $1,380, and in January, 1911, $5,030—that is, almost four times as much, while the receipts per consumer were 94.5 cents in January, 1910, and 99.2 cents in January, 1911. That even very small residences are now electrically lighted is shown by reference to the suburb of Stockfeld, where there are some 500 residences for which the monthly rent is not over $4.50 to $6.25. All of them are now electrically lighted, 1400 lamps being installed in this suburb. The energy is either metered and paid for at the rate of 10 cents per kw-hour, or prepayment meters are employed. The city of Strassburg has 40,000 households and almost 2200 meters are now installed. The results obtained show that electric light can successfully compete with gas and even kerosene-oil lighting. The other problem of central stations, namely, to extend the hours of use of electric energy, is far more difficult to solve. The capacity of the Strassburg station is 18,000 kw, but in spite of large motor connections the load during the day hours is only 4000 kw and during the night is only 1200 kw. It is thus necessary to encourage the use of electricity for other purposes than lighting, and especially for cooking. The author recommends a flat rate for all consumption up to a certain number of watts. If more than this number of watts is consumed the excess is metered and paid for at 10 cents per kw-hour.—*Elek. Zeit.*, Oct. 5.

Energy for Traction from Combined Stations.—The joint committee of representatives of the (British) Municipal Electrical Association and the (British) Municipal Tramways Association has adopted a set of principles to serve as a basis for the charge for electrical energy supplied for traction purposes from combined stations. Some of the more important ones are as follows: That the charge should be based upon the actual cost of production. That in order to ascertain the actual cost of production it is necessary that the "standing costs" and the "running costs" should be properly separated. That the tramways department's proportion of the standing costs should be the ratio which the maximum demand for traction purposes at the generating station bears to the total maximum demand on the generating station. That the tramways department's proportion of the running costs should be the ratio which the total number of units delivered to feeders at the station for traction purposes bears to the total number of units delivered to the feeders at the station for all purposes. That the traction maximum demand should be taken to be the mean of the figures representing (1) the maximum traction demand at any time of the year, and (2) the average of the daily maximum traction demand (Sundays excepted) taken over a period of a month coincident with the maximum demand on the station. The method of ascertaining the traction maximum shall be taken as the maximum observed load, deducting therefrom 20 per cent —Lond. *Electrician*, Oct. 6.

Installations, Systems and Appliances.

Melbourne.—An abstract of last year's financial report of the municipal central station of Melbourne. The number of kw-hours sold for private lighting increased by 149,028, in spite of the growing use of metallic-filament lamps, while the power sales for motor service increased by no less than 537,969 kw-hours. The total output for all purposes was 8,920,489 kw-hours, as follows: Private lighting, 3,803,091 kw-hours; heating and motor service, 3,098,960 kw-hours; street lighting, 1,736,695 kw-hours; municipal buildings, 281,743 kw-hours. The electricity department provided free lamp renewals to consumers using carbon lamps. The growing use of metallic-filament lamps, however, has led the committee to consider how far consumers using these lamps can be given an equivalent benefit. The main difficulty arises in the case of consumers who have installed both types of lamps. The number of factories operated by steam decreased from 1316 in 1903 to 1192 in 1909, while the number of factories operated by electric motors increased from 195 in 1903 to 802 in 1909. The total cost of energy generation, including capital charges, was 5.42 cents per kw-hour sold in 1910 (against 5.56 in 1909).—Lond. *Electrician*, Oct. 6.

Sm[illegible]ral Stations.—H. B[illegible]kman.—An illustrated article on central stations in small towns or villages. He shows that such small stations may have a distinct right of existence. A small station which is operated in connection with an existing water mill is described and shown to be financially successful.—*Elek. Zeit.*, Sept. 21.

Wires, Wiring and Conduits.

[illegible] Properties of Hard-Drawn Copper.—D. R. Pye.—A note on a recent paper read before the (British) Institute of Metals, in which the author deplored the lack of any satisfactory definition of standard hard-drawn copper. Although the (British) Post Office specification was highly satisfactory for the sizes of wire used in telephone and telegraph construction, it was quite unsuitable for larger sizes. The various definitions adopted from time to time were reviewed, and it was suggested that the one at present adopted by the engineering standards committee, namely, "the term hard-drawn copper wire shall apply to wire which does not elongate more than 4 per cent on a gage length of 10 in. when broken by tension," though not contradictory of the properties of hard-drawn copper, was unsatisfactory, since a specification should preferably fix a minimum elongation as a safeguard against the wire becoming brittle. An important point is that tensile strength per square inch and elongation at fracture both depend on the diameter of the wire. Experiments were described confirming a suggestion made by A. P. Trotter that the tensile strength per square inch diminishes with increase in diameter according to a linear law. It was also shown that the elongation at fracture for similarly manufactured wires depends very much on the diameter, being considerably greater for larger sizes of wire. In view of these experiments it was suggested that a satisfactory definition of hard-drawn copper wire should fix a minimum tensile strength per square inch given by the formula $T = 30 - 20D$, and a minimum elongation per cent at fracture given by the formula $e = 5D$, where D is the diameter in inches. The specification would hold good for sizes up to 0.5 in. diameter.—Lond. *Electrician*, Oct. 6.

Machine for Calculating Electric Networks.—J. Nowak.—The author emphasizes the difficulties of making network calculations by analytic or by graphical methods on account of the many equations and large number of unknown values. For this reason such methods are unsuitable for continuously controlling the load of a network, although such a control is very advisable. The author has designed a machine which carries out these calculations purely mechanically. Its construction and action are described and its use is discussed.—*Elek. Zeit.*, Sept. 28 and Oct. 5.

Units, Measurements and Instruments.

[illegible] of Dielectric Losses with a Bridge.—K. W. Wagner.—The dielectric losses cause the current in a condenser to lead the emf not by 90 deg. but by 90 deg. — α. A condenser is therefore equivalent to a pure capacity C_1 in

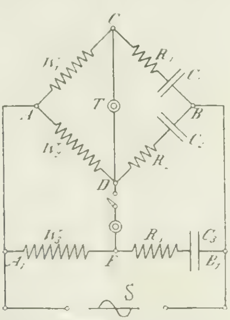
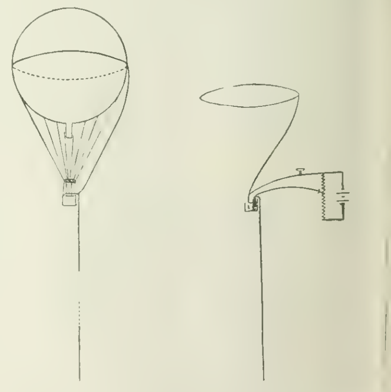


Fig. 2—Diagram of Connections.

series with a non-inductive resistance R_1. One of the m[ost] exact methods for measuring R_1 and C_1 is by mean[s of a] bridge arrangement A, B, C, D (Fig. 2), in which W_1, [...] and R_2 are non-inductive ohmic resistances and C_2 is [an] air condenser in which the dielectric loss is negligi[bly] small. Under these conditions the ratio of W_1 to W_2 equ[als] that of C_2 to C_1 and equals that of R_1 to R_2 if the curr[ent] through the telephone T is zero, S being a source of cu[r]rent. If this method is used, however, certain difficult[ies] are experienced and the accuracy is especially affected [by] the capacity and leakage of the different parts of the brid[ge] to earth. This trouble can be overcome by bringing t[he] branch C D to the potential of earth. As shown in t[he] illustration, the auxiliary branch A_1 E B_1 is connected [in] parallel with the bridge, point E being earthed. T[he] bridge is first approximately adjusted. After that W_3 and C_3 are so adjusted that the current in a telephone [be]tween E and D or between E and C becomes a minimu[m]. The telephone is then removed and the bridge is adjus[ted]. The rationale of this arrangement is discussed and [a] numerical example is added.—*Elek. Zeit.*, Oct. 5.

Telegraphy, Telephony and Signals.

The Balloon as a Wireless Telegraph Receiving Stat[ion].—P. Ludewig.—An account of the arrangement of [the] antenna for receiving wireless telegraph messages on [bal]loons. When the balloon was half filled a wire was wo[und] round the equator of the gas bag, being interwoven thro[ugh]


Figs. 3 and 4—Balloon as a Wireless Receiving Station

the protecting cordage, and the end of the wire was p[...] in the basket. The wire formed the upper half o[f the] antenna. To form the lower half a heavy wire was dr[...] from the basket after the balloon had risen. Fig. 3 s[hows] the completed arrangement. The object of the tests w[as to] discover with how simple means picking up of mes[sages] was possible. A Schloemilch cell was used as rec[eiver] and this was connected direct to the antenna, as sho[wn in] Fig. 4, in order that the room taken up should be as [small] as possible. With this arrangement accurate tuning [is], of course, impossible. Approximation to the wave-l[ength] of 500 m at the sending station was obtained whe[n the] wire from the basket was 125 m long or equal to [one-]fourth wave-length. The choice of the simple mea[ns for] receiving also solved the problem as to whether damp[ed or] undamped waves should be used for sending, the [...] tuning capacity of the receiving station making th[e use] of the first named a necessity. Some of the r[esults] obtained in the tests, although not all, were satisfact[ory].—Lond. *Electrician*, Oct. 6.

Electrochemistry and Batteries.

Cost of Alkali Chloride Electrolysis.—V. Engelha[rdt].—The author discusses the direct production of hypochloride

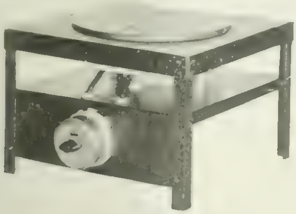
sol ions and the production of chlorine and caustic alkali sep ately by electrolysis of common salt at the consumers' and compares the cost with the cost of producing iching solution from bleaching powder bought in the ma et. Among the processes for separating producing cau ic soda and chlorine, for which figures of cost are giv i. are the Billiter diaphragm cell and the mercury- cell. Under the conditions at present existing in y the author reaches the following conclusions: ng to the different processes, the maximum energy r which alkali chloride electrolysis is profitable varies 1 0.75 cent and 1.125 cents per kw-hour. In the installations of the textile industry the direct elec- production of hypochlorite (electric bleaching) is ral financially profitable only when there is a cer- ing of active chlorine. But even if the cost of g the bleaching liquor by electrolysis is somewhat han with the use of bleaching powder, the other l advantages of electrolytic hypochlorite (less wear of the fibers, smaller acid consumption, etc.) still he use of the electrolytic hypochlorite process. In pap and pulp mills, as well as in larger installations of the xtile (especially linen) industry, it will in general be more profitable not to produce directly a hypochlorite solution, but to produce separately chlorine and caustic soda and make use of or sell the caustic soda. With satisfactory prices for energy the erection of such plants is justified *per se*, as against the purchase of chloride of lime. In the large-scale chemical industry and under average conditions the diaphragm processes are superior to the mercury-cathode processes with respect to both first cost and cost of operation. In the case of erection of a new plant the use of a mercury-cathode cell will be justified only when there is a sure market for the caustic soda free from sodium chloride at a higher selling price and if very cheap energy is available.—*Met. and Chem. Eng'ing*, October.

Vanadium.—W. F. Bleecker.—The conclusion of his long serial on the chemistry and metallurgy of vanadium. The author deals with the metallurgy of vanadium ores, the nature and composition of mill solutions, the preparation of vanadate of iron, electrolytic methods of precipitation, production of vanadic acid and the author's electrolytic method for vanadic acid. The presence of titanium in vanadium ores and products is briefly discussed and notes are given on the use of vanadium for steel making.—*Met. and Chem. Eng'ing*, October.

New Apparatus and Appliances

ELECTRIC HOT PLATE.

A in. disk stove now being placed on the market by the eneral Electric Company is designed for use in read increasing the capacity of the kitchen equipment of h els and restaurants, and also for use in carpenter shop binderies and other manufacturing establishments



Electric Hot Plate.

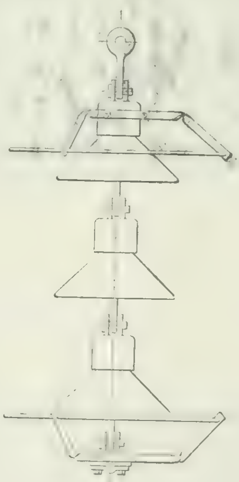
a rapid-heating hot plate free from the inherent f gas plates. The stove is provided with a heating ement of "calorite," and a three-heat indicating witc serves to give 375 watts, 750 watts and 1500 watts eat ssipation on 95-128 volts, or 300 watts, 600 watts nd 1 o watts on 200-250 volts.

RO ECTING RINGS FOR TRANSMISSION-LINE INSULATORS.

The Locke Insulator Manufacturing Company, Victor, Y. is now manufacturing and marketing the Nicholson cing ings for transmission lines which were first used on e li s of the Niagara, Lockport & Ontario Power Comany, nd formed the subject of a paper read by the inento at the Charlotte, N. C., meeting of the American stitt of Electrical Engineers, March, 1910, as mentioned ssue dated April 7, 1910.

A oke of lightning within, say, a quarter of a mile les of a transmission line frequently induces surges ch ause an insulator to flash over, and the power arc that follows, being concentrated under the shells of the insulator in grounding to the pin, mechanically ruptures the insulator owing to the concentrated heat of the arc; and after the shells are thus cracked the current follows in full force, creating a destructive effect.

It was upon this analysis that the arcing ring was based. The device allows the flashover to take place between an upper ring, which is connected to the line cable, and a lower



Nicholson Arcing Ring.

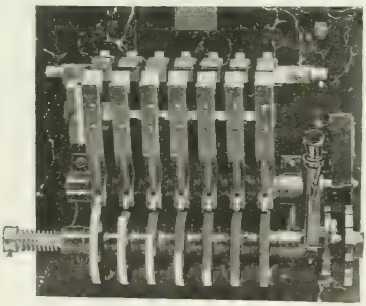
ring, which is grounded to the cross-arm or pin, and is so removed from the insulator as to prevent the heating above referred to. After the circuit-breakers have gone out it has been demonstrated that the line thus protected with the Nicholson rings can be cut in again, the insulators being intact. This result is, of course, gratifying as compared with the old condition of a line grounded through ruptured insulators, in which case it was necessary to send out line-

men to make repairs before operation could be resumed. It will be apparent that this security is especially valuable in the case where an important motor load is being carried on a single circuit and cannot be transferred to a duplicate line, or in the case of isolated, inaccessible portions of a line.

Very many ideas have been held regarding the service to be performed by high-voltage insulators. Some engineers expect them to remain immune from damage by line discharges, depending for line protection upon lightning arresters and ground wires; others have advocated making the insulator rugged enough to remain intact following a flashover, such flashover, moreover, preventing destruction in the power house. The Nicholson ring is, however, based on the growing idea that insulators are special pieces of apparatus that are in a sense frail and should be protected against destructive discharges as in the case of any other piece of apparatus.

MULTIPLE SWITCH FOR MOTOR STARTING.

A multiple-switch motor starter which can be used also as a speed regulator of large size is shown in the illustration. The device, made by the Independent Electric Manufacturing Company, of Milwaukee, is designed for direct-current operation and is provided with underload release. It is intended for use in starting large, heavy-duty motors. The interesting characteristic is that the operator can start this controller without leaving one position or without the trouble of throwing in one contact with one hand while



Multiple Switch for Motor Starting.

holding another contact handle with the other hand. A master lever is provided with a pawl which engages a ratchet by a forward movement, throwing in a contact lever by means of a cam. By a reverse movement of the master lever the pawl is made to engage the next ratchet and a second forward movement will throw in another contact. The construction is such that the operator cannot leave the contact levers on any of the intermediate brushes. As soon as the master lever is released a secondary lever engages the ratchet and throws the contact levers to the "off" position.

DIFFUSING GLASSWARE FOR INCANDESCENT LAMPS.

The "Luceo" reflectors made by the Jefferson Glass Company, Follansbee, W. Va., are designed to be used in connection with brilliant light sources so as to obtain the maximum diffusion with a minimum of glare. The glassware is characterized by a peculiar limpid translucency, closely resembling that of white onyx, while the surface as seen by reflected light, possesses the waxy gloss ch: acteristic of the same natural product. In addition the flectors possess two qualifications which add to their u fulness. They do not readily collect dust or soil, and wl

Fig. 1—Bowl Reflector.

cleaning is necessary the operation can be performed w a minimum amount of trouble and expense. The manuf turer claims that, by reason of its peculiar surface and c position, it is not necessary to have the light sources curately placed or focused, and that the distribution light is all that can be desired for all purposes of illum tion. The distribution from a 60-watt frosted tung electric lamp, with a bowl reflector of the type showr illustrated in Fig. 2. The glassware is said not to af the color value of the light, the reflector when the lam lighted having the exact color of the light source wi

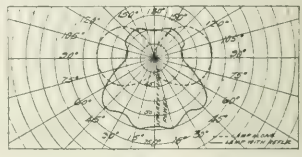


Fig. 2—Distribution Curve.

without streaks and variations. Two types of reflector at present made, giving wide and medium angles of dist tion, in addition to hemispheres, which may be used s as ceiling bowls or joined together to form spheres.

PORTABLE AND STATIONARY DIRECT-CURR METERS.

New voltmeters and ammeters are being put upo market by the American Ever Ready Company, New City. Although the d'Arsonval principle is followe construction is entirely new. Instead of a horse-shoe a circular magnet is used which eliminates waste spa the case and permits a larger magnet to be used would be possible with the horse-shoe type.

The dead beat is secured in a new way. The pract reducing the air gap between the magnet ends an armature to an extremely fine point, has been aband In that type of construction the lines of force p through the aluminum armature secured the desired beat effect, but the closeness of the adjustment wa ductive of trouble. In the Eveready meters a met bar bridges the opening between the magnet ends. Attac d to the pivot staff on which the armature swings is an mi- num disk which rotates between the bridge and the ag- net. The lines of force in their effort to reach the dg encounter the aluminum disk and produce the dea beat effect. This shunting of the lines of force throu the bridge in no way affects the efficiency of the meter ince the magnets are larger than would be necessary if here were no magnetic shunt. The efficiency of the mag ts is great and permits a strong spring to be used.

Where extremely close relation of parts is nec sary

e manufacture of small meters is .. difficult and costly opposition, whereas by the method of construction followed in the Eveready meters small meters are as easy to uild and are as accurate as the larger types.

Another step toward simplification is the method of conructing the armature. Instead of attaching separate vots to each end of the armature frame, the pivot staff is e piece from one bearing jewel to the other. This avoids

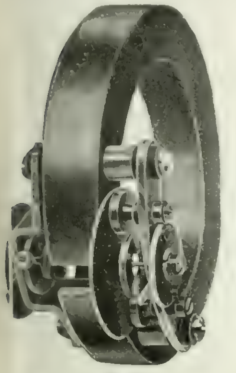
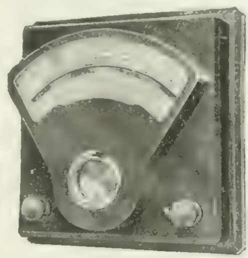


Fig. 1—Circular Magnet.



Figs. 2 and 3—Ammeter and Voltmeter.

tl trouble that is inevitable where the pivot staff is made u in three pieces. It is claimed that this reduces the cnce of broken jewels to a minimum and that with this cstruction there is little chance of the expansion or contrtion from heat and cold affecting the action of the in-

ELECTRIC "ALPHA-BET" LAMPS.

n unusually interesting and pleasing novelty in the way ectric-sign lighting has made its appearance in Chi-. This sign lighting is designed for interior installa- as in show windows or in various sections of depart- stores, and although the signs are not large they are t, dainty and attractive. The method employed is to he letters of the alphabet, each consisting of an in- al incandescent lamp containing a number of minia- u carbon filaments. These alphabet lamps are 3½ in. hi and are made of clear glass tubing backed by a white nt-like substance which serves as the base of the tiny nts and also contains the wires connecting the fila- in series. This backing also acts as an effective or. Fig. 1 shows the alphabet lamp R and Fig. 2 nine of the letters assembled to make a word. The es do not do justice to the attractiveness of this of sign lighting, however. The number of miniature its used in each lamp varies from twelve in the case nd W to five for I. Each lamp is made in the form ontinuous tube bent in the form desired and is an lamp, the filaments burning in a vacuum, of course. shown in Fig. 1, each lamp is mounted on an in- al porcelain base. This base is provided on one with projecting clips and on the other with re- cles for the corresponding clips of the next letter. letters are arranged in a metal trough, as shown in , and they are operated from any convenient source -volt energy, by means of a terminal block put in e the first letter. A blank porcelain base or "space" in the trough where necessary to separate one word another. As stated, the filaments in the lamps themselves are connected in series, but the two metal strips running through the bases of the lamps are like little busbar to which each end of the individual series circuit of each lamp is connected, so that the system of wiring of the sign as a whole is series multiple.

The filaments in each alphabet lamp, whether five in the case of the letter I or twelve in the case of the letter W, or any intermediate number, are designed so that each lamp, irrespective of the number of filaments, takes 11 watts. It is said that each lamp gives about 2½ cp. and that, on an average, each of the tiny filaments gives per-

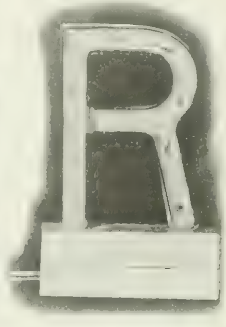


Fig. 1—Electric Alphabet Lamp.

haps one-third of 1 cp. All the letters of the alphabet are provided, of course, and they can be arranged to make any sign or combination desired. It is said that one Chicago department store, with a supply of forty letters, is enabled to make twenty-seven different signs. The lamps, although small, are made strongly and can be arranged by an office boy to spell out a sign.

The consumption of energy is, of course, slight. For instance, the sign "This Way for Waists" contains sixteen letters which would mean a consumption of 176 watts, so that the sign could burn over five hours for 10 cents, assuming the price of energy to be 10 cents a kw-hour. The stand or trough for the lamps can be made in oxidized, nickel, brass or other finish. A flasher can be connected in the circuit to produce changing effects if desired. No wiring is visible about the sign. While the lamps made of clear glass tubing backed by the white reflecting substance are effective and pleasing, there is no reason why colored glass tubing should not be used if desired.

Mr. A. W. Gast is the inventor of this ingenious system of interior sign lighting. Mr. Gast has had long experience in the development of miniature incandescent lamps, having been connected for years with the miniature lamp department of the Western Electric Company in Chicago, where he brought out some notable improvements in miniature lamp manufacture, particularly as adapted for telephone switchboard signals . Mr. Gast is now treasurer and

Fig. 2—Electric Alphabet Lamps Arranged for Sign.

manager of the Chicago Miniature Lamp Works, 13-17 North Jefferson Street, Chicago, and this company is putting the new Alpha-Bet lamps, as they are called, on the market. It may be of interest to add that the lamps, which are made under patented processes, are sold outright to consumers, the price being fixed at $3 a lamp.

Industrial and Commercial News

The Week in Trade.

PREVALENCE of low prices and necessity to replenish low stocks are the most probable causes of the present expansion in business transactions throughout the country. Advancement of the season has without doubt been responsible for some of the increase in the turnover, but the large number of small orders being placed for early delivery serves to show that confidence in the future is not fully established among the majority of business interests. The market for men's wear is improving, and demand for dry goods is showing signs of broadening. While buyers of cotton goods are waiting for readjustment of prices and are not placing orders very far ahead, the outlook in this direction is encouraging. Sales of wool in the past few weeks have been on a larger scale than in several months, and steady progress in this industry is expected. New business, induced by low prices, is being received by the steel mills in sufficient volume to insure activity for some time to come, but earnings are naturally showing a falling off as a result of price reductions. Inquiries for rails, cars and bridge equipment have decreased in volume since last report, and while many of the roads are believed to be considering new supplies there exists a rather general tendency to delay action as long as possible. Production of pig-iron is fairly heavy, and many consumers are making strong efforts to close contracts for their needs in the first quarter of 1912 at present prices. These are so low that many operators are keeping furnaces out of blast, considering that the present market leaves too small a margin of profit in view of the cost of operation. Anthracite coal is in good demand, and shipments to New England, in anticipation of the close of river navigation, are very large. As a consequence of the crop movement a substantial decrease has taken place in the number of idle cars. Business failures for the week ended Oct. 19, as reported by *Bradstreet's*, were 258, as compared with 212 for the previous week, 197 for the corresponding week in 1910, 244 in 1909, 231 in 1908 and 220 in 1907.

The Copper Market.

WITH prospects of an increase of at least 20,000,000 lb. in surplus copper stocks this month, consumers do not seem greatly concerned with the recent advance in prices. They feel that they can afford to wait further developments in the situation, and only a few have been obliged to enter the market at existing rates. These are but slightly higher than last week's quotations. Between 12.40 cents and 12.45 cents cash and about 12½ cents delivered are now asked for electrolytic, while the European price is from £57 10s to

[illegible]	Bid.	Asked.	Settling Price.
[illegible]	12.15	12.25	
October	12.15	12.25	12.20
November	12.15	12.25	12.20
December	12.15	12.25	12.20
January	12.15	12.25	12.20

[illegible]

	Noon. £	s	d	Closing. £	s	d
[illegible]	55	15	0	55	13	[illegible]
[illegible]	56	10	0	56	10	0

[illegible]

	Highest.			Lowest.		
[illegible]	12.35			11.57		
[illegible]	£57	10	0	£53	7	[illegible]
[illegible]	58	2	6	54	0	[illegible]
[illegible]	61	10	[illegible]	[illegible]	[illegible]	

£57 12s. Most of the sales made in this country in the past few days have been at 12¼ cents to 12⅜ cents. The temporary advance in price has been caused by manipulation based upon the belief that stocks held by consumers were exceedingly low and that the time was opportune for an increase in rates. While there is a great deal of scattered buying, aggregating a fair tonnage, this is not in sufficient volume to make a permanent inroad upon the stocks held by producers, and there is no mistaking the fact that the rate of consumption does not approach the rate of output. Inasmuch as producers continue to sanction large output in the face of high costs of operation and slackening in both foreign and domestic interest the situation is rapidly assuming a decidedly serious aspect. Demand for finished copper products has fallen off sharply and in spite of low prices. Exports for the month, including Oct. 24, aggregate 16,686 tons. The daily call on the Metal Exchange Oct. 24 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

Eastern Michigan Edison Company to Build Plant a Ann Arbor.—Plans have been completed by the Easte Michigan Edison Company of Detroit, Mich., for the erectio of a generating plant at Ann Arbor, Mich., which will co $250,000 including real estate. The new plant will have capacity of 800 hp and will be located near the present wate works pumping station on the Huron River, where a da will be built, forming a basin of some 300 acres. The ne station will be known as the Barton plant, and the energ generated there will be distributed to customers of the Was tenaw Light & Power Company of Detroit, in Ann Arb Ypsilanti, Saline, Wayne and Dearborn. When the plant completed, the plant of the Eastern Michigan Edison Co pany at Argo, Mich., will be used as a substation and t present dam at this place will be removed. In connection wi its new plant, the company has planned to beautify the la along the river, and has retained a Boston landscape garden for designing the improvements. Contracts for the erecti of the plant will be let within thirty days.

$15,000,000 Hydroelectric Project in New Hampshire The Central New Hampshire Power Company has been corporated in Maine, with a capital of $10,000,000 comm stock and $5,000,000 preferred stock to develop extensive wat power sites in Sullivan, Merimack, Hillsboro and Graf Counties, N. H. The officers of the company are: Preside Robert C. Bacon, of Brattleboro, Vt.; treasurer, Clarence Eaton, of Portland, Maine, and clerk, James E. Manter, Portland, Maine. It is stated that the new company has secu options on property which will give it control of water rig on the Black Water, Sugar, Mascoma, Smith, Warner Contoocook Rivers. Reservoirs will be formed by the erect of dams at various points along these rivers, and it is that the combined potentiality of these streams will be ne 100,000 guaranteed ten-hour horse-power and about 20 secondary horse-power. The energy will be utilized at vari manufacturing centers in New Hampshire and Massachus

Electricity on Catskill Aqueduct.—H. S. Kerbaugh, I who are building the dam at Kensico Lake, Westche County, New York, where a large storage reservoir is to e constructed as a part of the Catskill Aqueduct project for water supply of New York City, have entered into a cont with the Yonkers Electric Light & Power Company fo a supply of energy aggregating 4000 kw to be used on the struction work. The energy will be furnished at about 4 volts, the line voltage being increased to this by a ste p transformer at Yonkers, and lowered as desired by tr formers at the customer's end of the line. Cable-ways, h air-compressors, pumps and concrete mixers are to be dr by this energy. The dam will be 1830 ft. in length, 25 high, and 227 ft. in width at the bottom and 27 ft. at the to

Hoosier Sales Company to Make Farmers' Lighting Plants.—The Hoosier Sales Company, of Jamestown, N. Y., has been incorporated under the laws of New York State, with a capital of $150,000, to make and sell machinery and devices for generating electricity; also to manufacture motors and batteries. The directors are Frank L. Wyman, of Indianapolis, Scott H. Penfield and Benjamin S. Dean, of Jamestown, N. Y. The company will make isolated electric plants for farmers' use. These plants comprise a small gasoline engine, a dynamo, a storage battery, switchboard and the necessary accessories. The new company will be associated with the Metal Products Company, of Greenville, Pa.

Arbitration by Technical Judges.—Judge Learned Hand, of the United States District Court in the Southern District of New York, recently rendered an opinion in the case of Parke, Davis & Company vs. the Mulford Company, involving infringement of patents used in the manufacture of chemicals, in which he says: "I cannot stop without calling attention to the extraordinary condition of the law which makes it possible for a man without any knowledge of even the rudiments of chemistry to pass upon such questions as these. * * * In Germany, where the natural spirit eagerly seeks for all the assistance it can get from the whole range of human knowledge, they do quite differently. There the courts summon technical judges to whom technical questions are submitted and who can independently pass upon the issues without blindly groping among testimony wholly out of their ken. How long we shall continue to blunder along without the aid of unpartisan and authoritative scientific assistance in the administration of justice no one knows, but all fair persons not conventionalized by provincial legal habits of mind ought, I should think, to unite to effect some such advance." In making this comment upon the present condition of the law in the United States Judge Hand was merely expressing the thought underlying the plan of the New York Chamber of Commerce for the adjustment of commercial disputes by arbitrators selected from an official list. This plan provides, in a most practical way, for the disposition of technical questions arising in business by men peculiarly qualified by reason of their experience to deal with such questions. As the list covers men in all lines of business and industry, there is no longer any necessity for submitting such questions to untrained jurors, or judges unprepared for such technical questions. The plan was described in these columns Aug. 5.

Louisville Lighting Company.—Gen. George H. Harries of the staff of H. M. Byllesby & Company, of Chicago, has been elected president of the Louisville Lighting Company, of Louisville, Ky., and of the Louisville Gas Company, which controls the former corporation. General Harries succeeds F. M. Sackett, who has been president of the companies since the retirement of Udolpho Snead several years ago. Mr. Sackett resigned to accept the position of first vice-president of the Fidelity Trust Company, a leading financial institution of Louisville. The election of General Harries indicates that the Byllesby interests have decided to purchase control of the Louisville public-service companies in spite of the fact that they have been unable to secure an option on the city's holdings amounting to about one-third of the total stock, to [illegible] reference was made in these columns Sept. 9. The [illegible]go concern is in a position to purchase practically all [illegible] remaining stock at 120 a share, though a pool which [illegible]rmed by Louisville trust companies for the purpose of [illegible]g a change of control to be effected was recently dis[illegible] The change in the executive head of the companies was accompanied by an unofficial announcement to the effect that the Louisville Lighting Company is considering bidding for the steam-heating franchise which is provided for in an [illegible]nce introduced in the General Council of Louisville [illegible] weeks ago at the instance of the Kentucky Electric [illegible]ny, of Louisville. This means, in the event of the [illegible] of the ordinance and the final decision of the Louis[illegible] Lighting Company to bid, that the franchise will bring [illegible]00, the upset price named in the pending ordinance.

Opposition to Montreal Traction Merger.—Alleging that [illegible] solution amalgamating the Montreal Street Railway [illegible]ny with the Montreal Tramways Company, to which [illegible]ce was made in the previous issue, was illegal; since shareholders were not supplied with full information before voting, Senator F. L. Beique has entered a suit against the Montreal Street Railway Company asking for annulment of [illegible] resolution. Earnings of the Montreal Street Railway [illegible]any in the fiscal year ended Sept. 30 were the largest in [illegible] history of the company, and it is believed that when [illegible] returns are announced a surplus over charges and the [illegible]nts to the city of about 14½ per cent on the total out[illegible]ng stock will be shown as compared with about 12 [illegible]nt in the previous year.

Annapolis Short Line Railway.—Messrs. Ford, Bacon & Davis, of New York, are now making a thorough examination of the Annapolis Short Line Railroad, with a view to ascertaining the best method of operating the property by which the business of the company can be increased and its operating expenses materially reduced. The Short Line Railroad is gradually increasing its business, but operating expenses have shown a tendency to increase, and it is now the intention of the officials of the company to ascertain whether or not the Short Line can increase its traffic and at the same time reduce its cost of operations. It has been stated more than once that the present half-hourly schedule is a pretty expensive proposition, and that the business which is now handled over the line does not warrant such frequent operations of trains between Baltimore and Annapolis. The entire situation is to be gone over carefully by the New York experts.

Public Service Company of Northern Illinois.—Announcement will be made soon of the organization of the Public Service Company of Northern Illinois, to be composed of the North Shore Electric Company, of Chicago; Economy Light & Power Company, of Joliet, and the Illinois Valley Gas & Electric Company, of Chicago. No doubt one or more additional public-service companies will be taken in the combination also. The North Shore Electric Company operates in the suburban area around Chicago, and the Economy company in the territory in and around Joliet in Will County, while the Illinois Valley company, which has its operating headquarters in Streator, serves Grundy, LaSalle and adjoining counties. Details of the financial aspects of the merger will be announced later.

Telephone Train Dispatching.—The Cincinnati, Hamilton & Dayton Railroad Company has completed plans for the installation of a telephone train-dispatching system on its main lines between Cincinnati and Toledo, Ohio, and between Hamilton, Ohio, and Indianapolis, Ind. The Western Union Telegraph Company is rebuilding its system along this road, and when the work is completed the telephone system will be installed. The Baltimore & Ohio Southwestern Railroad Company is also installing a telephone-dispatching system, and the first service, according to present advices, will be installed between Cincinnati and St. Louis.

Extensions at Lethbridge, Alberta.—The city of Lethbridge, Alberta, Canada, is advertising for bids for material required for extensions to its municipal electric plant. Boilers, steam auxiliaries, mechanical-draft apparatus, steam economizer, turbo-generator and condensing equipment, steam-driven exciter and substation equipment are needed. Tenders will be received until Nov. 24, and should be addressed to G. W. Robinson, secretary-treasurer of the city of Lethbridge. Specifications may be obtained from Arthur Reid, superintendent and engineer of the plant.

Telephone News Service Begun.—The New Jersey Telephone Herald Company, whose plan for furnishing daily news service by telephone was described in these columns Aug. 26, began its service in Newark, N. J., on Oct. 24. News was telephoned continuously during the day from a central transmitting station to subscribers' instruments in residences, department stores and restaurants. Over 500 persons listened simultaneously to reports of the championship baseball game.

Georgia Railway & Power Company.—Formal organization of the Georgia Railway & Power Company, with a capital of $27,000,000, for the purpose of acquiring hydroelectric properties in and near Atlanta, Ga., as described in these columns Sept. 23 and Oct. 7, took place this week, with Charles Magee, of Toronto, Can., as president. Approval of an issue of $30,000,000 bonds, paying 5 per cent interest and to run sixty-five years, has been asked of the Georgia Railroad Commission.

Holtzer-Cabot Electric Company Plans.—The Holtzer-Cabot Electric Company has decided to build a new plant on Needham Street, Newton Highlands, Mass., instead of rebuilding the portion of its Brookline (Mass.) plant which was destroyed by fire Oct. 6. The two buildings of the Brookline plant which were not seriously damaged will be repaired, but the main structure will not be used.

Capital of Standard Gas & Electric Company Increased.—A certificate of increase of capital from $24,000,000 to $45,000,000 has been granted by the State of Delaware to the Standard Gas & Electric Company, which has been incorporated by Chicago interests.

Aluminum Notes and Prices.—The aluminum market as of Oct. 24 is reported quiet, with ingots for remelting quoted at 20@22 cents spot No. 1 the base for large ingots. Rods and wire are held at 31 cents and sheets at 33 cents.

Financial.

THE WEEK IN WALL STREET.

ANNOUNCEMENT that the United States Steel Corporation [illegible] cancel its lease of the Great Northern iron ore properties and reduce the freight rates charged to independents for transportation of ore by the Lake Superior railroads under its control was made at the close of the past week and is regarded by many financial interests as almost conclusive evidence that a federal suit will not be instituted against the company under the Sherman anti-trust law. Optimism is, therefore, more general in the Street than has been the case for the past few weeks and, while trading is not active, the business situation seems greatly strengthened. News of the government's attitude toward the plan for reorganization of the American Tobacco Company under the statute is awaited with marked interest and, in spite of the petitions filed against the plan by the attorneys-general of Virginia and North and South Carolina on the ground that the subsidiary stocks are to be distributed among holders of American Tobacco common shares, it is thought in many quarters that it will be acceptable to the government. Trading

NEW YORK.

	Oct. 17.	Oct. 24.	Shares Sold.		Oct. 17.	Oct. 24.	Shares Sold.
[illegible]	[illegible]	[illegible]	7,800	Int. Met., pf.	[illegible]	44	[illegible]
[illegible]	[illegible]	[illegible]	3,800	Mackay Cos..	85*	[illegible]	
Amal. Cop...	[illegible]	[illegible]	[illegible]	Mackay C., pf.	[illegible]	73	100
Am. D. T..	[illegible]	[illegible]	—	Man. Elev....	[illegible]	135	—
Am. Loco..	[illegible]	[illegible]	1,900	Met. St. Ry..	15*	[illegible]	-
Am. Loco. pf.	104*	[illegible]	550	N.Y.&N.J.Tel.	[illegible]	[illegible]	—
Am. Tel. & C.	[illegible]	[illegible]	—	Steel com....	[illegible]	[illegible]	997,700
Am. T. & T..	135⅜	[illegible]	[illegible]	Steel, pfd...	[illegible]	[illegible]	8,760
B. R. T......	75	[illegible]	3,840	W. U. T....	[illegible]	[illegible]	6,300
Gen. Elec.	[illegible]	[illegible]	4,900	West'h, com..	[illegible]	64	3,900
Int. Met.	[illegible]	[illegible]	2,000	West'h, pfd..	[illegible]	[illegible]	100

PHILADELPHIA.

	Oct. 17.	Oct. 24.		Oct. 17.	Oct. 24.
Am. Rys.	[illegible]	[illegible]	Phila. R. T.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Phila. Elec.........	[illegible]	[illegible]
Elec. St. Bt'y....	[illegible]	[illegible]	Phila. Trac.........	83½	[illegible]
Elec. St. Bt'y, pf...	30*	30*	Union Trac.	[illegible]	51

CHICAGO.

	Oct. 17.	Oct. 24.		Oct. 17.	Oct. 24.
Chi. City Ry......	186*	[illegible]	Com. Edison	[illegible]	[illegible]
Chi. Elev. Rys....	27	[illegible]	Chi. Subway...	[illegible]	[illegible]
Chi. Elev. Rys., pf..	90*	[illegible]	Chi. Telephone......	119½	[illegible]
Chi. Rs. Ser. 1.....	92*	[illegible]	Nat'l Car..........	101*	104
Chi. Rs., Ser. 2.....	27*	[illegible]	Nat'l Car, pf.	[illegible]	118

BOSTON.

	Oct. 17.	Oct. 24.		Oct. 17.	Oct. 24.
Am. T. & T.	[illegible]	135	Mex. Tel...........	4*	4
Cum. Tel...........	150½	[illegible]	Mex. Tel., pf.	[illegible]	[illegible]
Edison	[illegible]	287	N. E. Tel..........	146	146
Gen. Elec..........	150¾	[illegible]	W. T. & T.	[illegible]	[illegible]
Mass. E. Ry........	19¾	[illegible]	W. T. & T., pf.	[illegible]	[illegible]
Mass. E. Ry., pf....	93	95			

*Last price quoted.
Shares sold for the week Oct. 16 to Oct. 21.

on the New York Stock Exchange Monday was dull and prices showed but little change. Reaction in cotton prices following the advances made last week was the principal feature of interest. Apathy was in decided evidence on Tuesday and only fractional changes were registered throughout the list. The bond market is not especially active, but investment demand is gradually improving. Tariff legislation is beginning to demand consideration by financial interests, and marked agitation in general business conditions from this source is probable. Large remittances of American funds continue to be made to European exchanges at very satisfactory rates, indicating the dull condition of the domestic market. Rates in the local money market Oct. 24 were 2¼@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in the tables are those at the close Oct. 24.

FINANCIAL NOTES.

American Telephone & Telegraph Company Grouping Subsidiaries.—In keeping with its plan for bringing the numerous units composing the Bell Telephone system under one operating head or control, the American Telephone & Telegraph Company has made an offer to the minority stockholders of the Bell Telephone Company of Missouri to exchange their holdings for American Telephone & Telegraph stock in the ratio of six shares of the Missouri company f[illegible] seven shares of American Telephone & Telegraph stock. T[illegible] company operates in St. Louis and the adjacent country, a[illegible] has $8,788,000 stock outstanding, of which the American Tel[illegible]phone & Telegraph Company already owns $5,831,800. [illegible] similar offer has been made to the minority stockholders [illegible] the Missouri & Kansas Telephone Company, which operat[illegible] throughout the State of Kansas and in that part of Missou[illegible] not served by the Bell Telephone Company of Missouri. T[illegible] ratio of exchange in this case is three shares of Americ[illegible] Telephone & Telegraph stock for seven of those now h[illegible] Of the $13,627,700 stock of this company outstanding, $[illegible]944,200 is already owned by the American Telephone & Te[illegible]graph Company. The company has not paid dividends sin[illegible] 1906. The American Telephone & Telegraph Company has [illegible]fered to give three shares of its stock and $20 in cash for f[illegible] shares of Western Telephone & Telegraph Company's p[illegible]ferred stock, and one share of American Telephone & Te[illegible]graph stock for five shares of Western Telephone comm[illegible] stock. The Western Telephone & Telegraph Company is [illegible] holding company which the American controls through own[illegible]ship of $12,187,600 of the $16,000,000 preferred stock [illegible] $9,443,000 of the $16,000,000 common stock. The West[illegible] Telephone & Telegraph Company owns 77 per cent of [illegible] stock of the Cleveland Telephone Company, 82 per cent [illegible] the stock of the Wisconsin Telephone Company, 82 per c[illegible] of the stock of the Northwestern Telephone Exchange and [illegible]per cent of the stock of the Southwestern Telegraph & T[illegible]phone Company.

Cities Service Stock Offered.—Preferred stock of Cities Service Company, which was incorporated under [illegible] laws of Delaware on Sept. 2, 1910, as a holding company [illegible] the gas and electric properties operated in Denver, Col., S[illegible]kane, Wash., and Joplin, Mo., by the Doherty Operating C[illegible]pany, is offered for investment. The authorized capital[illegible]tion of the company consists of $30,000,000 6 per cent cu[illegible]lative preferred stock, of which $8,661,240 is outstanding. [illegible] $20,000,000 common stock, of which $4,887,620 is outstan[illegible] Monthly dividends at 6 per cent per annum on the prefe[illegible] stock and of 3 per cent on the common stock have been [illegible] continuously since organization. The report of the com[illegible] for the year ended Sept. 30 gave the following: Earn[illegible] from subsidiary companies, $855,510; miscellaneous earn[illegible] $40,715; total gross earnings, $896,225; expenses, $27,649; [illegible] earnings, $868,576; dividends on preferred stock, $50[illegible] dividends on common stock, $143,659; total dividends, $[illegible]647; surplus, $221,929. The company has also declared [illegible] usual monthly dividend of one-half of 1 per cent on its [illegible]ferred stock, and one-quarter of 1 per cent on its com[illegible] stock, both payable Nov. 1 on stock of record Oct. 20.

Mountain States Telephone & Telegraph Company [illegible] Extensive Improvements.—In the first report issued [illegible] the merging of the Colorado Telephone Company, the R[illegible] Mountain Bell Telephone Company and the Tri-State [illegible]phone & Telegraph into the Mountain States Telephone & [illegible]graph Company last July, as mentioned in these colum[illegible] that time, E. B. Field, president of the Mountain States [illegible]pany, says that $2,000,000 will be spent by the company in [illegible] for improvements and expansion of the operating depart[illegible] The value of the exchange plant as given in the rep[illegible] $14,423,576 and in addition to this are real estate valu[illegible] $1,871,814 and a toll plant valued at $5,727,431. Constr[illegible] now in progress is valued at $727,400 and stocks and bon[illegible] $786,265. Earnings during the month of August, the firs[illegible] month of operation under the consolidated system, [illegible] $513,000, of which $473,000 was received through exchang[illegible]vice.

Pacific Gas & Electric Company Votes Large E[illegible]sion.—Stockholders of the Pacific Gas & Electric [illegible]pany at the special meeting held Oct. 23, as scheduled in [illegible] columns Sept. 2, voted to create a new mortgage securi[illegible] increase of the bonded indebtedness of the company to [illegible]000,000, and also voted for a parallel increase in the capi[illegible]tion, all in common stock, in accordance with the Cali[illegible] statute which prohibits a company from having outst[illegible] indebtedness in excess of its subscribed capital stock [illegible] stated in these columns Sept. 2, about $60,000,000 of the [illegible] will be used for refunding the company's present issue an[illegible] the balance will be reserved for development work [illegible] next ten years.

[H]elena Light & Railway Bonds.—A New York [illegible] is offering first mortgage, 5 per cent sinking fund gold [illegible] of the Helena Light & Railway Company, which owns a[nd] operates the entire street railway, electric lighting and g[as] business in Helena, Mont. The capitalization of the compa[ny] is as follows: Common stock, authorized and issued, $[illegible],000, and in hands of trustee for benefit of company, $339,- [illegible] [p]referred stock, authorized and issued, $600,000, and in [illegible] of trustee for benefit of the company, $226,000; first [mortga]ge 5 per cent bonds, authorized, $1,500,000; issued, [illegible]o; retired, $45,000. The bonds offered are coupon [illegible] denomination of $1000, are dated September 1, 1905, [and a]re due September 1, 1925. They are secured by a first [illegible]y mortgage on the entire property, plant and franchises [of the] company, and additionally secured by an operating [illegible] fund of 1½ per cent annually of outstanding bonds [illegible]ne, 1917, after which date the rate will be 2½ per cent. [The rai]lway system consists of 18.5 miles of standard track [illegible]g the principal streets and sections of the city, and [illegible] Fort Harrison and the town of East Helena. [The ele]ctric system for both lighting and power service covers [the bu]siness and principal residential sections, and new busi[ness ca]n be taken without any large extensions. All current [for lig]hting, power and railway service is obtained from the [illegible]ectric plants of the United Missouri River Company [under] an advantageous contract which expires Jan 1, 1922. [Cu]rrent is distributed through a modern stone substation [illegible] near the business centre of the city. The gas system [consists] of a combined coal and water gas plant. Gross earn[ings of] the company in the year ended December 31, 1910, [were $3]09,741; operating expenses and taxes were $192,799, and [net ear]nings from operation were $116,942. Interest on bonds [was $4]3,000, leaving a surplus over fixed charges of $73,942. [Sinking] fund requirements amounted to $13,568, and the sur[plus fo]r the year was $60,373. Dividend on preferred stock [was $1]8,700, and the final net profit was $41,673. The company [is unde]r the management of J. G. White & Company, Inc., of [New Yo]rk, Montreal and London.

[Re]organization of Hudson River Power Companies.—[The ph]ysical direction of the eight Hudson River power [compani]es which were sold to representatives of the bond[holders'] committee at a foreclosure sale at Ballston Spa, N. Y., [illegible], as mentioned in the issue of Sept. 2, has been taken [over by] the Stone & Webster Management Association. In [accorda]nce with the reorganization plan the properties have [been de]eded over to the bondholders' committee, which is [headed] by J. R. Hooper, of the New England Trust Com[pany.] A new company is to be incorporated under the laws [of New] York State and the committee will transfer the prop[erties to] this company. The name of the new company has [not bee]n announced yet, but it is understood that the capitali[zation a]s planned by the syndicate headed by Boston bankers [in char]ge of the reorganization, will consist of $2,500,000 6 [per cen]t preferred stock, $9,500,000 common stock and $10,- [illegible] 5 per cent fifty-year bonds, of which the initial issue [will be] $5,000,000. The plan will shortly be submitted to the [Public] Service Commission of the Second District of New [York fo]r its approval.

E[arni]ngs of Electric Companies.—Gross earnings of elec[tric com]panies show increases as follows: Dayton (Ohio) [Power] & Light Company for the year ended April 30, 1911, [illegible] an increase of $121,351 for the year; Dedham & Hyde [Park Ga]s & Electric Light Company for the year ended June [30, 1911,] $58,058, an increase of $6,845; Massachusetts Light[ing Com]panies for the year ended June 30, 1911, $1,213,185, an [increase] of $235,626; Portland (Maine) Electric Company for [the yea]r ended July 31, 1911, $472,974, an increase of $86,- [illegible] [Ro]ckville-Willimantic Lighting Company, Connecticut, [for the] year ended Dec. 31, 1910, $136,134, an increase of [illegible] Union Electric Company, of Dubuque, Ia., for the [year end]ed July 31, 1911, $398,701, an increase of $16,085; Wey[m]ou[th] Light & Power Company, of East Weymouth, Mass., for [th]e year ended June 30, 1911, $60,189, an increase of [illegible]

T[w]o Independent Telephone Companies in New York Stat[e] Sold to Bell Interests.—The Friendship Telephone Com[pa]ny, a holding company of the Bell interests, has purchas[ed] the Auburn and Skaneateles Telephone companies in west[er]n New York State. These companies were formerly allie[d] with the independent system headed by the Federal Telephone Company, which recently blocked the sale of the Rochester independent company to Bell interests. According to an official statement relative to acquisition of these two independent companies, the outstanding securities of the two companies involved are something over $400,000 and the payment to the holders is about $175,000.

Record Earnings of Philadelphia Rapid Transit Company.—Gross passenger earnings of the Philadelphia Rapid Transit Company in the quarter ended Sept. 30 were $5,298,373, larger returns than for any corresponding period in the history of the company. Miscellaneous income from other sources including trolley freight service brought this figure to $5,551,-157. Operating expenses were $3,398,546 and net earnings were $2,152,610. Fixed charges were $2,211,170, leaving a deficit of $58,560 for the quarter. September earnings were $1,810,129; miscellaneous income was $89,221, making a total revenue for the month of $1,899,351, an increase of 8.05 per cent as compared with that in September, 1910. Operating expenses were $1,127,562, and net earnings were $771,788. Fixed charges were $737,198, leaving a surplus for the month of $34,590, which was largely responsible for the reduction in the deficit for the quarter ended Sept. 30.

Mexican Light & Power Company, Ltd.—The statement of combined earnings of the Mexican Light & Power Company, Ltd., and the Pachuca Light & Power Company for September shows gross earnings, Mexican currency, of $693,559 as compared with $756,241 in September, 1910. Net earnings of the two companies were $527,861 as compared with $565,471 in the corresponding month of the previous year. Gross earnings of the two companies from Jan. 1 were $6,026,453, as compared with $5,148,324 in the corresponding period of 1910.

Minneapolis General Electric Increases Dividend.—A quarterly dividend of 2 per cent on its common stock, payable Nov. 1 to stockholders of record Oct. 18, has been declared by the Minneapolis General Electric Company, which places the issue on an 8 per cent basis. From August, 1910, to August, 1911, the quarterly rate was 1¾ per cent; from November, 1909, to May, 1910, the rate was 1½ per cent, and from 1906 to August, 1909, the semi-annual rate was 2 per cent.

Applications to List Public Utility Securities on New York Exchange.—Application has been made to list $6,261,-000 additional unifying and refunding mortgage 5 per cent bonds of the California Gas & Electric Corporation, of San Francisco, Cal., due 1937, and $55,086,500 additional capital stock of the American Telephone & Telegraph Company upon the New York Stock Exchange.

DIVIDENDS.

Jacksonville Traction Company, quarterly, preferred, $1.50 per share; common, $1.75 per share; both payable Nov. 1.

Lewiston, Augusta & Waterville Street Railway Company, quarterly, preferred, 1½ per cent, payable Nov. 1.

McCrum-Howell Company, quarterly, preferred, 1¾ per cent, payable Nov. 2.

Minneapolis General Electric Company, quarterly, common, 2 per cent, payable Nov. 1.

Montreal Light, Heat & Power Company, quarterly, 2 per cent, payable Nov. 15.

North American Company, quarterly, 1¼ per cent, payable Jan. 2.

Sierra Pacific Electric Company, quarterly, preferred, $1.50 per share, payable Nov. 1.

REPORTS OF EARNINGS.

HUDSON & MANHATTAN RAILROAD COMPANY.

Period.	Gross Earnings	Operating Expenses	Net Earnings	Fixed Charges	Net Surplus.
Sept., 1911	$377,007	$161,451	$215,556	$209,702	$5,854
Sept., 1910	[illegible]	151,487	171,706	191,596	*19,890

PORTLAND (ME.) ELECTRIC COMPANY.

Yr. July, 1911	$472,974	$210,650	$262,324	$159,319	$103,005
Yr. July, 1910	386,046	136,776	249,270	150,932	98,338

RIO DE JANEIRO TRAMWAY, LIGHT & POWER CO.

Sept., 1911	$1,118,664	$523,881	$594,783	——	——
Sept., 1910	982,762	474,614	508,148	——	——

SAO PAULO TRAMWAY, LIGHT & POWER CO., LTD.

Sept. 1911	$312,740	$110,908	$201,832	——	——
Sept. 1910	260,829	92,037	168,792	——	——

*Deficit.

General News

Construction News.

COLUMBIA, ALA.—The city of Columbia has contracted with the Omussee Light & Power Company to supply electricity for lighting the streets and residences in Columbia. The company has developed the water power at the falls at Wood's Mill, on Omussee Creek, about 3 miles from the city. The company will give a twenty-four-hour service. It is reported that a bonding company has offered to purchase the water rights and develop the entire power for the purpose of generating electricity to be transmitted to Columbia, Dothan, Slakely, Georgia, Headland and Ashford.

MONTGOMERY, ALA.—In a report submitted by the Water Works Department to the City Commissioners recently the installation of an electric air compressor costing $15,000 was recommended.

PIEDMONT, ALA.—At an election held recently the proposition to issue bonds to the amount of $25,000, the proceeds to be used for the installation of a municipal electric-light plant and for extensions to the water-works, was carried. The electric plant will be erected on a site purchased during the administration of Mayor C. E. Harris. The cost of the plant and extensions to the water-works system is estimated at about $20,000, bids for which have already been received. The street-lighting system will consist of sixty-five lamps. It is expected to have both systems completed by Jan. 1, 1912.

CROWN KING, ARIZ.—It is reported that plans are being considered by the Arizona Power Company for the erection of a transmission line between Crown King and Poland Junction, via Mayor and Blue Bell. M. V. Watson, of Prescott, is manager.

DOUGLAS, ARIZ.—The Douglas Improvement Company is contemplating enlarging its power plant and the construction of a transmission line through the valley with a view of supplying electricity for operating pumps for irrigation purposes.

YUMA, ARIZ.—The Yuma Electric & Water Company is preparing to build an addition to its electric-power plant, for which a permit has been taken out. Samuel DeCorse is superintendent.

JONESBORO, ARK.—Arrangements are being made by J. F. Christy, manager of the municipal water and light plant, for the erection of tungsten lamps to replace arc lamps now in use. The system will be extended to parts of the city now without lighting service.

BAKERSFIELD, CAL.—The Reward Oil Company has erected a new transformer station and will install electric motors for oil-drilling operations.

BERKELEY, CAL.—The Oakland Traction Company has applied to the Council for a franchise from Berkeley to the northern boundary of Alameda County.

BERKELEY, CAL.—The Sierra & San Francisco Power Company has notified the City Council of its intention to extend its system to Berkeley. E. J. Blanchard is secretary of the company.

BIG OAK FLAT, CAL.—Plans are being considered for the installation of electric-hoisting and air-compressor machinery at the Dutch mine.

CORCORAN, CAL.—Plans are being considered by G. Brandenburg for the installation of electric pumping plants on his Homeland tract, in Corcoran.

LAKEPORT, CAL.—The Board of County Supervisors has granted James A. Gunn, Jr., a fifty-year franchise to erect and maintain electric transmission lines over the county roads and public streets in Lake County.

LINCOLN, CAL.—A committee, consisting of L. E. Brown, Walter Jansen and C. E. Finnie, has been appointed to make arrangements for lighting the streets of the city.

LOCKEFORD, CAL.—The Central California Traction Company is contemplating the construction of a line from Campton to Lockeford, work on which will begin soon.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has applied to the Board of Public Utilities for permission to equip the Southern Pacific Santa Monica steam line for electrical operation.

LOS ANGELES, CAL.—The Newberry-Bendheim Electric Company has been awarded the contract for the installation of an electric-light system, including 1000 tungsten lamps of 25 cp, for the Third Church of Christ, at $2,430.

LOS ANGELES, CAL.—The Llewellyn Iron Works, of Los Angeles, Cal., have secured the contract for installing four direct-connected electric freight elevators in the five-story building being erected at Second and Central Avenues for the Haas Building Company. Morgan, Walls & Morgan, of Los Angeles, Cal., are the architects.

MARICOPA, CAL.—Edward Gillette, operating coal properties, is contemplating the installation of electric motors for drilling purposes.

MENTONE, CAL.—The Pacific Light & Power Company is planning to build an addition to its transformer station at Mentone.

PLANADA, CAL.—The Planada Development Company, of Los A[n]geles, Cal., has awarded the Ornamental Cement Stone Company a co[n]tract for seventy concrete lamp standards for a street-lighting syste[m] in Planada.

SACRAMENTO, CAL.—A general engineering and construction com-pany has been organized in Sacramento, of which W. P. Ireland, of Go[ld] Run, Placer County, is manager. The company has made prelimina[ry] contracts for surveying and other work preparatory to the developme[nt] of a large water and electric power project on the Yuba and Bear Rive[rs] for the purpose of supplying electricity to the cities of central Californi[a]. The company will also supply water for domestic and irrigation purpos[es]. The work contemplated by the company will involve an expenditure [of] about $5,000,000. James D. Stewart, lessee and general manager of t[he] United Water & Power Company, of San Francisco, Cal., is interested [in] the project. The company will soon be incorporated.

SAN DIEGO, CAL.—The San Diego Southern Railway Company [is] planning to build its electric system between San Diego and Otay.

SAN FRANCISCO, CAL.—The contract for furnishing and installi[ng] turbines, generators and main switchboard in the power house a[nd] laundry building of the San Francisco Hospital has been awarded [to] Frederick C. Roberts & Company, for $25,198. Robert Dalziel, J[r.], has been awarded the contract for furnishing and installing boile[rs], boiler-rooms and piping in power house and laundry, at $52,897.

SAN FRANCISCO, CAL.—At a special meeting of the stockholders [of] the Pacific Gas & Electric Company, it is reported that the stockhold[ers] voted to create a new mortgage under which bonds to an amount [not] exceeding $150,000,000 may be issued from time to time, and to incre[ase] the capital stock to an amount sufficient to enable it to comply with [the] California statute under which no corporation may have outstanding [in]debtedness in excess of its subscribed capital stock. The proceeds [of] the bonds will be used for refunding or retiring existing issues of [the] company and its susidiaries, amounting to $67,000,000, and the remain[der] will be reserved for extensions and improvements.

SIERRA CITY, CAL.—Plans are being considered by the Sierra Bu[ttes] Mine Company for the construction of two hydroelectric power pl[ants] on Sardine and Salmon Lakes. The proposed plants will have a t[otal] generating capacity of 20,000 hp. J. C. Folsom is superintendent.

TROPICO, CAL.—The Glendale Light & Power Company has [sub]mitted a proposition to the city offering to furnish 32-cp street lamp[s at] $1 each per month, the city to pay the cost of installation and for [re]newal of all lamps.

COLORADO SPRINGS, COL.—It is reported that bids will be [re]ceived until Nov. 6 for the construction of a power plant for the tu[ber]culosis colony of Modern Woodmen of America at Colorado Springs.

DENVER, COL.—The Mountain States Telephone Company is [con]templating extensive improvements and extensions to its properties, [in]volving an expenditure of about $2,000,000, during 1912.

DOVER, DEL.—The Standard Gas & Electric Company, incorpo[rated] by Chicago parties, has filed an amendment to its charter with the S[ecre]tary of State at Dover, Del., increasing its capital stock from $24.00[0,000] to $45,000,000.

WILMINGTON, DEL.—The Public Utilities Light, Heat & P[ower] Company has applied to the Street and Sewer Department for a fran[chise] to construct and operate an electric-light plant in Wilmington.

TAKOMA PARK, D. C.—Sealed proposals will be received by [Ben]jamin G. Davis, 110 Oak Avenue, Takoma Park, D. C., until No[v.] for supplying 100 electric lamps of at least 40 cp for lighting the st[reets] of the town of Takoma Park, Md., for a term of two years.

WASHINGTON, D. C.—Sealed bids will be received at the offi[ce of] the Chief Signal Officer, War Department, Washington, D. C., until [Oct.] 28, under proposal No. 555 for furnishing 4 miles of rubber-ins[ulated] submarine cable, type 51. For further information address Captain Burt, disbursing officer.

AUGUSTA, GA.—Plans are being considered for the installati[on of] ornamental lamp standards to be erected on Broad Street. It is pro[posed] to erect forty-four standards, each carrying two lamps.

MANCHESTER, GA.—The Manchester Commercial Club has vo[ted to] request the City Council to call an election to vote on the proposit[ion to] issue bonds to install a municipal electric-light plant in Manchest[er. A] committee was appointed to confer with the Council to determi[ne the] amount of bonds to be issued and the date of the election, etc.

ST. SIMON, GA.—Application has been made to the Georgia Ra[ilroad] Commission to give the St. Simon Railway Company authority to [is]sue $50,000 in bonds. Of the proceeds $18,000 is to be used to cov[er the] cost of the railway, $12,000 to provide for additional equipmen[t and] $20,000 to be held in reserve for future development. The co[mpany] owns and operates an electric railway extending from the pier [St.] Simon to the new Hotel St. Simon. H. F. Dunwody, manager [of the] Mutual Light & Water Company, of Brunswick, Ga., and othe[rs are] interested in the company.

VALDOSTA, GA.—President G. W. Varn, of the Consolidated Ice & Power Company, which has the contract for street lighting, has notified the City Council that he desires to surrender the contract. The reason given by Mr. Varn is that the deductions from the bills rendered by the company each month, on account of lamps not burning, are so large that it is now serving the city at a loss.

BOISE, IDAHO.—The property and holdings of the Boise & Interurban Railway Company in Boise, the Boise Valley, Caldwell and intervening points have been purchased by the Kuhn interests, represented by Messrs. W. S. Kuhn, of Pittsburgh, Pa. The deal included the transfer of securities of between $2,000,000 and $3,000,000. Negotiations are said to be under way by the Kuhn interests to purchase the property of the Boise Valley Railway Company and the Boise Railroad Company, both of Boise. The Kuhn interests now own a chain of power plants from Twin Falls in the east along the Snake River in Southern Idaho to Boise, and on as far west as Weiser. Their plan is eventually to control all power plants in this section of the State to supply southern Idaho with electricity for motors, lamps, irrigation, pumping and heating purposes.

MOUNTAIN HOME, IDAHO.—Work has commenced on the construction of a hydroelectric plant on the Snake River, near Mountain Home, by the Smith, Kerry & Chace Engineering Company, of Portland, Ore. It is estimated that 14,000 hp can be developed. The company has entered into a contract with the Gem Irrigation District to supply electricity for pumping water for irrigating purposes. About sixty miles of transmission line, with distributing branches, will be erected.

TWIN CITY, IDAHO.—The Twin Falls Street Railway Company has been granted a fifty-year franchise to construct and operate an electric railway on certain streets of the city.

BELLEVILLE, ILL.—Plans are being considered by the Retail Merchants' Association for the installation of an ornamental lighting system on Main Street. It is proposed to erect ornamental standards with cluster lamps.

BELMONT, ILL.—Preparations are being made for the installation of an electric plant in Belmont.

CHAMPAIGN, ILL.—Proposals will be received by the City Council until Nov. 4 for lighting the streets of the city with electricity, or gasoline for a term of ten years. N. M. Woodward is city clerk.

CHATSWORTH, ILL.—The Chatsworth Electric Company is reported to be contemplating the construction of transmission lines to Cabery, ... and Cullom.

CHICAGO, ILL.—Bids are being asked by the Metropolitan West Side Elevated Railway Company for the construction of a new substation to be erected at 259 South Franklin Street, Chicago. The building will be one story, of brick, steel and concrete construction.

CLINTON, ILL.—Plans are being considered by Charles Dickerson, commissioner of public buildings, for the installation of electrical pumping machinery at the municipal water-works pumping station.

FREEPORT, ILL.—Plans are being considered by the Freeport Railway & Light Company for improvements to its power plant in Freeport.

GALENA, ILL.—Plans are being considered by the Interstate Light & Power Company for the installation of an ornamental street-lighting system in Galena.

NEWMAN, ILL.—The Newman Electric Light Company, it is reported, has rebuilt its plant, which was recently destroyed by fire.

PAXTON, ILL.—H. L. Clarke, of Chicago, Ill., is endeavoring to interest the citizens of Paxton in an electric-lighting proposition. He proposes to organize a company to construct and operate an electric plant and supply electricity for street lighting and also to operate the city pumping station at a lower rate than the city is now paying. Steps have been taken by the City Council to have a new franchise drawn up. The new company, it is said, will be capitalized at $70,000.

ROBBROOK, ILL.—Negotiations have been consummated between the City Council and the Gibson City Electric Light & Power Company whereby the latter will extend its transmission lines from Gibson City to ...brook to supply electricity for business purposes at 10 cents per kw-hour and for domestic use at 12 cents per kw-hour.

VIRDEN, ILL.—The City Council is considering the question of improving the street-lighting system in Virden. The Virden Electric Light Company, which holds the present contract for street lighting, is endeavoring to secure a new contract.

ANGOLA, IND.—The City Council is considering the question of installing an ornamental street-lighting system.

DECATUR, IND.—The Holland-St. Louis Sugar Company, it is reported, is planning to erect a beet-sugar plant in Decatur, to cost about $...,000. The plant will be equipped throughout for electrical operation. L. G. Ellingham, of Indianapolis, Ind., is interested in the project.

HUNTINGTON, IND.—Plans are being considered by the Shaff Brothers Piano Manufacturing Company to build an addition to its plant. The plans include the installation of electric-generating machinery to supply electricity for lamps and motors for the factory, and also the adjoining glue plant.

INDIANAPOLIS, IND.—The Board of Public Works is reported to be considering the installation of a power plant in connection with a sewage-disposal plant. H. E. Klausman is city engineer.

INDIANAPOLIS, IND.—The Board of Park Commissioners has notified the Merchants' Heat & Light Company that unless the company improved its lighting system in the parks steps would be taken to cancel the contract.

MUNCIE, IND.—After operating the municipal electric-light plant for thirteen years the city of Muncie has discarded the plant and entered into a contract with the Muncie Electric Light Company to light the streets of the city for a period of ten years.

OSSIAN, IND.—Messrs. Reidel & Gray, of Ossian, Ind., are interested in a project to supply electricity for both street lighting and commercial purposes in this town. Application has been made to the Board of Trustees for a franchise to operate an electric-light system, and if granted the town will be wired and the service established before cold weather sets in.

SHERIDAN, IND.—The Town Board has sold the municipal electric-light plant to J. L. Vickery, of Sheridan. Under the terms of the sale Mr. Vickery is to assume the bonded indebtedness of $9,500 together with the current interest. The new owner will take over the system in November, but is given fifteen months to equip the plant for a twenty-four-hour service. He also proposes to build a water-works system and ice plant in connection with the light plant. The municipal plant was established in 1898 at an original cost of $6,000, and between $10,000 and $12,000 has been expended on the plant since.

SOUTH BEND, IND.—Preparations are being made by the Muessel Brewing Company for the construction of a large addition to its plant, which will be equipped for electric-motor drive.

ALGONA, IA.—It is reported that the $18,000 bond issue voted last summer for improvements to the municipal electric-light plant has been found to be illegal. It is expected that a second vote will be ordered. Part of the funds have been used.

ATLANTIC, IA.—It is reported that J. Bortenlanger, who held the contract for construction of the water and light plant in Atlantic, has thrown up his contract and the bonding company will complete the work.

AUGUSTA, IA.—Preparations are being made by L. J. Highland for the construction of a dam on the Skunk River in Augusta, the power to be utilized to generate electricity.

BOONE, IA.—The proposition to grant the Boone Electric Company a franchise to install a central heating distributing plant will be submitted to a vote on Oct. 30.

OSKALOOSA, IA.—The Des Moines River Power Company, it is reported, has notified the officers of the Oskaloosa Traction & Light Company that it will exercise its options on the Oskaloosa properties. The Oskaloosa Company operates the electric-light, heating plant and street-railway system, and also the Oskaloosa & Buxton Interurban Railway.

PRAIRIE CITY, IA.—The proposition to grant a franchise to the Colfax Electric Light Company, of Colfax, Ia., to install an electric-light system in Prairie City will be submitted to the voters on Oct. 30.

ROCKWELL CITY, IA.—The plant and holdings of the Rockwell City Electric Light & Power Company have been purchased by William Webb, of Sac City, Ia. The consideration is said to be about $20,000. Mr. Webb will take over the management of the plant about Nov. 1.

HORTON, KAN.—Extensive improvements are being made to the electric plant of the Horton Water & Light Company. As soon as improvements are completed a new street-lighting system will be installed. It is proposed to discard the arc lamps now in use and install ninety tungsten lamps. The question of erecting ornamental lamps in the business section is under consideration by the merchants.

INDEPENDENCE, KAN.—The State Utilities Commission, it is reported, has granted the Union Traction Company of Kansas permission to issue bonds to the amount of $450,000, the proceeds to be used to build an electric railway from Cherryvale to Parsons, Kan.

MEADE, KAN.—The Meade Telephone Company, it is reported, has received permission from the State Utilities Commission to issue bonds to the amount of $20,000, the proceeds to be used for improvements to its system.

MORRILL, KAN.—Preparations are being made for the installation of a municipal electric-light plant in Morrill. Bids for machinery have been called for. Malin Litchty is city clerk and G. E. Johnson engineer.

NEWTON, KAN.—The State Utilities Commission, it is stated, has granted the Kansas Gas & Electric Company permission to issue bonds to the amount of $20,000, the proceeds to be used to purchase the property of the Newton Telephone Company and make extensions to the Wichita line.

LOUISVILLE, KY.—The Kentucky Electric Company is contemplating furnishing steam heat in the business portion of the city.

SHREVEPORT, LA.—At an election held Oct. 17 the proposition to issue bonds to the amount of $310,000 to construct a municipal electric-light and power plant was defeated.

BINGHAM, MAINE.—The local power house of the Central Maine Power Company was destroyed by fire on Oct. 10, leaving the town without electrical service. The company is now erecting a transmission line from Skowhegan to Bingham, which will be ready for operation in a short time.

CORINNA, MAINE.—The Central Maine Power Company is extending its transmission line from the main power line between Dexter and Pittsfield to Corinna to supply electricity here. The local electric-light

[illegible] several weeks ago, and the town has been without electrical service since.

DOVER, MAINE.—The Greenville Light & Power Company has purchased the plant and holdings of the Dover & Foxcroft Light & Heat Company.

HARTLAND, MAINE.—The Hartland Electric Light & Power Company has filed amendments to its charter increasing its capital stock to $25,000.

BALTIMORE, MD.—Application has been made to the County Commissioners to extend the electric-light system to Randallstown, a distance of 3 miles from the present terminus of the line.

FT. WASHINGTON, MD.—Bids will be received at the office of the quartermaster, Ft. Washington, Md., until Oct. 31 for furnishing miscellaneous electrical supplies. For further information address Lieut. D. N. Swan, Jr., quartermaster.

CHICOPEE, MASS.—The Board of Aldermen has voted to appropriate $96,000 for rebuilding and enlarging the municipal electric-light plant.

MALDEN, MASS.—The City Council has rejected the contract recently submitted by the Malden Electric Company for lighting the streets of the city for a term of ten years and has asked that the entire matter be referred to the Board of State Gas and Electric Light Commissioners. The company offered to reduce the price of arc lamps from $100 to $98 each per year and similar reduction on other lamps.

ANN ARBOR, MICH.—Plans have been completed by the Eastern Michigan Edison Company for the erection of an electric-generating plant at Ann Arbor, involving an expenditure of $250,000. The proposed plant will be located on the Huron River, near the water-works pumping station, where a dam will be built which will form a pool or basin covering about 300 acres. This will be known as the Barton plant, and will have an output of 800 hp, which will be supplied to the customers of the Washtenaw Light & Power Company in Ann Arbor, Ypsilanti, Saline, Wayne and Dearborn. When this plant is completed the Argo dam will be removed and the Argo generating plant will be used as a substation. Contracts for erection of the plant will be awarded within thirty days.

DETROIT, MICH.—The Hupp Corporation has awarded the contract for the construction of its new power plant to the Rutley Construction Company, of Detroit, Mich.

HANCOCK, MICH.—It is reported that the City Council is considering the question of installing a municipal electric-light plant in Hancock. It is expected that the proposition will be submitted to the voters at the election next spring.

JACKSON, MICH.—It is reported that preliminary arrangements have been made to lease the property of the Michigan United Railways Company for a period of 999 years to a corporation which will start with a paid-up capital stock of $2,000,000. Under the terms of the proposed lease the Michigan United Railways Company is to make extensions and improvements to its property, involving an expenditure of $3,265,000, which will be met by an issue of bonds.

REED CITY, MICH.—Part of the dam of the Osceola Light & Power Company, of Reed City, was carried away recently, causing the electric plant to be closed down. The city is now without electrical service, and probably will be for some time.

DULUTH, MINN.—Plans have been prepared by Oscar Claussen, of St. Paul, Minn., and Charles L. Pillsbury, of Minneapolis, engineers, for the installation of a municipal electric-light plant, to cost approximately $901,798. The cost of the power house and machinery is estimated at $240,000; overhead distributing system, $272,855; underground distributing system, $85,000, and meters, $72,000. The plans also include an emergency plant to secure power from the Great Northern Power Company.

HENDRICKS, MINN.—A franchise has been granted to Ernest Smelser to install and operate an electric-light system in Hendricks.

KERHOVEN, MINN.—The installation of a municipal electric-light plant is reported to be under consideration.

MINNEAPOLIS, MINN.—The Center Improvement Association is conducting a campaign to secure funds for the installation of 147 ornamental lamps, to cost $7,025.

MINNEAPOLIS, MINN.—The public lighting committee is contemplating remodeling the electric-light plant in the court house and the city hall with a view of providing electricity to operate 200 ornamental street lamps. It is understood that a consulting engineer will be engaged and bids called for the work.

MINNEAPOLIS, MINN.—Plans are being considered by the City Council for the installation of ornamental lamps in the central district. It is proposed to erect 130 additional ornamental lamps for which the Board of Tax Levy recently appropriated $7,500, with $4,200 for maintenance during the year 1912. The Bridge Square Improvement Association is also advocating the erection of ornamental lamps on Washington Avenue, between the Milwaukee & Minneapolis and St. Louis stations on Hennepin and Nicollet Avenues and First Avenue, between Washington Avenue and High Street, and in the vicinity of the Soo line station.

NEW ULM, MINN.—In a report submitted by Earle D. Jackson, of St. Paul, Minn., the installation of an additional engine and generator at the electric-light and water-works plant, to cost $3,800, is recommended, instead of the construction of a condenser and cooling tower, the cost of which is estimated at $11,000.

OWATONNA, MINN.—A. L. Ober, of Chatfield, Minn., who was granted a franchise some time ago, is planning to erect another power plant in Owatonna to supply electricity from the Zumbro River to Byron, Rochester, Dodge Center, Kassón, Claremont and Owatonna.

RED LAKE FALLS, MINN.—The city of Red Lake Falls is considering the question of granting an electric-light and power franchis , for which proposals have already been called for.

WARBA, MINN.—It is reported that the village of Warba will soon be lighted bý electricity. Energy for operating the system will be supplied by the electric plant of the Warba Hardwood Manufacturing Company.

WINONA, MINN.—Arrangements are being made for extensive improvements to the light, power and water service of the Winona Railway & Light Company, which will involve an expenditure of about $20,000. The company is now in the hands of a receiver.

WYKOFF, MINN.—The proposition to install an electric-light system in Wykoff, the cost not to exceed $3,000, will be submitted to a vote.

KANSAS CITY, MO.—The question of installing a new ornamental street-lighting system in the business section of the city is under consideration.

HELENA, MONT.—Judge Carl Rasch in the federal court has appointed George F. Shelton, of Butte, Mont., receiver of the United Missouri River Power Company, which owns the Canyon ferry, the Hauser Lake and the uncompleted Holter hydroelectric plants on the Missouri River. The receiver was appointed at the request of the United States Mortgage & Trust Company, of New York, N. Y., which holds $12,500,000 in bonds of the company.

MISSOULA, MONT.—The Clark Street Railway Company is planning to build an electric railway from Missoula to the foot of Flathead Lake.

RUBY, MONT.—Plans are being considered by the Madison River Power Company for the installation of a lighting and power system between Ruby and Virginia City. A transformer station is to be erected at Laurin.

CENTRAL CITY, NEB.—The City Council is reported to have decided to replace the present arc lamps with tungsten lamps for street lighting.

KEARNEY, NEB.—Plans are being considered by the City Council for the installation of a municipal electric-light plant, for which plans and estimates have been prepared. It is proposed to operate the plant in connection with the city water-works system. An extra boiler is available at the water plant, and all that would be required is an extra engine and electric generator. The present plan is to light all of Central Avenue from Nineteenth Street to the Midway Hotel, using ornamental standards with cluster lamps. In addition it is proposed to furnish electricity for 21[illegible] lamps at street intersections and public parks and school houses in the city.

NELIGH, NEB.—Plans are being considered by the business men to install an ornamental lighting system on the business streets of the city. It is proposed to replace the present arc lamps with cluster lamps erected on ornamental standards.

NORFOLK, NEB.—Extensive improvements and additions are being made by the Norfolk Electric Light & Power Company to its property in this city, including the construction of a new power house and the installation of a 500-kw generating unit, consisting of a heavy duty compound condensing engine and a three-phase generator.

OVERTON, NEB.—The Village Board is reported to have granted a franchise to W. W. Hill to construct and operate an electric-light plant for a period of twenty years. The town has contracted for twenty street lamps.

MENDHAM, N. J.—The Borough Council has granted the Bernards Electric Company a forty-year franchise and has also entered into a contract for street lighting for a period of five years. Under the terms of the contract the company is to supply at least forty lamps at the rate of $18 per lamp per year and to supply electricity to private consumers at a maximum rate of 15 cents per kw-hour. The Bernards company, which is controlled by the Eastern Pennsylvania Light & Power Company, has agreed to make improvements to its plant and distributing system and be ready to furnish the service within seventy-five days.

SPRING LAKE, N. J.—The Borough Council is considering the question of establishing a municipal electric-light plant in conjunction with the new water-works system.

TRENTON, N. J.—Arrangements are being made by the Public Service Electric Company to supply electricity from the local plant on Chancery Street in Princeton, Monmouth Junction, Cranbury, Skillman, Hopewell and other nearby places. When the necessary changes are made at the local plant the power house at Rocky Hill will be abandoned. Machinery to provide for 2000 additional hp will be installed at the Chancery Street plant.

AUBURN, N. Y.—Announcement has been made that the plant and holdings of the Auburn Telephone Company, together with the Skaneateles and Allied Telephone Companies in Onondaga and Cayuga counties, have been purchased by the Bell interests through the Friendship Telephone Company, a holding company. These companies have heretofore been independent and were among the larger components of the system of the Federal Telephone Company.

BINGHAMTON, N. Y.—Application has been made to the City Council

Peters Brothers, of Chenango Forks, for a franchise to supply electricity for lamps, heat and motors in Binghamton. The firm of Peters Brothers is planning to erect a large hydroelectric plant on the Chenango River in Chenango Forks.

GLENS FALLS, N. Y.—The Stone & Webster Management Association, of Boston, Mass., has taken over from the receivers the physical operation of the eight companies of the Hudson River Power Company. As a further step to their rehabilitation the various affiliated Hudson River properties have been deeded over to the bondholders' committee, and to James R. Hooper of the New England Trust Company, who will in turn transfer them to the proposed new company to be incorporated under New York laws. The name of the new company has not yet been decided, but according to the reorganization plan, which will in the immediate future be formally submitted to the New York Public Service Commission for approval, the capitalization of the new company will be $...00,000 preferred stock, $9,500,000 common stock, and $10,000,000 in bonds, of which only $5,000,000 will be initially issued.

GOUVERNEUR, N. Y.—The Northern Power Company is contemplating the erection of another transmission line from its power plant located at Hannawa Falls to Gouverneur, via Edwards and Fullerville. The company expects to supply about 800 hp in the village of Edwards for ... purposes alone. The zinc plant now being erected near the village ... utilize electricity to operate its plant, and the power company will ... furnish energy to the Ontario Talc Company as soon as preparations are completed to increase the output of the latter company's plant.

LONG ISLAND CITY, N. Y.—It is stated that the contract awarded ... Long Island Railroad Company to P. H. Clements & Company ... includes the equipment of the entire railway from Long Island ... Port Washington for electrical operation.

NEW YORK, N. Y.—Bids will be received by Patrick A. Whitney, ...sioner of Correction, Department of Correction, 148 East Twen...e Street, New York, N. Y., until Oct. 31, for furnishing material and erecting addition to power plant on Hart's Island, to be used as engine and dynamo room. Blank forms and further information may be obtained and plans and drawings seen at the above office.

...AN, N. Y.—The special lighting committee appointed to confer ... Olean Electric Light & Power Company to try to secure a re... in the rate for street lighting has adopted a resolution that the ...on to install a municipal electric-light plant, to cost $75,000, be ...d to the voters at the general election to be held Nov. 7. ...an Electric Light & Power Company has submitted a proposition ... to supply street arc lamps at $65 each per year, provided the ... 250 lamps for a period of ten years. The city now pays $72 ... for about 150 lamps.

OSWEGO, N. Y.—Plans are being considered for the installation of an ornamental street-lighting system in the business district of the ...

...HESTER, N. Y.—E. W. Edward & Son are planning to build ... house in connection with their new department store at St. ... Division Streets, Rochester. Crandall & Strobell, of Rochester, are architects.

...HESTER, N. Y.—The Board of Contract and Supply has awarded ...hester Railway & Light Company the contract for lighting 300 ...m boxes at the rate of $22.63 each per year, making a total of ... The rate last year was $25 per lamp; the reduction in price is due ... increase in the number of lamps, as but 200 lamps had been installed ...

...USAND ISLAND PARK, N. Y.—Plans are being considered by ...usand Island Park Association for the installation of a heating, ... and power plant at Thousand Island Park next year. The ... the plant is estimated at $7,500. J. P. Lewis, of Beaver Falls, ...s president.

...EA, N. C.—The Azalea Woodworking Company, it is stated, ...ke to receive prices on a generator with sufficient output to supply ...y for sixty lamps and a Corliss engine.

MORGANTON, N. C.—The City Council has granted H. L. Milner a ...e to install an electric-light system in Morganton.

...ON, OHIO.—The Northern Ohio Traction & Light Company has ... a proposal to the City Council for a renewal of the street- ... contract as follows: For arc lamps, $60 each per year and $21 ... year for incandescent lamps on a five-year contract, and $55 per lamp for arc lamps and $19.75 each year for incandescent ... a ten-year contract, with all-night and every-night service. ...s under the new contract are considerably lower than the city ...aying for the service. The present contract expires Oct. 12, 1912.

CINCINNATI, OHIO.—Plans have been completed by the Cincinnati, ... & Dayton Railroad Company for the installation of a telephone ...ng system on its main lines between Cincinnati and Toledo, ...d between Hamilton, Ohio, and Indianapolis, Ind.

CLEVELAND, OHIO.—The City Council has adopted a resolution ...g for the appointment of a committee to make an investigation ... rates of electricity for lamps now charged by the Cleveland Elec... Illuminating Company. This action was brought about through an ...tion of a measure fixing the maximum rate at 8 cents per kw ... the minimum at 4 cents per kw-hour. The question of sub... the proposition to issue $2,000,000 in bonds for extensions to the ...al lighting plants to the voters is under consideration.

FREMONT, OHIO.—The City Council has adopted a resolution authorizing the service director to call for bids to be opened on Nov. 21 for a new contract for lighting the streets for a period of ten years, involving an expenditure of $150,000. Plans and specifications for the new contract have been prepared by F. Froehlich, of Toledo, Ohio. The Fremont Yaryan Company has the present contract for street lighting, which has expired.

MARTIN'S FERRY, OHIO.—The City Council is considering the question of purchasing new arc lamps for lighting the streets of the city.

BROMIDE, OKLA.—The Bromide Oolitic Stone Works, it is reported, are in the market for a 150-kw, alternating-current, three-phase generator.

MULDROW, OKLA.—F. R. Stone, of Lima, Ohio, is reported to have secured the contract for the construction of the combined electric-light plant and water-works pumping station for the city of Muldrow, at $26,-760.

SULPHUR, OKLA.—The Rapid Transit Interurban Company, of Tecumseh, Okla., is reported to be contemplating the installation of an electric plant to supply electricity to cities along the route of its proposed railway.

TULSA, OKLA.—All bids submitted for the installation of gas and electric fixtures in the county court house are reported to have been rejected by the Board of County Commissioners, as all were in excess of the architect's estimate. The clerk has been notified to call for new bids and the architect was instructed to prepare specifications calling for less expensive goods.

ALBANY, ORE.—The City Council has revoked the franchise of the Portland, Eugene & Eastern Railway Company on all streets where tracks have not been laid.

BAKER, ORE.—The Central Oregon Power & Irrigation Company, recently organized, is planning to irrigate a large tract of land in Harney County. The company proposes to utilize electricity generated by water-power of Blitzen River to pump water from Malheur Lake for irrigation purposes. The first unit to be irrigated will consist of 10,000 acres. It is estimated that there is sufficient power and available water and land to increase the project to 40,000 acres. Surveys are being made under the direction of C. W. Parrish, irrigation engineer of the Pacific Power & Light Company, who is one of the incorporators. W. A. Pope and S. S. Stuart are also interested in the enterprise. We are informed that the Pacific Power & Light Company has no connection whatever with the new company.

EUGENE, ORE.—The City Council has passed an ordinance providing for the sale of $25,000 in bonds for street lighting. Tungsten series lamps, it is said, will be installed.

EUGENE, ORE.—The City Council has refused the offer of the Oregon Power Company to purchase the municipal electric-light plant. The city is planning for the installation of a complete transmission and distributing system from the municipal plant at Waterville, bonds for which were recently voted.

LENTS, ORE.—The Commercial Club is considering plans for lighting the streets of the town by electricity.

MYRTLE CREEK, ORE.—The City Council is planning to increase the output of the municipal lighting plant, for which machinery is being purchased.

ALTOONA, PA.—The Penn Central Light, Power & Heat Company is extending its transmission line to the powder works at Horrell station to supply electricity to operate the works. The line is being erected over Brush and Scotch Mountains.

CARLISLE, PA.—The City Council has passed a resolution authorizing the installation of an ornamental lighting system for the public square. It is proposed to erect twelve ornamental lamp standards carrying cluster lamps at each of the six corners and four arc lamps at the avenue intersections. Five or eight lamps will be erected on each standard. At present there are nine arc lamps. The cost will be paid by the churches, several banking concerns, County Commissioners, the borough and the Carlisle Gas & Water Company.

PHILADELPHIA, PA.—Sealed proposals will be received by Joseph F. Hasskarl, director, at the Department of Wharves, Docks and Ferries, 55 Bourse Building, Philadelphia, Pa., until Nov. 1, for furnishing electrical apparatus for Vine Street Pier and immigrant quarters. The cost of the work is estimated at $5,500.

PINE GROVE, PA.—An effort is being made to install an electric-light system in Pine Grove. F. H. Hochrath, of Philadelphia, is interested in the project and proposes to furnish the service through the plant of the Tremont & Pine Grove Electric Light, Heat & Power Company, which is located in Tremont. At present the streets of the town are lighted by oil lamps.

RED BANK, PA.—The Red Bank Electric Company has filed a certificate showing an increase in its indebtedness to the amount of $10,000.

ROYERSFORD, PA.—The City Council has decided to submit the proposition to establish a municipal light plant in Royersford to a vote at the November election.

SHARON, PA.—The City Council is considering the question of establishing a municipal electric-light plant, to cost approximately $50,000.

BLUNT, S. D.—The local electric-light plant, owned by the Aberdeen Engineering Company, has been purchased by Frank J. Gunsalus, of Blunt. The price paid for the plant was $15,000, and includes city fran-

chise, contract and power plant. G. A. McLaughlin, of Aberdeen, S. D., [illegible]

FLANDREAU, S. D.—The installation of an electric-light plant in Flandreau is reported to be under consideration. Foster Philips is said to be interested in the project.

GARRETSON, S. D.—Investigations are being made by J. A. Wiberg, of Luverne, Minn., with a view of installing and operating an electric-light plant in Garretson.

PHILIP, S. D.—Application has been made to the City Council by F. E. Morrison for a franchise to establish an electric-light plant in [illegible]

PIERRE, S. D.—The United States government is installing an electric-light plant at the Cheyenne River agency.

STICKNEY, S. D.—It is reported that local capitalists are organizing a company for the purpose of establishing an electric-light plant in Stickney.

CHATTANOOGA, TENN.—Plans are being considered by the East Tennessee Telephone Company for further extension of its telephone cables, which will involve an expenditure of from $30,000 to $35,000.

LONSDALE, TENN.—The Council has granted the Eastern Tennessee Power Company a franchise to supply electricity in Lonsdale.

BRYAN, TEX.—Arrangements have been made by the City Council for issuing $23,000 in bonds for improvements to the public utility plants, of which $7,000 will be used for the electric-light plant.

CAMERON, TEX.—Extensive improvements are contemplated by the Cameron Water, Power & Light Company, which will involve an expenditure of about $18,000. Plans for the proposed improvements have been prepared by N. Warrenfield, of Dallas, Tex. The company was recently awarded a contract to supply the city with water and street lighting for a term of twenty years.

COTULLA, TEX.—J. R. Black, of Cotulla, is planning to construct a dam across the Nueces River to form a storage reservoir to supply water to irrigate 12,000 acres of land. A hydroelectric and cotton mill will be installed in connection with this project. Electricity generated by the hydroelectric plant will be transmitted to Cotulla and other places in this vicinity.

GALVESTON, TEX.—Capital stock of the Galveston-Houston Electric Company to the amount of $300,000 is being offered for sale, the proceeds to be used for extensions and improvements to the property; to meet the increasing demands made upon the company

KENEDY, TEX.—A new electric-light plant is being erected in Kenedy by the Kenedy Light & Power Company. The proposed plant will have sufficient output to supply 2000 lamps. The company expects to have the plant ready for operation about Nov. 1 and to establish a twenty-four-hour service about Jan. 1, 1912. Messrs. Autry and McAda are interested in the company.

MIDLAND, TEX.—The City Council has contracted with the Midland Light Company for the installation of a number of additional lamps. The company is planning to improve its plant.

SAN ANTONIO, TEX.—The Medina Irrigation Company, which is constructing a dam and irrigation system near San Antonio at a cost of about $6,000,000, is planning to erect large cotton mills and oil mills and other industrial plants to utilize products that are to be raised upon the land that is to be reclaimed. The main dam will be 170 ft. high, 107 ft. thick at the base, about 50 ft. wide at the top and 1500 ft. long. The reservoir will cover approximately 6000 acres and hold enough water to irrigate 100,000 acres of land. A second reservoir will be built below the main dam by construction of another dam 40 ft. high and about 1000 ft. long. The canals and laterals will have a total length of about 228 miles. Plans have been prepared for the installation of a hydroelectric plant in connection with the irrigation system. The construction of an electric interurban railway to extend from San Antonio through the irrigated property and intermediate towns is contemplated, work on which will soon begin. This company is one of the several projects which F. S. Pearson, of New York, N. Y., and associates are interested in.

SHERMAN, TEX.—An executive committee has been appointed in Sherman to take charge of the work of arranging the details for the construction of an interurban railway between Sherman and Greenville, and also between Gainesville and this city. A fund of $20,000 has been raised to pay for preliminary work on the project. C. B. Dorchester, E. B. Caraway, D. B. Lyon, C. C. Mayhew and Joseph Etter are members of the committee.

TEMPLE, TEX.—The construction of an interurban electric railway between Temple and Marlin, a distance of about 30 miles, is under consideration by a syndicate of Dayton, Ohio, men, headed by Dr. S. F. George. The promoters are asking a bonus of $75,000 from the residents of the towns on the route of the proposed railway. Of this amount the citizens of Temple will be required to donate $50,000.

VICTORIA, TEX.—The City Council has granted the St. Louis, Brownsville & Mexico Railway Company a fifty-year franchise to construct and operate a system of motor cars in Victoria. The company is planning to extend its steam railway from Bloomington to Victoria, and the proposed motor-car system in this city will be operated in connection with that line. The company was recently granted a similar franchise in Brownsville.

MONROE, UTAH.—At the special election held Oct. 12 the proposition to issue bonds to the amount of $10,000 to purchase the local electric-light plant was carried.

OGDEN, UTAH.—The Merchants' Light & Power Company has awarded a contract to the Falkenau Electrical Construction Company, of Chicago, Ill., to complete the permanent substation equipment and to erec the main trunk lines which will transmit electricity to all parts of the city for commercial purposes. The entire work will call for an expenditur of about $75,000. The company is now erecting arc lamps for lighting the streets of the city. P. M. Parry is manager.

SALT LAKE CITY, UTAH—The Salt Lake & Ogden Electric Railwa Company expects to purchase a 500-kw high-pressure steam turbine fo its power plant in Salt Lake City.

ST. JOHNSBURY, VT.—The St. Johnsbury Electric Company i erecting a new power station on the former Carrick property, whic it expects to have completed by Jan. 1. This is the fourth station t be operated by the company and will give the company a large suppl of power for manufacturing purposes. To encourage new industries t locate in St. Johnsbury the company announces that it is ready to erec a building for any reliable manufacturing firm that may wish to locat there and rent the same for 6 per cent on its actual cost and furnis the company energy at the regular rate. The St. Johnsbury company ha extended its system to Danville and will supply electricity for lightin the streets and residences in that village. Preparations are being ma to extend its transmission lines to East Johnsbury and Concord. Th streets in Concord will be lighted by forty 32-cp incandescent lamps.

DANVILLE, VA.—The Board of Aldermen has approved of the l cation of the new municipal electric-light plant, which will be erect at a cost of $150,000. The proposed plant will be located on Brid Street, on what is known as the old Lee Warehouse property.

ELLENSBURG, WASH.—Resolutions have been passed by the C Council creating improvement districts for the installation of stre lighting systems. Cluster lamps will be erected in the business distri

NEWPORT, WASH.—The telephone system of the Newport Te phone Company has been acquired by the Interstate Telephone Compa of Spokane, for a consideration of $25,000. The Newport system w be connected with the long-distance lines.

OTHELLO, WASH.—The Washington Fruit Lands & Irrigation Co pany is planning to install electric pumping machinery on the Colum River highlands.

SEDRO-WOOLLEY, WASH.—Bids will be received by the St Board of Control, Olympia, Wash., until Nov. 6 for the erection o power house and also for mechanical equipment, boilers, engines, e for power plant for the Northern Hospital for Insane at Sedro-Wool Plans may be seen at the office of Saunders & Lawton, architects, Ala Building, Seattle, Wash.

SULTAN, WASH.—The city clerk is reported to have been author to advertise for bids for the installation of a lighting system.

SPOKANE, WASH.—It is reported that work will soon begin on construction of the spillway dam at Long Lake, 30 miles north Spokane, where the Washington Water Power Company proposes develop 90,000 hp. The proposed dam will be 320 ft. in length, 19C at the highest point and 145 ft. in width at the base, built of cyclop masonry. The spillway is to be surmounted with three roller dams, 25 ft. in length and 19 ft. in diameter. The tunnel through which flow of the Spokane River will be diverted is 225 ft. in length and o into a cut of 250 ft. The entrance to the tunnel will be of forced concrete construction and steel girders. The cost of the e work is estimated at $4,000,000.

TOPPENISH, WASH.—The Reservation Electric Company is ning to install an electric-lighting system at the Yakima Indian C

MADISON, WIS.—Bids will be received by the State Board of trol, Madison, Wis., until Nov. 1, for rewiring the lighting fixtures the Northern Hospital for Insane at Winnebago, Wis. Vaughn & M of Milwaukee, Wis., are consulting engineers.

CHEYENNE, WYO.—It is reported that investigations have been by a party of capitalists headed by L. D. McCall of power and irrig projects in the State of Wyoming. As a result of this investigation, said, a company will be incorporated with a capital stock of $2,500,0 develop two water-power sites in Carbon County and irrigate 20 acres of land in the Encampment and Saratoga districts.

CALGARY, ALTA., CAN.—The Western Canada Power, He & Light Company is planning to lay mains from Bow Island to Cal also to Macleod, Claresholm, Granum, Staveley, Nanton, High River and Okotoka.

CALGARY, ALTA, CAN.—Sealed tenders will be received by City Commissioners, Calgary, Alta., until Nov. 15 for both track and line material for street railway. For further information apply t the City Commissioners.

TRAIL, B. C., CAN.—The Canadian Pacific Railway Company, is reported, is contemplating equipping its railway from Trail to Rossland, B. C., for electrical operation.

VANCOUVER, B. C., CAN.—The fire and police committee h au thorized City Electrician McCrossan to call for bids for the insta ion of an ornamental street-lighting system on Hastings and neigh ing streets. An underground distributing system will be installed, a 250 lamp standards erected.

[illegible]

[illegible]station. The property is located on Powell Street, opposite the B[illegible]ish Columbia Sugar Refinery Works. It is expected to have the st[illegible]on completed in time to receive energy from the company's hydro-el[illegible]tric plant at Stave Falls the latter part of November.

[illegible]EACHVILLE, ONT., CAN.—The village of Beachville is contemplating the installation of an electric-light system, electricity for same to be secured from the Hydroelectric Power Commission The proposition will soon be submitted to the ratepayers.

[illegible]LT, ONT., CAN.—The Water Works Commission has decided to [illegible] the pumping station.

[illegible] ONT., CAN.—[illegible] Company, of Campbellford. Thomas Tuer, superintendent of [illegible]t, has been appointed local manager for the new company.

[illegible]NTO, ONT., CAN.—Tenders will be received until Nov. 1 for [illegible] Company, at Niagara Falls, Ont. Plans and specifications may [illegible] St[illegible]t, Toronto, Ont.

[illegible] MEX.—The Chapala [illegible] Puente Grande, and will remodel and reconstruct its transmis[illegible]stem extending to the Hostatipaquillo and Etzatlan mining dis[illegible]

[illegible], MEX.—The Mexico [illegible] & Power Company, [illegible]y completed the construction of another of its large dams to co[illegible]rve the water supply for its hydroelectric plant at Necaxa, will s[illegible] install additional equipment that will add 30,000 hp to the present out[illegible] of the plant. Announcement has been made that the Mexico Tr[illegible]ays Company, a subsidiary of the company, which operates the ele[illegible]c railway system in the federal district and this city, will soon beg[illegible] work on the construction of an electric interurban railway to exten[illegible] from this city to Puebla, a distance of 129 miles, and also to Pa[illegible]ca, a distance of 94 miles.

[illegible]GOLES, MEX.—Plans are being considered by C. W. Phillips and [illegible]s for the installation of a hydroelectric plant near the Penn[illegible]gold mines, near Nogales. Other machinery will also be installed.

[illegible]RAL, CHIHUAHUA, MEX.—Edmund Putnam and associates are [illegible]g to install an electric hoist and other machinery at the Provi[illegible] mine, near Parral.

[illegible] LUIS POTOSI, MEX.—It is reported that the local street-car [illegible] operated under the name of the San Luis Tramway Company, [illegible] purchased by English interests, will be equipped for electrical [illegible]n, work on which will begin in the near future. The same inter[illegible] is said, are negotiating for the purchase of the street-railway [illegible] in Tampico. If the deal is consummated the system will be [illegible] electrical operation.

New Industrial Companies.

[illegible] ATLANTIC VEHICLE COMPANY, of New York, N. Y., has [illegible] a charter with a capital stock of $10,000 for the purpose [illegible]facturing motor vehicles. The incorporators are: Philip A. Car[illegible] East Forty-seventh Street; Joseph F. Dempsey and Eugene A. [illegible], 59 Wall Street, all of New York, N. Y.

[illegible]TOMATIC CALENDAR CLOCK COMPANY, of Wilmington, [illegible]s been incorporated with a capital stock of $1,000,000 by J. F. [illegible] J. D. Rhodes, of Washington, D. C., and A. P. Stevenson, of [illegible]n, Del.

[illegible] BURTIS COMPANY, of Trenton, N. J., has been incorporated [illegible] capital stock of $125,000 to deal in electric fixtures, etc. The in[illegible]ors are: J. Woolsey Burtis, 3 North Montgomery Street; Alleyne [illegible] 136 East State Street, and Hervery S. Moore, all of Trenton.

[illegible] DISC-O-PHONE COMPANY, of New York, N. Y., has been [illegible]rated with a capital stock of $10,000 by William C. Crumlish, of [illegible]gton, Del.; Howard Bayley, Thirty-first Street and Broadway, [illegible]iam F. Rea, 456 Broadway, New York, N. Y. The company [illegible]s to manufacture talking machines, records and supplies.

T[illegible] DOUBLE-PHONE MANUFACTURING COMPANY, of Boston, Mass., has been granted a charter with a capital stock of $100,000 to man[illegible]cture double-phones. E. Berger is president and G. M. Faulkner, of B[illegible]okline, Mass., treasurer.

TH[illegible] GARLAND CONSTRUCTION COMPANY, of Rochester, N. Y., has [illegible]en incorporated with a capital stock of $10,000 for the purpose of doin[illegible] a general contracting and engineering business, etc. The incorporators are: Edson G. Whitcomb, 48 Powers Building; Gordan Garland, 391 Birr Street, and Everett K. Van Allen, 530 Powers Building, all of Rochester, N. Y.

THE INDIANA GAS ENGINE COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $25,000 to manufacture gas engines and all kinds of mechanical and electrical machinery and devices. The incorporators are: Granville G. Westerfield, James W. Comaty, Samuel S. Brewer and Bernard Korbly.

THE INTERNATIONAL MOTOR COMPANY, of New York, N. Y., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000,000, by Richard S. Aldrichs, Graham Foster and Joseph A. Bennett, of New York, N. Y., and Harry W. Davis, of Wilmington, Del. The company proposes to manufacture motors, engines and incidental devices.

THE PAUL LACROIX AUTOMOBILE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 to manufacture and deal in motor vehicles. The incorporators are: Paul Lacroix, 353 West Eighty-fifth Street; Harry U. Kibbe, 258 Riverside Drive; Harvey T. Andrews, 35 Mount Morris Park West, all of New York, N. Y.

THE QUEEN CITY ELECTRIC AUTOMOBILE COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $50,000 by A. C. Towne, of Kenmore, N. Y.; C. S. Chamberlain, 93 Lancaster Avenue, and Moses T. Day, 1212 Prudential Building, Buffalo, N. Y.

THE THERMODYNE ENGINE COMPANY, of New York, N. Y., has been incorporated by William Esson, 161 West 105th Street; W. H. Fritchman and L T. Fetzer, 44 Pine Street, all of New York, N. Y. The company is capitalized at $30,000 and proposes to manufacture machinery, engines, etc.

THE UNION OXY-CARBIDE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $50.000 for the purpose of doing a mechanical engineering business and manufacturing machinery. The incorporators are: G. H. Schwarz, A. M. Bremer and P. A. Rose, of New York, N. Y.

THE UNITED RAILWAY APPLIANCES COMPANY, of Salamanca, N. Y., has been incorporated with a capital stock of $100,000 by J. Harvey, C. Paul and J. E. Maloney, of Salamanca. The company proposes to manufacture railroad appliances and supplies.

New Incorporations.

ATLANTA, GA.—A charter has been granted to the Georgia Railway & Power Company with a capital stock of $27,000,000. The company is to take over the plant and holdings of the Georgia Railway & Electric Company, of Atlanta, and all the hydroelectric plants in the north and northeastern sections of the State. C. Elmer Smith, of York, Pa., is to be president of the company.

BENTON, ILL.—The Egyptian Southern Railway Company has been incorporated with a capital stock of $10,000 to construct an electric railway from McLeansboro to Herrin. The directors are: Walter W. Williams, W. H. Hart, George A. Powers, L. W. Brand, all of Benton, Ill.

BRADFORD, ILL.—Articles of incorporation have been filed for the Central Illinois Interurban Railroad Company, with a capital stock of $100,000. The company proposes to build an electric railway from a point in or near the city of Kewanee, in Henry County, to a point in or near the city of Henry, in Marshall County. The incorporators are: C. N. Gerard, of Bradford, Ill.; E. A. Beadle, of Kewanee, Ill.; H. R. Hess, of Whitefield, Ill.; Howard G. Stener, of Henry, Ill., and H. H. Haines, of Peoria, Ill.

EDWARDSVILLE, ILL.—The Edwardsville Gas & Electric Company has filed articles of incorporation under the laws of the State of Indiana for the purpose of supplying electricity and gas for light, heat and power purposes in Edwardsville, Ill. The incorporators are: Paul J. Scheller, Henry Darmettelle and H. J. Peckinpaugh. The main office of the company will be located in Evansville, Ind.

OLNEY, ILL.—Articles of incorporation have been filed for the Terre Haute & Ohio River Railroad Company for the purpose of building a railway from Clark County, Illinois, opposite Terre Haute, Ind., to Elizabeth, Ill., on the Ohio River. The company is capitalized at $160,000.

EVANSVILLE, IND.—The Central Gas & Power Company has been incorporated with a capital stock of $10,000 for the purpose of operating an electrical distributing system. The incorporators are: P. J. Scheller, Henry Dannettell and H. J. Peckinpaugh.

FERDINAND, IND.—The Ferdinand Railway Company has been incorporated to take over a steam railroad, 7 miles in length, extending from Ferdinand to Huntersburg. The charter provides for operating the road with steam or other motive power and for construction of branch lines. It is understood that the railway will be converted into an interurban road. The directors are: Henry Beekman, J. H. Beekman, Peter Muller and Mathias Ollinger.

COLFAX, IA.—Articles of incorporation have been filed for the Colfax Electric Light Company with a capital stock of $35,000 by A. J. and F. J. Breeden.

Personal.

[illegible] has been appointed assistant superintendent [illegible] of the Kentucky [illegible] Company, of Louisville.

[illegible] formerly of the [illegible] department of the [illegible] Electric Company, has been appointed [illegible] of the [illegible] Lighting Company, Louisville, Ky.

MR. M. RUSSELL ARMSTRONG has been appointed chief engineer of the municipal electric-light plant at Columbus, Ohio. Mr. Armstrong is a graduate of the Ohio State University in the class of 1911.

[illegible], the newly appointed [illegible] of lighting for the Ohio Valley Electric Company at Huntington, W. Va., was formerly engineer of power for the Louisville (Ky.) Lighting Company.

DR. KURT DYCKERHOFF, of Wiesbaden, Germany, is on a visit to this country in order to inspect some of the more important electrical manufacturing and operating plants, including electrochemical works.

MR. CHAUNCY L. HIGHT, recently with Wetmore, Savage Company, Boston, has accepted the management of the New York office of Henry D. Sears, Boston, and will be located at 143 Liberty Street after Nov. 1.

DR. C. P. STEINMETZ will present a paper entitled "Phenomena Beyond the Elastic Limit with Special Reference to Electrical Effect" before the Engineering Society of the Stevens Institute of Technology on April 1[illegible], 1912.

MR. J. D. LYON, manager of the electrical commercial department of the Cincinnati Union Gas & Electric Company, has been appointed a member of the committee on rate revision of the National Electric Light Association.

MR. FRANK F. FOWLE has been appointed vice-president of the Electric Club of Chicago, succeeding Mr. A. A. Gray, resigned. Mr. Fowle has also taken on himself the duties of chairman of the speakers committee of the club.

MR. PHILIP S. DODD, director of publicity National Electric Lamp Company, is making a trip through the Pacific Coast States addressing the different commercial sections of the National Electric Light Association on co-operative methods.

DR. L. R. GEISSLER, who until recently has been connected with the Psychological Laboratory of Cornell University, has accepted an appointment as associate psychologist in the physical laboratory of the National Electric Lamp Association, Cleveland, Ohio.

MR. EGBERT DOUGLAS, who has made an excellent record as commercial engineer of the Milwaukee Electric Railway & Light Company, has been promoted to be sales manager of that company, and as such will have charge of the selling work and commercial organization.

MR. NAOHIRO MORI, engineer for the Osaka (Japan) Electric Light Company, is spending a few weeks in Pittsburgh, studying the construction and erection of two 5000-kw Westinghouse turbo-generators which will be used by his company when completed. Mr. Mori is a graduate of the Osaka Technical College.

MR. J. M. KLINGELSMITH, formerly connected with the Lansden Company, of Newark, N. J., and lately in charge of the electric-truck department of the Anderson Electric Car Company, of Chicago, has been appointed western representative of the Edison Storage Battery Company, with headquarters in the People's Gas & Coke Company Building, Chicago, Ill.

MR. NORMAN G. KENON, president of the Union Gas & Electric Company, of Cincinnati, has just returned from a five-months' trip abroad, where he visited Switzerland, France and other European countries. Mrs. Kenon accompanied her husband on the trip. Mr. Rollin W. White has served as acting president of the Cincinnati company in Mr. Kenon's absence.

MR. A. M. WORTHINGTON, general manager of the Louisville Lighting Company in Louisville, was presented with a gold watch and chain by the directors of the concern last week. Mr. Worthington was forced to resign his position on account of illness and will move to a different climate. The clerks in the office also presented him with a handsome alligator handbag for traveling purposes.

GEN. GEORGE H. HARRIES has become the head of the Louisville lighting companies. As announced in these columns Oct. 7, General Harries severed his connection with the Washington public-service companies to become connected with Byllesby & Company, though at that time it was not known that he had been selected for the Louisville post. His friends and associates in Washington are to give him a banquet in November.

MR. F. X. CLEARY has resigned his position as advertising manager for the Western Electric Company, to engage in special advertising and sales promotion service. Mr. Cleary's long service as salesman, sales manager and advertising manager has given him a wide experience and acquaintanceship in the electrical field, which will continue to be his line of future effort. Mr. P. L. Thomson, formerly manager of the Western Electric Company's Pittsburgh house, has been appointed advertising manager.

MR. C. D. CHASTENEY has resigned as sales manager of the De Laval Steam Turbine Company, of Trenton, N. J., having acquired an interest in the Turbine Equipment Company, of 30 Church Street, New York, which company represents the De Laval Steam Turbine Company in New York State, parts of New Jersey and Connecticut. Mr. Chasteney was graduated from Stevens Institute of Technology in 1901, and has be with the De Laval Steam Turbine Company since the organization of t American company ten years ago.

MR. S. P. WAY, superintendent of the Union Electric Light & Pow Company, of St. Louis, Mo., has been made assistant general manager the Milwaukee Electric Company, to have charge of the light and pow department, the appointment to take effect Nov. 1. Mr. R. Stearns remains assistant general manager directing the railway depa ment. Mr. Egbert Douglas, who has been commercial engineer, succe Mr. C. N. Duffy as general sales agent, and Mr. Duffy will devote entire time to the duties of comptroller of the company.

MR. D. STERRETT PINDELL has been added to the staff of the gineering and construction firm of C. G. Young, 60 Wall Street, N York City. Mr. Pindell has had an extensive experience in a wide ra of engineering, construction and operation of public service utili throughout the United States and Canada, including steam and elec railways, electric lighting, hydroelectric power development, building struction, etc. His present activities will be especially in conn with examinations and reports of which the firm he joins mak specialty.

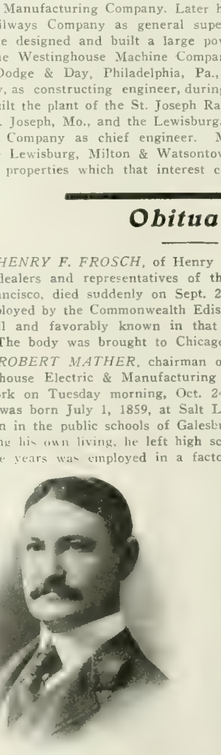
MR. J. R. TOWNSEND, formerly electrical engineer of the Mahon & Shenango Railway & Light Company, Youngstown, Ohio, with which was associated for five years, and recently sales engineer in charge of power house and railway equipment division of the Westinghouse Elec & Manufacturing Company, Detroit district office, has accepted the n agement of the Portland (Ore.) district office of J. C. Farrar & Comp who are Pacific Coast agents for the Lord Manufacturing Company and Electrical Engineers' Equipment Company and also are contracting trical engineers. Along this line Mr. Townsend will have charge of construction of the switchboard and busbar portion of electric p houses, in which field his principals are specialists.

MR. CHARLES S. JOHANN has resigned as sales engineer of Allis-Chalmers Company to accept the position of secretary and gen manager of the Morris & Somerset Electric Company with headquar at Morristown, N. J. Mr. Johann, after passing through the appre course at the Westinghouse shops at East Pittsburgh, served both the engineering department and the sales department of the Westingh Electric Manufacturing Company. Later he was connected with the A ican Railways Company as general superintendent at Springfield, where he designed and built a large power house for the lighting pany; the Westinghouse Machine Company, as manager of its Balti office; Dodge & Day, Philadelphia, Pa., as engineer; E. W. Cla Company, as constructing engineer, during which connection he enla and rebuilt the plant of the St. Joseph Railway, Light, Heat & Power pany, St. Joseph, Mo., and the Lewisburg, Milton & Watertown Pass Railway Company as chief engineer. Mr. Johann retains his pos with the Lewisburg, Milton & Watsontown Passenger Railway Com and the properties which that interest controls.

Obituary.

MR. HENRY F. FROSCH, of Henry F. Frosch & Company, elec supply dealers and representatives of the Federal Electric Compa San Francisco, died suddenly on Sept. 27. Some years ago Mr. F was employed by the Commonwealth Edison Company, of Chicago, a was well and favorably known in that city, as well as in San cisco. The body was brought to Chicago for burial.

MR. ROBERT MATHER, chairman of the board of directors Westinghouse Electric & Manufacturing Company, died at his ho New York on Tuesday morning, Oct. 24, from acute peritonitis. Mather was born July 1, 1859, at Salt Lake City, and received his education in the public schools of Galesburg, Ill. Owing to the ne of making his own living, he left high school at the age of thirtee for three years was employed in a factory engaged in the manuf of telegraph instruments sequently obtaining ment in the office at Gal of the master mechanic Chicago, Burlington & Railroad. While working he prepared for coll studying at night. In was graduated from Kn lege, and by continui night studies, working at railroading, he three years later the deg A.M. from that college cently the degree of was conferred on him b College, of which he w of the trustees at the his death. From 1882 Mr. Mather worked



ROBERT MATHER.

treasurer's office of the Chicago, Burlington & Quincy Railro voting his spare time to the study of law, and in 1886 he was a to the Illinois bar. In 1889 he became attorney at Chica the Chicago, Rock Island & Pacific Railroad, and

[illegible] elected general counsel [illegible]. In [illegible] occupied various offices of the road [illegible] vice-president. In 1889 he became chairman [illegible] committee and in [illegible]4 president of the Rock Island Company [illegible] New Jersey. In [illegible] was elected third vice-president of the St. Louis & San Francisco Railroad, the following year becoming first vice-president. He was also first vice-president of the Chicago & Eastern Illinois Railroad and of the [illegible] [Evansvi]lle & Terre Haute Railroad, and chairman of the board of directors of [the] St. Louis, Kansas City & [illegible] Mr. Mather was a [di]rector in a large number of important corporations, including the National Bank of the Republic, of Chicago, and the Mercantile Trust Company, American Realty Company, and Equitable Life Insurance Company, New York. He was also interested [illegible] Havana, being a director [illegible] Havana [illegible] Railway Company. In January, 1909, Mr. Mather was made chairman of the [board of] directors of the Westinghouse [illegible] & Manufacturing [Compan]y, and thereupon severed his railroad connections and concentrated [his work] on the Westinghouse [illegible]. Mr. Mather [illegible] [stro]ng character and positive methods which gave him a dominating in[fluenc]e in any interest with which he was [illegible] associated. Funeral [service]s were held in New York on Wednesday, and [illegible] took [place] [illegible] Plymouth Church, Chicago, on Friday.

Trade Publications.

[ELE]CTRIC GLASSWARE.—The Haskins Glass Company, Wheeling, [W.] Va., has issued Catalog No. 16, devoted to gas, electric incandescent and arc-lighting glassware and a booklet on the Haskins-Lucida [glass]ware for incandescent lamps. The latter is highly translucent and [b]y gives excellent diffusion. It possesses reflecting power as well and is [ma]de up in a number of standard shapes. It has a pearly lustre and is [smo]oth on both surfaces, so that it is readily kept clean.

[IRID]ESCENT GLASSWARE.—Catalogue No. 53 of the Fostoria [Gla]ss Specialty Company, Fostoria, Ohio, entitled "Iris Illuminating [Glassware]," lists, describes and illustrates over 300 different styles of [shade]s and reflectors in colored and iridescent patterns for gas and elec[tric l]amps. It conforms in size of page and general conception to the [c]ompany's 100-page Catalogue No. 52 on cut and etched ware with [th]e additional feature that each of the ten distinct motifs employed in [the] [illegible] of the "Iris" ware is illustrated by a three-color cut. [The] colored plates bring out, so far as it is possible for cuts to do, the [delicat]e shadings and blending tints which constitute much of the [charm o]f art glass, although it is not found practical to reproduce [throu]gh the medium of printer's ink the play of iridescent colors that [cha]racteristic of many of the types shown.

[HO]T BLAST HEATING AND VENTILATING OUTFITS.—In a [illegible] four page book bearing the title "Heating and Ventilating" the [Green] Fuel Economizer Company, of Mattewan, N. Y., has brought to[gether] the information required for the designing and proportioning of [hot-bla]st outfits for heating, ventilating, drying, etc. The book contains [a] dozen tables of temperatures required in rooms for various pur[poses]; on heat transmission through building materials; heat given off by [ligh]ts and by lamps, standard sizes of hot-blast heaters, frictional re[sistanc]e of air washers, relative humidities, humidities and temperatures [thr]ough the United States, amounts of air required for ventilation, [illegible] pressures, velocities and horse-powers; total weight of [illegible] various pressures and temperatures; pressure and power con[sumed] in friction; speed, capacity and power of steel-plate fans; friction [of air] through hot-blast coils, etc. The text takes up not only the usual [matter] relating to the construction of fans, heaters and heating and [ventilati]ng systems, but also the calculation and designing of piping [illegible]. There is also a chapter on the loss of head of air flowing [throu]gh orifices and equivalent orifices, in which is presented a method [of com]bining the resistances of ducts in parallel and series connections [similar to] Ohm's and Kirchoff's laws for electrical circuits. An[other c]hapter gives the result of an extensive series of tests upon Green's "[illegible] Flo" steam heating coils, by means of which heaters of suit[able siz]es may be selected for any given duty. The general illustrations [in the] book include not only views of buildings equipped with heating [and ven]tilating apparatus built by the Green Fuel Economizer Company, [but al]so detailed plans, elevations and "ghost" views showing the actual [arrange]ment of the fans, heaters, piping, outlets, etc.

BUSINESS NOTES.

MINERALLAC ELECTRIC COMPANY.—The Minerallac Electric Company has removed its offices from No. 400 South Hoyne Avenue to the Merchants' Loan and Trust Building, Chicago.

THE STATES ELECTRIC COMPANY has moved its office and factory to more commodious quarters at 622-630 West Adams Street, Chicago, where the company has much increased facilities for handling work.

THE HESS-BRIGHT MANUFACTURING COMPANY, of Philadelphia, makers of ball bearings, announces that word has been received from the Deutsche Waffen und Munitionsfabriken, which the Hess-Bright company represents as importers, that the "DWF" have just been awarded the "Gran Premio" at the International Industrial and Trade Exhibition of Turin, this being the highest distinction.

THE ECONOMY SWITCH BOX & MANUFACTURING COMPANY, Cleveland, Ohio, has appointed W. M. Sheehan & Company, 136 Liberty Street, New York, its Eastern representatives for the territory including New York, New Jersey and New England. A full stock of Economy switch boxes, switch plates and the other specialties will be carried at all times.

THE ILG ELECTRIC VENTILATING COMPANY, Chicago, manufacturer of air-cooled motor fans, blowers and exhausters, has established a branch office at 13 Park Row, New York, in charge of Mr. George Breidert, an experienced engineer and expert on fan and blower work. A full line of direct-connected fans and blowers, including forge blowers, etc., will be kept in stock in New York for immediate delivery.

THE DONGAN ELECTRIC MANUFACTURING COMPANY, Detroit, Mich., has appointed Mr. Arthur P. Pierson, of 136 Liberty Street, New York City, as sole selling and distributing agent for its entire line of bell-ringing, toy, Christmas-tree lighting and sign-lighting transformers. Mr. Pierson, who has long been actively identified with the electrical business, has undertaken the marketing of the entire output of this line.

THE LOUISVILLE GAS & ELECTRIC FURNITURE COMPANY, which started business in Louisville, Ky., a short time ago, is doing unusually well, and the management is well pleased with surrounding trade conditions. Mr. E. T. Martin, who for twenty years has been connected with an electrical concern of Chicago, has taken charge of the chandelier and furniture section of the business, and Mr. A. G. Boebel, who has been doing electrical work in the Falls cities for a number of years, is to assume charge of the electrical department. The traveling agents and road members of the establishment will be under the direction of Mr. George Reno, who was connected with a similar business in Chicago.

THE MOORE LIGHT COMPANY has made a number of installations in New York recently, including long Moore tubes for the show windows of R. M. Haan, at 505 Fifth Avenue, and Madame Clarice, at 1548 Broadway. New work has been completed in the Baltimore Dairy Lunch Rooms on Twenty-third Street and Beekman Street, and in the uptown office of the New York *World*. The wholesale houses of Cheney Brothers, 216 Fourth Avenue, and Albert Godde, Pedin & Company, 13 West Twentieth Street, have been equipped with color-matching installations with the white Moore light. The fact that the white Moore tube shows all colors in their true values has induced many textile manufacturers recently to utilize this form of illumination, including the Rhode Island Worsted Company, Stafford Springs, Conn.; J. H. & C. K. Eagle, Shamokin, Pa.; Cheney Brothers, South Manchester, Conn.; Footer's Dye Works, Cumberland, Md., and the American Thread Company, Willimantic, Conn.

SALES REPRESENTATIVES OF THE ESTERLINE COMPANY.—The Esterline Company, Lafayette, Ind., manufacturers of the Esterline graphic meter and the Berdon electric-lighting system for motor vehicles, announces the appointment of the following sales representatives. These concerns will handle a complete line of Esterline Company's product in the cities named, and will give the company's customers technical service of every kind and character: New York City, Mr. Mortimer L. Newman, 114 Liberty Street; Atlanta, Ga., the Automobile Specialties Company, Mr. L. O. Surles, manager, 222-234 Peachtree Street; Denver, Col., Western Engineering & Specialties Company, 1732 Glenarm Street; San Francisco, Cal., the Symonds-Berle-Kirkpatrick Company; Los Angeles, Cal., the Symonds-Berle-Kirkpatrick Company; Cleveland, Ohio, Chas. F. Saenger & Company, 210 Electric Building; Boston, Mass., the Standard Engineering Company, 53 State Street; New Haven, Conn., the Standard Engineering Company, 810½ Chapel Street; Waterbury, Conn., the Standard Engineering Company, 16 East Main Street.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 17, 1911.

[Prepared by Robert Starr Allyn, 15 Exchange Place, New York.]

[1,005,7]94. TROLLEY; S. M. Balzer, Andover, N. J. App. filed Oct. 28, [19]07. The trolley wheel is mounted on a bearing so as to have a [pi]voted as well as rotary movement.

[1,005,7]97. TROLLEY GUARD AND FINDER; H. E. Bayer, Pittsburgh, [Pa.] App. filed June 13, 1910. Has diverging finding arms locked to [the] harp and unlocked by the rope.

1,005,805. ADJUSTABLE SERIES SHUNT; A. J. Brown, Milwaukee, Wis. App. filed Feb. 14, 1910. A zigzag strip with an adjustable short-circuiting clamp.

1,005,842. ELECTROMOTOR; B. F. Hutches, Jr., Allendale, N. J. App. filed June 17, 1910. A central stationary field and an outer rotating armature; particularly for small motors.

1,005,847. ELECTRIC WIRE TERMINAL CLIP; J. H. Kaesen, New York, N. Y. App. filed Dec. 2, 1910. Gripping jaws are closed by turning a sleeve; for spark-plugs, etc.

1,005,853. EDUCATIONAL TOY; L. B. Lewis, Columbus, Ohio. App. [illegible]

1,005,855. ALTERNATING-CURRENT ELECTROMAGNET; D. L. Lindquist, Yonkers, N. Y. App. filed June 16, 1909. A longitudinally laminated core with secondary conductors, each inclosing a fractional number of the laminations.

1,005,856. ALTERNATING-CURRENT ELECTROMAGNET; D. L. Lindquist, Yonkers, N. Y. App. filed Feb. 9, 1910. The magnetic fluxes due to the primary and secondary circuits differ in phase, and a selected ohmic resistance is inserted in the secondary.

1,005,857. ALTERNATING-CURRENT ELECTROMAGNET; D. L. Lindquist, Yonkers, N. Y. App. filed Feb. 9, 1910. Has stationary and movable cores with a secondary on each.

1,005,858. DYNAMO-ELECTRIC MACHINE; C. E. Lord, Norwood, Ohio. App. filed Sept. 24, 1906. Removable pole shoes are split into two portions so that one with its windings may be removed from the other.

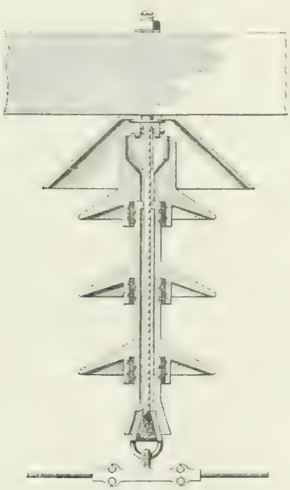
1,005,862. PRINTING TELEGRAPH; A. S. McCaskey, Chicago, Ill. App. filed May 3, 1901. The transmitter has a keyboard like a typewriter. Sets of pole changers are acted upon successively by the keys and brought into connection with the main line subsequent to the operation of the keys.

1,005,866. MEANS OF PREVENTING AN ELECTRIC DISCHARGE THROUGH A GAS COLUMN; D. McF. Moore, Newark, N. J. App. filed April 7, 1906. Sand permits gas circulation, but prevents high-potential discharge.

1,005,867. VACUUM-TUBE LIGHTING; D. McF. Moore, Newark, N. J. App. filed May 8, 1906. Gas is fed into a tube for modifying the spectrum.

1,005,870. DEVICE FOR SUPPORTING ARTICLES IN AN ELECTROPLATING BATH; M. L. Packer, Columbus, Ohio. App. filed Feb. 3, 1911. A vertical rod with bent wire hooks.

1,005,874. SPACER AND BRACER FOR COMMUTATOR NECKS; H. H. Ralston, Norwood, Ohio. App. filed Aug. 1, 1907. Spacing



1,006,040.—Insulator.

blocks between the commutator necks to prevent [illegible] and edge[illegible]

1,005,880. METHOD OF FORMING JOINTS IN METAL; A. F. Rietzel, Lynn, Mass. App. filed Oct. 2, 1906. One or both elements are provided with flanges and the parts pressed together and electrically welded.

1,005,899. SWITCH; G. G. Stout, Parkersburg, W. Va. App. filed Sept. 26, 1907. A solenoid magnet and armature for closing a lighting circuit.

1,005,904. SYSTEM OF ELECTRICAL DISTRIBUTION; H. L. Van Valkenburg, Norwood, Ohio. App. filed Feb. 19, 1906. For transferring a voltmeter or a synchronizer from one generator to another or to the busbars.

1,005,905. SYSTEM OF ELECTRICAL DISTRIBUTION; H. L. Van Valkenburg, Norwood, Ohio. App. filed Feb. 28, 1906. A plurality of generators in parallel. Switches are arranged so as to prevent a voltmeter or synchronizer from being thrown into circuit unless all the switches are in their normal positions.

1,005,910. KEY SWITCH; A. H. Weiss, Chicago, Ill. App. filed March 23, 1905. Telephone switchboard keys are returned by helical springs.

1,005,926. ELECTRIC SWITCH; R. B. Benjamin, Chicago, Ill. App. filed July 18, 1907. A pull switch for turning on and off one or more lamps of a cluster.

1,005,937. SYSTEM OF ELECTRICAL DISTRIBUTION; H. W. Cheney, Milwaukee, Wis. App. filed Oct. 6, 1909. A number of circuit-breakers may be closed independently and tripped simultaneously.

1,006,003. AUTOMATICALLY CONTROLLED MIXING MACHINE OR THE LIKE; N. Pecci, Paterson, N. J. App. filed April 5, 1911. A dough mixer is driven by an electric motor which can be set to stop after a desired number of revolutions.

1,006,005. CIRCUIT-CLOSER; F. A. Pierce, Wheeling, W. Va. App. filed Nov. 6, 1909. Operated by an approaching train to actuate mechanism for applying train brakes.

1,006,021. ELECTRIC LIGHTING; C. P. Steinmetz, Schenectady, N. Y. App. filed April 30, 1900. A vaporous color-modifying substance is introduced into an envelope and its chemical activity with reference to the envelope is neutralized.

1,006,040. INSULATOR; J. Alsberg, New York, N. Y. App. filed J[illegible] 29, 1907. Spun glass formed into a flexible cable or hanger.

1,006,041. INSULATOR; J. Alsberg, New York, N. Y. App. filed Sep[illegible] 28, 1908. A flexible insulating cable hanger surrounded by a tubula[illegible] member.

[illegible] INSULATOR; J. Alsberg, New York, N. Y. App. filed June [illegible] A flexible insulating member surrounded by connected petticoated insulators.

1,[illegible] ELECTROMAGNETIC IGNITING DEVICE FOR AR[illegible] LAMPS; K. von Dreger, Berlin, Germany. App. filed Feb. 15, 1910 The carbons are arranged side by side and one is movable to sta[illegible] the arc.

1,006,079. SUBMARINE SOUND SIGNALING; J. Gardner, Knott End[illegible] England. App. filed March 10, 1908. Construction and arrangemen[illegible] of diaphragm and contacts for augmenting sound in the receiver.

1,006,089. ALTERNATING-CURRENT RELAY; J. F. D. Hoge, Nev[illegible] York, N. Y. App. filed April 11, 1910. The vibrating member [illegible] mounted so as to have also a bodily movement.

1,006,090. ALTERNATING-CURRENT RELAY; J. F. D. Hoge, Ne[illegible] York, N. Y. App. filed July 27, 1910. The armature has an adju[illegible]able nodal point.

1,006,091. ALTERNATING-CURRENT RELAY; J. F. D. Hoge, Ne[illegible] York, N. Y. App. filed Sept. 23, 1910. The armature is weight[illegible] to provide a stationary node.

1,006,103. METHOD OF MAKING BALL BEARINGS; O. C. Knip[illegible] Washington, D. C. App. filed Dec. 20, 1909. The inner sleeve [illegible] core is formed of two parts welded together.

1,006,104. ELECTRIC HEATER; R. and F. Kuhn and F. E. Shailo[illegible] Detroit, Mich. App. filed June 11, 1910. Detachably locks the vess[illegible] to the heater.

1,006,112. PRINTING TELEGRAPH SYSTEM; A. S. McCaskey, Ch[illegible]cago, Ill. App. filed May 3, 1901. Receiving mechanism compris[illegible] a distributor, a selector and a printing device such as a typewriter.

1,006,129. COMBINATION ELECTRIC HEATER; E. H. Richardso[illegible] Ontario, Cal. App. filed Nov. 9, 1909. Laundry iron, stove, wat[illegible] heater or curling-iron heater.

1,006,140. POLE-REVERSING SWITCH AND WIRING SYSTE[illegible] O. R. and O. M. Simenson, Olympia, Wash. App. filed Oct. 27, 191[illegible] Wall or ceiling type with rotary thumb turn.

1,006,148. ELECTRICAL SWITCH; C. L. Terry and P. Townse[illegible] Cleveland, Ohio. App. filed Jan. 17, 1910. A switch lever w[illegible] catches inside the casing to prevent withdrawal of the terminal plu[illegible]

1,006,193. ELECTRIC SWITCH; H. J. Ford, San Quentin, Cal. A[illegible] filed April 18, 1911. Solenoids for operating a railroad-track swit[illegible]

1,006,198. SEAL FOR SECTIONAL LEADING-IN WIRES; T. Frech, Jr., Cleveland, Ohio. App. filed Jan. 10, 1907. For inc[illegible]descent lamps.

1,006,235. POLICE-SIGNALING AND CONTROLLING SYSTEM; C. Lamb, Chicago, Ill. App. filed Oct. 5, 1909. A chart at a cent[illegible] precinct has movable members indicating the location of the pat[illegible]men on their beats.

1,006,268. INSULATOR-BRACKET; C. L. Peirce, Jr., Pittsburgh, App. filed Oct. 26, 1910. The bracket is supported between two an[illegible] irons.

1,006,296. ELECTRIC SWITCH; F. E. Seeley, Bridgeport, Conn. A[illegible] filed May 19, 1911. A pull-socket lamp with return-spring adj[illegible]ment accessible only from the lamp end.

1,006,301. HOLDER FOR CURRENT COLLECTORS; O. M. Shir[illegible] New Brighton, Pa. App. filed March 22, 1911. For electric cra[illegible] etc. A grooved rectangular block is held in place by springs.

1,006,330. OBTAINING ZINC AND (OR) COPPER FROM C[illegible]PLEX ORES OR THE LIKE; J. R. Williams and H. W. and Bradley, Sheffield, England. App. filed Aug. 9, 1909. Silicate-taining ores are subjected to dilute sulphuric acid and then elec[illegible]lyzed.

1,006,333. VAPOR ELECTRIC LAMP; H. I. Wood, Schenectady, N[illegible] App. filed Feb. 14, 1903. A carbon filament normally lightly to[illegible]ing the surface of one electrode provides a starting path.

1,006,344. PRINTING TELEGRAPH; M. S. Ayau, New York, N[illegible] App. filed Nov. 14, 1907. The message is typewritten, transm[illegible] and transcribed at the receiving station with a single circuit [illegible] two current-strength impulses.

1,006,354. RAIL BOND; J. W. Burgess, Minden, W. Va. App. May 26, 1911. Tubular shanks are wedged into the rail ends.

1,006,382. OVERHEAD TROLLEY; J. H. Howard, Kansas City, [illegible] App. filed Nov. 10, 1903. The trolley wheel controls pre[illegible] mechanism for maintaining uniform pressure on the wire.

1,006,389. ELECTROLYTIC MANUFACTURE OF DIFFICUL[illegible] SOLUBLE SALTS OR HEAVY METALS; C. Lukow, C[illegible] Germany. App. filed Jan. 20, 1910. The electrolyte contains a [illegible]ture of a "dissolving salt" and a "precipitating salt."

1,006,394. ELECTRIC PUSH-BUTTON; J. L. Morrell, New York, N. Y. App. filed June 9, 1911. Spring with center-wedge conta[illegible] bell circuits, etc.

1,006,415. ELECTRIC GARMENT; A. C. Stubling and F. C. Gi[illegible]on, Portland, Ore. App. filed Jan. 30, 1911. A coat with hor[illegible]tal heater elements and switches.

1,006,421. VAPOR ELECTRIC LAMP; H. L. Wood, Schenectad[illegible] N. Y. App. filed Feb. 14, 1903. The lamp is started by current th[illegible]gh a carbon filament.

1,006,429. APPARATUS FOR TRANSMITTING SOUND WA[illegible]S; F. H. Brown, Los Angeles, Cal. App. filed April 17, 1907. E[illegible]ro-magnetic wireless.

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NEW YORK, SATURDAY, NOVEMBER 4, 1911.

CONTENTS.

SOME ADVANTAGES OF COMMISSION REGULATION OF PUBLIC UTILITIES

With the increasing development of state regulation of public utilities, it is well to call attention to the fact that, notwithstanding some belief to the contrary, the public-service corporations under state regulation enjoy rather pronounced advantages which are none the less real because not immediately apparent. When the majority of the public-utility laws were drawn up, the fact was recognized that if public-service corporations were to be controlled and regulated, they must at the same time be protected. In general, this protection is afforded in two ways—protection from the ruinous effects of aggressive competition where circumstances do not warrant a second utility, and an assurance of a reasonable rate of return upon an equitable valuation to reward an adequate service rendered. The first is made possible through the agency of the so-called "convenience and necessity law" which is operative in most states under commission control. The law recognizes that a public-service corporation is, in its very nature, monopolistic in character, and protects it from competition except where the public welfare demands the existence of a second utility. The utility commission in administering the law determines whether such a second utility is necessary or not. This provision, as Chairman Roemer of the Wisconsin commission has put it, is not intended as auxiliary to the power of the commission to enforce rates and service, as is sometimes erroneously assumed, but is a remedy of last resort and may be applied only in exceptional cases. A public-utility business, if properly conducted, is virtually safeguarded under this law. In Wisconsin not a single certificate of convenience and necessity has ever been granted to an electric central station, although several requests for such have been made. Under this law it is impossible, practically, for a municipality to operate its own plant in competition with an existing private plant. Under certain conditions the municipality has the right under the law to purchase the private plant at a valuation fixed by the commission. Very few municipalities have availed themselves of this opportunity, for experience has shown that where the public can obtain all the advantages of public ownership without any of the disadvantages it is good policy to keep out of the electric central-station business.

One of the great benefits accruing to a public-service corporation operating under commission regulation results from the required standard method of accounting, which enables the utility to know the exact condition of its business, its growth from year to year, and to detect the previously unsuspected unprofitable business. Furthermore, an accurate knowledge of a utility's business and the condition of its finances makes it possible for a commission

such as the Wisconsin commission to formulate after a careful investigation a rate schedule which follows the cost of service as nearly as practicable and which guarantees to the utility concerned a fair and reasonable rate of interest and an ample depreciation fund. That a rate schedule which is formulated by an impartial commission and which recognizes all the elements of expense will result in the fullest development of a profitable business has been amply demonstrated. In this connection the case may be cited of the Madison Gas & Electric Company, whose rates were reduced and a new rate schedule devised in a decision of the Wisconsin commission under date of March 8, 1910. During a three-year period including a year's operation under the new schedule, with a public confidence that the rates were reasonable and with no effort to secure new business, the company's residence-lighting consumers increased 34 per cent, and the number of kilowatt-hours sold for this purpose increased 70 per cent, chiefly during the last year of the period. Notwithstanding the decrease in rates, the revenues increased 35 per cent for the class. During the same period stores actually decreased their installations but increased the amount of energy consumed by 25 per cent. This increase in business did not require an increase in station capacity, but was brought about by a longer use of the connected load and an increase in the number of appliances used—a condition of affairs encouraged by commission action. This increased business, together with a more economical management, increased the net earnings of the company from 3.06 cents to 3.25 cents per kw-hour sold. Similar results were noted in the city of Ripon, Wis. The commission reduced the rates of the Ripon Water & Light Company and ordered a revised rate schedule. One year's operation under the new rates has shown that in the case of residence consumers the connected load has decreased about 4 per cent, whereas the number of consumers has increased 10 per cent and the consumption of electricity 22 per cent as compared with the year previous. The total energy consumption increased materially, but at the same time the instantaneous maximum demand remained practically unaltered. This increase in business occurred in spite of the fact that one class of business was abandoned because shown to be an actual loss.

In every case in Wisconsin where a utility has kept its accounts in proper shape and has petitioned for an increase in rates the increase has been granted, provided the service rendered was satisfactory and an increase was necessary in order to assure a reasonable rate of return after allowing for an ample depreciation fund. This increase in net revenues has been accomplished either through an actual increase in rates, a modification of the minimum bill or a revision in the percentage of active connected load. It is rather interesting to note that of the numerous petitions requesting an increase in rates on the part of municipal electric plants not one has as yet been granted, for the reason that their accounts, as a rule, have always been kept in such miserable shape that absolutely no information could be obtained from them that would warrant a rate increase. The commission has invariably dismissed the petitions with a statement that until a proper record has been kept no change in the existing rates could be ordered. The effect has been that municipalities are beginning to be better informed concerning the condition of their electric-utility business. Electric railway companies have found commission authority to their advantage in cases where their charter or franchise contained maximum-fare provisions which were found to be insufficient to return a proper interest on the investment.

It is stated upon good authority that in every single case where the Wisconsin commission has ordered a revision in rates, whether an increase or decrease, the utility concerned has enjoyed a marked increase in business and in net revenues. The average utility, like an individual, is very apt to get into a rut, and unless it gets out, either of its own accord or because compelled to, it can show nothing but a very mediocre development. After all has been said concerning the advantages of commission control, the strongest indorsement and the most convincing testimony comes from the very men who a few years ago were most bitterly opposed to state intervention in the utility business, but who now, after a better understanding through actual contact with it, are among its most loyal and enthusiastic supporters.

TREATMENT OF LOW-GRADE ORES BY ELECTRICAL PROCESSES.

One of the subjects discussed at the recent annual sessio of the American Mining Congress in Chicago and of par ticular interest to electrical men related to the Malm proces of reducing complex low-grade ores. This is a combinatio of the chlorine process and the electrolytic method, the us of electricity being particularly applicable to the recover of zinc, the value of which is said to run as high as $1 a ton in some of the refactory low-grade ores for which th method is intended primarily. The principal cost of ope ating the process is due to the purchase or production electrical energy for the electrolytic reduction of the zi chloride. The advantage of the process lies in the fa that zinc has been considered an unwelcome and partic larly refractory element of the complex ores, and has be wasted to a large extent heretofore. In the Malm proce the zinc recovered may very well be the most valuable co stituent of the ore. Dr. Malm and his spokesmen a understood to have made a very interesting proposition the American Mining Congress. They suggested that t organization appoint a committee to investigate the vari processes for reducing low-grade complex ores, and if t committee should find after disinterested investigation, c sidering all the available methods, that the Malm proces an economical and valuable one it be asked to report fact to the congress at a future session, recommending adoption or official authorization of this method. In t event it is understood that the inventor will be willing contribute the Malm process, which is covered by pate freely to the mining industry, making a donation of i some official body can be found to receive it and apprec and push it. Otherwise, the invention will be pushed y private capital, and possibly a situation may arise analog to the so-called "smelter trust."

The official action of the congress did not go so fa as this. In its resolutions the mining congress declared, h ever, that "the development of processes of ore treat nt capable of handling with profit the vast low-grade dep its

and mine dumps of our mining districts is of the greatest importance to the mining industry and to all related industries." Therefore it was declared to be the sense of the American Mining Congress that the Congress of the United States be asked to provide for the establishment, under the direction of the Bureau of Mines, of a metallurgical experimental ore-testing station to devise methods for the extraction of metals from low-grade ores. The mining congress also volunteered to draft a bill providing for the establishment of such a testing station. The subject is one of interest and importance to the electrical industry, for if the Malm process, or some analogous process, is widely adopted it means a greatly increased consumption of electrical energy in the metal mining industry.

FARMERS' ELECTRICAL SUPPLY.

The recent Illinois State Electric Association convention brought out an interesting symposium on rural transmission lines for the supply of farmers. There is a considerable amount of such service at the present time in certain sections of the country, notwithstanding the very small revenue per mile of pole line which such business offers. Where farmers are supplied from existing single-phase or three-phase transmission lines running between towns the problem is not so much one of pole-line cost as of the cost of the necessary step-down transformers and lightning protection. This problem, which is now receiving attention from manufacturers and transmission-line operators, is one which is fairly near a solution. Another problem relates to distribution from the nearest town or main transmission line to the farmer's premises. This is much more serious, for it involves an investment in pole lines which is prohibitive in many farming districts. From information brought out at the Illinois convention and elsewhere it is evident that pole lines for supplying farmers cost from $150 to $600 per mile. The lowest figure applies to 2200-volt lines of iron wire with small 25-ft. poles, about thirty to the mile; in other words, to a very light construction subject to rapid deterioration, which deterioration, however, is not in itself so grave as the probable danger and interruption to service caused by the frequent breaking down of such lines after a few years' use. On the other hand, it is impracticable to follow out expensive city line-construction standards in country work. At any rate, it is probably useless to count on carrying on extensive farm-service business over pole lines costing less than $200 per mile. Now, with such a pole-line investment added to the other investments necessary, the number of consumers per mile of line must be more than is commonly found available, or the amount of electricity taken by each consumer per year must be considerably more than the ordinary requirements of house lighting.

Probably few investors can be found who would be willing to go into enterprises of this kind, which show in prospect less than 20 per cent for interest, profit and depreciation on the entire investment. With an investment of, for example, $200 per kilowatt of maximum demand to reach a rural distributing center, and a further investment of $100 to reach a farmer with 1 kw of maximum demand, a revenue of $60 per year would be required from that one farmer customer alone. This is by no means an unusual example, as in the majority of cases the cost would be higher than this. At the same time there are many cases where conditions are more favorable. Whether the electric-service company assumes the investment of the necessary pole lines to reach each individual farmer, or whether part of this investment is taken by the farmer himself, as in a number of the cases reported in Illinois, it is evident that the ultimate success of rural electric distribution is dependent on a much larger use of electricity by each consumer than would be necessitated by lighting alone. It is a question of using sufficient electricity for power and heating requirements of the farm to bring the revenue per consumer up to a profitable point. The principal power-consuming operations of the farm consist of water-pumping, feed-cutting, grinding, plowing, harvesting and hoisting for storage. Horses and windmills have been the chief sources of power aside from manual labor on the farm, but gasoline engines are already finding extensive use. The use of such engines should be encouraging to the electrical man, rather than the reverse, because mechanical power as furnished by the gasoline engine is sure to cause an evolution or development away from the old methods and to create a demand for mechanical power, which will pave the way for electric-motor service where it is available. As brought out at the Illinois convention, a commendable effort is being made by the National Electric Light Association and by gasoline manufacturers and agricultural engineers to get the government to investigate the matter of power requirements and power costs on the farm. If electricity were used for all farm operations and included trucks and vehicles, the amount of power would assume proportions which would put a very different aspect on rural electrical service.

WORKSHOP LIGHTING.

An important article on this topic, abstracted from a foreign contemporary, appears in the *Digest* in this issue. It is striking evidence of the interest which has been aroused in the general campaign for good illumination, and is especially pertinent in the discussion of actual data obtained in both well-lighted and ill-lighted shops. Yet, however excellent data on proper illumination may be presented to the public eye, there is still some uncertainty about good examples being followed in this, as in all things. A certain type of works manager is quite content to let what he considers well enough alone, whether in manufacturing methods, lighting or precautions against accidents. Anything which means added cost is abhorrent to his economical soul. Fortunately, in most cases of this kind the punishment fits the crime and the unprogressive manufacturer finds himself, he knows not exactly why, at a disadvantage compared with his more wide-awake competitors. True enough, good illumination often costs no more than poor illumination, sometimes not so much. Every illuminating engineer can call to mind in his own practice cases in which the lighting has been greatly improved with a positive reduction in cost; yet the expense of making a change often determines whether or not it shall be made, and a bill for wiring fixtures and lamps sometimes looks forbiddingly large. It is not always the

worst lighted shop that is most difficult to reach with improvements. Beyond a certain point of inefficiency the results are so evidently bad as to force themselves upon the attention even of the most cautious and niggardly. It is the moderately bad establishment which is most difficult to reach, a place in which perhaps there is considerable expenditure for lighting, although the results are altogether unsatisfactory. If the lighting is such as not positively to interfere obviously with the workmen, and looks moderately bright, it is sometimes difficult to persuade those in authority that an improvement in illumination is necessary and desirable. Hence it is that it is so difficult to make legislative enactments which have really any effective force.

The notes on legal requirements for illumination in the article under discussion are deserving of comment. The governments of Holland and Switzerland seem to go furthest in the way of definite requirements for the illumination of workshops, and these, while well intended, show only too plainly the difficulties of legal interference. The Dutch requirement is not less than 15 lux (1.4 ft.-candles) for the following group of trades, evidently considered to require better lighting than usual: embroidery and sewing, mechanical knitting and quilting, draftsmanship, printing, engraving metal or wood, manufacture of instruments, clock and watch repairing, working in gold or silver or precious stones. For "other works requiring good lighting" a minimum of 10 lux (0.9 ft.-candle) meets the demand. Evidently the specified minimum is far too low, so low that the legal requirements can be met in a shop so badly illuminated as scarcely to permit of efficient work at all. The Swiss laws make some important specifications concerning the area and arrangement of windows and require "satisfactory" natural and artificial illumination. Presumably the lighting is to be satisfactory to inspecting officials, and if these are kept as thoroughly subdued in Switzerland as most factory inspectors are in this country one hardly has reason to expect a very high grade of illumination, save in cases in which an enlightened management realizes its economical value.

If any legislation on the subject of artificial illumination is to be effective at all, it must go very much further than in these instances in specifying the requirements in various classes of industrial establishments, or it must at least demand so considerable an amount of light as to insure good results provided ordinary intelligence is brought to bear upon the arrangement of the service. We are rather inclined to think that the latter method will in the long run prove the more effective; for if an industrial plant is required to spend enough energy in lighting to produce really good results if the expenditure is wisely directed, ordinary self-interest will soon be effective in producing at least a moderately good grade of illuminating engineering. The present strong tendency toward the introduction of various plans for increasing industrial efficiency is sure to be shown in improved illumination, provided enough light is demanded by law to make good illumination possible. Indeed, there is some reason to hope that the current desire for higher efficiency may bring about a great improvement in workshop lighting quite irrespective of any legal requirements whatever. There is more activity in good workshop lighting in this country than in any other phase of illuminating engineering, and the results justify the expenditure. We have yet to learn of any industrial plant the management of which has regretted its expenditure for good natural or artificial lighting, and improvements made thus willingly for the benefit of the industry are vastly more satisfactory than any that can be enforced by legislation.

The thing most important to present progress is an extension of the present campaign of education for better light, reinforced by legislation only when experience has shown that this is necessary to reaching the result. We have faith to believe that American works managers as a whole require no such goad along the path of progress The illuminating engineers of the country ought to make it their business, as in no small measure they do, to ge after the individual workshop and show what they can accomplish. Good illumination is an art which cannot be easily formulated into a set of simple rules. Two shop turning out a similar product may under their existin conditions require quite different treatment in the matte of illumination, treatment which cannot be specified in an formal enactment. Labor organizations, too, ought on thei own account to serve as unofficial inspectors of illumina tion just as they do with respect to many other much les important matters. Most central stations at the preser time can command at least a moderate amount of train intelligence in illuminating engineering, and if their repr sentatives make a point of getting in touch with the loc industries and noting from personal inspection the cond tions of illumination, a vast amount of good will be a complished to the benefit of all parties concerned.

MAXIMUM DEMAND AND SIZE OF RESIDENCES.

The plan of estimating the probable maximum dema of a residence consumer upon the size of the house number of rooms is increasing in popularity among elect service companies. It has been generally conceded f some time that the maximum demand of a consumer sho be taken into account in making his rate. The maximu demand meter has found a limited application for determ ing this maximum demand, but its first cost has kept it fr general use in residence lighting business. For a nu ber of years many electric service companies which h based their rates on the number of hours' use of maximum demand per month have assumed that maximum demand of a residence consumer is a cert percentage of the consumer's connected load. An object to this plan is that it discourages the wiring of houses w a large number of lamps in closets, basements, hallw etc., which lamps have little effect on the maximum mand of a consumer, as they are turned on for onl a few moments at a time, but add very much to the popula y of electric lighting, because of their convenience. If e connected load is taken as a basis for estimating the m i- mum demand, the consumer with a large number of t e convenient lamps about the house will pay a much hig er net rate per kw-hour than one without many such la s, even though the maximum demand of the latter consu er

may actually be about equal to that of the former. Obviously, there is no justice in such a method of figuring, and further it has a detrimental effect on the growth of the business because it virtually puts a penalty on some of the conveniences of electric light and encourages consumers to wire houses in a way which will not give them the greatest convenience. This is not favorable to general popularity of electric service and increase of business.

method of overcoming these objections introduced in Detroit several years ago has gradually been finding favor with other companies, and the rate committee of the National Electric Light Association recommended in its last report the plan for residence lighting business. One of the recent notable additions to the list of companies using this system is that at St. Louis, as noted elsewhere. The plan in general is to estimate the consumer's maximum demand as being proportional to the size and general character of the house. The number of active rooms in the house is multiplied by a certain number of kilowatt-hours, which gives the number of kilowatt-hours the consumer must use before he exceeds the first portion of the bill. All energy used up to and including the first portion is billed at a certain rate, and the remainder or second portion at a much lower rate. The theory of the rate, of course, is to charge the consumer a high rate until he has paid the fixed and service charges incidental and proportional to his maximum demand. The rules of different companies vary as to what rooms are considered active, but usually they are the living-room, dining-room, kitchen and certain bedrooms. Basements, halls and closets are usually excluded. Heating apparatus is not counted, as one of the objects of such a rate is to allow such apparatus to be used on the low-rate portion of the bill. It is interesting to note the progress of a residence rate which a few years ago was comparatively little known, but through its merit secured the indorsement of the N. E. L. A. rate committee above referred to.

THE RADIATION PROPERTIES OF INCANDESCENT LAMPS.

Some of the processes of nature suggest the idea that in the established order of things as known to us in this universe the principle of conservation is held in check by the judicious intervention of the opposite principle of dissipation. In other words, the notion suggests itself that so important is the principle of change among the things which are that dissipative activity is encouraged as the scavenger of effete and unguarded conservation. A universe of perpetual and unvaried retention of the *status quo* is, by universal consent, not that in which we grope our way, although such a universe is, in a certain sense, the easiest to conceive of. The only question for serious debate is whether the changes we perceive in the existing order of our environment are of the oscillatory character of those that animate the ocean wave, wherein each particle of water aims, as it were, perpetually at maintaining mean sea-level and yet passes through unending up-and-down movement in the quest, or whether the changes around us, while oscillatory, are also attended by a definite motion of transition, in a direction from which there can be no ultimate retreat or return. From the above outlined viewpoint, among all the protean forms of energy within our perception, heat is the great dissipative energy which ever tends to change and upset the existing order at any one part of our known universe. Energy can be kept conservatively locked up in the chemical form or in the gravitational form for long periods of time, and energy can be transformed through the medium of magnetism and of electricity without necessarily losing much hold upon it; but energy once it takes the form of heat dissipates and disappears from view.

The losses of electric energy in transmission are through runaway heat in wires or machinery. The main source of inefficiency in any process transforming energy is the thefts of heat. The heat engines in our central stations have a net efficiency, in ordinary service, of only some 10 per cent, because the heat runs away faster than it can be made to work. Before it can be all communicated to the boiler water some of it has escaped through the furnace walls and chimney. Before the expanding steam can give up the energy at the engine shaft it has escaped through cylinder walls and exhaust. There is always one comfort for the engineer who reflects upon the waste of energy in, and inefficiency of, a heat engine, and that is that the incandescent lamp is still worse. In spite of the enormous amount of discovery, invention and work directed to the perfection of the incandescent lamp, it is only recently that we have succeeded in obtaining lamps of about 1 cp per watt consumed, whereas it is estimated that an ideally perfect lamp could produce more than 50 cp per watt consumed, if the light delivered were in the most favorable part of the visible spectrum, and if there were no waste of energy in heat. If, however, the light delivered were white or of mixed colors, the ideal lamp of perfect efficiency might give very much less candle-power, depending on the particular colors in its spectrum. The incandescent-lamp maker in his turn may take comfort in the fact that so low a luminous efficiency as that of the best modern lamp leaves all the more room for possible future discovery and development.

The *Elektrotechnische Zeitschrift* has recently published an article, by Dr. Johannes Russner, on certain measurements of the luminous efficiency of incandescent lamps made thermometrically. The lamp, without socket, is immersed in a 30 per cent solution of ferroammonium sulphate, to a layer thickness of 30 mm (1.2 in.). Such a layer has the property of absorbing passing non-luminous heat almost completely, while at the same time it is fairly transparent to luminous rays. The elevation of temperature in the solution is measured with the incandescing lamp inserted in the same for a definite interval of time. The test is then repeated with the lamp coated in blackened tinfoil, to prevent the escape of light through the solution, and the increase of corresponding temperature elevation is noted. The difference of the two temperature elevations, corrected for outstanding sources of error, then enables the luminous efficiency of the lamp to be determined. The results, given in the article, go to show that the luminous efficiency of certain 115-volt carbon-filament lamps averaged 1.6 per cent, and that of certain 115-volt metallic-filament lamps averaged 4.5 per cent, or nearly three times as much.

A. I. E. E. Meetings.

At a meeting of the American Institute of Electrical Engineers, to be held in the Engineering Societies Building, New York, on Nov. 19, a bronze bust of Helmholtz, presented by Mr. Edward D. Adams, will be accepted with appropriate ceremonies. Arrangements have also been made for an address in behalf of the Verband Deutscher Elektrotechniker by Dr. Adolf Franke, who is at present in this country and who was a student under Helmholtz.

Following the presentation ceremonies a paper entitled "Magnetic Properties of Iron at Frequencies up to 200,000 Cycles" will be presented by Mr. E. F. Alexanderson, Schenectady, N. Y.

At joint meetings of the Chicago Section of the A. I. E. E. and the Electrical Section of the Western Society of Engineers the following papers will be presented: *Going Value,* by Mr. F. F. Fowle, on Nov. 22; *Protection of High-Tension Power Circuit Apparatus,* by Mr. James Lyman, on Dec. 27; *Public Utility Commissions,* by Mr. W. J. Hagenah, on Jan. 28.

American Mining Congress.

The fourteenth annual session of the American Mining Congress was held in Chicago on Oct. 24 to 28. This body was formed to foster and promote mining in all its various branches, but is "practical" rather than technical. A feature of the meeting was an address on "The Federal Government and Its Relation to the Mining Industry," by President Taft. Several electrical papers were down on the program, but they did not receive much attention, owing to the disposition of the congress to devote more time to important non-technical subjects, such as the conservation of natural resources, the situation in Alaska and the prevention of mine accidents. Gen. Irving Hale, of Denver, was to have presented a report on the use of electricity in metal mining, but was prevented by ill health. A paper by Mr. W. A. Thomas, of Pittsburgh, on "Electric Mining," was read by title and also one on "Electricity in Mining," by Mr. D. B. Rushmore, of Schenectady. Mr. Samuel A. Taylor, of Pittsburgh, was elected president of the American Mining Congress for the ensuing year.

The resolutions committee, made up of one man from each state, presented resolutions on various subjects connected with the mining industry. The resolutions which were adopted asked, among other things, that the Congress of the United States be requested "to provide for the establishment, under the direction of the Bureau of Mines, of a metallurgical experiment ore-test station or stations for the purpose of devising methods for the extraction of metals from low-grade ores." This action is one step, perhaps, in a movement looking toward a great extension in electrolytic processes of ore reduction, and therefore a greatly increased use of electrical energy in mining. Other resolutions asked the aid of the government in the maintenance of mining schools; expressed sympathy with inland waterway projects; asked the modification of the Sherman law to permit reasonable trade agreements between competitors in the mining business, provided there is no undue burden on the public; declared in favor of a just compensation to workingmen for injuries received while engaged in their duties; recommended greater publicity in relation to the undertakings of the American Mining Congress; disapproved of the "efforts of interested parties to have established national parks on the public domain wherein are known to exist deposits of oil, coal and other mineral wealth"; thanked the President and Congress of the United States for the creation of the Bureau of Mines, and asked the enactment of laws to bring about the opening up and operation of coal mines in Alaska for the "present and permanent welfare of the Alaskan people."

Despite the fact that little attention was paid to the electrical papers, there was evinced a friendly feeling toward the use of electricity in mining. The attendance at the mining congress was about 800.

Extension of Street Lighting in Chicago.

In planning the notable extension of 10,000 arc lamps for the street lighting of Chicago, Mr. William Carroll, city electrician, and Mr. E. B. Ellicott, electrical engineer of the Sanitary District, who have charge of the work, are endeavoring to locate the new lamps, after consulting aldermen and other city authorities, where they wil[l be] needed most. The plans for this street-lighting exten[sion] contemplate underground feeders and overhead distri[bu]tion lines outside of the central business district, the o[ver]head construction consisting of 25-ft. steel poles suppo[rting] the lamps and one or two No. 6 weatherproof wires. T[here] has been some criticism of these overhead wires in [resi]dence districts, and of course the engineers would p[refer] underground work throughout; but the cost of puttin[g] the arc-lighting distribution wires underground is th[ought] to be prohibitive.

However, it is not the purpose of the city to forc[e] overhead wires on any neighborhood where the people [con]sider them objectionable. It is the intention, for the [time] being at least, to leave out streets or neighborhoods w[here] the property owners object strongly to the overhead w[ires] and proceed with the lighting plans where the people [want] the lamps badly enough to be willing to accept the ove[rhead] construction. But the city will place the wires u[nder]ground on any street or system of streets where the [prop]erty owners are willing to pay the difference in co[st be]tween underground construction and overhead constr[uction].

Electrically Controlled Fender Chains for Pa[nama] Canal Locks.

Huge chains stretched across the lock chambers wi[ll pro]tect the gates of the Panama Canal locks from [being] rammed when closed by any vessel that may becom[e un]controllable during the passage of the locks. After [a gate] thus guarded has been opened the chain itself w[ill be] dropped out of the way into a groove cast into the co[ncrete] of the lock chamber, allowing the vessel to proceed w[ithout] restriction. Altogether twenty-four of these fender [chains]

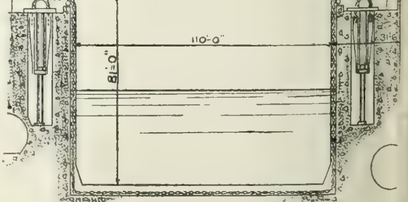

Fig. 1—Cross-Section of Locks.

will be employed at the Isthmus, the auxiliary guard gates which miter in a direction opposite to the main gate bei[ng] protected in the same manner. The forty-eight ha[ir]... handling mechanisms required will be operated by wat[er] pressure, but controlled electrically by solenoid-o[perated] valves and motor-operated centrifugal pumps.

Hydraulic cylinders will be employed to raise an[d] lower the chains, an arrangement of sheaves giving 4 ft. of chain movement for each foot of travel of the pistons. Eac[h] system of cylinders will comprise a stationary 40-in. cylinder inside of which is a movable 38-in. cylinder in th[e] co[...]

-ming a 25-in. fixed piston. The stroke of the cylinders will be 21 ft. 6 in., giving a total chain movement of 192 ft. from both sides of the chamber. By means of a remote-controlled solenoid valve, water pressure at 60 lb. per square inch, delivered by a centrifugal pump, will be turned into either the inner or outer cylinder, affecting the chain movement in the corresponding direction as desired. The motor-driven pumps will be started automatically by quick-acting switches which operate when required to restore pressure lost by leakage.

The most important function of the fender chains is to interpose a fixed but yielding resistance in case they are

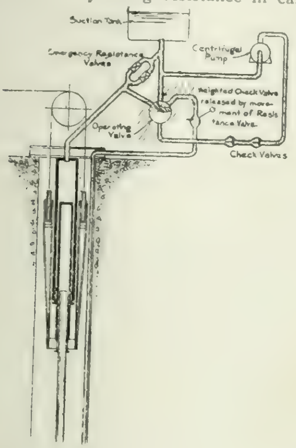

Fig. 2—Layout of Operating Machinery.

struck by a vessel, in this way arresting its movement without shock or damage and bringing it to a standstill as quickly as feasible. The water lines to the chain cylinders will be arranged with resistance valves so adjusted that if the ramming vessel imposes a stress beyond 750 lb. per square inch on the cylinders the chain will be paid out gradually by an automatic release until the ship comes to a stop. The emergency resistance valves will be arranged in parallel and so constructed that a constant stress of 750 lb. per square inch will be maintained on the cylinders. A ...-ton ship striking the chain is estimated to travel a distance of about 73 ft. before coming to a standstill.

Proposals have been asked for the equipment of these chain fenders and the bids will be opened at Washington Nov. 14.

Testing Motors for Panama Canal Lock-Valve Machines.

As mentioned in the *Electrical World* of May 4, 1911, page 1080, the Isthmian Canal Commission has purchased sample motors for testing with a view of purchasing 236 large electric motors to operate the valves in the locks on the Panama Canal. Allis-Chalmers, General Electric and Westinghouse motors have been secured for the test. A shed has been erected near the locks at Gatun, according to a recent issue of the *Canal Record*, and the motors are given tests for the climatic conditions on the Isthmus. Shop tests are now in progress in the United States, where the motors will be put through a working trial with one of the valve machines now ready at the works of the Wheeling Mold & Foundry Company. The object of the test on the Isthmus is to determine which type of motor will best stand the deteriorating effects of the climate. Upon their arrival the motors were placed in the dryroom of the storehouse at Gatun, and there the insulation resistance was measured at regular intervals for a week, and after storage in the dryroom it was measured further at intervals of twenty-four hours.

The tests include (1) the measuring of insulation resistance of the motors and the application of a 1500-volt high-potential test for one minute; (2) measuring of insulation resistance just prior to turning on steam and at intervals of six hours thereafter; (3) removal of handhole covers to admit saturated steam to the room so that the air is at a temperature of 50 deg. C.; (4) subject all motors to a high potential test of 1000 volts ten seconds every twenty four hours. These tests will be continued for one week. If the data do not show any decided results the tests will be continued, but in a temperature of 75 deg. C. In addition the motors will be immersed in water at normal air temperature, and the insulation resistance will be measured just prior to immersion and after immersion. At intervals of six hours for two days just prior to removal from the water a high-potential test of 500 volts will be applied for ten seconds.

If these tests do not show conclusive results internal heat will be applied by running the motors on regular pressure, or at higher pressure to produce the desired heating effect. This test will show the rapidity with which the moisture in the insulation will be driven off, and will also render the insulation more porous and finally weaken it as to its insulating properties.

Investigation of a Fire in a Hydroelectric Generating Station.

On April 3, 1911, as recounted in the *Electrical World* of April 13 last, page 895, there was an unusual fire in the generating station of the St. Croix Power Company at Apple River Falls, Wis. This company is controlled by the St. Paul Gas Light Company, which receives the entire output of the plant. As stated in this journal at the time, the financial loss was not serious, amounting in all to about $4,000, but the fire was due to an unusual accident and an investigation has been made by Mr. William S. Boyd, 76 West Monroe Street, Chicago, an electrical inspector for the Underwriters, who has published the result of his findings in a pamphlet containing information of considerable interest.

The station building is brick and one story high. It contains four General Electric 750-kw, 3-phase, 800-volt, 60-cycle generators, each directly connected to a Victor turbine waterwheel developing about 1200 hp. There are two 65-kw exciters, also directly connected to a turbine in each case. Six 500-kw air-cooled transformers raise the voltage from 800 volts to 25,000 volts, and at this potential the output is carried on a pole line to St. Paul, where it is reduced for commercial distribution to 2300 volts. The plant is well built and was considered practically free from fire hazard and no insurance was carried. The value of the plant is approximately $140,000, of which $40,000 is apportioned to the building and $100,000 to the machinery.

During the day of April 3 three of the four generators were in service, carrying about 25 per cent overload. At the time of the fire they were developing about 900 volts and carrying about 25 per cent overload, at a speed of 300 r.p.m. Neither this slight increase in voltage nor the overload was considered dangerous, as during the ten years of operation no trouble was experienced from this practice. It is believed that the failure which caused the fire was not due primarily to this condition. The generators, which were installed about ten years ago, have revolving armatures, and on account of the low machine voltage the windings are quite heavy, consisting of copper bars ¼ in. by ¾ in. in section, insulated with varnished cambric and paper. These bars are held in slots by wooden wedges

fitted into grooves in the armature core, together with the usual wire bands.

About 5 p. m. the day operator, while seated at his desk in front of the switchboard, heard an unusual noise behind him, and looking about saw some flashing on the No. 3 generator. He thought the transmission lines were short-circuited and rushed to the circuit panels and opened the switches, but the flashing continued, and while he was considering the matter a copper bar thrown from the machine in trouble struck him in the back. Without further delay he rushed into the nearby machine shop and shouted for help to the superintendent, Mr. John Pearson. When Mr. Pearson hastened to enter the generator room there was a rain of copper bars and a splutter of molten copper against the switchboard, which convinced him that it would be fatal to attempt to get to the field switch, which was then in the thick of the disturbance. A moment later he noticed that the west end of the ventilator was on fire. The frame bin in which the clean waste was stored was also blazing and the high-voltage current was arcing from a broken disconnecting switch to its grounded iron support in the west end of the room. Generator No. 3 was afire, and resembled a huge "pin-wheel" in operation.

Within two minutes the waterwheels were shut down and the operation of the plant was stopped. Measures were then taken to fight the fire, first with chemical extinguishers and afterward with water. Some difficulty was experienced because the apparatus was not adequate. However, by using larger hose, which arrived in response to an appeal to the neighboring power house at the village of Somerset, the fire was finally extinguished by attacking it through holes cut in the roof. The heavy metal covering of the roof was considered to be a deciding factor in the saving of the plant, as the men in charge felt that with a combustible roof covering the fire would have burned through, gained great ventilation and been beyond control before the larger 2-in. hose was secured. At it was, the fire damage to the building was confined practically to the woodwork of the roof, and about $1,500 was spent in repairing the building. The repairs to the generator cost about $2,500, and within eighty-four hours from the time the fire was extinguished the entire plant was in full operation again, with the exception of the damaged generator.

Mr. Boyd concludes that the fire was caused undoubtedly by a short-circuit in the armature of No. 3 generator, which burned through its windings, together with the binding wires, permitting the hot bars and molten copper to be thrown off by the centrifugal force of the revolving armature. Some of this hot metal lodged in the ventilator and ignited the framework. The open bin for waste was also fired in this manner. What caused the short-circuit is not so well known. It seems probable that moisture from the ventilator gradually produced a weak spot in the insulation of the armature, which gave way and caused the short-circuit. Each machine was protected by 1200-amp fuses at the switchboard. Those on the No. 3 machine leads operated as soon as the short-circuit occurred and cut off the other machines from the trouble, otherwise there would have been danger of their burning out also.

To safeguard the generators against a repetition of the trouble, Mr. Cutcheon, general superintendent of the company, suggests that each machine be provided with a reverse-current relay designed to "kill" it and disconnect it from the busbar system the moment any energy starts to flow from the busbars into the machine. Such a contrivance would have saved the machine and probably would have prevented the fire. Mr. Boyd's conclusions, which are of some interest to operators of hydroelectric generating stations, are as follows:

1. Electrical machinery operating in multiple and having rapidly revolving parts carrying heavy copper conductors should be so equipped and controlled that a short-circuit within a machine will automatically stop generation in the defective machine and will disconnect it from the syste

2. High-voltage conductors and apparatus should be pı tected from possible flying particles of metal, preferal by inclosures of non-combustible material.

3. Switchboards should be so located or guarded tl operators may manipulate controlling devices in safety.

4. Quick-acting valves controlling turbines should be located in all hydroelectric plants that water may promptly cut off by closing valves at a convenient po outside the generator room.

5. Ventilators or other roof structures of frame constr tion are a menace even on unexposed generating statio

6. Power houses having roofs composed of combusti material are always liable to serious damage, especi where remote from fire protection; but where a wood r is unavoidable the heavy mill type is least objectionable.

7. Roof coverings having good fire-retarding qualit are absolutely essential to the safety of power houses.

8. Frame air chambers for cooling transformers similar construction work, creating concealed spaces wl may obscure the presence of fire, constitute an unnecess fire danger.

9. Combustible supplies, especially waste, whether cl or oily, should be kept in covered inclosures or tanks structed of non-combustible material.

10. Standpipe and hose equipment with ample w supply and pressure to produce effective fire streams indispensable to the safety of power houses having c bustible roofs or floors or containing combustible mat in quantities. This is particularly true of stations re from public protection.

11. Ladders, fire axes, pike poles and crowbars shoul provided for all power houses having roofs, roof struct or other construction work of combustible material.

12. Electrical generators and motors of comparat low voltage rating are more liable to damage by heat by water where small fires are concerned.

13. Cool, determined, resourceful leadership, coupled good judgment, is the most important factor in the sa of property in time of fire.

Tungsten-Tube Furnace.

The great advances made recently in our knowled the physical properties of pure tungsten in connection the development of the tungsten-filament lamp have gested the substitution of tungsten for platinum as sistor for electric furnaces. Tungsten has for this pu the two great advantages of very high melting poin relatively low cost, but, on the other hand, must be tected from oxidation, which is unnecessary with plat

Electric furnaces with tungsten resistors are nc commercial use in the manufacture of tungsten lamp two furnaces of this kind, one a crucible furnace, the a tube furnace, were described in the recent Am Electrochemical Society paper by Messrs. R. Winn C. Dantsizen. In their tube furnace they use an alun tube wound with ductile tungsten foil.

Quite a different construction (though possibly of date) of tungsten-tube furnace is described in a issued Oct. 3 to Dr. William D. Coolidge, of the G Electric Company, and an active contributor in the de ment of the new tungsten lamp. He employs a solid sten tube, surrounded by some non-carbonaceous h sulator, like calcium oxide, alumina, thoria, etc. T in sulating mass is in turn surrounded by a layer of oke and the whole is inclosed in a metal box. To ven oxidation of the tungsten tube an atmosphere of hy oge or some other inert gas is maintained in it.

The tungsten tube is made of a mixture of allic tungsten and an alloy of bismuth, cadmium and m cury

This gives a plastic mixture which can easily be brought into the form of a tube, and the bismuth, cadmium and mercury are later driven out by a special heat treatment. Instead of pure tungsten the tube may be made of a mixture of tungsten with thoria, which has several advantages. It has a greater electric resistivity than pure tungsten, thus permitting the use of higher voltages for operation of the furnace; the thoria serves to stiffen the tungsten tube, and finally it is easy in this way so to charge the refractory tube that no tungsten is exposed to the direct oxidizing action of the air. To obtain this result it is only necessary to heat the tube in air and thereby oxidize the tungsten on the surface, which oxide is vaporizing as produced. There remains a porous shell of thoria completely enveloping the homogeneous inner portion of mixed tungsten and thoria. Such a tube is relatively inert, and at the high temperatures at which it is used it does not tend to stick or become welded to any articles which are placed in it for treatment.

Color Correction for Light of Mercury-Arc Lamp.

A patent issued to Dr. C. P. Steinmetz on Oct. 17 contains much interesting information concerning methods that may be employed for introducing red rays into the light obtained from mercury-arc lamps. For this purpose use can be made of potassium, sodium, lithium, rhubidium, indium or thallium, combined with the mercury mass. However these substances vigorously attack the glass envelope and form a black deposit on the inside thereof.

This difficulty can be overcome by introducing the substance as an anhydrous iodid or other halogen salt, rather than in its natural condition. The same beneficial results can be attained by allowing the color-modifying substances to act upon the inner walls of the glass inclosure to form transparent products. By the use of the meta-silicate of lithium this result can be accomplished. In order to re- ... e potential necessary to start the arc the inventor ... s the mercury in a glass vessel with hydrogen ex- ... l to a fairly high vacuum, and provides for an ex- ... iodin in the color-modifying substance by the ... of free iodin or of iodid of mercury. A white ... n be produced by combining the violet, blue, green ... low of the mercury light with the orange and red ... m and lithium.

The Treasury Department and the Illuminating Engineer.

... well-attended meeting of the Electric Club of Chi- ... eld on Sept. 27, during the convention of the Illu- ... g Engineering Society in that city, Mr. L. B. Marks, ... s the first president of the Illuminating Engineering ... made a brief talk that aroused a great deal of in- ... He said that he would take advantage of the oppor- ... to "fire one shot," and that shot consisted in a ... of the Treasury Department of the United States ... ent for its contemptuous attitude toward illumi- ... engineering in designing and maintaining public ...

... speaker said that the salaries of the men responsible for the lighting plans of public buildings under the control of the Treasury Department has been reduced to a point ... they hardly afford a living wage. A dozen men ... e named, he said, who were really competent to ... illuminating engineering of a high order and who had left the Treasury Department because of the insufficient remuneration. Mr. Marks made a plea for the diffusion of education that will make insistent a demand for better illumination of public buildings throughout the United States. The Illuminating Engineering Society contemplates such work as one of its objects, but it hasn't scratched the surface yet. It is a fact that the Treasury Department does not recognize the simplest principles of good illumination. In the Treasury Department building itself at Washington there are bare lamps in the field of vision. The condition of affairs in this particular is disgraceful. Individual illuminating engineers cannot get a hearing before the department, and the co-operation of all electrical organizations is needed to remedy this condition of affairs.

Mr. E. L. Elliott, of New York, who was the next speaker, said that the government's lack of attention to illuminating engineering had been a little overstated by Mr. Marks. The new office buildings of Congress in Washington were cited as examples where the government had employed illuminating engineering advice. To Mr. Elliott it appeared that the fact that illuminating engineers were too valuable for the government to employ was rather encouraging. The government hires cheap help and cannot compete with private enterprise. The speaker urged greater co-operation between architects and illuminating engineers.

In answer to a question put by Mr. James H. Delany, of Chicago, Mr. Marks spoke briefly of the relations of architects and illuminating engineers. He referred to the late Mr. Carrère as an able architect in New York who might perhaps have come to a realization of the importance of illuminating engineering had he lived. Mr. Marks added that Mr. Elliott was mistaken in supposing that the Treasury Department had employed illuminating engineers. Other departments of the United States government have done this, but the fact is that the Treasury Department has charge of nearly all federal buildings throughout the country, and it was this department that he was criticising; other departments of the government are more advanced. For instance, in the State, War and Navy Building in Washington the advice of illuminating engineers has been followed, although the Treasury Department officials have laughed at the idea. It is a fact that that department does not appreciate what the illuminating engineer does.

Mr. Marks also complained that in some cases where the illuminating engineer is called in he is simply employed to design an electric system and to locate the outlets, some other person selecting the fixtures. Such a procedure spoils any consistent plant for a system of illumination. Reverting to the Treasury Department's attitude, the speaker said that the condition to which he referred was a standing joke. It is "up to us," he said, to remedy the existing conditions. Engineers have offered their services free of charge to the Treasury Department, so that the question of cost does not enter into the matter. Mr. Marks said that he was speaking for what be believed to be the good of the public; he was not representing any society or any firm of engineers.

Mr. T. G. Grier, of Chicago, in an amusing speech said that it might be the duty of salesmen to convince the Treasury Department that it should buy the proper kind of materials for illuminating engineering.

Mr. F. J. Pearson, former president of the Chicago Section of the Illuminating Engineering Society, said that what Mr. Marks had said was but too true. The government seems to be continually making experiments in the erection of its public buildings. Probably the principal cause of this state of affairs is the fact that the people seem to have lost sight of the fact that the office of supervising architect of the Treasury Department is one of much importance and dignity. The appointment to this office should not be a political one, but so long as it is and so long as the engineering public acquiesce in the situation the condition complained of will probably continue. Certain materials are exploited in the designing of public buildings, regardless of the engineering principles involved. Mr. Pearson noted the fact that these conditions do not obtain in the War or Navy Department or in the Bureau of Standards, because these departments are administered by men of engineering train-

ing. In particular the speaker commended the work of the Bureau of Standards, making especial mention of Dr. Rosa and Dr. Hyde.

In conclusion Mr. Marks repeated that he was not finding fault with the State, War or Navy Department or the Bureau of Standards. It is the Treasury Department, however, that has charge of the thousands of public buildings scattered throughout the country, and it is to that department that his criticism is directed.

Production of Electrolytic Zinc in the Metallurgy of Complex Ores.

In a paper describing the Malm process for the recovery of metals from complex ores, read before the recent American Mining Congress in Chicago by Col. A. G. Brownlee, of Idaho Springs, Col., an interesting reference was made to the electrical features of the process. The ore is subjected to the action of chlorine gas and to various processes, so that chlorides of all the metals contained in it, as gold, silver, copper, lead and zinc, are formed. After various treatments only zinc chloride in solution is left, and from this the moisture is removed, the residuum being fused and run into electrolytic cells. Here electricity is applied, and the zinc is deposited in metallic form. The zinc cells are operated at a temperature of about 450 deg. C. The various precipitates of gold, silver, copper and lead are separately collected in filter presses, and the molten metallic zinc is tapped from the electrolytic cells at regular intervals.

From 60 to 70 per cent of the cost of operating this process goes for electrical energy. Direct current at low voltage is used for the electrolytic work, which applies to zinc only, and the consumption of electricity varies with the zinc or zinc-equivalent contents of the ore. In practice recovery has been made of 14.2 lb. to 14.4 lb. of zinc per hp-day. With energy at $50 per hp-year it is figured that the cost of converting zinc chloride into metallic bars of zinc amounts to but a little over a cent a pound of the metal produced. Electrolytic zinc made abroad is sold in New York at a premium as high as 2.5 cents a pound over spelter, which is an impure product. It is asserted that by the Malm process as a whole not less than 90 per cent of the values of all the metals in refractory ore may be recovered. It is said that the process promises to become as important a factor in the extraction of all the metals in complex ores as the cyanide process has proved in the treatment of straight gold ores.

Suburban Electric Service.

Mr. John G. Learned, general contract agent for the North Shore Electric Company, of Chicago, addressed the Electric Club of that city on Oct. 18 on "Central-Station Business in the Suburban Districts." Mr. Learned exhibited a large wall map showing the seventy-two cities and villages in which the company has franchises. (See *Electrical World* of Feb. 23, 1911, pp. 479-485.) The territory served by the North Shore Electric Company covers 1200 sq. miles, and surrounds Chicago on the north, west and south. Fifty-two of the seventy-two towns served have street-lighting contracts with the company and the latter is pumping water for fourteen municipalities. The area tributary to the company is largely composed of farming land and the company is gradually picking up some business from farmers, although so far the customers of this class are mostly "gentlemen farmers"—that is, rich Chicagoans who desire to use electricity on their country places. The company has twelve display rooms in different communities and advertises in thirty-four weekly and two daily newspapers.

Owing to the fact that lamps and motors are supplied from the same alternating-current circuits the company is rather strict in its requirements relating to motors. However, single-phase motors up to 5 hp are taken on the lines without question, unless there is some special objection, as in the case of pumping motors at the end of long lines. Motors of 5 hp to 7½ hp are taken on, provided their operation will not affect the lighting regulation, which the company looks after very carefully. Non-inductive starters are required. For sizes from 7½ hp to 35 hp squirrel-cage motors are stipulated, and above 35 hp all motors must be of the slip-ring type. Furthermore, all motors must be provided with no-voltage release apparatus.

Free renewals are made in the case of standard carbon lamps. The company does not, however, make deliveries of lamps, but requires the customer to apply at certain established stations and in some cases on certain days when the lamp agent is traveling through that section of the territory. An allowance of 20 cents is made for each burned-out carbon lamp supplied by the company and tendered in exchange for tungsten or other special lamps. The company is considering the use of Gem lamps instead of the standard carbon lamps.

Thirty solicitors are employed by the company, which has 30,000 customers. The various electrical household appliances, such as washing machines, flatirons, etc., are of great assistance to the company in going after new business, and the North Shore people make a point of co-operating with the manufacturers of apparatus of this description. The electric fireless cooker has not proved a success so far, but washing machines are in demand, while electric flatirons are very popular, there being one in service to every five customers.

Among those taking part in the brief discussion were Messrs. Frank F. Fowle, William M. Connelly, R. F. Gaston and H. E. Niesz.

Reactance in Alternating-Current Circuits.

For the subject of his annual lecture at the joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers in Chicago on Oct. 25 Dr. C. P. Steinmetz chose "Reactance in Alternating-Current Circuits." Mr. J. G. Wray presided at the meeting, and Mr. B. J. Arnold introduced the speaker. Dr. Steinmetz contrasted the unfavorable conception of reactance formerly held by engineers with the uses which have been found for it in later years, and he considered each of the uses in turn, concluding with a warning against the possible danger of using reactance without a full understanding of its characteristics.

There has been a general impression that reactance in alternating-current circuits is objectionable, but, on the other hand, engineers are now installing it in large stations to insure safety of the system. Reactance became of importance with the introduction of alternating-current distribution following the appearance of the transformer in 1886. It was observed that the drop in alternating-current circuits was far in excess of what it was in direct-current circuits. This phenomenon is due to self-induction, and it was only by the conception of reactance—an apparent resistance that consumes voltage—that measures were taken to correct this defect. Reactance differs from ohmic resistance in that the voltage consumed is not in phase with the current, and as the result the reactance does not consume power.

It took a number of years to develop this conception, and it was not until 1893 that engineers were able to grapple successfully with the situation presented. It was the problem of the seven years from 1886 to 1893 to control and eliminate reactance drop by designing transformers and

their alternating-current apparatus with that end in view. By using conductors of moderate size and by employing lower frequencies the reactance drop was brought under control, and this made alternating-current distribution practicable. However, direct current is still in use where there are large amounts of power to be distributed in congested districts, as in New York and Chicago, for example.

Early transformers had from 15 to 20 per cent reactance, but the reactance was brought down gradually until it is no longer a formidable characteristic of transformers, now reaching perhaps 1½ to 2 per cent. A corresponding development took place in the generators, with the final result that reactance ceased to be an enemy of the alternating-current system. Modern designers, however, have gone past the point where reactance is held to be harmful, for reactance, even excessive reactance, is not an unmitigated evil; there are cases where it is useful. Even in the early years it was used to impose voltage regulation by what is now known as phase control. If the phase of an alternating current is varied the effect of the reactance voltage can be correspondingly varied. Resistance drop always increases with the increase of load. By changing the phase of the current it is possible to secure control of the voltage. This can be done in synchronous machines by a change of excitation, and this has become the standard system of voltage regulation in long-distance railway systems. In the large transmission systems in the West operation is only possible by the use of synchronous machines, synchronous motors being also used at the centers of distribution.

The first use of reactance for voltage regulation was made in generators and lines. Obviously this method is useful only where each synchronous motor has its own generator to act upon. The reactance of lines alone is not sufficient to give regulation. At the present time standard long-distance railway systems make use of reactive coils. Some ludicrous situations have arisen from the modern applications of reactance; transformers, for instance, are required to be of less than 2 per cent reactance, while the buyer then turns around and buys 15 per cent reactive coils for his secondary circuits.

Alternating-current generators are now operated satisfactorily in parallel. Modern steam-turbine 25-cycle alternators have reactances sometimes as low as 2 to 3 per cent. They are operated in parallel very successfully, but when they are operated in multiple hunting is apt to appear, with resulting instability.

The resistance in the machines themselves is small, perhaps a fraction of 1 per cent, but when cables from other power houses in a network add their resistance the stabilizing power of the small reactance in the machines may vanish. In this case reactive coils must be used. Such stabilizing reactances are a necessity whenever the distance between the machines is not small compared with the reactance.

The electric arc cannot be operated on a simple supply circuit; resistance or reactance is required in the circuit. In the alternating-current arc circuit a power-factor above 70 per cent can never be reached unless resistance is used. Reactance is used to give stability.

An entirely different use of reactance is made when it is employed as a protective device. It is supposed to act as a barrier, keeping high-voltage disturbances out of the station by use of the so-called choke coils. But this use of reactance has been less frequent of late, for it has limitations and cannot be used promiscuously. It protects only at frequencies which are very many times higher than the normal frequency. It will not act as low frequency. Reactance to protect effectively must have no appreciable capacity. Thus the frequency range of protective reactance is limited, and, furthermore, the device must be designed so that it will have negligible capacity. Again, these protective devices serve not only to keep high-voltage disturbances out of the station, but also to prevent any disturbance of this sort originating in the station from getting out. The rule works both ways. The device is useful if properly installed and applied, but the situation of the station and line must be studied.

Quite recently another application of reactance has been made in huge high-power generating stations where hundreds of thousands of kilowatts are developed. The whole system here has extremely small resistance and reactance; any disturbance is therefore liable to be dangerous. Switches, which must be of reasonable size and cost, cannot be relied upon to open circuits carrying very large amounts of power. Therefore reactance is introduced, say 8 to 10 per cent, which can be used as a safety device and placed in the generator or the transformer, or externally applied. Experience shows that in large transformers, even of 25 cycles, it is possible to give 8 per cent reactance, which is sufficient. In the generator the case is different, for it is practicable to get only 3 or 4 per cent internal reactance, and it is usually more economical to add what is needed in the shape of a reactive coil or step-up auto-transformer. At this point Dr. Steinmetz gave a brief exposition of machine design to show the maximum-economy point in armature reaction.

In the huge units of the great modern power stations regulation is not so important as formerly. If, for instance, the output is 100,000 kw a variation of 10,000 kw thrown on or off is not so serious a matter as in the case of a station rated at 20,000 kw or 30,000 kw. External reactance has, however, a less unfavorable effect on regulation than has armature reactance.

In concluding, the lecturer called attention to one more point in relation to the use of reactance in alternating-current circuits. It must be remembered, he said, that where there is reactance in a circuit energy is stored in the magnetic field of that circuit. Reactance must always be considered as energy storage. It represents a momentum, so to speak. Therefore currents must not be ruptured instantly where there is appreciable reactance. One of the main advantages of the oil switch is that it opens at zero current. Where there is high reactance engineers and station operators must guard against setting stored energy free at too rapid a rate. Reactance is indeed required, but it must be realized that the stored energy which it implies must not be let loose in a destructive manner; otherwise that energy may run wild and do serious damage.

In answer to questions asked by Mr. G. W. Cravens and another gentleman, the speaker gave some further explanation of the characteristics of resistance and reactance. While reactance used with generators can vary over a considerable range, it should not be too much or too little. In railway practice from 15 to 18 per cent of reactance is used coincident with from 2 to 10 per cent of resistance. In general it may be said that the reactance should not be over 40 per cent of a total circuit, or less than twice the amount of resistance. Iron cores are not placed in the external reactive coils used with generators because they are uneconomical. If iron cores were used they would have to be operated at low density, and they would be too large and heavy to be practicable.

Uses of the Amp-Hour Meter.

Before the Car Lighting Club of Chicago on Oct. 18 Mr. Robert C. Lanphier gave an illustrated account of the amp-hour meter, which, he said, has a wide field of application for various services where the watt-hour meter is not available. Amp-hour meters are used with storage batteries on electric vehicles, in central-station service, in central energy telephone systems, for train-lighting service and in control of electroplating operations. The Sangamo amp-hour meter was developed something over three years ago at the suggestion of Mr. Ernest Lunn, of the

Commonwealth Edison Company, Chicago. It is practically a Faraday-disk or mercury-motor meter. The mercury chamber is shaped like an invertible inkwell, preventing spilling of mercury in any position. A "differential shunt" causes the meter to run slower on battery charging than on discharging, thus giving to the battery automatically the necessary percentage of overcharge, say, 15 per cent, every time it is charged. A "resetting device" permits setting the indicating hand ahead, by any desired percentage, when a periodical overcharge is wanted. A stop-charge contact opens the charging circuit by actual amp-hours input.

For straight storage-battery train lighting the amp-hour meter is used under practically the same conditions as on electric automobiles. With axle-drive equipment a new arrangement will allow the use of the meter not only to stop the charge at the proper time and to indicate the condition of the battery with respect to charge, but also to serve as a controller, operating through relays, to transfer the battery from charge to discharge at the proper time and to cut off the generator at full battery charge.

Mr. Lanphier described the compensated type of amp-hour meter, which is speeded up on discharge above the correct speed at any given load, so as to compensate at each load for the reduction in effective capacity of the battery at that particular discharge rate. Another feature, and a new one, is the distant-operated dial device by which the meter can be placed at one point on a railroad car or electric automobile while the dial can be placed at any other desired point, the only connection being a small cable. The speaker also described the method of using the meter with stationary batteries in central stations.

A special use of the amp-hour meter is in connection with the Delco system of cranking, lighting and ignition used on Cadillac gasoline automobiles this year. Here the meter acts as a controller to open and close the field circuit of the generator, so that the battery is never allowed to become overcharged and, by a further adjustment, the battery cannot be discharged to too great an extent. Amp-hour meters are also used on submarine boats of the United States Navy in connection with storage batteries and should prove of considerable value in keeping the batteries in a fully charged condition when a boat has to run submerged.

A peculiar form of amp-hour meter has been built by the Sangamo company for the Interborough Rapid Transit Company, the meter being, in fact, not an amp-hour meter, but an amp-squared-hour meter. This meter is intended to record on the dial the product of amperes squared by time instead of amp-hours merely. Two of these meters are being used for testing the load on distributing cables of the Interborough company, for with the resistance of a cable known the product of the meter reading in amp-squared-hours by the resistance gives the total energy lost in any cable during the period over which the load has passed through the meter. This is a very interesting and novel way of arriving at the energy losses and much more accurate than any method of taking voltage drop between distant ends of the cable with a varying load.

Messrs. A. J. Farrelly, J. B. Gray, C. R. Gilman, H. W. Young, G. B. Colegrove, F. E. Hutchinson, G. W. Cravens, C. L. Williams and others took part in the discussion. Several of the gentlemen mentioned are car-lighting engineers and they spoke in favorable terms of the use of the amp-hour meter in connection with storage-battery train lighting. No one else volunteering, Mr. Lanphier was asked to "knock" his own instrument. He said that some difficulty had been experienced from vibration of the meters in railroad service, but this had now been corrected by the use of lock washers. Occasional trouble has arisen from the cracking of jewels, but this has not occurred very often. Trouble with the gear ratio may be obviated by rigid shop inspection.

Illinois State Convention at Rockford.

More than 100 central-station men were present at tl annual convention of the Illinois State Electrical Associ tion, held at Rockford Oct. 24 to 26, the total registratio including associate members and manufacturers' represe tatives, bringing the number of those present up to 3c In connection with the convention an electric show w held in the Rockford Armory, where a number of electric and local manufacturers made exhibits of interest to t central-station visitors and the general public.

SOLICITING MOTOR BUSINESS.

With President W. G. Austin, of Effingham, in the cha the first convention session was opened Tuesday afterno with an illustrated discussion by Mr. George B. Colem of the Rockford Electric Company, on the subject of lo motor applications and methods of obtaining motor-dr business. Mr. Coleman demonstrated the use of pho graphs of typical installations for convincing prospect customers of the benefits of motor drive, and displa forms of letters with curve sheets and illustrations attach used for soliciting this class of business. The stereopti was also employed to exhibit further applications of mo drive.

On Wednesday morning Mr. John G. Learned, of North Shore Electric Company, Chicago, read his pa giving suggestions for the sale of energy for motor serv While the motor-service salesman, said the speaker, pre ably should be equipped with a technical education, very fact may hamper him with engineering details, c fusing the customer and delaying the signing of the c tract. For this reason the commercial instinct should dominate, and great care should be taken in the selectio men, since a poor representative can do much harn the course of a very few visits to a prospective custo Mr. Leonard outlined the proper method of approachi prospective customer, advising the salesman to mak thorough study of the field in which he is working, toge with the personnel of the various firms he is to visit. speaker exhibited forms used by the North Shore Ele Company for itemizing isolated-plant costs and for adve ing its service. Mr. Learned also brought out the b ficial effect on a person who receives confirmation o central station's statements by electrical-appliance sale apparently having no interest in the central station's af The speaker urged such co-operation, although on a competitive basis as far as the sale of motors is conce leaving the choice of the particular make to the custo selection.

A paper by Mr. T. P. Pinckard, of Peoria, Ill., was read by Mr. R. S. Wallace. The author urged the portance of eternally keeping after prospective motor tomers to increase the central station's motor load. pointed out that this work of conversion of isolated is gradually becoming easier. Usually the obstacle causes slow-moving negotiations is the incredulity o prospective customer, rather than his antagonism. Pinckard urged the careful study of the costs of prod of the isolated plant, taking care to inspire confider the superior quality of central-station service.

Mr. A. C. Martin, of the Rockford Electric Com followed with a paper on the same subject, in whi spoke of the need for removing the prejudice that exists against purchased energy, which is on this ac alone improperly believed to be more expensive ha private-plant service. An excellent method, he ment is to secure letters from the company's present motor ers. These copies, he said, should be kept in a loose-leaf ote- book and carried by the salesman for the ready ref ence of other prospective customers. On his initial c the salesman should always omit all reference to the s of service, but finally bring the talk around to the sub t of

e manufacturers' present equipment, its defects and the ossibility of making an indicator test of the plant. The rrect cost of operating an isolated plant, said Mr. Martin, after all the most important factor entering into the osing of a contract. Definite estimates should always be cluded of the cost of heating, together with suggestions r improvements in motor arrangement which will give a ore efficient drive.

The subject was discussed by Dr. E. J. Berg, of Champign, and Messrs. Charles A. Munroe, of Joliet; Frank J. aker, of Chicago; A. C. Martin, of Rockford; G. B. Colenn, of Rockford; C. W. Pen Dell, of Chicago; John F. ilchrist, of Chicago; H. J. Pepper, of Champaign; E. B. illman, of Quincy; H. A. Foster, of Fairbury; F. M. sabaugh, of Mount Vernon; L. R. Spaulding, of Mount orris; E. Macdonald, of Lincoln; E. O. Brown, of Elmwod; E. J. Condon, of Harvard, and David Davis, of ichfield.

SALE OF ELECTRICITY TO FARMERS.

A paper on "The Sale of Electricity to Farmers," prepred by Mr. E. L. Brown, of Elmwood, Ill., was read by h son, Mr. E. O. Brown. It described the local system, wich comprises 30 miles of transmission lines connecting eht small towns and incidentally supplying about fifty s with electric service for lighting and motors. The od plant and plan of supplying electricity to farmers we described in the *Electrical World* of March 2, 1911.

Mr. R. H. Abbott, of Petersburg, Ill., followed with a paer describing his own service to farmers along the rte of his 16,500-volt, single-phase transmission line. High-tension transformers step down to 2400 volts for pimary distribution. All transformers, poles, lines, lightnig arresters, etc., are owned by the farm customers, each of whom pays a minimum charge of $2 per month.

H. W. Bullock, of Eureka, Ill., presented a descripi f the supply of central-station service to farms along insmission lines into Roanoke and Metamora. Be the lighting of the houses, and of dooryards, barna and feedyards by tungsten lamps on poles, motors ere used for agricultural purposes, such as pumping grinding feed, sawing wood, elevating grain into and driving cream separators, churns, washing-mas, sewing-machines and fans.

aper by Mr. J. G. Learned, of Chicago, referred to port of the committee on electricity in the rural dis appointed by the National Electric Light Associa The speaker urged education of the farmer to the where he will realize the advantages and economy of elericity. The farm business, he said, is usually "offpe," and in respect to its diversity factor will pay the ceral station. Mr. Learned's paper included a list of farm itions of motors, together with an enumeration of rse-power rating of motors required to drive various achines.

E. P. Edwards, of the General Electric Company, ctady, N. Y., discussed the future of electricity on the There are 30,000,000 horses and mules in this coun id Mr. Edwards, 90 per cent of which are employed culture. In spite of the attention given to improv ps and to conservation on the farm practically no re yet available on the best forms of motive equip which can be used and the cost of performing the st farm operations. It is known, however, that about p-hours are required to plow an acre of ground. al labor on the farm is paid an average of 11 cents per our, and, as such labor is equivalent to about 1/8 hp, human energy is seen to be worth 88 cents per hp-hour. The verage cost of an animal hp-hour is 8 cents, including intest, maintenance and depreciation of stock and equipmen. Mr. Edwards urged that the United States Department of Agriculture and the various agricultural colleges investigate this highly important subject of the cost of power for farm services and the applications of electricity to such operations, although in the meantime, he said, private manufacturers are taking up the testing of practical farm applications. Even assuming that only one-fourth of the farms of this country are reached by central-station lines, Mr. Edwards pointed out the enormous significance to the central-station business of this load. The subject of farm supply was further discussed by Messrs. Theo. Bass, of Farmington; H. J. Pepper, of Champaign; C. W. Pen Dell, of Chicago; W. G. Austin, of Effingham; E. J. Negley, of Canton; S. B. Cushing, of Chicago; F. J. Baker, of Chicago; E. J. Condon, of Harvard, and J. J. Frey, of Hillsboro, and by Dr. E. J. Berg, of Champaign.

MUNICIPAL WATER PUMPING.

Mr. E. Macdonald, of Lincoln, Ill., presented a paper on the subject of "Pumping Water for City Supplies." The paper outlined examples of costs of pumping in small towns and the saving to the municipality over operating its own steam pumps. The cost of such pumping service, said Mr. Macdonald, varies from 5 cents to 2 cents per kw-hour, and is 7 cents or less per 1000 gal. pumped. Tests of the 75-hp motor-driven pump in use at Lincoln have shown that it operates with about 3 tons less coal per 1,000,000 gal. pumped than is required by either of the steam pumps.

Mr. F. J. Baker, of Chicago, pointed out objections to contracts on a basis of payment per 1000 gal. pumped, since depreciation of machinery and equipment and lowering of the water level in the wells may change appreciably the margin of profit of the electric company. Mr. Baker observed that in instances where the company gets the water pumping the matter of a municipal lighting plant is usually thus settled, since agitation for a municipal electric plant usually centers about the city water-works. For this reason, he said, central stations could afford to take city pumping at reduced profit or at none. Mr. W. J. Kyle, of Chicago, asserted, however, that the Massachusetts Public Service Commission has ruled that a city must pay the same price for its service as any other customer. Mr. E. J. Condon, of Harvard, urged that the municipal contracts be always taken at a profit and that on account of greater simplicity service be charged for on the basis of water pumped.

Mr. E. Macdonald, of Lincoln, pointed out that water meters are usually inaccurate and that the principal reliance should be placed in electric meters. Pumping equipment, he added, should be maintained by the company, since city officials are likely to be very careless in the upkeep of apparatus, thus contributing to the cost of water pumped under contracts on a pumpage basis. Mr. C. W. Pen Dell, of Chicago, described the operation of automatic motor-driven municipal pumping plants operated by the North Shore Electric Company, in which both the deep-well and centrifugal high-duty pumps are started automatically, without attendance, to maintain an ample reservoir supply. In case of fire the two centrifugal pumps are connected in series for double pressure. Mr. Charles Munroe, of Joliet, advised the conversion of municipalities to the payment of a fair rate for energy rather than the taking of this business at cost.

UNIFORM ACCOUNTING.

A paper by Mr. F. W. Gregory, of East St. Louis, Ill., read in the author's absence by Mr. R. C. Hardy, opened the Wednesday afternoon session. The author warned against the conservative practice of charging to operating expenses many legitimate capital expenditures. This not only deceives the management as to the profits, but keeps the book cost of a property down to a figure sometimes less than the actual replacement cost. A public-service commission investigating such a company's affairs could hardly allow credit or returns on these legitimate investments where so classified. Using the eight main divisions of the N. E. L. A. scheme of classification of accounts, both the largest and the smallest companies, he said, could obtain a

fair comparison of their unit costs. As a practical point Mr. Gregory suggested the use of loose-leaf ledgers in case a system of uniform accounting is to be adopted, later subject to the regulation of a commission. In closing, the author urged the adoption of the national association's schedule, which is now being used by a number of companies throughout the country.

Mr. H. E. Addenbrooke, of Chicago, followed with an analysis of the National Association's classification of accounts, and pointed out the benefits resulting from a uniform system of accounting. Mr. Addenbrooke's paper included analyses of expense, income and investment accounts applicable to the smallest as well as the larger companies. In the discussion which followed Mr. F. J. Baker, of Chicago; Mr. R. S. Wallace, of Peoria, and Mr. E. W. Smith, of Kewanee, testified to the excellent results expected of the N. E. L. A. schedule, which eight Illinois companies have adopted during the past year. Mr. Baker also detailed an account of the North Shore's "morgue" for filing photographs and accurate descriptions of obsolete apparatus replaced during the reconstruction of stations. Such descriptive data, he thought, would be of value in demonstrating to a commission the equipment rendered obsolete in the development of a given system. In answer to a question from Mr. David Davis, of Litchfield, Mr. Addenbrooke said that some states permit companies to capitalize the loss entailed due to the discount on their bonds, while others allow charging off this amount. Mr. Baker observed that this cost should be charged to a suspense fund and equalized over the life of the bonds.

PROGRESS IN ELECTRICAL ENGINEERING.

One of the treats of the convention was an address by Dr. Ernst Berg, professor of electrical engineering at the University of Illinois, on the subject of "Recent Progress in Electrical Engineering." Professor Berg referred briefly to the periods of development about 1893 and later in 1905, observing that at the present time the design of steam and electrical machinery has reached almost its logical limit of efficiency and size. The next advance, he declared, will be the obtaining of energy directly from the sun with the aid of a low-pressure turbine. While a pound of steam at 200 lb. pressure contains 265,000 foot-pounds of energy, the same quantity at atmospheric pressure represents an energy content of 132,000 foot-pounds—about half that of the high-pressure steam. On this rather surprising fact is based the operation of the sun-power turbine, which receives its low-pressure steam from glass-covered courts containing pipes warmed by the sun's radiation. A plant of this kind recently completed in Philadelphia and shipped to the Sahara Desert, where it is to be operated, said Dr. Berg, actually developed 10,000 kw from an area 500 ft. square in the latitude of Philadelphia. Professor Berg then launched into a terse review of recent theoretical progress in electricity, outlining the experiments and phenomena which have led to the formulation of the electronic theory and the modern conceptions of the ultimate identity of electricity and matter. In this connection he gave some interesting estimates of the dimensions and magnitudes of the quantities involved, expressed in practical units.

ILLUMINATION.

Mr. A. J. Cole, of the Westinghouse Electric & Manufacturing Company, Chicago, followed with a paper on "The Wire-Type Tungsten Lamp," preceded by a clear description of the source and manufacture of the tungsten filament and data on its strength when new and after several hours' use, etc., obtained from a personal study. The wire-type lamp was also described in detail, and analyses were made of the cost of operating lamps of various specific consumption at different scales of energy cost.

"Modern Street-Lighting Systems" was the subject of the next paper, prepared by Mr. Warren Partridge, of Springfield, Ill., presenting a very complete enumeration of the various forms of arc and incandescent units now obtainable for street lighting. Mr. Partridge discussed the subject of ornamental post lighting from the standpoint of appearance, efficiency, contracts with customers, charges for service, arrangement of lamps, etc.

Mr. R. S. Wallace, of Peoria, observed that where possible contracts should be made on a candle-power basi rather than the watt basis, in order that the company may benefit from such improvements in illuminants as may occu from time to time, the city at the same time profiting when new contracts are to be let.

SINGLE-PHASE MOTOR.

Thursday morning's session was opened by Mr. F. N Jewett, of the Wagner Electric Manufacturing Company St. Louis, Mo., with a paper on the interesting new unity power-factor single-phase motor recently brought out b this company and described in preceding issues of th *Electrical World.* The construction of the double windin of the motor was clearly explained, and a number of curve were included, illustrating its performance under variou conditions, together with the beneficial effect on usef generator output of a unity-power-factor load. Mr. Jewett paper also referred briefly to the new adjustable-spe single-phase motor which is now being developed. At th close of the paper the author answered a number of que tions regarding the use and operation of these motors, p by Messrs. C. W. Pen Dell, of Chicago; J. H. Delany, Chicago; W. A. Thomas, of Pittsburgh; S. B. Cushing, Chicago; A. C. Martin, of Rockford; J. G. Learned, Chicago, and Warren Partridge, of Springfield.

ELECTRICITY IN COAL MINING.

Mr. W. A. Thomas, of the Westinghouse Electric Manufacturing Company, Pittsburgh, Pa., read an intere ing paper on the subject of the use of electricity in c mines. The advantages of such drive to the mine opera are reduced cost of operation and investment and improv reliability. Primary applications of motors in mines those of cutting, hauling and hoisting the material from mine, while secondary applications are producing dr pumping, draining and lighting in the mines. The lat secondary services are often undertaken first and la followed by the primary uses. Electricity for mine us increasing in popularity much faster than compressed- drive, although motor-driven compressors can often operated to advantage by central-station compan Mechanical haulage greatly increases the output of given mine. Electric locomotives are now almost enti used for this purpose, 204 electrical out of a total of mining locomotives being now employed in Illinois handling 54 per cent of the output.

A recent advance in the art has been marked by the alternating-current hoist motors now available. The au described various methods of reducing the peaks of ho ing demand on central-station lines by the use of sto batteries and motor-generator sets, rotary-converter mo driven flywheel sets and flywheel equalizing sets. Fig were added for a typical mining installation where operations are done by electricity, the consumption a aging from 2.1 to 4 kw-hours per ton of coal mi although these values will be less where the pumping does not represent so large a part of the energy consu Many mines, said Mr. Thomas, put off converting to tric drive on account of the lack of capital require as well as the prejudice which still lingers among opera rs.

Mr. C. W. Pen Dell, of Chicago, told of the satisfa use of 60-cycle, 100-kw converters supplying energy fluctuating crane and hoist loads in Chicago. As an experiment, he said, he has paralleled two such mach es, loaded them to 50 per cent of their rating and then star ed on and off an additional load of 125 per cent without us-

in any trouble in the operation of the converters. Not only does the rotary converter show an efficiency of 15 per cent higher than that of the motor-generator, but much difficulty is often experienced in obtaining repair parts for the high-voltage motors of the latter sets. Mr. J. J. Frey, of Hillsboro, told of the use of electricity in mines in his vicinity, where motors have been installed to extend the economical life of shafts already worked to their limit by hand methods. A 300-hp coal washer, said Mr. Frey, also forms an important portion of his load. These mining services are restricted to off-peak use.

PUBLIC POLICY.

…te of growing interest to central-station men was struck in a paper on "Public Policy," by Mr. Charles T. … of the H. L. Doherty Company, which was read by Mr. … M. Sinsabaugh, of Mount Vernon. Many attacks on public-utility companies, observed the author, can be attributed rather to the lack of courteous explanations on the part of companies in transactions with customers than to dissatisfaction with high rates. Central-station men were … to make friends with their customers, especially … come into the office to register complaints. Com… employees are important to a public utility's success, … remitting efforts should be made to increase the … y of even the ordinary men by coaching and encouraging them in the practice of their duties and in unfailing courtesy to the public. Efficiency, courage and … now sell higher than ever before, wrote Mr. Brown. … successful manager is he who does more than is required by his superiors, offers few excuses, guards against accidents and plans for the future. Such a man makes himself indispensable and invaluable in his position. The public unconsciously estimates the company by the per… of its manager, and if the latter is popular, honest … re the standing of the company benefits accord… … ach customer's complaint should be carefully in… … and arbitrary decisions which may create enemies … Usually the central station is one of the big in… the community, and its manager should get close … g men and point out to them that, although its … ket is limited to the city, it wants local manufac… develop their production, so that in turn it and … unity may prosper. The author urged the fullest … in the conduct of utility business, the central … king the public into its confidence as the surest … avoiding false criticism by enemies of its in… he time is past, concluded the author, when com… … expect successfully to do a small volume of … at high rates.

Mr. J. H. Delany, of Chicago, pointed out that poor service acts as a fertilizer to the discontent of customers. … average consumer, he said, desires service and is will… … for it. Care must be taken not to misjudge the … of consumers, who sometimes have just grounds … on. The good-will of the customer must be held … ts, and sometimes it is even advisable to "dis… … same valued employee more than once to satisfy … who feel themselves injured or aggrieved.

Mr. … H. Golding, of Rockford, said that, while towns … er, human nature is practically the same throughout the … and an open policy with public and officials will … found the best course. Where a customer com… … a high bill and the Rockford company satisfies … at this contention is honest, although finding no … ation for the increased meter reading, it stands will… to adjust the amount of the bill, impressing on the … that this is done to retain his good-will. In no single instance, said Mr. Golding, has such a customer … ck for a second adjustment. The same liberal … also maintained in the exchange of defective tung… … While the first cost per lamp may be slightly … the important result is obtained of keeping customers well satisfied. Mr. F. N. Jewett, of St. Louis, referred to the practice of a successful Eastern central station in keeping the newspapers its friends by furnishing them from time to time with news of its new equipment, plant additions, etc., taking care to impress on the public that its equipment is of the most up-to-date character and its service the most modern. Recently, when this company was embarrassed by the prospect of an ice jam in the water-power plant from which its supply is obtained the newspaper reporters were called in and the situation laid before them, with an account of the efforts being made to meet the emergency and the impaired service which might nevertheless be expected. An interesting story was thus worked up, and when the shut-down came, a couple of days later, the company had won the sympathy of the public and no complaints were registered.

Mr. J. G. Learned, of Chicago, said that the matter of public friendliness and sympathy is of the greatest value when franchises are needed or city lighting contracts are to be secured. In addition to supplying local newspapers with material for articles describing its plants the North Shore Electric Company purchases advertising to an amount equivalent to the monthly electric bills of the newspaper plants. The motto adopted by the North Shore company

President-elect H. A. Foster.

is "A square deal to the public," and employees are continuously urged both to talk and to live up to this maxim.

"Motion Study in New Business" was the subject of the concluding paper, by Mr. E. W. Osborn, of the Rockford Electric Company. Taking a cue from the recent tendency in manufacturing operations to eliminate lost movements, Mr. Osborn pointed out the increase in efficacy which new-business solicitors will gain by systematizing and laying out their work so that no waste may result. "Being in the field at 9 o'clock and making every minute of that time up to 5 o'clock count will bring any salesman success," observed Mr. Osborn. Nor should the solicitor neglect the acquaintance of the customer after his contract has been obtained. Many odd minutes can be spent to advantage by pleasant calls to inquire whether the service is unsatisfactory. In this way many slight complaints will be smoothed out and little or fancied grievances avoided, which, if allowed to run on, might result in an ultimate loss of the business. Holding old business is as important a part of the solicitor's task as is the securing of new business. Meter record sheets might also be examined each month in advance of the regular mailing of bills to customers, and in cases of unusually heavy consumption ready explanations should be sought, for use when the customers' complaints are received.

ELECTION OF OFFICERS.

At its executive session, which followed the technical program of Thursday morning, the Illinois State Electrical Association elected officers as follows: Mr. H. A. Foster, Fairbury, president; Mr. J. J. Frey, Hillsboro, first vice-president; Mr. F. H. Golding, Rockford, second vice-president; Mr. E. Macdonald, Lincoln, third vice-president; Mr. F. W. Reimers, Rock Island, fourth vice-president; Mr. C. W. King, Lewiston, treasurer; Mr. H. E. Chubbuck, Peoria, secretary; Mr. C. A. Willoughby, Peoria, assistant secretary. The members of the executive committee for the same period are Messrs. W. B. McKinley, Champaign; F. J. Baker, Chicago; R. S. Wallace, Peoria; E. W. Smith, Kewanee; W. G. Austin, Effingham.

The committee on resolutions, composed of Messrs. R. C. Hardy, C. W. King and J. J. Frey, presented resolutions of respect regarding the death of Mr. W. J. Wetzel, of Eureka, in a plant accident last September. Thanks were also tendered to the technical and local press, the electrical supply men and the people of Rockford, and especially to the Rockford Electric Company and Mr. F. H. Golding, its manager, for the successful convention.

ENTERTAINMENT FEATURES.

During the convention at Rockford an electrical show was held in the local armory, the exhibitors being electrical manufacturers and several non-electrical local manufacturing companies. The building was tastefully decorated for the occasion and brilliantly lighted with the aid of many tungsten lamps.

On Tuesday evening the supply men tendered the convention delegates a smoker at the Hotel Nelson, accompanied by a Dutch lunch and vaudeville entertainment. Mr. W. R. Pinckard, of Chicago, introduced as toastmaster Mr. A. G. Brown, secretary of the Rockford Chamber of Commerce, and brief addresses in keeping with the gayety of the occasion were made by Mayor W. W. Bennett of Rockford; Mr. R. K. Welsh, attorney for the electric company; Mr. Cooper Wilkins, Mr. Fred Carpenter, of the Rockford Public Service Department; Mr. H. N. Remington, Mr. C. W. King and Mr. Fred Benson.

On Wednesday evening the association banquet was held, the convention being the guests of the Rockford Electric Company. Mr. F. H. Golding, manager of the company, introduced Mr. R. K. Welsh, its attorney, who acted as toastmaster and called upon Mayor W. W. Bennett; Capt. David Davis, of Litchfield, and Messrs. C. W. King, of Lewiston; W. G. Austin, of Effingham; J. H. Delany, of Chicago; C. W. Ferguson, of Rockford, and J. G. Learned, of Chicago.

Public Service Commission News.

MASSACHUSETTS COMMISSION.

A continued hearing on the subject of the demand indicator was held Oct. 27 by the Massachusetts Gas and Electric Light Commission. Mr. Junius Auerbach, representing some large consumers of electricity, said that the board should have authority to regulate these indicators and determine the actual amount of electricity used by a customer. He said he believed the principle of the indicator to be correct and that its removal would be an injustice to large consumers because by it a wholesale rate is given that class of customers, which could not be determined without its aid. He called attention to the fact that the Boston Chamber of Commerce, after considering the matter, had refused to indorse the proposition to do away with the indicators, and said there was no public demand for their abolition.

Mr. Joseph B. Eastman said that a consumer is entitled to know that any device upon which his charge for electricity is based is correct and is tested by public authority.

Mr. Everett W. Burdett, counsel for the Massachusetts Electric Lighting Association, said that his clients are anxious that the commission shall be given full power to test demand indicators and to require them to be kept at the proper standard. He said his clients were opposed to the proposition to prohibit their use. He said the purpose of the indicators is to enable the company to have accurate information about the electricity used. It has long been recognized that demand enters largely into cost, and that is the reason the indicator is employed. It is, said Mr. Burdett, a benefit to the consumer, for it enables him to get into a different class from that he otherwise would be in, with the effect of reducing his charges.

The Gloucester Electric Company has filed with the Massachusetts Gas and Electric Light Commission an appeal from an order of the Gloucester city government which granted authority to the Oceanside Company to run wires from its private lighting plant in its hotel in Gloucester to Magnolia, where it rents cottages in connection with its hotel. The route of the proposed line is on a public highway.

NEW HAMPSHIRE COMMISSION.

The New Hampshire Public Service Commission last week received a petition from the Keene Gas & Electric Company asking for permission to sell its lines and business in Ashuelot, N. H., to the Ashuelot company, and the latter company has petitioned the commissioners for authority to issue sufficient additional capital stock to take over the business.

WISCONSIN COMMISSION.

After a careful investigation into the present financial condition and the proposed extensions of the Apple River Power Company, the commission has approved the company's application for authority to issue $250,000 par value of 5 per cent bonds. The mortgage has been issued to the Illinois Trust & Savings Bank and William H. Henkle, trustees. The proceeds to be derived from the sale of the bonds are to be used for paying an outstanding note of $125,000, for paying an outstanding indebtedness incurred by reason of additions made to the property and for making future extensions.

The Wausau Street Railway Company has been authorized to issue 1000 shares of common stock of par value $100 each, to be exchanged at par for a like amount of illegal stock now outstanding. It is specified that the total amount of legal stock outstanding shall in no event exceed $400,000. The stock to be called in was illegal because issued subsequent to the passage of the stock and bond law and without being authorized by the commission. The North Milwaukee Light & Power Company has been authorized to issue $12,040 par value of stock. The proceeds are to be used in paying off an outstanding mortgage indebtedness of $4,500, the proceeds from this source having been used for construction purposes and in paying outstanding indebtedness of $7,500, incurred by reason of extensions and additions made to the property.

The commission has taken testimony on the application of the State Long Distance Telephone Company for authority to increase its rates. The company in its petition desired specially to increase the rate for business telephones from $2.50 to $3 per month, for the reason that the present total revenues are not sufficient to pay a reasonable return after providing for depreciation, and that, furthermore, the business telephones are not paying their proportionate share. Statistics of operation were introduced at the hearing to show that the number of business calls outnumbered all others, rural telephones included, in the ratio of three to one. For this reason the petitioner contended that the necessary increase in total revenues should come from an increase in the rates for business telephones.

one. The commission has taken the case under consideration.

NEW YORK COMMISSION.

The Public Service Commission for the Second District has ordered all operating electrical corporations within its jurisdiction to file information as to the electric meters which measure their output of electric energy. The information includes an estimate of the connected load of each company in kilowatts and of the total generating capacity of the various plants. The purpose of this order is to ascertain how completely the electrical companies are equipped with respect to instruments for measuring their output. These meters correspond to the large station meters which form an important part of a gas company's equipment.

The commission will hold a hearing at Mineola this week on the complaint of patrons of the Nassau Light & Power Company as to the rates charged for electricity for lighting purposes.

The second hearing on the petition filed by stationary engineers against the motor rates of the New York Edison Company, scheduled for Nov. 1, was postponed until Nov. 8.

MARYLAND COMMISSION.

The Maryland Public Service Commission has been requested by Mr. Charles England, chairman of the traffic committee of the Chamber of Commerce, to postpone the hearing on the telephone rates for one week. The request was granted. Mr. England stated that the members of the Chamber of Commerce are anxious to submit dates and evidence to the commission which cannot be collected before that time. Chairman Ambler said that he had conferred with the officials of the company, and that they were pleased to have the case postponed.

The function of the commission with respect to the protection of corporations from those whom the corporations deem unfair in business relations was appealed to for the first time last week, when the commission received a petition from the Consolidated Gas, Electric Light & Power Company, asking for a decision as to whether compliance with the demands of a customer for a special rate would be discrimination as against the other patrons of the company. It is set forth in the petition that the company made a contract with the Paper Mills Company to supply gas and electricity for illumination and power purposes at the regular rates, and that up to Feb. 16, 1911, the contract was satisfactorily maintained by both parties. Since that date the bills have not been regularly paid, says the company, and to the date of Sept. 23, 1911, they total $1,174.97, upon which partial payments to the amount of $517.04 have been made. The Paper Mills Company, so the petition states, has advised the Gas & Electric Company that it will not pay more than $100 per month for the service contracted for, and the Gas & Electric Company craves a ruling as to its right to comply with this demand without discriminating against other users of its product. The company asks the commission to decide whether a continuation of service to the Paper Mills Company under the conditions stated would be in accordance with the provisions of the public-utilities law or would amount to a violation of that law. Considerable speculation has been caused as to the reason for the petition.

The commission has been requested by the Maryland and Citizens' Telephone companies to act as arbitrator in a dispute which has arisen between them. Until July 28 last the two companies had an agreement by which the Citizens' company strung its wires on the cross-arms of the poles of the Maryland company on the Frederick Road. The Maryland company now asks the Citizens' company to remove its wires, alleging that the wires are in bad condition. This the Citizens' company denies, and has not complied with the request and will not remove the wires until the Public Service Commission has gone into the matter and reached a decision.

OHIO COMMISSION.

Many complaints have been made by men interested in Ohio public-utility corporations in regard to the position taken by the Public Service Commission on stock bonuses and excessive capitalization. Several decisions rendered within the past few days indicate that the commission will not grant authority to increase the issue of securities where the value of the property is already covered and the capitalization is in excess of its worth. In some cases it has been found that the physical value of properties is fully covered by bonds, while the stocks represent the earning power or the value of franchises upon which the earning power is based. Members of the commission state that this stand may retard the development of public utilities for a year or two, but finally the knowledge that securities are to be sold for a definite purpose will inspire confidence in the investors and public alike that will be valuable to the corporations.

The Men's Club of Rubicon, a social organization of Dayton, has requested the commission to make an investigation of the methods used by the Dayton Power & Light Company. It is claimed that the company is operating without a franchise from the city and that it is charging a minimum rate of 90 cents a month, which is claimed to be a violation of the laws. The petition asks if the company can operate without a grant from the city.

CURRENT NEWS AND NOTES.

Wireless at "Mass. Tech."—A wireless station is being fitted up at the Massachusetts Institute of Technology by the Wireless Society of that school. A 10-kw transformer, property of the engineering department, will be a part of a powerful sending station, by which the young engineers will be able to communicate with many other Eastern colleges as well as regular stations. Prof. Harold Pender, of the department of electrical engineering, is aiding the society in the design of the station.

* * *

Resuscitation from Electric Shock.—The United States Bureau of Mines, Washington, has issued a circular (Miners' Circular No. 5) entitled "Electrical Accidents in Mines: Their Causes and Prevention." One section contains rules, with illustrations, for resuscitation from electric shock, the Sylvester method of artificial respiration being specified. According to this older method the patient is placed face upward. In many recent rules the newer Schaefer, or prone, method is employed, in which the patient is placed face downward.

* * *

Public Relations of Utility Companies.—Mr. H. O. Seymour, general agent for public relations of the Chicago Telephone Company and formerly general manager of the Wisconsin Telephone Company, addressed the Electric Club of Chicago on Oct. 25 on "Corporate Public Relations." The subject of "excessive return" on investment was touched upon, and Mr. Seymour pointed out that the early investors were pioneers and entitled to credit and remuneration for their courage and perspicacity. Mr. K. B. Miller spoke of the Los Angeles situation, and said that at one time in that city the pendulum swung too far from the median line of strict justice to the corporations. It is now coming back, however, and after some oscillations a pretty fair balance will be struck undoubtedly. The rate question is very complex, for the indirect costs and charges are hard to determine. Messrs. George B. Foster, Commonwealth Edison Company; W. R. Abbott, Chicago Telephone Company; H. E. Niesz and J. H. Delany, Cosmopolitan Electric Company, took part in the discussion also.

The Silver King Mining Company.—The Silver King Mining Company, of Marion County, Oregon, is considering the establishment of an electric smelter, the first of its kind in the State.

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Slogan Sign for Warren, Ohio.—A committee of business men of Warren, Ohio, is extending invitations for suggestions for a motto to be placed on a huge civic electric sign to be erected at that place. Warren is described as the electrical center of the Central States, famous for diversified manufacture, superb in beauty and as a place to work, invest or live in. Suggestions should be sent to the postmaster.

* * *

Scranton Company Section, N. E. L. A.—The first meeting of the season of the Scranton Company Section of the N. E. L. A. was held in the Board of Trade Building Oct. 26. Three papers were presented as follows: "Operating Costs," by Mr. L. B. Webster; "Special Station Construction Problems," by Mr. J. B. Pigott, and "Co-operation and New Business," by Mr. T. C. Walsh. The section has now over fifty members.

* * *

Electricity Versus Compressed Air.—In a paper recently presented before the American Institute of Mining Engineers Mr. K. A. Pauly gave figures showing the advantages of electric motors over compressed-air engines in mining operations. In one case the estimated first cost of plant for a given service is $54,500 for air and $53,800 for electricity, while the operating costs per annum are $35,365 and $25,168 respectively. In another case the first cost for air is $512,000 and for electricity $520,600, the respective annual operating costs being $322,670 and $232,542.

* * *

N. E. L. A. Section Meeting in Pittsburgh.—The Allegheny County Light Company Section of the National Electric Light Association held a meeting in connection with a banquet at the Hotel Rittenhouse, Pittsburgh, on Oct. 30. The speakers included Mr. W. A. Donkin, secretary of the Pittsburgh Industrial Commission; Mr. R. S. Orr, general superintendent of the Allegheny County Light Company and president of the Pennsylvania Electric Association, and Mr. Robert L. Jaynes, Jupiter of the Sons of Jove. The keynote of the meeting was harmony of electrical interests in boosting Pittsburgh.

* * *

Electricity in Pound Lots.—In discussing the electron theory and modern scientific conceptions of the ultimate identity of electricity and matter before the Illinois Electrical Association at Rockford on Oct. 23 Dr. E. J. Berg, of the University of Illinois, gave some striking comparisons of the magnitudes of these ultimate particles in terms of practical units. At schedule rates for electricity in Chicago he estimated roughly a pound of electrons would be worth about $6,000 and the system of the Commonwealth Edison Company would be capable of producing about a pound each hour. Such a pound of electrons would keep a 50-cp lamp in service for 5000 years.

* * *

Cleveland Section A. I. E. E. Meeting.—"Industrial Lighting," by Mr. C. L. Eschleman, of the Adams-Bagnall Electric Company, and "The Choice of an Illuminant," by Mr. I. H. Van Horn, of the National Electric Lamp Association, were the titles of two papers read at a meeting of the Cleveland Section of the American Institute of Electrical Engineers held on Oct. 23. Mr. Eschleman cited statistics and personal experiences tending to prove the sacrifice of output and quality and the greater percentage of accidents in poorly lighted factories and the relatively low cost of good illumination when compared with the value of its benefits. Mr Van Horn gave a detailed analysis of the qualifications which an illuminant shoul possess, and reported the results of some recent tests to determine the critical frequency of visible flicker for various kinds of incandescent lamps. Both papers were illustrated by the stereopticon.

* * *

Hydroelectric Municipal Plant at Sudbury Reservoir.—In addition to the hydroelectric station now bein operated by the State of Massachusetts, through its Metropolitan Water and Sewerage Board, at the Wachuset da at Clinton, a description of which appeared in a rece number of the *Electrical World*, there is probably soon t be installed a second generating plant, to be located at th dam of the Sudbury reservoir. The fall at the Sudbur dam, though less than that at Clinton, is yet sufficient t give it value for commercial purposes, and its possibiliti have been examined by Mr. Dexter Brackett, chief eng neer of the Water and Sewerage Board, which has autho ity to build a station at this point.

* * *

Tentative Subway Plans for Chicago.—The Subwa Commission of Chicago on Oct. 31 presented tentati plans to the local transportation committee of the Ci Council. Two initial subways are recommended to be co nected with the four elevated railways of the city and furnish through routes for rapid transit through the hea of the city. There may be also two initial surface-railw subways connecting the three sides of the city. The co mission recommends as the initial step the building of system to connect the elevated railways. This plan co templates high-level subways, through routing, no gra crossings, few curves, low cost, and provides for unlimit expansion. The length of the elevated-railway subwa would be 3.85 miles.

* * *

Peoria's Flashlight Police-Call System.—In Peo Ill., the Gamewell Fire Alarm Telegraph Company has stalled what is said to be the largest light-signaling poli call system in the country. On the police-patrol sig boxes scattered about the streets are placed red incand cent lamps. When it is desired to communicate with pat men on the street from police headquarters these lamps a certain number of them, are put in circuit and they once attract the attention of the policemen on the vari beats, who proceed to the signal boxes and get the ne sary instructions by telephone. By this means if, for stance, a burglary is reported the patrolmen on nearby b can be notified in a very few minutes. A number of pa of city officials from other cities have inspected this fl light police-call system in Peoria.

* * *

Increase in Taxes on Ohio Telephone Companie Telephone managers in Ohio view the work of the S Tax Commission so far with anything but satisfac The commission has fixed tentative valuations upon a of the large properties, and they show immense incre from the figures used last year. Telephone propertie the State were fixed by the commission last yea $21,000,000. It is believed that the figures for 1910 reach $55,000,000. A few of the tentative increases fol Cleveland Telephone Company, from $2,037,702 to $6, 000; Cincinnati & Suburban Telephone Company, $2,722,330 to $10,000,000; Central Union Telephone pany (including all Bell property in the State outsic Cleveland and Cincinnati), from $4,903,698 to $13,000 Cuyahoga Telephone Company, Cleveland, from $1,29 to $4,500,000; Akron People's Telephone Company, A from $234,780 to $450,000. Increases in the valuati telegraph properties in the State are as follows: P tal from $397,550 to $796,500; Western Union, from $2,3 to $4,045,680; Put-in Bay Telegraph Company, from $800 to $5,000.

ILLINOIS MUNICIPAL POLE-LINE TAX.—A decision in a case brought by the city of Springfield, Ill., against the Postal Telegraph Cable Company confirmed the contention of the former that cities can levy a reasonable tax for the use of streets by telegraph poles.

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ELECTRICITY FOR OSSIAN, IND.—The village of Ossian, Ind., has granted an electric-light franchise to the milling firm of Reidel & Gray, who are empowered to place poles and wires in the streets and alleys of the town. The distributors will buy electrical energy from the Ft. Wayne & Northern Indiana Traction Company, of Ft. Wayne, Ind.

* * *

MOUSE SHUTS OFF ELECTRIC LIGHT.—The town of Crookston, Minn, was recently thrown into darkness by a mouse, which was electrocuted by crawling between the points of the main switch, its charred body short-circuiting the line. A panic was narrowly averted in a public building where there was a children's show, and many citizens assumed that bank robbers who had shortly before visited a neighboring town were responsible for the sudden darkness.

* * *

ELECTRICAL MEN INSPECT BRIDGE.—Members of the St. Louis League of Electrical Interests inspected on Oct. 28 the Municipal Free Bridge now being erected across the Mississippi River. The inspection was made as the result of an invitation from Mr. O. B. Barrows, of the American Steel & Wire Company. Following it, at the noonday luncheon of Oct. 31, Mr. Edward B. Fay, of Brenneke & Fay, bridge engineers, addressed the league on "Construction Details of the Municipal Free Bridge."

* * *

DANGER OF RÖNTGEN RAYS.—Mr. Thurman L. Wagner, of St. Louis, is one of the Röntgen-ray experimenters who have suffered by reason of devotion to the useful applications of Röntgen's great discovery. For eight years Mr. Wagner has suffered from X-ray burns which have affected both hands, and recently his left hand was amputated in order to save his life. It is hoped that the injuries to the right hand are not serious. The number of physicians and inventors who have been seriously injured, or who have even lost their lives, in perfecting Röntgen-ray apparatus has reached considerable proportions.

* * *

THE PEAK LOAD OF A BASEBALL CROWD.—Many businesses have long had their peak loads, load factors, diversity factors, etc., but it seems that not until electrical men applied their engineering instincts to the problems of electricity supply have these quantities been recognized, named and given their due consideration. The latest unusual application of the demand printing attachment of a well-known electrical meter was at a recent Chicago baseball game where the rate of passage of the crowd through the gates was recorded with a view to determining the time of peak load so that in future better provisions might be made for handling the throngs.

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QUINCY, ILL., ADVERTISES ITS WATER-POWER POSSIBILITIES.—The business men of Quincy, Ill., which city is about 35 miles south of Keokuk, Ia., where the great Mississippi River hydroelectric dam is in process of erection, are alive to their opportunities. They are advertising extensively to point out that Quincy is adjacent to the great dam and that it will be in the zone of lowest cost for the power when available. The attention of manufacturers is called to the possibilities of this zone, which the Quincy people say is destined to become the industrial center of the United States. The business men of Keokuk, Ia., and Burlington, Ia., are also bestirring themselves to take advantage of the cheap electrical power which will be available on the completion of the Keokuk dam.

PROPOSED PANAMA TRIP OF THE INSTITUTE.—It is proposed that a trip of inspection to the Panama Canal be undertaken by the American Institute of Electrical Engineers, with sailings from New York and New Orleans between Jan. 20 and 30, 1912. Each boat can accommodate eighty-eight passengers, making the total number 176. The round-trip price per passenger is $125 from New York and $95 from New Orleans. These rates do not include hotel accommodations on the Isthmus, which, at the Tivoli, are $5 to $6 a day, American plan. The round trip from New York requires twenty-one days and from New Orleans about seventeen days. This allows seven days on the Canal Zone. However, if desired, only one and one-half days need be spent on the Isthmus, the remainder of the week being taken up by an extension trip to Santa Maria without extra charge. Prompt action will be necessary to secure reservations, as the trip will be a popular one undoubtedly. Mr. S. D. Sprong, of New York, is chairman of the committee.

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ILLINOIS LEGISLATURE FAILS TO PASS DEEP WATERWAY BILL.—Governor Deneen's deep waterway bill was defeated on Oct. 25 at a special session of the Illinois Legislature. In a statement issued by the government after the defeat of his bill he says that he has endeavored during his term of office to place the State in a position where it could utilize the water-power to be created in the Des Plaines and Illinois Rivers by a deep waterway between Lockport and Utica, Ill. His idea is to pay off the bonds issued for the construction of the work by the revenue received from the water-power. The Governor declares that the corporations which are interested in the utilization of the water-power of the Des Plaines and Illinois Rivers are aggressive and vigilant; but he contends that the water-power rights created entirely through the expenditure of public money will be worth $2,500,000 a year and should be retained under public control. Companies which utilize water-power on the Des Plaines and Illinois Rivers, and to which the Governor seems to refer, are the Economy Light & Power Company, of Joliet; the Illinois Valley Gas & Electric Company, with headquarters at Streator, and the Marseilles Land & Water Power Company, of Marseilles.

* * *

COPENHAGEN PEAK-LOAD TELEPHONE AUXILIARY.—In Copenhagen, Denmark, which has 550,000 inhabitants, there are about 40,000 telephones in service. The rapid growth of the system has necessitated careful study of telephone traffic and resulted in several interesting devices for economy of time and labor. Among these is an automatic equipment, invented by Director Fr. Johannsen, of the Copenhagen Telephone Company, for transferring an incoming call to an idle operator in case the called operator is busy. At each operator's position three of the answering cords are connected with automatic selectors, and thereby changed into "transfer cords." When any operator uses such a cord in attending to a call she transfers the call to a disengaged colleague, the automatic device of the selector moving along until it reaches a wire from a disengaged operator within the same group of twenty operators to which the first operator belongs. The disengaged operator answers the call at once, even if she is obliged to transfer one of her own calls in order to do so. In one of the Copenhagen stations it was found that 220 jacks could be handled at each position with the peak-load auxiliary apparatus in service just as expeditiously as 160 jacks could be handled with the purely manual equipment. The automatic selector employed in Copenhagen is of the electro-pneumatic type, the motive power being supplied by air compressed to one atmosphere of pressure. The speed of movement is such that all twenty contacts are "searched" in 0.6 second. In case all contacts are engaged at one time the selector travels back and forth until it finds a disengaged contact.

Faraday Portrait.—Miss Jane Bernard, who had been amanuensis to her uncle, Michael Faraday, died in England recently. By her will she bequeathed Butler's portrait of Faraday to the English nation.

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Los Angeles Electrical Exposition.—The Los Angeles Electrical Exposition will be held in Fiesta Park from Nov. 25 to Dec. 9. An effort is making to provide a large and fine display of electrical apparatus and novelties.

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Louisville Central-Station Steam Heating.—It has been announced that the Louisville (Ky.) Lighting Company intends to enter a strong bid for the franchise to erect and maintain a public-service heating plant which the General Council will offer for sale in a short time.

* * *

Enameled Copper Wire Used for Surgical Sutures.—A company manufacturing enamel-insulated wire for electrical purposes has found an unexpected application of its product for surgical work. On the purest copper wire of No. 30 gage a coating of enamel is baked in the usual way, making an excellent thread for suture work.

* * *

Sun-Power Plant for Sahara Desert.—A large "sun-power" plant was recently completed in Philadelphia and shipped, it is stated, to the Sahara Desert. It employs a glass-covered court 500 ft. square containing heating pipes, the steam from which is led to a low-pressure steam turbine. It is claimed that on test in Philadelphia the arrangement developed an enormous capacity in horse-power, which will be more than doubled on the "burning sands" of the desert.

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Electrical Students at Kentucky State College.—Twenty-one seniors, twenty-three juniors, thirty-five sophomores and eighty-seven freshmen are this year registered in the combined course of electrical and mechanical engineering at the Kentucky State College, Lexington. The aim of this institution is to develop men familiar with both the steam and electrical ends of power plants, and work in surveying and business contracts is also included in the "dynamic engineering" course above alluded to. Prof. F. Paul Anderson is director of the engineering schools, and Prof. W. E. Freeman is in charge of electrical engineering.

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Dummy Meters.—At a recent electrical gathering in Chicago one of the gentlemen present told a story about an experience he had had in Boston some years ago while selling meters. One day a typical New England Yankee from a small town came in and said he wanted twenty-five watt-hour meters. A price of $11.50 each was quoted, but the visitor said that he did not want to pay more than $3 each and that he wanted only the outside case and the dial, the interior mechanism being superfluous. In answer to a further question the caller said that he furnished electric light in his town at a flat rate, but he wanted to put the dummy meters in because of their moral effect in preventing his customers from burning their lamps all night long.

* * *

The Copper Industry.—At the recent American Mining Congress held in Chicago Mr. Horace J. Stevens, of Houghton, Mich., read a paper on "The Copper Industry," in which he made the interesting statement that the copper produced in the decade ended Dec. 31, 1910, was the equivalent of more than three-fourths of the entire production for the preceding century. The demands of the electrical industries are very largely responsible for this remarkable increase in the demand for copper. The great bulk of the world's copper is now refined by electrolysis and it is of further interest to note that the number of copper mines using electrical energy in the work of producing copper has largely increased during the last decade. There is now a surplus of about 300,000,000 lb. of copper on hand, but in view of the enormous rate of consumption this is not a particularly serious matter. Mr. Stevens concluded his paper by a bitter arraignment of the United States government for its policy in relation to the conservation of natural resources, particularly mineral lands.

* * *

Prime Movers Committee of N. E. L. A.—The first meeting of the 1911-1912 committee on prime movers of the National Electric Light Association was held in Chicago on Oct. 24. All the members of the committee were present, including Mr. I. E. Moultrop, of Boston, chairman; Messrs. W. L. Abbott, of Chicago; John Hunter, of St. Louis; R. S. Kelsch, of Montreal; J. B. Klumpp, of Philadelphia, and W. N. Ryerson, of Duluth. The committee will report at the Seattle convention of the association next year on gas, water-power and steam prime movers, paying particular attention to hydroelectric development. The work to be undertaken was outlined and Messrs. Ryerson and Kelsch were appointed a sub-committee on water-power, Messrs. Hunter and Abbott on steam-turbine, boiler and furnace work, and Mr. Klumpp on gas prime movers with especial reference to an investigation of the Humphreys pump. The next meeting will be held in New York, it is expected, and probably at the time of the December meeting of the American Society of Mechanical Engineers.

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Colorado Electric Club.—At the midweek lunch of the Colorado Electric Club on Oct. 18 the guests included the senior class of the University of Colorado, the Jovians attending the Denver national rejuvenation, Mr. Dana Pierce, electrical engineer of the Underwriters' Laboratories, Chicago, and Colonel Collier, of San Diego, in charge of the 1915 all-year exposition in that city. Over 200 were present. Talks were given by Colonel Collier and by Judge Milliken, of Denver, asking for a national co-operation to boost travel to the West during 1915, and by Mr. Dana Pierce, commending the growing co-operation between manufacturer and underwriters in the development of standards to the betterment of practice. Mr. Jaynes, tenth Jupiter; Mr. H. Harris, of the Pittsburgh Industrial Commission; Professor Evans, of Colorado University; President Carstarphen, of the Electric Club; and Mr. Cudmore, of Cleveland, all spoke briefly, each fo[r] his own interest, but with co-operation as a keynote. Th[e] electric show was attended by the entire assembly at th[e] close of the luncheon.

* * *

Electrical Journals as a Technical School's Text books.—Once each week the senior engineering students i[n] the Kentucky State College at Lexington meet to revie[w] articles in the current engineering press. Every secon[d] week the electrical journals are gone over, after havin[g] previously been assigned, one publication or one issue t[o] each member of the class. When called upon the student[s] review briefly the principal new or interesting subject[s] contained in their respective papers and show considerab[le] enthusiasm and interest in finding unusual or speciall[y] valuable subject matter. The benefit of this practice is, o[f] course, manifold, each member of the class profiting fro[m] the careful perusal which one of their number has give[n] each of the various issues. When interesting subjects a[re] uncovered others of the class can later refer to the[se] articles for their own leisurely reading. Another gre[at] value of the method lies, too, in the practical and up-to-da[te] ideas of electrical machinery and affairs which th[e] students gain from such current electrical literature, alo[ng] with the use of their textbooks.

CINCINNATI'S PLUM STREET STATION.

Conversion of a Reciprocating Steam Plant to Modern Turbine Equipment.

Natural-Gas Boiler Equipment.—Details of Switchboard Signaling.—Street-Lighting Equipment of 128 Seventy-five-Lamp Mercury-Arc Rectifiers.

THE recent history of steam-power progress is virtually recorded in the equipment of the Cincinnati Union Gas & Electric Company's Plum Street station, a lant which has spanned the periods of reciprocating-engine pe drive and direct connection, and finally high-speed ine-generator equipment. The lesson, too, of the rapid lescence of electrical machinery is nowhere better ex- ified than in the street-lighting service performed by station, first with rope-driven direct-current arc hines, then with series alternating current arcs sup- l through constant-current transformers, and in the r future with direct-current magnetite arcs through rec- r sets. The recent contract for 6000 such high-efficiency s and 128 seventy-five lamp rectifier sets for Cincinnati e largest order ever placed for similar equipment.

he Cincinnati central station is also notable for several its huge reciprocating-engine-driven machines. It con- ns the largest 60-cycle engine-driven alternator ever t, the largest 300-volt direct-current generator and the gest double-generator, 125-volt Edison three-wire set. d of grim interest it is, too, to note that the two steam ines now operating at Plum Street, although occupying lly one-sixth the total engine-room space, have a com- bied capacity 15 per cent greater than all of the recipro- ing equipment.

ARRANGEMENT OF PLANT.

he arrangement of engine and boiler-rooms in the Cin- ati plant, as a result of its successive additions, probably has no counterpart among other steam stations of the country. The two boiler-rooms make up roughly a large T, the old boilers forming the shank of the letter and the new room the transept. Completing the 166-ft. by 342-ft. rectangle of the outside walls, under the right arm is the original engine-room, 60 ft. by 251 ft., and at the left is the new addition, equivalent in size, and containing the turbines and the three very large reciprocating engines. While this layout to a certain extent groups the older boilers and steam units within short header distances, it unfortunately cuts up the engine-room, separating the controlling switchboard from the principal portion of the generating machinery.

The original Plum Street plant was completed in 1898, while the last new addition was finished in 1902. As above outlined, the general outside dimensions of the station are in the form of a large rectangle, 166 ft. wide and 342 ft., a city block, long. During these series of changes, however, the plant has been kept thoroughly modern, being brought down to date as successive units were added. It contains, for example, such modern refinements as remote-controlled oil switches for all alternating-current machinery, motor-operated valves on all steam and exhaust lines, visible signaling circuits, curve-drawing instruments, special meters and regulators on the switchboard, etc.

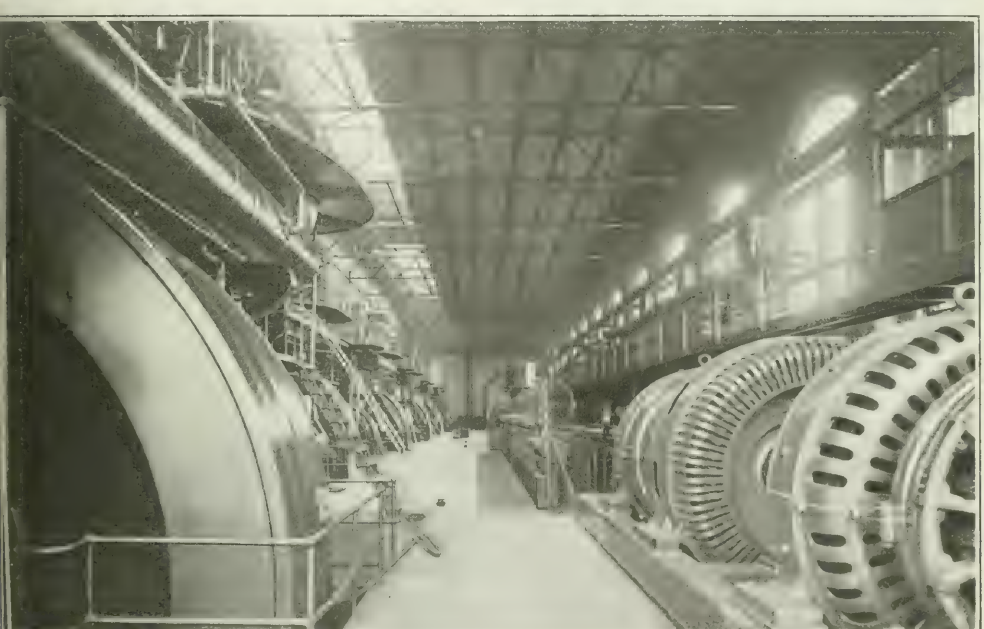


Fig. 1—Interior of Older Engine-Room, Showing Switchboard, Motor-Generator Sets, Etc.

BOILER-ROOM EQUIPMENT.

Natural gas from the West Virginia fields is ordinarily used as fuel, although all of the boilers are arranged with coal chutes from the overhead bunkers and with automatic stokers, so that the latter fuel is always available for emergency use. During the winter peak loads, however, a group of eight of the boilers in the new section is fired with coal exclusively.

The old boiler-room, measuring 251 ft. by 46 ft., contains in one row six 525-hp Babcock & Wilcox, six 525-hp Edge Moor and two Stirling boilers, all equipped with American underfeed stokers, with the exception of one of the Stirling units, an 825-hp boiler, which is fired by a Jones underfeed

stoker. The new boiler-room, 91 ft. by 166 ft., contains sixteen 542-hp Stirling boilers, eight of which are equipped with Jones stokers for coal burning exclusively and eight with gas burners and American stokers, all of the forced-draft underfeed type. The speed of operation of the Jones stokers and draft fans is automatically controlled from the steam-header pressure.

These average twenty-one gas burners to each gas-

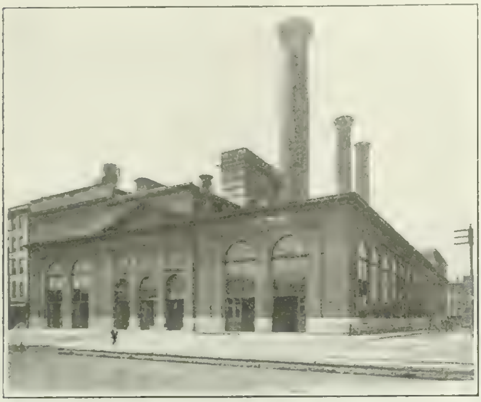


Fig. 2—Plum Street Station, Cincinnati, Showing Discarded Cooling-Tower Arrangement, and Canal Source of Water Supply.

equipped boiler, the gas being delivered to the furnaces in the older room through a 20-in. main extending the length of the boiler fronts. From this main 9-in. lines are branched off to each pair of furnaces. The gas burners used are of home-made design, comprising simply 1-in. pipes thrust through 6-in. openings for admitting the secondary air. Gas is delivered to the burners at 8 oz. per square inch pressure and is regulated by hand. The only alteration required in the coal grates for gas burning is the provision of a tile covering over the bars.

Coal is delivered to the plant by wagons, and is hoisted by two McCaslin and one Jeffries conveyors to the overhead bunkers, where it is distributed above the boilers, ready for emergency use. A reserve of 4000 tons is at all times held in the bunkers in this way.

The boilers maintain a steam pressure of 160 lb. per square inch. No superheaters are installed. The group of six Edge Moor boilers is equipped with a Greene economizer for raising the temperature of the feed water. The plant is provided with three large stacks, one 22 ft. in diameter and 204 ft. high and two 17 ft. in diameter and 201 ft. high.

Feed water for the boilers is taken from the canal which passes along Plum Street in front of the station. This canal is fed from the Miami River, 35 miles distant, and its water, although of unpromising appearance, is well suited for boiler purposes. Several paper mills are in operation a few miles above Cincinnati, and one explanation offered is that some of the waste matter from these mills discharged into the canal acts as a softener, adapting the water for boiler-feed use.

OLD ENGINE ROOM.

The older engine-room contains seven vertical cross-compound Allis engine-driven sets, ranging from 900 kw to 1500 kw in rating. Here also are the motor-generator and exciter sets, arc-lamp equipment, switchboard gallery, etc. Several of these engine sets drive both a direct-current generator and an alternator on the same shaft, the alternating-current units averaging 500 kw and the direct-current machines ranging from 1000 kw to 450 kw. Two others of the sets drive pairs of 125-volt, three-wire generators, one pair with disk-type commutators. The foregoing engine-driven equipment is of General Electric an Bullock manufacture.

With the exception of unit No. 1, the 1500-kw, 300-vol direct-current machine nearest the Plum Street front, al of these Allis engines operate at the comparatively hig speed of 120 r.p.m. Four of the present engines wer originally used for rope-driving the Brush arc machine once installed at Plum Street, the old grooves being sti visible behind the screens that have been consideratel erected for their concealment. The direct-connected ma chines set on to their shafts are of a later date. All of th engines in the old section exhaust into a pair of jet cor densers, the steam-driven Bibus rotary vacuum pumps fc which are in the boiler-room adjoining.

NOTABLE RECIPROCATING UNITS.

Among the varied large apparatus in the newer engin room, principal historical interest surrounds the 3200-kv 60-cycle, 4500-volt, three-phase Bullock alternator, drive by a 42-in. by 88-in. by 60-in. vertical cross-compoun Allis-Chalmers engine at 75 r.p.m. This alternator, tl only one of the so-called "Berlin" type in America, is al declared to be the largest 60-cycle engine-driven machi ever built. It was completed under the design of Mr. B. Behrend, then chief engineer of the manufacturing cor pany at Cincinnati. The rotating flywheel field element 31 ft. in diameter and weighs complete with its co 190 tons.

Adjoining the large alternator set is a generally simil engine, driving the huge 2500-kw, 300-volt direct-curre Bullock generator, itself a record breaker in the dire current class and the largest 300-volt continuous-curre generator ever built. The flywheel with which it is pi vided alone weighs 100 tons and runs at 75 r.p.m. T armature is 30 ft. in diameter and the commutator 16 across.

The third noteworthy machine at Plum Street is the tv unit, three-wire set, made up of two 125-volt, 1250- direct-current General Electric generators driven by vertical cross-compound McIntosh & Seymour engi This outfit is declared to be the largest three-wire balan set in existence, having a total rated capacity of 2500 l

All three of the very large engines in the new section are operated condensing, exhausting into a jet-type condens served by a steam-driven vacuum pump located in

Fig. 3—Coal-Unloading Hopper (at Left) and Ash Hoppers, s charging Into Conveyor.

engine-room. Condensing water for the station is obtaed from Cincinnati's famous canal, locally known as he Rhein," which passes in front of the power house. is stream, which has a sluggish current, gives ample cong water for carrying the entire load condensing at any ne of the year, all of the condensers with the exceptio of that on one of the turbines being of the jet type.

MODERN TURBINE-GENERATORS.

Several years ago, in 1907, the first turbine unit vas

added to the Plum Street plant. This 5500-kw vertical Curtis turbine drives its 4500-volt, three-phase, 60-cycle alternator at 720 r.p.m., its exhaust being cared for by a Worthington base-type surface condenser. A 3-ft. free exhaust line is run to the top of the building. The circulating pumps, step-bearing pumps, accumulator, oil filter, air and circulating pumps, all engine-driven, are located on the basement level below the main floor.

The latest unit in the Cincinnati family is a nominal 7200-kw horizontal Westinghouse turbine-generator set, running at 1800 r.p.m. This turbine is of the double-flow type, securing the advantage of compactness due to this construction. It is equipped with a Leblanc jet-type condenser, freed of air and water by rotary turbine-driven pumps.

The free-exhaust line and air intake pipe are led directly from the roof as shown. While nominally rated at 7200 kw on a twenty-four-hour continuous basis, this newest turbine is capable of carrying without effort loads exceeding 10,000 kw, on the basis of the usual short-hour rating. The floor space allotted to the horizontal units is hardly one-half of that of the vertical turbines, including all auxiliary apparatus, space to withdraw condenser tubes, etc.—an interesting commentary on the relative space economics of horizontal and vertical units in practice.

For signaling between the switchboard operator and the tenders on duty at the turbines in the adjoining room, 200 ft. distant, pedestals are provided containing lettered glasses, "Stop," "Start," "Stand-by," "Load," "Asst. wanted" and "O.K.," behind each of which is a lamp in series with the corresponding lamp in its companion pedestal. These lamps are connected up with three-way switches, one of the pair at each station. To signal the attendant the switchboard operator pushes the button lighting, say, "Start" in both pedestals. As his own lamp is burning normally he knows the distant signal must also be alight. To acknowledge the signal the attendant pushes the corresponding button, extinguishing the lamps. By means of a relay in the pedestal alarm bells at both the adjacent and distant signals are kept ringing as long as any lamp is burning. With this device the attendant can, of course, also originate signals back to the switchboard.

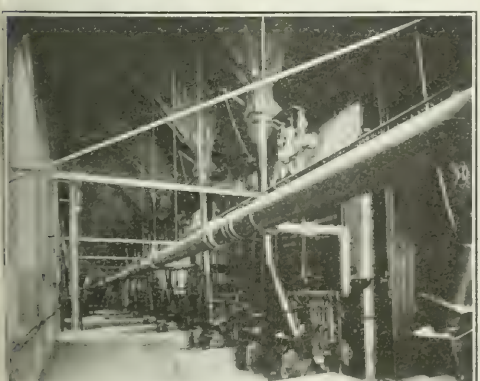


Fig. 4—Old Boiler-Room, Showing Arrangement for Gas and Underfeed Coal Firing.

STEAM PIPING.

On all important steam headers, boiler lines, machine steam lines and exhausts motor-operated valves are provided, no less than fifty-four of these being in use in the station. The valves controlled range in size up to 50 in. and are operated by motors of from 1 hp to 3 hp. The controlling switches are located at emergency stations scattered through the plant, inclosed in glass-covered cases which can be forcibly entered when necessary. With the aid of these valves it is possible to control steam lines without approaching the site of trouble, a valuable precaution in an emergency. All steam headers are ranged at the basement level.

AUXILIARY ELECTRICAL APPARATUS.

Direct-current energy for excitation purposes is furnished by two 125-kw, 125-volt machines, one turbine driven and the other operated by a 4500-volt synchronous motor. On the floor of the older engine-room there is also located a 3000-kw, 220/110-volt direct-current substation, feeding into the downtown Edison network along with the steam-driven direct-current machines. It is the practice, however, to use the turbines only during the major portion of the day, reserving the engine-driven direct-current generators for auxiliary use during the peak period.

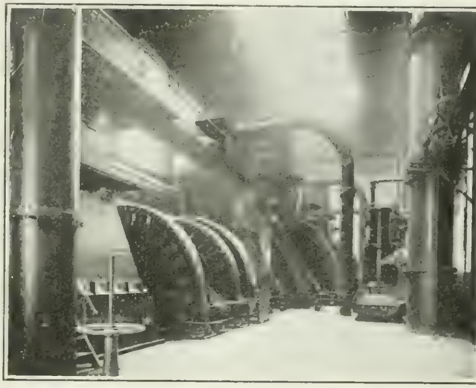


Fig. 5—Huge Reciprocating-Engine-Driven Units in New Engine-Room.

The accompanying reproduction of a typical winter load curve on the Cincinnati station shows the sharp and steep peaks experienced, due to the demands for lighting service. Another characteristic of the Cincinnati service, resulting from the city's location in the midst of steep river valleys, is the suddenness with which dark clouds may descend over the business section, causing a rapid increase in load from 10,000 kw, normal, to 30,000 kw for a short time. The 4500-volt motor-generator equipment at Plum Street comprises two 500-kw, 300-volt Bullock sets, one 1000-kw, 300-volt Westinghouse set, one 200-kw Bullock three-unit 300/150-volt set and one 1000-kw Westinghouse three-unit set.

SWITCHBOARD AND CONTROL.

Along the north side of the old engine-room is arranged the switchboard gallery, controlling both the direct-current and alternating-current systems. The 4500-volt alternating-current oil switches are all remote-controlled. The nine General Electric type E main feeder oil switches are in the new engine-room alongside the three similar machine switches (one of Westinghouse make) for the two turbo and one large engine-driven alternators. On the same side of the room are the twenty-one Westinghouse single-phase induction-type feeder regulators on the lighting feeders. The main switchboard is equipped with Tirrill regulators, synchroscope, power-factor meters, frequency meter and the usual complement of instruments. From this gallery pedestal signals, already described, lead to the distant turbines.

The new engine-room is served by a 40-ton Niles motor crane and the old room by a 30-ton Pawling & Harnischfeger crane.

The natural gas obtained at Cincinnati is rather rich in

fuel value, containing 1050 lb. Fahr. heat units per cubic foot. Using this fuel the Plum Street station averages a kw-hour at the switchboard for every 32 cu. ft. of gas burned under the boilers, including, of course, the supply of steam to all auxiliary apparatus.

DIRECT-CURRENT DISTRIBUTION.

The underground district of Cincinnati, which is also the Edison three-wire direct-current territory, is bounded by the Ohio River on the south, Liberty Street on the north, Broadway on the east and Freeman Avenue on the west.

Fig. 6—7200-kw Horizontal Turbine Set, Feeder Regulators and Oil Switches in New Addition.

Feeding into the 110/220-volt network, besides the engine and motor-driven generators at the Plum Street plant, is a substation at Fourth and Plum Streets in the building containing the company's offices. Two 1000-kw motor-generator sets are installed here, besides an 8000-amp-hour, 220-volt storage battery. In the Edison building at Fifth and Walnut Streets there is a duplicate of the battery above mentioned. At the corner of Gano and St. Clair Streets a new substation is now being erected. One 1000-kw and one 1500-kw motor-generator set will be installed at once, while future provision is made for four 1000-kw sets. All motor generators on the Cincinnati system are of the synchronous type, contributing to the improved power-factor characteristics of the system.

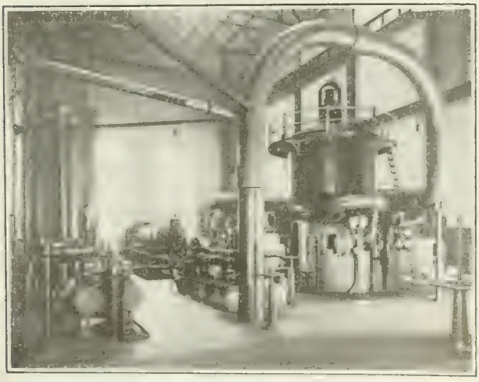


Fig. 7—5500-kw Vertical Turbine Generator in New Addition.

As already mentioned, the contract of replacing Cincinnati's present series alternating-current arc lamps with magnetite arcs represents the largest order for such equipment ever entered. Four distributing points will be provided, the Plum Street group of rectifiers supplying the downtown section, while substations will be located at Price Hill, Walnut Hills and Cumminsville, each station containing from thirty to forty-five of the seventy-five-lamp rectifier sets. These stations are now being installed, and the present plant equipment of thirty-four Wagner 35-amp constant-current transformers, seventeen for the underground and seventeen for the overhead series alternating-current circuits, as shown in the foreground of Fig. 8, is being removed to make way for the new rectifiers. The

Fig. 8—Feeder-Regulator Relays and Busbar Compartment in Present Plant.

new lamps will be of the 4-amp type, and the 6000 are to be installed by June 1, 1912. A number of important improvements in this connection have been undertaken by

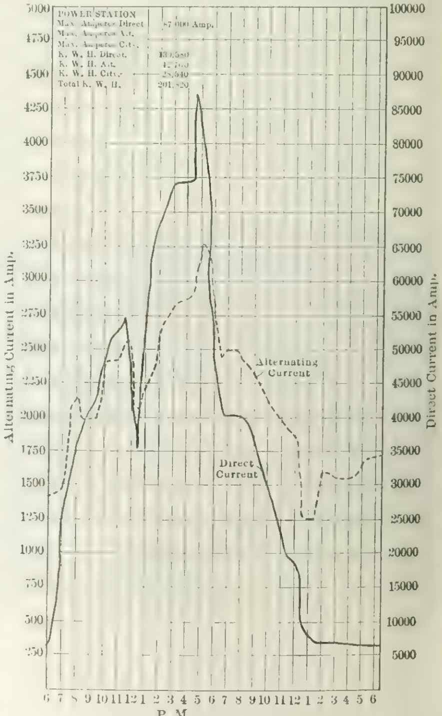


Fig. 9—Typical Winter Load Curve.

the manufacturer, especially in the design of the station apparatus.

Mr. Rollin W. White has been acting president of the Cincinnati Gas & Electric Company. Mr. E. W. McClintock is chief engineer of the Plum Street Station, and Mr. W. P. Vance is chief electrician.

THE PRACTICAL RUNNING OF THE LOCOMOBILE.

Small Combined Boiler and Engine Units of Remarkable Steam Efficiency.—A Coal Consumption as Low as 0.71 lb. per Hp.-hour Recorded.

By Warren H. Miller

IT was the writer's privilege to visit Germany this summer for the purpose of seeing something of the gas-engine central electric stations of that country and of learning at first hand just how the locomobile was holding its own in actual daily service in all sorts of industrial in-…lations and with the ordinary engine service, such as the …rated steam engine gets under the general run of …nsed engineers who are hired in the open labor market … that purpose. I wanted to see whether the great …nomies obtained under blue-ribbon-test conditions by …versity professors with trained assistants and expert …vice were being excelled or even approximated under …inary conditions of industrial service. Too often a …ng that works out all right under intelligent manage-…nt falls off badly out in the works, because simple or …etimes complicated essentials are neglected or left un-…e, or else done not wisely but too well. Through the …lness of the two great German locomobile manufac-…ers, both of whom turn out from 2000 units to 3000 units … year, I was given every facility to visit plants and ask …stions, to judge for myself by what I saw as to how the …mobiles were being handled in every kind of factory … under all sorts of conditions.

…he Berlin offices of both Heinrich Lanz, of Mannheim, … R. Wolf & Company, of Magdeburg, put men at my …osal, and I visited the works at both Mannheim and …gdeburg, besides inspecting isolated electric stations in …ony, Thuringia, the Rhine provinces and Westphalia.

…ne fact stood out prominently from the very first: the …gine being on the boiler both of them must be kept neat … clean, if only for the engine's sake, and, the firemen …ing been eliminated, the whole plant comes under the …ediate care of the engineer-fireman, invariably a man … much greater experience and intelligence than the aver-…e fireman. Up to 250 hp one man suffices to run both …iler and engine, and he keeps them both at maximum

F… 1—Two 130-hp Wolf Locomobiles in Plant of F. Ergang, Magdeburg, Germany.

…iency, thereby saving himself much labor and trouble. …larger units two men are required, but the tendency is … ncrease the number of units, with one man responsible … each.

…he engine and boiler lagging are usually highly enam-…l, and trimmed with polished brass or steel work, all of …ch is kept wiped down with waste even to the boiler end … its fire door—a refreshing contrast to the usual sooty and ashy boiler front of our firerooms. I never saw a really dirty plant in Germany; in fact, to allow the boiler to become ashy and sooty would mean also the same thing happening to the engine, with consequent hot bearings and their attendant miseries.

It is often urged that the attendance in Germany is of much higher and more intelligent order than that which we get at home. While it is true that the engineer usually

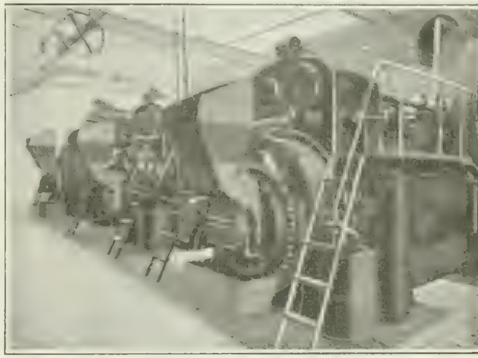


Fig. 2—Lanz Locomobiles at the Berlin Ice Palace.

knew his coal and water consumption more accurately than our average "engineer," the men I saw running locomobiles were exactly the same kind of German mechanics as one finds in our steam plants at home and of about the same qualifications as the Irish or American applicant for the same position.

The fuel used was mostly brown coal (lignite) mixed with one-sixth soft coal or brown coal briquettes, the heat value being about 3000 calories, and the water used averaged 0.5 grain to 2 grains of solids in the United States gallon, being treated outside the boiler and filtered if more than that.

There are a number of features inherent in superheated steam which make running the engine easy compared with saturated steam. There are no water troubles, either from water shots passing the separator or condensed water constantly dribbling out of stuffing boxes, thereby ruining the rods and packing. The oil consumption also is somewhat less than with saturated steam, besides which the engine has such great overload capacity that in time of peak load there is no especial period of labor and anxiety as is the case with saturated steam.

In the Wolf, Lanz and Dresden engines the packing used in all pipe-flange joints, cylinder heads, front and rear boiler heads, superheater valve flanges, etc., is a hard asbestos and fiber packing looking much like leather or papier-mâché. It is manufactured and sold extensively in the United States, though I have forgotten its trade name with us. It is guaranteed up to 400 deg. C. and is easily cut from the sheet and bolt-holed on the job for gaskets. With the Lanz engines no packing at all is used in the cylinder heads, as this company prefers the scraped metal-to-metal joint. I made particular inquiries as to the clearance and the effect of expansion upon it and upon the lap and lead of the valve setting. The clearance allowed is much smaller than with us, being 0.37 mm to 4 mm in large engines and in both high-pressure and low-pressure cylinders. All adjustments for lap, lead and clearance are made at the factory, with the engine hot, with the full steam pressure and superheat of running conditions on, and if altered subsequently should be readjusted when hot. It then makes no difference where the expansion takes them when cold, as they will return to proper adjustment when warmed up.

In the matter of valve-stem and piston-rod packing each

company has its own patent labyrinthine cast-iron ringed piston-rod packing, and in both the cylinder oil is introduced through this labyrinth at a higher pressure than the superheated steam in the cylinder. For the valve stems the Wolf and Dresden companies take advantage of the piston-valve construction to have the exhaust on the stem side of the piston valve, so that the superheated steam never comes in contact with the rod and ordinary metallic packing with a turn of soft can be used. The Lanz company, with its lift-valve gear, must needs allow superheated steam upon the valve stem during admission and its solution of the problem is to make the valve stem labyrinthine and grind it into a cast-iron bushing, no other packing being used. It is tight and will stay so, provided no lime, acids or solids are present in the steam.

At the Ergang boiler and engine works of Magdeburg they were good enough to start and stop one of their 250-hp Wolf locomobiles so that I could see the entire process, and it certainly is simplicity itself. The matter of getting rid of entrained water in the superheater, left there over night, perhaps when the engine grows cold, was another question which interested me. If you follow directions there will

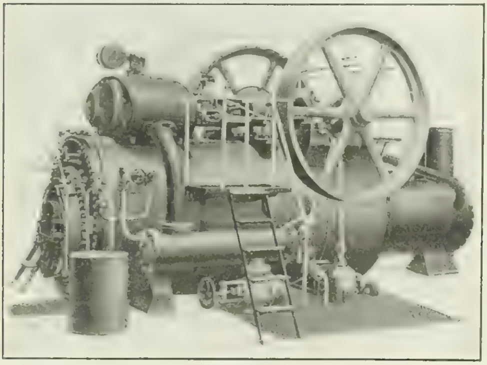


Fig. 3—150-hp Locomobile.

not be any water in the superheater, for the invariable custom is to let down the fires ten to fifteen minutes before quitting time so they can be banked at 6 o'clock, the end of the German day's work. The valve between the boiler and the superheater is then closed and the engine runs down to a standstill and its throttle is then closed. The superheater bleed-valve into the chimney is then opened and all the remaining steam blown out, after which the heat remaining in the grate thoroughly dries out the superheater. During the night it fills up with air. On starting up in the morning the superheater is allowed to heat up to some 300 deg. C., after which the steam is admitted, and as soon as it comes blue from the superheater it is ready for the engine. This is started with the drain open precisely the same as any saturated steam engine. In all plants the steam pressure carried is twelve atmospheres (160 lb.) and superheat 300 deg. C., and this was always lived up to.

There is not room within the scope of this article to describe more than three of the many plants I was allowed to inspect, but these three are quite typical of the results that are being obtained all over Germany, Russia and France. The first of these is the power house of the Ice Palace, in Berlin, containing 550 hp in a group of three locomobiles, compound jet-condensing, one of 150 hp, one 170 hp and one 230 hp normal loading. The three occupy a room 36 ft. x 48 ft. and run the entire electric-light and refrigerating apparatus of the Ice Palace, running time being practically continuous for the ice machines and lights. The electric equipment consists of four dynamos, 60 kw each, at 220 volts, which operate the entire lighting system and charge an accumulating battery capable of handling 360 16-cp lamps. The ice machines maintain a thickness of 12 cm over an area of 2000 sq. m and were made by the firm of A. Borsig, of Berlin, on the sulphurous acid gas (SO_2) system. The cooling is by 20,000 m of brine pipes at — 10 deg. C. There are two of the SO_2 ice machines of 125 hp each, belt-driven from the two flywheels of the 250-hp locomobile. The coal used per day of twenty hours is 15,000 lb., or 1.35 lb. per effective hp-hour, including the steam used for heating the building. It is ordinary soft coal slack, fed by automatic shovel feeders. Two attendants and a chief electrician run the three locomobiles, the switchboard and dynamos and the two ice machines. There are two ten-hour shifts, making a total expense of six men, or $9 attendance, for the entire equipment. The oil consumption in twenty hours was 16 lb. of cylinder oil and 20 lb. of machine oil, the cylinder oil being a special superheated steam oil supplied by our own Vacuum Oil Company. The steam pressure maintained was 11.5 atmospheres on the gages; superheat, 350 deg. C.; cylinder clearance, 2 mm. Tube system and corrugated furnace had been withdrawn and thoroughly cleaned once a year for the three locomobiles, and the superheaters were all cleaned with the steam blast once a day regularly.

Compare this plant in your mind's eye with an equivalent institution at home. We would want, first, a boiler-room with three 300-hp water-tube boilers for 160-lb. pressure, taking an attendance of two men per shift and a floor space of not less than 38 ft. x 60 ft., allowing an economizer to utilize 6 ft. of back and alley. Next we would want an engine-room 30 ft. x 60 ft. and a wing to put the ice machines and their condensers in, which latter wouldn't count, as the same thing is done at the Berlin Ice Palace. To attend this equipment two oilers and a chief would suffice, or ten men for the two shifts, aggregating in wages $27. Our coal would be about 2.5 lb. per effective hp-hour; say 30,000 lb. per day—a very modest estimate—or $45. Tota[l] American cost, exclusive of oil, $72; total German cost a[t] Ice Palace, $31.50. If we were to use a locomobile installa[-]tion with saturated steam we should undoubtedly have fa[r] less bother and trouble, save the wages of four firemen an[d] cut the coal bill in half, besides reducing enormously th[e] initial expense of installation.

The next example is the central power station of th[e] boiler and machine works of F. Ergang in Magdeburg. This company makes a specialty of tanks and brewer[y] apparatus of light 1/8-in. sheet iron, soldered in seamles[s] joints with the oxyhydrogen blowpipe, the so-called Autoge[n] process of the Sirius Company, Dusseldorf. During th[e] last ten years it has bought steadily larger and large[r] locomobiles from the Wolf company. It has a number o[f] these in the works and three in the central power statio[n,] the largest being 250 hp normal loading and 300 hp max[i]mum. The load fluctuates all the way from 50 to 300 an[d] consists of factory shafting put on by a clutch, a powe[r] dynamo and a light dynamo. The week's coal consumptio[n] was 30,000 lb. of brown coal (lignite) of 2500 calori[es] mixed with 5000 lb. of soft coal screenings of 6000 calorie[s] running day, eleven hours, making the brown coal per effe[c]tive hp-hour 2.1 lb. The steam pressure carried was twel[ve] atmospheres; feed water, 45 deg. C. Boiler tubes are wit[h]drawn for cleaning once in two years. The company us[es] Magdeburg city water, passing it through a water-softeni[ng] and filtering plant, which gave it the above excellent r[e]sults with 3½ kilos of lime and 2 kilos of soda added [to] the city water per day before filtering. The soot on t[he] superheater was cleaned off with the steam blast as wi[th] other plants. The big locomobile had shut down for t[he] night when we arrived and its grate was clean, thou[gh] still hot (grate surface, by the way, about 5 ft. long [x] 3 ft. 6 in. wide). At the instance of my host, Lieutena[nt] von Hazebrouck, of the Wolf company, it was started [...] It took the engineer about three minutes. I

ened the cylinder drain cock, opened the superheater alve, closed the superheater drain and opened the main rottle, and in a few seconds the engine was up to speed. ext he put on the jet condenser, the vacuum took hold nd we were in normal running shape. The reverse of ese operations took place on shutting down. The super-ater drain led into the chimney, where the noise and por of it would be out of harm's way, but by opening a imney door we were able to observe it. Outgoing steam as a clear blue at the nozzle.

The plant of Glauer & Company, screw works, Magde-rg, is interesting in showing the economy of a 165-hp rmal Wolf locomobile, running at 100 hp or two-thirds ad on brown coal briquettes of 5000 calories heat values. onsumption was 20,000 lb. of briquettes in sixty hours 100 hp, twelve atmospheres pressure and 0.85 vacuum; ed water, 55 deg. C.; cooling water, 3 liters per hp-hour. e briquette consumption then figures 3.3 lb. per effective hour, which is excellent for an engine on less than two-t rds normal rating with an ash residue of 12½ per cent. is equivalent to 2.8 lb. of brown coal, or 1.4 lb. of soft al, per hp-hour and bears out in practice the test indica- that at underloads superheated steam engines lose little in efficiency. This engine drove a 170-kw, 220- irect-current generator to supply energy to the mo- n the works.

s to general types of locomobiles, with the Wolf com-pany the tandem-compound, direct-current, with double s-erheat and both high-pressure and low-pressure cylin-ders jacketed by the chimney uptake is the present favorite. are many of them to be seen running in Berlin, eburg, Mannheim and throughout Westphalia. This holds the world's record for low coal consumption— per hp-hour. There were a number of them being m the erecting floor in Magdeburg when I was there. naller and older type, running from 40 hp up to 83 hp n compound, with the high-pressure cylinder in the and the low-pressure cylinder in the steam dome, very popular, particularly in Russia, where most of are sold. It has a high economy, 7 lb. to 8 lb. of and is very light, so that the Russian duty, which pound weight, is less. The Lanz company and also resden company build only one type of locomobile, ring a high superheat and one superheater coil to perheat and double coil, one for the low and one for gh, as with the Wolf. To obtain the same economy nz engine must have considerably higher superheat, has its compensation in the single superheater coil. ains for the future to show which type will become st popular in our country.

230-VOLT MOTORS IN ZINC MINES AT JOPLIN, MO.

Ser ce Rendered in 125 Different Mines for Pumping, Hoisting and Other Operations—Methods of Carrying High-Tension Cables Down the Shafts.

THE famous Empire District of Missouri and Kansas, centering about Joplin and Galena, produces about $15,000,000 worth of lead and zinc ores yearly. A large number of the mines and mills in this district are operated electrically from the transmission network of the Empire District Electric Company, whose 37,000-hp system, including steam, water-power and gas-engine plants, was described in the *Electrical World* of Dec. 1, 1910.

For supplying the large quantities of energy used in the mine and mills, the Empire District company has developed and standardized the practice of using 2300-volt motors for all sizes above 30 hp. Of particular interest is the fact that a number of these primary-motor installations are used for pumping duty in the mines themselves, 200 ft. to 300 ft. under ground, amid conditions of moisture and loading about as severe as can be imagined imposed on high-voltage electrical machinery.

Practically all of the mines in the Empire District have to be pumped to free the lower levels of water, and on account of the intercommunication of the lower strata the pumping of one mine will often drain others, so that the cost of running one mine pump is sometimes shared by several neighboring owners. These mine pump motors range in size from 50 hp to 150 hp and drive centrifugal pumps which take water from collect-sumps. These sumps are usually large enough to retain at least several hours' seepage into the mine, so that the chambers will not fill should the pump be out of service for a short time.

For conveying the 2300-volt, three-phase cables down the mine shafts, which are usually of the rough rock and not

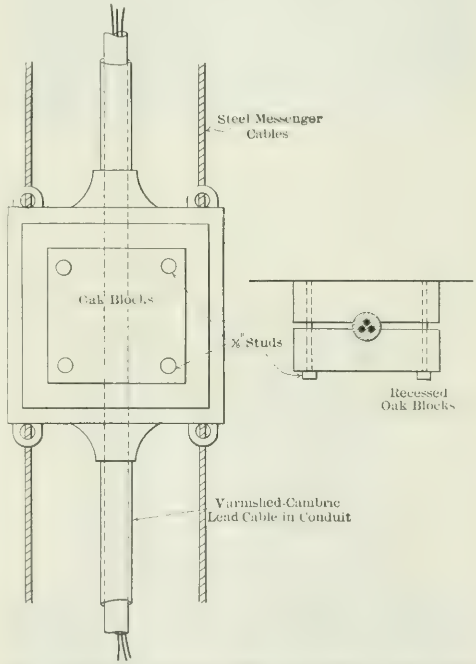


Fig. 1—Supporting Boxes for 2300-Volt Cables in Mine Shaft.

cribbed, the power company has developed the arrangement of conduit and cable boxes shown in the accompanying sketch. Lead-covered, varnished cambric three-conductor cable of No. 4 or No. 6 cross-section is used, this cable being carried by iron conduit for mechanical protection against injury. Some of the vertical drops from the surface to the pump level are 225 ft. in depth, and to support the cable down these shafts cable clamp boxes, as illustrated, are introduced at intervals ranging from 30 ft. to 40 ft.

These cast-iron boxes, 12 in. square and 7 in. deep, have their end bells threaded to screw on to the conduit pipe and each contains a pair of recessed blocks of oak which are clamped together by ⅝-in. stud bolts screwing into the box casting. These blocks grip the cable firmly, without injury, supporting it throughout the short lengths of 30 ft. to 40 ft. between boxes. The doors of the boxes are fastened on with screws and all joints are puttied. On the back of the box castings are lugs, to which are fixed the steel cables supporting the series of boxes from the

top of the shaft. The 2300-volt cables are carried in conduit directly to the motor, which may be several hundred feet distant from the entry shaft.

Where steam-driven hoists have been replaced by motor drive in the Empire District substantial gains in speed and economy have been recorded. For example, the American Davy mine at Joplin, after installing a pair of 75-hp, 220-volt motor-driven hoists, is now hoisting on each shift about 600 1400-lb. cans of rock per day, a gain of fifty to seventy-five cans per hoist per day over the steam operation. The hoisting speeds of these buckets reach 1500 ft. per minute, and the operator acquires considerable dexterity in stopping this headlong rise at precisely the proper instant, hooking the upset line onto the bucket and discharging the contents into the crusher. Successive trips to the 250-ft. levels have been made at 32-second intervals, including the time taken to empty and change buckets.

Fig. 2—Typical Mine Substation in Joplin District.

Motors are generally used about the mines for operating the crusher rolls, jigs, slime-tables, air compressors for drills, etc. Curiously (on account of the open nature of the ground) no electric drills have been found to work satisfactorily in the Joplin district, although many are in practical use elsewhere. Fig. 2 shows the interior of a typical mine substation, revealing the excellent and permanent construction which characterizes these installations. The large motor shown drives an air compressor, and in the background is another motor which operates the mill. These are 2300-volt machines, but for services smaller than 30 hp 220-volt motors are used about the mills and in the mines. No 440-volt motor distribution is permitted in the mines, since it is believed that a shock from this alternating-current pressure would be quite as serious as from a higher voltage, while not inspiring the men with the caution insured by the 2300-volt service. Th small 220-volt motor shown underground in Fig. 3 wa originally installed for operating a small pump. It h later been applied to pulling the cable drawing the ca cars laden with ore from the working face of the mine the shaft. By means of the belt shown the little motor thus used to convey material during minihg hours a then to pump water at other times, so that it is in almo continuous service.

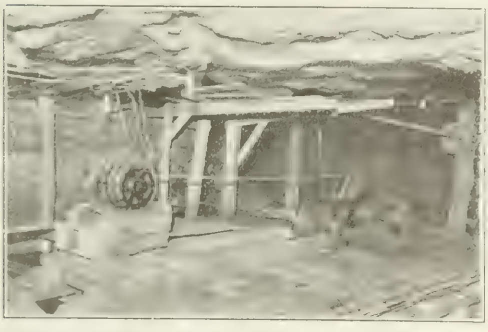


Fig. 3—220-Volt Motor Operating Small Pump and Can-Car Railway in Mine.

The Empire District Electric Company's 37,000-hp, 2 cycle system, which includes steam, gas-engine and wate power plants, is connected by a network of over 100 mil of 33,000-volt transmission lines. The transmission volta is reduced by nineteen different substations at vario points, the smallest of these substations having 500 rating. The towns of the district, aggregating a populati of over 100,000, are lighted by the Empire District Elect Company, two-phase, 60-cycle energy being supplied this purpose by motor-generator sets.

The company's total motor load now aggregates 16, hp, made up from among 125 different mine custome whose connected rating ranges from 50 hp to 1500 hp; power requirements of 115 miles of interurban railw and the commercial power load of Joplin, Galena, W City and Carterville. All energy is sold by meter o demand schedule, the amount being billed to mine c tomers in hp-hours instead of kw-hours, since the m operators prefer to deal with the former more fami and easily understood term.

Mr. George E. Hayler, Jr., is general superintendent the Empire District Electric Company, which is one the Doherty properties.

MOTOR-OPERATED LIFT BRIDGE.

A Span of 425 Ft., Weighing 780 Tons, Lifted by Dir Current Motor of Crane Type.

The great new Fratt bridge, which is now being c pleted across the Missouri River at Kansas City, is oper by electric motors and is arranged to clear river steam traffic on a lift principle quite unique among movable sp

Fig. 1—Motor-Operated Lift Bridge at Kansas City, with Mo ble Deck Half Raised.

Besides the unusual provision of its movable lower ck the 425-ft. main span, carrying two railroad tracks wo electric-car tracks, a railway, and foot paths, also ha the distinction of being the longest riveted span ever built

As shown in the illustration, the bridge is a double-d ked structure, the lower platform of which, carrying the ail- road tracks, can be drawn up against the main bridge loor

steel cables which pass over motor-operated drums and sheaves and are counterbalanced by great concrete weights. The lower deck is divided into fourteen panels suspended by vertical hangers from the truss chords when the deck is lowered into normal position. From each of these uprights ..-in. steel cables pass up over 5-ft. sheaves on the top chords and thence over the drums to the counterweights.

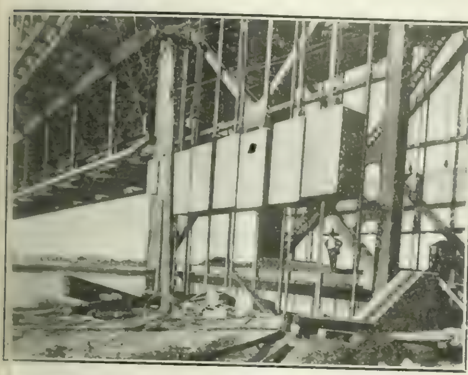


Fig. 2—Huge Concrete Counterweights Operated by Two 250-hp Motors.

The deck has a vertical rise and fall of 46 ft., clearing the water by 65 ft. when in its raised position. The work of moving the deck is done by two 250-hp, 550-volt grounded-return Westinghouse direct-current crane motors, either of which is able to move the deck singly. These motors are mounted in the housings on the ends of the span and each drives its drum, over which pass all the cables of the adjacent half of the bridge. These cables, as shown, make .. 90 deg. or less arc of contact on the winding drum.

To enable either motor to operate both halves of the bridge should the other motor be injured, the two winding drums are themselves interconnected by cables and move synchronously, assuring that all parts of the deck shall rise together. The dead load of the deck is conterbalanced by thirty-two huge concrete blocks, most of which weigh 25 tons each. As constructed the bridge is stable in any position so that the motors are required only to move, but not to lift any part of the structure. This type of bridge also avoids the heavy wind resistance encountered in swing and bascule bridges, which represents a large part of the work done by the motors in moving those types of bridge. The deck structure is of nickel steel, having the same strength as a deck of ordinary carbon steel weighing a third more. As built the total weight to be raised is about 780 tons, while including the counterbalances the total mass moved is about 1500 tons through 46 ft.

Either or both of the 250-hp main motors can be controlled from either station at opposite ends of the bridge. The motors are fitted with magnetic brakes which are automatically applied when the motor circuit is opened.

When the deck is in its normal lower position its steel panels are securely seated and the cables are relieved of carrying all except their counterweight loads. To fix the deck securely in position it is held down by twenty-six interior locks and two end locks, all operated through a system of rods and bell cranks by a 15-hp motor. The end locks are provided with large bearing surfaces for taking the brake thrusts of moving train loads on the deck. The interior locks are made up in the form of suspended segments which can be swung together to arrest the bridge motion or opened to allow it to be raised.

The proper seating of the various panels is reported at the operators' houses by lamps having their circuits made up of contacts in series at each panel. In this way the lamps remain extinguished until the last panel is in position. To prevent overrunning of the motors in raising or lowering the deck their control circuits are equipped with limit switches in the form of worm-operated contacts, opening the circuits when the deck reaches the end of its travel.

The movable span is one of three bridging the water, which, with the steel-viaduct approaches, make up the total length of 4150 ft. of steel structure. The upper deck is at the level of the Kansas City streets, the purpose of the bridge being the opening up of a large, now unused territory lying north of the river and very near the center of the city. The lower deck is at the railroad grade, but as the Missouri is a navigable stream a clearance of 55 ft. is required by the government.

The new bridge will be operated with central-station energy from the Missouri River power plant of the Kansas City Electric Light Company, near its south approach.

The firm of Waddell & Harrington, who have designed many famous movable bridges in this country, among them the Halsted Street lift bridge at Chicago, designed the Kansas City structure, the unique features of which are the patented invention of Dr. J. A. L. Waddell.

ELECTRIC DRIVE IN A LUMBER MILL.

Thirty Induction Motors Installed.—Power Data of Woodworking Machinery.

One of the most complete motor-driven industrial plants in Salt Lake City is the lumber mill of Morrison, Merrill & Company, which is supplied with power by the Utah Light & Railway Company. The establishment is one of the most prominent in the State and has been using electric power in a small way for about five years. Recently the expansion of the company's business necessitated the building of a new mill at the intersection of First North and Third West Streets, and after an investigation of the merits of individual-motor driving it was decided by the owners to install electricity throughout the establishment, providing a

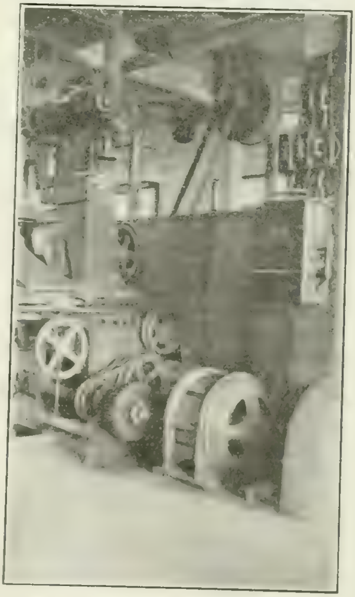


Fig. 1—Motor-Driven Band Rip-Saw.

[illegible] motors, aggregating about 225 hp in total rating, are in service, all being of the induction type and varying in size from 1 hp to 35 hp. A list of the machines driven and the ratings of the corresponding motors is given in the accompanying table.

The original lumber plant of this house contained about 58 hp in motors, and the success of this method of driving was so pronounced that electricity received favorable consideration when the present building was erected a few months ago. The mill building is practically 100 ft. square and is constructed of concrete and brick, with interior mill type of framing, having two stories and a basement. Energy is brought to the plant by a 220-volt, three-phase circuit, carried along the exterior of the building from a step-down transformer installation mounted on a pole in the yard. The circuit enters the building in iron conduit and passes to a switchboard mounted in a glass-incased frame on panels hung about 10 ft. from the floor and reached from the latter by a short stairway, no floor space being required

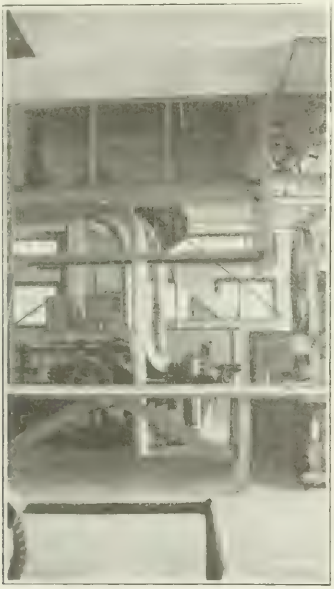


Fig. 2—Switchboard.

for the fuse, switch and meter installation. The switchboard platform is about 9 ft. x 4 ft. x 1 ft. in dimensions, the meter being readily accessible. The platform is supported on 2-in x 4-in. floor timbers and carried from above by 4-in. x 4-in. uprights. The current coil of the meter is inclosed behind the glass casing of the switchboard in front of the busbars.

All motors are wound for 220-volt, three-phase service and, as the induction type is used, such speed changes as are necessary are made by mechanical means at the different machines. All local-distribution wiring is run in conduit. The heaviest machines in the plant are equipped with exhaust fans for shavings and sawdust, run by the regular driving motor. In many woodworking establishments the exhaust fans are run even when the machinery is shut down, raising the power consumption unduly. The arrangement of the fans at the Morrison-Merrill plant, as above noted, has resulted in attractive savings in power. The plant operates nine hours per day, and the absence of belts and line shafts has been found to result in greatly improved conditions of production. The company collects all the dust and shavings from its machines in a system of galvanized-iron pipes, which ultimately discharge into a 14- trunk line leading to a neighboring refrigerating plant ab[out] 200 ft. distant. The latter establishment burns the refu[se] in its boilers and supplies steam heat to the woodworki[ng] plant, no boilers being in use on the premises of the latt[er]. So far as possible motors are located on the ceiling of eit[her] the basement or the first story, geared and short belt driv[es] being freely used. The compactness of the installation fr[om] the point of view of the motive-power engineer is no[te]worthy. Headroom is preserved for production servi[ce], giving a maximum freedom in handling long pieces of ti[m]ber, both by team and by hand. The direct drive insu[res] steady output, which is specially important in a busin[ess] where skilled labor plays so essential a part. The cost [of] energy is about 15 cents per 1000 ft. board measure hand[led] in the machines, and electricity has kept out steam, desp[ite] the availability of free shavings.

TABLE OF MOTOR DRIVES, MORRISON, MERRILL & COMPANY, S[ALT] LAKE CITY.

Machine	Motor		
[illegible]	1	[illegible] hp	1,700 r.p.m.
General blower	1	[illegible]	1,700
One [illegible] double head double cope tenoner Hawley & Hermance	1	[illegible]	1,700
One double-spindle emery wheel	1	1	1,700
One Hall & Browne 4-in. sash sticker	1	[illegible]	1,700
One American hollow-chisel mortiser and [illegible]	1	[illegible]	1,700
One New Britain Machine Company No. 7 chain mortiser	1		1,700
One [illegible] Berlin Sander No. 24 and 1 12-in. Oneida blower	1	25	900
One [illegible] Berlin molder and 1 12-in. Oneida blower	1	[illegible]	900
One 281 Berlin band rip saw	1	15	1,200
One 8-in. sash sticker and Oneida blower	1	[illegible]	1,200
One self-feed rip saw	1	[illegible]	1,700
One arm sander	1	[illegible]	1,700
One 36-in. band saw	1	[illegible]	1,700
One window-frame machine with cross-cut saw	1	[illegible]	1,700
One double head shaper for sash work	1	[illegible]	1,700
One Berlin rip saw, No. 226	1	[illegible]	1,700
One swing cut-off saw	1	[illegible]	1,700
One slasher cut-off saw	1	[illegible]	1,700
One 24-in. joiner, Berlin No. 199	1	[illegible]	1,700
One rip saw	1	[illegible]	1,800
One small variety saw	1	[illegible]	1,800
One window-frame pocket machine, double head rip saw and double cross cut	1	[illegible]	1,700
One 18-in. Berlin planer	1	[illegible]	900
One Dado machine	1	[illegible]	1,700
One small drill press	1	2	1,700
[illegible] saw	1	2	1,700
One small rip saw	1	3	1,700
One 20-in. joiner	1	3	1,700
One freight elevator	1	7½	1,120
One 30-in. surfacer (double), Berlin No. 177	1	35	900
Four small machines not accounted.			

COST OF ENERGY

April [illegible] May [illegible] 1911, consumed 3,650 kw-hours, rate [illegible] cents [illegible] equals one month. Maximum demand, 65 hp.

CURING MEATS WITH THE AID OF ELECTRIC[ITY]

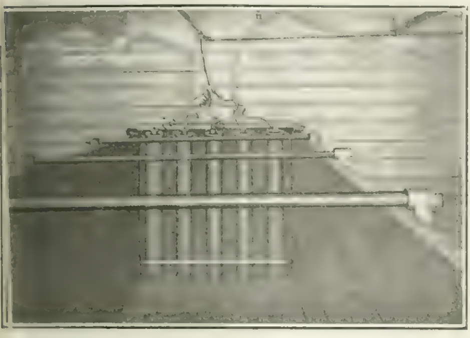
Time of Curing Bacon Reduced by Electricity [from] Eighteen or Twenty Days to Three or Four Day[s]

Hams are ordinarily cured by pickling from ninety t[o] [illegible] days in a solution of salt, sugar and saltpeter, during [w]hich period they must be frequently changed in positio[n]. A Cincinnati packer has discovered, however, that if 60-cycle alternating current be passed through the brine conta[in]ing the hams the pores of the meat are opened to the flui[d] and the same hams can be completely cured in from thi[rty] to thirty-five days.

This effects a considerable saving in plant space, material, labor and investment, and the product ob[tai]ned equals in all respects the naturally pickled ham. Of s[pe]cial interest in this regard is the fact that the packers, C[...] Roth & Company, pride themselves upon the unm[at]ched flavor obtained by their secret pickling formula, a pr[ice]less

[he]ritage handed down through several generations, and [th]erefore would hardly permit any mere advantage of [sa]ving time to affect the unique local reputation of their [pr]oduct.

The green hams to be cured are piled on trays in wooden [va]ts, 16 ft. x 4 ft. x 5 ft., each vat holding about 5000 lb. [of] meat. At the ends of the vats are the electrodes, each



F[ig. 1]—Interior of Curing Vat, Showing Set of Electrodes in Tile Tubes.

[co]mprising five 3½-in. carbon cylinders 4 ft. long, in- ... in unglazed 6-in. tubular tiles. The vertical arrange- ... of these electrodes and their connection to the lead ... are shown in Fig. 1, from a photograph of the interior ... vat. After the hams are in position the brine, held ... [te]mperature of 34 deg. to 36 deg. Fahr., is turned into ... [v]at and kept circulating by motor-driven pumps on ... [fl]oor below. From the switchboard a current strength ... to 35 amp. 60-cycle alternating, is turned through ... [va]t, the drop in potential between the opposite sets of ... [electro]des being about 40 volts. This discharge is usually ... [continu]ed throughout the pickling period of a month or ... although recent experiments seem to show that ... good results are obtained by using the current flow ... [alterna]tely twenty-four hours on and twenty-four hours off. ... same way bacon, which ordinarily requires eighteen ... [twe]nty days, can be completely cured in three or four ...

[The] Roth plant now has ten of these 5000-lb. electric ... continuous service. The company operates its own ... direct-current steam plant, and alternating current ... for pickling is obtained through an inverted

[F]ig. 2—Row of Ten Electric-Curing Vats in Roth Plant.

rota[ry] converter. By means of face-plate contact arms the [st]rength of current flowing in any circuit can be adjust[ed], and an intermediate position of the vat switches cuts the ammeter in circuit for making the current adjustment.

Th[e] present curing vats have been in use nearly a year, and [ar]e the result of nearly four years' experimenting at the Cincinnati plant. During the course of these tests direct current was first used, but the products of electrolysis liberated at the electrodes fouled the solution and caused changes in its composition. With alternating current these effects are avoided, but the pore-opening action remains. The new vats and electric-treating apparatus were built by the Electric Meat Curing Company, Cleveland, Ohio, which is now planning several other installations of the principle.

Electricity plays a number of other important rôles around the Roth plant. From the pickling vats the hams are hauled to the smokehouses, 1400 ft. distant, by two 110-volt one-ton locomotives. The trucks used have 24-in.-gage grooved wheels for running on the tracks, but when trundled along the floors their large rubber-tired wheels are brought into use. The company's modern garage contains six electric trucks, from 1-ton up to 10-ton capacity, and a number of electric runabouts for its local salesmen. All elevators in the building are of the automatic electric type, and motors are used for slicing meats, crimping extra covers on cans for long-distance shipments, branding hams, operating vacuum conveyor systems, phonographs, mailing machines, adding machines, etc. The offices are heated in winter by thirty-five non-luminous resistor-type radiators. The various refrigerating brines and pickling liquors are handled by motor-driven pumps, and in the roof garden is a large swimming pool, holding 17,500 gal., water for which is pumped electrically. The presence of this pool has an important fire-insurance value to the building. Children of the employees and neighborhood are welcomed to this airy playground, while for their elders on the floor below there is an auditorium with a stage and large electric organ.

FEEDER-LINE CONSTRUCTION AT CINCINNATI.

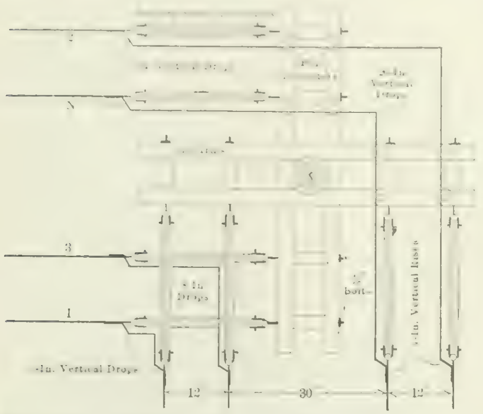
Method Whereby Life of Pins is Trebled.

For making turns on its 4500-volt No. 00 feeder lines the Cincinnati Union Gas & Electric Company has adopted the rigid, dead-ended construction shown in the accompanying sketch. Whereas the life of the former pin-type construction was barely three years, the strain-bolt type bids fair to last ten.

As illustrated, all wires are dead-ended to wood strain insulators attached by ⅝-in. bolts inserted through the oak arms, the unbalanced stresses being in turn transmitted to guy lines attached to the ends of the cross-arms. The stiff-wire jumpers used to connect between the dead-ended lines are bent accurately into square turns on the ground, and when in position are supported on insulators on the outside of the turns, as shown. The whole construction is thus made rigid, and the appearance is very pleasing. Hickory strain insulators are used, made in the company's own shops. These insulators measure 2½ in. in maximum diameter and 26 in. between the eyes formed by their end straps. The cross-arms for corner work are of oak, 3¼ in. by 4¼ in. in section, and are slightly longer than the standard arm. The wide clearance, 30 in., between pole pins contributes to the convenience and safety of linemen. Joints between jumpers and line wires are wrapped and soldered. As shown, the short inside jumpers are without support, but the outer ones are carried up and over insulators on the cross-arms. The ⅝-in. strain bolts are cut extra long to permit adjustment for slack, etc.

On the poles next to each turn, branch or other departure from the straight construction the phase wires are clearly designated by porcelain numbers screwed to the cross-arms. Painting the numbers on the arms was found expensive and unsatisfactory, as the figures were not durable. The porcelain numbers, white on a blue background, can be changed as desired, and may even be allowed to fall from

the pole tops without injury. A test for proper porcelain material, according to Mr. F. R. Healey, line superintendent of the company, is a sharp hammer blow on the face of the letter. If the porcelain cracks from the metal



Dead-Ended Construction Used on Feeder Turns at Cincinnati.

in large flakes the material is poor, but if the coating adheres tightly except for small cracks at the point of concussion the figures may be accepted as fit for the rough use of line work. These letters are also placed at intervals in very long, straight runs, so that in case of trouble linemen will not be required to go far to identify the phase positions. Cross-arms of Washington fir are used on such straight-away construction.

SOME NOTES ON PUMPS.

By W. H. Wakeman.

Fig. 1 illustrates one of a pair of duplex pumps that are used on light service. Water flows to them under 20 lb. pressure, and they raise it to 45 lb. for use in a large building. If it was necessary to raise this water 15 ft. or 20 ft. by suction large air chambers would be considered essential, but none were included in the original equipment, except one on the combined discharge pipe. The valve shown in the illustration is provided to shut off the supply when the pump must be packed, etc. One of these pumps is sufficient for the service required, but two were installed to insure continuous service, which is an excellent plan, as it enables the engineer to take better care of them than is possible with only one in use, as he can shut down one at any time and use the other.

Although water flowed to these pumps under pressure, they were noisy part of the time when only one was in operation, and therefore the other was also started to afford temporary relief from the shocks and jars, but this was not satisfactory. An air chamber made of 4-in. pipe was put on opposite to the inlet pipe, as shown, and it proves to be a great improvement, as either of them can be run faster than before with but little noise. It was much less trouble and expense to locate this air chamber as illustrated than to cut it into the supply pipe, and it could not do better work than it does in its present location, because it cushions the suction chamber, thus preventing the ram-like action that would otherwise take place when the body of water in that pipe, especially where it is straight for many yards, is started into rapid motion, and then suddenly checked by the pump.

Fig. 2 shows the water piston of a hot-water pump that is packed with fibrous packing. One day I noticed that the pump from which this was taken was running much faster than usual with the ordinary load. Investigati showed that nearly all of the packing was in good ord but there was a groove cut completely across it, as show at 2, thus forming a passage which caused excessive "sli It is my custom when packing such a pump to put the joi in the first ring at the top, the second directly opposite, t third at the right hand and the fourth at the left hand, th "breaking joints" effectually. To allow for expansion the packing rings when soaked in hot water the joints we

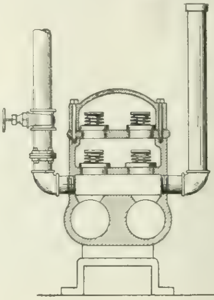


Fig. 1—Duplex Pump.

left open ⅛ in. or more. See Fig. 3. This formed a w spot, and water entering here had succeeded in cuttin groove through the three other rings. Although this c tom had been followed for several years this was the f failure of the kind noted, but ever since that experie the joints are made as illustrated in Fig. 4, without reg to expansion of the packing.

The packing in this pump is "set out" or expanded b tapering nut screwed on the rod. Another pump in plant has only stiff rings of packing, without any de to prevent them from collapsing, except a thin brass b that is not worthy of consideration. Still another is fi with a solid bronze piston, except the follower plate, w is put on separate and held in place by a nut. See Fi which contains no packing. When this is in the w cylinder it leaves a space ¼ in. wide in which to put packing. For hot water it is desirable to use square packing, but this must be just the right size to fill the sp or it will leak badly, as no means are provided for adjus it. While it can be forced into place, it requires mor less skill to do it, also a fair stock of patience, espec if time for doing the job is limited and the limit is no reached. Where packing can be put in comparatively l and expanded afterward it is much more convenient, it affords an ignorant or careless engineer a chanc expand it too much.

Fig. 6 illustrates the worst-scored pump piston rod

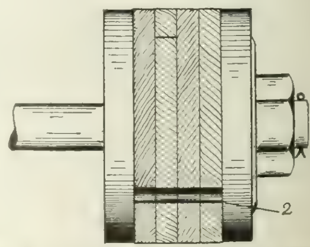
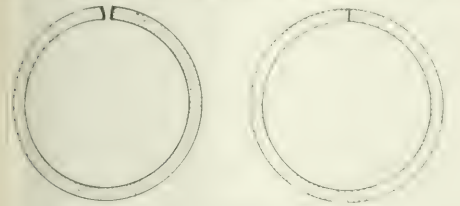


Fig. 2—Water Piston of a Hot-Water Pump.

I ever saw. Hot water from a heating system wa delivered to a receiver, to which this pump was conn ted through a pipe that was buried in the ground for s eral rods. Sand came into the receiver with the hot wat but

hether this was due to an imperfect joint or to a corroded pe will never be known. The pump was nearly new, but rod where it went into the water cylinder was worn an 1 5 in. by actual measurement. While this does not ear to be very bad when stated as a fraction of an



Figs. 3 and 4—Joints in Packing.

it looks a great deal worse when the rod is examined, especially when the full diameter is only 1⅛ in.

The steam cylinder of Fig. 7 is 8 in. in diameter. The water plunger is formed by continuing the piston rod into the water cylinder, according to common practice, but there is no piston on the end of it, and, considering that it is only ¾ in. in diameter, it is an easy matter to secure a very high water pressure. This constitutes an outside packed power pump of the hydraulic style, because the total force of steam acting on an 8-in. piston, minus the friction load, is exerted on a ¾-in. plunger. It is used to operate the rams in a pair of lumber dry kilns, to which it is connected by ordinary pipe and valves. Sometimes the water pressure

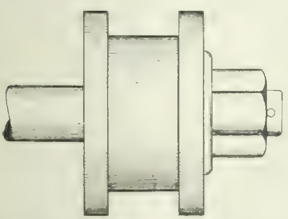


Fig. 5—Method of Installing Packings.

sed until the pump stops with 60 lb. steam pressure. W oes not this burst these connections?

owner of this plant installed one dry kiln complete, veral years later another was added. The pumps run by laborers or whoever happened to be available purpose, and consequently became dilapidated in ance and very uncertain in action. I dismantled both , selected the best parts of each, had some of them l and made one good pump out of the pair. This nnected to both kilns, consequently each was operated when wanted. This was practical because neither was pumped up more than about twice per week and both were not required at the same time.

Fig. 8 is an oil pump that is used to force oil into the steam pipe of a duplex pump. This pump takes hot water receiver in the usual way, and therefore it is con- by a balanced valve opened and closed by a float. pump shown is connected on the boiler side of this because it requires lubrication about once each day. this pump was new it worked hard, but no special

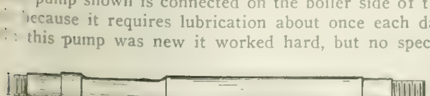


Fig. 6—Pump Piston Rod.

attention was given to it, because it was expected to move easier as it grew older. On the contrary, it worked harder, and finally but very little oil could be forced through it.

The internal construction and condition of it are shown in Fig. 9. In this connection the reader should remember that oil is pumped downward through the passages shown against steam pressure; hence, whenever the plunger (which is not shown) is drawn upward oil would be blown

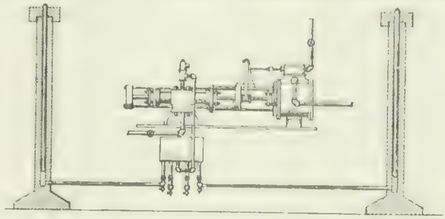


Fig. 7—Outside-Packed Plunger Pump.

out if means were not provided to prevent this action. With the needle valve open the plunger is brought downward, forcing oil through the upper check valve, which is thus carried downward against the action of a spiral spring. When the plunger is drawn upward oil cannot follow it, because this check valve closes. Below the needle valve there is a ball check valve, and this caused the trouble mentioned. The ball had worked down into the spring, as illustrated, until it was below the center, and when oil flowed down it took the ball and entirely closed the lower

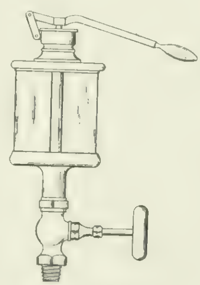


Fig. 8—Oil Pump.

opening; hence only a few drops escaped, after which no more could pass. The bushing 3 was taken out, the ball removed from the spring and placed on top of it, where it now forms a perfect joint and prevents oil from going upward when the needle valve is opened, but allows oil to pass downward freely. This defect was undoubtedly due to ignorance on the part of a workman in the shop where

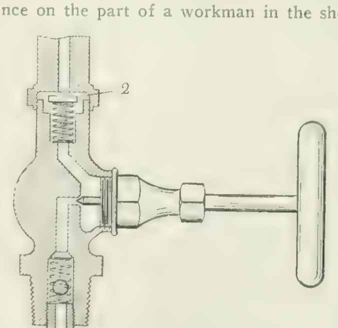


Fig. 9—Section of Valve.

this pump was made, as the ball remains in its proper place and oil is easily pumped against the steam pressure, thus indicating that if it had been correctly placed when the machine was assembled it would have remained there.

SPACE REPRESENTATION OF CENTRAL-STATION RATES.

An Analytical and Graphical Study of Central-Station Rates and Their Representation in Space by Means of Points on Planes.

By [illegible] E. Eisenmenger.

EVERY system of electric-service rates with very few exceptions is built up on only the two elements of the customer's energy consumption as measured by a watt-hour meter and of his maximum demand on the central station, either as measured by a demand meter or as defined by a limiting device or as represented by something more or less equivalent to the maximum demand, such as kilowatts connected, number of sockets connected, number of rooms, floor area, etc.

This means that for each definite system of rates the amount a of the customer's monthly (or yearly) bill is a function F of his energy consumption e and his maximum demand d.

$$a = F(d,e) \qquad (1)$$

The nature of the function depends entirely on the nature of the rates; in fact, the function *is* the respective rates system, mathematically expressed. The rates system is characterized by its equation (1), which shows the way for a graphical representation. As there are three variables a, d and e, use must be made of three dimensions and a solid rectangular system of co-ordinates. The geometrical representation will then be a surface in space. The surface represents equation (1) in the same way in which a curve in a plane represents an equation between two variables. Since the surface corresponds exactly to the equation, and the equation characterizes the rates system, the surface can also be used to characterize the system of rates.

All lengths in the direction of the axis of e are measured in kw-hours, those in the direction of d in kilowatts (or rooms, square feet, number of sockets, etc.), whereas the scale in the vertical direction axis a is given in dollars (or cents). In the following the axes of d and e have been assumed as being horizontal, while the axis of a is vertical. The axis of d (kilowatt axis) is assumed to run from the contemplator toward the right side of the background, the axis of e (kw-hours) toward the left.

Taking only the two horizontal axes d and e into consideration, each individual customer is represented by a point on the horizontal bottom plane—his "characteristic point" P, Fig. 1. This point being connected with the origin of co-ordinates, the line OP will include an angle λ with the axis of demand OD, the tangent of which is proportional to e [illegible] d, and therefore is proportional to this customer' load-factor.

This angle has a certain maximum value which corre sponds to the load-factor 100 per cent, or 730 hours' us per month. All points in the plane beyond the 100 pe cent load-factor line (that is, in the shaded part of Fi 1) have no equivalent in actual practice since their loa factor is larger than 100 per cent. From the above it clear that all points on a line issuing from the origin represent customers with the same load-factor.

Rising from the bottom plane into the third dimensio there is measured off upward from the characteristic poi of every customer the amount of his bill under the syste of rates being considered and the upper ends of all the verticals form the surface representing the rate syster The load-factor lines then change into vertical load-fact planes passing the origin of co-ordinates O and includi the angle λ with the plane of co-ordinates ad. For eve point on such a plane the load-factor represented by t value $e \div d$ is proportional to tan λ and is constant. Ther fore a certain part of the surface will be cut off for pra tical purposes by the vertical 100 per cent load-factor pla (This part has been painted black on the models, phot graphs of which are reproduced in the accompanying ill trations.)

In many cases it is possible to express the same syst of rates by various schedules so that at first sight t various rate schedules seem to be different from each ot whereas they are inherently the same. The crite whether two rate schedules are expressing the same r system is that when they are reduced to mathematical f tions these functions are the same in both cases and co quently the representing surface is also the same.

We will now see what kinds of surfaces we get un different circumstances.

One of the simplest cases is the straight kw-hour m rate. Call the kw-hour charge z cents per kw-hour, t function F takes the shape

$$a = F(d,e) = ze \qquad (a \text{ in cents})$$

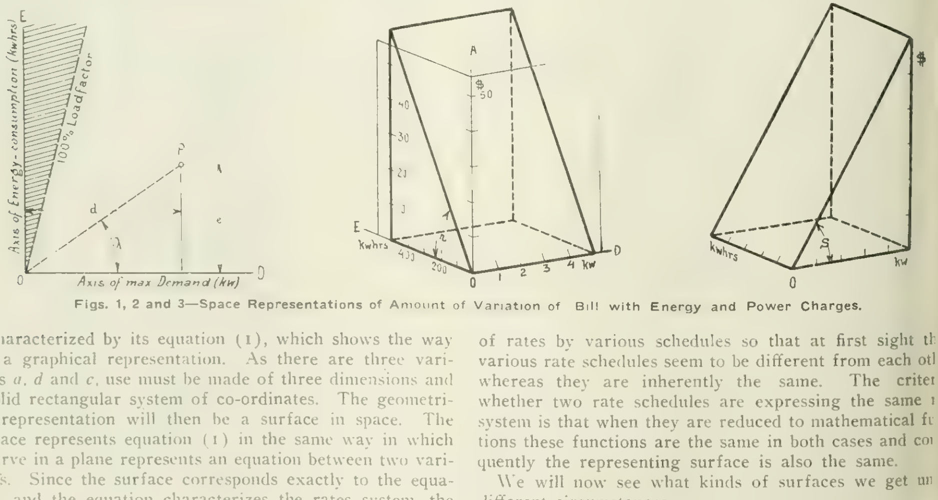
The straight meter rate is a special case since the is now independent of the maximum demand. The [illegible] metrical correlate is a plane passing through the axis [illegible] and rising from the horizontal bottom plane of de a angle the tangent of which is proportional to the kw-h charge z.

A similar solid would represent the flat rate based on the kilowatts of maximum demand, except that this model would have to be turned around by 90 deg. with respect to the former.

The equation is $a = yd$ (3)

where y is the unit charge per kilowatt maximum demand (kilowatts connected, etc.) in cents and is proportion to tan S.

A combination of the straight kw-hour rate system and the kilowatt flat-rate system makes up the Hopkinson [illegible]



Figs. 1, 2 and 3—Space Representations of Amount of Variation of Bill with Energy and Power Charges.

[1] The principles underlying [illegible] is described in this article were first [illegible] contribution to the report of the rate [illegible] tric Light Association at the recent yearly convention of the latter in New York.

In the same way a combination of Figs. 2 and 3 represents the Hopkinson system (Fig. 4) with the charges represented by the tangents of the angles r and s.

$$\text{The equation is } a = yd + ze \quad (4)$$

and this is an equation of the first degree representing a plane. Setting $d = 0$ we get the equation of the trace of the plane on the ae plane of co-ordinates $a = ze$; that means

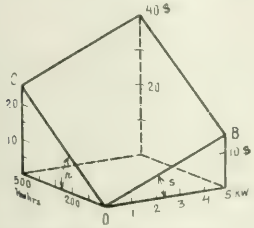


Fig. 4—Representation of Hopkinson System.

s trace rises at an angle from the axis of e, the tangent which is z

$$\tan r = z$$

Similarly we get $\tan s = y$

One step further is the three-charge-rate system, or herty rate system, according to which each cuser pays a certain constant amount per month which is ependent of either his kilowatt-maximum demand or kw-hours consumed. In addition he is charged an unt proportional to his maximum demand and another proportional to his energy consumption. The cus-r's bill is then

$$a = x + dy + ez \quad (5)$$

re x, y and z are constants for each individual system rates, x being the monthly customer charge in cents, y z kilowatt charge and kw-hour charge as above.

This equation again is that of a plane; this time it is a special case, but a plane in a general position in e (Fig. 5). Setting both d and $e = 0$, equation (5) rees to $a = x$, which means that the plane intersects the s of a at the distance x above the origin. From this it is that the customer charge x is geometrically repreed by the vertical distance above the origin O, at which plane of rates intersects the axis of a. The passing of plane of rates through the origin O would mean that no tomer charge is made, and, on the other hand, the higher point of intersection between the plane of rates and axis of a is located above O the larger the customer rge will be, whether it is explicitly expressed in the schedule or not.

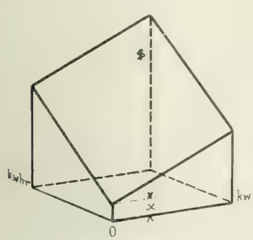


Fig. 5—General Representation of Plane in Space

The demand and energy charges y and z are geometrily represented by the tangents of the angles which the ces of the plane include with the respective horizontal s.

Leaving out for the present such rates as result in equas of higher than the first degree, and, therefore, in cved surfaces, it is seen from the above that the Doherty system is the general case, and the Hopkinson system, the flat-kilowatt rate and the straight meter rate are only special cases.

There are, however, other special cases possible and widely applied; for instance, both kilowatt charge and kw-hour charge are zero and only the constant is charged.

This will take place in all such cases where a minimum charge applies; for instance, if it is stipulated that no bills are made out below \$1 per month, all those customers who according to the rest of the rate schedule would be charged less than \$1 will then be charged only by this

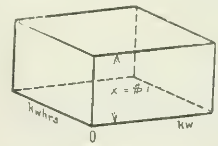


Fig. 6—Representation of Constant Charge.

minimum charge of \$1 and neither kilowatt charges nor kw-hour charges will be made to them. The graphical representation, of course, is found (by setting the angles r and $s = 0$) as a horizontal plane at the distance x above the bottom plane (Fig. 6).

Another special case which occurs in the practice of rates can be found by setting only the demand charge y of the three-charge system equal zero (angle $s = 0$)

$$a = x + ze \quad (6)$$

This would mean a combination of a constant amount x with a kw-hour charge z (Fig. 7). The customer is charged, first, the constant of say \$50 per month and, second, on top of this a charge of 3 cents per kw-hour.

It ought to be understood that this and similar kinds of rates are usually not given in this simple form in the schedules, but the form given by the schedules can be reduced into the above shape, as will be shown later. It is interesting to see that a great number of central stations (in fact, probably the majority of them) are using for certain classes of their customers a pure three-charge system without explicitly making the three charges. The three charges are, however, usually only implied, being concealed or disguised in one or the other way, as will be shown later.

Many central stations offer different rate schedules to the customer and leave the option to him on which one of these schedules he wants to be served. The customer, of course, will choose the schedule which gives him the lowest bill. This amounts to the same as if only one schedule applied to each separate point of the bottom plane and this schedule will always be the one represented by the lower plane.

A similar combination of schedules—whether optional or

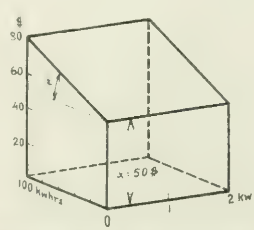


Fig. 7—Constant Amount Plus a Kw-hour Charge.

not—is in use in the majority of cases and the schedules used are almost universally of the three-charge system type —including its special cases, which result in setting one or two of the charges = 0. In many cases, however, the charges are not given in this simple way, but are concealed and disguised and can only be found by a simple mathematical analysis.

A very frequent way of expressing one or two of the three charges implicitly is by only giving kw-hour charges by the application of the multiple rate. A multiple-rate system is a rate system which stipulates a certain price p per kw-hour (the primary charge) until a certain kw-hour consumption of e_0 kw-hours is reached. For any consump-

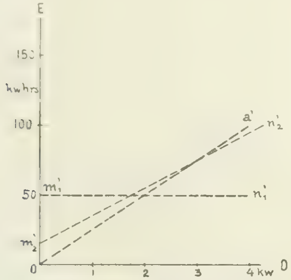


Fig. 8—Relation Between Power and Energy.

tion beyond this the kw-hour is charged at a lower rate s, the so-called secondary rate.

This energy consumption of e_0 kw-hours to which the primary charge is limited is a function of the customer's maximum demand:

$$e_0 = f\,(d) \qquad (7)$$

As long as a customer's energy consumption is smaller than $e_0 = f\,(d)$ he will be served by the primary charge on a straight meter rate

$$a = p.e \qquad (8)$$

After his energy consumption e has become larger than $f\,(d)$ his bill will be:

$$a = p.f\,(d) + [e - f\,(d)]\,s$$
$$= (p - s).f\,(d) + es \qquad (9)$$

In other words, if we draw in the de plane the curve representing $e = f\,(d)$ all customers between that line and the axis of d will be served on the straight meter rate of p cents per kw-hour, equation (8), and all the others will be served on a different rate, equation (9), the *character of this latter rate depending on the nature of the function* $f\,(d)$. We are having, therefore, *two different ranges* which are divided by the curve representing the equation $e = f\,(d)$ and this curve will, therefore, be called the "dividing line."

Theoretically, of course, $f\,(d)$ might be any function of

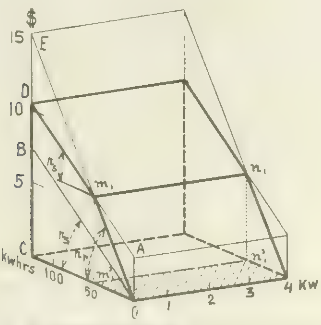


Fig. 9—Representation of Two-Rate Charge.

the kilowatt demand, but in all practical cases only straight lines are employed as dividing lines. Function $f\,(d)$ then has the shape $f\,(d) = e_0 = md + n$, and we are getting two important special cases by setting first m and then $n = 0$. In the first case we get $f\,(d) = n$; that means the secondary charge applies after the consumption has reached a certain amount of n kw-hours independent of the kilowatt demand; for instance, 50 kw-hours. This would correspond to $m'_1\,n'_1$ in Fig. 8, which shows again the de plane (bottom plane). Equation (9) then changes into

$$a = (p - s)\,n + es \qquad (9a)$$

Since p, s and n all are constants, the first term $(p - s)\,n$ of the right member also is a constant and the equation has the type of equation (6),

$$a = x + ze$$

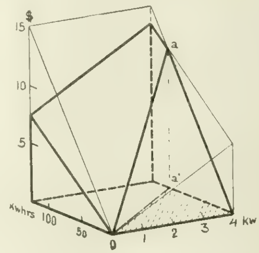


Fig. 10—Model of Multiple System.

where x is the fixed customer charge and z the kw-hou charge; no demand charge is made. This rate systei expresses, therefore, in its secondary range a system of th type Fig. 7.

Fig. 9 is the model of a rate of that kind (primary charg $p = 12$ cents per kw-hour up to 50 kw-hours, after whic the secondary charge of $s = 6$ cents applies) and show from a geometrical point of view the same results as w found algebraically. If the secondary plane is parallel to th demand axis that means no demand charge is mad $(y = 0)$, and if produced backward beyond its range th secondary plane intersects the axis of a at the distance O. above the origin O, that means a constant customer charg OA is made where $OA = (p - s)\,n = (12 - 6)\,.50 =$ 300 cents.

The second special case mentioned above (setting $n =$ in the equation $f\,(d) = md + n$) results in a straight lin issuing from the origin O (Oa' in Fig. 8) and rising fro the kilowatt axis at an angle the tangent of which is m That means the secondary rate applies after a certain loa factor is reached or, in other words, after the maximu demand has been used for a certain number of hours p month. This is the famous Wright system.

The function $f\,(d) = md + n$ is reduced to $f\,(d) = m$ and equation (9) becomes

$$a = (p - s)\,md + es \qquad (9$$

p, s and m are constants and calling $(p - s)\,m = y$ a $s = z$, we get

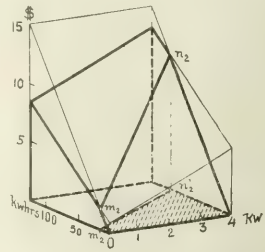


Fig. 11—Model of Three-Charge System.

$a = yd - ze$, which is identical with the equation () for the Hopkinson rate.

Fig. 10 is a model for a multiple system of this kd ($p = 12$ cents per kw-hour; $s = 6$ cents per kw-hour plying after twenty-five hours' monthly use of the mai mum demand, Oa' in Fig. 8). This model shows that n secondary range we are having a Hopkinson sys n

(compare Fig. 4) and also shows plainly where the Wright schedule and the Hopkinson say the same, viz., in the secondary range, and where and in what way they differ from each other.

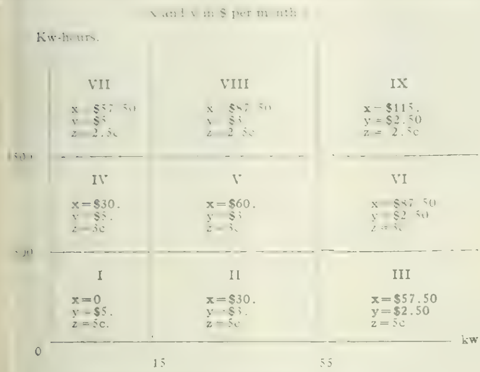


Fig. 12—Nine Ranges of Charges.

.f a secondary charge is made after a certain constant umber of kw-hours, the result is a constant customer arge for the secondary plane. If, on the other hand, the condary charge is being made after a certain number hours' use of the maximum demand, the result is a de-nnd charge. It may be expected from this that by a mbination of these two methods one can get a true ree-charge system with both customer charge and demand arge, and this actually is the case. The secondary charge i this case is to be used after a number of kw-hours is ached which equals a certain number of hours' use of maximum demand plus a constant number of kw-hours. If $f(d) = md + n$, equation (9) changes into

$$a = (p - s)(md + n) + es \qquad (9c)$$
$$= (p - s)\,n + (p - s)\,md + es$$

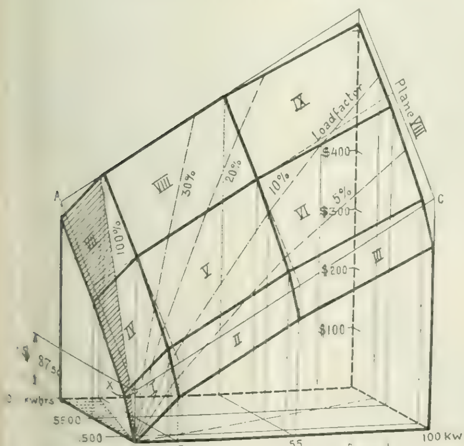


Fig. 13—Space Representation of Charges in Fig. 12.

$$= x + yd + ze$$

where

$$x = (p - s)\,n = \text{constant}$$
$$y = (p - s)\,m = \text{constant}$$
$$z = s = \text{constant}$$

We see, therefore, a true three-charge system resulting. Fig. 11 represents a model for a system of rates of this type ($p = 12$ cents per kw-hour, $s = 6$ cents per kw-hour, $m =$ twenty hours, $n = 15$ kw-hours; that means the secondary charge applies after twenty hours' monthly use of maximum demand + 15 kw-hours is reached. m', n'_2 in Fig. 8. The shape of the model, Fig. 11, shows from the geometrical point of view that we now are getting a true three-charge system in the secondary range.

We get then $x = (p - s)\,n = 90$ cents
$y = 120$ cents per kilowatt
$z = 6$ cents per kw-hour

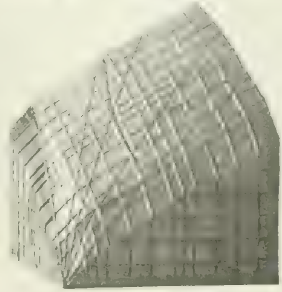


Fig. 14—Boston Lighting Rate.
100-kw simultaneous demand; 1000 kw-hours; $615.

Another method by which three-charge systems can be made without explicitly making all three charges is in use, for instance, in certain schedules of the rates in Boston and Chicago. The Boston rate, Schedule "C," for instance, says that 5 cents per kw-hour is charged up to 1500 kw-hours' use per month, 3 cents for each kw-hour between 1500 kw-hours and 5500 kw-hours and 2.5 cents for each kw-hour above 5500 kw-hours. Besides the following monthly demand charges are made:

$5.00 = 500c for each kilowatt below 15 kw
$3.00 = 300c for each kilowatt between 15 kw and 55 kw
$2.50 = 250c for each kilowatt above 55 kw

Another method by which three-charge systems can be made without explicitly making all three charges is in use, for instance, in certain schedules of the rates in Boston and Chicago. In Boston according to the so-called Schedule C rate 5 cents per kw-hour is charged up to 1500 kw-hours' use per month, 3 cents for each kw-hour between 1500 kw-hours and 5500 kw-hours, and 2.5 cents for each kw-hour above 5500. Besides the following monthly demand charges are also made: $5 for each kilowatt below 15 kw; $3 for each kilowatt between 15 kw and 55 kw; $2.50 for each kilowatt above 55 kw.

The bottom plane will, therefore, be subdivided into nine

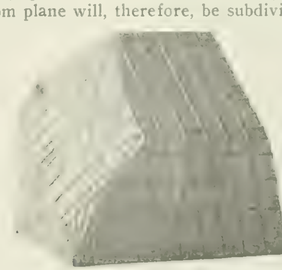


Fig. 15—Boston Lighting Rate.
100-kw simultaneous demand; 1000 kw-hours; $480.

different ranges, according to Fig. 12, and it must be expected that the function $F(d, e)$ representing the rate system is different for each one of these ranges. In range I (Fig. 12) there is, of course, an explicitly expressed Hopkinson rate, where $x = 0$, $y = 500$ and $z = 5$.

The charges for the other eight ranges are easily found,

Fig. 16—Boston Lighting Rate.
2-kw simultaneous demand; 120 kw hours; $13.20.

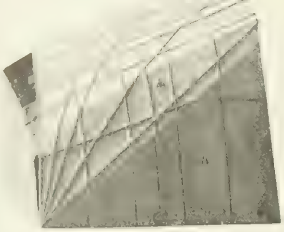


Fig. 17—Chicago Rate.
100-kw simultaneous demand; 10,000 kw hours; $495.

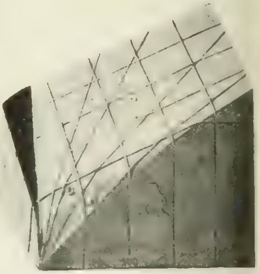


Fig. 18—Chicago Rate.
250-kw simultaneous demand; 25,00[illegible] kw-hours; $952.91.

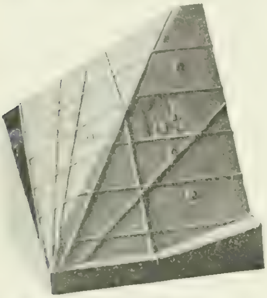


Fig. 19—Denver Lighting Rate.
40 connected 16-cp lamps [illegible] 2 kw; 120 kw-hours [illegible]

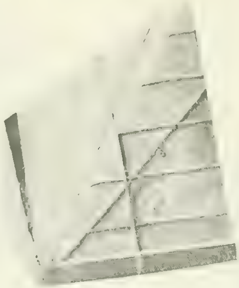


Fig. 20—Lowell Rate.
2-kw connected load, 120 kw-hours; $12.78.

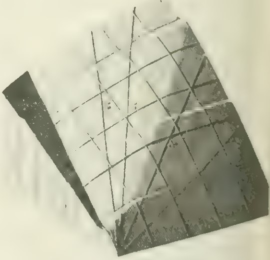


Fig. 21—New York Rate.
100-kw connected load; 10,000 k[illegible] hours; $891.00.

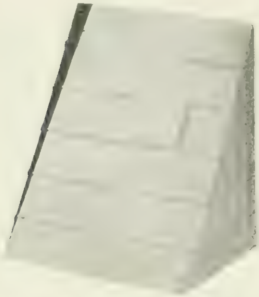


Fig. 22—New York Rate.
[illegible] connected load 12[illegible] kw-hours; $12.00.

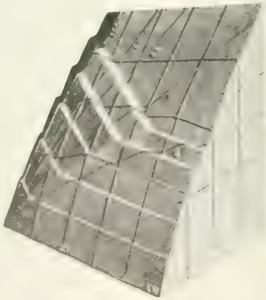


Fig. 23—Minneapolis Rate.
50-kw simultaneous demand; 4000 kw-hours [illegible]

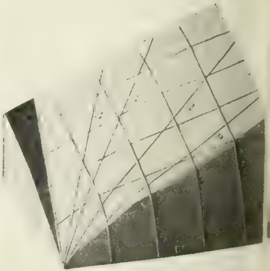


Fig. 24—Boston Motor-Service Ra[illegible]
100-kw simultaneous demand; 1[illegible] kw-hours; $373.63.

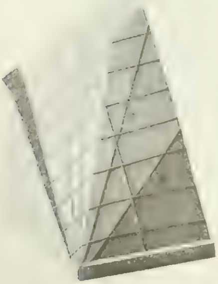


Fig. 25—Boston Motor-Service Rate.
2-kw simultaneous demand; 200 kw-hours; $16.68.

Fig. 26—Baltimore Rate.
[illegible] demand; 12,000 kw-hours; $680.00.

Fig. 27—Wilmington Rate.
250-kw simultaneous demand assumption; 1 kw corresponds to 3[illegible] cp. 25,000 kw-hours; $1,293.71.

will be shown in the following by the example of [ra]nge VIII—that is, a customer with a maximum demand [be]tween 15 kw and 55 kw and an energy consumption of [m]ore than 5500 kw-hours.

[T]he customer has to pay 5 cents for each one of the [fir]st 1500 kw-hours, 3 cents for each kw-hour between 1500 [an]d 5500, and finally 2.5 cents for each kw-hour beyond [the] first 5500 kw-hours. Moreover, the customer's de[ma]nd is charged 500 cents for the first 15 kw and 300 [ce]nts for the rest, the assumption being, as explained [ab]ove, that his demand is larger than 15 kw and smaller [tha]n 55 kw.

[Th]e total monthly bill is therefore, in cents,

$$a = 1500 \times 5 + 4000 \times 3 + (e - 5500) \, 2.5 + 15 \times 500 + (d - 15) \, 300$$

$$= 8750 + 300 \, d + 2.5 \, e$$

The rate in this range, therefore, is equivalent to a full [three-]charge system with a customer charge of $x = 8750$ [cents] = \$87.50 per month; a demand charge $y = 300$ cents [or \$]3 per kilowatt per month, an energy charge = 2.5 [cent]s per kw-hour.

[In] the same way the charges have been determined for [all ra]nges and the results have been recorded in Fig. 12. [I]t can be seen from this that the customer charges can b[e] quite considerable and are much higher than is usually [ass]umed, running in this particular case up to \$115 a [mo]nth. Customer charges of about the same order are [als]o implied in the schedules for large customers in other c[iti]es, although they are not always explicitly expressed. [A]fter the three charges for each range are found the [corr]esponding planes can be constructed without difficulty, [the] intersection of each plane with its neighbor being, of [course], directly above the 1500 kw-hour or 5500 kw-hour [line o]r the 15-kw or 55-kw line respectively. Fig. 13 is an o[ut]line drawing of the solid representing this rate system gi[vi]ng at the same time the plane of the range VIII pro[duc]ed (*ABCX*) in order to show the geometrical meaning [of the] above algebraical deduction. The height *OX* is the [custom]er charge of \$87.50. Fig. 14 is a photograph of the [mode]l of the above schedule.[2]

[In a]ddition to Schedule C there are two optional sched[u]les in Boston, called Schedule A and Schedule D_1, which ar[e] described below; these will cut off parts of the surface of [th]e solid shown in Fig. 14. Schedule A is a straight-meter ra[te] of 11 cents per kw-hour and Schedule D_1 charges \$2[16]0 per year for each customer (\$180 per month) as fix[ed] charge and besides 3 cents per kw-hour. D_1 is there[fo]re a three-charge system with demand charge $y = 0$ an[d b]oth remaining charges explicitly made in the schedule. Th[e] equation is $a = 18{,}000 + 3\,e$ (in cents) and of Schedule [A, $a = 11$]e.

[Wh]erever these planes are lower than the nine planes [refer]red to above they cut off a corresponding piece of the [solid], the resulting composite block being as shown in Fig. [15, wh]ich represents a model of the combination of Sched[ules] A, C and D_1, and gives the lowest one of the three [s]chedules for each respective customer.

[Fig.] 16 is the part of the model of Fig. 15 near the origin [of c]ordinates built on a greatly enlarged scale in order [to sho]w two additional features which cannot be ex[presse]d in the smaller scale. The first one is a minimum [charg]e of \$1 per month, which results in the step at the [left] edge of the model, and the other one is a stipulation [of Sc]hedule C that the demand shall in no case be taken into [consider]ation at less than 0.2 kw. Therefore, for all such [custo]mers whose demand is smaller than 200 watts the [equati]on $a = yd + ze$ in range I becomes

$$a = y \times 0.2 + ze$$

$$= 500 \times 0.2 + 5\,e = 100 + 5\,e.$$

which results in the inclined step at the left side of Fig. 16.

The Chicago rates, which are represented in Figs. 17 and 18 in two different scales, are composed in a similar way of (1) a Schedule C on the same principles as in Schedule C in Boston, but with different numerical values and (2) an optional Schedule A, which is a Wright schedule, and, therefore is represented by two planes.[3] The model shows that schedule A is the more advantageous one for short-hour users.

Fig. 19, the Denver lighting rate, consists of a straight meter rate, Plane M, and an alternative three-charge system called "readiness to serve," Plane RTS, involving a customer charge of \$9 per customer per year plus a "demand charge" of \$1.80 per year per 16 cp connected and 5 cents per kw-hour. All bills are subject to 10 per cent discount for prompt payment.[4]

The meter rate and the "readiness-to-serve rate" again combine into one solid. As a reverse operation of the resolution of a multiple system into two different rates as shown, the Denver rates might also be reduced into one multiple-rate system without changing anything else but the form of expressing the rates. The bill of each customer, the total income of the central station and the model would not be affected by such a change. The minimum charge is 5 cents per month per lamp installed and not less than \$1 per month. This results in the peculiarly shaped step at the bottom of Fig. 19.

An interesting rate system is in use in New York,[5] as represented in Figs. 21 and 22. This is a multiple-rate system, but with more than two gradations. There is a primary charge of 10 cents per kw-hour for the first thirty hours' monthly use of connected load; a secondary charge of 9 cents for the next thirty hours; a tertiary charge of 8 cents for the next thirty hours; a quaternary charge of 6 cents for the next thirty hours; a quintenary charge of 5 cents for the next 300 hours and a sextenary charge of 5 cents for the excess above 420 hours. This is, therefore, as it were, an extension of the Wright schedule. This results in six planes all meeting at the origin *O*, and each one tilted at a smaller angle toward the horizontal than its predecessor, so that a series of triangles results somewhat like a fan bent into a curved surface. Furthermore, there is a reduction of 5 per cent to be made of the total bill if the aggregate of energy used averages 5000 kw-hours monthly and 10 per cent if 10,000 kw-hours is exceeded. Therefore, the height of all planes has to be lowered by 5 per cent between 5000 kw-hours and 10,000 kw-hours, and by 10 per cent above the 10,000 kw-hour line. This would result in a sudden drop of the amount of the bill as the customer's energy consumption rises, for instance, above the 5000 kw-hour line, and all customers using between 4750 kw-hours and 4999 kw-hours would have to pay more than if their energy consumption had reached 5000 kw-hours. To avoid this no bill is issued to a customer for a consumption of less than 5000 kw-hours at a cost greater than it would have been had the energy used actually amounted to 5000 kw-hours at unchanged connected load. This means that in the model the saw-tooth humps resulting from the sudden drop of the amount of the bill have to be smoothed out in the following way: Draw horizontal lines parallel to the kw-hour axis through every point of the line of intersection of the discounted surface (5 per cent) with the 5000 kw-hour plane; in other words, through every point of the lowest edge of the 5 per cent discounted surface. The locus of all these hori-

[2]The models of which the accompanying photographs were taken ... [necessari]ly to be made in various scales; the scale is indicated at the ... [o]f each cut by giving the number of kilowatts which correspond to the length, the number of kw-hours corresponding to the width and the number of dollars represented by the height of the model at its highest point.

[3]As regards numerical values, for all models throughout have been chosen the net amounts of the bills after all cash or other discounts are given.

[4]The demand charge in this case is, therefore, not based on the maximum demand, but on the candle-power connected and the scale of the axis *d* should, therefore, be expressed in candle-power as unit. In order, however, to bring this model to approximately the same basis as the rest it has been assumed in a more or less arbitrary way that twenty 16-cp lamps correspond to 1 kw (connected), so that the scale is given also in this case with the kilowatt as the unit.

[5]This system has been superseded recently by another schedule.

zontal lines forms six planes parallel to the kw-hour axis and the change from the undiscounted to the discounted surface has to be made on these planes, as shown in the photograph. The same thing, of course, applies to the 10,000 kw-hour line. A minimum charge is made under this schedule, but it is not a fixed amount, but based on a certain minimum amount of kw-hours (2000). One must draw the intersection of the surface with the 2000-kw-hour plane and through this intersection line pass planes parallel to the kw-hour axis in the same way as described above. These planes will then determine the minimum charge. A large part of the range of this minimum charge, however, is cut off by another schedule, a straight 10-cent meter rate, as shown in the model.

The equations of the planes are easily found:

Primary $a = 10\,e$.

Secondary $a = 10 \times 30\,d + 9\,(e - 30\,d) = 30\,d + 9\,e$.

Tertiary $a = 10 \times 30\,d + 9 \times 30\,d + 8\,(e - 60\,d)$.
$= 90\,d + 8\,e$.

Quatenary $a = 10 \times 30\,d + 9 \times 30\,d + 8 \times 30\,d$
$+ 6\,(e - 90\,d) = 270\,d + 6\,e$.

Similarly:

Quintenary $300\,d + 5\,e$.

Sextenary $600\,d + 7.5\,e$.

All planes after the primary are Hopkinson planes.

A similar gradation by quantity discounts is shown in the Minneapolis model, Fig. 23. The basis of this system is a pure Wright schedule with a dividing line of fifty-two hours' monthly use. Two different kinds of discounts are granted. One is a quantity discount varying by steps of 5 per cent between 0 per cent and 25 per cent, which in this rate is made after the bill has reached a certain amount and not as in New York after a certain number of kw-hours is reached. This means that the lines along which the discounts are changing from one percentage to the next are the intersections with horizontal planes instead of with constant kw-hour planes (vertical) as in New York. The humps are smoothed out in exactly the same way as described above. After this a cash discount is allowed on bills paid within a certain time. This discount, however, is not a certain percentage, but 4 cents per kw-hour on the primary rate of 14 cents and 1 cent per kw-hour on the secondary of 7 cents. The cash discount, therefore, is a smaller percentage for customers whose bill is constituted in great part of the secondary charge—that is, for long-hour users. The larger the load-factor of a customer who gets the benefit of the secondary rate the smaller his cash discount will be in per cent. Since in this model, as in all others, the net bills have been reproduced, the lines along which the quantity discounts are changing are, therefore, not horizontal in the secondary range, but they rise with rising load-factors, whereas the same lines in the primary range remain horizontal.

The Boston motor-service rates, Schedule B, are shown in two different scales in Figs. 24 and 25. This schedule is as follows:

A price of 12 cents per kw-hour is charged for all electricity furnished, with five different deductions which apply partly after certain load-factors and partly after certain amounts of monthly bills are reached. The fifth deduction reduces the average price per kw-hour to 11 cents whenever the average price, after the foregoing deductions have been made, exceeds 11 cents, but in no case shall the monthly bill be less than $1. By expressing this schedule in form of equations $a = F\,(d, e)$ there are obtained nine different planes.

Here as in all previous cases the lines of mutual intersection of the planes in space (including the traces on the planes of co-ordinates) can be found by application of the rules of elementary analytic geometry and descriptive geometry. By projecting the lines of intersection on the horizontal plane of *de* there are obtained the dividing lines between the ranges of the different planes, both graphically, as the result of descriptive geometrical methods, and by their equations, as the result of the application of analytic geometry.

Fig. 26 illustrates an interesting system of rates; the Baltimore schedule, which is represented not by planes but by curved surfaces (hyperbolic paraboloids). This rate system is a Wright schedule (primary 10 cents per kw-hour up to fifty hours' use, secondary 5 cents, 5 per cent cash discount) with the additional feature that beginning from a demand of 3.75 kw certain deductions are made from the secondary charge as the maximum demand increases. The secondary charge of originally 5 cents per kw-hour diminishes 0.1 cent for every 0.75 kw of maximum demand between 3.75 kw and 18.75 kw, so that it reaches 3 cents at 18.75 kw. Between 18.75 kw and 93.7 kw a diminution of 0.1 cent takes place only for every 7.5 kw and beyond this for every 56.25 kw. This results in three different paraboloids, the ranges of which are divided from each other by the 18.75-kw and 93.75-kw lines (parallel to the axis of *e*).

As can be seen from Fig. 26 in the range of the first paraboloid (3.75 kw to 18.75 kw) the surface forms a peculiarly shaped horn. This horn is the result of the fact that the secondary charge decreases much more rapidly between 3.75 kw and 18.75 kw than in the range beyond 18.75 kw. A similar horn would show in the ranges of the other paraboloids if the model was extended far enough into the large energy consumptions. These horns are, however, of little practical importance, since they are not only cut off to a large extent by the 100 per cent load factor, but they also apply to very large load-factors only and customers with very large load-factors are served on another schedule, the industrial schedule.

Since, as stated above, the secondary charge is a variable only for demands above 3.75 kw, for demands below that amount (residences, etc.) there is a pure Wright schedule. According to a further stipulation the secondary charge does not apply at all if the use of energy does not exceed a minimum total of 50 kw-hours. By imagining the shape of the model it can be easily seen that this is only another wording for what was found already in the Boston retail rates (Fig. 16), namely, that no demand shall be taken into consideration at less than a certain minimum; this minimum in Baltimore is 1.11 kw. As the Baltimore rates also provide a minimum charge per customer ($1) the retail model will be of exactly the same type as Fig. 16.

Even in those rare cases where, as in Baltimore, the surfaces of the models are not planes but curved surfaces, there will always exist an equivalent three-charge rate which can be found by passing a tangential plane through the point under consideration on the surface. This plane will indicate the three charges by its position in space. In this case, therefore, the three charges will vary gradually from one point on the surface to the next (that is, from one type of customer to the next), whereas in the majority of cases (where the surfaces are planes) the three charges are constants for a certain range and then change abruptly.

The above discussion of a number of representative rate systems does not, of course, in any way claim to embrace all the rate systems in use. It will be found, however, that the vast majority of all rates can be reduced to the simple elements as the examples dealt with above, such as multiple rates, graduated unit prices, quantity discounts, minimum charges of various descriptions, etc., and it is then an easy matter to get a clear idea of the character of a certain type of rate by means of representing it by a model.

A geometrical and algebraical analysis of a certain system of rates along the lines indicated in this article may also show how to avoid an unnecessary complication in making the schedule to express a certain desired system of rates.

LETTERS ON PRACTICAL SUBJECTS

PHOSPHOR-BRONZE ARMATURE BINDING WIRE.

The accompanying table giving the properties of phosphor-bronze wire as used for binding wire on armatures may be useful to some readers of these pages.

Number.	Diameter, Inches.	Elongation in 8 In., per Cent	Elastic Limit, Pounds per Square Inch.	Tensile Strength Pounds per Square Inch.
20	0.032	0.30	95,000	130,000
17	0.045	0.40	90,000	130,000
15	0.057	0.50	80,000	130,000
14	0.064	0.50	80,000	125,000
13	0.072	0.60	80,000	125,000
10	0.102	0.75	80,000	125,000

Kenyon, R. I. H. M. Nichols.

COMPARATIVE FLOOR SPACE OCCUPIED BY ENGINES AND TURBINES.

A certain electric light and power station was formerly supplied with power by four tandem compound condensing engines, belted to one long shaft, from which power was taken to drive several generators, as shown in Fig. 1. The space occupied by this machinery was 62 ft. long.

The use of these engines was discontinued and one steam turbine installed, which furnished an equal amount of

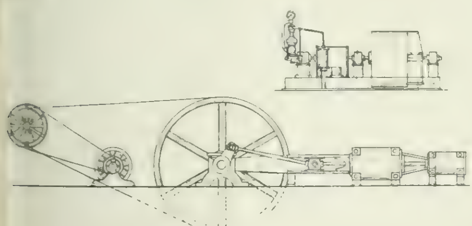


Fig. 1—Side View of Belted Units and Turbine.

power. This is shown above the engine in Fig. 1, and as they are both drawn to the same scale the comparative space is at once apparent, as only 22 ft. are required by the turbine.

Fig. 2 is an end view of the same machines, showing the engines each 10 ft. wide, exclusive of the space between them, while the turbine is only 4½ ft. wide. As these are drawn to the same scale, the differences in space required can be seen at a glance, thus giving a graphic representation of the great improvement made in this

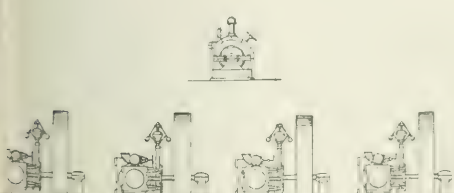


Fig. 2—End View of Belted Units and Turbine.

respect by introducing one turbine to displace four engines. One day this turbine broke down and the internal parts were shipped by express to the manufacturers for repairs. They were returned in two months. A comparative break in one of the engines would have disabled one-quarter of this plant for two or three days. This illustrates a phase of the subject that is not always included in description of such plants.

New Haven, Conn. W. H. Wakeman.

USE OF IRON PIPE IN PLACE OF CONDUIT.

In so far as the writer has been able to ascertain electrical conduit is merely commercial wrought-iron pipe of standard weight that has been carefully reamed inside to remove burrs and then treated with zinc, or an enamel baked on, to prevent rust. The threads on the ends of conduit lengths are standard pipe threads. Hence, where underwriters' inspectors do not have jurisdiction iron pipe can be used instead of conduit. The pipe is cheaper, and in dry locations it appears to serve as well as conduit. A coat of black stove-pipe enamel on the outside of the pipe will give it a finished appearance, and more than a superficial inspection is required to distinguish a pipe so treated from conduit. It is the practice in some industrial plants where the buildings are all of fireproof construction and where no insurance is carried to use galvanized-iron pipe instead of conduit.

Dayton, Ohio. G. M. Keller.

GENERATOR AND MOTOR BELTS.

The providing of serviceable and economical motor and generator belts is a problem which has vexed many a designing engineer and station manager. The rubber belt is not to be considered for this service. Rubber has become too scarce and costly to be considered in the same breath with transmission belting, and belts made with many of the so-called "rubber substitutes" will be considered by the same purchaser but once after he buys them, and that consideration is how to get rid of them without loss of first cost or delay to the plant. Good leather belting, honestly made from well-tanned hides, leaves nothing to be desired in the way of belting for almost any purpose; but genuine leather belting, cut from the backs of bullocks, is too much like turtle soup—for every genuine one there are ten imitations.

The only way to procure a leather belt which is strictly short lap, from the backs of hides, and which has been properly tanned and which measures not less than 3/16-in. in thickness and weighs not less than 32 oz. to the square foot of single thickness, is to inspect everything from the time the hides are dehaired until the belt is delivered. The tanner has methods of profit whereby he can hasten the tanning process, and the currier has other methods of great interest to him, as thereby he can take thin, light hides which will not pass the thickness and weight specifications and by stuffing these hides with fish oil and other substances he soon causes the light hides to thicken past the limit and to weigh 16 oz. to the pound when he gets through with them. And on top of all that there is a way of cutting the sides and belly of the hide into short-lap pieces for belts which, when sold at regular short-lap prices, prove most profitable. Belts thus made cause power to be lost through uneven running, for steady power cannot possibly be transmitted through belts which have stretched on the edges until they are swaying from side to side and threaten to run entirely off the edges of the pulleys every time the belt-length comes around.

The writer has been through this belt business and has come to the conclusion that the leather belt can be dispensed with altogether and impregnated stitched cotton belts substituted for the leather, with satisfactory results, in every case likely to come up in general engineering practice. The writer some time since specified these belts for a factory which was driven by a 15-hp induction motor with a 6-in. by 6-in. pulley. In this factory there was a pressure

[illegible] 3 in. belts running over 4 in. by 3 in. pulleys on the blower-shaft. All three of these belts have been in continual use for several months, have given no trouble at all and are apparently in just as good condition as the day they were installed.

It will not do, however, to select any piece of this belting which comes to hand, put it on the pulleys and expect it to give good service. In place of haphazard methods the belt must be carefully selected and put through certain tests before acceptance. A good method of testing this kind of belting is to lift a crosswise yarn, unravel it and count the number of threads. In the best belting these threads are seven in number. Another yarn should then be taken out of the lengthwise weave and its threads counted also. These threads should equal in number those in the other yarn. When this is the case the weave is said to be equalized and the best possible combination has been made in both warp and filling. Next, make a knife cut exactly 3 in. from the end of the belt. It is not necessary that 3 in. be taken for the distance of the cut, but this is a convenient distance and is taken for the reason that many of the belt samples are cut 3 in. in length, hence it is possible to test out samples by taking that length of cut. Carefully remove a length of the yarn from the warp, and it may be noted that it is wavy or crinkly, on account of the weave. It is the straightening of these kinks which gives the stretch that is sometimes troublesome in this class of belt, but when the directions given hereinafter are followed there will be no trouble from undue stretching. Straighten the bit of yarn by pulling it between the fingers, taking care that none of the twist is taken out of the yarn. If some of the twist is lost, put it back again, for the yarn must not be unduly lengthened by untwisting it. After the crinkle has all been taken out measure the length of the yarn again and note the increase caused by rubbing out the waves or crinkles. The elongation should not be much greater or less than 25 per cent in any belt which is accepted. When the elongation is more than 25 per cent the belt is so slackly woven that it will stretch unduly, and when the elongation is less than the stated amount the belt is too tightly woven and the pull upon the threads will result in cutting or breaking them before the belt has worn out otherwise.

There is another point which must be strictly looked after if good service is to be obtained from this type of belting. The transmission should be designed and the diameters and faces of pulleys chosen so that together with the necessary belt speeds the belt will in no case be subjected to a working pull or strain of more than 40 lb. to the inch of width. A belt thus designed and proportioned will wear long and give little trouble. Belts of this material may be put together in a variety of ways. They may be laced, but a hinge lacing is preferable. A good way to join this kind of belt is by means of "Bristol" belt hooks. This fastening is a wrought-steel plate with rows of teeth turned up at either end, the teeth being driven through the belt and clinched on the pulley side. The fastenings hold well and when the belt is taken up or shortened it is necessary to cut out only 1 in. of belt, that being the length taken up by the fastening in question.

The best belts of this material are filled with linseed oil or with a preparation of paraffin. Either filling suffices, but the paraffin filling is the more pliable and the writer believes the belt lasts longer than the belt filled with paint oil. Still, either kind is good, and if selected as directed will save more than two-thirds of belt bills.

Scranton, Pa. JAMES SCOTT.

FILING ENGINEERING CLIPPINGS.

I was interested in the description in the first issue of October (page 887) by Mr. H. M. Nichols of his envelope system for filing clippings. I use a similar system which I have further improved by using translucent envelopes which save writing, as the headings given the article by the author can be readily seen and the clipping can at once be placed in the file in alphabetical order. Each clipping is by itself and protected from injury, and can easily be handled and rearranged according to the place desired in one's studies. Some of the envelopes are of the size of an index card, and there are several larger sizes up to the size of a magazine page. I have called them "Kwiktofile" and "Kwiktofind."

Penn Yan, N. Y. EDWARD R. TAYLOR.

A METHOD OF MAKING UP A GROUND WIRE.

Where a ground wire is to be connected to a pipe and no ground clamp is available the method herein described and illustrated can be used. A length, possibly 3 ft., of the ground conductor is "skinned" and carefully scraped or cleaned with fine sandpaper. The pipe on which the connection is to be made is filed bright and clean for a distance of several inches and "tinned" if the connection is to be soldered. Then the bared end of the conductor is arranged on the brightened portion of the ground pipe, as indicated

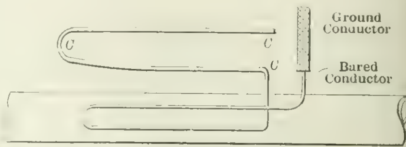


Fig. 1—First Step in Making Connection.

in Fig. 1. The free end of the wire (c, c, c, Fig. 1) is th[en] served around the pipe as suggested in Fig. 2, and the fr[ee] end, c, of the wire is passed through the loop B. The e[nd] A is then pulled. This draws the loop B and the end c tightly against the other turns and effectively prevents t[he] wrapping from unwinding.

In an actual connection the turns on the pipe are wo[und] closely together. They are shown separated in Fig. 2 b[et]ter to illustrate the method. The connection can be solde[red] with a blow torch and wire solder using a paste flux or [by] pouring molten solder over the connection until it is [hot] enough for the solder to adhere. The soldering pot sho[uld] be held under the connection during the pouring to ca[tch] the solder as it drops from the connection.

Where soldering is not feasible the connection can [be]

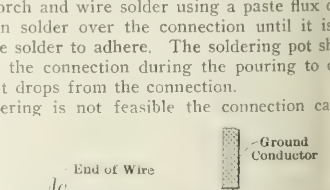


Fig. 2—Connection Ready to Pull.

wrapped with a couple of layers of tinfoil and then [with] several layers of friction tape. These layers exc[lude] moisture and prevent oxidization. One of the large [tele]phone companies has used the tinfoil and tape metho[d on] many hundreds of ground connections for telephone [sub]scribers' stations with excellent results. The tinfoil [and] tape should extend along the pipe for several inche[s on] each side of the connection and should be wrapped fi[rmly] so that they will form a moisture-proof jacket.

Bridgeport, Conn. GEORGE L. EDG[

SOLDERING WITH BLOW TORCH AND IRON.

When soldering connection between wires smaller [th]an No. 8 many wiremen use a blow torch for heating the joint. While a joint can be made in this way, the [wri]ter

has found it much better to use a soldering copper where small wires are involved. Where a blow torch is used the insulation on the conductors is nearly always ignited and burns with a thick smoke and blackens any object on which it deposits. If the work is being done near a clean ceiling or side wall the result is a sooty spot near the point where each joint is made. It is probable also that the excessive heat of the blow torch injures the adjacent insulation on the conductors. Furthermore, the blow torch is difficult to manipulate in restricted locations. A small alcohol torch is sometimes used instead of a blow torch and is better adapted for the work, but it is probably not as good as a soldering iron.

In using a soldering copper it is heated in the flame of a blow torch. To solder the joint the hot tool is placed under and in close contact with it and wire solder is fed into the turns of the joint. After the solder has flowed over the entire surface of the joint the iron is removed and the joint is shaken to throw off surplus solder. There is no ignition of insulation and no sooty smoke where a joint is soldered in this way. The soldering copper can be used in confined spaces where the use of a torch would be out of the question. It is understood that the wires to be soldered must be scraped clean and bright before the tool is applied. Any of the commercial soldering pastes will probably be found convenient as a flux.

Toledo, Ohio. CARL JENNINGS

HOME-MADE DEVICES USED IN ENLARGING STATION.

Extensive enlargements and improvements now in process at the Colfax Avenue (South Bend, Ind.) station of the Indiana & Michigan Electric Company, which have been vigorously prosecuted for over two years, are seemingly unable to keep pace with the increasing business of that company and the new turbine station, recently completed and described in these columns at various times, is now undergoing enlargement in the boiler house. Four steel stacks are to be removed and two reinforced concrete stacks, 220 ft. high with a flue diameter of 11 ft., are being erected and one has already, as shown by Fig. 2, reached a height of 180 ft.

Fig. 1 shows the manner in which a stack was commenced, two sections of mold being visible above ground with another section just in sight below the ground line. The method by which the reinforcing is centered and held in place is shown by the upper stage above the stack. Fig. 2 shows the other stack, which had reached an elevation of about 160 ft. at the time the photograph was taken, with 60 ft. more to go. In the foreground of this half-tone may be seen the sheet piling along the excavation for the water tunnel. The rail beside the excavation is for a traveler of 8-ft. gage which carries a stiff-legged crane, which in turn is fitted with a bull-wheel, movable boom and which is actuated by a three-drum hoisting engine. This traveler is described later.

The manner of mixing and hoisting concrete for the stack and for the large amount of underground work and the base of the stacks calls for several mixers of the most improved types. Fig. 3 shows an electrically driven tube mixer of large capacity, equipped with a power loader which takes material direct from barrows, a hole having been excavated in the ground to permit the loader to go down very low so that barrows may be dumped directly into the loader. The mixer is arranged to discharge into small steel cars, which are pushed over light tracks to the point where concrete is required. This half-tone also shows the base of the higher stack and the fine appearance of the concrete composing this stack is plainly visible. The writer has never seen a cleaner or better appearing bit of concrete work, which is made from Indiana gravel and good, clean sand.

Hoisting material to the top of the stack is effected by a very ingenious and simple piece of apparatus shown by Fig. 4. This rig is so simple that the writer is almost ashamed to describe it, but at the same time the device is a masterpiece of true engineering and of making good with the simplest articles. The winding drum is an old affair

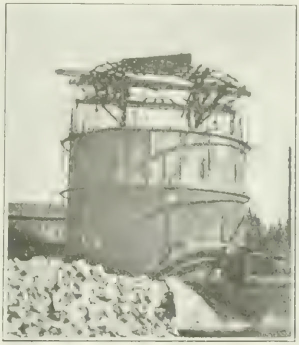


Fig. 1—Beginning of Stack.

taken from some contractor's wall derrick. Being hollow, a piece of steam pipe was thrust through it for a shaft and the drum turns loose upon the pipe shaft, which is housed in slots cut in pieces of 2-in. planking, which form the frame of the little machine. A 24-in. pulley, bolted to one head of the drum, receives a 6-in. rubber belt from a 6-in. pulley placed on a short shaft located on a couple of blocks which in turn rest directly upon the ground or upon another pair of short blocks. Another 24-in. pulley upon the lower shaft receives power from a small three-phase motor conveniently located in a rain-proof box near by.

A simple plank lever, fully shown by the half-tone, is located upon the upper shaft. When it is desired to hoist a load of concrete the handle of the plank lever is de-

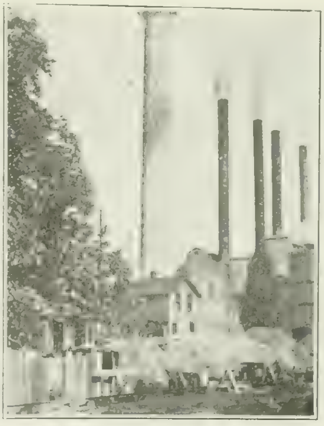


Fig. 2—Concrete Stack.

pressed. This raises the shaft and tightens the short rubber belt, causing the drum to wind upon it the hoisting cable. When the load of concrete has arrived at the top of the chimney the plank lever is raised and this lowers the shaft, loosens the belt and the drum ceases to wind on more of the cable. But this is not all that the machine does.

Between the folds of the belt, directly below the pulley, there is a segment of planks nailed together and fitted to the circumference of the pulley. When the end of the plank lever is raised the shaft is lowered and the belt loses power, as stated, but when the lever is raised still farther the face of the 24-in. by 6-in. pulley is brought into contact

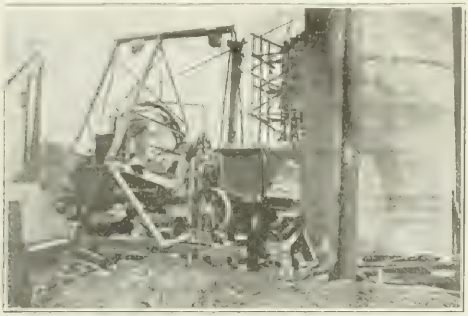


Fig. 3—Electrically Driven Cube Mixer.

with the segment which acts as a brake and holds the load securely at any point. The entire amount of material used in one of these large stacks was hoisted by means of this simple home-made machine, which seems capable of hoisting material for another stack without repairs or renewals of any of its home-made parts. In fact, the entire series of operations in connection with the improvement of the Colfax Avenue station seems to have been carried on by the use of the simplest material. The derricks employed in the excavating work are built up from telegraph poles and common timber shapes which will be available for their usual purposes after the construction work is finished. Resourcefulness is shown in the economical make-up of the necessary machine and appliances.

One machine in particular is well worthy of note. It is the crane referred to above, which travels upon such a wide track and handles all the material from the water tunnel. Fig. 5 gives a head-on view of the machine, showing very plainly the manner of its construction from square timber

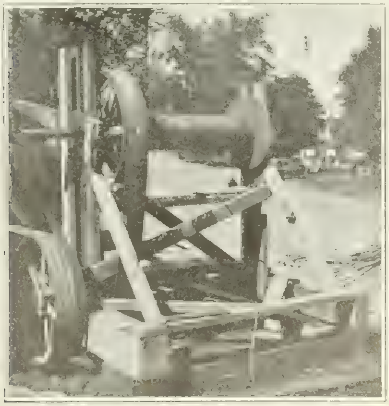


Fig. 4—Simple Brake Hoist for Stack Work.

and stock sizes of stuff. The width of track is discernible in this half-tone and also the manner in which the floor of the hoist is raised upon a sort of rudimentary truck to a plane several feet above the ground line. Taken in connection with Fig. 6 a very clear idea of the construction of the traveler may be obtained, enough to permit an engineer to use in other operations the excellent ideas there contained. The iron used in the derrick is nearly all plate cuttings, bolts and pins. There are very few forgings used, and such as are required are nearly all formed by bending plate or standard shapes of structural steel into very simple forms. Fig. 5 also shows the loading platform upon

Fig. 5—Front View of Traveling Hoist.

which a man stands to receive and dump the buckets o material as they are hoisted, one of the buckets being showı on top of the loading deck. This deck is picked up by th traveler and moved along as found necessary.

The traveler is not self-propelling. A set of tackl rigged ahead and another set in the rear, with the line therefrom brought into the traveler house, where they ma be given a turn around the winch-head, furnishes ampl propelling power, deadmen being located ahead and behin the traveler for attaching the towing tackle.

Fig. 6 shows very plainly the simple construction of th device. The boom consists of two timbers spliced to th required length. The truck frame consists of four moı timbers laid in pairs with the wheels between and mounte on short shafts. Little further description is necessar the bracing being plainly seen and the location of tl hoisting engine over the rear axle furnishing ample loa to prevent the tipping up of the traveler under any load is required to handle in digging the ditch or placing tl double line of conduit tile. It seems to the writer that tl steelwork of this and of several other pieces of contractoı apparatus used upon this work has been designed with view of being interchangeable and capable of being us

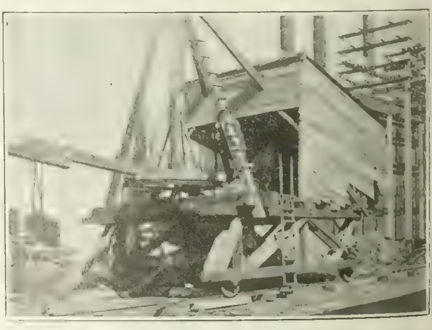


Fig. 6—Side View of Traveling Hoist.

in many future operations where derricks and travelers f different size and capacity may be required. To this sta ard steelwork timbering of required dimensions is fi d and the material-handling apparatus is put together qui y and with little expense.

South Bend, Ind. JAMES F. HOBAR

QUESTIONS AND ANSWERS

In using air-cooled transformers in connection with rotary converters, ... ascertain how much air to provide for the transformers. W. L. ...

The manufacturers usually specify 150 cu. ft. of air per minute for each kilowatt lost in the transformers.

What is the cost of running a ... in large cities where ... streets are paved with asphalt. ... M.

The cost would depend very much on the character of the subsoil. In New York, for instance, much of the work would require blasting of rock, which in many sections comes within a foot or two of the street surface. In another city of over 1,000,000 inhabitants with sandy subsoil it is stated that the cost of making a 100-ft. extension, including the replacement of asphalt, is approximately $350, $270 for material and $80 for labor. In the average American city the cost of running a tile duct on an asphalted street would approximate $1 a foot.

... it necessary to ground the frame of an alternator? L. L.

The Underwriters require the frame of a machine generating an emf greater than 550 volts to be permanently and effectively grounded, while one having a lower emf must be insulated wherever feasible. In addition a high-potential machine should be surrounded by an insulating ...form, according to the Underwriters, so arranged that ... must stand on it in order to touch any part of the ...chine. In an alternating-current system of distribution ...ing many branches a fault in a cable is by no means an ...mmon occurrence. If such a fault occur then everyone ... insulated from earth is under the influence of this ...rt-circuit to earth. If it were possible for current to ... through the fault and then through any one back to ...machine it would result in shock more or less injurious. ...y cases of shock are due to persons touching the frame ...the machine, and this of itself should be sufficient reason ... grounding a machine. With an insulated machine it is ...ible for a fault to occur in a cable and one in the ...ling of the machine at the same time and both pass ...ticed. With a grounded machine current would flow ... the coils of the machine be more or less overheated ...rding to the extent of the fault.

...he August number in an answer to a question asked by "W. T. W." ... stated that when two of the eight poles of a revolving-field generator ...moved and the other poles are not redistributed the frequency of the ...ered emf will be the same as formerly. The only change will be that ... delivered emf will be decreased by 25 per cent and the voltage regula... will be poorer than formerly. I cannot see how you can remove two ... without changing the frequency. In the case of an eight-pole ...hine having a frequency of 60 cycles, for instance, the generator would ... at 900 r.p.m. Why should not the frequency be reduced 25 per cent ...vo poles are removed just as the emf is reduced? If not, why is it ...ssary to have more than two poles on any frequency at any speed? F. J. F.

...he method of determining the frequency of an alter...or in cycles per second, by multiplying the number of ...es by the speed in r.p.m. and dividing the result by ..., is applicable to any alternator constructed according to the ordinary method with uniformly distributed poles. That it cannot be applied directly to an eight-pole alternator when two of the poles are removed and the other poles are not redistributed is evident at once from the fact ... the emf generated in any electrical conductor on the ... of the armature changes its direction as it passes from ...er a north to a south pole. If it passes from a north ... to a south pole at the rate of 120 times a second, then ... frequency of the emf is 120 alternations per second, or 60 cycles. The fact that throughout a portion of the revolution of the armature an individual conductor passes through a north pole of zero magnetism and also through a south pole of zero magnetism does not affect the frequency. It affects merely the emf, which in this individual conductor at this instant is therefore zero. Since this conductor is connected in series with other conductors which at this moment are under other poles of full magnetic strength, it is evident that the total emf of the armature is decreased merely in proportion to the reduction in the number of active poles.

I have a 45-hp, three-phase, 220-volt, 1800 r.p.m. induction motor which I desire to change so as to have it operate at 900 r.p.m. on a 440-volt circuit. Is there a book from which I can obtain the necessary winding data to suit this case, or if not how may the change be made? W. G. C.

We know of no book which will give you just this information. The motor is probably a 60-cycle machine, wound for four poles. In order that it may operate at 900 r.p.m. it must be rewound for eight poles. This change will involve an entirely new set of coils. The new coils should be wound with roughly one-half the slot-throw of the present coils, and should be built up with twice the number of turns of one-half the size of wire formerly used. If the coils are then arranged with one-half the present number of coils in each group, and the individual groups are connected continuously just as they now are, with the exception of there being twice as many groups as formerly, the machine should operate at 900 r.p.m. and should be suitable for an emf of 440 volts. However, the output will be somewhat less than before—that is to say, the machine cannot properly be rated as a 5-hp machine. The above instructions would be intelligible only to a person familiar with the winding of motors, but your attention should be called to the fact that no other person should be allowed to undertake the rewinding of the machine.

We will appreciate any information regarding a 50-hp, 220-volt, three-phase, 60-cycle, squirrel-cage-type motor which we have. Through carelessness the shop boys ran a box dry on this motor the other day and it stuck fast; and after getting the journal in order the motor would not run. After an examination it was found that one side of the starting box, that is, one side of the three-cornered piece which goes next to the shaft in the rotor to which the starting lever is attached, was burnt. It was also found that one outside wire leading to the motor from the transformers was carrying very little current, while the middle wire seemed to be carrying too much, the middle knife on switch becoming red hot. We are unable to account for this as all the connections are correct. This high-voltage line also heats the motor very hot. G. M. M. & S.

Assuming that the motor mentioned could be started without difficulty before the accident, it is very probable that when one of the wires was found to be carrying more current than either of the other two wires the trouble was in the circuits external to the motor and not in the motor itself. That is to say, more than likely the load on the three phases of the generator was much unbalanced and the motor was taking most of its load through the phase of the generator which was loaded most lightly, attempting in this way to balance the load on the generator. This is an inherent characteristic of motors, but does not become prominent unless the load on the generator is markedly unbalanced. Trouble of this nature can be remedied only by balancing the load, or rather voltages, on the generator which supplies energy to the motor. Concerning the present trouble with the starting of the machine, it may be that the difficulty is in the rotor circuit, or there may be difficulty in the stator circuit. Again, it may be that trouble exists in both the rotor and stator. Assuming that you have examined the stator and found that the coils have not become burned, it is safe to assume that the trouble is in the rotor and is confined to the automatic starting rheostat. If this assumption is correct the only proper method is to dismount the rheostat, locate any burned-out places and make such repairs as then may be found to be necesary.

Central Station
Management, Policies and Commercial Methods

VISITING-NURSE SERVICE.

A recently established feature of the welfare work of the Commonwealth Edison Company, Chicago, is the visiting-nurse service. All absentees are reported promptly to the employment bureau and a registered visiting nurse, employed especially for the purpose, is sent to the residence of the absent employee on the same day. Advice or temporary professional assistance is given where needed, although the nurse cannot remain in attendance on any case of illness. The nurse turns in reports each morning on the calls of the previous day and these are forwarded to the heads of departments by the employment bureau. The service is of value both to the company and to employees.

FLAT-RATE CONTROLLERS AS WEDGES FOR METERED BUSINESS AT ROCKFORD, ILL.

The Rockford (Ill.) Electric Company has about fifty flat-rate controllers in use at the present time, although a larger number have been installed and later converted to metered business at the request of the customers. In its flat-rate service campaign the company has offered four 20-cp tungsten lamps for $1 per month, five for $1.25 and six for $1.50. No provision is made for connecting up heating appliances under this schedule or for cutting out the controller in case the customer desires to use all his lamps on some special occasion. The service is restricted purely to the lighting specified, and as the minimum flat rate, as well as the most popular, is $1 monthly, many such customers have preferred to be changed to service under the meter minimum of 50 cents a month. The controllers in service have been subjected to regular inspections at intervals of one or two months during periods when the work of the meter department is light.

During its wiring campaign the Rockford company is offering to wire a six-room house with porch and bath for $18. It will also furnish fixtures as follows: Parlor, three-lamp ceiling fixture, $2.75; dining-room, two-lamp, $2.25; kitchen, pendant, $1; bedrooms, two-lamp pendants, $2; bathroom, bracket, 80 cents; porch, 65 cents; hanging and connecting fixtures, $28.45.

BONUS FOR RAPID WORK.

Recently a contract was executed by which the North Shore Electric Company agreed to furnish electrical energy to the Edgar Allen American Manganese Steel Company, of Chicago Heights. The carrying out of this contract meant the abandonment of an isolated plant that had been furnishing power for the works and the building of a substation. Electricity is delivered to the consumer at 2300/4000 volts, three-phase, 60-cycle, and is reduced to 220 volts for shop-motor circuits and 110-220 volts for lighting. Two 110-kw, 220-volt rotary converters and two 500-ft. air compressors driven by 100-hp motors are included in the substation equipment, the cost of which was about $20,000. Fifty days before the time set for the completion of the work the president of the Edgar Allen company offered the North Shore company a bonus of $500 if the plant should be finished ready for operation thirty days ahead of time. This meant that the rotary converters and other necessary material must be shipped from the factory by express and extra pressure was put upon the work so that the load from the isolated plant was transferred from the new substation a month ahead of the time scheduled. The Edgar Allen company was much pleased and sent its check for $500 to the central-station company in recognition of this achievement.

PRACTICE METER DIALS FOR READERS' USE.

The Kentucky Electric Company, of Louisville, has had made an enlarged replica of a watt-hour meter dial about 4 ft. across for the use and instruction of its meter readers. The individual dials are 10 in. in diameter and the pointer of each is pivoted under a friction-screw setting so as to remain in any position as placed. This enlarged dial model has been found of much service in instructing new meter readers. After an explanation of the operation of the dials and practice in the simpler settings some of the more puzzling readings involving positions of the figure 9 are set up on the dials and the new men called upon to read them. The large dials are also of use when new men find difficult meter readings on their routes. In such cases a note is made of the position of the meter hands, the dial hands of the office model are set similarly and the proper reading is determined by one of the more experienced inspectors at the close of the day.

GUESSING ON KILOWATT-HOUR OUTPUT.

In previous years it has been the custom of employees of the Commonwealth Edison Company, of Chicago, to institute a guessing contest at the close of the year, the man coming closest to the highest maximum load of the winter in kilowatts getting the largest proportion of a pool to which each one entering the contest contributes. At the suggestion of the statistical department of the company, however, a change is made this year by which the largest day's kw-hour output has been substituted for the largest day's maximum load. It is suggested that a large kw-hour output is more desirable than a high maximum demand. For the last three winters the largest day's output has been as follows: Jan. 7, 1909, 1,510,250 kw-hours; Jan. 4, 19[illegible] 2,162,235; Jan. 5, 1911, 2,355,760. If bright, clear weather prevails the output will be comparatively low and if the weather is dark the output will be comparatively high; also if moderate weather prevails the output will be comparatively low, and if the weather is cold the consumption will be greater, due to the large street-railway heating load in Chicago.

ONE WAY TO GET MOTORS INSTALLED.

Sometimes prospective motor users who might well afford to enjoy the economies of electric drive are frightened by the first cost of the installation. Mr. David Davis, of Litchfield, Ill., before the Illinois Electrical Association convention at Rockford, Oct. 25, told of such a prospective customer, who declared he could not afford the expense of putting in the motor the central-station men suggested. Some time later a manufacturer's representative, who is a cheerful talker, visited Litchfield, and after a friendly conversation with the obdurate prospective customer found out how much the latter was willing to spend for electric drive. Easily adapting the requirements of the drive to

this price, the salesman figured out an installation and took the order. When the motor was installed it at once proved too small for the load, as the central-station men had predicted, and the energy it consumed far exceeded the estimate made by the salesman. The customer was plainly worried by this time, but, having got his feet wet, philosophically decided to plunge in all the way and ordered the size of motor that had been suggested for him in the first place, paying the full price. Of course, once installed, this motor drive has proved a source of much satisfaction and economy to him, but it is probable that the installation could have been made in no other way than by the [illegible].

LETTERS THAT AID THE MOTOR SOLICITOR.

Sometimes good work with a prospective motor-service customer can be accomplished by starting him to think in his own way of what might be done to lower his operating expenses and improve his motor service. Men of large business interests are often too busily occupied to give the central station's solicitor the attention necessary to go into the proposition to the point where its attractiveness is fully revealed. If a letter containing the nub of the situation at a glance can be brought to the notice of the busy manager his interest is at once stimulated. The average soliciting letter is prosy and perhaps finds its way to the waste-basket after a glance at the heading.

A novelty calculated to catch the eye of the reader has been introduced by the Rockford Electric Company, which attaches characteristic load-curves or illustrations to the tersely worded communications it sends out. While the ordinary letter of this kind would reach the waste-basket, the unusual appearance of the pictures or diagrams contained in the Rockford letters provokes a second glance. Since the machines illustrated are of the types used in his own factory and in the load-curve the manager recognizes the shortcomings of his own installation, his interest is likely to be stimulated to the point where on his next call the salesman meets a lot of ready questions about motor-drive, first cost and operating expense.

EXPERIENCE WITH TUNGSTEN SIGN LAMPS AT JOPLIN, MO.

The experience of central-station companies with low-voltage tungsten sign lamps has been one of varied degrees of satisfaction, according to reports obtained from those having the maintenance of such installations in charge. To series-multiple arrangements of such lamps, however, can usually be traced most of these troubles, the failure of one lamp of a group so overloading its fellows that they in turn rapidly succumb.

The Empire District Electric Company, which operates in Joplin and Webb City, Mo.; Galena, Kan., and other cities of the famous lead and zinc mining districts, began the use of tungsten sign lamps in 1909. After opening up its commercial department the first sign sold was to an undertaking establishment, as noted in these columns Oct. 7. This sign was equipped with carbon lamps. The second display went to a bank, and, it being decided that the bank's sign should appear more "lively" than that of the undertaker, tungstens were used for the first time. Ever since the company has advocated the use of tungsten sign lamps exclusively.

It now has 15,000 such lamps, used continuously from dusk until midnight, with free renewals, and, according to Mr. J. E. Harsh, commercial manager of the company, tests made show that the full rated life of the lamp is being obtained, while breakage in handling is reported slight.

LIGHT LAMP-DELIVERY WAGON.

The Rochester Railway & Light Company has recently placed in service its first lamp-delivery wagon, thereby rendering it unnecessary for patrons to come to the office with lamps they desire to have changed. Heretofore consumers entitled to free lamp renewals had to come to the office of

Rochester Lamp-Delivery Wagon.

the company with an identification card to obtain new lamps. Now a girl in the lamp department receives telephonic requests for renewals and the calls are routed for the driver of the wagon. The latter is built on a Baker chassis with shaft-drive and averages 45 miles a day. The top is of mahogany and holds approximately 800 lamps in standard packages. On the floor in front of the driver there is a box for lamps other than standard. The wagon is of the light pleasure-vehicle type and is completely inclosed. The company expects to install two more wagons of the same type shortly, indicating satisfaction with the system and with the wagon as well.

CHEAP POLE LINES AND THE USE OF IRON-WIRE SECONDARIES.

Following a symposium on electric service to agricultural communities at the Rockford convention of the Illinois State Electrical Association, Oct. 25, the discussion turned on the subject of cheaply constructed distributing lines and the use of iron wire for distributing circuits. Mr. Theodore Bass, of Farmington, Ill., described a service to a group of three farms supplied with energy from his 16,500-volt transmission line. The farmers hauled and erected the poles, paying $200 for the high-tension step-down transformer and the three distributing transformers. Iron wire is used for secondaries. Mr. A. O. Brown, of Elmwood, however, cited an instance where he had attempted to operate a 5-hp motor at the end of a mile extension of No. 8 iron wire, but found the motor would deliver hardly 2 hp. Mr. W. G. Austin, of Effingham, on the other hand, reported the successful operation of a 7-hp motor at the end of a mile of 2200-volt line of No. 10 iron wire. Mr. E. J. Negley, of Canton, spoke of trouble with fuses and transformers used on a 2-mile transmission line to a coal mine. This line was later protected by stringing a No. 2 copper ground wire, earthed at every third pole. Mr. R. H. Abbott, of Petersburg, cited the construction of 2 miles of country line for $445, the farmers furnishing the labor. Another member declared he had constructed 32 miles of 1100-volt line, using No. 6

hard-drawn copper wire on 30-ft. poles, at a cost of from $150 to $200 per mile.

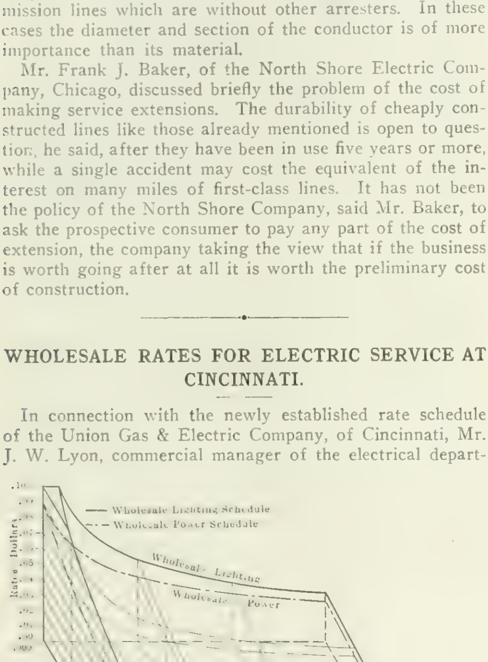
Mr. S. B. Cushing, of Chicago, pointed out that iron wires when used should be tested at frequent intervals for strength, since they are seriously attacked by rust. The occurrence of a single accident from fallen line wires, he observed, might prove much more expensive than the cost of many miles of first-class construction.

Dr. E. J. Berg, of the University of Illinois, explained that for all practical purposes within 1 per cent the effects of self-induction can be disregarded in the case of iron wire. Mechanically, he added, copper has the great advantage of resisting rust. For such discharge paths as lightning rods the material of the conductor has little effect, the form of section, however, being very significant, since the law of loss by induction follows the law of torsion. Professor Berg also explained the discharge of lightning surges by corona in the case of certain 110,000-volt transmission lines which are without other arresters. In these cases the diameter and section of the conductor is of more importance than its material.

Mr. Frank J. Baker, of the North Shore Electric Company, Chicago, discussed briefly the problem of the cost of making service extensions. The durability of cheaply constructed lines like those already mentioned is open to question, he said, after they have been in use five years or more, while a single accident may cost the equivalent of the interest on many miles of first-class lines. It has not been the policy of the North Shore Company, said Mr. Baker, to ask the prospective consumer to pay any part of the cost of extension, the company taking the view that if the business is worth going after at all it is worth the preliminary cost of construction.

WHOLESALE RATES FOR ELECTRIC SERVICE AT CINCINNATI.

In connection with the newly established rate schedule of the Union Gas & Electric Company, of Cincinnati, Mr. J. W. Lyon, commercial manager of the electrical department, has had drawn up an isometric solid diagram of the rates for wholesale lighting and motor service as given in tabular form in its schedule book. The co-ordinates used are kw-hours monthly consumption and hours' use of the maximum demand, the corresponding rates in cents per kw-hour being shown as vertical distances from the ground plane. The Cincinnati wholesale rate, as shown in the accompanying reproduction, forms a perfectly smooth surface, without breaks or steps, for both lighting and motor service. At the upper left-hand corner of the sketch is shown the intercept of the lighting rate by the city ordinance. The motor-service rate is indicated by the dotted surface just below that representing the lighting schedule. As noted in a preceding issue, the wholesale lighting schedule ranges from the ordinance rate of 10 cents down to the minimum of 1.88 cents per kw-hour for a consumption of 50,000 kw-hours used during 300 hours' equivalent. The wholesale motor-service rate similarly ranges from 9.02 cents per kw-hour for 1000 kw-hours at thirty hours' use down to 1.5 cents for 50,000 kw-hours at 300 hours' use. As is revealed by the developed rate surfaces, the new schedule properly puts a premium on long-hour use rather than on the consumption of a large quantity at poor load-factor.



Rate Diagram for Wholesale Service.

FARMERS' SERVICES TAPPED FROM A 13,000-VOLT TRANSMISSION LINE.

A number of farmers along the 13,000-volt transmission line of the Liberty Light & Power Company, which connects Liberty, Ind., with the generating station at Richmond, 18 miles distant, are furnished electric-lighting service through $1\frac{1}{2}$-kw transformers, reducing from the transmission potential to the 110 or 220-volt secondary pressures in a single step.

By grouping, two or more farm customers are supplied from the same $1\frac{1}{2}$-kw transformer. The first transformer out of Richmond, $3\frac{1}{2}$ miles distant, serves four farms, and at two-mile intervals are two other groups of two each the fourth and last group being 14 miles from Richmond and the power house.

The transformers are mounted on the poles carrying the 13,000-volt single-phase transmission line. To protect them against the weather it has been found necessary to provide a housing completely inclosing the transformer cases, the fuses being left exposed so as to be accessible. Home-made horn-gap lightning arresters are constructed out of No. 4 copper wire, and mounted on insulators. During the summer lightning season these gaps are reduced to an opening of $\frac{3}{4}$ in., but in winter they are bent back to a clearance of $1\frac{1}{8}$-in. to guard against shorting by sleet and snow. Solid grounds have been used on these 13,000-volt arresters, but as a result of local experience on nearby 6600-volt lines with home-made high-resistance grounds these are to replace the solid grounds, which have given trouble because of the circuit-breakers opening as a result of static discharges. The high-resistance grounds are made by burying blocks of wood, 4 in. by 4 in. by 18 in., several pounds of wet salt being scattered about the wood to provide a conducting moisture. Bare No. 8 copper wire is used for customers' 220 and 110-volt secondaries, some of which approximate half a mile in length.

The farm services on the Liberty-Richmond line were installed in deference to the demands of the farm owners rather than as a result of central-station solicitation. The farmers are required to buy their own transformers, which are installed by the company at the customers' expense. The company furnishes and maintains the meters for each customer, however, free of cost.

As an example of the connection cost to the customer the two farmers composing the last group connected paid together $250 for their transformer, 1500 ft. of bare-wire secondary pole line, and the wiring of their premises. Each farm customer is charged a fixed transformer-loss cost of $1 per month, to which is added the cost of the energy consumed. The rates for the latter element are 13 cents per kw-hour for the first 30 kw-hours, 10 cents for the next, 8 cents for the next and 6 cents per kw-hour

thereafter. Meters are read at three-month intervals, the average income from each customer per quarter being about $5. All of the present farm customers are well-to-do, and have as many as twenty lamps in their homes, but they are, of course, proverbially early to bed, and their hours of lamp use are short.

In spite of the twenty-four-hour service, no motors are yet in use for pumping or other farm work, although several fans and irons are now connected up. In this respect much more development is to be expected on the Liberty line. As a business proposition it is doubtful whether the farm business is profitable to the central station, and indeed whether a company is justified in cutting into a 13,000-volt or 6600-volt line to serve one or two small consumers. The departure at Liberty is looked upon only as an experiment by the company, which has nearly 35 miles of transmission lines connecting nearby towns. Mr. R. S. Ashe is president and manager of the company and Mr. H. A. Wehrly is superintendent.

A MOTOR-DRIVEN ROAD ROLLER.

The motor-driven road roller shown in the accompanying illustration is used by Mr. George Stump, a contractor, for ...ing roads and paving streets in Independence, Kan. The roller is operated by a 10-hp, 220-volt, single-phase motor, to which energy is supplied through 160 ft. of flexible cable from a portable step-down transformer mounted on cartwheels. The primary side of this transformer can be tapped on to any 2300-volt, single-phase distribution circuit in the neighborhood of the street to be

Contractor's Paving Roller Driven by 10-hp Single-Phase Motor.

...ed, and the flexible cable carried by the roller is long enough to roll any local 300-ft. block. When the roller is ...e used at a short distance from the existing transmission lines of the company the necessary poles are quickly ... and the line extended at cost to the contractor. Paving ...k to be done, however, is usually already reached by ... company's lines, and then it is only necessary to run a ...p to the transformer cart.

This cart also carries a watt-hour meter, which is read ...regular intervals like any other customer's meter, the ...ractor paying 10 cents per kw-hour for the energy ...l. At this rate the cost of operating the roller in paving ...lock of street has averaged $6, which includes rolling the ...ugh ground before applying the crushed rock, rolling the crushed rock and then finally rolling the finished brick paving. The cost of operating the electric roller, the contractor declares, is much less than maintaining an equivalent steam roller.

The motor-driven roller weighs, complete, 15,000 lb. with ... motor in place. The motor runs at 1200 r.p.m. and has ... speed reduced by a gear and pinion, the latter's slow-...ed shaft ending in a bevel pinion which drives two ...ing gears in opposite directions. By means of clutches the sprocket-wheel shaft which chain-drives the rear roller can be clutched on to one or the other of the bevel wheels for driving the roller in the forward or reverse direction. The motor thus remains running during ordinary operation, starting and stopping of the roller being controlled by the clutches. The motor is provided with a starter near the operator's seat, but is accelerated idle before the drive is clutched in. The driving roller is 4 ft. in diameter and 4 ft. 6 in. wide, while the front roller is 3 ft. in diameter. In a number of months' operation the roller has proved its ability to climb almost any kind of a grade, even through the most difficult material. It has been operated up grades of 8 per cent. and as a try-out test was made to run over a series of 8-in. x 8-in. timbers placed 2 ft. apart.

The roller was designed by Mr. Stump and Mr. W. R. Murrow, manager of the Independence Electric Company, and was built by the United Iron Works, of Independence.

CENTRAL-STATION DEVELOPMENT AT FARGO, N. D.

A Plant with One Consumer to 5.33 Inhabitants.

The commercial development of the central-station business at Fargo, N. D., by the Union Light, Heat & Power Company presents the unusual record of one electric-service customer to every 5.33 inhabitants. This record, which is equaled by comparatively few if any electric light and power companies of the United States operating in cities as large as Fargo, is a testimonial both to the enterprise of the central-station management for a number of years past and to the general progressiveness and prosperity of the population of Fargo.

By the 1900 census Fargo, N. D., had a population of 14,331. The increase of population was 49 per cent in ten years. Fargo is the metropolis of North Dakota and western Minnesota. It is the center of a great wheat-raising country. There is comparatively little manufacturing, but there are fifty-six wholesale and jobbing houses and distributing agencies serving the large territory of which Fargo is the center. There are fifty-seven manufacturing industries. Just east of Fargo across the Red River in Minnesota is the city of Moorhead, with a population of about 5000. Following are some interesting facts and factors bearing on the development of this business.

On Sept. 1, 1911, the company had 2524 metered lighting consumers, 138 metered power consumers and twenty-five flat-rate consumers, mainly on window-lighting and sign contracts. The connected load in incandescent lamps was 2161 kw. There were 117 500-watt commercial arcs, 806 electric flatirons and five moving-picture machines; ten flaming arcs, miscellaneous heating and other appliances to the number of seventy-two of 500 watts capacity each average; metered signs, fifty-one, containing 2362 lamps; flat-rate signs, forty-nine, containing 3126 lamps. The total connected commercial lighting load, exclusive of power and heating, was 2437 kw. For municipal lighting there are 139 arc lamps taking 550 watts each and 209 40-watt tungsten lamps. In addition to these for special downtown street lighting there are 137 five-lamp ornamental posts, each post taking 340 watts. The total connected city lighting load is 125 kw. The total of city and commercial lighting loads is 2563 kw. The power load consists of sixty-five alternating-current motors with a total horse-power of 293 and 303 direct-current motors with a total horse-power of 1384. The total motor load is 1258 kw. The company also furnishes power to the street railway, which is figured for statistical purposes as a connected load of 123 kw. Including this the connected load for all purposes figures 3945 kw. The alternating-current portion of the system is supplied through 138 transformers with a total capacity of 861 kw. There are

393 miles of pole lines. This is equivalent to about [illegible] ft of pole line per consumer. The station capacity is 1610 kw, which is equivalent to about 60 watts per capita of population. The maximum demand on the station Sept. 1 was 1205 kw. The load-factor for the week ended Sept. 1 was 28 per cent.

The lighting rates are based on 11 cents per kw-hour for the first 100 kw-hours, 9 cents for the second 100 kw-hours and step-by-step reductions for additional amounts until all energy over 10,000 kw-hours per month is sold at 3.55 cents. The power rate for the first 500 kw-hours per month is 6.66 cents, with step-by-step reductions for amounts in excess of this consumption. The customary discount of 10 per cent for prompt payment of lighting and power bills is allowed. The company is owned by the Northern States Power Company, which in turn is controlled by H. M. Byllesby & Company, of Chicago.

ADVERTISING ELECTRICAL NOVELTIES.

The general public now knows that devices for adding to the convenience of home operations are on the market, and may be had of dealers or central stations, many of which have departments for the sale of equipment of this kind. The problem before the new business department in seeking to build up a larger consumption of energy in the operation of domestic apparatus, then, is to present the advantages which it possesses in a striking form, and one that will attract attention.

While the newspaper advertisements and other notices issued by the company may refer effectively to this branch of the business, it has been found by many managers that a graphic display is better than any other kind. Actions speak louder than words, and the pictorial presentation of electrically operated irons, toasters, etc., is much more effective than when one is merely told about it. In solving the question of graphic display one idea worth general adoption is the distribution of photographs in the form of post-cards, each of the pictures showing some phase of domestic economy in which electricity plays a part.

The traffic manager of an Ohio Valley lighting company decided that in order to get the best results he would make his own photos, instead of buying them from novelty manu-

Fig. 1—Post Card Advertising Use of Toaster.

facturers, who frequently offer the same sort of picture to a dozen different users. He succeeded in securing the services of two well-known young women of that city, and they agreed readily to pose for his camera. The result was that he secured a series of pictures which are attractive merely as photographs, and which are certain to be kept by the people who receive them. The series consists of fifteen views, some of which are reproduced herewith.

The post-cards upon which the pictures have been mounted are sent out at regular intervals to a selected list

Fig. 2—Post Card Advertising Use of Percolator.

of consumers, care being taken to select those most likely to be in the market for modern devices for the home. This particular company maintains a department for the sale of equipment of this sort at its general offices, and it is reported that a healthy increase in the demand has been noted since the cards have been in circulation.

EASILY UNDERSTOOD STATEMENTS OF RATES.

Rates for electric service which involve a discount on a part of the bill, which discount is based on a certain number of hours' use per month of a consumer's connected load or maximum demand, or upon some assumed maximum demand calculated from his connected load, have long been common among the more progressive electric-service companies and recently have been required in most of the cases before the Wisconsin Railroad and Public Service Commission where that commission has specified the rates to be charged. The principal valid objection urged against this system has been the difficulty of stating the rate in such a way that the consumer can understand it. It is probable that the majority of consumers who are served with electricity under such rate systems do not really understand the rates. It, therefore, should be a matter of much study on the part of the electric-service company to state its rate in as popular and easily understood language as possible avoiding technical terms except where absolutely necessary and remembering that the every-day language of the man in the central-station business is worse than Greek to the ordinary consumer. The following suggestions as to the wording of published rate sheets are offered by a manager who has given the matter considerable thought and has drawn up the rate sheets for a number of companies. They represent an attempt to state the case in plain language so that the ordinary consumer or uneducated employee of the company can easily figure the rate on any consumer's installation.

In order to make matters plain to the electric-service company reader who may wish to know the foundation of the rate specified before seeing its popular statement, an example is given of a rate sheet, first as it was actually drawn up by the manager in technical language, showing the fundamental derivation of the rate, and second th

popular statement of the rate as made up for publication. The actual figures given are, of course, simply for the purpose of an example and only represent the practice of one company with a given set of local conditions. The following is the technical statement of the rate system.

TECHNICAL STATEMENT OF RATES.

Electric lighting rate: 14 cents per kw-hour for electrical energy used equivalent to thirty hours' use per month of the consumer's maximum demand, the maximum demand being estimated by the rules given below. For electrical energy used in excess of one hour's use per day of the consumer's maximum demand, 6 cents per kw-hour. Minimum bill, $1 per month.

The following are rules for estimating the maximum lighting demand:

For stores, offices, depots, restaurants, livery stables and all places of business where all the lamps are lighted during the company's heavy-load period, that is from 5 to 6 p. m. in winter, the maximum demand shall be counted as the full connected capacity of lamps.

For hotels and boarding houses, public halls, churches and theaters the maximum load shall be counted as one-half the connected capacity in lamps.

For residences count the maximum demand as 40 watts for each room in the house, exclusive of bathroom, basement, porches, stairways, attics, storerooms, small halls, entrances, woodshed and barn. Small motors of ½ hp and less and electric irons or other heating appliances are not counted.

Unlimited power rate: Twelve cents per kw-hour for electrical energy used equivalent to thirty hours' per month of the consumer's maximum demand, the rules for estimating the maximum demand being given later. Six cents per kw-hour for electrical energy used in excess of the foregoing amount.

Off-peak power rate: Power consumers agreeing not to operate motors between 4:30 and 8 p. m. during November, December, January and February will be given the regular unlimited power rate less 4 cents per kw-hour on the 12-cent portion of the bill.

Minimum bill, $1 per horsepower connected per month. The rule for estimating the maximum power demand of a consumer is to take 1 kw per horse-power of motor connected, except where a motor is much underloaded and consumer desires a test. In such case the company will make a test for such period as seems to it best to determine the real maximum demand.

POPULAR STATEMENT OF THE SAME RATES.

"Electric light, 14 cents per kw-hour for the first portion of the monthly bill and 6 cents per kw-hour for the second or remaining portion. The number of kw-hours in the first portion is determined as follows:

"For stores, offices, depots, restaurants, livery stables and all places of business multiply by 30 the connected capacity of the lamps in kilowatts.

For private residences multiply the number of rooms in the house by 1.2 kw-hours, but do not count bathrooms, basements, cellars, porches, stairways, attics, storerooms, small halls, entrances, woodsheds and barns.

"For hotels, boarding houses, public halls, churches and theaters multiply by 30 the connected capacity of the lamps in kilowatts and divide by 2.

"Do not count flatirons, heating and cooking appliances or vacuum cleaners as connected load.

"When the kw-hours used in a month as shown by the meter are equal to or less than the first portion the rate on the whole bill is 14 cents per kw-hour.

"When the kw-hours used in a month exceed the first portion all of the kw-hours of the first portion are to be billed at 14 cents and all in excess of the first portion are to be billed at 6 cents per kw-hour.

"The number of kilowatts taken by various kinds of incandescent lamps to be used in estimating under the foregoing rules is as follows:

Kind of Lamps	Kilowatts
16 cp carbon-filament	[illegible]
8 cp carbon-filament	[illegible]
32 cp carbon-filament	[illegible]
20 cp tantalum-filament (40-watt)	[illegible]
40 cp tantalum-filament (80-watts)	[illegible]
20 cp tungsten-filament ([illegible]-watt)	[illegible]
32 cp tungsten-filament ([illegible]-watt)	[illegible]
48 cp tungsten-filament ([illegible]-watt)	[illegible]
80 cp tungsten-filament ([illegible]-watts)	[illegible]
120 cp tungsten-filament ([illegible]-watt)	[illegible]
200 cp tungsten-filament ([illegible]-watts)	[illegible]
350 cp tungsten-filament ([illegible]-watt)	[illegible]
450 cp tungsten-filament (500-watt)	.500

"The minimum monthly lighting charge is $1 for service, and no service will be accepted or billed for less than this amount.

"Power rates on unlimited contract: 12 cents per kw-hour for the first portion of the bill and 4 cents per kw-hour for the second or remaining portion. To determine the first portion, multiply the horse-power of the motor by 30.

"Power rates on limited off-peak contract: 8 cents per kw-hour for the first portion of the monthly bill and 4 cents for the secondary or remaining portion. Consumers accepting this limited off-peak power rate must do so with the express understanding and agreement that in consideration of the reduced rate they are, when requested by the company's representative, to discontinue operation of motors between 4:30 p. m. and 8 p. m. between Oct. 15 and Feb. 15 whenever the company's reserve plant capacity is needed during these hours for other purposes.

"No power service will be rendered for less than $1 per horse-power or fraction thereof of motor connected per month.

"Voltage: The company will aim to maintain as near as possible to 109 volts at consumer's lamp terminals if buildings are properly wired, and 218 volts at motor terminals.

"A kilowatt is equal to 1000 watts, thus ten 100-watt tungsten lamps equal 1 kw of connected load."

There is another popular method of stating the same rate system which may appeal to some as being easier to understand at first reading than the foregoing. This method of statement is based on the discount idea and may appeal to some minds more easily than the foregoing method. The same rates stated according to the discount method would be as follows:

ANOTHER POPULAR STATEMENT OF THE RATES.

"Electric light: 14 cents per kw-hour. A discount of 8 cents per kw-hour will be given on whatever portion of a consumer's monthly bill exceeds said consumer's discount limit. This limit is figured for each consumer thus:

"For stores, offices, depots, restaurants, livery stables and all places of business multiply by 30 the total capacity in kilowatts of the lamps connected.

"For private residences multiply the number of rooms in the house by 1.2 kw-hours, but do not count bathrooms, basements, cellars, porches, stairways, attics, storerooms, small halls, entrances woodsheds and barns.

"For hotels and boarding houses, public halls, churches and theatres multiply by 30 the connected capacity of the lamps in kilowatts and divide by 2.

"Do not count flatirons heating and cooking appliances or vacuum cleaners as connected load.

"When the kw-hours used in a month exceed the consumer's discount limit as figured by the rules just given the kw-hours in excess of the discount limit will be billed at a discount of 8 cents per kw-hour from the base rate of 14 cents, or, in other words, at a net rate of 6 cents per kw-hour."

Where there are more than two rates the terms "first discount limit," "second discount limit," etc., can be used.

Wiring and Illumination

AN ELECTRIC FOUNTAIN IN THE CLASSIC GARDEN OF A NEW ORLEANS PRIVATE HOME.

The central feature of an exquisitely arranged Italian garden covering the terraces of the magnificent St. Charles Avenue residence of Mr. Lawrence Fabacher, of New Orleans, is an electric fountain, on which is projected the colored illumination of a 30-amp arc lantern. The color changes in the lantern are effected by a revolving disk driven by a small motor, the entire lamp and mechanism being concealed in the structure above the fountain. The display was designed by Mr. Fabacher and executed locally, having been completed only within the last few days. The cost is reported to have been several thousand dollars, so that such fountains are not likely to become household necessities in modest homes, according to Mr. W. E. Clement, contracting agent for the New Orleans Railway & Light Company, which furnishes the electrical energy. The effect of the changing hues on the bubbling water is declared to be most pleasing amid the dark settings furnished by the classic garden.

METHODS OF SOLDERING WIRES IN TERMINAL LUGS.

By H. D. George.

Where many terminal lugs are to be soldered to conductors a convenient and time-saving method of making the connections is to melt a pot of solder over a plumbers' furnace, pour the solder in the hole in the lug and then plunge the bared end of the conductor into it, as shown in Fig. 1. The insides of the holes of all commercial lugs are "tinned" so the solder adheres to them readily, and the bared end of the conductor should also first be tinned. This may be done as follows: The end of the wire is carefully scraped with a knife or with a piece of fine sandpaper (the sandpaper is best because it cannot nick the wire) and then smeared with soldering flux and thrust into the solder pot. If a soldering stick is used the wire must be heated somewhat in the solder before the stick compound will melt and adhere. It requires but a fraction of a minute to "tin" the wire end in the pot. After removal the end should be knocked against some solid object to remove surplus solder.

Immediately after the tinned end is pushed into the

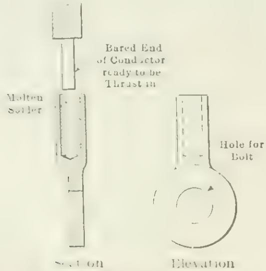


Fig. 1—Soldering Wire in Lug.

hole in the lug the lug should be soused with a piece of wet waste to cool it rapidly. The job is finished by scraping or filing off any shreds or globules of solder that adhered to the exposed surfaces of the lug and by brightening it with fine sandpaper if necessary.

The insulation from the conductor ends should be cut back just far enough so that it will abut against the shoulder of the lug, as suggested in Fig. 2 *A*. The appearance is very unsightly and indicates careless work if there is a gap between the shoulder and the insulation, as at *B*. If

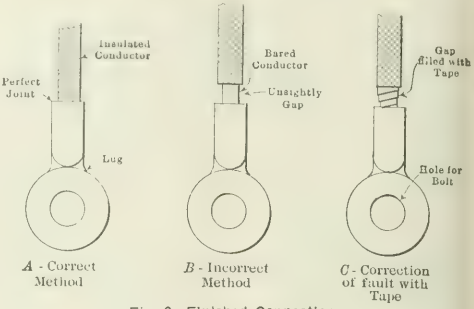


Fig. 2—Finished Connections.

because of some mishap a connection does result, having the appearance of Fig. 2 *B* a partial correction can be made by filling the gap with servings of tape, as shown a Fig. 2 *C*. The tape of the standard ⅞-in. width should be torn into strips about ¼ in. wide before applying.

Only enough molten solder should be poured into th hole in the lug to fill it almost to the brim when th conductor is in position. If too much is poured in it wi be squeezed out by the wire and will flow over the lug It must then be removed at a sacrifice of time.

Another method of soldering wires in lugs is to hea

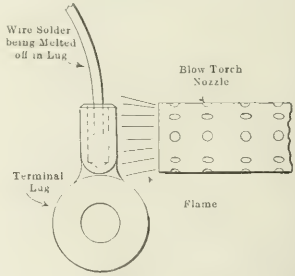


Fig. 3—Making Joint with Blow Torch and Solder Wire.

the lug with a blow-torch flame, as outlined in Fig. When the lug is sufficiently hot wire solder is fed into t hole. The solder melts and the bared conductor end then thrust into it, as above described. However, the u of a blow torch in this way should be avoided if possib as it blackens the exposed surfaces of the lug. A thorou cleaning with fine sandpaper is then necessary, and th requires considerably more time than is justifiable.

CANDLE-POWER LIFE PERFORMANCE OF INCANDESCENT LAMPS.

By G. S. Merrill.

The mean spherical candle-power or the total lumens g erated by a light source is the proper basis for judging s performance. This fact is generally recognized and ne s no discussion. In calculations and tests involving inc descent lamps it has been the common practice to use e mean horizontal candle-power as a basis from which e mean spherical candle-power could be derived if desi d, by the use of reduction factors* applying to the partic r

*Reduction factor $= \left(\dfrac{\text{Mean spherical candle-power}}{\text{Mean horizontal candle-power}}\right)$

type, kind and size of lamp under consideration. It has been found that the reduction factor is very uniform for new lamps of the same kind and hence can be used as an easy way of obtaining the initial mean spherical candle-power from measurement of the mean horizontal intensity. However, the use of a reduction factor may give misleading results when applied to other than the conditions for which it has actually been determined. The common acceptance and use of mean horizontal candle-power as indicating lamp performance, on the evident assumption that the total light flux bears a constant relation to the horizontal intensity, has led to considerable error in judging the true performance of some types of lamps.

In the case of the regular tantalum lamps the effect of service is to darken the bulb in a distinct band about the horizontal projection of the filament, due to the concentration of the filament in a relatively short axial length and to the proximity of the filament to the side of the bulb. This distribution of blackening serves to reduce the mean horizontal candle-power. However, it is important to note that the reduction in mean horizontal candle-power results only in part from the absorption of light by the darkened band and that a part of the reduction is due to the fact that some of the light that would normally pass through the bulb in a horizontal direction is *reflected* from the deposit of the sloping sides of the bulb through the tip end of the lamp. The mean spherical candle-power, therefore, does not decrease nearly as much as does the mean horizontal in this case, and consequently the change of mean horizontal candle-power with service can be no criterion of the real lamp performance. Since light is reflected through the tip end of the lamp as it becomes old the mean lower hemispherical candle-power does not decrease as much as either the mean horizontal or mean spherical. The same general considerations that apply to the tantalum lamps apply to those tungsten-filament lamps whose construction is somewhat similar, and point to the conclusion that changes in mean horizontal candle-power with service should not be used in judging the performance of different kinds, sizes and types of lamps, since the corresponding changes in total light flux may be very different in different lamps.

In carbon-filament lamps the filament conforms somewhat to the shape of the bulb and the blackening is distributed much more uniformly over the side and tip end. Consequently the reduction factor changes only a very little with service, so that the total light flux varies approximately in direct ratio to the mean horizontal candle-power during the normal life of the lamp. When the mean horizontal candle-power of a clear 110-volt, 50-watt or 60-watt carbon lamp in a straight-sided bulb has reached 80 per cent of the initial value, the mean spherical candle-power will have reached approximately 80 per cent of its initial value also, whereas when the mean horizontal candle-power of a clear watt, 110-volt drawn-wire tungsten-filament in a straight-sided bulb has dropped to 80 per cent mean horizontal its mean spherical candle-power will be about 85 per cent of the initial. In order that the latter lamp may show the same percentage depreciation in mean spherical candle-power as the carbon lamp it should be run to about 75 per cent mean horizontal rather than to 80 per cent, and since for this particular lamp the hours to 75 per cent or previous burn-out are nearly 20 per cent greater than the hours to 80 per cent or previous burn-out, it is evident that to judge the performance on the basis of life to 80 per cent mean horizontal candle-power in comparison with carbon lamps to the same percentage is exceedingly unjust.

It is important to express the performance of metal-filament lamps in terms of total light generated rather than in terms of horizontal intensity, since otherwise these lamps receive no credit for a part of the light flux they produce, and they are at a considerable disadvantage where the life is estimated to 80 per cent of initial mean horizontal intensity rather than to 80 per cent of the mean spherical intensity which corresponds to the commonly accepted "useful life" of carbon lamps. The fact that the reduction factor changes in a different manner and in different amounts according to the size and shape of bulb, to the disposition of the filament in the bulb, and finally to the initial specific consumption at which the lamps are operated, indicates the necessity of using the mean spherical candle-power performance on life test where comparative performance or where cost of producing light with different lamps is to be determined.

FIRE HAZARD AND INSURANCE RATES IN POWER PLANTS.

By C. J. Williams.

The subject of insurance costs to electrical plants is worthy of much better consideration than has usually been given it in the past by plant owners. A noticeable growth in interest has recently taken place and much is being written on the subject by operating electrical men. A salient feature of most of the discussions appearing in convention reports and the technical press is the entire absence of any comment on the various fire hazards existing in stations and the undivided attention given to insurance charges for the stations containing those hazards. The effect is attacked without reference to the cause.

Another point of interest is the apparent failure of insurance engineers to give due publicity to their methods for measuring fire hazards in this class of buildings. Out of this lack of co-operation observable between plant owners on the one hand and insurance companies on the other the tendency has been growing for the former to impute unjust discrimination against power plants in insurance ratings and for the latter to assume negligence toward undeniable fire hazards to be universal among plant operators. The community of interest actually existing should be able to overcome such petty barriers.

It may be admitted, for instance, that insurance ratings, though made from actual condition reports, may suffer at times from the inadequate appreciation by non-technical inspectors of influencing variations of power plants from ordinary types of construction and operation. Such reports will fail to give proper apportionment between structural and occupational hazards and give excuse for imputation of incompetency of the report and its result in rate estimates.

In passing, however, it is well to note that this lack of suitable knowledge by the inspector, with its resultant errors, has offsetting it a far more general lack of appreciation by light-plant managements of the elements of fire hazard in their building arrangements and use. Three out of four service companies could effect a reduction of 25 per cent in fire insurance by an ordinary thorough house cleaning. Many can do still more. And a saving in maintenance cost is contingent on the same class of improvements.

The dearth of information among plant owners on plant fire hazard is only such as might be expected from the low average proportion of the total number of fires to the total number of plants and the much lower number of fires due to any one of the many different causes.

If the chance of serious fire in any one plant is 1 per cent, the chance from, say, oily waste might be 1 in 10,000. The low total probability takes a serious fire into one plant only once in 100 years. It is not likely that the average management has ever even heard of a fire from workmen's clothing on steam pipes, from puncture in oil-reactive coils, or one of the hundred recorded causes. The plant man has been trained to figure on what happens 99 times out of 100, while the insurance estimates must note the happen-

... in the tenth-thousandth case as a considerable proportional ... A charge of 1 cent per $100 of insurance may be a considerable proportion of insurance rate on a particularly well-arranged station.

The insurance inspector is at least working from a definite rating schedule, which applies relative estimates to the value of each fire hazard in the plant. The fairness of any charge is a question of amount only, and this must be determined by the experience which has been recorded, either by insurance companies or the power plants themselves.

The Underwriters' standards set forth for power plants are unusually good, only because builders and operators of stations neglect to consider in advance the fire-hazard problem or to call in competent advice.

A plant building may be readily constructed and machinery so arranged as to minimize fire risk and fire rate and not in any way prejudice convenience of operation, but distinctly lower fixed charges of all kinds.

The failure so to construct and operate may be largely ascribed to that same prevalent carelessness which until recently made depreciation accounts a rarity and entirely non-uniform. Depreciation has become largely standard as an itemized accounting of the time hazard. The itemized accounting of fire hazard must be recognized as no less important.

In gathering comparative fire data among lighting companies, to determine the justice of total fire rates and component charges, figures can be depended upon only when they include complete records for all plants over large territories and for many years. One year in one state among half the plants offers no basis for determining fire probability.

It is to be particularly noted that managements tend to belittle their fire losses when they become public and to suppress entirely data on small fires (which might have become big ones). This tendency makes true analysis of minor hazards difficult. It is not so much from a desire to avoid just insurance charges—there may even be no insurance carried—but the publication makes the local public distrust the reliability of service and stockholders blame a management as peculiarly careless when it may even be unusually attentive to fire prevention details. In this way other plant managements fail to profit by the bad fire experience of plants in their immediate neighborhood and sometimes of their own plant.

If electrical companies will collect absolutely thorough information even on incipient fires, which involves much closer investigation and more active co-operation from superintendent to boiler cleaner, a set of fire estimates might be evolved on which would be equitably based a low basis rate to cover the still unanalyzed hazard and a set of charges justly covering each fire hazard so determined, whether from construction, use or carelessness. Improvement following in these conditions would reduce uncomfortably large insurance charges and maintenance leaks would also be stopped.

As a matter of fact, the Underwriters have quite recently made strong efforts for this closer analysis and are applying over the central and western parts of the country a schedule with a basis of only 8 cents per $100 of insurance carried.

It is found by experience that those plants where all fire causes and fire damageability are carefully minimized are greatly benefited by the elimination of charges possible under this analytic schedule, whereas those plants where fire causes and susceptibilities are numerous will pay for such conditions a proportional contribution toward the total power-station fire loss of the country. Such a discrimination, determined by conditions, should receive the active support of all station managements. Present standards are briefly as follows:

1. Brick, stone or reinforced concrete walls and partitions 2 in. thick and increasing for height above 15 ft.

2. Partitions, floors and roof to be entirely non-combustible.

3. Roof and floor supports to be fireproofed to prevent warping from interior or exterior fires.

4. Lighting circuits to be in conduit. Station wiring to have non-combustible covering or be run in fireproof ducts.

5. Heating, if any, by steam, hot water or hot air.

6. No machine or woodworking or combustible supplies.

7. Switchboards non-combustible, oil switches, remote control and in fireproof room cut off from main station. Oil transformers similarly isolated and rooms drained.

8. Waste cans used for oily waste, metal lockers for extra clothing of men. Lubricating oils kept in metal cabinets or central oiling systems.

9. Sand pails, chemical extinguishers and public fire protection to be provided.

Where the station fails in any of the foregoing requirements the involved fire hazard is met with a proportional charge in insurance rate. These charges, again, are necessarily more or less interdependent. Combustible roof or floor will make otherwise negligible hazards assume con siderable value. Even unprotected steel roof or floor sup ports have made almost complete fire losses by warping from heat of comparatively small station fires.

The station covering standard requirements will possibly have one chance in a thousand for complete destruction Or, more clearly, out of 1000 equal valued standard sta tions the value of one will be wiped out in one or severa fires somewhere among the 1000 plants each year. A mini mum rate of 10 cents will cover these losses, or by furthe analysis, say, 8 cents on station and 15 cents on electrica contents, which are more damageable. From this poi charges must be added for each fire hazard that is allowe to exist. If values subject to one fire increase, which wi be the case in larger stations than the average, with con bustible roofs or floors to carry fire, an area charge wi equalize the contributory tax toward total loss among th 1000 stations.

If, however, only one-half the stations carry full i surance, the rest carrying from one-fourth to one-half a paying only that part of their total proportionate tax, th fire loss will remain the same and losses cannot be indem fied. Either all rates must be increased to meet such a co dition or, more equitably, those stations paying less t should pay higher rate of tax, since they are still indemnifi for their average loss, the large ones being very rare, wh paying a less than proper share toward the unchanged to of small losses. The latter method is employed by surance men in power-plant schedule application. Instan might be multiplied, but the following station of $300,0 value illustrates hazards and rate analysis in a represen tive modern station for light and power:

	Present Condition.	Wood Floor a Roof R move
Basis with full insurance.	.08	.08
1. Lack of parapets between wood-roofed divisions.	.03	.
2. Roof wood sheathing on steel trusses...........	.05	.
3. Unprotected steel trusses and columns	.02	.02
4. Area 30,000 sq. ft..........................	.22	
5. Inflammable insulation on exposed wires.	.05	.03
6. 44,000-volt oil switches and oil transformers...	.07	.03
7. Boiler room communicates	.10	
8. No metal lockers or waste cans	.05	.05
9. No protective devices.......................	.10	.05
10. Exposure to ordinary windows from lumber yard at 10 ft............................	.11	.11
Building and non electrical contents	.88	.3
Electrical contents	1.02	.4

Most of the charges may be readily removed from he standard building by inexpensive improvements. A ve investigation by operating companies will usually reve a dozen forgotten or overlooked features of fire hazard ue

to operation methods alone. Even construction defects may usually be removed with rate reductions which will pay good return on the investment, lower depreciation being considered. Power-station designers will find a very close relation between durability, convenience and low insurance.

With better methods employed by builders and operators the present wide diversity in minor defects, giving some excuse for errors of analysis application by non-engineer inspectors and adding seriously to insurance charges in any event, will be largely done away with.

Light and power companies having risks of simple fire-hazard analysis approaching standard will gain the attitude toward insurance companies now held by fortunate possessors of such plants, of appreciation for assistance toward economical operation, rather than of continual irritation at the collection by insurance companies of presumably exaggerated insurance taxes.

Letter to the Editor.

Electrical Exhibit at Agricultural Fairs.

the Editor of Electrical World:

Sir: With the increasing attention paid to the farmer and his electrical needs by electric-service companies, and with the efforts of a large number of manufacturers to sell small isolated electric plants to farmers and owners of country estates, it is rather surprising that so few electrical concerns exhibit their wares at the various state fairs held throughout the country. It is true that a few electrical ...ufacturers do take advantage of the opportunity to show the farmer and the farmer's wife what utilities and conveniences they have to offer, but the number of concerns that are awake to this opportunity is surprisingly small. ...ny national and state associations of electrical men dis...s the possibilities of electricity in the rural districts with ...h earnestness and elaboration, but the state fairs and perhaps other agricultural fairs and farmers' institutes offer an actual opportunity to "get next" to the farmer that appears to have been overlooked by electrical business men and operators, usually so alert.

Applied electricity should not be looked upon as a thing apart in American life. It is not to be considered as something available only in cities. Exhibit rooms are maintained by electric-service companies in many communities, large and small, and with good results. Why not, therefore, extend the idea to the state fairs, where the farmers go to learn the developments of the year? The American farmer is usually a sensible, intelligent man, with money to spend. He knows more about electrical development than the average electrical man thinks he does. He is getting around to the point where he is willing to consider the possible use of electric lighting and electric motors in his business. Furthermore, Mrs. Farmer is beginning to think there is no reason why she should not have electrical conveniences as well as the city woman—and there isn't.

Where available, the farmer will find it more convenient and satisfactory, and perhaps more economical, to use central-station service. But in many instances it is impracticable to turn to this source of supply, and in that case the ruralist is not to be taken out and shot at sunrise because he installs an isolated plant. The private plant may serve as an introduction to central-station service later. In the country, as in the city, the question of central-station supply versus private plant is to be fought out on its merits, in each case with a fair field and no favor. Now is a good time, when the possibilities of electrical application in the country are being realized dimly, for central-station men and isolated-plant advocates to show some mutual toleration and respect. Both groups should pay more attention to the introduction of electrical conveniences where none now exist than to the pleasing pastime of throwing rocks at the other fellows. It will be some time before the saturation point is reached in supplying the electrical needs of the three million square miles, more or less, of these United States.

Chicago, Ill. James T. Gordon

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

...*Hysteresis in Polyphase Induction Motors.*—D ...ertson.—The author first emphasizes that it is erro...us to assume that the hysteresis of the rotor iron in an ...uction motor is a cause of loss. Except for the high-...uency pulsations in the teeth, quite the reverse is true, ... if the hysteresis could only be made large enough the ...r would run without slip, and consequently also without rotor losses except those due to mechanical friction and the pulsations just mentioned. On the other hand, the ...of high-hysteresis materials will raise the tooth pulsa-... loss and, owing to the fact that these materials have ...essarily a low permeability, increase the magnetizing ...rrent and corresponding stator resistance losses. The ...rmer effect will probably be small, as the hysteresis com...nent of these pulsation losses in which the flux is not ...ersed will be small; and the latter effect becomes of ...portance only when the reluctance of the iron becomes ...nparable with that of the air-gap. An improvement in ... performance of the motor is therefore to be expected by ...ng high-hysteresis iron, especially if the rotor slots are ...sed or nearly so. The stampings for the stator should ...of a low-loss, special-alloy steel brand, such as "stalloy," ... those of the rotor should be of the cheapest brand. ...le rotor hysteresis produces a torque opposing relative motion of flux and rotor; the hysteresis torque is thus a driving torque at all speeds below synchronism and a retarding one at higher speeds. Its amount is practically constant, except at synchronism, when it may have any value not exceeding that just mentioned and may act in either way. Its production may be explained thus: If there were absolutely no resistance to its motion, the rotor would run at synchronous speed with its axis of magnetization coincident with that of the rotor field. When a small resistance is applied the rotor drops behind a little until the torque due to the relative displacement of these axes balances the load; it then runs at synchronism as before, but keeping this relative position of the two axes. With a greater load a larger displacement is required until the full hysteresis torque and maximum displacement are obtained. When the load is increased beyond this the rotor slips continuously and the balance of the necessary driving torque is obtained from the rotor currents. The axis of magnetization continues to rotate at synchronous speed, at a fixed distance behind the axis of excitation; owing to the relative motion of the flux axis and the material of the rotor, energy is now absorbed by the rotor hysteresis equal to the hysteresis torque multiplied by the slip speed. The power taken from the stator by the rotor hysteresis is equal to the same torque multiplied by the synchronous speed. The remainder, equal

to this torque multiplied by the speed of the rotor, is converted into mechanical power. The hysteresis torque is measured by the work done in rotor hysteresis per unit angular slip of flux and material; it is consequently constant for a given flux, as the energy converted into heat by hysteresis each cycle is independent of frequency. The power taken from the stator due to this cause is thus constant below synchronism and equal to that spent in rotor hysteresis when the rotor is at rest but the flux is the same. The author discusses the practical possibilities of a pure hysteresis motor and shows that there is no field for it except for certain special purposes where a self-starting synchronous motor of small output is required, such as is necessary in connection with certain laboratory measurements. Additional torque at synchronous speed can be obtained by having one large tooth per pole on the rotor, but this gives no assistance when starting or when the rotor begins to slip.—Lond. *Electrician,* Oct. 13.

Polyphase Commutator Machines.—F. NIETHAMMER AND E. SIEGEL.—The authors have formerly discussed the problem of the belt leakage of polyphase induction motors. They now discuss the upper harmonics of the fluxes in polyphase commutator motors. In the ordinary polyphase induction motor the fundamental waves of the primary ampere-turns and of the secondary ampere-turns always compensate each other, with the exception of those necessary for producing the useful flux, and this is true for any speed and any relative position of stator or rotor. The upper harmonics behave differently when the machine is at rest and when it is running. At rest they are directly added together, since they are revolving with equal speed, but when the motor revolves this is no longer the case. The authors show now that it is different with polyphase machines with commutator. The rotary ampere-turns produced by the rotor winding are independent of the speed, and each upper harmonic maintains its speed rotation at all speeds of the motor. The secondary ampere-turns behave just like the primary ampere-turns, and both are, therefore, directly added together at all speeds. The phenomena in the machine are the same at all speeds and comparable with those at a short-circuit of an induction motor at rest for a given position of its rotor. Just as the belt leakage can be changed in induction motors by changing the relative position of stator and rotor, so the same result can be obtained in the polyphase commutator motor by displacement of the brushes. The authors first deal with three-phase machines and then with two-phase machines.—*Elek. u. Masch.* (Vienna), Sept. 24.

Speed Regulation of Series Commutator Motors.—A note on a recent British patent (26,119, Oct. 5, 1911) of J. Gray (Latour). Each phase winding on the stator is permanently connected in series with the corresponding phase winding of a transformer, the secondary winding of which is taken to the brushes. By means of a two-way switch the stator windings can be star-connected for low speeds and for starting, and delta-connected for higher speeds.—Lond. *Elec. Eng'ing,* Oct. 12.

Frequency Transformers.—A note on a recent British patent (600, Sept. 21, 1911) of Brown, Boveri & Company. In one method of transferring power at one frequency from a primary set of mains to another set of mains at a different frequency two induction motors with slip rings are used, coupled to the same shaft. A stationary winding connected to two sets of brushes is also provided, either as a separate machine or on the same shaft as the induction motors. The stator of one of the latter is connected between the primary mains and its rotor to one set of these brushes, while the stator of the second motor and the other set of brushes are connected to the secondary mains, the rotor being short-circuited. The power supplied by one machine is transmitted to the mains at half the frequency, partly through the slip rings and partly by the machine acting as generator, the machines having the same number of poles and running at the same speed. The power can be varied by altering the excitation of the winding.—Lond. *Elec. Eng'ing,* Sept. 28.

Lamps and Lighting.

Incandescent Lamps When Operated at Varying Voltage.—J. RUSSNER.—In order to separate the light radiation from the heat radiation, the author places an incandescent lamp without socket in a layer 30 mm thick of a 30 per cent solution of ferrous ammonium sulphate. This absorbs the heat rays almost completely, while it permits the light rays to pass with a loss of 15 per cent. As a result of the absorption of the heat rays the temperature of the solution increases. This increase of temperature is measured with a Beckmann thermometer. The incandescent lamp is then taken out of the solution and is enveloped with tinfoil blackened with lampblack on one side and is then placed again in the solution and lighted for the same length of time. In this case both the light and the heat rays are absorbed by the lampblack and changed into heat. The temperature of the solution increases now a little more. The difference in the increase of temperature in the first and in the second experiment is used by the author to separate the light radiation from the heat radiation. The author has made these

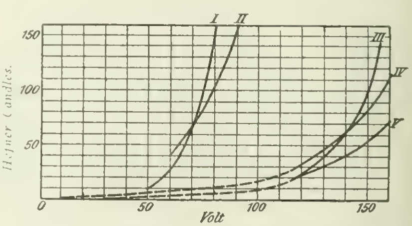


Fig. 1—Variation of Light with Voltage.

experiments with different voltages and found the following results: A 115-volt carbon lamp operated at 115 volts, 125 volts and 135 volts had an efficiency of 1.56, 2.2 and 3.1 per cent respectively. A 60-volt metallic-filament lamp operated at 60, 70 and 80 volts had an efficiency of 4.3, 5.3 and 6 per cent respectively. A 115-volt metallic-filament lamp when operated at 115, 125 and 135 volts had an efficiency of 4.5, 5.2 and 6 per cent. Efficiency is here defined as the ratio of the watts changed into light radiation to the total watts. The author has also measured the horizontal candle-power of incandescent lamps with increasing voltage the results being given in Fig. 1. The abscissas give the voltage and the ordinates the hefner candles. Curve I refers to a 50-volt carbon lamp and curve III to a 115-volt carbon lamp. Curves II, IV and V refer to metallic-filament lamps. When the voltage is slowly raised with carbon lamp the carbon filament comes up to a red heat simultaneously all over its length, which shows that little heat is conducted away from the two leading-in wires. is different with various types of metallic-filament lamp which begin to get red hot first in the center. This shows that considerable heat is lost through the leading-in wires.—*Elek. Zeit.,* Oct. 12.

Workshop Lighting.—W. MANKTELOW.—A long artic on workshop lighting in which the author discusses the su ject under the following headings: "Legislation and ad quate illumination," "desirable illumination," "natural ill mination," "artificial illumination," "general lighting" a "local lighting." He concludes "that a low local and a hi and even general illumination should be provided, and metal parts should, as far as possible, be covered with so dull paint; a dull white would be preferable from an il minating point of view, but, for obvious reasons, a d slate or green color is generally adopted." A lower il mination should really suffice at night than is required day. That a much higher intensity actually appears nec

sary in many cases is entirely due to uneven distribution and to too high local intensities. The author then takes up the personal factor in workshop lighting and gives figures for the illumination provided in actual workshops. Although such rules must be used with extreme caution, it may be taken that 1 mean spherical candle-power per 4 or 5 sq. ft. of floor area will give a suitable general illumination for most workships, while 1 mean spherical candle-power per 1 to 2 sq. ft. will, according to circumstances, give a sufficient additional "local" illumination.—Lond. *Elec. Review*, Oct. 6.

Filament Supports.—A note on a recent British patent (30,323, Oct. 5, 1911) of the British Thomson-Houston Company (General Electric Company of this country). The strength of filaments at their points of support is increased by this method of mounting. The copper leading-in wires are flattened and perforated at the ends, through which the filament is passed. It is then surrounded at this point by a helix of some tough material, such as drawn molybdenum, and the wires, filament and helix are welded together by an arc. The filament is supported at the curved end of the bulb by a similar helix, which is fused at one end into a glass support attached to the bulb. The filament is then slipped over one of the coils of the helix and mounted so that a certain amount of tension is exerted on the filament. Should this tension be too great it is adjusted during incandescence, as the heat communicated to the helix causes it to soften, and the coil adjoining the filament is drawn out.—Lond. *Elec. Eng'ing*, Oct. 12.

Carbon Lamp.—R. A. Houstoun.—The continuation of his serial on studies in light production. The author deals with the carbon incandescent lamp and compares its behavior with that of a black body. He gives a summary of various determinations of efficiencies of carbon lamps and of the heat loss by conduction and convection.—Lond. *Electrician*, Oct. 13.

Generation, Transmission and Distribution.

Ontario Transmission System.—P. W. Sothmann and . Teichmueller.—A long illustrated article on the 110,000-volt transmission system of Ontario, Canada, construction of the line and stations.—*Elek. Zeit.*, Sept. 28, Oct. 5 and 12.

Wireless Telegraphy.—A. Blondel.—An article on methods of detecting at the receiving station the direction from which a wireless telegram is received. These methods depend on the action of the electromagnetic waves on two antennas at the receiving station. Two different arrangements are possible according to whether the emfs in the two antennas are added one to the other or subtracted one from the other. Both arrangements are discussed with the aid of diagrams.—*La Lumière Elec.*, Oct. 7.

Traction.

Tramcar Meters.—R. G. and J. G. Cunliffe.—A paper read before the (British) Municipal Tramways Association. The result of a long series of investigations into the relationship between energy consumption and maintenance costs carried out during the past few years at Manchester has been to demonstrate clearly that in the case of certain wearing parts of the equipments, in which the energy losses increase with wear, the economical life is determined by the energy loss rather than by the extent of the wear. In Fig. 1 curve A gives the units per car-mile, curve B the units per ton-mile, curve C the car-mileage run and curve D the average weight per car. Curves A and B, Fig. 2, show that the rate of energy consumption commenced to fall from the time that the methods were applied in 1908, the saving increasing as the equipments were gradually brought to a state of increased efficiency. The whole of the large increase in rate of energy consumption prior to 1907 was not due to the increasing inefficiency of the equipments, as the proportion of large double-truck cars in use was steadily increasing while the covering of cars was proceeding at a rapid rate, but curve B shows that the units per ton-mile also increased to a considerable extent and the effect of increasing weight ought to have been slightly to diminish this, since weight added to a car does not proportionately increase its rate of energy consumption, so that there was no doubt as to the importance of the increasing losses. From curve C it is evident also

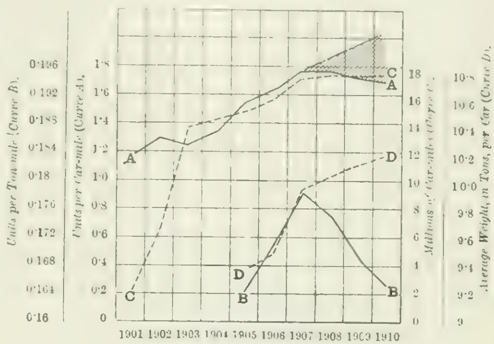


Fig. 2—Energy-Consumption Statistics.

that the mileage run was increasing rapidly and the transmission losses, being roughly proportional to the square of the mileage, were becoming of relatively greater importance. The actual saving effected is shown approximately by the shaded area in curve A and would have been greater but for the fact that the proportion of double-truck cars has continued to increase and the upper decks of many of the cars have been inclosed during the period under consideration, so that the average weight per car is much in excess of the 1907 value, as is shown by curve D. It is difficult to obtain an exact knowledge of either the value of the saving effected or the cost of obtaining it, but although the first cost of renewing faulty field coils, worm gearing, etc., and adopting a heavier gage of trolley wire where necessary was comparatively heavy, it has already been balanced by the saving in energy, which, in addition, is cumulative over a number of years, during which the increase in maintenance charges will be very slight. On the whole, by keeping down the losses it is possible to maintain the equipments in a better condition, with increased public safety and comfort, and, at the same time, to effect a saving, but this necessitates as exact a knowledge as possible of the values of the various losses, and one of the principal functions of the meters ought to be to supply this information. This, however, can only be done by meters capable of giving absolute values. The watt-hour meter gives complete information, the amp-hour meter partly complete information, while the information given by the time meter is incomplete. As an auxiliary meter the authors have developed a volt-hour meter. Concerning the different types of the meters for tramway use the authors reach the following final conclusions. The amp-hour meter can, with proper supervision, be made to operate with an accuracy within 1 per cent and its uncorrected values may be employed for the purpose of placing motormen and cars in their correct order of merit, while, when corrected for variation of average voltage by the volt-hour meter, its readings give the energy consumption. If percentage differences between the results of various men are required the corrected values must be used. The watt-hour meter, owing to its great complexity, more fragile construction, susceptibility to lightning discharges and greater inaccuracy, is not so desirable or valuable an instrument as is the corrected amp-hour meter. The time-meter, although very accurate in its measurement of time, cannot be trusted to measure energy within 10 per cent and,

if used at all, should be employed only in connection with the energy meter for purposes of investigation, in which connection it is very valuable. The volt-hour meter is indispensable for many purposes and ought to be employed on all tramway systems for the purpose of measuring average voltages. On small undertakings, with light traffic, approximately equal savings may be effected in the driving and in the detection of faulty equipments, but, as the congestion increases, the state of the equipments becomes of increasing importance, more especially as regards the feeding and distributing system, where the losses are a fraction of the total energy consumption and do not merely affect the consumption of individual cars. A copper voltameter for use on electric cars is described in an appendix to the paper.—Lond. *Electrician,* Oct. 6.

Electric Traction in Vienna.—An abstract of the financial report for the Vienna tramways for 1910. There were 271,584,931 passengers carried, as compared with 267,449,171 passengers in the year 1909. This represents an increase of 1.5 per cent, as compared with 9.1 per cent for the preceding year. This unfavorable result was due partly to an increase in fares and partly to poor weather. There were operated 49,822,147 car-miles, an increase of 5.84 per cent. The gross earnings were $8,565,330, an increase of 13.9 per cent. On the electrically operated lines of the system the operating expenses, exclusive of "welfare" work, constituted 60.9 per cent of the gross earnings, as compared with 61.1 per cent in 1909. The average earnings were 15.4 cents per car-mile, an increase of 7.6 per cent. The average receipts per passenger were 3.22 cents, compared with 2.90 cents in 1909. The total length of the system, measured as single track, was 312 miles. The 9786 employees of the company received $3,465,990 in 1910, an increase of 14.5 per cent over the year before. This sum was equivalent to 40 per cent of the gross earnings. In addition 6 per cent of the gross earnings was set aside for employees' welfare purposes, such as pensions and sick benefits. The use of car meters has produced a steady decline in the energy consumption per car-mile. In one case the clocks showed a difference of 68 per cent in the efficiency of two motormen who were operating under the same speed conditions over a given route. In another test it was found that a good motorman maintained the schedule for 312 days with 33,200 current-minutes, whereas a poor motorman required 55,070 current-minutes. Premiums for current-time saving were awarded to the amount of $11,525 for a total of 6433 cases. The improvement of the motormen is shown by the fact that 28 per cent received premiums in 1910 as compared with 15 per cent in 1909. The car meters on the cars are supplemented by clocks, which have been installed at forty-eight time points. These clocks have been found very effective in spurring the motormen on to maintain their schedules, in reducing energy consumption and in aiding statistical work, such as mileage determinations. At the end of the fiscal year there were 1201 motor cars and 1348 trailers in service. The latest rolling stock, numbering ninety-nine motor cars and 205 trailers, is of the vestibule type with separate passages for entrance and exit, as in the American pay-as-you-enter cars. These cars have reduced the length of stops by some 25 per cent. The new motor cars use interpole motors which are large enough to haul two trailers, and braking resistor grids are placed under the seats for use as heaters. —Lond. *Electrician,* Oct. 6.

Single-Phase Traction.—A. Soulier.—A long and profusely illustrated description of the single-phase traction system of the Haute-Vienne district in France. The total length of the lines is 345 km (207 miles) and comprises four lines all starting from Limoges. Use is made of single-phase current at 10,000 volts supplied from two stations, one a water-power station of 2400 hp at Eymoutiers and the other a steam station of 1000 hp at Limoges.—*L'Industrie Elec.,* Oct. 10.

Installations, Systems and Appliances.

Central-Station Statistics of Austria.—L. Rosenbaum.—An article in which the author gives further results of an analysis of the recently published central-station statistics of Austria. The approximate connections of all stations are as follows: For lighting, 230,500 kw; for motor service (including traction), 255,000 kw; total, 485,500 kw. The connections of incandescent lamps per capita and the yearly increase of the same per capita are smallest in cities of medium size (with 20,000 to 100,000 inhabitants). This is essentially due to the existence of gas plants in such cities. The connections of stationary motors per capita do not depend in general on the size of the city and on the existence of gas plants; their yearly increase is almost twice the increase of the lamp connections and amounts on the average to 30 per cent. The load factor increases in general with the size of the city; its average is below 15 per cent.—*Elek. u. Masch.* (Vienna), Oct. 1.

Electric Cooking Apparatus.—An illustrated description of electric cooking apparatus shown at the Olympia electrical exhibition in London. The essential feature of it is

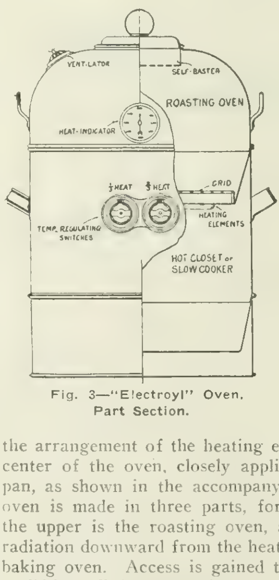


Fig. 3—"Electroyl" Oven, Part Section.

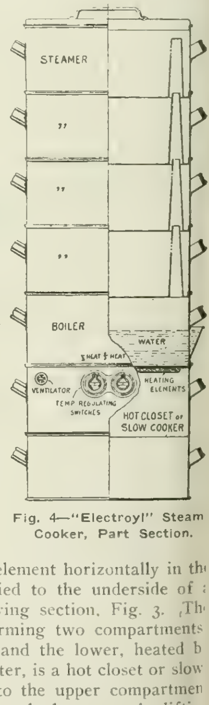


Fig. 4—"Electroyl" Steam Cooker, Part Section.

the arrangement of the heating element horizontally in the center of the oven, closely applied to the underside of a pan, as shown in the accompanying section, Fig. 3. The oven is made in three parts, forming two compartments; the upper is the roasting oven, and the lower, heated by radiation downward from the heater, is a hot closet or slow baking oven. Access is gained to the upper compartment by lifting off the top section and to the lower one by lifting off two sections. The top section or cover is curved so as to assist the circulation of the hot air, and is provided with a self-baster—a perforated vessel in the top in which fat can be placed, which, melting, drips upon the joint below. A direct-reading temperature indicator is fixed on the top section, and by means of two switches three rates of heating are provided. It will be seen that the heating element is perfectly protected from falling moisture or fat, and from its position or shape it exposes the minimum surface for radiation sideways, while it is most effectively situated for radiation into the lower oven and for radiation and convection into the upper one. The oven is made of tinned steel, is light to handle and presents bright external and internal surfaces, so that radiation losses are reduced to a minimum. It is made in three sizes taking 800, 1000 and 1200 watts

at full load respectively, and the price is very low. A similar arrangement is employed in the steam cooker shown in Fig. 4. This consists of a pair of sections like the lower pair in the oven, upon which are piled a series of steamers to almost any number, as shown. Directly the water in the boiler reaches boiling point all the steamers are ready for use; on removing the boiling pan the top of the section containing the heating element can be used for frying, grilling, etc., with ordinary utensils. The steam cooker is also made in three sizes, from 800 to 1500 watts.—Supplement to Lond. *Elec. Review,* Oct. 6.

Electric Cooking.—R. B. Matthews.—A long article on electric cooking, its present position and cost. The author first gives various tables and figures from actual practice showing that the loss due to shrinkage of meat is considerable with gas or coal heating while it is practically negligible with electric heating. This is considered not to be simply an advantage on paper but also to represent a considerable saving in the butcher's bill. Various data are given on the cost of electric cooking. The values given for the energy consumption approximate about ⅓ kw-hour per meal per person. Where gas costs 62 cents per 1000 cu. ft. and electricity is 2 cents per kw-hour the actual costs of cooking are about equal, while even at 3 cents per kw-hour electricity is cheaper than coal. Moreover, there are many other special advantages of electric cooking.—Lond. *Elec Review,* Oct. 6.

Safety Device for Belt Drives.—F. C. Moins.—A note describing a simple method of automatically stopping a motor should a belt break. Passing under a flywheel or driving belt is a cord (Fig. 5), one end secured to a

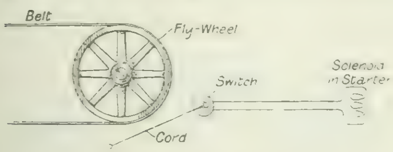


Fig. 5—Device for Stopping a Motor.

bracket and the other end secured to an ordinary 5-amp switch knob. From the switch two wires are run to the no-voltage release coil of the starter. When the strap breaks it fouls the string and closes the switch, which short-circuits the release coil of the starter and stops the motor. The author has found it of great value; moreover, it is quite inexpensive.—Lond. *Elec Eng'ing,* Oct. 12.

Electrochemistry and Batteries.

Dry Storage Battery.—A note on a recent British patent (28,755, Oct. 5, 1911) of G. Inrig and Gavan Inrig, Ltd. A dry storage battery, with no plates to buckle, is made up as follows: The positive electrode is a carbon block of star-shaped cross-section, fitted into the center of a block of depolarizing material. The electrode is separated from a zinc electrode of square section by a series of cane strips in. square to allow for air circulation. In charging the cell contact is made with the zinc through the moisture absorbed by the cane strips from the electrolyte. As the charging proceeds a spongy deposit collects on the zinc and makes a permanent porous connection between the zinc and the electrolyte.—Lond. *Elec. Eng'ing,* Oct. 12.

Units, Measurements and Instruments.

Variable Condenser.—An illustrated description of a variable condenser exhibited at the Olympia electrical exhibition in London. It consists (Fig. 6) of a metal cylinder *A* fixed on an ebonite base *B* and covered with a thin sheet of mica, in contact with which is a layer of mercury *M* contained in the annular space between the mica and a glass cylinder *C*. The height of the layer of mercury is varied by squeezing a rubber bag *E* containing mercury, in communication with the annular space *D*, through a tube *F*. For this purpose a piston *H* is pressed down in a cylinder *G* by the screw *K L* and handwheel *N*. The capacity is, of course, proportional to the area of the mercury surface and therefore to

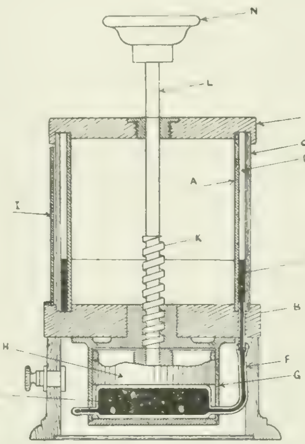


Fig. 6 Section of Mercury Condenser

the height of the mercury, which is read off an index *I*. There is nothing to go wrong in the device; it will not spark over; it remains at the value it is set for without locking, and the same capacity is contained in a volume less than one-fourth of the usual type of variable air condensers.—Lond. *Elec. Review,* Oct. 13.

Instruments and Meters.—An illustrated description of various instruments and meters shown at the recent Olympian electrical exhibition in London. Among them are testing sets, a new alternating-current leakage recorder, a three-phase alternating-current ship's telegraph, a direct-current leakage recorder, a speed indicator, laboratory and switchboard instruments, an automatic transformer switch for auto-transformers for metallic-filament lamps (which has already been described in the Digest) and meters. The article is to be continued.—Lond. *Electrician,* Oct. 13.

Telegraphy, Telephony and Signals.

Anglo-Belgian Loaded Telephone Cable.—An article on the new telephone cable between England and Belgium. Special loaded coils have been introduced, which enable a superimposed or "phantom" circuit to be worked, in addition to two ordinary loop circuits. The constants of the cable are given as follows: Resistance per nautical mile of loop conductor = 14.2 ohms at 15 deg. C. without coils. Capacity per nautical mile of loop conductor = 0.157 mfd without coils. Capacity per nautical mile of phantom circuit without coils = 0.314 mfd. Self-inductance of the coils for the transformer circuit = 0.1 henry. Ohmic resistance of the inductive and non-inductive coils in the transformer circuit = 6.6 ohms. Effective resistance of the inductive and non-inductive coils of the transformer circuit at 800

2 – =	3,000	4,000	5,000	6,000	7,000
Transformer circuit	0.863	0.872	0.893	0.920	0.977
Phantom circuit. .		0.877	0.904	0.928	

cycles with 1 milliampere at 15 deg. C. = 11.5 ohms. Self-inductance of the coils in the phantom circuit = 0.05 henry. Ohmic resistance of all coils in the phantom circuit = 3.3 ohms. Effective resistance of all the coils in the phantom circuit at 800 cycles with 1 milliampere at 15 deg. C. = 4.6 ohms. Capacity of the coils in the transformer circuit =

0.004 mfd. Additional capacity of the coils in the phantom circuit is less than 0.0001 mfd. The value of βl for 50 nautical miles, measured with the Franke machine, is shown on the preceding page.

It will be seen that the βl values are almost independent of the frequency. One week after the cable had been laid a fault occurred. It was found to be due to a bad joint between one of the cores and the insulation of the coils, and was repaired in twelve hours.—Lond. *Elec. Review*, Oct. 6.

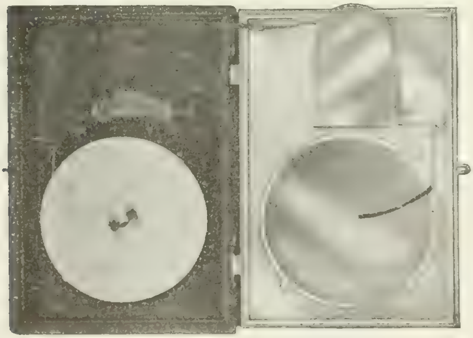
Rome.—J. Reyval.—The first part of an article on the different stations which supply the city of Rome in Italy with electric energy. To the end of 1910 these were four, namely, the water-power station of Tivoli of 5888 kw, the water-power station of Subiaco of 2944 kw, the steam station of San Paolo of 18,000 kw and the steam station of Tor di Quinto of 15,000 kw, the total power available at the end of 1910 being 28,332 kw. Since this was not sufficient, further power supplies have been made available, namely, the new water-power station of Arci of 2944 kw and the Terni water-power station of 22,000 kw. There are now 53,276 kw at Rome's disposal.— *La Lumière Elec.*, Oct. 7.

New Apparatus and Appliances

AN ELECTRIC RECORDING INSTRUMENT.

A new type of electric recording instrument particularly adaptable for use as a recording voltmeter or ammeter has been designed by the Brown Instrument Company and the Keystone Electrical Instrument Company of Philadelphia, Pa. Recognizing the necessity of a recording instrument which is both accurate in operation and simple in construction, much time has been spent in designing an instrument which can be mounted on the wall or switchboard and used by the most inexperienced workman.

In the common form of recording instruments no means are provided for shifting the recording pen arm out of the way when the chart which receives the record is changed; consequently there is serious danger of bending the pen in removing the chart. In this respect the new recording instrument is novel in construction, in that the essential parts of the instrument are mounted on the door instead of in the case, the clock mechanism and chart alone remaining in the case when the door is opened. Consequently there is no possibility of bending the pen because there is no occasion to handle it for any reason whatsoever. As soon as the door is thrown open the entire voltmeter system and the inking device is swung aside automatically, permitting the old chart to be easily removed and a new one substituted.



Interior View of Instrument.

The illustration above shows the instrument with the door thrown open ready to have a new record chart installed. The millivoltmeter system which is used in the instrument is a simplified form of the D'Arsonval system, universally used in electrical instruments of precision. The recording pen comes in contact with the paper momentarily only for the purpose of making a dot, thereby eliminating all friction between the pen and the chart. An inking pad is placed immediately beside the pen carrying sufficient ink for a week's supply, and this pad touches the pen point frequently, keeping it damp. When the door is closed the arm seen at the left in the cut and operating by the clock mechanism comes in contact automatically with the inking device, and every half minute, or quarter minute if preferred, it pushes the inking pad away from the pen, permitting it to swing freely. It then falls, allowing the inking pad by its own weight to press the recording pen against the paper.

MAGNETIC CHUCK.

In machine shop work one of the best labor savers among the numerous electrical devices is the magnetic chuck. It possesses a wide range of usefulness chiefly in holding pieces of work on the grinder, shaper and milling machine in preference to the older methods of clamping or bolting. In the chucks placed on the market by the D & W Fuse Company, Providence, R. I., the magnet coils are practically indestructible from overheating, as they are wound with deltabeston wire, a heatproof insulation of asbestos, and are designed so that should they become accidentally injured they can be removed by a workman and a new coil inserted. Chucks are made for surface grinding, planing and milling or for ring and cup grinding. The general design of stationary flat chucks for light work is shown in Fig. 1. The rotary chuck and chuck plate are shown in Fig. 2. By means of the chuck plate one chuck can be made to cover a wide range of operation in the grinding of rings, ball races, etc., as any number of plates can be used with a given chuck. The chucks are oilproof and waterproof and are fitted with a demagnetizing switch for easily releasing the work. Other magnetic chucks are also built by the company.

Fig. 1—Stationary Flat Chuck.

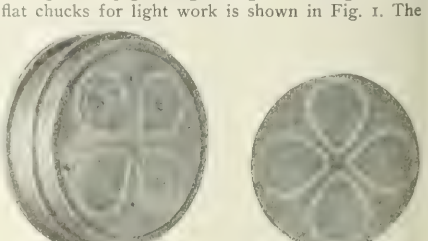


Fig. 2—Rotary Chuck and Chuck Plate.

SHADE-HOLDER TYPE OF INCANDESCENT LAMP DIMMER.

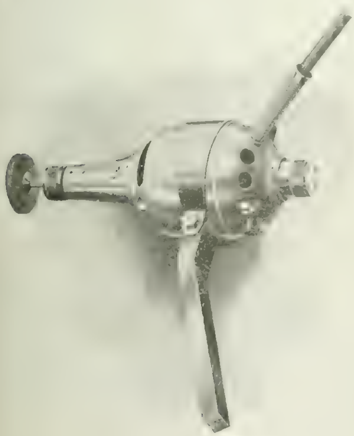
The form of "Dim-a-lite" illustrated, made by the Wirt Electric Specialty Company, Philadelphia, represents an interesting addition to this company's line of incandescent lamp dimmers, as it may be operated by simply turning the shade of the lamp. The dimmer is particularly adapted to

Dimmer Operated by Turning the Shade.

a bracket or portable light and will fit any electric fixture. It gives five gradations of light—"full," "dim," "low," "night light" and "out." The device can be easily attached in a few seconds and is stated to be very suitable for the metal-filament lamps. The appearance is neat, and an extra depth to the shadeholder gives sufficient "skirt" to bring the light well within the shade for the sake of "eye comfort."

PORTABLE ELECTRIC GRINDER.

Illustrated herewith is a new portable electric grinder made by the Hamilton-Beach Manufacturing Company, of Racine, Wis., intended for use in machine-shop practice for grinding dies, reamers, cutters, etc. The motor is of 1/2-hp and is of the universal type, operating on either



Portable Electric Grinder.

direct-current or alternating-current circuits at from 104 to 125 volts, and at 60 cycles in case of alternating current. The motor has been carefully designed for this special work and runs at a speed of 10,000 r.p.m. under light load and about 7000 r.p.m. when making a heavy cut. It is said that the only practical way to work up tempered-tool-steel tools is to grind them, and it is impossible to do this in many cases without a portable grinder. The machine illustrated weighs 5 lb. and the outer casings are made of aluminum. It has dust-proof bearings and the armature shaft is ground on centers to a mirror finish. The motor is air-cooled and is provided with adjustable end thrust and bearing. A shank is provided by which the motor is attached to the tool-post of the lathe, miller or other machine tool with which it may be used. Ten feet of cord and an attachment plug are also provided. Any kind of abrading wheel may be attached to the shaft, and felt or oiled-stone wheels may be used when a very fine finish is desired. The advantages claimed for this machine are the speed and efficiency of the motor and the lightness and convenience of the tool as a whole.

ART-GLASS FIXTURES OF HARD WOOD.

A new type of art-glass fixture, which is being marketed by the Rockford Light Furniture Company, of Rockford, Ill., makes use of a patented hard-wood construction, replacing the usual metal and lead beading. The strips framing the glass are made up of several layers of white basswood with cross-grained whitewood, and the whole is covered with a surface veneer of any ornamental hard wood desired. All parts of the framing are put together with screws. The glass is also held in position under screws and washers, but by an ingenious arrangement the smaller lower panes are set directly between layers of the five-ply framing itself. The handsome appearance of these wood fixtures lends an effect of quiet beauty and dignity not obtained with the usual materials from which such portable and shower fixtures are made. The wood fixtures are sup-

Portable Table Lamp of Hard Wood.

plied in sixty different patterns, with any hard-wood finish desired. They are shipped knocked down in compact form, the shade with its threaded socket being screwed on to the standard when assembling. In case any pane of glass becomes broken it can easily be replaced by loosening the screws and inserting the new piece.

A NEW DIRECT-TYPE CRUDE-OIL ENGINE.

Many refinements of design, tending toward simplicity, convenience and economy of operation, mark the new Atlas crude-oil engine, which is of the Diesel internal-combustion type and so shares all of the well-known and remarkable efficiencies of this gradual-combustion principle. Efficiencies five times that of the ordinary non-condensing steam plant and double that of the best gas-producer outfits are claimed as characteristics of Diesel-type operation, too well known to need further mention here.

In bringing out the new Atlas crude-oil engine the designers of the Atlas Engine Works, Indianapolis, have sought to produce a prime mover which, while embodying all the remarkable efficiencies of operation of the earlier models of the Diesel principle, shall meet the practical needs of operation by its accessibility, convenience and simplicity of design wherever possible.

Among the points accomplished in this direction the following may be noted from an examination of the new Atlas engine: The valve heads carrying all the valve mechanism may be lifted off without disturbing the valve settings or mechanism. The cylinders are provided with liners of close-grained iron, separate from the casting and jacket, so that in case of wear the liners can be replaced cheaply, saving reboring and new pistons. The pistons are made of a similar hard iron, with slightly softer rings. The machine work on these cylinders and piston parts is done to an accuracy of 1/1000 inch, as is characteristic of the fine fitting of engines of this type. The relief valves with which the cylinders are provided also serve as inspection ports, through which the cylinder interiors may be examined. The crank cases, filled with a mixture of oil and water, are accessible through openings in the frame, by which all interior parts can be reached from the outside. Tension bolts joining the cylinder castings and base relieve the frame of mechanical strains and render it rigid in compression. The exhaust valves are cooled both internally and externally. The cooling water which has circulated in the valve recesses is then led out and into the exhaust pipe, where it is sprayed against the exhaust cage, also undergoing evaporation and cooling the exhaust gases.

The governor, which is of the fly-ball type, controls the first stage of the fuel injection pump, which works against no pressure, simply delivering the fuel in proportionate quantities to the second-stage pump. The latter operates at constant stroke, forcing the fuel oil at the rate received into the air jet at 900 lb. pressure. This is then fed into the highly compressed and overheated air in the clearance space of the cylinder during about one-tenth of the working stroke. Throughout this brief but actual period—about one one-hundredth of a second—the fuel jet is ignited and burns steadily, maintaining the initial compression pressure of 500 lb. After the first tenth of the working stroke the fuel is cut off and the gas expands adiabatically. On the next up-stroke the burned gases are expelled; during the following down-stroke fresh free air is drawn into the cylinder and the next up-stroke serves to compress this air to about 500 lb. pressure, heating it to 1000 deg. Fahr.

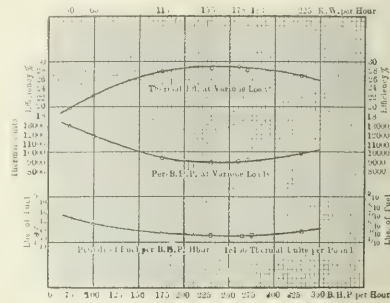


Fig. 2—Efficiency and Fuel Consumption Curves Based on Test Results.

Fig. 1—300-Brake-hp Atlas Cr. de-Oil Engine.

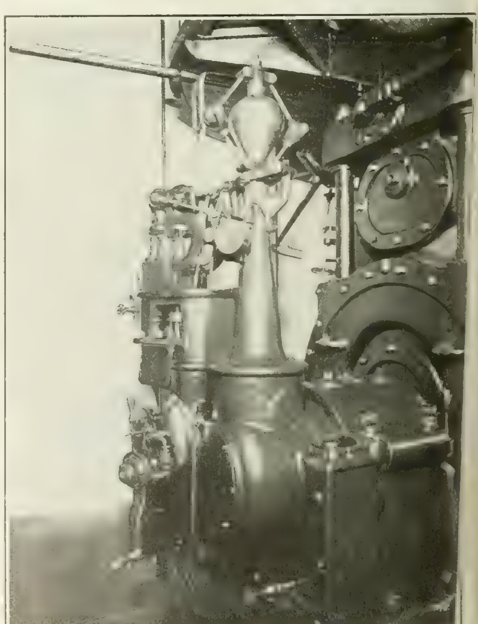


Fig. 3—Governor Mechanism and Fuel Pumps.

[illegible] four-cycle series is [illegible]. The shaft from which the admission and exhaust valves are separately operated by rocker arms is itself driven through an intermediate vertical shaft and bevel-gear reduction from the main shaft.

The cheapest oil available at the nearest refinery or tank station can, it is stated, be used successfully in these new

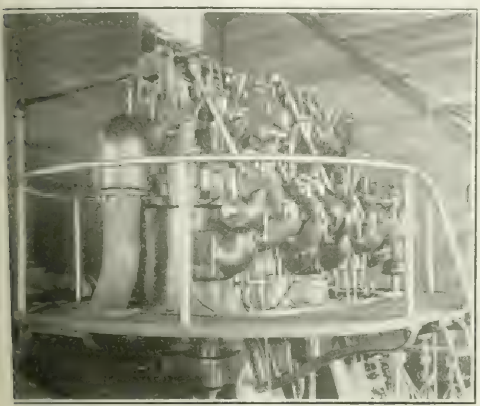


Fig. 4—Valve Mechanism of Engine.

gines. Fluidity sufficient to be handled by a pump appears to be about the only requirement for the fuel. Such [illegible], containing 19,000 lb.-Fahrenheit heat units per pound [illegible]s all petroleum products do, practically independent of [illegible]ir quality), can now be purchased for 2 cents a gallon, [illegible]re or less, depending on location. Since the Atlas engine [illegible]duces a brake hp-hour on less than ½ lb. of oil, the [illegible]l expense of operating a 100-kw plant would be hardly [illegible] per day. The advantage of handling fuel oil compared [illegible]h coal needs no detailed analysis here.

[illegible]ests made on the Atlas Diesel-type engine show that [illegible] efficiency is practically as good at half load as at full [illegible]d, reaching the highest point at about 80 per cent load. [illegible]se engines are capable of 20 per cent overload without [illegible]nificant loss in speed. When severely overloaded, how[illegible]r, unlike the ordinary explosion-type combustion engine,

Comparing Atlas oil-engine operation, using 19,000-heat-unit oil, costing 2 cents per gallon, with a simple Corliss steam plant burning 12,150-unit coal, costing $3.50 per ton, the manufacturers compute an annual saving of 80 per cent. Assuming, as seems reasonable, that the starting

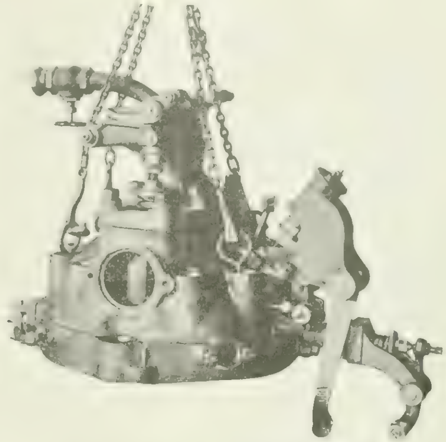


Fig. 5—Valve Head Lifted from Cylinder.

and light-load inefficiencies, costs of handling coal, additional labor, etc., will equal the entire fuel cost for the oil engine, the manufacturers estimate that the latter will pay for itself in fuel savings in four years, or proportionately sooner if operated more than sixty hours per week. On producer-plant operation a saving of 46.4 per cent is claimed.

A series of exhaustion, endurance and economy tests have been conducted on a 300-brake-hp, two-cylinder engine at the Indianapolis factory. Continuous service runs, 168 hours per week, without stopping, followed by 144-hour runs, allowing the engine to cool twenty-four hours to detect effects of rapid starting when cold, etc., have revealed no perceptible wear on bearing surfaces, no repairs and no adjustments beyond the ordinary ones with the engine in motion.

SUMMARY OF TESTS ON 300-HP ATLAS OIL ENGINE.

[illegible]	[illegible] 21 11	6-20-11	6-20-11	6-19-11	6-21-11	6-20-11	6-21 11
[illegible] test in hours	1.	1.5	3.	2.	2.5	4.	1.
[illegible] kilowatts by switchboard meter	[illegible]	[illegible]	132.	173.5	200.4	205.75	249.
[illegible]watts to compressor by wattmeter...	24.7[illegible]	22.66	23.6	25.5	[illegible]	29 25	31.
[illegible]smission losses to compressors, 23.6 per [illegible]	5.84	5.34	5.5	6.	6.98	6.91	7.31
[illegible] watts used by compressor	18.91	17.32	18.1	19.5	22.62	22.35	23.69
[illegible] power used by compressor	25.32	23.20	24.25	26.13	30.31	29.94	31 74
[illegible] delivered to line	[illegible]	65.98	113.9	154.	177.78	183.4	225.31
[illegible] horse-power	[illegible]	88.41	152.62	206.36	238.22	245.75	301.91
[illegible]ator efficiency, per cent manufacture[illegible] [illegible]	[illegible]	88.	89.	90.	91.	91.3	91.
[illegible] horse power..	[illegible]	100.4	171.4	229.2	261.7	269.4	331.7
Re[illegible]lutions of engine per minute	[illegible]	174.1	173.13	[illegible]	[illegible]	171 9	171
Pu[illegible]oil used, pounds per hour..	50.	61.3	81.	[illegible]	12[illegible]4	128	167
Po[illegible] oil per kw-hour	1.04	.93	.71	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] oil per 100 kw-hours....	14.22	12.73	9.73	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] oil per brake hp-hour .	.67	61	.472	[illegible]	[illegible]	.476	[illegible]
[illegible] oil per 100 brake hp-hours	9.18	8.36	6.47	[illegible]	[illegible]	6.51	[illegible]
[illegible]al units per brake hp-hour.	[illegible]	11680.	9038.	[illegible]	[illegible]	9115.	[illegible]
[illegible] efficiency of engine, 2545 therm[illegible] [illegible] per brake hp	19.8	21.7	28.15	[illegible]	[illegible]	28	26 4
[illegible]st of 100 kw-hours in cents, oil at [illegible] [illegible]nts per gallon	28 44	[illegible]	19 46	[illegible]	[illegible]	[illegible]	20.3

[illegible] do not labor and halt, but simply fall off in speed like an [illegible]verloaded steam engine. The thermal efficiency of the At[illegible]s engine, based upon the indicator diagram, is 37½ per [illegible] and on the brake horse-power developed 30 per cent. [illegible] mechanical efficiency is hence about 80 per cent. 11 per cent or more going to the compressor.

The accompanying table shows a summary of results from tests on this unit made by Mr. C. E. Sargent, M.E., an authority on internal-combustion engines.

The Atlas crude-oil engine is built in three sizes: Two-cylinder, 300-brake-hp; three-cylinder, 450-brake-hp; and four-cylinder, 600-brake-hp.

Industrial and Commercial News

THE WEEK IN TRADE.

FILING of the federal suit seeking dissolution of the United States Steel Corporation on the ground that it is a monopoly in restraint of trade in violation of the Sherman anti-trust law forms the leading item of interest in business circles. Protest that the time for bringing the suit is inopportune, since arraignment of the leading industrial enterprise of the country injects further hindrance in the path of trade revival, is gradually losing its force. There now seems to be a widespread realization that, since the suit was certain to be brought, the sooner the status of the corporation is made clear the more rapidly will trade respond. As a matter of fact, the first shock is passing away, and there is far less anxiety exhibited toward the outcome than was shown in the Standard Oil and American Tobacco suits. There is every reason to believe that the Steel Corporation will be able to refute nearly all of the charges when the case is brought to trial and that no general reorganization such as was ordered in the foregoing cases will be required. That the iron and steel trades are not reflecting the pessimism found elsewhere is shown in the quarterly report of the Steel Corporation, covering earnings for the three months ended Sept. 30, which were better than in any quarter since the corresponding quarter last year. Net earnings were $29,522,725, as compared with $28,108,520 for the second quarter and $25,990,978 in the last quarter of 1910. Orders for railroad equipment, especially for cars, have been larger than those in several weeks, and it is expected that these will be still further increased before long. Demand for pig-iron is improving, and many consumers are expressing a willingness to close contracts for the future at prevailing rates. There is decided advancement shown in the wool trade, and New England mills are expanding their operations. Uncertain prices in the cotton markets are prompting buyers to hold off for the present, and there is little disposition in evidence toward closing contracts extending very far into the future. Business failures for the week ended Oct. 26, as reported by *Bradstreet's*, were 231, as compared with 258 last week, 220 for the corresponding week in 1910, 217 in 1909, 241 in 1908 and 223 in 1907.

THE COPPER MARKET.

COPPER prices continue to fluctuate between narrow limits, and in spite of a mild tendency toward advancement last week electrolytic is obtainable at 12.30 cents to 12.35 cents cash, although the larger agencies are still quoting 12.50 cents. Slightly lower prices than the foregoing are being asked by second hands. European quotations on electrolytic are between £57 and £57 5s. Standard copper in New York shows little change from the dullness of recent weeks, and all positions from spot to January inclusive have averaged 12.20 cents with 12 cents bid. Approach of the October report of the Copper Producers' Association is influencing purchasers to withhold as much as possible, pending confirmation of their views that stocks will be increased and that low prices will continue. The foreign attitude toward copper purchasing offers little encouragement to producers, and as the temporary setback in industrial conditions due to the suit against the Steel Corporation is almost certain to result in further dullness in the copper trade the outlook for disposing of large amounts of the metal in the immediate future is not very alluring. Estimates on the October showing place domestic consumption at 50,000,000 lb., export deliveries at 50,000,000 lb. to 55,000,000 lb. and output at 130,000,000 lb., which indicates an increase of 20,000,000 lb. in surplus copper stocks. There is every reason to bear out the opinion that the copper market at this time is decidedly in the hands of the purchasing element, and that a substantial increase must take place in demand for copper before prices will show permanent improvement. Exports for the month of October, lacking one day, aggregate 21,330 tons, which compares with 24,008 tons in the same period in September. The daily call on the Metal Exchange Oct. 31 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.95	12.10	[illegible]
November	11.90	12.05	[illegible]
December	11.90	12.05	11.97½
January	11.97½	12.15	12.05

The London market closed Oct. 31, as follows:

	Noon.			Closing.		
	£	s	d	£	s	d
Standard copper	55	7	6	[illegible]	[illegible]	[illegible]
Standard copper, futures	56	2	6	[illegible]	[illegible]	[illegible]

Extreme fluctuations for this year:

	Highest			Lowest		
Standard	12.35			[illegible]		
London, spot	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]
London, futures	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Best selected	61	10	0	[illegible]	[illegible]	[illegible]

INDUSTRIAL AND COMMERCIAL NOTES.

Federal Light & Traction Company.—A recent statement shows that the Federal Light & Traction Company, 60 Broadway, New York, now operates public utilities supplying Aberdeen, Hoquiam and Cosmopolis, Wash. (Gray's Harbor Railway & Light Company); Sheridan, Wyo. (Sheridan Electric Light & Power Company, Sheridan County Electric Company); Albuquerque, N. M. (Albuquerque Gas, Electric Light & Power Company, Albuquerque Electric Power Company); Trinidad, Col. (Trinidad Electric Transmission, Railway & Gas Company). Also the electric railway, lighting and power and gas plant of Tucson, Ariz.; the electric railway, lighting and power plant of Las Vegas, N. M.; the electric lighting and power plants of Rawlins, Wyo., Montrose, Col., and Hobart, Okla. and the Springfield Railway & Light Company, which own the stock of the Springfield Gas & Electric Company and th Springfield Traction Company, of Springfield, Mo. The plant supplying Aberdeen, Hoquiam, Cosmopolis, Sheridan, Albuquerque, Tucson, Las Vegas, Rawlins, Montrose and Hobar were acquired June 1, 1910; the Springfield plant was acquire in May of this year, and that of the Trinidad company (for merly the Colorado Railway, Light & Power Company) o Aug. 2. The plant of the Gray's Harbor Railway & Ligh Company has been increased 70 per cent; at Sheridan, Wyo. 3000-kw generating plant (Sheridan County Electric Company has been established 10 miles from the city near coal mine and the generating plant at Albuquerque has been double The net earnings of all the properties were $264,596 for th year ended June 1, 1910, and $625,337 for the year ended Ju 31, 1911. The latter figure includes net earnings of the Spring field and Trinidad properties.

Alberger Pump Orders.—The Alberger Pump Compan New York, recently received an order from the city of Wo cester through George W. Stetson, its Boston representati for three four-stage belt-driven turbine pumps, with a capaci of 1400 g.p.m. each, against a total head of 550 feet, and guaranteed efficiency of 70 per cent, deliveries being requir Sept. 5, 9 and 12, with a penalty for each day of delay. As matter of fact the deliveries were made on Sept. 1, 8 and thus in two cases anticipating the required dates. As illu trating the extent to which formality was set aside, the leg documents necessary to make a full binding contract were r received by the pump builders until after the pumps we shipped. Deliveries under a contract for dry-dock pumps ha begun at the Navy Yard in Brooklyn. This is the largest ord for centrifugal pumps ever given by the government to c contractor, and includes eleven 54-inch main pumps and sev 15-inch drainage pumps, with all the electric motors and co trol; valves and pipe connections.

Electrical Development on Canadian Pacific.—Wat power rights on the Adams River, in British Columbia, capa of developing 100,000 hp have been secured by the Canadia Pacific Railway. It is thought that this is a preliminary st toward electrification of its mountain system.

Hamilton Gas & Electric Company.—The Hamilton Gas & Electric Company has filed a voluntary petition in bankruptcy in the United States District Court at Cincinnati, and W. A. Everson, secretary and general manager of the company, has been appointed temporary receiver until the company and the bondholders can get together and unite upon a receiver or trustee. The liabilities are given as $1,013,856.36, while the appraised assets are $536,603.21. No valuation has been placed upon the perpetual franchise nor the entire stock of the Hamilton Otto Coke Company which the company owns. These are left open for appraisement. Attorney Robert Ramsey, who represents the company and is financially interested in it, states that the figures which appear in the schedule of liabilities should not be considered upon their face value, as the company has practically no assets except from some personal loans advanced by those closely connected with it to tide over troubles. On the other hand, the assets could not be valued in dollars and cents, he says. The franchise is of great value, as well as the stock of the Hamilton Otto Coke Company. Mr. Ramsey stated that the unequal competition brought about by the city's municipal gas plant caused the trouble. Plans have been under way for some time that, if consummated, might have relieved the trouble and prevented the company from going into the bankruptcy court, but a few bondholders who did not receive their interest when due last July had brought suit to recover on their coupons, and, as the officials felt that all should be treated alike, it was for this reason that the petition was filed.

Georgia Power Company.—The Georgia Power Company, through its chief engineer, C. O. Lenz, 71 Broadway, New York, has ordered from the General Electric Company transformers aggregating 33,500 kw in capacity to be installed in its substations as follows: At the Gainesville substation, 1500 kw; at Atlanta, 20,000 kw; at Newman, 3000 kw; at Cartersville, 6000 kw, and at Lindale 3000 kw. The high-tension side of these transformers will be wound for 110,000 or 55,000 volts, and the low-tension side for 22,000 or 11,000 volts. The order includes high and low tension switches, lightning arresters, etc. All of the high-tension apparatus and fuses, except oil switches, will be placed out of doors. Small shelters, probably of concrete, will be provided for the oil switches. The Georgia Railway & Power Company, which was recently incorporated to acquire numerous hydroelectric properties in Atlanta, Ga., and adjacent territory, including the water-power properties of the Georgia Power Company, has acquired the Savannah River Power Company, of Anderson, S. C. This company operates a power station at Greggs [illegible]ls, Anderson County, S. C., which furnishes energy to [illegible]ville and Greenwood, S. C. A hearing on the application [illegible] Georgia Railway & Power Company to the Georgia Rail[illegible] Commission for authority to issue $30,000,000 in bonds [illegible] $37,000,000 in stock is scheduled for Nov. 7 at Atlanta. [illegible] have been secured [illegible] properties in [illegible]

American Telephone & Telegraph Statement.—The re[illegible] of the American Telephone & Telegraph Company to the [illegible] York Stock Exchange as of Sept. 30, 1911, shows the [illegible]wing assets: Construction, equipment and supplies, $47,-[illegible]8; telephone instruments, $12,311,702; real estate, $2,188,-[illegible] stocks and bonds, $367,310,332; treasury bonds, $5,000,000; loans to telephone companies, $25,760,270; special demand notes, $[illegible]898,262; cash and deposits, $14,142,278; accounts receivable, $[illegible]05,489; total, $514,217,795. Liabilities: Capital stock, $275,-[illegible]0; capital stock instalments, $991,625; collateral trust [illegible]s, $78,000,000; convertible bonds, $22,025,000; coupon notes, $15,000; accrued interest, $1,067,079; taxes, $416,755; unearned revenue, $2,786; notes payable to Western Union Telegraph Company, due 1912-15, $16,500,000; notes payable to subsidiary companies, $14,245,000; dividends payable Oct. 16, $[illegible]19,816; other accounts payable, $1,349,396; reserve for depreciation, $37,581,970; surplus, $56,338,446; revenue balance, $[illegible]74,117; total, $514,217,795.

Westinghouse Electric & Manufacturing Company.—Notice has been given to holders of assenting stock of the Westinghouse Electric & Manufacturing Company that the name of this stock has been changed to "common stock." This change in name involves no change in the stockholders' rights, and was made because all the outstanding stock of the company, other than the preferred stock, consists of the so-called "assenting stock," so that this stock is in fact, as it should be in name, common stock. New stock certificates have been prepared and will be exchanged on presentation of old certificates at the Union Trust Company, Pittsbugh, Pa., the United States Mortgage & Trust Company, New York City, and the New England Trust Company, Boston, Mass.

Dr. Pearson Finances $25,000,000 Power Company to Operate in Spain.—The Barcelona Company has been organized under Canadian laws with a capitalization of $25,000,000 to construct and operate hydroelectric plants and traction lines in the city of Barcelona and the entire northeastern section of Spain. Dr. F. S. Pearson, the active head of the syndicate controlling the Rio de Janeiro Tramway, Light & Power Company, the Sao Paulo Tramway, Light & Power Company and the Mexico Tramways Company, is financing the project. Generating stations aggregating 250,000 hp are under consideration. The new company has acquired one of the tramways in Barcelona, and has concessions for suburban lines, on which work will begin at once. Its head office is at Toronto.

Oroville Electric Corporation.—According to J. W. Goodwin, of San Francisco, president of the Oroville Electric Corporation, his company has made preliminary plans to build a power station on the Feather River 40 miles north of Oroville, Cal., and to extend its distribution system through Oroville and Marysville into Sacramento. The Oro Electric Corporation, controlling the Oro Water, Light & Power Company, was organized in March, 1911, with a capital of $10,000,000, of which $7,500,000 is said to have been subscribed. Bonds to the amount of $10,000,000 were recently authorized, and $5,000,000 of these will be issued shortly.

Bosch Magneto Works.—The projected removal from Springfield, Mass., of the Bosch Magneto Company's works is prompted by the nearness of rendering works which make themselves obnoxious to operatives. The *Springfield Republican* editorially says that the rendering industry should be required to move to another location, leaving the vastly more valuable industry in its present location. The plant of the Bosch company is designed to employ eventually 3000 mechanics. "Springfield and Chicopee cannot afford to have the Bosch company pull up its stakes here," says the *Republican*.

October Incorporations.—Compilation by the *Journal of Commerce*, New York, shows that papers filed in the Eastern States during October for companies with an authorized capital of $1,000,000 or over, including increases in capital, represented a total of $124,220,000, an increase of $47,216,000 over September, and $30,525,000 as compared with October, 1910. Papers filed by other companies with an individual capital of $100,000 or over, including states other than those in the East, brought the month's total up to $187,178,500, as compared with $156,912,-000 in September and $176,437,317 in October, 1910.

Oskaloosa Traction & Light Company Sold.—The Des Moines River Power Company, composed largely of Eastern capitalists, with whom A. C. Miller, of Des Moines, Ia., is associated, has purchased the Oskaloosa Traction & Light Company, of Oskaloosa, Ia. The purchasers will carry out the contracts of the old company, including the building of a distribution circuit to New Sharon, 12 miles north of Oskaloosa. Other plans of the Des Moines River Power Company include the building of a dam some 8 miles south of Oskaloosa for developing about 10,000 hp in the section.

H. M. Byllesby & Company to Build $5,000,000 Plant in Kentucky.—General George H. Harries, whose election to the presidency of the Louisville (Ky.) lighting companies was mentioned in these columns last week, has announced that H. M. Byllesby & Company, of Chicago, will shortly begin the erection of a large power station at Cumberland Falls, Ky. The cost of the plant is estimated at $5,000,000. It is intimated that energy will be transmitted to Knoxville, Nashville, Cincinnati and Louisville.

Telephone Merger Backed by English Capital.—John W. Garland, of Pittsburgh, is completing details for an independent telephone merger embracing New Jersey, Pennsylvania, Ohio, Indiana, West Virginia and a portion of Illinois. An English syndicate well supplied with funds is understood to be behind the merger.

Aluminum Notes and Prices.—The aluminum market as of October 31 was reported dull, with ingots for remelting quoted at 20@22 cents spot No. 1 the base for large ingots. Rods and wire were held at 31 cents, and sheets at 33 cents.

Winnipeg Electric Company Sold.—The E. R. Reece Engineering Company, an American concern, has purchased the holdings of the Winnipeg Electric Company, which operates in Winnipeg, Man., and vicinity.

Financial.

THE WEEK IN WALL STREET.

STEEL shares declined in the closing days of last week as [illegible] the government suit [illegible] late Thursday afternoon against the Steel Corporation, the common stock falling to 50 on large transactions, as against 58½ at the close on Thursday. Other securities declined slightly under the lead of the Steel shares, but a mild recovery took place throughout the list on Monday, followed by general advance on Tuesday, with Steel common quoted at 54⅞ at the close. Attorney-General Wickersham, at the first hearing on the reorganization plan of the American Tobacco Company in the United States Circuit Court on Monday, intimated that the government would accept the plan, provided certain modifications involving federal supervision are agreed upon. He asked that the government be granted permission to intervene at any time within five years and restrain the further working of the plan in case it does not restore competition; that none of the companies into which the American Tobacco Company is to be divided be permitted to own stock in any of the other companies; that no two be allowed to have common officers or directors, nor be permitted to purchase through common agencies or effect business in any way other than as separate and distinct organizations. He suggested that the government would permit each company to control 40 per cent of the business in its respective field as a maximum. It seems probable that the government will approve the general scope of the plan and retain the right to supervise its workings for a period of five years. Trading in American Tobacco common on Tuesday resulted in an advance of 30 points. The stock market is quiet, waiting upon the outcome of the Tobacco case. Earnings of Western railroads show fair progress in gross, and railroad securities have been relatively firm in the market during the week. The local money market on Tuesday was very quiet, in spite of financing of November requirements. Rates Oct. 31 were: Call, 2@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in the tables are those at the close Oct. 31.

NEW YORK.

	Oct. 24.	Oct. 31.	Shares Sold.		Oct. 24.	Oct. 31.	Shares Sold.
[illegible]		3*	4,560	Int. Met., pf.	44½	[illegible]	[illegible]
All. Ch. pf...	11¼*	[illegible]	[illegible]	Mackay Cos..	85*	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	Mackay C., pf.	73*	[illegible]	[illegible]
[illegible]	33[illegible]	33[illegible]*	——	[illegible]	13[illegible]	[illegible]	250
Am. Loco....	34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	——
[illegible]	[illegible]	103*	800	[illegible]	[illegible]	[illegible]	— —
[illegible]	[illegible]	[illegible]		Steel com....	59¾	54⅞	1,203,800
Am. T. & T..	134⅜	135	7,550	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	74¼	4,800	[illegible]	[illegible]	[illegible]	[illegible]
Gen. Elec....	150⅜	148¾	2,900	West'h, com..	64	[illegible]	[illegible]
[illegible]	[illegible]	14¾	7,000	[illegible]	11[illegible]	[illegible]	— — —

PHILADELPHIA.

	Oct. 24.	Oct. 31.		Oct. 24.	Oct. 31.
[illegible]	[illegible]	[illegible]	Phila. R. T.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Phila. Elec..	[illegible]	[illegible]
Elec. St. Bt'y......	53¼	52	Phila. Trac..	[illegible]	[illegible]
Elec. St. Bt'y, pf...	30*	30*	Union Trac.	[illegible]	[illegible]

CHICAGO.

	Oct. 24.	Oct. 31.		Oct. 24.	Oct. 31.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Elev. Rys., pf..	93	[illegible]	[illegible]	[illegible]	[illegible]
Chi. Rs., Ser. 1.....	96½	[illegible]	Nat'l [illegible]	[illegible]	[illegible]
Chi. Rs., Ser. 2.....	32¾	[illegible]	Nat'l [illegible]	[illegible]	[illegible]

BOSTON.

	Oct. 24.	Oct. 31.		Oct. 24.	Oct. 31.
[illegible] & T.	.135	[illegible]	[illegible] Tel...........	4*	[illegible]
[illegible]	[illegible]	150½*	[illegible] Tel., pf.......	6*	[illegible]
Edison	287	292	[illegible] E. Tel..........	146*	[illegible]
Gen. Elec..........	150¾*	[illegible]	[illegible] T. & T........	263¼	[illegible]
[illegible]	[illegible]	21	[illegible]	[illegible]	105
Mass. E. Ry., pf....	95	[illegible]			

*Last price quoted.
[illegible] week Oct. 23 to Oct. 28.

FINANCIAL NOTES.

Galveston-Houston Electric Company Preferred Stock Offering.—An offering of $300,000 6 per cent cumulative preferred stock of the Galveston-Houston Electric Company is being made at 93½ to yield 6.4 per cent. This company owns substantially all the preferred and common stocks of the Galveston Electric Company, the Houston Electric Company and the entire capital stock of the Galveston-Houston Electric Railway Company. The Galveston Electric Company does the entire electric railway business and a portion of the electric lighting business in Galveston, Tex.; the Houston Electric Company does the entire electric railway business in Houston, Tex., and the Galveston-Houston Electric Railway Company will own and operate 45 miles of interurban electric railway now practically completed between Galveston and Houston, which, it is expected, will be in full operation in November. The capitalization of the Galveston-Houston Electric Company consists of an authorized issue of $3,000,000 (per cent cumulative preferred stock, of which $2,000,000 is outstanding and of which $300,000 is now offered; also an authorized issue of $4,000,000 common stock, paying dividend at the rate of 3 per cent per annum, of which $3,000,000 is outstanding. There are also authorized $2,000,000 coupon note due 1914, of which $600,000 is outstanding, which bear interes at the rate of 6 per cent and are convertible into commo stock at par. There is an authorized issue of $2,500,000 firs mortgage 5 per cent gold bonds of the Galveston Electri Company, due 1940, of which $1,213,000 is outstanding; a authorized issue of $2,500,000 first mortgage 5 per cent gol bonds of the Houston Electric Company, due in 1925, c which $2,193,000 is outstanding, and an authorized issue c $5,000,000 first mortgage 5 per cent gold bonds of the Ga veston-Houston Electric Railway Company, due 1954, of whic $2,750,000 has been issued. Additional bonds of the Galve ton Electric Company and Galveston-Houston Electric Rai way Company can be issued only to the amount of 80 p cent of the actual cost of permanent additions and improv ments to the property. All the Houston Electric Compa bonds authorized have been issued, and $307,000 face val have been purchased for the sinking fund. Interest on t $2,750,000 Galveston-Houston Electric Railway bonds will charged to "interest during construction" until the completi of the interurban line. These bonds are guaranteed as principal, interest and sinking fund by the Galveston-Houst Electric Company. Gross earnings of the combined compan for the twelve months ending Aug. 31, 1911, were $1,447,7 operating expenses, $848,135; and net earnings, $599,591; terest charges and taxes were $246,363, leaving a balance $353,227. The bond sinking fund amounted to $55,970, le ing a balance of $297,257 available for dividends on $2,300, preferred stock, the requirement for which, including t now offered, is $138,000. The Galveston property has b under the management of Stone & Webster since 1905, the Houston property since 1900.

Public Utility Securities Listed on New York Exchan

Applications to list the following securities have been proved by the governing committee of the New York St Exchange; Westinghouse Electric & Manufacturing Comp $36,738,900 common stock to be substituted on the list, on cial notice of issuance, in exchange for a like amount of standing assenting stock; Public Service Corporation of N Jersey—$5,000,000 additional general-mortgage 5 per cent s ing-fund fifty-year coupon bonds, due 1959, which make total amount listed to date $30,000,000; Pacific Gas & Elec Company—$5,401,000 California Gas & Electric Corpora unifying and refunding mortgage 5 per cent thirty-year bo due 1937. In addition to these, authority is given to add $86 of the bonds on official notice of sale and distribution, w places the total amount authorized to be listed at $20,151,0

Detroit Edison Company to Increase Stock.—Stockh ers of the Detroit Edison Company will meet in New City Nov. 15 to vote upon an increase in capital stock f $9,000,000 to $15,000,000, the proceeds of which will be use furnish funds for extensions and additions made necessar the continual growth of the company's business. Of the ent authorized $9,000,000 capital stock, $6,000,000 is outstan and $3,000,000 has been reserved against an equal amour outstanding convertible debenture bonds. It is propose to issue $1,500,000 of the new stock at an early date and this ill be offered to the stockholders, pro rata, for subscription at ar

Milwaukee Electric Railway & Light Company.—he Wisconsin Railway Commission has authorized the Milw Electric Railway & Light Company to issue $2,000,000 refu ng and extension mortgage 4½ per cent bonds.

Maryland Electric Company.—The report of the Mry- land Electric Company for the fiscal year ended Jun 30, 1911, has been submitted to the Maryland Public Service m- mission. The statement of the company shows operating e

enue for the period of $2[illegible] and operating expenses of $2[illegible], leaving a net operating revenue of $4,[illegible]. Against this were charged outside operating expenses of $4,071.50, representing the money expended in the up-keep of the Bay Ridge resort, which was not in operation during the year. This left a total net deficit of $8.75. Other income received by the company during the fiscal year amounted to $216,790.58, made up as follows: $216,000, representing rents accrued for lease of road; $480.83, representing revenue from separately owned properties, the Annapolis Land & Improvement Company and the Maryland Land & Improvement Company; $309.75, representing income from sale of electric power. The deductions from this were as follows: $12,199.50, representing taxes accrued for the year; $8.75, the total net deficit from operation, as above; $1,500, rents accrued for the lease of other roads; $1,568.75 for hire of equipment; $11,776.14, joint facilities, and $2,250.60, miscellaneous rents. Other deductions included interest accrued on funded debt amounting to $252,145.80; other interest, $10,285, and extinguishment of discounts on securities, $20,460, the total deduction from the gross corporate income of the company being $299,966.29, representing a net corporate loss of $95,383.96. In the report as filed with the Public Service Commission no revenue expenses or taxes are shown from the operation of Bay Shore Park, for the reason that the property is leased to the United Railways & Electric Company under a general leasing agreement, and no specified amount of income is paid for the property, as the taxes and expenses are borne by the United Railways.

Montreal Street Railway's Year.—Earnings of the Montreal Street Railway Company in the year ended Sept. 30, 1911, to which reference was made in the previous issue, were the largest in the history of the company. Gross earnings were $4,775,301, as compared with $4,352,551 in 1910; expenses were $2,679,806, as compared with $2,455,301, and net earnings were $2,095,495, which compares with $1,897,250 in the year ended Sept. 30, 1910. Other income was $114,808, as compared with $85,878, making a total income of $2,210,303, which compares with $1,983,123 in the previous year. Charges, taxes, etc., were $583,904, as compared with $507,978, leaving a surplus available for dividends of $1,626,398, which compares with $1,475,150 in the preceding year and is equivalent to 16.26 per cent on $10,000,000 capital stock before deduction of insurance and contingent reserves. The earnings in the preceding year were equal to 14.75 per cent on the same stock. Dividends were $1,000,000, and insurance and contingent reserves were $275,000, leaving a surplus for the year of $351,398, which compares with $200,150 in the year preceding. E. A. Roberts, president of the company, in his report refers to the negotiations toward effecting an amalgamation with the Montreal Tramways Company, and to negotiations with the city of Montreal for the purpose of making a new contract that will be more applicable to present-day conditions than the present one, in view of the growth and congestion of the city. He expresses the [illegible] that amalgamation with the Montreal Tramways Company will help to complete speedily the negotiations for a new franchise.

Public Service Corporation of New Jersey.—The report of the Public Service Corporation of New Jersey and its subsidiary companies for the nine months ended Sept. 30, 1911, filed with the New York Stock Exchange, shows the following: Gross earnings of operating companies, $21,975,080; income from miscellaneous sources, $1,391,455, making total earnings $23,366,536. Operating expenses and taxes were [illegible]111,211, and net earnings were $11,255,324. Fixed charges of the operating companies were $8,269,553, leaving a balance of $2,985,770. The fixed charges of the Public Service Corporation of New Jersey were $1,870,098. The combined surplus of the Public Service Corporation of New Jersey and the subsidiary companies was $1,115,672, which, with the previous surplus (plus adjustment) of $1,707,698, made a total surplus of $2,823,370. Dividends paid to Sept. 30, 1911, were $1,125,000, leaving a surplus of $1,698,370. Profit and loss of the subsidiary companies not taken upon the books of the Public Service Corporation of New Jersey was $718,020, and the balance to the credit of profit and loss Sept. 30, 1911, was $980,350. The general balance sheet of Sept. 30, 1911, showed as follows:—Assets: Investments at cost, $62,303,001; bonds in treasury, $5,000,000; advanced to Public Service Railway Company, $3,584,250; advanced to Public Service Electric Company, $1,505,162; cash, $631,527; cash to redeem gold notes, $4,000,000; accrued interest and rentals receivable, $835,160; accounts receivable, $44,173; advance payments, $414; deferred charges account of discount and commission on bonds and notes, $2,804,228; total, $80,707,918. Liabilities: Capital stock, $25,000,000; gold bonds, $30,000,000; certificates, $19,970,440; gold notes, $4,000,000; accounts payable, $152,392; taxes, advance and accrued, $21,067; interest accrued, $456,668; reserve, $125,000; profit and loss, $980,350; total, $80,707,918.

Pacific Gas & Electric Company.—The consolidated balance sheet of the Pacific Gas & Electric Company, as of July 31, 1911, showed assets as follows: Plant and other property, $112,084,682; funds to future construction, $845,888; free treasury securities, $892,596 (market value in excess of $1,300,000); materials and supplies, $1,107,404; advances on contracts, $73,350; notes receivable, $8,037; consumers' accounts, $1,083,532; cash, $1,084,998; deferred and contingent assets, $1,789,638; bond discount and other deferred charges, $1,819,856; total $120,789,986. Liabilities: Common stock, $20,000,000; preferred stock, $10,000,000; bonds, $64,072,097; sub-company funds accrued, $1,028,068; consumers' deposits, $307,941; notes payable (since paid), $200,000; current obligations, $944,618; San Francisco rate-case funds due customers, $457,442; other liabilities, $172,739; insurance reserve, $341,451; uncollectible accounts reserve, $65,222; sinking-fund and depreciation reserve, $7,463,280; surplus, $15,559,146; total, $120,789,986.

Ontario Power Company.—The report of Ontario Power Company, of Niagara Falls, Ont., for the nine months ended Sept. 30, 1911, shows gross earnings of $622,443, operating expenses of $110,191, and net earnings of $512,251 for this period. Other income was $64,755, making a total income of $577,006. Interest charges were $504,293, leaving a surplus of $72,713.

Keystone Telephone Company.—Gross earnings of the Keystone Telephone Company of Philadelphia for the three months ended September 30 were $290,606, which compares with $282,809 for the corresponding period in 1910. Expenses and taxes were $148,885, leaving net earnings of $141,721, as compared with $141,587 in the three months ended September 30, 1910.

DIVIDENDS.

Detroit United Railways Company, quarterly, 1¼ per cent, payable Dec. 1.

Northern Texas Electric Company, quarterly, $1.50 per share, payable Dec. 1.

Pensacola Electric Company, semi-annual, preferred, $3 per share, payable Dec. 1.

Tampa Electric Company, quarterly, $2 per share, and an extra dividend of $1 per share, both payable Nov. 15.

REPORTS OF EARNINGS.

AMERICAN CITIES COMPANY.

Period	Gross Earnings	Operating Expenses.	Net Earnings.	Fixed Charges	Net Surplus
Sept., 1911	$1,125,412	[illegible]	$445,457	[illegible]	[illegible]
Sept., 1910	[illegible]	[illegible]	420,187	[illegible]	[illegible]
12 m., Sept., '11	13,146,319	7,886,519	5,259,800	3,008,862	2,250,938
12 m. Sept., '10	12,437,190	7,513,023	4,924,167	2,916,031	2,008,136

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.

Sept., 1911	[illegible]	[illegible]	$264,957	$50,007	$214,950
Sept., 1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9 m., Sept., '11	5,436,126	3,218,060	2,218,066	458,362	1,759,704
9 m., Sept. '10	5,436,126	2,879,889	2,198,804	434,974	1,763,829

MASSACHUSETTS ELECTRIC COMPANIES.

Qtr., Sept., '11	$2,799,061	$1,560,208	$1,238,853	$472,969	$765,883
Qtr., Sept., '10	2,741,764	1,434,626	1,307,138	459,512	847,625
12 m., Sept., '11	8,938,815	5,682,884	3,255,931	1,851,786	1,404,144
12 m., Sept., '10	8,560,949	5,360,295	3,200,654	1,792,936	1,407,717

NASHVILLE RAILWAY & LIGHT COMPANY.

Sept., 1911	$179,132	$98,312	$80,819	$39,294	$41,525
Sept., 1910	163,307	89,522	73,785	38,288	35,497
9 m., Sept., '11	1,440,175	849,789	590,386	346,058	244,328
9 m., Sept., '10	1,341,847	777,993	563,854	342,448	221,405

NORTHERN OHIO TRACTION & LIGHT COMPANY.

Sept., 1911	$246,015	$128,812	$117,203	$44,321	$72,882
Sept., 1910	224,901	117,857	107,044	43,391	63,653
9 m., Sept., '11	2,019,746	1,110,504	909,242	399,069	510,172
9 m., Sept., '10	1,837,406	1,009,858	827,548	390,161	437,387

General News

Construction News.

[illegible] Anniston Electric & Gas Company to supply electricity for lighting the streets and residences of the city. The contract calls for the erection of twenty-five street lamps and lighting seventy residences.

BIRMINGHAM, ALA.—The Birmingham, Ensley & Bessemer Railroad Company, it is reported, is contemplating the erection of a power plant to supply electricity to operate an electric railway from East Lake to Ensley. The power house will be built to provide for future extensions.

KETCHIKAN, ALASKA.—The Granby Mining & Smelting Company, of British Columbia, has acquired a smelting plant near Ketchikan and is planning to build a hydroelectric power plant to supply electricity for operating the plant and mining machinery.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association has awarded the contract for the construction of power plant No. 2 on the South Consolidated Canal to Olsen & Graf, for $22,922.

FORSYTH, ARK.—Contracts for the construction of a 40-ft. reinforced concrete dam and power house for the Ozark Power & Water Company, to be located on the White River, 2 miles above Forsyth, have been awarded to the Ambursen Hydraulic Construction Company, 165 Broadway, New York, N. Y. The General Electric Company, of Schenectady, N. Y., secured the contract for three 1500-kw generators and waterwheels. Contracts for the erection of the transmission line from the power house to Springfield, Mo., a distance of 43 miles, have not yet been awarded. Holman & Laird, of St. Louis, Mo., are consulting engineers.

OSCEOLA, ARK.—The City Council has passed an ordinance creating an improvement district for the purpose of building and operating an electric-light plant in Osceola. This move was made necessary owing to the notification of Abner Driver, who has furnished electrical service to the city for fifteen years, that he would close down his plant [illegible]

ALHAMBRA, CAL.—The Board of Trustees is planning to install an ornamental street-lighting system on North Marguerita Street. Ornamental lamp standards, each carrying three lamps, will be erected.

BAKERSFIELD, CAL.—The Lost Hills Telephone & Telegraph Company is planning to build a new line in the Lost Hills oil-field district, to cost about $25,000. Richard Hastings is manager.

EL CENTRO, CAL.—Notice of appropriation has been filed by Frank M. Salisbury, of Imperial, and W. H. West, of Brawley, of 50,000 in. of water in the Alamo River, acting in behalf of a syndicate which proposes to build a dam across the Alamo River three-fourths of a mile east of the Alamo Bridge. The proposed dam will cost about $75,000 and will conserve water to irrigate 50,000 acres of land in the vicinity of Estelle and Rockwood.

EUREKA, CAL.—Negotiations have practically been closed whereby the Western States Gas & Electric Company will take over the Blue Lake light and power plant, owned and operated by the Minor Mill Lumber Company. With the purchase of the Blue Lake plant the Western States Gas & Electric Company has practically the entire control of the electric-light and power service in Humboldt County. The company has already taken over the light and power plants in Arcata, Fortuna and Ferndale.

FRESNO, CAL.—The San Joaquin Light & Power Company is reported to be contemplating the installation of electric pumping machinery on its property in the Caruthers district.

GLENDALE, CAL.—The city has decided to erect ornamental lamp standards, each carrying four lamps, on Fourth Street, Glendale Avenue and Grand Boulevard. Property owners will bear the expense. H. B. Lynch, manager of the municipal electric plant, is in charge of the work.

LINDSAY, CAL.—The Tulare Power Company is reported to have awarded a contract to the Hunt-Mirk Company, of San Francisco, Cal., for the erection of a power plant in Lindsay. The plant will be located on the Giannini ranch, just outside of the city limits, and will be equipped with steam turbines and have an output of 3000 hp. F. T. Billings is one of the directors.

LIVERMORE, CAL.—Preparations are being made by the Livermore Water & Power Company to extend its transmission lines from Pleasanton to Sunol, a distance of 5 miles.

LOS ANGELES, CAL.—It is reported that the Board of Public Works has extended the time for receiving bids for machinery for the municipal aqueduct power plant in San Francisquito Canyon from Oct. 23 to Nov. 10.

LOS ANGELES, CAL.—The Pacific Light & Power Corporation has awarded a contract to the Pelton Water Wheel Company for the installation of three Pelton-Francis turbines. The turbines will drive three 3000-kw generating units.

LOS ANGELES, CAL.—An electric power plant will be installed in the New Rosslyn Hotel, to be erected at Fifth and Main Streets by Hart Brothers, plans for which are being prepared by Parkinson & Bergstrom, architects, of Los Angeles, Cal.

OAKLAND, CAL.—Plans have been approved by the Southern Pacific Company for the erection of a concrete and steel power-storage plant at the Melrose terminal of the Seventh Street local, at a cost of $30,000. The lower floor will be used for storage of cars and the upper story will be used exclusively for storage batteries and generators. This station will receive energy from the Fruitvale plant.

OROVILLE, CAL.—Preparations are being made by the Oro Electric Corporation for extensive improvements and extensions to its system. The plans include the enlargement of the power plant of the Oro Water, Light & Power Company, a subsidiary, located near Oroville, the construction of a new power plant on the Feather River about 40 miles north of Oroville and extension of its transmission lines into Marysville, Sacramento and Oakland. Bonds to the amount of $10,000,000 were recently authorized by the company, of which $5,000,000 will be issued immediately. J. W. Goodwin is president of the company.

PASADENA, CAL.—The Nazarene University Park Company has applied for a twenty-year franchise to build an electric railway on Washington Street. The Pacific Electric Railway Company has refused to construct the line and the stockholders of the Nazarene company have voted to appropriate $32,000 to construct the road. J. W. Goodwin is president of the Nazarene company.

PERRIS, CAL.—The Board of Trustees has granted the Southern Sierras Power Company a franchise to erect a transmission line along the roads and city streets to supply electricity in Perris. It is expected to have the line completed by next April.

REDDING, CAL.—The Northern California Power Company has filed notice of diversion of 250,000 in. of water from the Pit River. The company proposes to build a large hydroelectric plant about 1 mile below the Big Bend Hot Springs with a total generating capacity of 120,000 hp. Three high-tension transmission lines carried on steel towers will be erected through the Sacramento Valley. The cost of the entire project is estimated at about $4,000,000.

RED BLUFF, CAL.—Notice of appropriation of 300,000 in. of water to be taken from the Sacramento River at the mouth of Resbank Creek, 3 miles below Red Bluff, has been filed by A. L. Collins, an engineer who has been connected with the Sierra & San Francisco Power Company. The water is to be used for irrigation purposes in Tehama, Colusa, and Yolo Counties.

SAN BERNARDINO, CAL.—The Southern Sierra Power Company has awarded the contract for the construction of its transmission line from Bishop to San Bernardino, a distance of about 240 miles, to T. C. Dobbins, of Los Angeles, Cal. The contract is for labor only and amounts to about $250,000. The company, it is reported, is planning to erect an auxiliary steam plant at Banning, Cal.

SAN JOSE, CAL.—The San José & Almaden Railway Company, recently incorporated with a capital stock of $120,000, is planning to build an electric railway from San José to New Almaden, a distance of about 12 miles, for which the company has been granted a franchise. C. A. Nones, C. P. Anderson and D. M. Burnett are interested in the company.

SARATOGA, CAL.—The Grand Lodge of Odd Fellows has awarded the contract for the construction of administration building, power house and outbuildings for the new Odd Fellows' Home to Williams Brothers & Henderson, Monadnock Block, San Francisco, Cal., for $118,786.

VISALIA, CAL.—The Mount Whitney Power Company has awarded a contract to the Pelton Water Wheel Company for a Pelton-Francis turbine to be installed in power house No. 2. The new wheel is rated at 2250 hp and will be direct-connected to a General Electric generator.

WATTS, CAL.—The Pacific Light & Power Company has been granted a fifty-year franchise to supply electricity for lamps and motors in Watts.

WOODLAND, CAL.—The Sacramento-Woodland Electric Railway Company has awarded a contract for the construction of its proposed railway from Woodland to Sacramento to the Dozier Contracting & Engineering Company.

BOULDER, COL.—The City Council has granted the Boulder Electric Light & Power Company a franchise to extend its street-railway system into the northern section of the town. The extension will require about 2 miles of track and will cost about $15,000.

TELLURIDE, COL.—The Telluride Electric Light & Power Company has submitted a proposition to light the streets of the city under a five-year contract as follows: For 2000-cp lamps at $3 each per month; 50-cp incandescent lamps at $1.25 per lamp per month, with all-night service and 16-cp incandescent lamps for lighting the city buildings at 75 cents each per month. The company also offers to furnish 16-cp lamps at [illegible] cents per lamp per month for residences, with a minimum charge of [illegible] per month, and to supply electricity for lamps for residences at 12

[illegible] per kw-hour, with a [illegible] [illegible], provided that [illegible] the meter deposit has been reduced to $10. For commercial purposes the company will supply 16-cp lamps, burning until 10 o'clock, at 60 cents per lamp per month, and with all-night service, $1.50 each per month, with a minimum charge of $1 per month; standard arc lamps for private use, burning until 10 o'clock, at $5 each per month; with all-night service, $9 [illegible] The company [illegible] rates because of concessions made by the Telluride Power Company, which furnishes energy for operating the local system.

MANSFIELD, CONN.—It is reported that plans are being considered for the erection of several new buildings for the Connecticut colony for epileptics at Mansfield, including power and heating plant, water supply, etc.

MANCHESTER, CONN.—The Manchester Light & Power Company and the South Manchester Light, Power & Tramway Company have been consolidated and will be operated under the name of the latter company. The company will supply electricity for lamps and motors in the villages of Manchester and South Manchester and to operate the electric railways running through the town. The company is capitalized [illegible]

WALLINGFORD, CONN.—It is reported that new bids will be called for during the next six weeks for additional equipment for the municipal electric-light plant, consisting of a 500-kw turbine and other electrical equipment, to cost approximately $30,000.

WASHINGTON, D. C.—Sealed bids will be received at the office of the Commissioners of District of Columbia, Washington, D. C., until Nov. 9 for furnishing and installing electric wiring, switches, wall plugs, lamps, reflectors, etc., in the Eastern High School. Plans and specifications and form of proposal may be obtained from the purchasing officer of the District of Columbia.

WASHINGTON, D. C.—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 14 for furnishing at the navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 4038—Miscellaneous brass and copper pipe, sheet brass, rolled naval brass and copper rod; Schedule 40[illegible]—Transformers. Boston, Mass., and Brooklyn, N. Y., Schedule 40[illegible]—Miscellaneous sheet copper. Norfolk, Va., Schedule 4051—One generator set. Applications for proposals should designate schedules [illegible] number.

BROOKSVILLE, FLA.—At an election to be held Nov. 24 the proposition to grant a franchise to Mr. Fuller, of Umatilla, to install an electric-light plant and water-works system will be submitted to a vote.

WINTER HAVEN, FLA.—Preparations are being made to install an electric-light system in Winter Haven. Boyd Brothers are interested in [illegible]

[illegible] GA.—The Georgia Railway & Power Company [illegible] has purchased the property of the Savannah River Power [illegible] Anderson, S. C., for $1,550,000. In order to acquire [illegible] properties the Georgia Railway & Power Company has applied to [illegible] Georgia Railway Commission for permission to issue $30,000,000 [illegible] and $37,000,000 in capital stock. The Georgia company has [illegible] options on the system of the Georgia Railway & Electric Company [illegible] Atlanta, and the water-power properties at Tallulah Falls, [illegible], Cartersville, two other properties at Newman, Ga., and one [illegible] Falls. It is reported [illegible] the extension of the interurban electric railway from Anderson [illegible]. Charles McGee, of Toronto, Can., is president of the [illegible] Railway & Power Company.

[illegible], GA.—It is reported that [illegible] considered by [illegible] J. Roberts to establish an electric-light and power plant to supply electricity for lamps and motors in two or more towns.

[illegible]ERVILLE, GA.—The Village Council has authorized the Mayor [illegible] into a contract with the Augusta-Aiken Railway & Electric [illegible] for street lighting. The contract calls for about 200 tungsten [illegible] 60 cp and eight or ten arc lamps. The town will be rewired [illegible]

[illegible]INGTON, GA.—A site has been purchased by the city near [illegible] railroad tracks at the depot on which it will erect a new [illegible] electric-light plant at a cost of about $25,000. Contracts for construction of the plant will be soon awarded. When the new plant is completed a twenty-four-hour service will be established.

BATAVIA, ILL.—Plans are being considered by the Aurora, Elgin & Chicago Railroad Company for the installation of a 5000-kw turbine engine increasing the output of the plant to 8500 kw. An addition will [illegible] the power house.

BATAVIA, ILL.—The City Council has authorized the light committee to make an investigation of the equipment of the municipal electric-light plant with a view of making improvements to the plant. It is proposed to replace the engine now in use with a steam turbine.

BEARDSTOWN, ILL.—The electric light committee of the City Council has adopted a resolution recommending the installation of a municipal electric-light plant in Beardstown.

CHAMPAIGN, ILL.—The City Council has authorized the city engineer to prepare plans and specifications for a street-lighting system to consist of 800 tungsten lamps to be placed on concrete standards with lead-cored cables placed in underground conduits.

EAST ST. LOUIS, ILL.—It is understood that arrangements have been made whereby the East St. Louis & Suburban Railway Company will supply the East St. Louis, Columbia & Waterloo Railway Company with energy to operate its railway until the company builds its own power house. The East St. Louis, Columbia & Waterloo Railway Company expects to have cars running between Dupo and East St. Louis by Jan. 1.

FARMINGTON, ILL.—The Farmington Light & Power Company is contemplating erecting a transmission line southwest of the city to supply electricity to the farmers in that section.

MATTOON, ILL.—Plans have been submitted to the City Council by City Engineer James for the installation of a flashlight alarm and telephone system for the police.

MOKENA, ILL.—The Village Board, it is reported, will install a municipal electric-light plant if satisfactory arrangements cannot be made with the North Shore Electric Company for the erection of a transmission line to this village.

OREGON, ILL.—Preparations are being made by the Oregon Power Company for extensive improvements to its plant next year. The proposed improvements will be made during the winter and will double the present output of the plant. The company now supplies electrical service in Polo, Mount Morris, Oregon, Franklin Grove, Lee Center, Amboy, Sublette, Compton, Shaw Station and Ashton, and is contemplating extending its transmission lines to other towns in this section of the State.

PETERSBURG, ILL.—Abbott Brothers, owners of the local electric-light plant in Petersburg, have taken over the electric-light system in Tallula, where the plant was recently destroyed by fire, and will erect a transmission line from their plant in this city to supply electricity in that town.

PROPHETSTOWN, ILL.—Plans are being considered for the installation of a 130-hp engine in the local electric-light plant next spring.

SHELDON, ILL.—The Sheldon Electric Light & Power Company, it is reported, is contemplating the installation of an ice plant. Robert Ross has been elected president of the company.

STREATOR, ILL.—The City Council is considering the question of installing an ornamental street-lighting system in Streator. The Illinois Valley Gas & Electric Company has submitted a proposition offering to install 220 or 230 arc lamps in the business district and 200 lamps in the residence section, one-half to burn all night and the remainder on a moonlight schedule.

SULLIVAN, ILL.—The Sullivan Electric Company is contemplating extending its transmission line to Arthur. The company is enlarging its power house and will install additional machinery.

TAYLORSVILLE, ILL.—The City Council has notified the Taylorsville Gas & Electric Company that it must remove its poles from the square and replace all uninsulated wires with stranded wire within the limits of the city. Unless the company complies with the ordinance its franchise will be forfeited. The company is given thirty days to comply with the order.

FT. WAYNE, IND.—The Kehoe Light & Power Company, recently incorporated with a capital stock of $100,000, proposes to furnish electricity for lamps and motors to small towns along the lines of the interurban railways within a radius of 50 miles of Ft. Wayne. At present the company will confine itself to the towns along the lines of the Ft. Wayne & Northern Indiana Traction Company. A contract has already been signed whereby the company will supply electricity to light the town of Ossian. Energy for operating the system will be secured from the traction company. The officers are: C. M. Niezer, president; T. J. Kehoe, vice-president, and M. J. Kehoe, secretary and treasurer.

FRANCISVILLE, IND.—The Central Indiana Water, Light, Heat & Power Company, recently incorporated, it is reported, will soon ask for proposals for construction of water, light, heat and power plants in a number of nearby towns and cities. E. A. Rossiter is president of the company.

GOSHEN, IND.—The Goshen Home Telephone Company is planning to erect a new copper telephone line between Goshen and Bristol, and to make other improvements to its system.

MARTINSVILLE, IND.—The street-lighting committee has rejected all bids submitted for the proposed new plant and is now investigating the cost of purchasing the material direct. The committee is also considering the question of installing an ornamental street-lighting system.

SHELBYVILLE, IND.—The plant and holdings of the Shelby County Water, Gas & Electric Company have been taken over by the Indiana Service Company. H. L. Olds, of Indianapolis, Ind., is president of the company.

SOUTH BEND, IND.—The Board of School Trustees is considering the question of installing an electric-generating plant in the new high school, now in course of construction. George Knoblock is president of the board.

WASHINGTON, IND.—The promoters of the Vincennes, Washington & Eastern Traction Company have submitted a proposition to the city offering to take over the municipal electric plant and operate it in connection with the interurban system.

BRIGHTON, IA.—The Brighton mill dam and water rights, including a site for the erection of a hydroelectric plant, have been purchased by L. Whitney, of Mount Pleasant, and L. J. Highland, of Burlington, for

[illegible] completed will supply electricity to Brighton and towns in this vicinity.

[illegible] a franchise to operate an electric-light plant in Charles City.

CLARINDA, IA.—The Lee Electric Light Company has entered into a contract with the Bedford Light, Heat & Power Company to supply electricity to operate the electric system in Bedford, 23 miles distant. The Bedford company will close down its generating plant as soon as energy is received from the Lee company. Preparations are being made by the Lee Electric Light Company to extend its transmission line from New Market, the present terminus, to Bedford, a distance of 15 miles. Electrical service will also be supplied to residents along the route of the proposed line.

CLARION, IA.—After being without electrical service for seventy-three days, due to the burning of the electric-light plant, the service has been resumed. An entire new plant is being built. Electroliers are being erected for the new street-lighting system.

COON RAPIDS, IA.—The City Council it is reported, has approved plans for the installation of electroliers on Main Street.

DUNLAP, IA.—At an election held recently the voters approved the granting of a franchise to L. R. Betts, of Council Bluffs, to construct and operate an electric-light plant in Dunlap. It is understood that work will begin on construction of the plant at once.

FOREST CITY, IA.—If granted a franchise, the Forest City Electric Light & Power Company will make extensive improvements to its system, involving an expenditure of about $10,000.

GALVA, IA.—The proposition to issue bonds to the amount of $8,500 for the construction of an electric-light plant in Galva will be submitted to a vote.

HARLAN, IA.—Owing to the blowing out of a cylinder head on the large engine in the municipal electric-light plant the service is badly crippled. It will take about a month to make the necessary repairs. George W. Cox is superintendent.

JEWELL, IA.—Plans are being considered for the installation of an ornamental street-lighting system. It is proposed to erect ornamental lamp standards with cluster lamps.

OSCALOOSA, IA.—The Des Moines River Power Company has purchased the property of the Oskaloosa Traction & Light Company, which included the electric-light plant, heating plant, the local street-railway system, the Oskaloosa and Buxton electric railway, the municipal lighting franchise and the city heating franchise. The price paid for the plant is understood to be about $200,000. The Des Moines company is contemplating the development of several power sites along the Des Moines River and is planning to build a dam about 7 miles from Oskaloosa on the Des Moines River to develop about 10,000 hp. The new company will carry out the contracts of the old company, including the erection of a transmission line to New Sharon, 12 miles north of the city. A. C. Miller, of Des Moines, Ia., is interested in the new company.

POCAHONTAS, IA.—The contract for construction of a municipal electric-light plant for the city of Pocahontas, bids for which were opened Oct. 27, has been awarded to the Dwyer Field Company, of St. Paul, Minn., at $11,800. George Schnieders is clerk.

ROLAND, IA.—The installation of an electrolier system of street lighting is reported to be under consideration.

STORY CITY, IA.—The Commercial Club is considering the question of installing an electrolier system of street lighting in Story City.

VAN HORNE, IA.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric-light plant in Van Horne. The town has been without electrical service since the plant of the Van Horne Electric Light & Power Company was destroyed by fire early last spring.

OSBORNE, KAN.—The City Council, it is reported, will soon call an election to vote on the proposition to issue bonds to the amount of $25,000 for the construction of a municipal electric-light plant. Plans and specifications for the proposed plant have been prepared by Rollins & Westover, of Kansas City, Mo.

WATERVILLE, KAN.—Plans are being considered for the construction of a municipal electric-light plant in Waterville, Kan., for which bonds to the amount of $30,000 have been voted. Mr. Black, of the J. S. Worley Engineering Company, of Kansas City, Mo., is engineer in charge.

CAMPBELLSVILLE, KY.—Owing to the City Council and the Campbellsville Electric Light Company being unable to come to an agreement in regard to the rates for street lighting, the company has discontinued the service. The company has been supplying arc lamps at $50 each per year. The company has increased its rates for the service, claiming that it was furnishing the service at a loss under the old contract.

CUMBERLAND FALLS, KY.—It is reported that H. M. Byllesby & Company, of Chicago, Ill., are making surveys at Cumberland Falls, on the Cumberland River, near Williamsburg, with a view of developing the water power to be utilized to generate electricity for transmission to Lexington, Ky., Knoxville, Tenn., and other smaller cities.

MILLERSBURG, KY.—Preparations are being made for the installation of a municipal electric-light plant in Millersburg. It is understood that contracts for machinery have been awarded.

SHREVEPORT, LA.—At a refe[illegible] [illegible] of the Municipal Ownership League, the voters approve[d] the contract entered into between the City Commissioners and the Shreveport Gas, Electric Light & Power Company for lighting the streets of the city for a period of six years, under the terms of which the compan[y] is to supply arc lamps at $62.50 each per year, which is $12.50 per lam[p] less than the city is paying under the present contract, and means saving of about $20,000 during the next six years. In addition to th[e] reduction in price for the service the company agrees to install over sixt[y] lamps at locations donated by the Council and to supply electricity t[o] light the city hall free of charge. The voters defeated the proposition t[o] issue $310,000 in bonds to establish a municipal plant at a special electio[n] held Oct. 17.

PORTLAND, MAINE.—The New Hampshire Water & Electric Pow[er] Company has filed an amendment to its charter increasing its capital s[tock] from $100,000 to $200,000.

PORTLAND, MAINE.—Plans are being considered for the install[a]tion of new street lamps on Congress and Middle Streets. It is pr[o]posed to erect tungsten cluster lamps.

BALTIMORE, MD.—The Board of Estimate is considering the que[s]tion of installing ornamental electric lamps on Charles Street Avenu[e] the St. Paul Lane Boulevard and Merryman Lane Boulevard. The Pe[a]body Heights Improvement Association has petitioned for electric lam[ps] in that district. The cost of installing the lamps is estimated [at] $13,076, and the maintenance for a period of six months dating fr[om] July, 1912, will amount to $1,154.

SALISBURY, MD.—The Salisbury Light, Heat & Power Company [is] planning to establish a twenty-four-hour service in the near futu[re]. The meter system will be installed and the minimum charge will be [re]duced from $1.50 to $1 per month.

LEE, MASS.—The Berkshire Street Railway Company has purcha[sed] of the Lee Lime Company the mill building, water privilege and t[wo] tenement houses, known as the Bostwick shoddy mill property in L[ee]. It is stated that the consideration was about $10,000.

BAY CITY, MICH.—Extensive improvements are being made to [the] plant of the Kolb Brewing Company, including the installation o[f a] power plant which will provide electricity to operate its bottling wo[rks].

DETROIT, MICH.—A special meeting of the stockholders of [the] Detroit Edison Company will be held Nov. 15 to vote on the prop[osi]tion to increase the capital stock of the company from $9,000,000 [to] $15,000,000. It is proposed to issue $1,500,000 of the new stock in [the] near future, which will be offered to the stockholders at par.

MUSKEGON, MICH.—Owing to inability to secure satisfactory r[ates] for lighting the city from the Muskegon Traction & Lighting Com[pany] or the Grand Rapids-Muskegon Power Company, the members of [the] City Council, it is reported, are working to secure the co-operatio[n of] other smaller cities in Muskegon, Oceana and Newaygo Counties i[n a] large municipal light and power plant project. It is proposed that [the] cities of Muskegon, Whitehall and Montague, in Muskegon Cou[nty], Fremont, in Newaygo County, and Hart and Shelby, in Oceana Co[unty] shall purchase jointly the rights of the Wheeler Power Company [to a] power site on White River and erect a hydroelectric plant to supply [elec]tricity to the different cities.

ROMEO, MICH.—The Detroit Edison Company, of Detroit, M[ich.], it is reported, is negotiating for the purchase of the local muni[cipal] electric-light plant. The company has made an inventory of the [plant] with a view of making a bid for it should the plant be offere[d for] sale. The plant was established twelve years ago and cost about [$]000. There is a demand for a twenty-four-hour service, which wi[ll re]quire an expenditure of $1,600 to equip the plant for the extra se[rvice].

AITKIN, MINN.—M. D. Stoner, president of the Cuyuna Lig[ht &] Power Company, of Deerwood, Minn., has withdrawn his offer to [buy] the Aitkin power plant and to furnish a continuous service for [illegible] and to operate the pumping plant of the village, an[d] to install an electric fire-alarm system, owing to adverse report [sub]mitted by the special committee appointed to investigate the propo[sal]. Mr. Stoner supplies electricity for lamps and motors in Deer[wood], Cuyuna, Ironton, Crosby and other parts of the Cuyuna iron ran[ge].

BALATON, MINN.—The installation of an electric-light pla[nt in] Balaton is reported to be under consideration. Local business me[n are] interested in the project.

MAYNARD, MINN.—The question of issuing bonds to the amo[unt of] $5,000 for the installation of a municipal electric-light plant in [Ma]ynard is under consideration.

MINNEAPOLIS, MINN.—Preliminary work has been started [on the] power dam of the Great Northern Development Company at Coon [Cr]eek, [on the] Mississippi River, 10 miles from Minneapolis. Contract [has] been awarded for grading embankment. It is expected to have [the] dam completed within one year. It is estimated that 15,000 hp can [be de]veloped at Coon Creek.

OLIVIA, MINN.—The installation of a new generator in the m[uni]cipal electric-light plant is reported to be under consideration.

PIERZ, MINN.—It is reported that the private telephone line, [ow]ned by P. W. Blake, has been purchased by John Stroming, of Sw[anville], who, it is said, will extend the line 15 miles.

VIRGINIA, MINN.—The proposition to acquire the electri[c] plan[t of the] Virginia Electric Light, Power & Water Company will [be] sub[m]itted to a vote at an election to be held Nov. 21.

ST. LOUIS, MO.—[illegible]

BUTTE, MONT.—The County Commissioners have awarded the contract for electric fixtures for the new court house to the Butte Electric [illegible]

MILES CITY, MONT.—Plans are being considered by the Mountain States Telephone Company for the erection of about 10 miles of rural telephone lines.

TERRY, MONT.—At an election held Oct. 9 the citizens voted to grant a franchise to E. H. Phillips to construct and operate an electric-light plant in Terry.

BEAVER CITY, NEB.—The installation of an electric-light plant in Beaver City is under consideration. It is proposed to organize a stock company to construct and operate the system.

KEARNEY, NEB.—The City Council has voted to submit the proposition to appropriate $50,000 for the construction of a municipal elec- [illegible]

OVERTON, NEB.—W. H. Hill, who was recently granted a franchise [illegible]

FALLON, NEV.—Sealed bids will be received at the office of the United States Reclamation Service, Fallon, Nev., until Dec. 6 for the [illegible]se from the United States of electric energy generated at the Lahontan dam of the Truckee-Carson project. For further information address the United States Reclamation Service at Washington, D. C.; Fallon, Nev., or Los Angeles, Cal. F. H. Newell is director.

ASHUELOT, N. H.—The Keene Gas & Electric Company, of Keene, [illegible] its lines and system in Ashuelot to the Ashuelot company. The latter [illegible] has petitioned the commission for authority to issue sufficient [illegible]l capital stock to take over the business.

MANCHESTER, N. H.—The Board of Mayor and Aldermen has [illegible]ed to authorize the Manchester Street Railway Company to replace the wooden poles supporting the trolley wires with iron poles throughout [illegible]

BINGHAMTON, N. Y.—The contract for the construction of an electric conduit system and installation of boulevard lamp-posts in the city [illegible]hamton, bids for which were opened Oct. 25, has been awarded [illegible] Gest, of New York, N. Y., the cost not to exceed $22,200.

[illegible]KPORT, N. Y.—The Brockport Gas & Electric Light Company [illegible]ed to the Public Service Commission, Second District, for per[illegible] to execute a mortgage for $150,000 and to issue presently $80,000 [illegible]

[illegible]EE, N. Y.—The Board of Village Trustees has decided not to [illegible] the proposition submitted by E. L. Bailey, proprietor of the local [illegible]ght plant, whereby the village was to take over the plant.

[illegible] BRIGHTON, N. Y.—The Board of Estimate and Apportionment [illegible]ted a resolution providing for an issue of corporate stock of the [illegible] New York to an amount not exceeding $100,000, the proceeds [illegible]sed to purchase and install necessary engines, boilers and ap[illegible]nces and electrical equipment at the new Grant City pumping [illegible]borough of Richmond, in connection with improving the water [illegible]ystem of the borough.

[illegible] YORK, N. Y.—The Public Service Commission, Second Dis- [illegible] [illegible]0,000 in bonds, the proceeds to be used for extensions and im- [illegible]

[illegible] Charities, foot of East Twenty-sixth Street, New York, N. Y., [illegible] 6 for furnishing and installing new lighting equipment and [illegible]ing old equipment, as specified, at the Morgue buildings on the [illegible] the foot of East Twenty-sixth Street. Blank forms and further [illegible]m may be obtained at the office of the supervising engineer [illegible]y be seen. Michael J. Drummond is commissioner.

[illegible]R, N. Y.—The Livingston-Niagara Power Company, re[illegible]corporated, has perfected organization, and the following of- [illegible] Hershey, of Avon, N. Y., and C. J. Brown, of Rochester, vice-[illegible]ts; Harry G. Strong, of Rochester, secretary, and H. C. [illegible]r, treasurer. The company has been granted permission by [illegible]ic Service Commission to issue capital stock to the amount of [illegible] An open mortgage of $600,000 has been recommended by the [illegible]on, thereby permitting issuing of bonds to that amount as the [illegible]f the company may require, to be approved by the commission. Under the present authorization the company is permitted to make an immediate issue of $268,421, to be sold at not less than 95. The company has taken over several important power companies in Livingston County. Following the completion of the power station at Golah, where energy from Niagara is stepped down for distribution, the company has been pushing work on the erection of its distributing lines. Electrical service is already supplied by the company in Avon and Livonia over one of its new lines. Energy is also supplied to the Lima-Honeoye Falls [illegible] railway and also to the State [illegible] at Industry. Plans are being made to begin work on the erection of the transmission line extending from the power station at Golah to Scottsville, and possibly to Mumford. The line will eventually be extended to Caledonia. It is expected to have the line completed to Scottsville by the first of the year.

DEVIL'S LAKE, N. D.—The Stetler Investment Company, of Devil's Lake, has purchased the railway of the Devil's Lake & Chautauqua Railway Company, which reaches summer resorts on the shores of Devil's Lake. It is announced that the railway will be equipped for electrical operation immediately.

SHARON, N. D.—The Sharon Electric Light & Power Company is reported to have awarded a contract for the installation of a new lighting system in Sharon to the Battery & Globe Electric Company, of Milwaukee, Wis.

McVILLE, N. D.—The installation of an electric-light system in McVille is reported to be under consideration.

COLUMBUS, OHIO.—The contract for furnishing 320 arc lamps to be used in extending the municipal lighting system over the recently annexed territory has been awarded to the General Electric Company, of Schenectady, N. Y. The lamps and four rectifer equipments for the lighting plant will cost $11,190.

HAMILTON, OHIO.—The Hamilton Gas & Electric Company is reported to have applied to the federal court in Cincinnati, Ohio, for a receiver. The company states that, owing to the competition of the municipal gas plant, recently completed, it is no longer able to pay dividends. The liabilities of the company are placed at $1,000,000 and the assets at $800,000. J. C. Thomas, of Cincinnati, Ohio, is president of the company.

NILES, OHIO.—The installation of a new street-lighting system in Niles is under consideration.

BUTLER, OKLA.—Messrs. Kise & Mason have purchased a site in Butler on which they propose to erect an electric-light plant. Work will begin at once on the proposed plant.

GUTHRIE, OKLA.—The City Council is reported to be contemplating the purchase of the franchise of the Guthrie Light & Power Company.

BANDON, ORE.—The Smith-Powers Logging Company is reported to be contemplating establishing a large electric plant, to cost from $400,000 to $500,000, and extend high-tension lines to its various logging camps to supply electricity for logging operations. The company is now making tests of the electric donkey engine.

GATES, ORE.—Plans are being considered by the Silver King Mining Company, which operates in the Elkhorn district, for the erection of an electric smelting plant.

RIDDLE, ORE.—The Riddle Development League is contemplating the installation of an electric-light plant to supply electricity to the residents of the Umpqua Valley.

GREENVILLE, PA.—H. Borland, of Pittsburgh, acting for Eastern capitalists, has purchased the plant of the Greenville Electric Light, Heat & Power Company. The consideration is said to be $100,000. It is understood that the new owners will rebuild the plant.

JOHNSTOWN, PA.—The Penn Central Light & Power Company is reported to be negotiating for the purchase of electric-light properties in Cambria County on the route of its system from Huntingdon County into this county. The company has taken an option on the electric plant in Lily, owned by Julius F. Klemstine, and is also negotiating with the Citizens' Light, Heat & Power Company, of Portage, for its property. The Citizens' company supplies electricity in Portage, Jamestown and Cassandra, and is also planning to extend its transmission lines into Wilmore.

PITTSBURGH, PA.—Negotiations are under way between John W. Garland, of Pittsburgh, Pa., chairman of the reorganization committee of the National Telephone bondholders, and a syndicate of capitalists by which the latter will acquire the independent telephone companies operating in New Jersey, Pennsylvania, West Virginia, Ohio, Indiana and part of Illinois. The deal will mean the payment of $10,000,000 in cash and the issuance of $22,000,000 in bonds.

WARREN, PA.—The City Council has passed an ordinance requiring all wires, except those of the Warren Electrical Light Company, placed underground in the business section of the city. The Bell Telephone Company of Pennsylvania was granted a franchise to lay its conduits throughout the borough. The ordinance requires that the Bell company rent space in its conduit to the American Bell Telephone Company, the Postal Telegraph and the Western Union Telegraph companies. Improvements are contemplated by the Bell company in Warren, which will involve an expenditure of about $75,000.

SIOUX FALLS, S. D.—A petition has been presented to the City Commission asking for the installation of ornamental lamps on Main Avenue from Fifth to Twelfth Street.

WOONSOCKET, S. D.—The Shuler Electric Company has applied to the City Council for a franchise to install and operate an electric-light plant in Woonsocket.

CHATTANOOGA, TENN.—It is announced that the Eastern Tennessee Power Company, which is erecting a large power plant on the Ocee River, near Parksville, Tenn., will be ready to supply electricity in Chattanooga, Knoxville and Rome, Tenn., by Jan. 1, 1912. Contracts are now being made for service to begin at that date.

[illegible]

PULASKI, TENN.—Plans are being considered for rebuilding the municipal electric-light plant. It is understood that bids will soon be [illegible]

BROWNSVILLE, TEX.—Bonds to the amount of $50,000 have been authorized, the proceeds to be used for improvements to the municipal electric-light plant and water-works system.

CALVERT, TEX.—The City Council has granted the Calvert Water, Ice & Electric Light Company a renewal of its franchise for a period of twenty-five years.

CARLSBAD, TEX.—Bids will be received by the Anti-Tuberculosis Commission of Texas, Austin, Tex., until Nov. 14 for the erection of a tuberculosis sanatorium at Carlsbad, to include administration, subsistence, power and equipment buildings, infirmary, barns and lean-tos. Plans and specifications may be obtained at the office of the commission, Austin; Concho Land Company, San Angelo, Tex., and Henry T. Phelps, architect, San Antonio, Tex. Ralph Steiner, M.D., is chairman of the commission.

GIDDINGS, TEX.—The Giddings Creamery Company has changed its name to the Giddings Creamery-Ice Manufacturing Company. The company is capitalized at $20,000 and contemplates operating an electric light plant in addition to its ice and cold-storage business.

PECOS, TEX.—Judge James F. Ross, of Pecos, Tex., who represents Cobe, McKenna & Company, agents of the Balmorhea and Toyah irrigation systems, has submitted a proposition to build an irrigation dam in the Toyah Valley at a cost of about $200,000. The proposed system is to be built and operated on the plan of the Carlsbad dam built by the government at Carlsbad, N. M., and the Elephant Butte dam project now under construction above El Paso in New Mexico.

YOAKUM, TEX.—The Yoakum Improvement Company is planning to install a 500-hp engine and a 150-kw, 60-cycle generator in its plant. J. W. Greer is secretary and manager.

RICHMOND, VA.—The Washington & Old Dominion Railroad Company has leased the Bluemont branch of the Southern Railway, extending from Alexandria to Bluemont, a distance of 39 miles, for a term of fifty years from July 1, 1912. It is understood that the road will be equipped for electrical operation as soon as possible.

ROANOKE, VA.—The Roanoke Railway & Electric Company is reported to have entered into a contract with the Appalachian Power Company to supply electrical energy generated at the hydroelectric plant on New River in Roanoke. Electricity will be transmitted at 80,000 volts to the substation of the Roanoke Railway & Electric Company on Walnut Street.

CASTLE ROCK, WASH.—The City Council has granted H. B. Davis, J. W. Seldon and the Tacoma Investment Company a fifty-year franchise to construct and operate an electric-light plant in Castle Rock. The company was also given a contract to light the streets of the city for a period of five years.

DAYTON, WASH.—The Pacific Power & Light Company, which recently acquired the property of the Dayton Electric Light Company, is planning to make extensions and improvements to the local system. The Pacific company has extended its transmission line into the city.

SEATTLE, WASH.—The City Council has passed ordinances providing for enlarging the municipal lighting plant at a cost of $1,000,000 and for improvements to the city water-works system to cost $500,000.

SEATTLE, WASH.—R. H. Thomson, city engineer, has submitted a report to the City Utilities Committee in which he recommends two power projects to be owned by the municipality. The report submitted stated that 25,000 hp could be developed by the Lake Cushman project at an approximate cost of $2,325,000 and that 40,000 hp could be obtained in connection with the White River project, the cost of which is estimated at about $3,560,000.

SNOHOMISH, WASH.—The City Council has authorized the Mayor and the city clerk to enter into a new contract for street lighting with the Everett Gas Company for a period of ten years. This contract provides for not less than thirty-five magnetite arc lamps at $72 each per year.

SPOKANE, WASH.—Plans have been filed with the City Commissioners for the installation of an ornamental lighting system on Second Avenue between Division and Walnut Streets. The plans call for the erection of ninety-four electroliers, each carrying five lamps. The total cost of the system is estimated at $56,400, of which the property owners will be asked to pay $45,400. The cost of the electroliers at $123 each aggregates $11,562, and the maintenance at $48 each per year for ten years will be $45,120. The actual cost to the city will be the cost of lighting the street.

WALLA WALLA, WASH.—The Pacific Power & Light Company has applied for franchises for extensions to its transmission lines in Walla Walla County. The company proposes to install systems in Dixie, Two Rivers, Burbank, Attalia and other small towns in this section.

WALLA WALLA, WASH.—Plans are being considered by the Pacific Telephone & Telegraph Company for extensive improvements and extensions to its toll lines, involving an expenditure of $80,000, including the erection of a toll line between Walla Walla and [illegible] cost $1,000; a line from this city to Colfax, $17,200; a line between Prosser and Wallula, $14,000; a line between North Yakima and Prosser, $15,000, and a line between Arlington and state line points, $30,000.

WHEELING, W. VA.—The County Commissioners have entered into a contract with the Wheeling Electrical Company to supply electricity to light the county building.

DE PERE, WIS.—Orders have been placed by the De Pere Electric Light & Power Company for a new switchboard and regulating machinery. The new equipment will be utilized in connection with the current from the High Falls as well as power generated at the local plant. The cost of the improvements is estimated at about $3,000.

MANITOWOC, WIS.—The City Council is reported to have voted to issue bonds for improvements to the water and light plant.

MILTON, WIS.—The Milton Water, Light & Power Company, recently organized, has been granted a franchise to construct and operate an electric-light plant in Milton. Work has already begun on the plant, and orders have been placed for equipment for the electric plant. It is understood that the company is planning to build a water-works system in the spring. Dr. J. H. Burdick and Dr. G. E. Crossley are interested in the company.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company, it is reported, will issue $2,000,000 additional refunding and extension mortgage bonds.

VERMILION, ALTA., CAN.—The contract for the construction of a new electric power house in Vermilion is reported to have been awarded to Ferrell & Walker.

WINNIPEG, MAN., CAN.—The plant and holdings of the Winnipeg Electric Company, which supplies electricity, gas and street-railway service in Winnipeg and vicinity, are reported to have been purchased by the E. R. Reese Engineering Company, an American concern. The new owners, it is said, will build rural lines throughout the province.

BEACHVILLE, ONT., CAN.—At an election held recently the ratepayers voted to appropriate funds for the installation of a distributing system for Niagara power to be supplied by the Hydroelectric Power Commission. The village of Boden also voted in favor of an appropriation to install a distributing system to utilize energy supplied by the Hydroelectric Power Commission.

BERLIN, ONT., CAN.—The City Council has adopted a resolution providing for the installation of a new street-lighting system. The present plan calls for the erection of 1500 lamps of 100 cp to be placed throughout the entire town before the first of the year.

HAMILTON, ONT., CAN.—The controllers have decided to place orders at once for duplicating the present electric pumping equipment at the Beach water-works station, providing the Council grants its approval. It has also been decided to notify the Hydroelectric Commission that an additional 1000 hp will be required by Nov. 1, 1912, in addition to the 1000 hp now taken by the city. By that time the city expects to supply electricity for lighting all the municipal buildings, Gore Park, and probably some of the schools and the government buildings in the city.

HAMILTON, ONT., CAN.—Proposals will be asked for during the next two months by the Hydroelectric Department of the city of Hamilton for material required in the construction of a distributing plant for energy supplied by the Hydroelectric Power Commission throughout the city of Hamilton as follows: (a) Substation building, heating, lighting, plumbing, etc., for same; (b) station equipment, including transformers, switches, switchboards, lightning arresters, instruments, oil tanks, etc.; (c) wooden poles, cross-arms, pins, side blocks, braces, insulators, machine bolts, pole steps, guy wire, etc.; (d) reinforced poles, condulets, conduits, steel reinforcing, cross-arms and castings; (e) underground conduit system construction, including cable racks, manholes and manhole castings, structural steel, pillars and castings; (f) conduit ducts, tile, fibre or other system for underground distribution; (g) weatherproof and rubber-covered copper and aluminum and standard wire, lead-incased cables and installation of same, distribution boxes, pot-head and connectors; (h) line transformers, meters, cut-outs and devices, lamps, wiring supplies or other appliances, devices [illegible] or material to be used in connection with construction [illegible] equipment of above. Companies, firms or individuals desiring to submit bids on any of the above equipment or apparatus must file applications [illegible] specifications with E. I. Sifton, consulting engineer, City [illegible] Hamilton, Ont., Can., stating specifically the portions and sections [illegible] wish to bid on. For sections A, B and E a deposit of $10 will be [illegible], which will be refunded on return of same. George H. [illegible] is Mayor.

MIMICO, ONT., CAN.—The municipality of Mimico has entered [illegible] contract with the Hydroelectric Power Commission for 50 hp at $3[illegible] per hp per year for a period of fifty years.

ST. MARY'S, ONT., CAN.—At an election held recently the by-law appropriating $15,000 to secure energy from the Hydroelectric Power Commission was carried.

THREE RIVERS, QUE., CAN.—The citizens have voted to construct a street-railway system to be owned and operated by the municipality, to cost approximately $800,000.

SCOTT, SASK., CAN.—Contracts have been awarded by the [illegible] for construction and equipment of a combined electric light [illegible] plant, amounting to $28,310.

New Industrial Companies.

THE CAPITAL GAS ENGINE COMPANY, of Sacramento, Cal., has [illegible] [illegible] ners of the Bell machine shop. The new company has taken over the [illegible]

THE EASTMAN MOTOR TRUCK COMPANY OF AMERICA, of Wilmington, Del., has filed articles of incorporation with a capital stock $25,000. The incorporators are: J. H. Shields, of Minneapolis, Minn.; E. Semmes, of Washington, D. C.; L. J. Eastman, B. R. Kenworthy, Philadelphia, Pa., and H. G. Eastburn, of Wilmington, Del.

THE ECONOMIC BLOWER COMPANY, of New Jersey [illegible] ticles of incorporation with a capital stock of $100,000 to manufacture machinery, engines and mechanical devices. The incorporators are: C. Reeves and T. F. Farrell, of Jersey City, N. J., and W. Grupe, Hoboken, N. J.

THE ELECTRIC AD-LITE COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $10,000 for the purpose of manufacturing electrical and mechanical devices. The incorporators are: Joseph G. Kanter, Benjamin F. Kanter and Frank V. Daniles, all of 32 Union Square, New York, N. Y.

THE EVANS FITTING COMPANY, of Camden, N. J., has been granted a charter with a capital stock of $50,000. The company proposes to manufacture steel fittings for hydraulic and other piping. The incorporators are: F. R. Hansell, J. A. MacPeak and I. C. Clow, of Camden, N. J.

THE GALLAGHER-TOMPKINS COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $175,000 for the purpose of manufacturing engines, machinery, etc. The incorporators are: F. B. Tomkins, R. W. Gallagher and G. D. Zahm, of New York, N. Y.

THE GENERAL ELECTRIC OZONE COMPANY OF AMERICA has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $200,000. The incorporators are: N. P. Coin, W. J. Maloney and H. E. Latter, of Wilmington, Del.

THE GENERAL GLASS MANUUFACTURING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture glass signs, lamps, metal goods, etc. The incorporators are: R. J. Fox, H. S. Hanson and James S. Miller.

THE HALLDOW MANUFACTURING COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $10,000 to manufacture electrical appliances. The incorporators are: Charles M. Mudge, H. W. Mudge and L. C. Seward, of 1007 La Salle Street, Chicago, Ill.

THE HATCH OIL ENGINE COMPANY, of New York, N. Y., has been incorporated by C. W. Hatch, W. P. Hatch, Jr., and A. Anderson, of Brooklyn, N. Y. The company is capitalized at $100,000 and proposes to manufacture machinery.

THE HOOSIER SALES COMPANY, of Jamestown, N. Y., has filed articles of incorporation with a capital stock of $150,000 for the purpose of manufacturing electrical goods. The incorporators are: Frank L. Wyman, of Indianapolis, Ind.; Scott H. Penfield, of Jamestown, N. Y., and Benjamin S. Dean, 609 East Eighth Street, Jamestown, N. Y.

THE KUHLMAN ELECTRIC COMPANY, of Elkhart, Ind., has been organized with a capital stock of $20,000 for the purpose of manufacturing and dealing in electric appliances, devices and supplies. E. Kuhlman is president of the company and John A. Johnson secretary.

THE M. & E. MANUFACTURING COMPANY, of Newton, Ia., has been granted a charter with a capital stock of $12,000 for the purpose of manufacturing lighting plants, fixtures and tools. The incorporators are: A. Elliott, R. S. Redman, F. G. Morrison, Lee Brown and C. H. [illegible]

THE MODERN SPECIALTIES MANUFACTURING COMPANY, of Goshen, Ind., has filed articles of incorporation, with a capital stock of $25,000, to manufacture and deal in all kinds of machinery, appliances, mechanical and electrical devices and specialties. The incorporators are: John Winter, Elmer E. Ash, Clinton C. Teidman and Albert Snapp.

THE MOORE CONTINUOUS SAFETY RAIL COMPANY, of Galesburg, Ill., has been granted a charter with a capital stock of $20,000 to manufacture and deal in railroad supplies and machinery. The incorporators are: R. D. Moore, Luke W. Sanborn, R. R. Drake, W. E. Doy and R. C. Rice.

THE NIAGARA SEARCHLIGHT COMPANY, of Niagara Falls, N. Y., has been incorporated with a capital stock of $25,000 by R. M. Eaton, R. H. Gettens and R. R. Gessford, of Niagara Falls, N. Y. The company proposes to manufacture electric lamps, fixtures, etc.

THE PEABODY ELECTRIC COMPANY, of Muskogee, Okla., has been organized with a capital stock of $15,000 to do general electrical construction work. A. D. Peabody is president and F. H. Weber, secretary.

THE PENNSYLVANIA STEEL RAILWAY TIE COMPANY, of Dover, Del., has been incorporated by F. R. Hansel, of Philadelphia, Pa.; George H. Martin and S. G. Seymour, of Camden, N. J. The company is capitalized at $10,000,000 and proposes to manufacture and distribute iron, steel and metal products.

[illegible] COMPANY, of Waxahachie, Tex., has been incorporated with a capital stock of $50,000 by E. W. Rice, G. W. Coleman and J. T. Spencer. The company proposes to do a general engineering business.

THE SANITARY SUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 to manufacture vacuum cleaners. The incorporators are: C. Leviton, A. Lamb and J. Lowenhaupt.

THE SUNSET COMPANY, of Newark, N. J., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing engines, dynamos, electrical appliances, etc. The incorporators are: C. D. Winters, I. B. Glueckfield and J. Beckingham.

THE UNION ELECTRICAL COMPANY, of Louisville, Ky., has been incorporated with a capital stock of $1,000, to do electrical construction work and deal in electrical supplies. The incorporators are: H. F. Karwiese, F. C. Whitener, H. A. Sigmier and W. J. Busam.

THE WHYLAND-NELSON MOTOR CAR COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $10,000. The company proposes to manufacture motors, engines, motor vehicles, etc. The incorporators are: Frank A. Shoemaker, 91 California Street; Frank W. Whyland, 91 Claremont Avenue, Buffalo, N. Y., and Joel W. [illegible]

New Incorporations.

FRESNO, CAL.—The Kerman Telephone Company has been incorporated with a capital stock of $35,000, by T. F. Saunders, Jacob Mausar, H. A. Hechtman, W. I. Hechtman and J. A. Johnson.

WALLACE, IND.—The Wallace Co-operative Telephone Company has been incorporated with a capital stock of $13,000 to construct and operate telephone systems throughout Park and Fountain Counties. The directors are: Thomas Keller, A. B. Grimes, Butler Meyers, John Wallett and W. E. Spragg.

AUGUSTA, MAINE.—The American Volsam Company has been incorporated to build and operate plants to generate and distribute electricity and also to quarry minerals, etc. The officers are: E. J. Pike, president; L. J. Coleman, treasurer, and C. L. Andrews, clerk.

WESTFIELD, MAINE.—The Westfield Light & Power Company has been granted a charter with a capital stock of $10,000 to supply electricity for lamps, heat and motors in Westfield, Maine. The officers of the company are: Lincoln R. Sinclair, president; Enoch B. Briggs, treasurer, and Thomas C. Bell, clerk, all of Westfield, Maine.

BOSTON, MASS.—The United States Light & Heating Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: Norman J. MacGaffin, Malvina P. Healey and Clarence R. Yeaton.

DEERWOOD, MINN.—The Cuyuna Northern Railway Company has been incorporated by Cuyler Adams, F. S. Adams and C. C. Adams, all of Deerwood. The company is capitalized at $1,000,000 and proposes to construct and operate an electric railway from Sherwood through Crow Wing County to a point on the Mississippi River.

Personal.

MR. C. E. SEARCH has been appointed works manager of the Allis-Chalmers Company of Milwaukee, succeeding Mr. David Van Alstyne, who has resigned, to take effect on Nov. 15.

MR. EUGENE C. IVEY, secretary and treasurer of the Citizens' Light & Power Company, Lenori, N. C., was married Oct. 25 at Charlottesville, Va., to Miss Annie Carver Vasseur.

MR. I. C. COPLEY, president of the Western United Gas & Electric Company, of Aurora, Ill., was elected president of the American Gas Institute at the recent convention in St. Louis.

MISS ANNEBELL FRASER, librarian of the Commonwealth Edison Company, Chicago, has been appointed assistant editor of the "Question Box" of the National Electric Light Association.

PROF. W. M. ANDERSON, who graduated from the Rose Polytechnic Institute in the class of 1894, has taken charge of the electrical engineering department of the University of Louisville.

MR. H. L. JUDD has been elected chairman of the North Shore Electric Company (Chicago) Section of the National Electric Light Association. He is superintendent for the company at Oak Park, Ill.

MR. A. W. HARPER has resigned from the commercial department of the Penn Central Light & Power Company, Altoona, Pa., to accept a position as commercial agent of the Sandusky Gas & Electric Company.

MR. DAVID VAN ALSTYNE, vice-president of the Allis-Chalmers Company, of Milwaukee, and in charge of its manufacturing operations, will sever his connection with that company on Nov. 15, in order to engage in business in New York. Mr. Van Alstyne was formerly vice-president of the American Locomotive Works.

MR. ETIENNE DE FODOR, general director of the Budapest General Electric Company, was recently the object of ovations from various

[illegible] of his thirtieth anniversary as an electrical engineer. A banquet given [illegible] government, the Mayor, leading men of the municipality and a large number of engineers. Mr. de Fodor was born in Pressburg on Nov. 8, 1856, and after having finished his studies, he joined, in 1881, the few Edison pioneers that brought the incandescent system of lighting [illegible] an engineer and a business man, and in Hungary is regarded as an authority upon all wide-reaching engineering subjects and projects.

MR. A. T. MACDONALD, for the past two years general traffic manager of the Louisville Lighting Company, of Louisville, Ky., has been appointed general sales manager of the company. The new position for Mr. Macdonald is an expansion of that which he has held previously. He will have charge of the soliciting force of the company and of the sale of energy in all directions. He will also continue to edit the company's paper, *Chained Lightning*, which has been a valuable sales developer. Mr. Macdonald was identified with the editorial departments of many leading newspapers until about four years ago, when, after service as president of the Greater Louisville Exposition, he was elected secretary of the Louisville Commercial Club. While holding this position he organized and presented the Southern Electrical Exposition at the First Regiment Armory, in Louisville, a display which called attention in an effective manner to the development of electricity in the South. Central stations and manufacturers co-operated to make this exposition one of the most successful of the kind ever held south of the Ohio River. Mr. Macdonald has received credit for much of the success of the Louisville Lighting Company in the direction of developing new business in store lightning, signs, electric vehicles and motor service.

Obituary.

MR. STEPHEN V. COOK died at his home in Chicago on Oct. 21, aged eighty-six years. Mr. Cook had a mechanical turn of mind and was interested in the telephone in its early development. One of his sons, Mr. Frank B. Cook, is well known as an inventor of telephone protective and other electrical devices.

MR. I. T. DYER, for a number of years superintendent of telegraph for the Chicago, Burlington & Quincy Railroad at St. Joseph, Mo., but more recently superintendent of telegraph for the San Pedro, Los Angeles & Salt Lake Railroad, with headquarters at Los Angeles, died at his home in the latter city on Oct. 25. Mr. Dyer was well known among railroad men.

Trade Publications.

STORAGE BATTERY CARS is the title of Bulletin No. 13, just issued by the Gould Storage Battery Company, 341 Fifth Avenue, New York. It explains the economics of the storage battery car, describes the standard type made by the Gould Company and cites the conditions under which storage battery cars can be used most profitably.

INERTIA VALVE GEAR.—Bulletin No. 36 of the Bates Machine Company, Joliet, Ill., describes and illustrates the new Bates inertia valve gear, now regularly applied to all Bates Corliss engines. This new gear has attracted much attention because of its positiveness and quiet operation, and the absence of hooks, springs and rollers.

SYNCHRONOUS CONDENSERS.—Bulletin No. 4859, recently issued by the General Electric Company, describes its line of synchronous condensers especially adapted for floating on the line for improving the power-factor. These condensers have been designed to meet the demand for a comparatively inexpensive high-speed machine of this nature.

SMALL PLANT DIRECT-CURRENT SWITCHBOARDS.—Bulletin No. 4876, issued by the General Electric Company, on the above subject, illustrates and describes that company's 76-in. direct-current panels designed for general use in small central stations and isolated plants and includes connection and dimension diagrams. A choice of protective equipment is given to meet different requirements in regard to price.

AMP-HOUR METERS.—Central-station managers selling energy for vehicle charging will be interested in Bulletin No. 19 issued by the Sangamo Electric Company, Springfield, Ill., describing amp-hour meters for use in this class of service. Complete wiring diagrams for various types of well-known electric vehicles given should prove of assistance to managers who desire to equip to meet the conditions of vehicle-charging service.

ROTARY CONVERTERS FOR RAILWAY SERVICE.—Descriptive Leaflet No. 2378, covering rotary converters for railway service, has just been issued by the Westinghouse Electric & Manufacturing Company, This is a four-page leaflet, 9½ in. by 11 in., and contains a number of illustrations describing the various parts of rotary converters, such as armature coils, spider, equalizer connections, collector rings, commutator brush riggings, etc. Under each illustration is given a short description of the method of construction of the part shown. One page is devoted [illegible] illustrations of rotary converters completely assembled.

BUSINESS NOTES.

DAY & ZIMMERMAN.—Mr. Kern Dodge having retired from the firm of Dodge, Day & Zimmerman, the business will hereafter be conducted under the name of Day & Zimmerman.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, Ind., has opened a Chicago office at 404 Fisher Building for the sale of its meters and transformers. Mr. A. G. Lucas is the Chicago manager in charge of the new office.

CENTURY ELECTRIC COMPANY ESTABLISHES SEATTLE OFFICE.—The Century Electric Company, St. Louis, has established a district sales office at Seattle, Wash., which will be in charge, as district sales agent, of Mr. Henry T. Thedinga, 343 Central Building.

A. EUGENE MICHEL and staff, advertising engineers, have moved into the Park Row Building, 21 Park Row, New York, where larger space has been secured. Temporarily the photo-retouching and illustrating department will remain in the Hudson Terminal Buildings, but all business will be managed from the new offices.

PRINTOMETER.—The Minerallac Electric Company has transferrec the manufacture of the instrument formerly known as the Chicag Printing Attachment to the Chicago Electric Meter Company. The de vice will be known hereafter by the trade name "Printometer." Th Minerallac Company will continue to act as distributor.

HUGHES ELECTRIC STOVES.—One of the principal attractions a the Colorado Electric Show was the booth of the Colorado Electri Specialties Company, which was fitted up as an electrical kitchen an contained the complete line of Hughes cookstoves, ranges and plate An electrically roasted lamb each day was served to visitors.

$75,000 FIRE AT BROOKLYN (N. Y.) SWITCHBOARD FAC TORY.—The three-story brick factory of the H. Krantz Manufacturin Company, maker of high-grade switchboards and controlling apparatu at Brooklyn, N. Y., was destroyed by fire on the morning of Oct. 2 The damage to building and stock was about $75,000, fully covered b insurance.

ROTH BROTHERS & COMPANY, Chicago, Ill., have recently shipp to the Wagner Manufacturing Company of Sidney, Ohio, manufacture of aluminum ware, ten 5-hp polishing motors of a new, improved, ven lated type which the company has recently placed on the market. A ten machines will be used for polishing the aluminum utensils man factured by the Wagner Company.

THE GRANGER ELECTRIC & MANUFACTURING COMPANY, Warren, Ind., which manufactures a full line of heating appliances, i cluding electric flatirons, toasters, heating pads, etc., has appointed M Arthur P. Pierson, of 136 Liberty Street, New York, as its selling age for New York and New England territory. A representative line stock and samples will be carried in New York.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Ma has received a number of inquiries since the fire at its Brookline wo asking what effect the fire would have on the delivery of motors. T officers of the company desire that it may be clearly understood t the fire has had no effect whatsoever on the motor department, si that part of the company's work is conducted in a separate fact located in Boston. The Brookline factory is again in partial operati and the delay in delivering sundries manufactured there will be slight, the officials say.

THE NORTHERN EQUIPMENT COMPANY, Chicago, Ill., nounces that it has completed a sales arrangement for its "Copes" boi feed regulators and "Copes" pump governors with the Dravo-D Company, merchant engineer of Pittsburgh, which has recently es lished a steam specialty department, with headquarters in Pittsbu covering the Pittsburgh, Cleveland, Philadelphia, Chicago and V Virginia territories. D. D. Pendleton, who has for the past five y represented the Northern Equipment Company in the Pittsburgh dist has completed arrangements with the Dravo-Doyle Company so that will have all rights in that district, thus giving it complete jurisdic n over the territory mentioned above.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention in November, 1911.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

American Institute of Electrical Engineers. Honorary secretary, Ralph W. Pope; acting secretary, F. L. Hutchinson. Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

[illegible] I. E. Weeks, Davenport, Ia.

[illegible] Railway [illegible] Interborough Rapid Transit Company, New York.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, [illegible], N. Y.

[illegible] Thorpe, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting [illegible]

[illegible]

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, D. Morris, 323 Hagerman Building, Colorado Springs, Col.

[illegible] American Trust Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, W. Russell, Jr., 25 West 42d St., New York.

[illegible] Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 [illegible] Ave., Chicago. Annual meeting, Chicago, January each year.

[illegible] TRADES ASSOCIATION OF CANADA. Secretary, William R [illegible] Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. [illegible] Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, [illegible]

[illegible] TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, [illegible] H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. [illegible] meeting, San Francisco, second Thursday of each month.

[illegible] VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Rob[illegible] 124 West 42d St., New York. Meetings, fourth Tuesday of each [illegible]

[illegible] TRADES SOCIETY OF NEW YORK (Member National Electrical [illegible] Association). Secretary, Franz Neilson, 80 Wall St., New York. [illegible] of Directors meets second Thursday of each month.

[illegible] TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. [illegible] 1324 Land Title Building, Philadelphia, Pa. Meetings, second and [illegible] Thursday of each month.

[illegible] STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. [illegible] Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. [illegible] West Palm Beach, Fla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, [illegible] Ill.

[illegible] ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in [illegible] York, New England, Philadelphia and Chicago.

[illegible] ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW [illegible] Secretary, L. H. Woods, 2355 Jerome Ave., New York.

[illegible] ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, In[illegible] Ind.

[illegible] COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, [illegible] Indiana St., Chicago. Meetings, second Friday of each month.

[illegible] ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, [illegible] George, Houston, Tex.

[illegible] ELECTROTECHNICAL COMMISSION (international body [illegible] various national electrical engineering societies contributing [illegible] support). Secretary, C. le Maistre, 28 Victoria St., Westminster, [illegible] S. W., England. Next meeting at Berlin in 1913.

[illegible] ELECTRICAL ASSOCIATION. Secretary, A. W. Zahm, Mason City, Ia.

[illegible]

[illegible] WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James [illegible] Nicholson, Newton, Kan.

[illegible] ELECTRICAL ASSOCIATION. Secretary, W. H. Bower Spangen[illegible] 627 Poydras St., New Orleans, La. Meets third Monday of each [illegible]

[illegible] ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Water[illegible] Maine.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., second week in June, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

NATIONAL ELECTRIC INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Joseph B. Ware, Grand Rapids, Mich.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Bombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

VERMONT ELECTRICAL ASSOCIATION. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next annual meeting Jan. 23-25, 1912.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 24, 1911.

[Prepared by Robert Starr Allyn, 15 Exchange Place, New York.]

1,006,494. ELECTRIC BATTERY; W. Morrison, Chicago, Ill. App. filed Aug. 11, 1902. Bromine gravity battery with a bed of granular carbon containing free bromine.

1,006,504. ALTERNATING-CURRENT SWITCH; A Simon, Milwaukee, Wis. App. filed Feb. 21, 1907. Coils in axial alignment produce magnetic fluxes of different phase.

1,006,522. CIRCUIT-BREAKER; C. C. Badeau, Bethlehem, Pa. App. filed Sept. 18, 1906. Rolling contact between the arm and handle.

1,006,536. WELDING MACHINE; G. E. Dean, Albion, Mich. App. filed April 21, 1911. For welding rods to frames to form shelves, racks, etc.

1,006,537. WELDING MACHINE; G. E. Dean, Albion, Mich. App. filed July 13, 1911. For welding wire mesh to frames for shelves, etc.

1,006,560. RHEOSTAT FOR ELECTRIC MOTORS; J. T. Kalweit and W. H. Gaulke, Milwaukee, Wis. App. filed July 7, 1910. Box for starting switch and details of contacts, and mountings for the contacts and armature.

1,006,569. DEVICE FOR DRIVING ELECTRIC SECONDARY CLOCKS; G. O. Larsson, Stockholm, Sweden. App. filed Oct. 26, 1908. Has a condenser in the secondary clock circuit and contacts for charging and discharging.

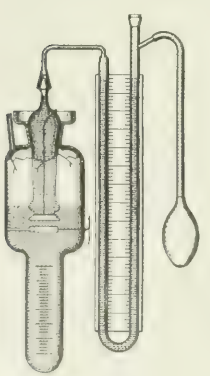
1,006,591. DEVICE FOR HOLDING RECEIVERS OF TELEPHONES; E. L. Persons, Concord, N. H. App. filed June 12, 1911. The receiver is carried by a long arm adapted to be moved by pressure of the head.

1,006,612. ELECTROLYTIC METER; E. Weintraub, Lynn, Mass. App. filed Feb. 14, 1910. Mercury is forced from a reservoir into the container by air pressure. Pressure is relieved by a capillary tube.

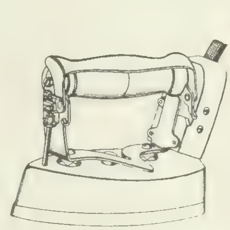
1,006,615. CENTRAL-ENERGY TELEPHONE SYSTEM; C. S. Winston, Chicago, Ill. App. filed March 10, 1906. Three-wire system for central-station wiring.

1,006,619. PROTECTION OF HIGH-TENSION DIRECT-CURRENT MOTORS IN SERIES; T. von Zweigbergk, Southport, England. App. filed March 28, 1910. A supplementary circuit from the motor side of a circuit-breaker has a terminal near the motor commutator so as to insure connection to the circuit-breaker in case of a flash.

1,006,620. TUNGSTEN FURNACE; A. Appelberg, Schenectady, N. Y. App. filed Oct. 16, 1908. Air-tight chamber is supplied with inert gas and has a door at the bottom.



1,006,612.—Electrolytic Meter.



1,006,727.—Automatic Flatiron.

1,006,631. SYSTEM OF ELECTRICAL DISTRIBUTION; W. H. Clarke, Chicago, Ill. App. filed July 1, 1907. For lamps or other translating devices in multiple on a variable potential.

1,006,635. SPACE TELEPHONY; L. De Forest, New York, N. Y. App. filed July 8, 1907. A telephone transmitter and electromagnets are arranged near the spark electrodes in the antenna.

1,006,636. SPACE TELEPHONY; L. De Forest, New York, N. Y. App. filed July 8, 1907. A plurality of transmitting devices and a plurality of independent oscillation circuits.

1,006,651. ELECTRIC-LIGHT-SOCKET CAP; J. H. Goss, Waterbury, Conn. App. filed Jan. 3, 1911. Connection between the cap and its hub.

1,006,655. ELECTRIC RESISTANCE; R. C. Harris, Gateshead, England. App. filed Feb. 18, 1911. A strip is perforated and bent so as to bring the perforations into alignment for a supporting rod.

1,006,657. VAPOR ELECTRIC DEVICE; J. L. R. Hayden, Schenectady, N. Y. App. filed April 16, 1907. The evacuated envelope has a condensing chamber for gases formed by the operation.

1,006,673. COMMUTATOR OF DYNAMO-ELECTRIC MACHINES; C. A. Parsons, A. H. Law and J. P. Stockbridge, Newcastle-Upon-Tyne, England. App. filed April 9, 1910. The commutator bars and connectors are dovetailed and inter-connected.

1,006,697. ACID-PROOF ELECTRIC-BATTERY TERMINAL; K. R. Smith, Totnes, England. App. filed Feb. 15, 1907. The wire is connected to the electrode by a celluloid plug and sleeve.

1,006,703. RELAY; A. L. Townsend, Washington, D. C. App. filed March 23, 1911. Self-polarizing and self-adjusting for telegraphy.

1,006,727. AUTOMATIC FLATIRON; A. S. Cubitt, Pittsfield, Mass. App. filed May 7, 1910. Has a switch controlled by the grasp of the hand and also thermostatically.

1,006,729. ATTACHMENT FOR VAPOR LAMPS; A. Dempster, Schenectady, N. Y. App. filed Nov. 9, 1905. Automatic electromagnetic cut-in.

1,006,744. DYNAMO-ELECTRIC MACHINE; V. A. Fynn, London, England. App. filed May 26, 1910. Self-exciting and self-regulating.

1,006,749. CONTROL MECHANISM; H. Haudenschild, Toledo, Ohio. App. filed Jan. 20, 1908. Compact rheostat-controlling switch and brake as for sewing-machine drive.

1,006,756. ELECTRIC BRANDING DEVICE; J. A. Jordan, Bangor, Ireland. App. filed Feb. 25, 1911. Hand device for branding meat.

1,006,767. ELECTRIC HAIR-DRYER; H. J. Mauger, Schenectady, N. Y. App. filed Jan. 19, 1910. A lamp, motor, fan and reflector.

1,006,774. BINOXIDE-OF-HYDROGEN ELECTRODE; W. Morrison, Des Moines, Ia. App. filed Nov. 29, 1909. Binoxide is added to a solution of sulphate of ammonia for treating the paste.

1,006,786. SPACE TELEGRAPHY; G. S. Piggott, Chicago, Ill. App. filed June 19, 1903. Signaling means control the discharge between the sparking terminals of a static electric machine.

1,006,795. SPARK-GAP; J. D. Robertson, Toledo, Ohio. App. filed Nov. 30, 1910. A non-conducting plug with a spark-gap inside and a sight opening; for testing ignition circuits.

1,006,802. AUTOMATIC CIRCUIT-CONTROLLER FOR ELECTRIC MOTORS; S. Sparrow, St. Louis, Mo. App. filed May 27, 1909. Centrifugal governing device for short-circuiting the individual coil of the armature.

1,006,805. MERCURY-VAPOR DEVICE; E. Thomson, Swampscott, Mass. App. filed Jan. 21, 1911. The envelope with electrodes i[s] inside a closed receptacle containing gas under pressure.

1,006,824. ALARM-ACTUATING MECHANISM FOR INCUBATORS; W. M. Braly, Blackwell, Okla. App. filed April 2, 1910. A ther[-]mostat and electric alarm.

1,006,833. TELEPHONE RECEIVER; W. W. Dean, Elyria, Ohio. App. filed Oct. 8, 1908. Sheet metal shell.

1,006,835. MAGNETIC SEPARATOR FOR ORES; J. B. Etherington, Winthrop, Mass. App. filed Jan. 24, 1910. The table is supporte[d] upon horizontal bars arranged to vibrate in guides transverse to th[e] line of ore feed.

1,006,836. PROCESS AND APPARATUS FOR ELECTROLYTIC RE-COVERY OF WASTE LIQUOR; F. F. Farnham, McKeesport, P[a.] App. filed Aug. 11, 1911. Iron and sulphuric acid from ferro[us] sulphate.

1,006,864. ELECTROTHERAPEUTIC APPARATUS; M. G. McElhi[n]ney, Ottawa, Can. App. filed March 15, 1910. A condenser receivi[ng] static charges is periodically neutralized to produce a pulsati[ng] current.

1,006,876. METALLURGY OF ZINC ORES AND COMPOUNDS; L. J. Queneau, Overbrook, Pa. App. filed Jan. 7, 1910. Electrical[ly] heated rotating furnace with a fluid resistor.

1,006,877. METALLURGY OF ZINC; A. J. L. Queneau, Philadelph[ia,] Pa. App. filed June 8, 1911. Rotary reducing chamber with molten resistor and a condenser.

1,006,884. ELECTRIC LAMP SOCKET; F. E. Seeley, Bridgepo[rt,] Conn. App. filed April 4, 1910. Thumb-turn snap switch with slidi[ng] contacts and quadruple break.

1,006,898. WATER-LEVEL ALARM FOR BOILERS; L. Beeb[e,] Saginaw, Mich. App. filed April 15, 1910. Steam whistle and el[ec]tric signal controlled by a float.

1,006,901. RAILWAY SIGNAL; A. H. Bernadou, Philadelphia, [Pa.] App. filed May 26, 1908. Bell signals to alarm the entire t[rain] crew in case the train approaches an occupied block.

1,006,981. LOCK SWITCH; T. D. Robinson, Lockport, N. Y. A[pp.] filed Jan. 24, 1911. Combination lock for automobile ignition circ[uit] switches.

1,006,996. CIRCUIT-CLOSER FOR TROLLEY SIGNALS; W. [E.] Chapman, Needham, Mass. App. filed May 28, 1908. A circ[uit-]closing arm is arranged near the trolley wire and a retarder h[olds] the signal circuit closed a short time after passage of the tro[lley] wheel.

1,007,000. HEATING SYSTEM; E. E. Gold, New York, N. Y. [App.] filed Dec. 23, 1910. A hot-water system with an electric heater [in]serted inside a portion of the pipe.

1,007,003. ARC LAMP; J. W. Kendrick, Franklin, Pa. App. filed [J]... 17, 1910. Rotatable disk electrodes for projectors, moving [pic]tures, etc.

1,007,005. METAL JOINT; A. Lukasewske, New York, N. Y. A[pp.] filed May 27, 1905. "Thermit" joint as between a copper bond [and] a steel rail.

1,007,030. TELEPHONE TRANSMITTER; A. A. Jahnke, Richmond, Cal. App. filed Nov. 18, 1910. Two fluids of different conductivity meet back of a diaphragm whose vibrations vary the cross-sectional area of the fluid column.

1,007,031. MICROPHONE TRANSMITTER; A. A. Jahnke, Richmond, Cal. App. filed Nov. 18, 1910. The carbon is kept cool by alcohol vapor.

1,007,036. TELEPHONE SYSTEM; A. D. T. Libby, Elyria, Ohio. App. filed May 28, 1909. Trunking system.

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NEW YORK, SATURDAY, NOVEMBER 11, 1911.

CONTENTS.

STRINGING TRANSMISSION LINES.

An article by Mr. Alfred Still, printed elsewhere in this issue, on methods of determining sag and span in erecting conductors for transmission lines gives a very convenient graphical short cut to the solution of some of the otherwise difficult problems. The situation with respect to line construction has changed very radically since the early days of power transmission. Then transmission lines were laid out on the same general plan that has been followed for years in the construction of telephone, telegraph and electric-light lines. The poles employed were those customarily in use for general purposes, the spacing was about fifty to the mile, and the simplest approximation to the proper relations between sag and tension was all-sufficient in those days. For high voltages, however, a reduction in the number of insulation points becomes a matter of great importance, and in many instances, particularly in traversing rough country where the poles are set on widely differing levels, the computation of the supporting structure is no easy matter. Short cuts, therefore, such as Mr. Still presents are exceedingly useful. They are all more or less close approximations to a rigorous solution of the very difficult equations involved, and are in all probability quite sufficient in precision for any practical purposes. Of the data necessary in line design, certain items, like the ultimate strength and elastic limit of the wire and its variation in length with temperature when unstressed, are as well known as the conductivity and other electrical characteristics of the proposed line. The expansion due to temperature when under severe stress and the properties of the conductor following a stress beyond its elastic limit are by no means so thoroughly determined. In fact, a good deal of investigation is still necessary before these quantities can have definite values assigned to them.

The result is that in planning a line one has to keep on the safe side with respect to his assumptions concerning these factors, and having done this he can go on through the ordinary computations with considerable confidence. Laying out a line subject only to the normal stresses that come from its own mechanical characteristics is an easy matter, rendered all the easier by graphical devices like that before us. The really serious questions in the design of a transmission line or engineering structure are those which have to do with the abnormal stresses which come upon it from wind, sleet, extraordinary temperature variations, and failure of lines or supports taken singly or in combination. The meteorological conditions along a proposed line are of fundamental importance, and a knowledge of them may make a considerable difference in the cost and security of the resulting structure. As a rule, the possible wind pressure is exaggerated, owing to the fact that the anemometers in general use overrun on the high

velocities by a large percentage, and the results obtained from them are almost universally published uncorrected. The velocities taken on any assumption regarding the condition to be met on a given line must therefore, as Mr. Still indicates, be reduced to the actual velocities by tables which are now fairly well known. A similar uncertainty exists regarding the probable effects of sleet. As a general meteorological proposition, very high wind pressures and heavy coatings of sleet do not co-exist. In certain regions there is greater likelihood of this combination being found than in general, and if it is possible to obtain the data, the matter should in one way or another be taken into account prior to the design of a line. As a whole, transmission lines are less likely to fail from sleet than most others, since the wires are generally exceptionally strong and accumulate no thicker sleet, at least, than do weaker wires. As a rule, the power-distribution circuits generally will go down before the transmission line.

In modern transmission circuits at high voltage where suspension insulators are freely used, and indeed where pin type insulators are employed, another danger enters, of which small account is usually taken. Lines are almost universally designed for the static stresses alone, but in long spans the dynamic stresses owing to persistent and violent swaying of the wires during wind must be reckoned with. Actual swaying of the lines so that they touch, or approach near enough to flash across, is a very rare although not unknown phenomenon, but the effects of gusts in imposing unusual stresses on the line structure have sometimes to be reckoned with, usually only at particular points on the line. Some instances of special anchoring to overcome such difficulties have been mentioned in these columns. And, finally, the questions of extraordinary stresses on the supporting structures due to breakage of one or more wires have to be considered with reference to the proportioning of sag and span. Most of the early lines were built upon the theory that the structure must stand rigidly even if the conductors of a given span should all give way. Such a requirement becomes unnecessary if the supporting structures are planned for a certain amount of flexibility either in the poles or towers or in the suspension. One of the great advantages of the suspension insulators lies in the fact that this flexibility can be and is given in the method of supporting the wires. It is no longer in the least necessary that every tower should be able, as a rigid support, to take the full stress due to the failure of the conductors. A broken conductor now merely redistributes the stresses between two anchorages. Even with pin-type insulators the tie-wires ought to be planned to allow slipping rather than to permit the conductor breaking the pin or wrenching off the insulator in a case of breakage. More than this, the poles or towers themselves can be given a certain flexibility well within their elastic limits, so that failure of a span will be of little moment, save as a temporary inconvenience. The steel A poles so freely used by the Italian engineers are an admirable instance of conferring flexibility on a line of very simple design. Sag and span calculations therefore, important as they are, are only a means to an end, and it is their relation to the mechanical design of the supports which is the thing of ultimate importance.

HYSTERESIS TORQUE.

In an article by Prof. D. Robertson in a recent issue o the London *Electrician*, as noted in the *Digest* last week attention was called to certain features of the hysteresis i the secondary core of an induction motor. On account o the fact that this hysteresis is accompanied with a torqu in a direction tending to accelerate the rotor to full syn chronous speed the author makes the somewhat startlin statement that the hysteresis in the secondary core is not source of loss. It would appear to be equally logical t state that there is no loss in the secondary conductors be cause the current in them produces a torque in the primar magnetic field. The real fact to which the author direc attention has long been fully recognized, namely, that of th total power received by the secondary the amount dissipate by hysteresis varies directly with the slip. However, th accelerating torque attributable to hysteresis is consta from standstill to synchronous speed, and there is no chan in the power taken from the primary for hysteresis throug out this speed range. Thus, to the extent that the spe approaches synchronism the synchronous torque produc useful power output, and the dissipation by loss in t secondary core disappears. It is especially worthy of no however, that the hysteresis loss in the secondary ir is a real quantity, directly determinable by the we known hysteresis loss formula involving the magne density and the frequency of reversal, which in t case bears to the primary current frequency the ratio the slip to the synchronous speed. That this loss is sm at speeds near synchronism is true, but to state that there no secondary hysteresis loss is to ignore the well-establisl fact that the secondary core is subjected to the same la of dissipation of energy by reversal of magnetic flux as any other core in which the flux varies in value or directi

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THE TEMPERATURE-COEFFICIENT OF RESISTIVITY AND THE CON- DUCTIVITY OF COMMERCIAL COPPER.

As noted in our *Digest* recently two important re- searches on the electrical properties of copper ha been made and published in the *Bulletin* of the Bureau Standards, one on the electric conductivity of commer copper, by Messrs. Wolff and Dellinger, and the other the temperature-coefficient of copper resistivity, by M J. H. Dellinger. Copper and its resistivity are of great i portance in electrical engineering. Moreover, although the physicist is more interested in the behavior and prope of pure copper, the electrical engineer is more intere in the behavior and properties of good, average comme copper. A result of salient importance reached in these researches is that within the small limits of variatio in electric conductivity of good commercial copper the tem perature-coefficient and the conductivity are directly re- lated to each other, so that copper of 98 per cent cor uc- tivity has 98 per cent of the temperature-coefficier of standard copper having 100 per cent conductivity. his standard is not identical with Matthiessen's sta rd, although not far from it. The standard for annealed op- per is taken as 0.153022 international ohm for the r ist- ance of a meter of uniform copper wire weighing 1 ram ... deg. C. This corresponds to 0.141068 ohm i the

ter and gram at zero C. In practice the conductivity … wires is always measured by mass, or with reference … the meter and gram, rather than by volume, or with …ference to the centimeter cube, because the diameter …nnot be measured with a precision approaching that … finding the mass. If, however, the density of copper … taken as 8.89 at 20 deg. C., corresponding to 8.90 at 0 …. C., then the volume resistivity of standard copper at … bureau is 1.72128 microhm-cm at 20 deg. C.

…ccepting a straight-line law of resistivity between 0 deg. … and 100 deg. C., as now is universally adopted, copper …aves within this range as though it had zero resistivity … certain low temperature which is above the absolute …o of gases and which has been reached experimentally. B… actual measurement copper had a small but quite …finite resistivity at that temperature, so that the same …tight-line law does not continue to hold down to such …e low temperatures. Nevertheless, if we keep within th… working range of temperatures, 0 deg. C. to 100 deg. C., co…er behaves as though it had an absolute temperature of …ero-resistivity similar to the absolute temperature of …e volume in gases at — 273 deg. C. Just as the volume of … gas is proportional to its absolute temperature from th… datum — 273 C., so the resistivity of standard copper is …roportional to its "absolute resistivity temperature," wh…h starts at — 234 deg. C. Hence in passing from … deg. C. to 50 deg. C. and 100 deg. C. the resistivity of sta…dard copper rises in the ratio 234, 284 and 334 respectiv… With copper of, say, 98 per cent conductivity the abs…ute zero would be increased to — 234/0.98, or — 239 deg. It is greatly to be desired that international agreeme… may shortly be reached over these very important co…tants of copper.

MA…TIC PROPERTIES OF MANGANESE STEELS.

S…el, as a mechanical working material, is so wonderful a s…stance and presents so many and complex variations und… slight changes of chemical or thermal treatment that a f… understanding of its mechanism and internal working seer… very remote. Again, magnetism is not an easy subject … deal with quantitatively, at the best, and under the … conditions. It might, therefore, be conjectured, in … of observation, that the magnetic properties of … kinds of steel would be a particularly complicated …nd hard to unravel. One comfort to be found in …rinth of complex magnetic properties among alloys … in the deduction that since the magnetic behavior of …n alloys does not at present admit of being predicted with …ny reasonable degree of precision there may be valuable …iscoveries in store for use in electrical engineering amo… the numerous alloys of iron that remain to be investigate… in the future. For instance, it has only of recent year… become possible to use a steel in telephone-receiver …iaphragms that had less than ordinary electric conductivity, whil… not falling too low in magnetic conductivity, with the …esult that eddy-current losses in the diaphragm could be …we…d and the volume of sound increased for a given …ep…nic current strength. Again, it is not so many years …ince… was found possible, for the first time, to produce soft steel castings of good permeability, thereby greatly aiding the tasks of the dynamo designer. A paper on "The Magnetic Properties of Some Manganese Steels of Definite Chemical Composition," by Mr. Ezer Griffiths, has recently appeared in the *Journal* of the Institution of Electrical Engineers. It deals with samples of steel of about 0.8 per cent carbon, varying proportions of manganese from 0.4 per cent to 5 per cent, with very low silicon, sulphur and phosphorus. The paper shows that the flux density that can be produced in these manganese steels falls off steadily as the percentage of manganese is increased, there being a marked fall after 1 per cent of manganese is reached. The sample containing 3.85 per cent of manganese showed a somewhat anomalous behavior.

LONG-DISTANCE TELEPHONY IN AMERICA.

Among the papers read before the recent Turin Electrotechnical Congress was one by Dr. F. B. Jewett on "Long-Distance Telephony in America," with special reference to the Bell system. The paper draws attention to the fact that in administering any large telephone system it is almost inevitable that scientific discovery and technical invention must outrun and lead industrial application. The successful use of any telephone system requires that the subscriber's apparatus must be uniform in construction and performance throughout. It must be of a certain standard quality. This, again, calls for the maintenance of specific standard conditions in the lines, switchboards and the plant as a whole. On the other hand, all improvements must present themselves as variations from the norm. An improvement has to be very marked in character before it can justify the displacement of some element, or elements, throughout the system. The larger the system the greater its inherent inertia and the greater the difficulty and cost of introducing changes. Reference is made to the recent extension of industrial long-distance service from New York City to Denver, a distance of 2100 miles, and confidence is expressed in the belief that before very long direct communication will be available between New York and San Francisco, a distance of 3500 miles.

Except perhaps Asiatic Russia, there is no country so well adapted to the ultimate development of very long-distance telephone communication as North America, because the need for such very long-distance communication can develop only in a country of great length, in which one and the same language is spoken throughout, and in which the business needs of the country will justify the expense of the long-distance telephone construction. Geographically speaking, there would be more opportunity for the development of very long lines in a north-and-south rather than in an east-and-west direction, because cities lying far apart on the same meridian of longitude have naturally a common business day, with respect to solar time, whereas at the same distance apart on the same parallel of latitude the number of hours common to the same business day is necessarily reduced. The five hours' difference of time between New York and London does not limit telegraph traffic between them nearly so much as it would limit telephone traffic, assuming that the latter were possible.

Graduates from Electrical Courses in the United States.

[illegible] issues of July 27, 1907, Dec. 26, 1908, Feb. 10, 1910, and Dec. 22, 1910, contained statistics relating to the graduates from schools in the United States conducting systematic courses in electrical engineering, and below are given the data compiled from our fifth annual census of these schools. Compared with the results of the fourth census, there are indicated an increase of five in the number of schools, an increase of ninety-seven in the number of enrolled students and an increase of sixty-five in the number of graduates. However, two of the schools numbered in the present list appear to have practically abandoned instruction in electrical engineering, so that the net increase has been three instead of five schools. The total number of students recorded includes not only those taking the regular four-year course, but also certain short-course men and certain others taking post-graduate work. The census returns show that 168 students continued their studies beyond four years, with the expectation of receiving an engineering, master's or doctor's degree. It would thus seem that one student out of every ten becomes a candidate for an advanced degree.

TABLE I.—ELECTRICAL ENGINEERING STUDENTS AND GRADUATES.

	Number of Schools.	Students 1910–11.	Graduates 1911.	Total Graduates to June, 1911.
Class I	[illegible]	[illegible]	[illegible]	[illegible]
Class II	[illegible]	4,228	[illegible]	[illegible]
Class III . . .	[illegible]	1,566	[illegible]	[illegible]
Total	[illegible]	[illegible]	1,610	[illegible]

TABLE II.—COMPARISON OF STATISTICS FOR FIVE YEARS.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

As indicated in Table I, the schools have been grouped into three separate classes. Class I includes the schools of highest standing, the degrees from which confer more or less prestige on the graduate. Class III includes those schools in which the instruction is quite elementary, but which have regularly organized courses in electrical engineering. All other recognized schools giving complete courses of instruction in electrical engineering are included in Class II. During the past year there has been no change in the number of schools listed in Class I; there has been an addition of four to Class II and of one to Class III.

In estimating the number of students receiving less than four years' instruction, the estimates shown in Table III have been prepared on the basis of the percentages used last year. With a total of 17,300 graduates to date it can be assumed that about 36,800 entered the freshman class, of whom 19,500 received only one, two or three years of instruction. About 82 per cent of the freshmen become sophomores, 65 per cent juniors, 50 per cent seniors, 47 per cent graduates and 5 per cent post-graduates. It cannot be assumed that the short-course men are as a body of lower mental caliber than the graduates and post-graduates, for many of them have risen to positions of prominence in the industry. The industry owes a considerable debt to the engineering schools for the training received by these men.

TABLE III.—ESTIMATED NUMBER OF STUDENTS RECEIVING LESS THAN A FULL COURSE.

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Opinion Sustaining Right to Fix Resale Price on Patented Article.

Judge Coxe of the United States Circuit Court of [illegible] Southern District of New York handed down an opin[illegible] on Nov. 3 in a suit which involved the issue whether [illegible] owner of a patent can fix the price at which the paten[illegible] article may be resold. The suit was between the Walth[illegible] Watch Company and a New York jeweler, and the co[illegible] defined the issue concretely as follows: Is a retailer [illegible] purchases from the complainant a "Riverside movem[illegible] with instructions not to sell the same for less than [illegible] liable in equity if he sells for less than that sum? [illegible] opinion of the court is that this question must be answ[illegible] in the affirmative. Many of the authorities, the opi[illegible] states, have gone much further in sustaining the righ[illegible] the owner of a patent to impose conditions upon those [illegible] seek to use his monopoly. In support the cases are [illegible] of the Heaton Peninsular Company, the Victor Tal[illegible] Machine Company and the Crown Cork & Seal Comp[illegible] and, as indicating the opinion of the court as to the l[illegible] within which the doctrine of contributory infringe[illegible] should be confined, reference is made to the case of [illegible] telyou versus Johnson.

This opinion is quite at variance with the decree o[illegible] court in the Cleveland incandescent-lamp cases. In [illegible] cases Judge Killetts held that, while any of the defen[illegible] lawfully owning patents may grant to others or re[illegible] appropriate manufacturing licenses under such pa[illegible] upon terms and conditions fixed only by the lic[illegible] such licensor, however, is enjoined and proh[illegible] from requiring or imposing upon the licensee the [illegible] of a resale price to be observed by the lice[illegible] vendees; and it was ordered that purchasers of such [illegible] from either licensor or licensee, or from vendees of [illegible] the licensor or licensee, whether at wholesale or retail [illegible] not be in any manner restricted as to the price at [illegible] such lamps shall be sold to the public or to any dea[illegible] consumer.

Association of Railway Electrical Engineers

The fourth annual convention of the Association o[illegible] way Electrical Engineers was held in the Hotel La[illegible] Chicago, Nov. 7 to 10. In connection with the conv[illegible] the Railway Electric Supply Manufacturers' Asso[illegible] held an exhibition in a room near the conventio[illegible] This consisted of twenty-nine attractive exhibits, ne[illegible] of the lighter types of electrical apparatus used in c[illegible] tion with railroad equipment. The Manufacturers' a[illegible] tion also took entire charge of the entertainment pr[illegible] and on Monday evening before the actual opening [illegible] convention there was a pleasant informal recepti[illegible] dance in the Red Room of the hotel.

Mr. J. R. Sloan, of Altoona, Pa., made a brief [illegible] on Tuesday morning in which he spoke of courtes[illegible] tended to the president of the association by the Il[illegible] nating Engineering Society and the National Electri[illegible] Association. He also referred to the fact that the [illegible] States government, through the Bureau of Standa[illegible] issued a call for a conference on the standardiza[illegible] of incandescent lamps. Through the Pennsylvania [illegible]ilroad the association has been invited to take part in t[illegible] conference. Mr. Joseph A. Andreucetti, of Chicago, se[illegible]etary-treasurer, presented his report, showing a total [illegible]mbership of all classes of 551.

A communication was received from Mr. L. Gut[illegible]nn, [illegible] the St. Louis Section of the American Institute [illegible] Electrical Engineers, asking the co-operation of the as[illegible]iation in urging the President of the United States to [illegible]all the attention of Congress to the need of a permanent [illegible]mmission or government department to establish adequa[illegible] super-

ion of patents, copyrights and trademarks, to the end n a patent may have an intrinsic value when issued. Mr. .J. Farrelly, of Chicago, electrical engineer of the ago & Northwestern, said that the patent laws of this ntry need revision badly, and on his motion it was od that the association follow the recommendation of h St. Louis Section of the A. I. E. E.

r. W. A. Del Mar, of New York, had written a letter e association in relation to the terminology of electrical ductors, recommending that the various societies inested agree on a set of definitions, to be based on curet practice and to be adopted as authoritative under the ation of the American Institute of Electrical Engineers. Del Mar presented a set of definitions of such words s wire," "strand," "conductor," "cable," "duplex cable," tc and asked for their adoption if the society found them atisfactory. By vote the association expressed itself in avr of the standardization of the terminology of wires n cables and declared its willingness to co-operate with he A. I. E. E. in bringing about uniform definitions. Defiitions offered by Mr. Del Mar were referred to the comie on standards, of which Mr. D. J. Cartwright, of hipsburg, N. J., is chairman.

ere was some discussion of the matter of amending the onstitution in relation to the manner of voting on changes n andard practice. A committee consisting of Mr. Cartwright, Mr. C. R. Gilman, of Milwaukee, and Mr. H. G. M s, of Chicago, appointed to consider the matter, recommended that each senior active member of the association ha have one vote at meetings of the association on the uestion whether proposed changes shall be referred to a ett ballot of the members of the association. If this ett ballot is taken, however, in relation to proposed ta lard practice, only the ranking senior active member of e association connected with each railroad company ha have a vote, and the weight of his vote shall be in roportion to the number of electric-lighted cars operated y s company. This provision is intended to insure that he hanges in practice shall be made only by those most vit y interested, and that the votes shall be in proportion o e extent to which each railroad company would be [illegible].

e constitution was also amended in relation to the matter dues and payment of dues, and the first session was adj rned. A report of the remaining sessions, including the eports of the committees and the reading of papers, wil e given next week.

W d's Largest Turbo-Generator Placed in Operation.

T first of the three 20,000-kw turbo-generator sets being stalled in Waterside Station No. 1 of the New York Edi n Company, at Thirty-eighth Street and East River, was fficially placed in service on Nov. 3. The ceremonies [illegible] to the starting were witnessed by a number of [illegible] it engineers and a group of newspaper men, and [illegible] to bring out more forcibly the capacity of the [illegible] urbine the load from seven 3500-kw reciprocating [illegible] similar to those displaced to make room for the [illegible],000-kw turbines was transferred step by step to [illegible] ine. The seven units, of course, were not all oper[illegible] under maximum load, but this method of presenting [illegible] tive capacities of the engines and turbine was most [illegible]ve.

escribed at length in our issue of May 25, 1911, the substitution of these 20,000-kw units for four of the reciprocati units necessitated the rebuilding of the greater part of aterside Station No. 1. This work involved not only gre changes in the steam equipment but also the redesi of the south and west side mezzanine floors housing the itching and control apparatus.

The generators are of the four-pole, three-phase, 25-cycle type, wound for 6600 volts. The normal speed is 750 r.p.m. They are direct-connected to six-stage Curtis turbines, designed to operate on 175-lb. gage pressure, with a back pressure of 1½ lb. absolute in the exhaust chamber, and with steam superheated to 100 deg. Fahr. The steam consumption in pounds per kw-hour under these conditions is guaranteed to be as follows:

Load, [illegible] Kilowatt	[illegible] Kw Hour.	[illegible] Hour, Pounds.
10,000	[illegible]	150,000
15,000	14 4	[illegible]
20,000		[illegible]

The dimensions of the base of the machine are 17 ft. 6 in. by 17 ft. The height above the base is 35 ft. 7 in., and the height of the foundation above the basement floor is 10 ft. Each machine weighs approximately 420 tons, the revolving parts weighing 112 tons and the heaviest piece 110 tons. The runners are 13 ft. in diameter, and the total number of buckets they contain is 7200. It is interesting to note that the area occupied by one of the 20,000-kw units is 297 sq. ft. The area occupied by the single 3500-kw engine-generator unit of the type displaced is 918 sq. ft., so that, judged on this basis, the turbine generates approximately eighteen times as much power as the reciprocating engine per unit of area occupied.

20,000-kw Unit in New York Edison Waterside Station.

Assuming that the turbine is fully loaded all day and an evaporation of 9 lb. of water per 1 lb. of coal, the unit will require 7,200,000 lb. of steam a day, and about 400 tons of coal. To condense the steam 86,000,000 gal. of water will be required. For cooling the generator windings each unit requires 80,000 cu. ft. of air per minute or approximately 115,000,000 cu. ft. a day.

In order to bring out more fully the size of the unit, it might be stated that it has more than sufficient capacity to supply the entire State of Delaware with the electric service at present meted out by the various public-utility companies in that State. It is also large enough to meet the electrical wants of a state like Wyoming. For more detailed information on the unit, its condensing and switching equipment, the reader is referred to the issue of May 25, 1911, when all the changes incident to the substitution of the 20,000-kw units for reciprocating-engine units were fully described.

Gas Statistics.

The Census Office has just issued a preliminary statement of the census taken in 1909 of establishments engaged in the manufacture of gas, illuminating and heating. The total number of establishments was 1296. In 1907 the total number of central stations was 4714. The increase of gas plants during the previous five years was 27 per cent, or nearly the same as for all central stations, the figure for the latter being 30.2 per cent. If, however, the municipal electric-lighting plants are neglected, the increase of gas plants was the larger, the figure for central stations aside from municipal plants being 23.4. The capital invested in gas plants was $915,537,000, or somewhat less than in central stations in 1907, the cost of construction and equipment of the latter being reported at $1,096,913,622. The value of gas products was $166,814,000, which was somewhat less than the gross income of central stations for 1907, which was $175,642,338. The number of salaried officials and clerks was 13,515, and that of wage earners 37,215. The corresponding figures for central stations in 1907 were 12,000 and 34,642.

Naval Pageant at New York.

A naval review ending with a parade on Nov. 2 of twenty-four battleships accompanied by a flotilla of protected cruisers, gunboats, torpedo boats, submarines and tenders was held in the harbor of New York last week. The total of all vessels was 102, forming the greatest fleet of American warships ever mobilized in the history of the United States.

The official ceremonies in connection with the mobilization of practically all the vessels of the navy in Atlantic waters began on Nov. 1, when Mr. George von L. Meyer, Secretary of the Navy, accompanied by the members of the Senate and House committees on naval affairs, inspected the fleet as it rode at anchor in the Hudson River off Riverside Drive. On Thursday afternoon the fleet was reviewed by President Taft as it proceeded to sea. During the week spectators on the shore at night were treated to a magnificent electrical display. The ships at anchor were outlined in electric light and the numerous searchlamps with which the fighting ships are equipped were also brought into play. The accompanying illustration shows the ships as they appeared on the evening of Nov. 1, but does scant justice to the spectacle. It will be understood, of course, that the boats were anchored some distance from the shore and in a line 6 miles [illegible] also [illegible] obtain a satisfactory photograph of illuminated ship[s] which, although at anchor, swing with the tide or mov[e] with the waves. While the absence of fireworks made th[e] view less spectacular than that afforded by the Hudso[n] Fulton celebration a few years ago, the scene was never theless impressive.

Illuminated Battleships at Anchor in the Hudson River.

Commonwealth Edison Section, N. E. L. A., Takes Night Off.

The fourth annual banquet of the Commonwealth Edis[on] Section of the National Electric Light Association, giv[en] at the Hotel Sherman, Chicago, on the night of Nov. [...] was a truly remarkable affair. It partook partly of t[he] nature of the annual frolic of the section, but it was al[so] made the vehicle for impressive words of serious purpo[se]. The dinner and the "doings" consumed five and one-ha[lf] hours, and there were 850 men present, but every man w[as] keenly interested until the last.

It would take too much space to give an account of [all] the "stunts" that were performed. In general, the reve[ls] were conducted under the direction of an unseen persona[ge] known as "Queen Electra." She sent in her messeng[er] loaded with instructions and paraphernalia, and designat[ed] Mr. A. D. Bailey as her "starting engineer," an office t[hat] corresponded to that of toastmaster, with enlarged duti[es]. Mr. Bailey was distinguished by an impressive crown, ele[c]trically lighted from within, and so he presented a striki[ng] appearance when the room was darkened, as it was [at] intervals. There were other electrical effects and numer[ous] vaudeville acts, cartoons and photographs on a screen, [of] at well-known members, singing of parodies of pop[ular] songs, amusing "rube warblers," the music of the really [...] orchestra of the organization, and several other form[s of] entertainment. The whole affair was notable from the [fact] that every man who took part in it was an employee of [the] Commonwealth Edison Company, and the spirit of en[thu]siastic good-fellowship was manifested in a very conv[inc]ing manner.

The diners were seated at round tables, and one of [the] ideas carried out was an emulation of the generous [co]operation of the Knights of the Round Table in [King] Arthur's court. It will be remembered that the maga[zine] issued by the Commonwealth Edison Section bears [the] title *The Edison Round Table*.

The retiring chairman, Mr. Ernest F. Smith, [wh]en called upon by the starting engineer, reviewed the wo[rk] of the year. He said that the members in the section [n]ow [numbe]r 1290, an increase of 812 since the banquet [...] a

[...]r ago, when the membership stood at 487. Mr. Smith [th]anked the other officers and his loyal committeemen, [es]pecially Mr. P. Junkersfeld, chairman of the membership [co]mmittee, for their very effective work in the history of [a] successful year. However, he said, there is still much to [be] done in increasing the membership, as it is estimated that [th]e section contains but 58 per cent of the employees of the [co]mpany eligible for membership. Mr. Smith extended his [mo]st cordial good wishes to the incoming administration, [th]e personnel of which was not known at the time he spoke, [fo]r one of the features of the banquet was announcing the [ne]w officers, the results of the election having been kept [sec]ret.

A pleasant feature was the presentation of a handsome [ro]sewood gavel, suitably inscribed on a gold band, to the [re]tiring chairman. Mr. H. L. Gannett made this presenta[tio]n.

After a number of amusing mock regrets had been read [b]y the starting engineer, that functionary handed to Mr. [Sm]ith a formidable document which contained the names [of] the successful candidates. Mr. Smith broke the seal [an]d announced that the section had chosen the following [off]icers: Chairman, Mr. R. F. Schuchardt; vice-chairman, [M]r. W. C. Berry; secretary, Mr. C. B. Crothers; treasurer, [M]r. William A. Fox; executive committee, Messrs. W. J. [...]ner, W. Wardell and F. A. Kaup. Then there was [mo]re singing and enthusiasm and special verses of greet[in]g. Mr. Schuchardt made an earnest speech in accepting [th]e responsibilities of his position, and with the growth of [th]e section the position of chairman is a responsible one. [H]e announced that the general subject of the meetings of [th]e coming year would be the relations of the public-service [co]rporation to the community it serves, and that these large [qu]estions would be discussed by members and non-members [of] the section. Mr. Schuchardt, in the course of his speech, [ga]ve this carefully considered definition of a public-service [co]rporation: "A true public-service corporation—and this [defi]nition fits ours—is an organization of trained individuals [wh]ose efforts are directed toward utilizing capital to pro[vi]de for a community, as cheaply as possible, a commodity [th]e use of which improves the living and working condi[tio]ns of that community, and in so doing earns for those [ind]ividuals a return for their labors and for the capital [em]ployed a return for its use. In other words, it is an [org]anization which uses capital to provide a convenience [or] a necessity, and which, in order to justify itself, must [pro]vide this cheaply, and therefore must produce efficiently."

[T]hree Knights of the Round Table were featured on the [pro]gram. They were Messrs. Samuel Insull, Louis A. [Fer]guson and John F. Gilchrist. Mr. Insull and Mr. Fergu[son are] past-presidents of the N. E. L. A., and Mr. Gilchrist [is th]e president this year. The first of these to be called on [wa]s Mr. Ferguson, who explained that he was wholly under [th]e dominion of Queen Electra, and that he had been di[re]cted not to make a serious address. In its stead, after [co]mmenting on the unusual nature of the program, Mr. [Fergu]son recited a poem, "The Knight's Toast," with fine [...]

[Afte]r a vote of thanks to the N. E. L. A. orchestra had [been p]assed, Mr. Insull, the president of the company, was [...]n as the greatest knight of all those in the service [of mi]ghty Electra. Mr. Insull, as well as Mr. Ferguson [and l]ater Mr. Gilchrist, received a great ovation. He spoke [impr]essively and with deliberation. Last year he expressed [th]e hope that the section would double its membership, but [it h]ad gone away beyond that. The great importance of [the N.] E. L. A. was explained. In unity there is strength, [and th]e executive officers of the company could not have [atta]ined the success they have without the loyal support of [the] committees of employees. The company section is a [con]tinuation of the same idea. It gives an opportunity to [ex]change ideas, and the benefit of co-operation exists all [the] way down the line. The day may come when membership in the company section will be viewed as the first evidence of a man's desire to be useful to the company and to himself. Positions of responsibility in the electrical industry are necessarily increasing in number, and membership in the N. E. L. A. is a great aid to the young man in fitting himself for these positions.

Mr. Insull alluded to the fact that he had been nearly twenty years in the service of the company, which has grown so that it has been unable to keep in touch with every member of the organization. "Nevertheless," he said, "I like to feel that I am one of you." There is as great an opportunity in the electrical industry to-day as there ever has been, and Mr. Insull cited the example of Mr. Gilchrist, who started in with the company as an office boy and is now president of probably the greatest electrical society in the world. There is no reason why others should not succeed as Mr. Gilchrist has done, especially as the capital of the country flows more easily into the industry now than it did fifteen or even ten years ago. The speaker dwelt earnestly also on the influence of the N. E. L. A. in the direction of the personal welfare of its member companies and their employees, referring to the work of the public policy committee. Referring to the saving fund of the Commonwealth Edison Company, he announced that at present this fund has invested $110,000 in the company's securities and the fund is increasing at the rate of about $5,000 a month. At the end of the first five years of its existence it will amount to probably more than $500,000, which will be invested in the business. The president of the company urged the benefits of this saving fund on his hearers in words that will be remembered. There is no better way to save money, he said, than to invest it in the business in which you are engaged if you believe in that business. The company is anxious to encourage the largest possible ownership among its employees.

The interesting announcement was made by Mr. Insull that a pension fund would be established by the company, and it was hoped to get it in operation in the next few months. Speaking of the future, Mr. Insull said he believed the progress made by the company so far is small compared to what the future will show. The Commonwealth Edison Company has had peculiar opportunity in massing the production and distribution of electrical energy, reducing cost as a result of that policy, and giving alike to the small consumer and the large consumer the advantage of very cheap energy. The outlook is as bright as it ever has been. The trend of events shows that the production and distribution of energy in this great country will be done in mass, as it is to some extent in Chicago, and that the wheels of commerce and industry will be turned by energy supplied by central stations relatively few in number considering the large area of the country. Great possibilities will be brought to actuality, and Mr. Insull concluded by appealing to the young men present to do their part and secure the reward that comes to constant, intelligent service.

Mr. Gilchrist, president of the N. E. L. A., said that it was rather a curious coincidence, in view of all the nice things that had been said about everybody, that the banquet was held on All Saints' Day. He expressed his appreciation of the honor of the presidency of the N. E. L. A., and told in earnest words how he relied on the support of the membership. He commented on the size and significance of the gathering before him and the wide area covered by the Commonwealth company and its neighbor companies. He also spoke of the versatility of the men in the organization and expressed his great pride in it. He also made the interesting statement that two-thirds of the regular income of the N. E. L. A. comes now from Class B members. He spoke of similar company sections in various other cities and said that they were all of the same class of "live wires" as the men he was addressing. Every man in the industry should feel his responsibility to it, and Mr. Gilchrist spent

[illegible] Neglect not the gift that is in thee."

The banquet, with its alternating shades of grave and gay, was a most elaborate and successful affair. A great deal of hard, painstaking effort was necessary for the preparations, and appreciation of good work is due to Mr. R. F. Schuchardt, chairman of the banquet committee, and his associates on the committee, Messrs. A. D. Bailey, Guy Lunn, H. L. Gannett, E. H. Lakeman and E. J. Doyle. Among the others who contributed to the success of the occasion, either as writers, illustrators or performers, were Messrs. H. A. Seymour, W. A. Durgin, A. R. Gerlach, W. H. Ott, C. G. Axell, R. A Fischer, Harold Wright, William R White, R. R. Pilkington, M. R. McGovern, O. J. Bushnell, H. E. Addenbrooke, W. H. Childs, A. E. Evans, M. L. Eastman and Charles A. Lind.

Boston Edison Company Entertains Municipal Authorities.

The Edison Electric Illuminating Company, of Boston, Mass., recently entertained about 125 municipal officers from the thirty-eight cities and towns of its territory at a luncheon in the assembly hall of the main office building in Boston. A feature of the occasion was a greeting by President C. L. Edgar, after which a short address was delivered by Hon. E. W. Burdett, general counsel for the company. Mr. Burdett emphasized the unusual conditions of harmonious relationship between the company and the municipalities in which it operates, which made the luncheon and its cordial acceptance possible. He reviewed the growth of the company, pointing out the reductions in rates during its life from 25 cents to 11 cents per kw-hour, and contended that such a reduction during a period characterized by no little development and experimentation in the art calls for little urging from public officials. The average income has dropped from 13 cents to about 6 cents per kw-hour. Mr. Burdett pointed out that the policy of placing wires generally underground cannot be established in suburban territory on account of the enormous expense involved, which would inevitably raise the rates to prohibitive figures. An informal discussion then took place, in which the company sought criticisms of its policies and service from those present, meeting these frankly in a spirit indicating its effort for improvement. At the conclusion of the meeting the party was taken to the L Street station in South Boston, where the new 15,000-kw turbine installation was examined, and the rest of the day was devoted to informal good-fellowship, terminating in a theater party. The affair was the second of its kind in the history of the company and accomplished much in the way of securing a better understanding of the aims and policies of the participants.

Cleveland Central-Station Situation.

The proposition to issue $2,000,000 bonds for the construction of a municipal electric plant in Cleveland was carried at the general election last Tuesday. The Cleveland Electric Illuminating Company fought the project; but without avail. However, the points in opposition raised by Mr. Samuel Scovil before the Cleveland Chamber of Commerce are of interest.

The point of view of the citizen and taxpayer is the real question to be considered when an issue of this character is presented. Mr. Scovil said that the service rendered by the company was excellent and that there had not been a complaint that the company had failed to meet the growing needs of the city. Regarding statements as to the average cost of energy to consumers, Mr. Scovil said that in 1910 out of the total energy billed to 28,000 customers, consisting principally of residents subject to the maximum rate less than one-fourth was billed at the maximum rate, while over three-fourths was billed at 5 cents per kw-hour making the average cost 6.88 cents per kw-hour.

The City Council of Cleveland passed an ordinance in 1893 fixing the maximum rate for electricity. Every reduction since that date has been made voluntarily by the company. So far as the great bulk of customers are concerned there has been a reduction in the price of electricity during the last ten years of 42 per cent. The system of rate-making adopted by the company is one that has been approved by students of electrical service and expert public service commissions, sanctioned by state and federal court and sustained by universal practice. If electricity can b[e] sold to all consumers in the city of Cleveland at any suc[h] low price as 3 cents per kw-hour, the rate the advocates o[f] the proposed municipal plant have talked of introducing why has no public or private plant in this country or abroa[d] ever succeeded in approaching this figure?

Taking up the subject of valuation, Mr. Scovil said th[at] the report of the company to the Tax Commission of Oh[io] showed the cost of the property as of Jan. 1, 1911, to [be] $10,679,000. The Tax Commission valued the property [at] $11,375,000. The difference is represented by workin[g] capital of the company, such as stock supplies on han[d] accounts receivable, etc. The company had outstanding [on] Jan. 1, 1911, a total of $4,100,000 bonds, $800,000 preferr[ed] stock and $5,734,500 common stock. During the sevente[en] years that Mr. Scovil has been connected with the co[m]pany it has never sold a share of its stock for less th[an] par, and the bonds which it now has outstanding were s[old] on a 5¼ per cent interest basis. The company has nev[er] indulged in any stock-inflating consolidation. Its pla[nt], Mr. Scovil said, cannot be duplicated either by priva[te] capital or by the city at the price at which it stands on t[he] books, and the company is ready to offer every facility f[or] complete proof of this statement.

Concerning campaign statements in regard to earnin[gs] Mr. Scovil said that for the year 1910 the net income w[as] $843,429. There were included in the operating expen[ses] $209,772 for depreciation and an employees' fund. T[his] amount is equal to less than 2 per cent of the plant inve[st]ment fund. If there is any criticism of this amount it [is] that the sum is too small rather than too large. From [the] net earnings there was paid to the stockholders and bo[nd]holders in interest and dividends an amount equivalent [to] 6.3 per cent on the investment. This consisted of 5 per c[ent] to the bondholders, 6 per cent to the preferred sharehold[ers] and 8 per cent to the common stockholders. The surp[lus] after these payments was $173,655. In the eighteen ye[ars] of existence of the company the stockholders have recei[ved] an average of not more than 7 per cent on their investm[ent] and, taking the total of bonds and stock, there has b[een] distributed to bondholders and shareholders an average [of] less than 7 per cent.

In conclusion Mr. Scovil declared that if the situa[tion] demanded public action the State had created a pub[lic] service commission designed to consider in an impar[tial] and judicial manner all such controversies. The Clevel[and] Electric Illuminating Company has a right to expect th[ose] in control of the city affairs to protect its property in [the] same manner and in the same degree as they would [the] property of any other citizen. The people who have [in]vested in the securities have made the investment on [the] assumption that as long as they dealt fairly with the co[m]munity that the investment was to serve the commu[nity] would also deal fairly with the investment. The comp[any] understands fully and has never questioned the righ[t of] the people to regulate honestly its operation. In stan[ding] ready to offer every facility for the proof of the state[ment] that the equipment has been so built with economy [and] planned for economical operation that it cannot be dupli[cated] to-day for the price on the books, the comp[any]

ealizes that in so far as an inventory and complete audit of the property and books will not sustain the claim that he property which is used and useful for the service of he public has a value equal to the cost it must accept the onsequences. It must furnish its service on rates which vill be based on a lower valuation if such lower valuation e the result of the inventory.

Train-Lighting Instruction Car Put in Service by the Pennsylvania Railroad Company.

Continuing its policy of instructing employees in their everal lines of duty, the Pennsylvania Railroad Company as just placed in service a "train-lighting instruction car." The Pennsylvania Railroad has at this time no less than eight distinct axle-device systems, in addition to the large umber of straight storage equipments, and the instruction ar will offer an efficient means of furnishing uniform instructions to yard electricians. The present intention is that the car shall be sent to the different points at which ectrical forces are maintained, and the men at such points all be given lectures and demonstrations on the operation maintenance of the various equipments. For this pur- a car was selected and has been remodeled to suit the quirements.

The apparatus installed consists of a 32-cell storage battery, a 15-kw Curtis turbo-generator, a variable-speed motor with necessary controlling apparatus for driving the axle vices and the following axle generators with their regu-ing equipments: Newbold, Moskowitz, Bliss, Consoli-ted, Safety and Gould. One end of the car has been rtitioned off and equipped as an office and sleeping quar-s for the instructor.

The storage battery is placed within the car in order that the cells may be used in demonstrating as well as for lighting the car. The usual battery boxes under the car are omitted. The battery closets are lined with sheet lead and arranged with ventilators through the car roof to conduct away the gases and fumes given off when the batteries are on charge.

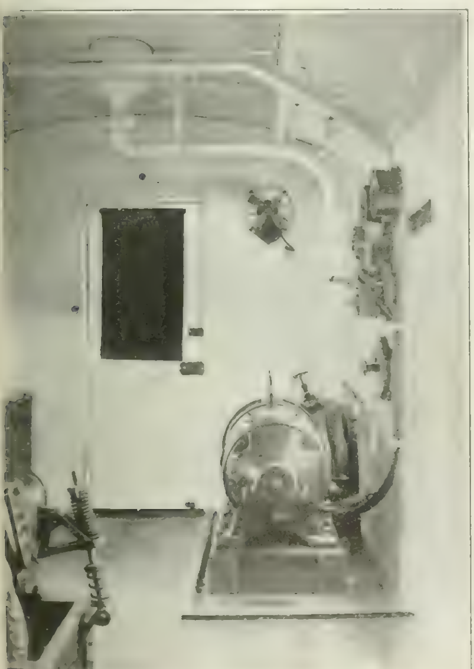

Fig. 1—Turbo-Generator Set.

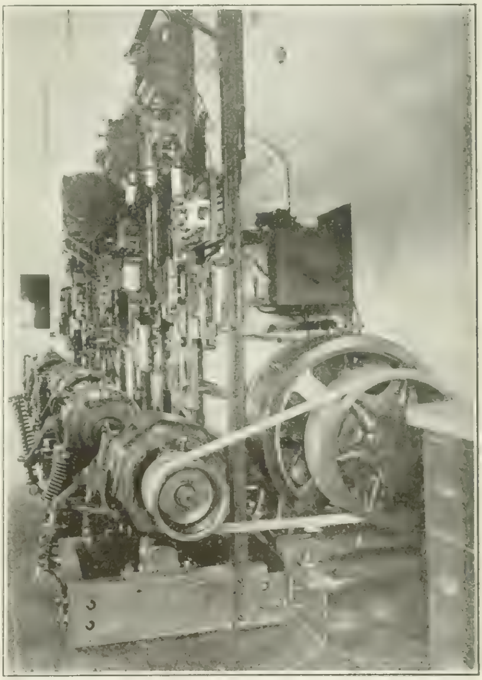

Fig. 2—Two of the Axle Generators, with Driving Motor.

Fig. 1 shows the 15-kw turbo-generator set, as formerly used on all Pennsylvania limited trains. In this case the usual switching devices are replaced by two single-pole automatic circuit-breakers, giving both overload and underload protection to the machine. The field rheostat and motors are seen mounted on the side of the car. Connections are such that the turbo-generator can be used for driving the motor, charging the batteries and lighting the car, though under ordinary conditions the motor will be driven from yard power lines.

On account of the limited space it was impossible to photograph the entire line of axle generators; consequently these were "taken" in pairs, one of which is shown in Fig. 2. The generators used in the instruction car are mounted on rocker shafts and are equipped with springs for regulating the belt tension, as is done in actual service. Immediately back of each machine is an angle-iron framework on which is mounted the corresponding regulating apparatus, the equipment in each case being identical with that installed on passenger cars.

Each generator is connected through suitable switching devices to the lamp load and batteries, enabling the operator to demonstrate the apparatus under all conditions of load. The lamps used for this are banked in porcelain receptacles on the ceiling of the car.

The driving motor is of the interpole type and is mounted on an iron framework equipped with rollers, which enable the operator to move the motor equipment along an I-beam track for belting up to any one of the six generators, as shown in Fig. 2. The control panel for this machine is

[illegible] the motor. The motor-starting rheostat is on the rear of the panel, and the front is equipped with two single-pole main switches, double-pole reversing switch, circuit-breaker and inclosed carbon pile, used as a field rheostat. A combined fuse and switch receptacle is installed, through which the motor is connected to the power circuit, there being several such receptacles spaced at suitable intervals along the side of the car.

The operator's office contains a folding couch, an upper berth, a clothes closet and a toilet, the finish throughout being white enamel. With the instruction car in operation it is intended that all employees whose duties have to do with the car lighting shall be instructed in the care and operation of the various equipments, with the twofold object of educating those interested and securing uniformity in their work.

Tungsten-Tube Furnace.

An ingenious design of an electric tungsten-tube furnace developed in the Research Laboratory of the General Electric Company is described in a patent granted to Dr. Axel Appelberg on Oct. 24. The furnace is especially suitable for the heat treatment of metallic filaments. The heating element consists of two tungsten tubes connected in series. They are mounted in tungsten bushings with copper terminal blocks and water-cooled brass-tube connections. By means of a spiral-spring arrangement a tight contact is always maintained between the tungsten tubes and the terminals. To concentrate the heat in the interior of the tungsten heating tubes (where the heat treatment of the filament is carried out) each heating tube is surrounded by a cylindrical heat-reflecting screen, consisting of two concentric tungsten tubes, with an alumina packing in the open space between the two tubes.

The whole furnace construction is air-tight, so that the atmospheric pressure in it may be regulated and the furnace be used, for instance, as a vacuum furnace. This arrangement permits control of the chemical nature of the atmosphere, since, for instance, a hydrogen atmosphere may be maintained in it. It is evident that a furnace of this type can be calibrated as to temperature and that any particular condition of temperature, etc., can be duplicated with certainty merely by regulating the current supply, the gas supply, the degree of exhaustion, etc.

The furnace is operated by alternating current, and temperatures almost up to the melting point of tungsten, which is over 3000 deg. C., can be attained. For 9-in. tungsten tubes with an internal diameter of 2 in. and a thickness of ⅛ in. a current of 5000 amp or even more may be used.

(In the note on tungsten-tube furnaces in our issue of Nov. 4, page 1100, reference was made to the design of Winne and Dantsizen, who were stated to use an "aluminum" tube wound with ductile tungsten foil. It is hardly necessary to say that "aluminum" was a printer's error for alundum; that is, electrically fused alumina.)

Revised Rubber-Covered Wire Specifications for Chicago.

Mr. William Carroll, city electrician of Chicago, has issued an announcement in which he gives notification that the new specifications for rubber-covered wire will be enforced by the department of electricity of the city of Chicago as follows: After Jan. 1, 1912, all wires in sizes from No. 14 to No. 0000, B. & S. gage, must comply with the new specifications to pass inspection by the city of Chicago. After July 1, 1912, all wires i[illegible] mils must comply with the new specifications. However, on all contracts signed previous to the date of the issuance of this notice—that is, Sept. 5, 1911—wire complying with the then existing "municipal specifications" may be used, provided that all such contracts are listed with the department of electricity within fifteen days from the date of the notice.

Turin International Electrical Congress—II.

Abstracts of only part of the eleven papers dealing with construction, central stations, switchboard and distribution, forming Section II of the Turin International Electrical Congress, were printed in the Oct. 28 issue, owing to pressure on our columns. The remaining papers of the section are given in abstract below.

PROTECTION OF INSULATORS FROM POWER ARCS.

Mr. W. Weicker gave an account of recent developments in insulator design and showed a number of photographs of insulators under the arcing test.

Insulators should be designed with as large a margin as practicable between the arcing-over voltage and the puncture voltage and yet they must thoroughly insulate th[e] normal potentials. Of course, it would be desirable t[o] avoid arcing over, but practical experience has show[n] that this is impossible of attainment and, therefore, mean[s] of harmlessly dissipating the energy of the arc must b[e] devised.

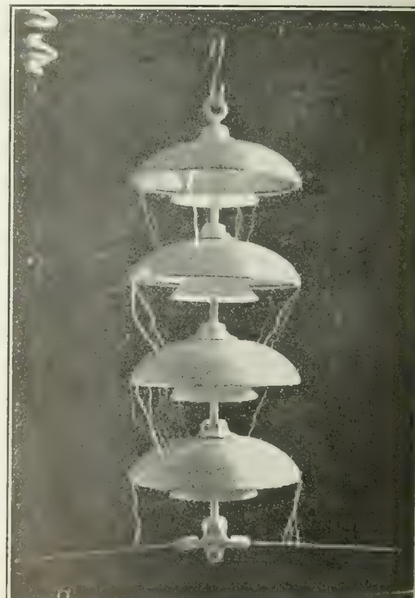

Fig. 1—Insulators Covered by Metallic Cap.

The arcing rings described by Mr. L. C. Nicholson be[-]fore the A. I. E. E. (1910) and in the *Electrical Worl[d]* March 23, 1911, were referred to and photographs show[n] of such rings in operation, both on pin and on suspensio[n] insulators. They provide effective protection from the a[rc] and have the advantage of being easily attached to a[ny] form of insulator.

The author points out that the metallic umbrella type [of] insulator recently introduced by the Porzellanfabri[k] Hermsdorf, affords an even greater degree of protecti[on]

from arcing over and has the advantage of equalizing the dielectric stress. This metallic umbrella principle has been extended to fulfil the requirements of the suspension-type insulator and as a result of experimental research a quite new form of insulator has been produced. Each unit consists of a porcelain insulator covered by a metallic cap shaped like a bowl that comes down over the sides and almost completely hides the insulator. This metallic cap serves the following useful purposes: It equalizes the dielectric stress; it provides a path for arcs, allowing a harmless dissipation of their energy; it protects the porcelain from mechanical injury during installation, or from missiles; it shields the insulator from rain and snow. Tests showed that the relation between arcing distance and arcing voltage was practically uniform under dry and rain conditions alike and that the arcing voltage increased in practically direct proportion with the number of units.

REGULATION OF ELECTRIC GENERATOR UNITS.

The theory of regulation of electric generator units was comprehensively and succinctly treated in a paper by Mr. J. L. Routin.

Dividing all regulation into two classes—mechanical regulation of the torque of the prime mover and electrical regulation of the emf or current, as the case may be, of the generator—the author shows that the interrelations of mechanical and electric regulation are such that both should be used in all cases except in direct-current installations, where variations in speed are permissible. In these latter cases a potential regulator that operates by controlling the torque of the prime mover will serve every practical purpose.

The earliest mechanical regulator was invented by Poncelet in 1829. It operated on the dynamometer principle, being actuated directly by changes in the torque. However, there were fundamental defects in its theoretical and practical working which prevented it ever coming into extensive use.

The only other method of mechanical regulation is that in which the regulator is actuated by changes in speed. Taking up the fly-ball governor, the author exposed the underlying principles of operation. He then outlined the effects of inertia upon regulation and discussed in detail the action of a speed governor, including the effects of inertia and friction, using the diagrams devised by Mr. Léauté and used in his famous memoirs on long-period oscillations. In this analysis the author gradually leads up to a method wherein theoretically all oscillation is eliminated. In the second part of the paper, under electric regulation, the disadvantages of compounding were enumerated, and then followed a brief outline of electro-mechanical compounding, which can be attained with a special form of governor or regulator described in detail in the latter part of the paper. This improved form of governor permits a practically perfect compensation for inertia and may be applied to mechanical, hydraulic or electric regulators. Each type was briefly described.

A schematic diagram of the electric regulator is shown in the accompanying illustration. The electromagnet 3, in series with the circuit to be controlled, acts on the lever 1 against the spring 9. Excess current in the magnet 3 pulls down the lever 1, bringing the contacts 10 and 11 together and thus energizing electromagnet 13, which closes 19, starting the motor 23 that operates the field rheostat, the gates of a turbine, the cut-off of an engine or whatever mechanism it may be intended to control. The moment the motor circuit is closed contactor 26 also closes, energizing 29, which exerts a pull in opposition to the magnet 3. If the departure from normal condition is but slight the magnet 29 will pull up the lever at once and it will vibrate rapidly until the normal condition is restored, the motor turning a little each time, but if the departure from normal condition is great the magnet 3 will exert sufficient pull to hold the contact 10 closed against the constant pull of 29. It will be seen that this regulator acts at a rate which is proportional to the magnitude of the departure from normal conditions and in this manner oscillations are avoided and normal conditions are re-established with great rapidity.

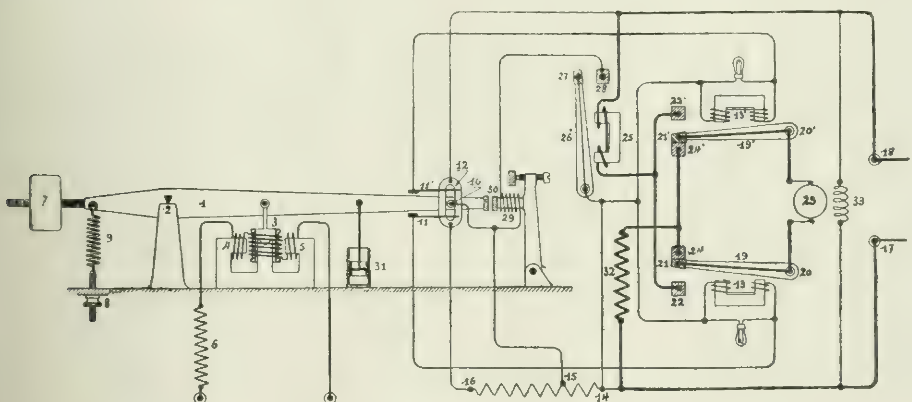

Fig. 2—Diagram Showing Electric Regulator.

This device can be used to regulate voltage or current and by connecting suitable reactance and resistance in the circuit in series with 3 and using a shunt transformer constant voltage can be maintained at any desired point on an alternating-current line. By employing a magneto to produce the current through 3 the regulators may be used to control speed.

The construction of the contacts to avoid rapid deterioration is quite remarkable. The contact 10 consists of a steel core plated with silver and the contacts 11 and 11′ are also of steel, plated with silver. The fixed winding 12 serves to magnetize these contacts. When the contacts approach each other the magnetic attraction tends to pull them together while the elasticity of the springs 11 and 11′ tends to oppose their being drawn together. As they come closer the magnetic pull increases very rapidly, while the spring pull decreases directly with the distance; therefore, they finally come together very suddenly and at a speed which is quite independent of the speed of movement of the main lever 1. Upon separating the same action takes place in reverse order; thus the magnetic attraction drags

[illegible] with 10, until the elastic force increases sufficiently to overcome the magnetic pull, when the two fly apart. This magnetic pull between the contacts has an entirely negligible effect upon the motion of the main lever 1.

ALUMINUM AS CONDUCTOR MATERIAL.

A very comprehensive report on the present status of aluminum conductors in the art of electric transmission was submitted by Mr. E. Huber-Stockar. In the introduction the author refers to Mr. H. W. Buck's paper on the same subject before the St. Louis Congress in 1904, and to Mr. E. Dusaugey's paper before the Marseilles Congress in 1908. Although the paper is limited to the use of aluminum as a transmission conductor, a brief reference is made to its use in the construction of machine windings, and it is interesting to note that in 1899, when aluminum was so cheap in comparison to copper, twelve 200-kw transformers with aluminum windings were built by the Oerlikon company and are still in service. However, at present electric-machine design has progressed to a point where the price of aluminum could never be low enough to offset the effect of the large volume in increasing the cost of the machine as a whole.

When copper and aluminum are used together in the same system the greatest care must be taken to avoid the tendency of linemen to string aluminum as though it were copper, for it is only by proper installation that satisfaction can be obtained. Where aluminum and copper are joined together no trouble will be experienced from galvanic action if the joint is made watertight. The use of mechanical joints in place of solder is to be looked upon as an advance in line construction, and they should preferably be used in copper lines also. The principal reason for using aluminum in preference to copper is the saving in first cost. Mr. W. von Möllendorff has shown (1910) that on the basis of equal conductance aluminum can cost 1.92 times as much per unit weight as copper, and on the basis of equal heat dissipation it can cost 2.2 times as much. At present it costs only 1.11 times as much, and therefore for equal conductance will show a saving of about 30 per cent over copper.

The author next discusses the various reasons why European companies have been so backward in the use of aluminum conductors, and exposes the various prejudices that exist in the minds of some.

Taking up bare conductors first, the author gives the results of a number of recent tests on the corrosion of aluminum in moist air, salt air, salt water, various gases, acids, etc., and these results indicate that in respect to its chemical stability aluminum is in general the equal of copper. There has been much said about the tendency of electrostatic repulsion to reduce impure condensation on aluminum conductors, but the author rejects all such tales as unworthy of the slightest credence. However, in general, an aluminum conductor under given conditions is not likely to collect much more moisture than copper. With respect to heat absorption, the ratio of aluminum to copper of equal conductance is 1.2105 to 1 per unit weight and 0.932 to 1 per unit surface.

Bare aluminum conductors laid in the earth have been tried out in railway return feeders, with the result that they were rapidly corroded by galvanic action. Aluminum conductors for making connection in the power house have many advantages. The large conductors on account of their large radiation surface show a great saving over copper, and small conductors have the advantage of greater rigidity for a given conductance, and in high-tension installations, where it is desirable to reduce the number of points of support to a minimum, this is of special importance. In discussing the use of expansion joints in buses the statement was made that because of the greater surface the temperature rise for equal [illegible] with copper, and that because of this copper and aluminum buses were about equal as regards the use of expansion joints. In long spans it is likely that an aluminum alloy may prove to be of greater value than either pure aluminum or pure copper. The author gave considerable data on an aluminum-copper alloy, known under the name of spree-aluminum. It has nearly double the strength of pure aluminum. Its breaking length is 10.7 km, as compared with 10.3 km for steel, 6.7 km for aluminum and 5.1 km for hard copper. The use of spree-aluminum cable shows a saving of about 7.3 per cent as compared with copper cable of equal conductance. The extraordinarily great elongation of aluminum enables it to withstand severe overloads by stretching and thus increasing the sag. However, in dealing with wire this cannot be relied on, as a scratch or a single imperfection will often cause the wire to break without any appreciable elongation. For this reason cables are to be preferred to single-wire conductors. Aluminum cables do not show as great a saving over copper cables as exists in the case of wires. However, on the basis of present prices the aluminum cable shows a saving of about 20 per cent.

Instructions are given for stringing and joining aluminum wire and cable, the construction being divided into three classes—spans under 50 m, spans from 50 m to 150 m and spans greater than 150 m. In the latter part of the paper uses of insulated aluminum wires and cables are discussed. While these uses are naturally much more limited on account of the high cost of the insulation, it is nevertheless true that in the longer sizes with cheap insulation the aluminum may be cheaper than copper.

At the end of the paper the author gives a bibliography and several statistical tables on aluminum, copper and spree-aluminum wires and cables, as well as data on a number of Continental and American installations.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has received and served upon the Buffalo General Electric Company the complaint of Frank C. Perkins, Erie County Bank Building, Buffalo, N. Y., objecting to the signing of a contract for service which contains a provision that in case the supply of energy shall fail, whether from natural causes or accident in any way, the company shall not be liable for damage to person or property resulting from the use of the electricity. Complainant also objects to the provision which prevents the use of any electrical conductors for light, heat and power purposes other than those connected with the company's mains. Under this requirement, complainant states, he will be unable to use a small gas engine and generator and conductors from same to the lighting circuit for auxiliary service.

The Public Service Commission, Second District, has received the petition of the Keeseville Electric Company for permission to execute a first consolidated mortgage for $200,000 on all its franchises and properties and to issue thereunder a like amount of bonds for the purpose of paying for the water-power of the Mooney horse-nail mill property at Ausable Forks, N. Y. The company now furnishes electric light in the village of Keeseville and the towns of Ausable, Chesterfield and Peru. It purposes to build a new power house and to install necessary machinery for generating a total of 500 hp in order that it may extend its operations to other parts of such towns and to the hamlet of Ausable Forks and the towns of Jay and Black Brook. Part of the proceeds of the bonds now asked for are to take up outstanding obligations of the petitioning company.

The Port Jervis Light & Power Company has been authorized to issue $18,000 of first-mortgage bonds, to se

the same at not less than 90 and to apply the proceeds from the sale to the reimbursement of its treasury for moneys expended from income in carrying out additions and improvements to its property.

The commission will this week hold a hearing on the complaint of the Board of Trustees of the village of Catskill against the Schoharie Light & Power Company as to the rate charged for street lighting in that village; also, on the application of the Wayne County Gas & Electric Company for permission to exercise franchises in the town of Manchester and the village of Newark, Wayne County, and on the complaint of residents of Coxsackie against the Upper Hudson Electric Company as to regulation of voltage of energy supplied for light, price of electricity and alleged discrimination in rates.

NEW HAMPSHIRE COMMISSION.

The commission has granted permission to the Ashuelot Electric Company to issue $70,000 of common and $70,000 of preferred stock to be used for payment of the Keene Electric Company.

The following regulations have been issued, governing the construction and filing of rates, charges and prices of public utilities, taking effect Nov. 1:

Every public utility subject to the provisions of an act establishing the Public Service Commission shall draw up schedules showing the rates, charges or prices for all varieties of service rendered by it. The schedules shall contain a full and complete list of all the kinds and classes of service rendered within the State of New Hampshire, with the rate, charge or price for each unit or item of such service. In any case where any such utility is providing service at other than the regular rate, charge or price, a full list of such exceptions shall be made, setting forth in each instance (1) the name of the person, partnership, association or corporation with which any contract for such service is in force; (2) the rate, charge or price fixed therein; (3) the date when such contract was made and the date when the same shall expire or may be legally terminated by the utility.

In any case where any rate or regulation of any utility provides for a discount from the regular rate, or in any way affects any rate, charge or price for service, such rule or regulation, or the effects of the same, shall also be set forth.

Each schedule of rates, charges and prices and a statement of rules affecting the same and list of exceptions thereto shall be filed with the Public Service Commission at its office in Concord, N. H.

Notice of any change in any rate, charge or price for service shall be filed with the commission at least thirty days before the date upon which the same is to become effective, unless such change shall be permitted to take effect on less notice by consent of the commission, granted upon application therefor.

Compliance with the order as to all available schedules of rates, charges or prices is required not later than Nov. 15, 1911, and full compliance in every instance not later than Jan. 1, 1912.

MARYLAND COMMISSION.

The Public Service Commission gave Attorney Arthur George Brown a hearing last week, arguing for the Chamber of Commerce against the petition of the Chesapeake & Potomac Telephone Company for permission to abrogate its flat-rate telephone contracts with business firms. Mr. Brown made an earnest plea for a system which he said was in accord with statutory policy of the State of Maryland and in actual operation in other cities of the country. At the conclusion of Mr. Brown's argument Mr. Ambler called attention to the fact that the commission did not intend to act hastily in the matter, but that it was inclined to think that there was justice in the plea of the company, because the reports of the experts that they had employed showed that the burden of the flat-rate telephones was borne by the subscribers who had measured service.

Anxious to determine whether or not a satisfactory device for registering telephone calls and adaptable for use in Baltimore city has been placed on the market, the Public Service Commission has sent its chief engineer, Charles E. Phelps, to Albany, N. Y., for the purpose of gathering at first hand information regarding the working of the telechronometer, a recent invention, which is being tested by the Public Service Commission of that State, to register the time during which a telephone connection lasts, somewhat as a watt-hour meter measures energy. The instrument begins to register immediately after the connection between the calling line and the called line is made. Its advocates claim for it the advantage of affording telephone companies a means of charging, and subscribers a means of paying for exactly the amount of service rendered.

MASSACHUSETTS COMMISSION.

Despite a recent positive ruling of the Gas & Electric Light Commission against the granting of franchises by municipal authorities to private parties desiring to transmit electricity across public highways, two new cases of this character have been brought before the board. In one instance Mr. Alfred S. Lowell, of Worcester, seeks authority to transmit electricity from a private generating station across a prominent public thoroughfare to a mercantile establishment owned by the same parties, and in the other case the Gloucester Electric Company appeals to the board against the Oceanside Company, which desires to transmit electricity from an isolated plant in a hotel property to summer cottagers located across the public highway.

Customers of the Electric Light & Power Company, of Abington and Rockland, have petitioned the board for a reduction in the price of electricity. The Foxboro Electric Company has petitioned the board for authority to purchase the Union Electric Light Company, of Franklin, and to issue stock to the amount of $145,300 for that purpose. The Brockton Gas Light Company has petitioned the board for authority to issue new stock to the amount of $250,000 to meet the cost of improvements and extensions, and the Weymouth Electric Light & Power Company has asked the commission to grant a stock increase of $50,000. The Selectmen of Framingham have petitioned for lower rates for gas sold by the local gas company.

WISCONSIN COMMISSION.

The commission has received an application from the village of West Salem for a certificate of convenience and necessity relative to the establishment of a second electric utility, or, as an alternative, an order for the enlargement, rebuilding and re-equipment of the existing utility and the improvement of its service. The existing plant is a privately owned water-power plant located some distance from the village. The petitioner alleges that numerous residences and industrial and manufacturing establishments desire electric service, but have been denied because of inadequate facilities. It is alleged that there is ample water-power available to satisfy all the requirements of the village. The annual report of the plant shows that the ratio of operating expenses to operating revenues is less than 50 per cent and less than that of almost any other plant in the State. The poor service rendered by the defendant has brought it into contact with the commission on previous occasions. The hearing has been set for the December calendar.

The commission has taken testimony in the matter of the investigation, on motion of the commission, of the rules, regulations and practices of the Green Bay Gas & Electric Company. The matter was taken up by the commission largely because of complaints registered by the Minahan

Building Company, a small electric utility in competition with the Green Bay Gas & Electric Company in certain portions of the business district of Green Bay. The substance of the complaint as stated at the hearing was that the Green Bay Gas & Electric Company has repeatedly sought through special offers to induce consumers of the petitioner to take service from the respondent company. It was alleged, and to a certain extent substantiated at the hearing, that these inducements took various forms, such as free lamp renewals, free fixtures, special rates for certain purposes, etc., or in general a departure from published tariffs and practices in the district served by both utilities. The commission has taken the case under advisement.

A suit of considerable importance to the commission and to the water-power owners of the State has been begun in the United States District Court. This suit involves the constitutionality of the water-powers act passed by the last Legislature, and was brought by the St. Croix Falls Improvement Company against the Attorney-General and the Railroad Commission. The complaint sets forth that the defendants maintain that under the new law the water-power is a public use held by the State and subject to the control of the State, and that the law repealed all franchises and permits and all rights under the general statutes or by virtue of riparian ownership under which the Wisconsin branch of the company is owning and operating the dam. According to the complaint, the Attorney-General has declared that unless the Wisconsin company applies to the commission and receives a franchise subject to all terms and conditions of the new law he will bring an action to abate the dam as a public nuisance and bring action to collect a sum of $50 for each day it maintains the dam after Jan. 1, 1912, and the Railroad Commission has declared that unless the company complies with the new law it will receive from any person or corporation properly organized an application for a franchise to construct and operate a dam where the complainant now operates its dam or at any other point where the company now owns land. The plaintiffs pray that the water-powers act may be declared unconstitutional; that the AttorneyGeneral be perpetually enjoined from interfering with the possession of the dam and from bringing actions against them, and that the commission be enjoined from receiving or acting upon applications for franchises to erect a dam on the land of the plaintiffs. The St. Croix Improvement Company is a three-million-dollar corporation, and energy is supplied from its dam on the St. Croix River to the city of Minneapolis and to several villages in the vicinity.

CURRENT NEWS AND NOTES.

ELECTRIC WELDING.—Among the papers to be presented at a meeting of the American Society of Mechanical Engineers in New York on Nov. 14 will be one on electric welding by Mr. C. B. Auel, of the Westinghouse Electric & Manufacturing Company. There will also be presented a paper on "thermit" welding by Mr. G. E. Pelissier, of the Goldschmidt Thermit Company. A general paper dealing with the apparatus used in the different processes will be read by Mr. H. R. Cobleigh, of the International Steam Pump Company.

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CHANGING ILLUMINATED SIGNBOARD.—The latest novelty among the large electric roof signs along State Street, Chicago, is a new illuminated signboard overlooking the Adams Street corner, in which the changes of expression on the face of the youngster it depicts are accomplished by moving a series of shutters. When first illuminated the sign shows the baby crying for a well-known breakfast food which the sign advertises. The reflector lamps are then extinguished and during this "dark change" a motor reverses the row of shutters, bringing into view, when the lamps are again lighted, the smiling countenance of the youngster, while below in electric letters appears the line explaining "He's got it."

* * *

MEETING OF BOSTON EDISON SECTION, N. E. L. A.—At the October meeting of the Boston Edison Section of the N. E. L. A. the following officers were elected for the ensuing year: President, Mr. D. S. Boyden; vice-presidents, Messrs. C. H. Ingalls and H. W. Stevens; secretary, Mr. W. F. Stevens; treasurer, Mr. S. J. Lent; executive committee, Messrs. C. H. Miles and G. H. Davidson. Following the election of officers papers were read by Messrs. C. A. White and C. H. Crockett on "A General Service Depot," and by Mr. D. S. Boyden on "Steam Heating." The first excursion of the year took place in October, the section visiting the works of the Hood Rubber Company at Watertown, Mass., which were recently equipped with electrical machinery.

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MEETINGS OF THE A. S. M. E.—The American Society of Mechanical Engineers will hold two meetings in New Haven on Nov. 15. At the afternoon session the general subject for discussion will be the cost of energy obtained from steam engines, steam turbines, gas and oil engines. At the evening session Prof. C. F. Scott, of the department of electrical engineering of Yale University, will deliver an illustrated lecture on the system and practices of the Hartford Electric Light Company. The A. S. M. E., the A. I. E. E. and the Boston Society of Civil Engineers will hold a joint meeting in Boston on Nov. 15, when a paper entitled "Some Refractory Substitutes for Wood" will be read by Prof. Charles L. Norton, of the department of physics of the Massachusetts Institute of Technology.

* * *

UNIVERSITY LECTURER FOR CENTRAL STATION EMPLOYEES.—Announcement has been made of a course of lectures on electrical subjects at the Johns Hopkins University for the employees of the Consolidated Gas, Electric Light & Power Company, of Baltimore. The lectures will be given in connection with the work of the company section of the National Electric Light Association. The work has been outlined by Messrs. Douglass Burnett, R. H. Tillman, R. F. Bonsall and others. A course of ten lectures will be delivered by Dr. John B. Whitehead, professor of applied electricity at the Johns Hopkins University, on alternate Tuesday nights. On the intervening Tuesday evenings members of the company's organization will discuss phases of its work. The section has elected the following officers: President, Mr. R. H. Tillman; vice-president, Mr. A. S. Loiseaux; secretary, Mr. D. C. Bruce; treasurer, Mr. R. F. Bonsall.

* * *

"CENTENNIAL" CORLISS ENGINE ON ITS WAY TO THE SCRAP HEAP.—Among other steam engines replaced by electric drive in the works of the Pullman Company in Chicago, as related in the *Electrical World* of March 23, 1911, was the famous vertical two-cylinder walking-beam Corliss engine exhibited at the Philadelphia Centennial Exposition of 1876. This engine, rated at 1400 hp, was the most famous stationary steam engine of its time, and it did faithful service at Pullman for more than thirty years, being pointed out to visitors as the great engine that attracted so much attention at the Centennial. It was 39 ft. high and weighed over 800 tons, being larger and heavier than present-day steam turbines of twenty times its rating. The company kept the old engine for some time in the effort to sell it to some person or society that would preserve it for its historical interest, but nobody seemed interested, and finally the ponderous machine was sold to the Oakdale Iron Company for scrap. The engine was dismantled and is now in the purchaser's yards.

Transmission Line Between Peoria and Pekin.—The Peoria Gas & Electric Company is building a transmission line to connect its generating station in Peoria with the generating station of the Citizens' Gas & Electric Company, of Pekin, Ill., which it controls. By means of this line energy may be sent from Peoria to Pekin or *vice versa*, as the exigencies of service demand. The length of the line is about 12 miles.

* * *

Frontiers of Science.—A course of lectures is to be given at Fullerton Hall, Art Institute, Chicago, this winter by University of Chicago professors on subjects that may be considered to be on the frontier lines of the sciences. Among the subjects announced are "New Proofs of the Kinetic Theory of Matter and the Atomic Theory of Electricity," by Dr. R. A. Millikan, professor of physics (Nov. 16), and "Some Recent Advances in Chemistry, with Special Reference to Radioactivity and the Nature of Matter," by Dr. Herbert N. McCoy, professor of physical chemistry (Nov. 23). The proceeds of the lectures are given to university-settlement work.

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Aeroplane Tractional Resistance.—The gliding angle of the average aeroplane is 1 to 6, according to a recent discussion of the subject of tractional resistances in the *Engineer*, London, thus fixing the frictional resistance of the air to the aeroplane's motion at about 370 lb. per ton carried. The frictional resistances for electric and steam-railway loads on level tracks range only from 10 lb. to 30 lb. per ton, while that of steamships may be as low as 1 lb. per ton. The engine-power required to convey a ton on a heavier-than-air machine is thus seen to be about equivalent to that necessary to drag the same load over rough ground without wheels, apparently putting an end to hopes for economic aeroplane transportation where any means of surface conveyance are available.

* * *

Symposium on Fuel Economy.—At a combined meeting of the Society of Chemical Industry and the New York Section of the American Electrochemical Society held during the present week, on Nov. 10, six papers were presented on the general subject of fuel economy. The papers and authors were as follows: *Some Attempts at Economy in Steam Making*, by Mr. J. W. Loveland; *Fuel Gasification for Industrial Purposes*, by Prof. Charles E. Lucke; *A Continuous Carbon Dioxide and Temperature Recorder and Its Application to Combustion Efficiency*, by Mr. Edward A. Uehling; *Is Peat an Important Fuel in America?* by Mr. Charles A. Davis; *Deterioration and Spontaneous Heating of Coal in Storage*, by Messrs. Horace C. Porter and F. K. Ovitz; *The Distribution of Heat in Boiler-Plant Operation*, by Mr. Perry Barker.

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The Electrical Engineer in Fictional Literature.—The young electrical engineer and his doings, as conceived by the average writer of fiction, usually make diverting reading for the practical fraternity. The current issue of a weekly story paper of large circulation has a tale which concerns itself with the affairs of a young man who runs "dynamos in the underground power house of a coal mine," adjusts "kilowatts and cut-offs," has $4,000 in the bank and reads Shakespeare and Bacon. The climax of electrical interest in the story, however, seems to come during an altercation in which the hero indulges with his helper in their underground quarters, finally threatening him: "I'll just—oh!—drop you into a magnetic field with fatal results, my good man." Whereat "Saul grinned nervously," while the dynamos—"dangerous mysteries, all too handy to the man they obeyed"—whirred on!

* * *

Boston 1912 Electric Show.—Preparations are being continued on a large scale for the electric show which is to be held in Boston in the fall of 1912 under the auspices of the Edison Electric Illuminating Company. As previously stated, the company has leased the entire Mechanics' Building, and 40 per cent of the exhibit space has already been sublet. Four conventions of organizations of prominence have been secured for the exhibition period in Boston, and the general plans of illumination are now well outlined. The company states that the lighting effects will be on a scale surpassing those of any world's exposition thus far held. Elaborate advertising is being carried in foreign and domestic technical journals, and much interest in the plans of the show is being displayed by foreign legations. Messrs. L. D. Gibbs and H. W. Moses, of the Boston Edison organization, attended the recent convention of the Sons of Jove in Denver, Col., on behalf of the show's interests. A worldwide search is being carried on, under the direction of Mr. Moses, for new applications of electricity which may be displayed or illustrated at the show. Headquarters are being maintained at 39 Boylston Street, Boston, Mass.

* * *

A New Suit Against the Chicago Gas Company.—In the controversy between the city of Chicago and the People's Gas Light & Coke Company over the question of rates the city has stolen a march on the company by bringing an unexpected suit in equity as a gas consumer. The city asserts that the present value of the company's property devoted to public use is not in excess of $45,000,000, instead of $70,000,000, as declared by the company. Some of the stocks and bonds issued by the company are said to represent either no consideration or inadequate consideration, owing to the exaggerated value of merged properties. Further, the company is said to be purchasing gas from another company controlled by stockholders of the People's company, the price being excessive. Excessive rentals for properties, exorbitant salaries and the ownership of tracts of land which are not used for the manufacture, sale or distribution of gas are also alleged. The rate for gas in Chicago until recently was 85 cents, but it was temporarily fixed at 80 cents by Judge Gibbons, pending litigation over the city's attempt to secure rates ranging from 75 cents to 68 cents covering a period of five years. The city now brings the new suit as a more direct method of reaching adjudication.

* * *

Niagara Power for Villages.—The New York State Public Service Commission, Second District, has given authority to the Livingston-Niagara Power Company, of Caledonia, N. Y., to issue stock to the amount of $85,000 and to execute a mortgage on its property, rights and franchises for a sum not to exceed $600,000, to be secured by thirty-year 6 per cent bonds. The proceeds of the sale of the stock and bonds are to be used for the construction of a main receiving station and approximately 50 miles of transmission line, with the necessary right-of-way; the acquisition and improvement of the Wheatland Power Company's property, and such distribution systems, transformers, meters, tools and equipment as may be required to complete the system for operation. The main receiving station, located at Golah, N. Y., and the southern line, about 21 miles in length, are now being completed and will operate at 11,000 volts. Distribution systems in the villages of Avon, East Avon, Lima, Livonia, South Lima and Honeoye Falls, supplied from the line, are being put in an operating condition, and twenty-four-hour service will be inaugurated. Construction work will be begun immediately on the western line to Scottsville, Garbutt, Mumford and Caledonia. The property of the Wheatland Power Company in Scottsville will be improved and distributing systems will be installed in Garbutt, Mumford and Caledonia at an early date, as there is a demand for energy in that section, which the Wheatland Power Company, owing to its limited output, is now unable to supply.

London Traction Merger.—It is reported that electric railways in London having an aggregate capital of $165,000,000 will be amalgamated in the near future, the arrangements having been agreed upon by all parties interested.

* * *

[illegible] to Panama Canal Benefits.—The New Orleans Railway & Light Company is advertising in Northern newspapers asking manufacturers, investors and power users to locate in New Orleans, equip for electric drive and purchase energy from the advertiser. One interesting argument advanced is "Be prepared to serve the extension of trade through the Panama Canal."

* * *

Balloon Advertising in Germany.—A Berlin balloon company utilizes one of its large dirigible balloons to fly over the city every clear evening. Projectors placed on each side of the car project advertisements on a sheet of white canvas fastened on the envelope of the balloon. These advertisements can easily be read from the ground below. The attention of the people on the streets is attracted by the noise of the engine and by electric lights turned on in the car after each advertisement. This form of publicity is being patronized by many of the important firms of Berlin and of Germany. The cost per night is 100 marks ($23.80), for which sum each advertisement is projected thirty times on each side of the balloon for a period of fifteen seconds.

* * *

St. Louis Section, N. E. L. A.—On Oct. 27, at the opening meeting of the St. Louis Section of the N. E. L. A. for the present season, Mr. S. N. Clarkson, power expert for the Union Electric Light & Power Company, gave a paper entitled "A Trip Through Some European Power Plants." Views were shown from the most interesting of both the steam and hydroelectric generating stations in the northern part of Italy and the adjoining section of Switzerland, and the talk included a detailed description of the 23,000-volt direct-current generating station at St. Maurice. The speaker also recounted some personal experiences on the trip when the plants were visited, and showed a number of slides of general interest from pictures taken in Great Britain and continental Europe.

* * *

Award of Nobel Prizes.—According to reports from Stockholm the Nobel prize for chemistry has been awarded to Mme. Marie Sklodowska Curie. The Nobel prize for physics has been awarded to Prof. Wilhelm Wien, of Würzburg University. Mme. Curie, who was a co-discoverer with her husband, the late Prof. Pierre Curie, of radium, in 1903 shared with him half of the Nobel prize for physics, the other half being awarded to Prof. Antoine Henri Becquerel. Each of the five Nobel prizes awarded annually amounts to $40,000. Recent announcement was made of the success of Mme. Curie in producing polonium, "a new element possessing a radio-activity superior to radium." It was reported on Oct. 18 that the Nobel prize for physics probably would be awarded this year to Mr. Thomas A. Edison.

* * *

"Seeing at a Distance" Bobs Up Again.—A Spokane (Wash.) newspaper dispatch says that Antonio Scarpelli brought suit against Phillipe Vignoli to recover $2,000 alleged to have been advanced by the former on the representation of the defendant that he was developing an invention by which one could see around the world by utilizing the Hertzian waves in a manner analogous to wireless telegraphy. Scarpelli thought it would be a fine thing to have long-distance vision of his friends in Italy and gave Vignoli more than $2,000, he says, to perfect the "invention." Later he became convinced that he was being swindled and he had Vignoli arrested. Seeing at long distance is no new conception, for a Polish schoolmaster with a richly consonanted name attracted much attention a number of years ago by his claims in this direction.

* * *

Meeting of Cleveland Electrical League.—The Electrical League of Cleveland held its first noonday lunch of the season Nov. 3 at the Gillsy Hotel. The attendance of 163 members and guests was very gratifying, and much enthusiasm in the work of the league was shown. President H. H. Cudmore introduced as the principal speaker Mr. Homer E. Niesz, president of the Electrical Club of Chicago. After describing the work and plans of his club Mr. Niesz spoke of Cleveland as the birthplace of the co-operative development movement which was started several years ago. Another step for which Cleveland is largely responsible is the "electrical page" which is appearing weekly in one or two daily newspapers in various cities. Mr. Niesz spoke of the way in which this had been brought to the attention of the Chicago club recently, and said that while no definite action had been taken toward arranging for an electrical page in the Chicago papers, yet the members of his club are very much interested in the matter. Noonday lunches of the Electrical Club of Cleveland will be held on alternate Thursdays from now on, and the plan is to hold a smoker once a month at which unusually interesting entertainment features will be provided.

* * *

Steel-Wire Gage.—The steel-wire manufacturers of the country have been using a number of wire gages differently designated, but all practically identical with the Washburn & Moen gage. Upon the recommendation of the Bureau of Standards at Washington a number of the principal wire manufacturers and important consumers have agreed to designate this gage as the "steel-wire gage"; or, in cases where it becomes necessary to distinguish it from the British standard wire gage, it may be called the United States steel-wire gage. The only wire gage recognized in acts of Congress is the Birmingham gage, which the Treasury Department uses in connection with the importation of wire, and until certain provisions of the tariff act are amended its employment probably cannot be discontinued. This gage, however, is considered by many as radically defective; moreover, it is nearly obsolete, both in the United States and in Great Britain, where it originated. For copper wires and wires of other metals the gage universally recognized in the United States is the "American wire gage," also known as the Brown & Sharpe gage. No confusion need arise between the steel-wire gage and the American wire gage, as the application of either gage is distinct and definite.

* * *

Annual Meeting of Electrical Credit Association of Chicago.—The sixteenth annual meeting of the Electrical Credit Association of Chicago, of which Mr. Frederic P. Vose is secretary, will be held at the Chicago Athletic Association, 12 South Michigan Avenue, on Nov. 16, beginning at 2 p. m. Papers will be presented as follows: *Disputed Accounts and the Executive Committee,* Mr. A. C. Kuehmsted, Gregory Electric Company; *Keeping Fait[h],* Mr. W. A. Brady, Commercial Electrical Supply Company; *Reporting Municipalities,* Mr. E. E. Ingels, B-R Electric Telephone Manufacturing Company; *Forms and Mod[el] Letters,* F. D. Van Winkle, Post-Glover Electric Company; *Does the Association Pay?* S. E. Kennedy, Central Electr[ic] Company; *Contractors as Credit Risks,* E. R. Gilmor[e], Western Electric Company; *The Credit and Sales Depar[t]ments,* George C. Steele, North Electric Company. A live[ly] discussion is anticipated. The annual dinner will be serv[ed] at 6:30 p. m. at the same place. Mr. A. A. Gray will act [as] toastmaster and Mr. H. H. Cudmore will lead the singin[g]. Mr. Kuehmsted is chairman of the entertainment com[mittee], and Mr. Henry Schwab, of the Monarch Electr[ic] & Wire Company, is chairman of the committee which w[ill] nominate officers for the ensuing year.

MODERN TURBINE PLANT AT INDIANAPOLIS.

he Mill Street Station of the Indianapolis Light & Heat Company Using Superheated Steam, Water-Borne Step-Bearings for Vertical Turbines, Etc.—Condenser Intake Dam Construction Shared by Park Board.

THE Mill Street station of the Indianapolis Light & Heat Company furnishes electrical service for the company's customers in Indianapolis and in Wood-ff Place, the city's famous "corporation within a corpora-n," and also transmits energy within a radius of 10 miles the neighboring towns of Broad Ripple, Lawrence, Fort Bjamin Harrison, Cumberland, Beach Grove, Southport a Michigan Hill. This modern turbine plant has now bome the principal generating center of the Indianapolis cpany, the older Kentucky Avenue station, with its recip-ating sets, being reserved for steam-heating service dur-n the winter months, when its electrical output is limited tohe equivalent of the demand for exhaust steam.

lthough the Mill Street station was planned for turbine opation and its first equipment installed nearly seven yes ago while turbines were yet a novelty in steam en-gi-ering, the foresight displayed in the design of the plt has made it adequate for all such extensions as have sie been necessary. In its layout, as shown in an acmpanying sketch, the station follows the plan of having a transverse boiler-room supplying steam for a group of turbines, a scheme the most notable exemplification of which is probably the Fisk Street station of the Common-wealth Edison Company, Chicago. The Mill Street plant is designed for a duplication of its present dimensions, the turbine-room to be extended further northwest by its present length, while a duplicate of the present boiler-room will be added parallel to the existing one.

COAL HANDLING AND BOILER ROOM ARRANGEMENT.

The plant is located on Mill Street, near Eighteenth Street, and is on a spur of the Cleveland, Cincinnati, Chicago & St. Louis Railroad, over which coal, supplies and machinery can be delivered directly to the station. Extending 25 ft. behind the boiler-room is the roofed coal-track space over the track hoppers leading to the coal crushers. For spotting the drop-bottom cars a motor-driven winch is provided at one side of the track. This winch, which has a belt-driven winding drum, is operated by a 10-hp induction motor installed inside the building walls, but controlled from a hand starter outside. Both steam-driven and electrically operated crushers are provided, the coal discharged from these machines being thence deposited in a McDonald bucket conveyor and by it elevated 60 ft. into the 1000-ton coal bunkers over the boiler-room. These bunkers are of steel and concrete and are carried on the steel framing of the boiler-room.

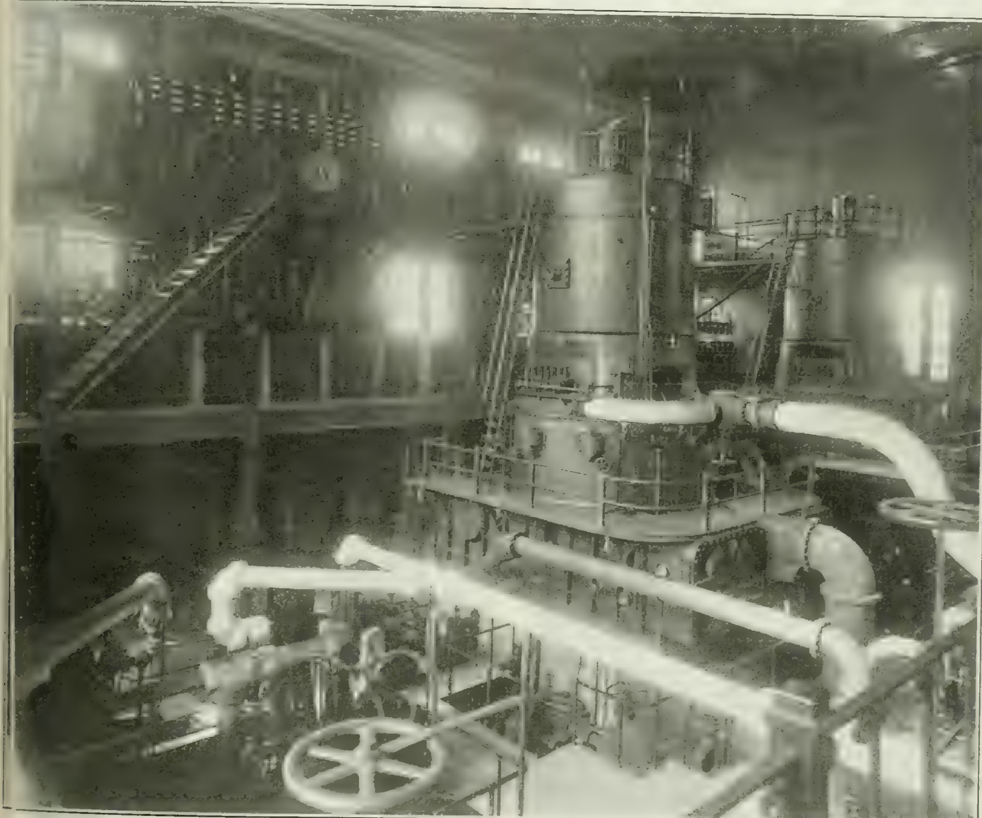


Fig. 1—Interior of Turbine-Room, Showing Large Vertical Units and Switching Apparatus.

The steam generating equipment comprises four 612-hp and four 729-hp Stirling boilers, all equipped with Roney

automatic stokers. These boilers produce steam at 160 lb. per square inch pressure and 125 deg. Fahr super-temperature, being provided with self-contained superheaters, thus permitting only superheated steam to be withdrawn from them.

The flue gases from the row of smaller boilers are carried

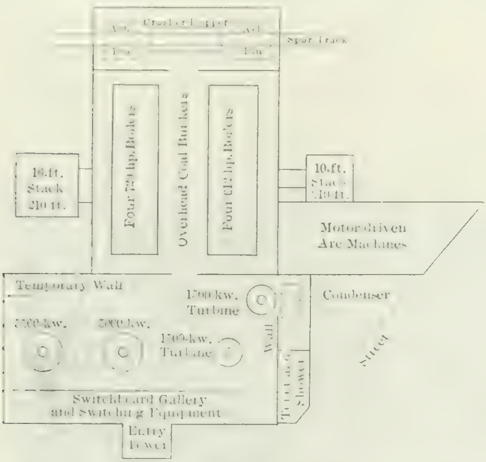


Fig. 2—Arrangement of Mill Street Station, of Indianapolis.

aloft through a 210-ft. brick chimney, 10 ft. in internal diameter. The four 729-hp units are served by a 16-ft. brick stack, 210 ft. above the grates and carried on a concrete-and-pile footing 38 ft. square. This large stack will also serve one-half of the future boiler-room, paralleling the present one. Space is provided at the base of the

Fig. 3—Feeder-Line Entries of Mill Street Station.

chimneys for feed-water heaters, which may be installed later.

Ashes from the grates are dumped through the basement into the same bucket conveyor used for handling the coal, which elevates them to the two 15-ft. by 15-ft. by 20-ft. concrete ash bunkers over the coal-car space outside. From these the ashes can be dumped directly into the empty railroad cars beneath or loaded through a chute on to wagons.

In addition to the 1000-ton coal supply in its overhead bunkers the Indianapolis company maintains about 10,000 tons in open storage in its yard adjoining the Mill Street station, and an equivalent amount at its Kentucky Avenue plant, so that it is well guarded against strike flurries. According to local experience such open storage is more conservative of the heat units in the coal than storage under cover in sheds, where the coal slacks and dries, breaking up almost into dust.

TURBINE GENERATING EQUIPMENT.

The turbine-room, which adjoins the 84-ft. by 76-ft. boiler-room, measures 113 ft. by 62 ft. in plan. The building is of brick, with steel-truss-supported roof, the northwest wall being a temporary one of sheeting, awaiting the extension of the plant, as already outlined.

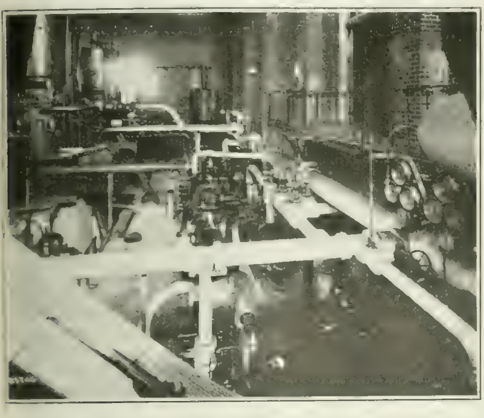
The first machines installed at Mill Street were two 1500-kw, 4100-volt, 60-cycle, three-phase Curtis turbo-generator sets, put in operation in 1905. In 1909 a 5000-kw turbine of similar type was added, and during the present year one of the smaller turbines was replaced by a 5500-kw unit.

When the second of the original small turbines was removed to make room for the larger set the local engineers were confronted with the problem of either discarding it entirely or finding room for it in the station, where it might be called upon in case of emergency. As practically all the available space in the building was occupied by the existing units and their auxiliary machinery, the rather extraordinary setting illustrated in Fig. 4 was determined upon, the condenser being placed in a brick addition built on to the main plant. As now placed the center of this

Fig. 4—Unique Setting of Reserve 1500-kw Turbine Unit a[nd]
Condenser.

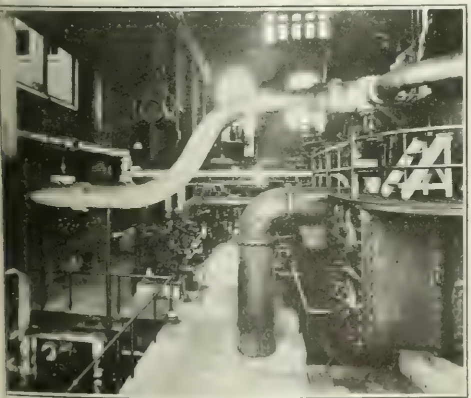
reconstructed 2250-kw turbine set is only 6 ft. from the south wall and 10 ft. from the east wall. The original position of the condenser with respect to the turbine would thus have brought it in line with the heavy brick wall of the building, rendering access to the tubes impossible. An intermediate 4-ft. length of vacuum line was therefore

added, as shown, and the condenser was accordingly brought clear of the wall and into the adjoining space, which also contains its auxiliary apparatus, pumps, etc. As already explained, this turbine is now reserved merely for auxiliary duty, and its unique setting was made only to save the total discard of the unit.



ig. 5—Steam Header and Auxiliary Piping Installed in Turbine-Room.

The two large turbines have base-type Worthington surace condensers, while those of the smaller unit are placed longside its concrete base. The two earlier turbines and he latest large one are equipped with water step-bearings, nd it is now planned to convert the oil bearing of the arlier large unit to the water type. As at present intalled two accumulators are provided, one for the oil and ne for the water-bearing lines, the pressures of which, ractically identical, approximate 1250 lb. per square inch. affles in the bearings reduce this pressure to about 800 lb. t the steps. The water bearings have the advantage, of ourse, of an easy and assured supply of lubricant, and



g. 6—High-Pressure Steam Headers and Auxiliaries in Turbine-Room.

ve been found quite as satisfactory in all other respects the oil bearings in use at Mill Street. Distilled water om the condensate of the turbines is used in the bearings. a precaution that a good supply shall always be on nd standpipes are connected to the lines from the hotlls, so that these pipes are continually kept full, and from them the bearing pumps take their supply. The make-up water required to be added to the condensate from the turbines is obtained from the city mains.

CONDUITS, PIPING, ETC.

Condensing water for the turbines is taken from Fall Creek, a small stream a quarter of a mile distant. This

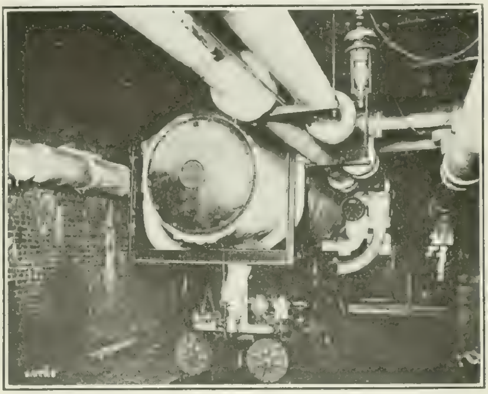


Fig. 7—Exhaust Feed-Water Heater and Pumps in Basement of Boiler-Room.

creek is bordered by a park and boulevard, and through an arrangement with the park board a 4-ft. masonry dam, 200 ft. wide, was built jointly at the expense of the city and the company. This dam adds greatly to the natural beauty of the park and also provides an ample pond for the plant intake line. The 4-ft. intake conduit slopes from the bank toward the wells beneath the turbines, from which the engine-driven pumps lift it through the condensers and back into the 4-ft. discharge pipe returning to the creek. Just before entering the plant the intake line broadens into a circular concrete strainer well, the water flowing through screens which free it of floating and entrained material. At the engine-room floor float gages, constructed of vertical slotted ¾-in. pipes, show the levels of the water in the wells beneath each turbine.

The boiler steam lines are provided with safety non-

Fig. 8—Coal and Ash-Handling Apparatus, Motor-Driven Car Spotter, Etc.

return valves, preventing back-flow of steam from the headers or other boilers in case of failure of one unit. Each row of boilers has its own header which joins the main transverse header in the turbine-room. By the arrangement of valves and by-pass lines used, steam can be supplied from either row of boilers to any group of

machines while other parts of the main and supplementary headers are undergoing repairs. The original fittings installed at Mill Street were of ferro-steel with screwed flanges, but these are now almost entirely replaced by cast steel with Crane lap joints.

All of the condenser auxiliary equipment is steam-driven. The excitation apparatus includes a 100-kw Curtis turbine-driven direct-current generator, running at 2400 r.p.m.; a marine-type, engine-driven exciter, and one 150-hp and one 85-hp. 4000-volt induction motor-generator set.

SWITCHING APPARATUS.

All switching and control equipment of the station is located on overhead galleries overlooking the turbine-room floor. On the first gallery are the oil switches and bus compartments mounted in brick cells. The upper story carries the main switchboard and also the induction-type feeder regulators for controlling the pressure of the long lighting feeders which radiate from the station. The switchboard is equipped with curve-drawing voltmeters, Tirrill regulators, etc. Motor-operated rheostats, with setting indicators, are provided for the large turbine field circuits.

On the gallery railing in front of the switchboard is a hand-operated load indicator which can be seen from any part of the turbine-room and from the boiler-room entrance. On this indicator from time to time the switchboard attendant observes the total load on the station as a guide to the turbine operators and firemen. A supplementary dial shows the time at half-hour intervals. The turbine-room is spanned by a 50-ton, three-motor Shaw crane, capable of handling any piece of machinery on the floor beneath.

In the downtown district of Indianapolis the Indianapolis Light & Heat Company maintains a 110-220-volt Edison three-wire circuit within the "mile square" bounded by North, East, South and West Streets. The company's direct-current substations, each containing a 1000-kw motor-generator set, are located, one at the Kentucky Avenue plant, one in the rear of the company's business offices at 48 Monument Place and the third on Wabash Street, near East. On Bird Street, just north of Ohio, a large storage battery is continuously maintained in service, "floating" on the Edison system. In addition to its motor-generator equipment, 3000 kw of engine-driven direct-current machinery is reserved at the Kentucky Avenue plant for auxiliary duty and for non-condensing operation in connection with the steam-heating service during the winter months.

Mr. C. C. Perry is president and general manager of the Indianapolis Light & Heat Company, Mr. T. A. Wynne is general superintendent, Mr. R. M. Cass is electrical engineer and Mr. E. Mettler is engineer of the Mill Street station.

SAGS AND TENSIONS OF OVERHEAD CONDUCTORS.

Graphical Method for Determining the Mechanical Constants of Transmission Lines.

By Alfred Still.

The formula in general use for determining the relation between sag and tension in conductors of overhead transmission lines is:

$$T = l^2W \div 8s \qquad (1)$$

where l and s are respectively the length of span and sag of the wire at the center of the span, both expressed in feet; W is the uniform weight of the conductor in pounds per foot of length and T is the tension in pounds in the conductor at the lowest point of the catenary. This formula is based on the fact that the catenary approximates to the parabola when s is small relatively to l, and the assumption that the curve formed by the conductors of an overhead transmission is parabolic introduces no appreciable error in the calculations. In the case of very long spans necessitating a maximum sag which may amount to over 10 per cent of the distance between supports, the less simple formula for the true catenary should be used if great accuracy is required. It may be noted that, although formula (1) gives the tension in the conductor at the center of the span, it is usual to consider this also as the tension at or near the supporting points, and unless the sag is very great relatively to the span the error is negligible. By transposing formula (1) there is obtained,

$$s = l^2W \div 8T \qquad (2)$$

from which the sag can be readily calculated for any assumed or known value of the tension T.

In order to calculate the safe minimum sag allowable under the most severe weather conditions, the weight W per foot run will be not merely that of the conductor itself, but the resultant load per foot due to the combined effect of wind and sleet or ice added to the weight of the conductor.

If w = weight in pounds per foot length of the unloaded conductor, then $W = n \times w$, where n is a multiplier to take into consideration the extra weight of the wire under the most severe weather conditions likely to be encountered in the district where the transmission line is located.

It is usual to assume that the wind pressure acts in a horizontal direction and that the total load on a conductor is the resultant of two forces, one acting vertically downward and due to weight of wire together with added weight of sleet or ice, if any, and one acting horizontally due to the wind pressure. These forces are indicated in Fig. 1,

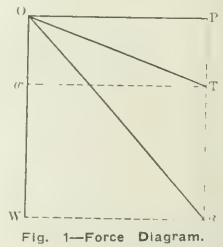


Fig. 1—Force Diagram.

where OP represents the wind pressure, Ow the weight o[f] the conductor and wW the added weight of ice. The re[-]sultant pressure OR is equal to $\sqrt{P^2 + W^2}$. If the lin[e] runs through a country where sleet does not form on th[e] wires the maximum resultant pressure is OT instead [of] OR if the assumed maximum force due to wind is the sa[me] in both cases.

In Fig. 2 there are shown values of the multipli[er] n (the ratio $OT \div Ow$) corresponding to various wi[nd] velocities for the standard sizes of aluminum conducto[rs] on the assumption that there can be no ice formation [on] the wires, while Fig. 3 gives values of n (ratio $OR \div Ow$) for similar conductors when the weight is increased by [a] coating of ice 0.5 in. thick with a correspondingly great[er] wind effect due to the increased diameter.

The formula used for the calculation of wind pressu[re] for use in drawing the diagrams is

$$P = dV^2 \div 4820 \qquad ($$

where d is the diameter in inches of the conductor or the ice coating, as the case may be; V is the actual wi[nd] velocity in miles per hour[1] and P is the wind pressure [in] pounds per foot length of conductor.

Similar diagrams can be drawn giving the value of t[he] multiplier n for copper conductors, but those here pu[b-]lished apply only to aluminum. When using the diagram[s]

[1] ... giving true wind velocities corresponding to the Wea[ther] ... velocities will be found in Mr. F. F. Fowle's art[icle] ... and wind velocities, on page 995 of the *Electrical W*[orld].

should be noted that the distances plotted horizontally represent the squares of the wind velocities and the sizes of the conductors are expressed in equivalent B. & S. wire-gage numbers and circ. mils for the larger sizes.

If the effects of wind and ice can be disregarded, the weight W in formula (1) is merely that of the conductor itself and, for a given material, it will be proportional to the area of cross-section of the wire. If T_a stands for the tension in the wire in pounds per square inch of cross-section, the formula giving the relation between the tension and sag may be written:

$$T_a = knl^2 / s \qquad (4)$$

where k is a constant which depends upon the material of the conductor, but not upon the diameter, and n is the above-mentioned multiplier depending upon the loading of the conductor.

For copper	$k = 0.486$ and T_a should not exceed 28,000.
For aluminum	$k = 0.147$ and T_a should not exceed 13,000.
For iron	$k = 0.427$ and T_a should not exceed 25,000.

The length of wire between supports of equal height bears a definite relation to the span and sag, and it is expressed by the formula

$$L = l + (8s^2 \div 3l) \qquad (5)$$

where l is the distance between supports and s the sag at the center, both being expressed in feet, as before.

The increase of length due to stress will be directly proportional to the tension T_a, provided the elastic limit of the material is not exceeded, and this condition will be satisfied if the maximum values of T_a do not exceed the proposed limits as previously given.

The formula for elastic stretching is:

$$L_e = T_a \times L \div M \qquad (6)$$

where L is the length of the wire when $T_a = 0$, L_e is the elongation due to the stress T_a, and M is the elastic modulus.

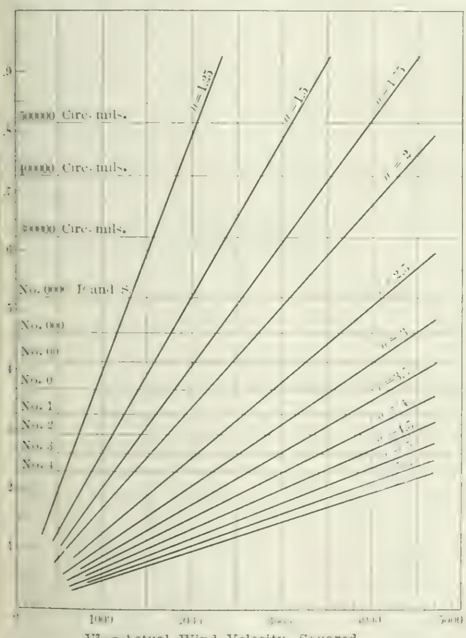


Fig. 2—Curves Showing Values of n Corresponding to Various Wind Velocities for Standard Sizes of Aluminum Conductors.

Values of M, as given by Mr. F. O. Blackwell, are as follows:

Hard-drawn copper wire	16,000,000
Hard-drawn copper cable	12,000,000
Hard-drawn aluminum wire	10,000,000
Hard-drawn aluminum cable	7,500,000
Galvanized-iron or steel cable	22,000,000

The increase of length due to temperature rise, provided the stress does not alter, is:

$$L_t = L \times a \times t \qquad (7)$$

where a is the temperature-elongation coefficient.

If t is expressed in degrees Fahrenheit the values of a are approximately:

For copper	$a = 0.0000096$
For aluminum	$a = 0.0000128$
For iron	$a = 0.0000065$

The purpose of the diagrams to be described hereafter is to simplify and expedite the calculation of sags and tensions required for the guidance of the men actually engaged on the erection of the line. It is a simple matter to calculate by means of formula (2) or the modified formula (4) the sag corresponding to any span (l), load (W) and tension (T), and by using either of these formulas the minimum allowable sag for the safe limiting tension T_a when the wire is subject to the greatest expected load in the matter of ice and wind pressure should be determined in the first instance. Having determined the amount of this sag—which should be that corresponding to the lowest expected temperature—the length of the wire in the span can be readily calculated by means of formula (5).

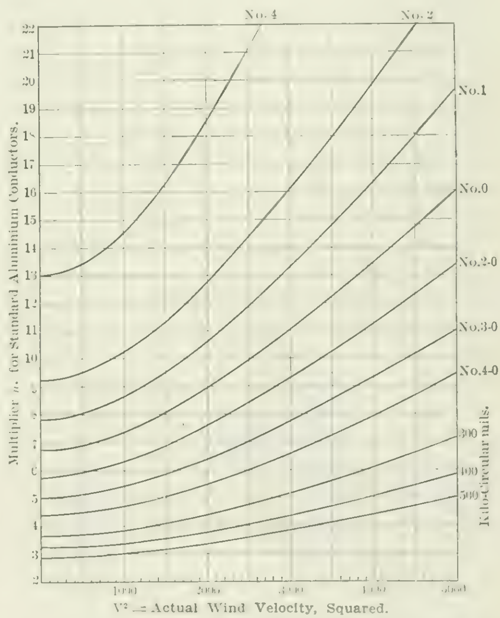


Fig. 3—Values of n for Similar Conductors with a Coating of Ice 0.5 In. Thick.

The calculation of the sags and corresponding tensions at other temperatures and under other conditions of loading is not by any means so simple a matter, because the alteration in the length of the conductor depends not only upon the temperature, but also on the tension. If the extra load on the conductor due to wind pressure and ice

(if any) be removed, the sag will adjust itself until the formula (2) is again satisfied, the weight W being in this case that of the wire only. A further condition is that the length of wire shall be equal to the length as originally calculated for the loaded wire, less the elastic contraction due to the reduction in the tension. If the temperature be now supposed to rise, the length of the wire will increase, but not in direct proportion to the temperature rise as indicated by formula (7) because so soon as there is any increase in length leading to an increased sag the tension in the wire is immediately relieved, and since it is assumed that the elastic limit has not been exceeded there will be a reduction in length which could be calculated by formula (6) *if the amount by which the tension is relieved were known.*

A mathematical formula which expresses the required another curve calculated for a definite constant temperature and giving the relation between sag and tension when a wire of definite known length under a known tension is subjected to various assumed changes in the tension. The point where the two curves cross will indicate the required conditions of sag and tension. This process is a lengthy and laborious one and has to be repeated for every assumed change of temperature.

The principles on which the writer's method is based are, briefly, these: Assuming the span to be known and constant, there is then a definite relation between length of wire and sag, as expressed by formula (5), and a definite relation between tension and sag when a wire of known material hangs in still air under its own weight only. This last relation is given by formula (4) when the multiplier n is unity. In accordance with the above, if there be drawn

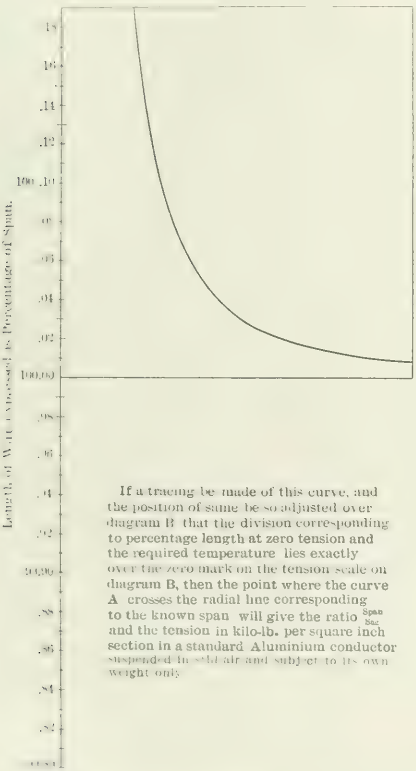


Fig. 4—Diagram Showing Relation Between Length of Wire and Ratio $m = \frac{\text{Span}}{\text{Sag}}$.

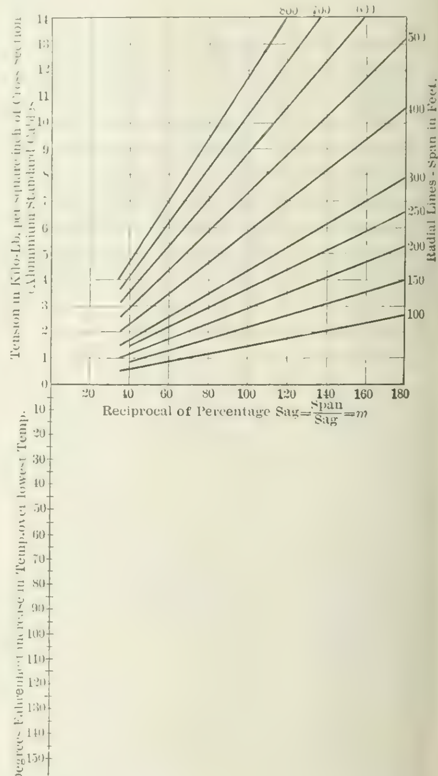


Fig. 5—Diagram Showing Relation Between Tension in Wire a[illegible] Ratio $m = \frac{\text{Span}}{\text{Sag}}$.

length or sag under normal conditions, in terms of the length corresponding to minimum temperature and heaviest loading, is very complex and difficult of solution. Mr. H. J. Glaubitz[2] has evolved an equation in which the first and third power of the unknown quantity (the deflection or sag) appear simultaneously. The solution of such an equation is tedious and is usually accomplished with the assistance of more or less scientific guesswork. The graphical method, which is probably in more general use, consists in plotting two curves, one showing the relation between sag and tension for the selected span when the wire hangs naturally under its own weight only, and

correctly to scale two curves, the one (A) (on transpare[nt] paper) giving the relation between length of wire and s[ag] and the other (B) giving the relation between tension a[nd] sag, and if the first be placed over the second so that t[he] division corresponding to the known tension shall coinci[de] with the division corresponding to the length of wire as ca[l]culated for that particular tension, then the length corr[e]sponding to any other value of the tension, if the tempera[]ture remains unaltered, can be read at a glance, and the pa[r]ticular length (and corresponding tension), together w[ith] the corresponding sag when the wire hangs naturally in st[ill] air, is directly indicated by the position of the point wh[ere] the curve A crosses the curve B. In order to obtain t[he]

[2]*Electrical World*, March 2[illegible], [illegible], page 731

information for any temperature higher than the assumed minimum, a scale of temperature can be drawn on diagram B, the divisions being so spaced as to agree with the correct increase of length due to temperature rise when this scale is placed under the scale for length of wire of diagram A. This will enable the position of diagram A to be shifted so that the length corresponding to zero value of the tension, instead of being the length at minimum temperature, will be the length which the wire would have at he higher temperature if all stress were removed, and the point where the two curves cross will, therefore, indicate the required particulars in regard to sag and tension at he increased temperature.

If curves were plotted from formula (2) giving the relation between tension and sag, each curve would be a rectangular hyperbola, and, for different spans, T would be proportional to l^2. This would make the drawing of a number of curves very tedious; but by plotting the tension T and the value $l \div s$ there is obtained a "straight-line" relation between the two quantities, and since, for different values of the span l, the tension T for a given value of $l \div s$ will be directly proportional to l, the drawing of a number of radiating straight lines giving the relation between T and $l \div s$ for various values of l becomes a very simple matter.

METHOD OF DRAWING THE DIAGRAMS.

The diagram A, Fig. 4, gives the relation between the length of wire, expressed as a percentage of the span l, and the ratio of $m = l \div s$. This relation is independent of the material of the wire and of the load, provided the load is uniformly distributed. It is derived from the formula (5).

Let L_o = percentage amount by which length of conductor differs from length of span, then

$$L_o = \frac{8\,s^2}{3\,l} \times \frac{100}{l}$$

and putting m for the value $l \div s$ we get

$$L_o = 800 \div 3\,m^2 \qquad (8)$$

by means of which the curve A can readily be plotted with m measured horizontally and L_o or $100 + L_o$ vertically. The vertical scale indicating the length should include values of L less than the span l because the length of wire if all tension is supposed to be removed will frequently be less than the length of span. This curve (A) should actually be drawn on transparent paper so that it can be placed over the second diagram.

In plotting diagram B, Fig. 5, the horizontal divisions representing the ratio m must obviously correspond exactly with the scale adopted for diagram A.

To divide correctly the vertical scale representing tension in pounds per square inch of cross-section use is made of formula (6) for determining the increase in length due to elastic stretching, but the percentage increase is $100\,T_a \div M$ and the scale of the tension T_a will depend upon the elastic modulus M, and, therefore, on the material. For stranded aluminum conductors a stress of 3000 lb. per square inch will produce an elongation of approximately ¼ per cent.

In order to plot the curves for various spans (all of which are straight lines radiating from a common center) use is made of the relation $T_a = kl^2 \div s$, which is the original formula (4), where $n = 1$, and if m be substituted for $l \div s$ there is obtained

$$T_a = m \times k \times l \qquad (9)$$

In regard to the scale for temperature rise, which may conveniently form a continuation of the tension scale below the datum line, use can be made of formula (7), but the percentage increase is $100 \times a \times t$, and the scale for temperature rise will depend upon the coefficient of expansion a and, therefore, on the material. For aluminum a rise of temperature of 55 deg. Fahr. will produce an increase in length of approximately 0.07 per cent.

METHOD OF USING THE DIAGRAMS.

The use of the diagrams is best illustrated by an example. Let particulars of line be as follows:

Span = 200 ft.

Conductors, No. 3-0 B. & S. gage stranded aluminum.

Lowest expected winter temperature = —20 deg. Fahr.

Ice coating, 0.5 in. thick.

Limiting safe stress, $T_a = 13{,}000$.

Maximum wind velocity = 60 miles per hour (which may occur simultaneously with the maximum ice load).

It is required to determine the sag and tension at a temperature of 60 deg. Fahr. when no wind is blowing and the conductor is subject to its own weight only.

From the diagram, Fig. 3, it is found that the multiplier n for $V^2 = 3600$ is 8.7, and by transposing formula (4) there is obtained

$$m = l \div s = T_a \div (k \times n \times l)$$

$$= \frac{13{,}000}{0.147 \times 8.7 \times 200} = 50.8$$

which corresponds to a length of 100.104 per cent as read off curve (A) or calculated by formula (5). Place 100.104 of the (transparent) diagram A over the mark corresponding to a tension of 13,000 kilo-lb. on diagram B and under the zero point of the tension scale will be found the length 99.93, which is the length (expressed as percentage of span) which the conductor would have at the lowest temperature if all tension were removed. At a temperature of 60 deg. Fahr. the rise of temperature over lowest winter temperature is $60 + 20 = 80$ deg. Place the division for length 99.93 over the mark for temperature 80 and the point on the length scale of diagram A which lies on the datum line of diagram B indicates the length which the wire would have at 80 deg. Fahr. if there were no mechanical stress. (In this example the length would be 100.032.) Observe now where the curve on diagram A crosses the span line marked 200 on diagram B and read off the value $m = 68$ (nearly), giving sag $= 200 \div 68 = 2.94$ ft. and $T_a = 2000$, giving $T = 2000 \times 0.1318 = 263.6$ lb., where 0.1318 is the cross-sectional area of a No. 3-0 conductor. This tension of 263.6 lb. is approximately the pull which should be indicated on a dynamometer if the conductors are being strung at a temperature of 60 deg. Fahr. and there is no wind blowing. If there is only a slight wind blowing at the time of erection the increased tension required is negligible; if the wind amounts to what in nautical terms would be described as a "strong breeze" (34 miles per hour), the multiplier n as read off diagram Fig. 2 is only 1.25 for a No. 3-0 aluminium cable. If, however, the stringing of the conductors were to be carried on in so strong a wind blowing across the length of the line the required tension and sag could easily be read off the diagrams without moving their relative positions. It is merely necessary to read the tension and sag values corresponding to an assumed span of $200 \times 1.25 = 250$ ft. instead of the actual span of 200 ft. The results for the same temperature rise (80 deg.) with an estimated wind velocity of 34 miles per hour would be $m = 65$, giving a sag $= 200 \div 65 = 3.08$ ft., and $T_a = 2400$, making the required pull on a dynamometer $T = 2400 \times 0.1318 = 316$ lb.

The reason for this method of correcting for wind pressure or load on wires will be clear when it is remembered that the law connecting tension T_a and ratio m is no longer

$$T_a = m \times k \times l$$

but

$$T_a = m \times k \times l \times n$$

and the effect of multiplying T_a by n is obtained by assuming a value for l which is n times as large as the actual span.

THE PRODUCTION AND UTILIZATION OF OZONE IN EUROPE.

Description of Various Kinds of Ozonizing Apparatus—Use of Ozone for Purification of Water and Air—Cost of Ventilation and Air Purification.

By John B. C. Kershaw.

OZONE is an allotropic modification of oxygen and possesses the chemical properties of the latter in a peculiarly active form, due to the fact that in the ozone molecule three atoms of oxygen are present in the space that usually holds two.

Ozone can be produced in various ways: (1) By the action of phosphorus upon moist air; (2) by the action of strong sulphuric acid upon potassium permanganate; (3) by the electrolysis of water, and (4) by the discharge of high-potential electricity through dry air. For practical purposes the last-named method is the only one employed for the production of ozone. Within the last ten years considerable improvements have been made in design of ozonizing apparatus and in the methods of application of this gas to numerous purposes. Removal of the dust and moisture from the air and of the suspended or chemical impurities from the water is an essential preliminary to the successful use of ozone.

The various types of machines now made for the production of ozone by the silent electric discharge are in many cases improved forms of the first type of apparatus constructed by Werner von Siemens in the year 1875. This Siemens ozonizer consisted of two concentric glass tubes, one slightly larger than the other, coated with tinfoil on the external and internal faces respectively. The two coatings were connected with the two poles of a high-potential electrical machine, and a current of dry air was passed along the annular space between the two glass tubes. Under these conditions ozone was produced, the amount being dependent upon rapid withdrawal of the air to avoid heating and upon the absence of sparking.

The following are the more important modifications of this original design of ozonizing apparatus, all the forms named being in actual use to-day in Europe for domestic or industrial purposes.

Siemens & Halske Ozonizers.—The ozonizer manufactured by this firm still keeps closely in design to the original invention of Werner von Siemens. It is of the tube type and the air current is passed along an annular space, in which the high-tension electrical discharge occurs. One glass tube has, however, been dispensed with, and an internal metal cylinder, separated by a slightly larger glass tub from the external cylinder of tinfoil, forms the ozonizin unit in each apparatus. The outer cylinder of the apparatu is surrounded with water, in order to keep down the tem perature, and all the external parts are kept at the earth p tential to reduce risks from shock.

Otto's Ozonizer.—The early form of the Otto ozonize was based upon the use of rotating-disk electrodes whic were provided with segmental openings by means of whic any sparking that might occur was stopped before it ha done much harm. Otto in his latest form of ozonize however, has adopted glass as dielectric, and his apparatu now consists of a series of sheets of glass, coated on alter nate sides with tinfoil and separated by narrow strips c insulating material which allow an air-space between eac adjacent sheet of glass.

Although plates of glass are used in place of tubes, th principle of this ozonizer is the same as that of the Siemer apparatus.

Rosenberg's Ozonizer.—This type of ozonizer diffe from the preceding two in that glass is replaced by m canite and the continuous sheets of tinfoil or other met which form the electrodes are replaced by copper or a

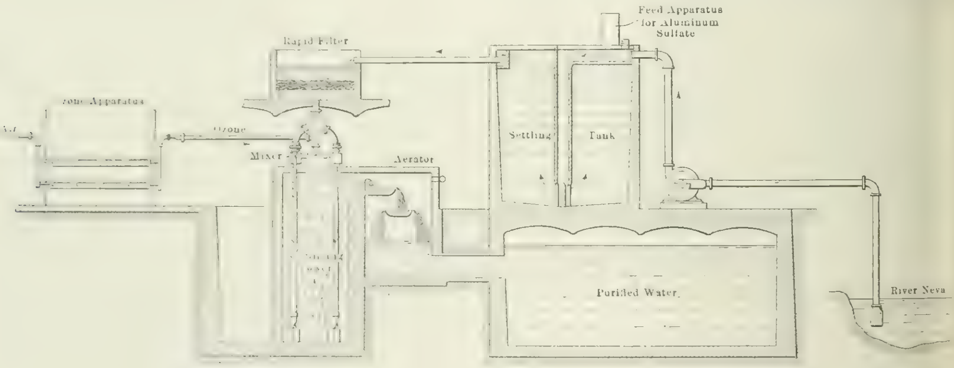


Fig. 1—Sectional Diagram of the Water-Purification Plant at St. Petersburg, Russia.

aluminum-alloy gauze of forty meshes to the inch. Ea complete element of the apparatus consists of a thin sh of micanite covered upon each side by a square of t gauze. The air is caused to pass by means of baffle pla over a series of three or more of these ozonizing elemen and the electrical discharge at 4500 volts takes place in air under treatment, without the presence of sparking. T absence of sparking under these conditions is said to be to the large number of rounded projections of the ga from which the discharge occurs, 230,400 to every squ foot of ozonizing surface, or 900,000 for the usual size the apparatus. The Rosenberg ozonizer is made in vari sizes and forms and is manufactured and sold by "Ozona Ltd., a London company.

De Fries' Ozonizer.—This ozonizer resembles that Rosenberg in the absence of any solid dielectric, each or unit being formed of a horizontal brass trough fit with a plate-glass cover and provided with an extern water-jacket. This trough is earthed and forms one p of the apparatus. Half-disks of brass with serrated edg are suspended from the glass cover at equal distances al g the length of the trough and form the other pole of e apparatus. When connected to a source of electricity at 2000 volts a silent electric discharge occurs between the sharp points of the semi-circular high tension poles a the inner water-cooled surface of the brass trough; and the air circulating through the trough is ozonized a it passes across the 4-in. space that separates the two ec- trodes.

Vosmaer's Ozonizer.—This ozonizer is another type in hich glass is dispensed with, the silent discharge being roduced by a series of points against a flat surface electrode. In this ozonizer sparking is prevented by special ectrical devices. Each tube contains one flat and one ointed electrode, held at a fixed distance apart by porce- stems and forks. The ozonizer consists of a number

Fig. 2—Settling Tanks and Rapid Filters at St. Petersburg.

these tubes grouped together on the feed-water prin-

YIELDS.

As regards the yield of ozone, it can be calculated from thermochemical data that 1 hp-hour ought to yield 1200 grams. The best yield that has come under the writer's notice for the ozonizers described above is 184 grams per electrical hp-hour (for the Rosenberg type of apparatus); an average figure is about 100 grams or 10 per cent of the theoretical. The cost of producing this ozone depends largely upon the cost at which electrical energy can be supplied; the standing and running charges of an ozone-generating plant, apart from this item of energy cost, are moderate and need not be considered here. Taking the cost of the kw-hour at 3 cents, the energy required to produce 1000 grams of ozone will cost 6 cents when using the most efficient type of ozonizer and double or this amount when using less satisfactory forms of apparatus.

WATER PURIFICATION.

most important application of ozone is for the pur-

Weisbaden (1901), 1,320,000 gal. per day (used only as reserve supply).

Paderborn (1902), 660,000 gal. per day.

Hermannstadt (1909), 880,000 gal. per day.

St. Petersburg (1910), two plants, 2,640,000 gal. per day and 9,900,000 gal. per day respectively.

Florence (1911), 1,100,000 gal. per day.

Fig. 3—Ozonizing Plant at St. Petersburg.

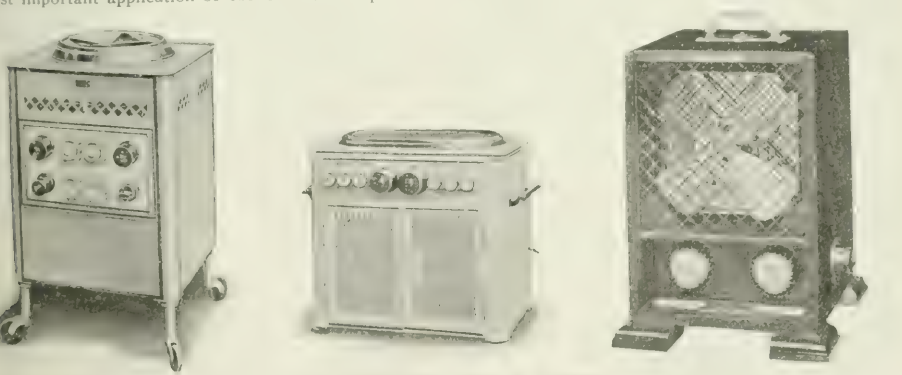
In addition to the above, works of this character are now being erected for the municipalities of Paris, Chemnitz and Rovigo. A large number of private installations have been supplied, among those being Cambridge University.

The St. Petersburg plant is the largest and most important for water purification by means of ozone. It comprises 128 sets of ozonizing apparatus and five sterilization towers and supplies a district of the city consuming 11,000,000 gal. per day. The water is taken directly from the River Neva and the results so far are considered quite satisfactory. Figs. 1, 2 and 3 show various portions of the St. Petersburg works.

As regards other ozonizers used for water purification, the de Fries apparatus is installed at the water purification works at St. Maur, near Paris. This installation has a capacity of 6,000,000 gal. per day.

At Chartres and at Nice the Otto ozonizer is used, the first-named works having a capacity of 1,325,000 gal. per day and those at Nice a capacity of 10,000,000 gal. per day.

In the United Kingdom the purification of water by means of ozone has not been applied by any public au-



Figs. 4, 5 and 6—Various Kinds of Ozonizers.

of water purification, quite a large number of installations of this character being now in operation in Europe.

he Siemens & Halske Company reports the following works in operation:

thority; and the installation at Cambridge University is the only one in operation known to the writer. Ozonair, Ltd., manufacturer of ozonizers, states, however, that it has orders for three installations on hand, one of these being for a town in the north of England.

Small portable water-sterilization plants for domestic and camp use are now being supplied by several firms, including the Siemens & Schuckert Company, the Lahmeyer Electrical Company, and Ozonair, Ltd., of London. These forms of water-sterilization apparatus are complete in themselves, and all that they require for operation is connection to an electric circuit and to the water-supply mains or pipes.

AIR PURIFICATION AND VENTILATION.

The peculiar smell observed when a static electrical plate machine is worked is due to the formation of ozone. This gas is also formed naturally during thunderstorms and in some unexplained way by the action of the sun and tides on long stretches of sandy shore and by the movement of clouds and air around mountain summits. In all these cases it is supposed a silent discharge of electricity occurs through the air and ozone is then produced in large or small amounts, according to the surrounding conditions. The amount of ozone found in the air is never great, but, when one considers the extent of the atmosphere, the total amount of ozone formed by natural agencies, under favorable conditions, must be exceedingly large. Ozone can always be detected by its peculiar odor in the air at many seaside and mountain resorts, and the invigorating character of these places is generally ascribed to the continual presence of this gas.

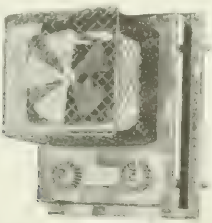


Fig. 7—Ozonair Apparatus for Air Purification.

Although it is quite impossible by artificial means to give the air of closed and crowded halls or rooms the freshness and bracing characteristics of the air of health resorts, there is no doubt whatever that much more might be effected in this direction than is yet attempted. By the installation of more efficient systems of ventilation and air purification, the fetid and germ-laden air which we at times have to breathe in crowded street cars, motor 'buses, railway cars, theaters, concert halls and other public places and buildings might be rendered far less poisonous and dangerous.

The ozone when produced by artificial means, in foul air, acts in two ways. As a concentrated form of oxygen it restores the balance between the oxygen and the inert or useless gases of the atmosphere and thus renders breathing easier, particularly for those affected with any heart, bronchial or lung troubles. Its more important services are, however, as a most active oxidizing agent and as a germicide. The minute particles of organic matter floating in the air of all places and buildings crowded with people (due to the exhalations from lungs and bodies) are rendered harmless by ozone, while a large number of bacteria and disease-producing germs are also rendered inactive or killed by this gas.

The purpose of this article is not to deal with systems of ventilation, though many of those at present in use provide a fine field for the application of scientific principles and for the installation of electrical machinery. The installation of one or more electric fans, churning up air already foul and creating drafts where they are least wanted, is not "scientific ventilation," but the reverse; and the sooner this is recognized the better for all concerned. The first essential of all systems of ventilation is that they shall substitute pure air for foul. Although the recognition o this fact has been long delayed, its significance and trutl appear to have been at least realized in Europe and th progress which has been made in recent years with mor scientific systems of air purification and ventilation ha been considerable.

The writer believes that in time no public vehicle o building will be considered well equipped unless provide with adequate and efficient ventilating and air-purifying apparatus.

In Germany the well-known firm of Siemens & Halsk is making a specialty of this kind of installations and ha brought out several designs and sizes of ozonizer for ai purification and ventilating purposes.

Figs. 4 and 5 show the forms used for ventilating pur poses. In a recent publication relating to this applicatio Messrs. Siemens & Halske give a list of thirty-four larg installations of ozonizers for ventilation and air purificatic in Berlin and other places in Europe, the list including tl German parliament house, the town hall at Amsterdam, tl freezing chambers of the slaughter houses at Cologne, Düsseldorf, Potsdam and Erfurt, and a number of theater concert halls, hotels, banks, etc. The largest of these i stallations is that of the German parliament house at Berli which supplies 200,000 cu. m (7,070,000 cu. ft.) per hou The ice skating rink at the Admiral Palats, Berlin, another big installation, producing 30,000 cu. m (1,060,5 cu. ft.) purified air per hour.

The "Playing Hall" at the Monte Carlo Casino is, how ever, likely to be better known in the United States th either of the above. An ozonizer installation, producii 2,121,000 cu. ft. of purified air per hour, is attached this hall.

The Rosenberg ozonizer, previously described and show in Figs. 6 and 7, is made by Ozonair, Ltd., Londc This company gives a list of twenty-six installations its ozonizers and apparatus for air purification in t United Kingdom and it also states that a large numb of equipments are shipped to clients in the colonies a abroad. Among the list of London users are the follo ing: D. H. Evans & Company, Oxford Street; Lloyds, t Royal Exchange, His Majesty's Theatre, the Piccadi Hotel and the Royal Courts of Justice.

COST OF AIR PURIFICATION.

As regards the working costs of the two systems of purification described above, Messrs. Siemens & Hal state that the electrical energy required for an ozonizer p ducing 1000 cu. m to 5000 cu. m (35,000 cu. ft. to 175, cu. ft.) air per hour ranges between 30 watts and 150 wa and that a complete ventilating equipment, including fan, for a building requiring 21,000 cu. ft. of puri air per hour would take 175 watts. Ozonair, Ltd., gives watts and 130 watts as the power required for installati s producing 30,000 cu. ft. and 60,000 cu. ft. purified air hour respectively.

The energy consumption decreases with the size, an complete equipment yielding 189,000 cu. ft. of ozonized per hour will require a power of only 590 watts.

These figures do not apply to the calculations of cos the actual ozone, as the cost of concentration of ozon the treated air is not stated. They show, however, that e cost of the air purification by means of ozone is not o hibitive and that in view of the benefits which may e obtained the cost is trifling.

It is important that the air should be filtered and d ed before passing into the ozonizer, and some of the fail es that have been experienced in the past have been du to neglect in this respect.

The absence of nitrogen oxides from the ozonized a is also imperative, since these oxides have a very har ul effect upon the mucous membrane of the nose and bron ial tubes.

ADDITIONAL CONDENSER TO IMPROVE PERFORMANCE OF STEAM TURBINE.

The St. Joseph (Mo.) Railway & Light Company has in operation a 1500-kw, two-stage vertical turbo-generator set, the steam consumption of which has proved excessive. This unit was one of the early models built and is believed to present so much clearance between its rotating and stationary parts that considerable steam leaks through without performing useful work. The presence of this surplus steam has been more than the 3200-sq. ft. surface condenser can handle at full load, so that the vacuum pressure has sometimes fallen as low as 22 in. to 24 in. of mercury, contributing further to the low efficiency of the unit.

To insure a good vacuum, improving the turbine's operation to this extent at least, the company is now providing the unit with a second condenser, which will have an area of 2000 sq. ft. This condenser is being connected to the former free-exhaust line, the relief valve having been removed and replaced at the far end of the new condenser. In case of pressure rise in the exhaust line the relief valve will thus permit the steam to exhaust through this second condenser and out into the atmosphere. In normal operation the 1500-kw turbine will in this way be served with a total of 5200 sq. ft. of condenser surface, which is expected to maintain a satisfactory vacuum at full load.

Cooling water for the condensers in the St. Joseph plant is supplied on a syphon-return system by motor-driven centrifugal pumps located in the pump house on the river bank, 600 ft. from the station. The two pumps, one 10 in. and the other 15 in., are controlled from the plant. The pipeline is 18 in. in diameter and is fitted with expansion joints.

Central Station
Management, Policies and Commercial Methods

CHURCH CONGREGATION RAISES FUND FOR ELECTRIC SIGN.

Recognizing the advantage of advertising its services according to the same successful methods used by local mercantile establishments, the congregation of the First Presbyterian Church of Joplin, Mo., has set about raising a fund of $500 for the purchase of an electric sign. The amount is being obtained by subscription among the members, and the sign, bearing the words "The Presbyterian Church," will be installed across the sidewalk in front of the edifice. "Churches, the same as commercial enterprises, should be advertised," declares Mr. James M. Evans, president of the local Presbyterian organization.

REMOTE MOTOR-OPERATED PUMP FOR BREWERY WATER SUPPLY.

The extreme flexibility of motor drive above all other forms of motive power is once again pointed out by a Louisville industrial pumping installation which furnishes water from a well of special quality to a brewery 3040 ft. distant. This brewery is located on the dry bed of Ballard's Creek, from which its supply was formerly obtained, but with the use of the creek water for other industrial purposes at points above, recourse was had to the well above mentioned, the water of which is found especially valuable for use about the brewing plant. This water is raised by an air lift and is then conveyed the 3040 ft. from the well to the brewery by a 15-hp, three-phase induction motor-driven centrifugal pump, capable of delivering 200 gal. per minute. Service is supplied from the lines of the Kentucky Electric Company.

MARSH DRAINAGE BY ELECTRICITY.

What is known as the Pekin and La Marsh Drainage District consists of about 2500 acres of land along the Illinois River, near Pekin, Ill., and protected from overflow by a dike on the river bank running back to the bluffs at both ends of the district. This area is in charge of drainage commissioners who drain the land and keep it in condition for cultivation by pumping the water from the inclosure over the dike into the river. Thus at all stages of the river the land is available for agriculture. The first pumping plant in connection with this drainage system was driven by steam engines, but, as the cost proved too high, the engines were superseded by gas engines supplied from a producer plant. After a year's service the gas-engine equipment was in its turn replaced by electric motors supplied with energy by the Citizens' Gas & Electric Company, of Pekin, which is controlled by the Peoria Gas & Electric Company. The plant of the Pekin company is located on the opposite side of the river, and but a short distance from the pumping station. Since the electric motors were installed no trouble has been experienced in keeping the water out of the drainage district.

TRIAL OF LAMP-POSTS ON ONLY ONE SIDE OF STREET.

An interesting experiment was recently made in Chicago by the South Park Improvement Association and the University of Chicago on street lighting along Lexington Avenue, adjoining the university grounds. Some temporary removable lamp-posts were erected, each with a 250-watt tungsten lamp in an opal globe. These posts were first placed 125 ft. apart along the curb on one side of the street only. The general effect obtained in this way was noted, and then the installation was changed so as to place lamps on alternate sides of the street, using the same spacing of one post for every 125 linear ft. of street. It was the unanimous decision of an inspection committee of eight, consisting of engineers and others, that, in general effect and usefulness on residence streets, having the lamp-posts all on one side of the street was better than alternating them. This was largely owing to the greater contrast between illumination around the lamp and midway between which resulted when the lamps were on alternate sides of the street. The cost of underground installation per mile of street is, of course, much less with the lamps all on one side.

TECHNICAL TERMS TO BE KEPT IN THE BACKGROUND IN SELLING.

In a recent address before the Milwaukee Electric Railway & Light Company Section of the National Electric Light Association Mr. Egbert Douglas, commercial engineer of the company, made some interesting observations on selling electricity for lighting. In order to get an audience, said Mr. Douglas, the solicitor must be "on to the

curves" of a successful salesman. He cannot open doors by announcing that he is Mr. Kilowatt. The speaker went on to say:

"In talking with a prospective customer one must be guarded in using technical terms, because usually they are unintelligible and therefore tiresome. To explain in an offhand way the meaning of a technical term which you use is a courtesy you owe to your prospective customer. If he is familiar with it he will at once give a reply that indicates as much. You are on safe ground thereafter. Much of the mystery which surrounds the use of electricity is due to the fact that the contact of the public has been too much with technical men. The job has been over-engineered. The endeavor of a salesman should be to strip his proposition of all technical language, as far as possible, and to define those terms which he must use in stating his proposition."

THE "FRICTIONLESS" TREE-TRIMMING SEASON.

In some parts of the country the early part of the fall of 1911 seems to have given an unusual amount of trouble from trees growing into contact with electric wires. This has probably been due to the rapid growth following plentiful rainfall after a drought. At any rate some electric-service companies have had difficulty in trimming trees away from their lines fast enough to keep ahead of the growth. In addition to the natural difficulties encountered in keeping clear of tree branches and twigs there is the ever present artificial difficulty, viz., the objection of the property owner to having his trees trimmed. In some cities and towns the trimming of trees on the public streets is a matter under the charge of some city officer or committee of the Council independent of the property owner. In either event the trimming of trees is a matter to tax to the limit the diplomacy of the public-service company manager and he should see to it that the task is not entirely given over to linemen with more zeal than tact. Unless the head lineman is possessed of unusual tact it is best for the manager of the small company, or some special representative in case of the large company, to go in advance of the tree-trimming gang and arrange with the property owners. It is sometimes the case that by volunteering to do some additional tree trimming besides that immediately around the wires permission to trim will be readily obtained where otherwise it would be withheld. While this adds to the work of tree trimming it doubtless pays because of its effect on public good-will.

Another thing it is well to remember is that the season of "frictionless" tree trimming is when the leaves are off the trees. The average property owner will object much less to tree trimming at such times than during the summer, when he feels that he wants all the shade it is possible to get and resents having any little portion taken away.

OMAHA'S CURBSIDE FEEDER TIE SWITCH.

With the exception of a 500-volt "power" circuit, the downtown central-station service of Omaha, Neb., is all alternating current, supplied through manhole transformers from 2300-volt feeder lines carried underground through the alleys of the business section. These feeders thus run parallel at one-block distances through the underground district and are numbered according to the "hundreds" of the house numbers in the blocks which they cut.

As a precautionary measure, so as to assure partial service at least in districts served by a feeder that has burned out or grounded, all of the feeders are intercepted along the main street by a crosstown emergency tie feeder, through which, by switches at the curbs, any damaged feeder can be energized after its damaged section has been isolated by other curbside switches. This distribution arrangement is best shown by the accompanying sketch, Fig. 1. Into each of the alley feeders curb-side oil switches of the type illustrated in Fig. 2 are inserted at the intersection of their respective alleys with Ninth and Fourteenth Streets. These switches are normally kept closed. The

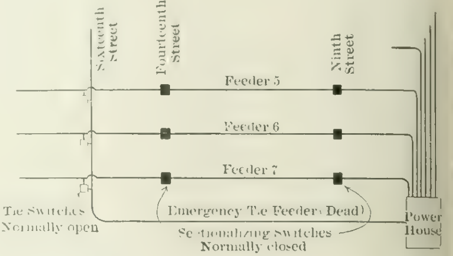


Fig. 1—Scheme of Feeder Layout in Underground District, Omaha

emergency tie feeder crosses the seven alley feeders a Sixteenth Street, in the heart of the business section, an at each such intersection taps from both lines are brough up to similar "tie" curb switches. These switches are nor mally kept open.

The alley feeders are only single-phase circuits, but th tie feeder (which is ordinarily held "dead" as a guar against damage) is a three-phase 250,000-circ. mil lead and-paper-covered cable, taps from its phases being brougl up to the tie switches corresponding to the phase of th feeder to be connected.

One of the 2300-volt curb-switch pedestals is shown i Fig. 2. The switch itself is a standard 6600-volt type, oi break, two-pole device, operated by an arm-handle, th position of which indicates whether the switch is open c closed. The pedestal cabinets in which these feed switches are mounted are of cast iron and measure over a about 5 ft. in height. They are, however, in little evidenc to the casual passer-by. Indeed, one may spend sever days in Omaha without noticing the presence of th

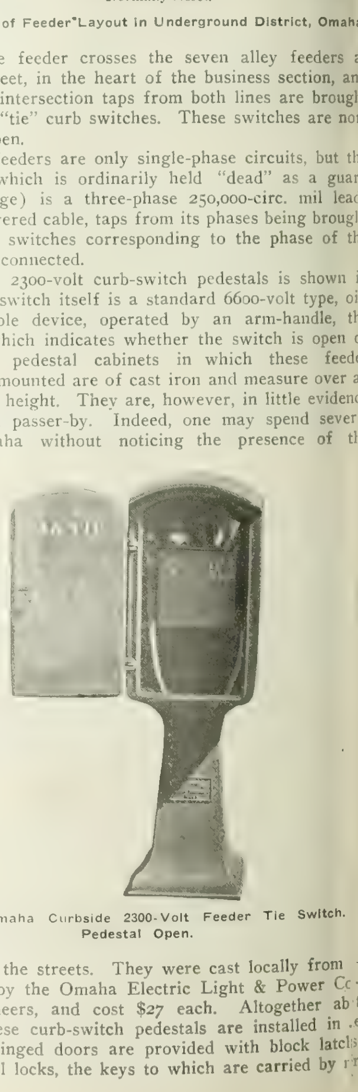


Fig. 2—Omaha Curbside 2300-Volt Feeder Tie Switch. Pedestal Open.

pedestals on the streets. They were cast locally from signs made by the Omaha Electric Light & Power Co pany's engineers, and cost $27 each. Altogether ab t thirty of these curb-switch pedestals are installed in e city. The hinged doors are provided with block latch, beside special locks, the keys to which are carried by n

f the company's underground department. A tag attached) each switch handle describes the location of the switch, gether with its normal position, whether open or closed. he switch photographed in Fig. 2 was, as shown by the enciling, the emergency tie connection between the tie

Fig. 3—Switch Pedestal in Business Section.

eder and alley feeder No. 4, the latter tap being brought on the left and the emergency tap on the right of the oil itch. This clear labeling at once informs any company presentative unfamiliar with the lines of the position all parts.

The practical use of the feeder switches will be clear om the sketch. If a feeder, for instance, goes bad be-een Fourteenth Street and Ninth Street the section can cut out by opening the two switches at these points. eanwhile the emergency feeder is energized and the itch connecting it with the circuit in trouble is closed, storing service to all parts of the feeder not directly volved in the breakdown. A similar system of emer-ncy switches has been carried out on the overhead-pole of the Omaha company and is found to be very valu- in maintaining partial service during injury and re- to a feeder circuit.

ECTRICITY IN SAN FRANCISCO'S "CHINATOWN."

the rehabilitation of the celebrated quarter of San cisco known as Chinatown electricity is accomplish- t a little in the way of improving conditions of nation and power utilization. Since the almost total ction of this noted section of the city by the fire succeeded the great earthquake of 1906, both Occi- and Oriental enterprise have been hard at work in rnizing the district. Many new and attractive mer- e buildings have been erected and equipped with gas lectric lighting; electric power is gradually being in- d in small shops which formerly depended wholly manual labor; and the telephone's popularity has me so great that one of the chief sights of Chinatown small exchange housed in a pagoda type of building, Chinese operators and supervision. Even the inner- throne room of the powerful Chinese Benevolent As-siation is equipped with a portable private telephone vich connects the ruling authorities of the district with t outside world.

Practically all the electricity supplied to Chinatown is nished by the local central-station systems of San Fran-cso. Both the Pacific Gas & Electric Company and the y Electric Company of San Francisco are actively engaged in securing new business, the former company in particular having on its staff a highly skilled Chinese gas and electric solicitor who works the territory in close association with the American solicitor having immediate supervision of the Chinese quarter. The present Chinese solicitor is Mr. Lee Ling, an experienced interpreter who

Fig. 1—Motor-Driven Noodle Factory.

is specially posted on the commercial phases of central-station service and who acts as an informal information bureau, court of appeal and emergency representative of the operating department.

The attractions of Chinatown as a center of tourist interest are so great that electric-sign and outline lighting

Fig. 2—Motor-Driven Sewing Machines.

are coming into rapid utilization. The accompanying photograph shows the extent to which advanced methods of window and outline lighting have been established in the Grant Avenue and Dupont Street section. The large mercantile retail house of the Sing Fat Company, shown at

the left of the illustration, is equipped with 1341 13-watt incandescent lamps for exterior illumination, 396 50-watt lamps and sixteen 26-watt lamps for interior illumination. A 10-hp electric elevator is also operated in this establishment, and six 5-amp arc lamps are in regular service. The Sing Chong Company, a wholesale and retail house in the same district, operates nightly 2500 13-watt lamps, ten Nernst lamps of the four-glower size and 12½ hp in electric motors. The Canton Bazaar operates 802 13-watt lamps on the outside of the building and 360 lamps of from 7 watts to 25 watts rating elsewhere. The outline lighting of the pagodas of these establishments is the source of many favorable comments from tourists seeing Chinatown during the evening, and the business is attractive from the central-station point of view on account of its protracted character, the season being practically continuous throughout the year and the demand well sustained through the evening hours. Electric signs are used to a considerable extent by Chinese restaurants in advertising chop suey and other gastronomic attractions peculiar

Fig. 3—Electric Lighting in Chinatown, San Francisco.

to the district. Street lighting by grouped installations of tungsten lamps mounted on iron poles with translucent globes has also attained some favor in the better-lighted portion of Chinatown.

The use of electric motors in Chinatown is at present confined largely to the operation of sewing machines and to the running of machinery in noodle factories. At present there are about a dozen factories in Chinatown for the production of underwear, overalls and miscellaneous clothing. In a representative shop twenty-eight sewing machines are belt-driven in two groups by two 2-hp, 220-volt, three-phase induction motors mounted on a platform in the basement below the sewing-room, all the wiring being in conduit, with condulet fittings and inclosed fuses. In another shop of the same character producing forty dozen pairs of overalls daily sixteen sewing machines are belt-driven by a 2-hp, 220-volt, direct-current motor, a 3-hp motor being used in driving two buttonhole machines. Conduit wiring is also used in this installation.

At the Canton noodle factory a 2-hp, 220-volt induction motor drives on the group plan a dough-mixer, a rolle and a noodle machine, the motor being located in the base ment and controlled by a starting switch in the machine room. Probably the largest noodle factory in Chinatow is the San Francisco branch of the Hong Kong noodl factory, which is equipped with a dough-mixer, cutter an two noodle machines, belt-driven through a countershaf from a 5-hp, 220-volt induction motor mounted on a plat form above the level of the operators' heads. The long hour operation of these factories renders them desirabl customers of central-station service, since the revenu derived from even a small motor operated for many hour daily tends to exceed that secured from a larger plant ru intermittently. The prevailing opinion that many dar mysteries may be found in Chinese food products of th simpler type is soon dispelled by a visit to one of the motor-driven establishments, in which the cleanliness of th electric drive is a factor which appeals forcibly to th proprietors apart from its value as a source of steady an economical motive power.

Wiring and Illumination

DISADVANTAGE OF GAS-LIGHTING IN THE MATTER OF HEAT.

Addressing the Milwaukee Company Section of the N. L. A. at a recent meeting, Mr. Egbert Douglas, sales ma ager of the Milwaukee Electric Railway & Light Compan gave as one reason for the superiority of electricity in co petition with gas for lighting the fact that the form radiates only about one-eighth as much heat for the sar quantity of illumination. In a store the heat of gas "arc is sufficient to raise the temperature from 3 to 5 deg., a this in summer has a marked effect in diminishing t number of customers entering the store. If the net mont profits are $200 a month they will be reduced $20 a mon if one person in ten avoids the store owing to the heat the gas lamps. Obviously, therefore, electric light is wo $20 more a month than gas. It may be assumed also th the effect of diminished sales will continue through t whole year, for it is reasonable to suppose that those w avoid the gas-lighted store will acquire the habit of buyi elsewhere. Speaking of the effect of high temperature sales, Mr. Douglas mentioned the fact that the soda fo tain which does the most business in a certain city cools store by using about four times as much energy for elect fans as the average soda fountain.

CONDUIT WIRING TO BE REQUIRED IN BUIL INGS OF CERTAIN CLASSES IN PITTSBURGH

The Department of Public Safety, Bureau of Electric of the city of Pittsburgh, Pa., has just issued, in the fo of a circular letter, a supplement to Rule No. 24, page of the Pittsburgh Wiring Manual of 1910, which modi s the existing requirements affecting the method of instal g wiring in certain classes of buildings. It also makes a w regulation regarding the locating of switches in sch ol buildings. The text of the letter is as follows:

"On and after Dec. 1, 1911, all buildings used r schools, auditoriums, churches, places of amusem it, garages, storerooms, storeroom-dwellings, apartments, w e-houses, office buildings and places of business must ve wiring installed with rigid conduit, flexible steel condu or armored conductors with the necessary fittings, inclu ng outlet boxes, condulets, bushings, lock-nut and all c er fittings necessary to make a complete and perfect jo of

onduit installation. In places where the work is exposed ıetal molding with approved fittings will be allowed.

"In all buildings used for school purposes switches conrolling each circuit must be placed on the tablet board; aid tablet boards must be placed in hall on each floor and ıust contain the requisite number of switches controlling ımps in each room on said floor."

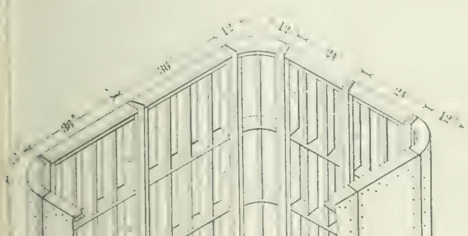
It is understood that the placing of switches on tablet oards in school building halls is to be required, so that the witches will be inaccessible to the school children. Some ifficulties have been experienced in the past due to the oungsters playing with the switches.

FORM FOR BUILDING CONCRETE MANHOLES.

By W. P. Munger.

As the building of concrete manholes becomes more gen-al engineers are confronted with the problem of forms. a special form is built up for each manhole the cost is gh, and if a standard form is made, so as to make all anholes of the same size, some manholes will be alto-ther too small for the cables entering them and the trans-ırmers they must hold.

To meet this demand of adaptability, low first cost, low st of operation and maintenance, the form shown was signed and used on some recent conduit installations. he form is built up of four kinds of members, 3-ft. side eces, 2-ft. side pieces, corner pieces and wedges, all of the embers when in place being 8 ft. tall. The 3-ft. and 2-ft. de pieces are made of a framework composed of ⅞-in. by in. dressed pine, securely nailed and covered with No. 24 ge galvanized iron nailed on with galvanized nails. The



Form for Concrete Manhole.

cner pieces are similarly constructed, except that the cering is bent to 12-in. radius, so as to give round corners in the finished manholes. The wedges have a 1-in. face a 1½-in. back and are drilled with 7/16-in. holes to mch those drilled in the corner and side pieces. For asmbling in the hole sufficient ⅜-in. by 6½-in. carriage bts, with thumb nuts and washers, are provided to bolt ea member to each of its neighbors four times. For asmbling there must also be provided sufficient braces, bt as they can be used again and again their cost is ngligible.

In using these forms, which are set up and taken down by common labor, it was found that the wedges became so tightly bound that the men removed them with picks, and several wedges were destroyed in this manner. The cost of new wedges is small, however.

By properly choosing the units the sides of manholes having a floor area of from 4 ft. by 4 ft. to 12 ft. by 12 ft. (by even feet) can be poured.

ILLUMINATION FOR READING REQUIRED BY DIFFERENT EYES.

By J. R. Cravath

In a paper before the last convention of the Illuminating Engineering Society, at Chicago, in October, 1911, the writer reported the results of tests on twelve different persons or "subjects" to determine the amount of light required for reading under several different conditions. While those tests were primarily for the purpose of determining the influence of different lighting systems and surroundings upon the light required, they were also intended to show the variations between different individuals, which must be provided for in practice when designing the illumination system of any large office space used by a number of persons. For the benefit of those not familiar with that paper it may be said that the tests failed to reveal any decided difference in the illumination required with direct as against indirect lighting for medium-sized office spaces under ordinary commercial working conditions. The results effectually disproved the theory which has been held by some that more illumination is required with ordinary commercial indirect lighting than with a direct-lighting system. The tests further indicated very strongly that the glare received from the paper which was being read obtruded itself in such an annoying manner that in most cases it caused the subjects under test to call for more light than was called for under less annoying conditions. Yet under none of the conditions in these tests was the glare sufficient to be distinctly noticeable or to prevent reading.

Glare from paper is more or less present with both direct and indirect systems, but the more diffuse the illumination and the smaller the amount of light received on the paper from one direction the less the amount of annoying glare which it is possible to receive from the paper. Less trouble from glare from the paper is therefore likely to be experienced with indirect diffused lighting systems and with direct lighting from a large number of scattered small units than with those in which a considerable portion of the light at any point is received from one direction. It is, of course, true that it is quite possible to avoid glare from the paper by shifting or tilting the paper to such an angle that the regular reflection from the glass does not enter the eye. We do this instinctively as a rule, but in general office desk work it is frequently inconvenient to do so. Furthermore, we reduce the illumination of the page by so doing, which naturally raises the question whether a system of illumination highly efficient as measured by photometer and wattmeter is really the most efficient if a considerable portion of the efficiency has to be thrown away to get comfort. In other words, shall we sacrifice our efficiency at the reading page or in the system of lighting itself? These are points which are certainly worth further study.

In the tests before referred to the writer found that under the most favorable conditions, with the least amount of glare reaching the eye from the paper, the minimum amount of illumination considered comfortable for continuous reading varied in the twelve subjects tested from 0.42 ft.-candle to 1.48 ft.-candles. The amount considered ample by the various subjects varied from 0.72 ft.-candle to 2.37 ft.-

candles. This certainly shows a great difference in eyes and accounts for some of the troubles illuminating engineers have had in trying to suit a number of people working in the same office under the same conditions. The opinion was expressed by the writer in the paper referred to that subjects could doubtless have been found had time permitted which would have required even more light than any of the twelve tested. I am informed by oculists that the retina usually becomes less sensitive with advancing age, and that this lack of sensitiveness cannot always be made up for by the use of glasses.

Since my convention paper I have had opportunity to make reading illumination tests on a subject forty-seven years of age who required much more light than any of those in the previous tests under similar conditions. The conditions of the tests were not identical with those of the previous twelve, but were sufficiently close to serve all practical purposes. The tests were made in a room having light cream ceilings, which was about 15 ft. square and had walls 8 ft. high. A single lamp with a clear prismatic reflector was placed about 2 ft. from the ceiling at the left of the subject, and the latter received no glare from the paper. The *Saturday Evening Post* regular reading type was used, as in the former tests. The light was dimmed by means of a rheostat and then raised to the values selected by the subject. This subject required an average of 3.6 ft.-candles as the minimum amount comfortable for continuous reading and 4.5 ft.-candles as the amount considered ample. This subject has worn glasses for many years for reading; in youth he was near-sighted, but he is now far-sighted when unaided by glasses. The subject in the five tests made showed a very small percentage of variation from the average, and seemed to have a very definite idea of the amount of light required. He could not read at all without conscious eye strain at values which any of the subjects previously tested would have considered ample.

These tests simply show what latitudes of individual requirements must be provided for when designing illumination systems. The writer has good reasons to believe that subjects could be found who would require more light than the one just tested. It is necessary now for illuminating engineers and their clients to ascertain how far any system of general illumination should go in meeting the desires of certain individuals requiring an abnormal amount of light. That there should be a limit somewhere goes without saying. At the present time this feature is undoubtedly one of the most troublesome elements involved in the design of the illumination of large offices.

REMOTE CONTROL OF ORNAMENTAL BLOCK LIGHTING AT PEORIA, ILL.

Five city blocks in Peoria, Ill., are now equipped with ornamental post lighting, six standards on each curb of each block. Each post carries four 60-watt tungsten lamps and one 100-watt tungsten lamp, the latter burning all night, while the former are extinguished at midnight. The lamps are operated at the expense of the city, but were installed by the adjoining property owners at a cost of $2 per front foot, the conduit being laid coincidently with the repaving of the streets. As a result of these first five blocks of ornamental lighting it is understood that at least twenty-five blocks additional are planned to be similarly equipped.

The group of six posts on each curb of the present installation are controlled from a solenoid-operated switch, all ten of the group circuits being thus manipulated directly from the power plant for turning on and off the all-night and the till-midnight lamps. The movement of the solenoid in these switches is opposed by a spring, and all the windings are connected in series by an extra wire pulled through the conduit runs. To light all the lamps on the posts a current of 8 amp is sent through this control circuit, pulling the solenoids to their extreme position, where contacts are made to light all the lamps. After 12 o'clock the control-current strength is reduced to 4 amp, thereby allowing the spring to pull the switch off the contacts for the 60-watt lamps but keeping the 100-watt lamps in service at the tops of the posts. This scheme, of course, requires a sustained current to hold the switch on the "on" positions. Experiments are now being made with an improved switch, in which a momentary impulse serves to close and open the respective contacts, the control circuit being at other times dead.

Other local experiments have taken the form of impressing superimposed alternating currents of different frequencies on the main lighting circuits to operate harmonically adjusted switches. The Peoria Gas & Electric Company has a number of flat-rate display lighting services, which must now be turned off by patrolmen at various hours, and these it is hoped to control from the power house, shutting off the 9, 10, 11 and 12 o'clock services at their respective hours by the aid of impulses over the lighting mains and without disturbing other installations.

The Peoria company also has in service a number o[f] single-unit multiple-type boulevard lamps on one of th[e] principal residence thoroughfares of the city. This mul[ti]ple circuit is lighted and extinguished at the same hour as the regular city arc lighting, being controlled from [a] solenoid switch, inserted in series with the arc circuit, whic[h] closes when the arc lamps are lighted. An arrangemen[t] similar to this, used at Toledo, Ohio, was described an[d] illustrated in the *Electrical World* of Oct. 20, 1910.

LETTERS TO THE EDITOR.

Visual Acuity and Pupillary Aperture.

To the Editor of Electrical World:

SIR:—I am much interested in running over Professo[r] Ashe's contribution to this subject in your issue of Oc[t.] 28, which is certainly not without importance, particular[ly] in its bearing on the use of acuity photometers. How[-]ever, I must again call attention to the fact that the co[n]ditions in my own experiments, quoted in the *Electric[al] World* of May 11, entirely eliminated all questions of th[is] sort. In these experiments the settings were made f[or] equal acuity on contiguous reading targets illuminated [by] the two lights respectively, which targets were view[ed] simultaneously by the same eye. The two were, therefo[re,] always viewed with identical pupillary aperture so far as [a] given balance was concerned, this aperture being dete[r]mined by the conjoint illumination from the two sourc[es.] There was not the slightest opportunity, therefore, for a differential effect due to pupillary aperture, and the abs[o]lute size of the pupil was a matter of no importance, sin[ce] if it affected acuity at all, the two targets were necessar[ily] affected simultaneously and to the same degree, from t[he] very conditions of the experiment.

The diaphragm which was used merely had the eff[ect] of holding the actual working aperture of the pupil stea[dy] so that similar conditions would exist in successive re[ad]ings under varying illumination. As a matter of fact, [its] presence was not found to exercise any perceptible influe[nce] on the acuity observed, doubtless because the pupill[ary] aperture, within the range of illuminations used, did [not] vary enough to affect materially the absolute acuity.

In a non-simultaneous comparison of acuity value[s I] am inclined to think the use of the stop would always [be] advisable as a precaution, particularly in dealing with v[er]y faint illuminations where the pupil naturally works at c[on]siderably widened aperture. There is no doubt that va[ri-]

tions in pupillary aperture do affect the absolute value of acuity very perceptibily in working without a diaphragm in varying light. The cause of this condition is perfectly well known, being simply that the refracting system of the eye is afflicted with zonal aberrations which come into play when the pupil is sufficiently widened. For this reason the eye ordinarily becomes somewhat myopic in very dim light. There may be in cases of astigmatism a material change in the errors of refraction due to that cause also. These variations render absolute acuity measurements troublesome, and it was because of them and the difficulties due to varying adaptation that I resorted to the balance for equal acuity, which eliminates both. Attempts at measuring absolutely pupillary aperture are so unsatisfactory, as Professor Ashe indicates, and as everyone who has experimented with it has found, that it is hard to understand how anyone could seriously have proposed such measurements as a basis for photometry; yet, strange to say, this has been done.

I am glad to note that Professor Ashe adheres to his steady, and I think well-founded, faith in the flicker photometer as an instrument for heterochromatic measurements. It may not be altogether perfect, but it seems to me to be open to fewer objections and to show fewer troublesome sources of error than any other instrument yet devised for such use.

In closing I would suggest to any readers of the *Electrical World* who may want to follow up this interesting matter of the pupil and its reactions to get and study Ludwig Bach's "Pupillenlehre." It is a very thorough and judicial résumé of the present knowledge of the subject, and particularly rich in references to the somewhat scattered literature.

[illegible], Mass. LOUIS BELL.

Condensation in Interior Conduit.

To the Editor of Electrical World:

SIR:—I notice in your issue of Oct. 7 a note entitled "Condensation in Rigid Conduit," from which I gather that in your country there is the same trouble from condensation in steel and iron conduits which is experienced in England.

Over twelve years ago the Sun Electrical Company, Ltd., investigated this complaint, and, as the outcome of experiments lasting over a considerable number of years, it introduced in 1907 the "Kalkos" system of conduit wiring. In this system the tubes are made of brass of special composition tinned inside and out. Owing to the high heat conductivity of these tubes the temperature inside quickly follows that of the atmosphere, and thus there is no cooling of the air and condensation does not take place. Moreover, the system is absolutely watertight when correctly installed even at the switch and light points.

Your contributor suggests using weatherproof insulation; this, too, is recommended by the leading steel conduit makers in this country, and cable manufacturers are also making special weatherproof cables for drawing into steel and iron conduit. We, on the other hand, recommend the use of taped wires only—that is, wires taped but not braided—and many hundreds of miles of this class of cable have been drawn into "Kalkos" conduits without any signs of breakdown. We, moreover, give a guarantee to replace all wires of standard grade which fail owing to condensation, if installed under our standard specification.

Regarding earthing, the whole system is earthed, and owing to the high current-carrying capacity of the tubes, which in most instances is greater than that of the installed wires, the grounding is ideal. Dollies of all switches are earthed so that there is absolutely no risk of shock even should they break down. Our switch, it may be added, is an ordinary tumbler, but at the same time is absolutely watertight.

The "Kalkos" system is being largely installed in England in factories, breweries, laundries and places where screwed iron tubes have failed owing to the bad conditions, and in no case has there been any complaint regarding this system.

London, England. E. R. MORTON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Speed Regulation of Large Induction Motors.—A. HEYLAND.—The author gives a review of a system which he has developed in connection with the Siemens-Schuckert Company.

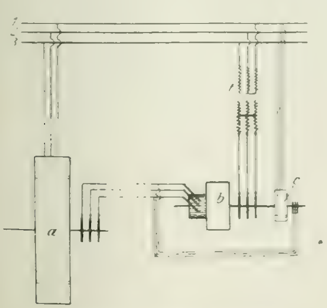


Fig. 1—System of Speed Regulation.

The system is especially applicable to plants in which speed regulation of induction motors of such large output is required that commutator motors could not be used. The system is shown in Fig. 1, where a is the main induction motor to be regulated, 1, 2 and 3 are the conductors of the three-phase supply network, and b is a frequency changer in form of a commutator motor driven by a small induction motor c. The primary of the driving motor c is connected to the network, while the rotor is connected to the rotor of the main motor a so that it must revolve with the same positive or negative slip as the main

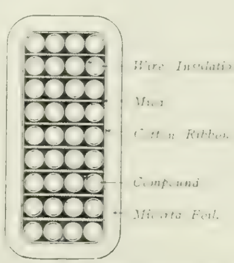


Fig. 2—Insulation of Coils for High-Tension Machines.

motor. The frequency change b is a commutator motor, the commutator brushes of which are connected to the rotor of the main motor a, while the slip-rings of the commutator motor b are connected to the network through the inter-

mediary of the adjustable transformer *t*. The differences of this arrangement from others are discussed and the excellent utilization of the active material and the high efficiency are claimed to be special advantages of this sys- [illegible] Oct. 19.

Insulation of Coils for High-Tension Machines.—K. Perlewitz.—It has been repeatedly found that the insulation of coils of high-tension machines may break down in time owing to chemical changes. It has further been found that these chemical changes occur only when there are spaces filled with air in the interior of the coils. All the troubles may be avoided by eliminating these air spaces. The firm of Emil Haefely in Basel uses the arrangement shown in Fig. 2, in which air spaces within the coils are entirely avoided and the conductors as far as they are placed within the slots are covered with an insulating layer corresponding to the slot cross-section. The external insulating cover of the coil is made from so-called micarta foil. Micarta foil consists of a carefully selected paper 0.04 mm in thickness covered with fine mica sheets of 0.08 mm thickness by means of a special varnish. The spaces between the different conductors are first completely filled with a compound, a layer of cotton ribbon is then wound around the coil, and finally the coil is covered with a layer of micarta foil. By means of a process which may be compared with the use of a flatiron the coil is heated under application of pressure whereby the whole coil becomes a solid unit without any air spaces.—*Elek. Zeit.*, Oct. 12.

Lamps and Lighting.

Metallic-Filament Lamps.—An article on a recent reduction in the prices of metallic-filament lamps in England. In the case of osram lamps the list price of the 200-260-volt, 32-watt, 40-watt and 55-watt lamps has been reduced to 75 cents (instead of 93 cents and $1), and the 100-135-volt, 17-watt, 25-watt, 32-watt and 55-watt sizes are now sold at 62 cents. The price of the new 200-260-volt, 20-watt lamp is 81 cents. Similar reductions have been made in other types and makes of metallic-filament lamps. Thus tungsten lamps with drawn-wire filaments are now sold at 62 cents each for the 100-125-volt, 17-watt, 25-watt, 30-watt, 40-watt and 60-watt sizes, and at 75 cents for the 200-260-volt, 30-watt, 40-watt and 60-watt sizes. Tantalum lamps from 200 volts to 250 volts sell at 75 cents.—Lond. *Elec. Eng'ing*, Oct. 19.

Sealing Wires Into Glass.—A note on a recent British patent (1880, Oct. 12, 1911) of G. B. Burnside. The wire is placed through a small aperture in the glass or other vitreous substance and heated by a blowpipe flame until perfect cohesion between the two takes place. The seal is then removed from the flame, and when at a dull red heat it is cooled by gradually increasing immersions, of about two or three seconds' duration, in some sperm or similar oil or in wax. For currents above 15 amp round tubular conductors, plugged with a conducting material, are employed. This form is very useful for mercury-vapor lamps or rectifiers, as the tubular cell is made of a substance that does not form an amalgam, and thus protects the copper from the mercury.—Lond. *Elec. Eng'ing*, Oct. 19.

Generation, Transmission and Distribution.

Electric Winding Machines.—W. Philippi.—The first part of a paper read before the Berlin Electrical Society on the different systems of electric winding. The author first discusses the use of the induction motor, although it has not found favor in Germany for winding purposes. He then takes up the use of the three-phase series motor and the double-commutator motor of Deri. All these motors need a gearing since they cannot be built for such low speeds that they can be coupled directly with the winding axle. The author then takes up the discussion of the use of direct-current motors, which are being employed to a far greater extent for winding machines, in connection with the well-known Ward Leonard system. The paper is to be concluded.—*Elek. Zeit.*, Oct. 19.

Energy Transmission to Rome.—J. Reyval.—An illustrated article on the Tivoli-Rome and the Subiaco-Rome transmission lines, which are worked in parallel. The tramways of Rome are supplied with energy from the system by means of a converter station operating in parallel with a storage battery. The tramway load has improved the power factor.—*La Lumière Elec.*, Oct. 14.

Traction.

Tramway Convention.—Zehme.—An account of the thirteenth annual convention of the German Association of Street Railway and Light Railway Companies. Among the engineering papers presented at the convention there was one by Drewes on the use of motor-cars on light railways, one by Lehrmann on interpole motors for traction, one by Kayser on lighting systems for electrically operated light railways (the use of metallic-filament lamps being advocated), one by Draeger on lighting systems for steam-operated light railways (the use of acetylene lighting being advocated), and a paper by Eichel on the development of alternating-current railways.—*Elek. Zeit.*, Oct. 12.

Interpole Motors for Traction.—Lehrmann.—An abstract of a paper presented at the recent convention of the German Association of Street Railway and Light Railway Companies. The results obtained with interpole motors by fifty-six German companies with 6372 motor cars are given. One thousand two hundred and forty-one of these cars are now equipped with interpole motors. The number of those companies in which more than 20 per cent of the motor car are equipped with interpole motors has increased in th last two years from six to thirty. The expected favorabl effects on the cost of maintenance due to the use of inter pole motors have already manifested themselves, improve ments being shown in the time spent for attendance an cleaning of the commutators and in the life of the brushes In several new plants higher emfs than the usual 500 volt or 600 volts have been employed with success. One plar has been changed from 550 volts to 750 volts. The ques tion as to the saving of energy with interpole motors ha not yet been finally settled. The only real disadvantage c interpole motors is their higher cost, and the question wa raised whether this higher cost is compensated by sufficier savings in operation. All companies with the exception c eight have answered this question in the affirmative. C the eight companies that did not so answer, four did n reply at all. Two do not yet want to commit themselv and one company answers the question in the negative.- *Elek. Zeit.*, Oct. 12.

Municipal Tramways.—James H. Rogers.—A paper pr sented before the (British) Municipal Tramways Associ tion. The author analyzes the financial results obtained c the eighty-eight municipally operated tramways in Englan of which undertakings twenty-six have no reserve fund all. He shows that a substantial reserve and renewals fu is essential for sound finance in connection with electi tramways, and considers that $1,000 per mile of track p annum is a minimum provision. The question of 1-ce fares and workmen's fares and also that of contributions the rates are discussed.—Lond. *Electrician*, Oct. 20.

Electric Traction.—J. Simey.—Illustrated descriptions some new electric-traction installations, especially the si gle-phase locomotive of the Dessau-Bitterfeld road and t electric equipment of the Bern-Simplon road with t Loetschberg tunnel, consisting of Siemens-Schuckert mot cars, a locomotive of the Oerlikon Company and a locon tive of the Allgemeine Elektricitäts Gesellschaft.— *Lumière Elec.*, Sept. 30 and Oct. 21.

Parma.—An illustrated article in which the various tails of a new tramway which has recently been set operation in the streets and suburbs of Parma, Italy, described. Single-phase current is used throughout.

pressure being 400 volts in the town and 4000 volts in the suburbs. The method employed for changing over from one voltage to the other is noted.—Lond. *Electrician*, Oct. 20.

Street-Railway Agreement.—E. SCHIFFL.—A critical discussion of the new agreement between the city of Berlin and the Great Berlin Street Railway Company. The author thinks that this agreement is not favorable enough for the city.—*Elek. Zeit.*, Oct. 19.

Installations, Systems and Appliances.

British Municipal Station.—An abstract of last year's financial report of the Middlebrough municipal supply station, which is being operated in conjunction with a supply in bulk from the Cleveland & Durham Electric Power Company. The bulk supply was first taken in the financial year 1908-9, when the number of kw-hours generated fell to 535,729, compared with 1,855,880 in the preceding year, and the number of kw-hours purchased was 1,408,733. For the year ended March 31 last 611,407 kw-hours were generated and 1,834,115 kw-hours were purchased. Deducting the loss in conversion, distribution, etc., the number of kw-hours sold was 2,021,886, an increase of about 200,000 compared with the output of the previous year. For private lighting 892,063 kw-hours were sold and for motor service and heating 1,104,100 kw-hours, the average revenue obtained for the two supplies being 7.26 cents and 2.30 cents respectively, the average price per kw-hour received for the whole supply, after allowing for discounts, being 4.36 cents. The total cost, including capital charges, per kw-hour sold was 3.96 cents last year, against 4.92 cents in 1907; the total revenue per kw-hour sold was 4.46 cents. It will be seen that the total cost of generating the kw-hour has been reduced by nearly 1 cent since the supply in bulk was taken. As regards the generating costs, the cost for fuel for the energy actually generated by the station plant works out at 0.8 cent per kw-hour generated, while the bulk supply averaged 1.08 cents per kw-hour purchased, the energy being measured on the low-tension side.—Lond. *Electrician*, Oct. 20.

Power-Factor Correction with Synchronous Motors.—N. SAHL.—An article discussing power-factor correction with synchronous motors. The author gives a number of convenient curves which enable one to shorten the rather complicated calculations on the subject. The first diagram gives curves showing the ratio of wattless component of a circuit to its kilovolt amperes and kilowatts at various power-factors. He then shows in a set of curves how the power-factor of a circuit is raised by the addition of non-inductive load. Then follow two sets of curves showing the amount of wattless component required to raise the power-factor of a given kilowatt or kilowatt-ampere load to a required higher value. Another set of curves is given for determining the maximum power-factor improvement which can be obtained with a given kilovolt-ampere original load at given power-factor and synchronous condenser of given kilovolt-ampere rating; also the mechanical load which the condenser will carry simultaneously. Then follow curves for determining the mechanical load on a synchronous condenser corresponding to required power-factor improvement and corresponding kilovolt-ampere rating of condenser, assuming the power and wattless components of the condenser load to be equal. He finally gives curves for determining the approximate excitation required by alternators at various power-factors. He shows how these curves can be applied to the solution of specific problems. —*El. Journal*, October.

Inspection and Insurance of Electrical Machinery.—An account of last year's report of the chief engineer of the British Engine, Boiler & Electrical Insurance Company. The increase in the number of electrical machines insured compared with 1909 was 14 per cent, in breakdowns 12.8 per cent, and in the cost of breakdowns 17.6 per cent. The ratios of breakdowns among the various classes of machinery were as follows: Generators, continuous-current, 1 in 16.5; alternating-current, 1 in 5.3. Motors, continuous-current, 1 in 8; alternating-current. 1 in 12. Generators and motors, continuous-current, 1 in 8.8; alternating-current, 1 in 11.2. Starters and controllers, 1 in 25.4. As to the parts which are believed to have failed first in electric motors information is given in the following table:

	Direct Current.	Alternating Current.
Armatures or rotors, per cent.......	[illegible]	30
Commutators or slip rings	2[illegible]	
Magnets or stator coils	1[illegible]	[illegible]
Brush gear or terminals............	6	2
Rotating parts not carrying current.	[illegible]	[illegible]
Stationary parts not carrying current	[illegible]	22
	100	100

Some typical examples of breakdowns are described. Information is also given concerning engines, boilers, etc.—Lond. *Electrician*, Oct. 20.

Danger of Fire from Gas, Electricity and Kerosene.—Statistical data collected from the official fire statistics of Prussia for 1909. The results are given in the following table, which gives the number of fires due to gas, electricity, kerosene and the careless handling of matches and states the damage done. A large number of the fires recorded under carelessness in using matches must be charged against gas-lighting:

	Number of Fires.	Damage.
Gas ...	1,198	$69,617
Electricity..................	382	404,699
Kerosene........................	4,765	310,226
Carelessness in using matches.	10,787	1,369,495

The number of fires per lamp was eighteen times as great for gas as for electricity.—*Elek. Zeit.*, Oct. 12.

Austria-Hungary.—E. HONIGMANN.—An article giving statistical data on the electrical export trade of Austria and Hungary in the first half year of 1911.—*Elek. Zeit.*, Oct. 12.

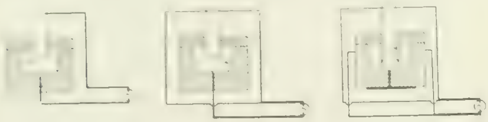
Electrophysics and Magnetism.

Magnetic Properties of Electrolytic Iron Layers Deposited in a Magnetic Field.—R. GANS.—Maurain had determined the magnetization curve of layers of iron deposited electrolytically in a magnetic field and had found that the formula of the magnetization curve was quite different from that obtained when there was no magnetic field acting during the electrolytic deposition. Kaufman and Meier have later shown that it was not the magnetic field but occluded hydrogen and the observance of certain conditions in the preparation of the solution and in the electrolysis which were the cause of the peculiar changes in the magnetization curves. By an entirely different method the present author gives the same result and shows that a strong magnetic field employed during electrolysis, while it has an influence on the instantaneous magnetic conditions of the iron, has no influence on its permanent magnetic properties.—*Phys. Zeit.*, Nov. 1.

Electrochemistry and Batteries.

Electric Steel Refining.—A. MUELLER.—A very long and detailed description of the results obtained with the Girod electric steel-refining furnace at Gutehoffnungshütte. In the Girod furnace there is a top electrode and a bottom electrode, and the way of conducting the single-phase current to the furnace is of great importance for the results. There are three methods in use, as shown in Fig. 3. In

[illegible] from the motor-generator set to the carbon and steel electrodes has been chosen, all of the cables being on the side of the furnace which faces the motor-generator. In method II the cable to the carbon electrode is divided into two sections which run parallel to each other. The steel electrode is connected by the shortest



I II III

Fig. 2—Diagrams of Connections.

path with the motor-generator set. Method III is the one used since August, 1910, at the Gutehoffnungshütte. The current is conducted to the carbon electrode in a manner similar to method II. But while in methods I and II the bottom steel electrode is insulated from the furnace body itself (only the metal bath being in the electric circuit), the steel electrodes are here electrically connected with the furnace body. The arrangement of the conductors is symmetrical around the furnace. With the first two methods the electric arc is deflected toward the side marked with the arrow, which results in a non-uniform heating of the steel bath and a rapid destruction of that side of the furnace which is exposed to the excessive direct heat of the arc. Method III avoids all this. Details are given of the construction of the lining, of the heat losses due to the water cooling of the electrodes, of the influence of temperature and size of furnace on the specific energy consumption, and of the metallurgical actions during the oxidation and deoxidation periods in the refining process.—*Met. and Chem. Eng'ing*, November.

Melting Ferromanganese in Electric Furnaces.—J. Bronn and W. Schemmann.—When ferromanganese is used as a deoxidizer in steel making it is usually added in the solid form. A considerable saving, as well as other advantages, is obtained if the ferromanganese is added to the steel in the molten form. To remelt ferromanganese the cupola and open hearth are unsuitable on account of the considerable loss of manganese. No such loss is experienced if the ferromanganese is melted in an electric furnace. The authors use a low-tension arc furnace with good success.—*Met. and Chem. Eng'ing*, November.

Steel-Refining Furnace.—T. D. Robertson.—An illustrated description of the Grönwall steel-refining furnace, which is operated by two-phase currents. If the supply is three-phase the Scott transformation method is used. There are two carbon electrodes at the top, each being connected to one phase. There is also a carbon block in the furnace bottom, which is connected to the neutral point. There is a vertical as well as a horizontal circulation of the metal in the bath.—*Met. and Chem. Eng'ing*, November.

Units, Measurements and Instruments.

Slipping-Contact Rectifying Detector.—L. W. Austin.—The author has formerly described (*Electrical World*, Vol. 48, page 924, 1906) a detector for electric waves in which a piece of tellurium is pressed against a rotating aluminum rod. The author has also found that any other slipping contact may be used as a detector. The best results are obtained with a highly polished copper or nickel disk which is driven by a motor and against which a piece of thin light copper wire is pressed. The only difficulty is to get a suitable surface on which the contact can slip. In many cases there is a tendency for the point to jump off, so that the signal is interrupted and the distinction between dots and dashes is rendered difficult. This difficulty has been overcome to a large extent by the introduction of high-frequency sparks. This detector is exceedingly sensitive. Its sensitiveness is from three to ten times that of electrolytic detectors for weak signals. The rationale of the detector action is probably of a quite complicated nature. There is to a certain extent a rectifying effect, but the rectification is not always in the same direction.—*Phys. Zeit.*, Oct. 15

Telegraphy, Telephony and Signals.

Telephone Cable.—An article stating that the new tele phone cable which has been laid between St. Margaret (Kent, England) and La Panne, in Belgium, represent the greatest advance that has yet been made in the applica tion of the Pupin coil system to telephony. The conductor are of the same size as in the earlier Anglo-French loade cable, namely, 160 lb. per nautical mile, but instead of th dielectric weighing 300 lb. per mile it weighs only 150 ll A special gutta-percha is used in the Anglo-Belgian cab with a particularly small leakance, and the ratio *S/K* ha been reduced from 120 in the Anglo-French cable to 12 i the Anglo-Belgian cable. The two circuits in the cabl instead of being used merely for two conversations, will l able to be used for three simultaneous conversations by tl use of what was formerly somewhat incorrectly calle duplexing and is now usually termed a "phantom" circu The wires of each circuit are bridged by repeating coi the center of each of which is connected to form the thi circuit, so that the two wires of each of the "side circuit are used in parallel for the "phantom" circuit, as has fr quently been done in the case of long-distance land line To enable this to be possible in the case of a loaded circu however, it was necessary to insert an additional series loading coils in each circuit. The two windings in the loa ing coil in the side circuits are placed as in the Ang French cable, on one core, and are, of course, so arrang that the inductive actions of the two windings assist c another. When the two conductors are used in parallel the phantom circuit these two windings therefore neutral one another, and another winding is necessary with a p of coils wound both in the same direction, instead of contrary directions, so that they act as an inductance when the two wires are used in parallel for the phant circuit, but the inductances oppose one another when two conductors are used in the ordinary way. The to length of the cable is 47.892 miles, and each wire ha length of 48.366 miles. The actual construction of the ca and the method of inserting the armoring and loading c follow exactly the methods employed in the Anglo-Fre cable. Loading coils are inserted one mile apart, and additional loading coil for the "phantom" circuit is inse at the same place. In construction this additional loac coil is similar to the others, except that one of the wind is reversed, and it merely increases the length of the b by 8 in. The figures of the principal constants of the c have already been given in the *Digest*.—Lond. *E Eng'ing*, Oct. 19.

Single-Line Telephone System.—A note on a recent ish patent (5734, Sept. 21, 1911) of C. H. Ellison W. J. Thorrowgood. In a battery ringing system in w several stations are connected in series the relays of th calling bells are shunted by condensers. The cang switches are inserted between the line and the station teries, which are connected between the line and earth. By this arrangement, while the stations are in series for telephone currents, part of the line is cut out from the ringing circuit, namely, that between the battery connection of the calling station and the end of the line away from the station which is being called.—Lond. *Elec. Eng'ing*, Sept 28.

Wireless Telegraphy.—Mosler.—In modern wireless telegraph receiving stations using thermo-detectors the so-called non-periodic circuit is now used preferably instead of a tuned receiving circuit. The author shows that the non-periodic circuit can also be used in connection with a

sounder and that this results in considerable simplification of the arrangements and in a noteworthy increase of sensitiveness in comparison with Schloemilch cell detectors.—*Elek. Zeit.*, Oct. 12.

Miscellaneous.

Physical Laboratory.—K. R. Koch.—A description, profusely illustrated by diagrams, of the new physical laboratory of the Institute of Technology of Stuttgart. *Phys. Zeit.*, Oct. 1.

Mica.—A. Kretzsch.—The author discusses briefly the occurrence of mica in Canada, North America, Brazil, India and in the German colonies in Africa, which in time may become considerable producers of mica.—*Elek. Zeit.*, Sept. 28.

Titanium Steel.—A note on the 1910 statistics of the American Iron & Steel Association. Out of 567,819 tons of various alloy steels, not less than 326,316 tons were titanium steel.—*Met. and Chem. Engin.*, November.

New Apparatus and Appliances

CONVENIENT MEANS FOR DETERMINING FLUE-GAS TEMPERATURES.

Indicating and recording thermometers and pyrometers are sometimes employed for measuring the temperature of flue gases, but their use is not general owing partly to the cost and also to the fact that many types of instruments are not reliable or break down in service. There is therefore a demand for cheap and efficient means of determining flue-gas temperatures, which the Green Fuel Economizer Company, Matteawan, N. Y., has met by devising the temperature pendants shown herewith. These pendants consist of fusible alloys of the proper composition to indicate the desired temperatures. The melting points of such metals were found to be too uncertain and evasive to be used as temperature tests, and the Green Fuel Economizer Company, therefore, devised the expedient of using the tensile strength of the metal, instead of the melting point, as the true indication of temperature. The pendants are made with a large body, having a certain definite weight, suspended from a narrow neck, and the composition of the metal and cross-section of this neck are adjusted until the weight of the pendant will pull the neck in two and fall at the desired temperature. In actual use the pendants are hung upon a small hook made upon the end of a long wire, which is introduced into the flue so that the pendant will be at the desired point. At present the company has perfected pendants for three temperatures, 425 deg., 500 deg. and 550 deg. Fahr., representing respectively the temperature at which the use of the economizer is justified with coal at commercial prices, the temperature at which an economizer is a good investment in all cases, and the temperature at which neglect to install an economizer becomes an inexcusable waste.

Temperature Pendant.

DIRECT-CURRENT AUTO-CONVERTER.

Occasions frequently arise where direct current at a higher voltage has to be converted into direct current at a lower voltage, and for this purpose a motor generator has hitherto been installed. This type of machine, consisting, as it does, of two entirely separate machines, requires a comparatively large floor area, and the cost is necessarily high for the output. The machine illustrated herewith has

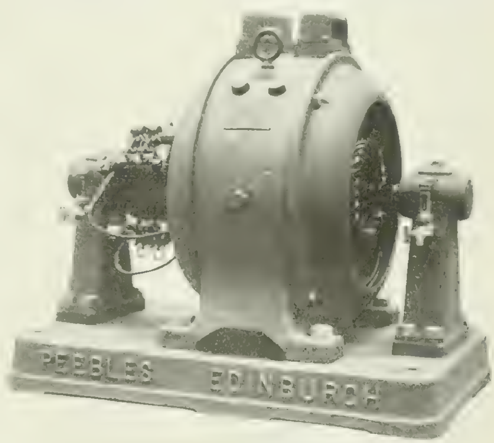


Fig. 1—Direct-Current Auto-Converter.

been developed for delivering direct current at low voltage from the same armature winding at which direct current at high voltage is received. It consists of only one machine with the usual rotating armature and commutator. It differs from the ordinary direct-current machine mainly in the arrangement of the field cores and windings. Each field pole is in two parts, which are subjected to different magnetomotive forces. Brushes are placed on the commutator not only at the neutral points between poles of unlike signs, but also at the points of division of each pole in two parts. When the voltage between the brushes at the so-called neutral points is kept constant that between the other brushes varies with the change in relative excitation of the two halves of the pole cores. There are thus two sets of brushes, one set receiving current from the source of supply and the other delivering current at a reduced or increased voltage. The two sets of brushes may be placed on a common commutator, or the machine may be provided with two commutators connected to the common armature winding, according to the amount of current and the ratio of transformation.

The machine can be designed for any ratio of transformation between the limits of 1 to 1 and 10 to 1. It is stated that its efficiency at all loads is higher by 5 per cent to 12 per cent than that of a motor generator of similar output. The performance of a 5-kw, 460-volt to 60-volt converter is shown in Fig. 2.

In addition to taking the place of an ordinary motor-generator set the machine can also be designed to convert

... of constant current in which form it becomes particularly suitable for projector, cinematograph and similar work. As a three-wire balancer it gives very satisfactory results, and it can also be designed to effect a double reduction in voltage, say from 500 volts to a three-wire circuit having 100 volts across the outers, in which latter case it is only necessary to introduce into the secondary circuit a suitable static balancing transformer. It is also eminently suitable for charging batteries for electric vehicles, motorboats, etc., where the pressure of supply available is too high for this purpose, the secondary pressure on the machine being easily variable by ordinary shunt regulation. It can further be arranged to charge batteries with a current which the machine will automatically keep

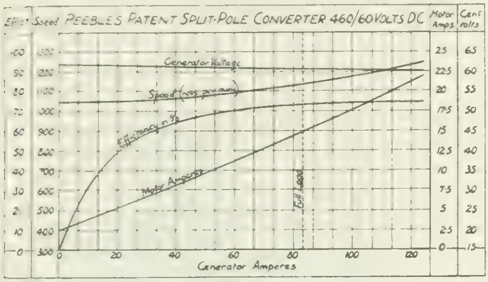


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Fig. 2—Characteristics of 5-kw Auto-Converter.

constant. One of the uses to which the machine can be put is in connection with the driving of paper-making machines, where the rolls have to be driven at varying speeds. In such cases a converter would be used to supply energy at variable voltage to, and thus to vary the speeds of, the different motors in the correct proportions up or down. The above are perhaps the most important uses of the direct-current auto-converter, although there are, of course, many other minor uses not specifically mentioned. This machine has been placed on the market by Bruce, Peebles & Company, Ltd., Edinburgh, Scotland.

HIGH-VOLTAGE TRANSFORMERS.

After a close study of the general construction and the details of the design required in transformers for high-tension service, the General Electric Company has decided that its Type "H" (core type) transformer most fully meets the requirements for high-voltage work on either self-cooled or water-cooled designs, single-phase or three-phase, in capacities up to and including 500 kva and 600 kva for outdoor and indoor service or circuits of any commercial voltage and frequency. Some of the new features of this line of transformers as designed for high-tension work are as follows:

The original method of fastening the laminations together with horn fibre channels and shellacked wooden dowel pins is superseded by the use of insulated metal rivets. The interleaving of the yoke laminations with the leg laminations is maintained, having proved superior to other forms of joints. A supporting plate furnishes additional mechanical reinforcement to the outside laminations. The clamps for the yoke laminations consist of steel angle plates. Bolts engaging with these clamps and notches cut in both the yoke and end laminations contribute to a firm engagement of the clamps and core, giving a rigid mechanical construction.

The coil supports engaging with the steel angle plates consist of treated wooden blocks providing generous bearing surface for the coils. ... this wood is supplemented by wet-process porcelain parts, giving greater insulation strength without loss of mechanical strength. These supports are adjustable to correct any tendency for the parts to get out of alignment during transportation and before the transformer is put in service.

The tank for the self-cooled transformer consists of a

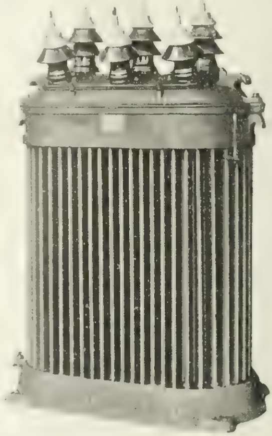


Fig. 1—Outdoor-Type Transformer.

corrugated steel body amalgamated with a cast-iron bas and cast-iron rim. This construction, originally recom mended about five years ago, is adhered to, as it gives thoroughly satisfactory construction, being free fro solder or riveted seams which may open up by sudde application of heat externally applied or by sudden sha mechanical strains.

For the water-cooled transformers the body is of smoo cast iron, which, with the base and rim, is made in or piece. The cooling coils for these transformers have bo inlet and outlet brought out at the side below the oil lev

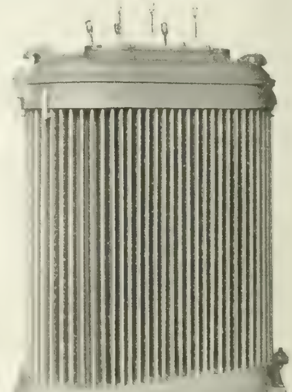


Fig. 2—Three-Phase Transformer with Flexible Leads.

so that no portion of the cooling oil is exposed to the ... effectively preventing any condensation of moisture fro the atmosphere and consequent deterioration of the ... These pipes may be of copper, brass or iron, determi d by the purity, etc., of the cooling water. The bases of ... self-cooled and water-cooled transformers are ...

ided with lugs to facilitate skidding and also with smooth bottoms to facilitate handling by rollers, etc., in transportation.

By a proper distribution of the metal and in reinforcing by deep ribs such portions of the cover as are subject to strains a very light construction is made possible. Hooks of unusual strength are provided so that the transformer itself, or complete tank and oil, may safely be raised or lifted by them. Bushing plates are placed over large openings in the cover and serve as supports for wet-process porcelain bushings through which the leads enter the case. The openings provide access to the interior of the tank for change of connections and facilitate examination without the necessity of removing the transformer itself from the tank.

The development, about two years ago, of the outdoor head and its application to these transformers have made possible a line of outdoor transformers using the same mechanical parts as the indoor type.

The cylindrical windings of core-type transformers are maintained, as having proved to be the strongest both electrically and mechanically. These coils, being separately wound and insulated, permit attention to details of insulation not possible where windings are not so manufactured. The "compounding" of the coils by the vacuum process—that is, the complete removal of all moisture and air before the impregnation with an oil-resisting insulating compound—insures a construction able to withstand the frequent strains and surges, both of normal and high frequency, daily occurring on large high-voltage systems.

A DIRECT-READING INSTRUMENT FOR MEASURING LOW RESISTANCES.

The Evershed "ducter," illustrated herewith, combines in one instrument the functions of the ammeter, the potential galvanometer and the slide rule. It gives a direct reading of the value of the resistance under test, without any more calculation than is involved in multiplying by tens. There is no preparation to be made beyond connecting the ducter to the cell which provides the testing current and pressing the contact spikes which complete the circuit against the terminals of the resistance which is to be tested. The movement is nearly aperiodic, and the index comes to rest in about three seconds from the moment when the contact spikes are applied to the test resistance. Hence the reading can be noted within four or five seconds, and a complete test will not usually occupy more than one minute from start to finish.

The ducter covers the entire range of low-resistance measurement, beginning at a few millionths of an ohm and ending at 5 ohms, a value which is well within the range of an ordinary Wheatstone bridge. By means of a five-way switch the whole range is divided into five grades, for which the scale readings must be multiplied by unity, ten, a hundred, a thousand and ten thousand respectively. The working principle of the instrument is similar to that of an ohmmeter, and it might be described very briefly as a potential ohmmeter. As will be seen by reference to Fig. 2, the movement consists of two coils *P* and *C* fixed upon an axle with their magnetic axes at a certain definite angle to each other.

The coil *P* is wound as a potential coil, and being connected in parallel with the test resistance *X* it is traversed by a current proportional to the drop. The other coil, *C*, is connected across the terminals of a resistance, or shunt, in the main circuit of the battery *E* and in series with the test resistance. This coil therefore is traversed by a current proportional to the current flowing through the test resistance, and provides a clockwise controlling torque opposed to the deflecting torque of the potential coil. The two coils move freely in the magnetic field of a powerful permanent magnet *N S*, and the angular position they take up depends solely upon the ratio of the current in the potential coil to that in the control coil. In other words, the deflection of the movable system depends solely upon the ratio of the drop across the test resistance to the current flowing in it; that is to say, it is a measure of the resistance *X*.

Any potential instrument for the measurement of very low resistance is liable to damage by excessive current, because the potential winding is necessarily designed to work with a very small potential difference, and the actual drop across a test resistance of unknown value may be enormous by comparison. In an extreme case there may be an unsuspected break in the circuit of the resistance under test, with the result that the full pressure of the testing battery is applied to the terminals of the potential circuit. Mishaps of this kind are quite unavoidable, but in the ducter the risk of damage is entirely removed by including an automatic cut-out in the circuit of the potential coil. The cut-out, which is shown at *K* in Fig. 2, is of the polarized magnetic type, and the moving parts have an inertia sufficiently small to insure the opening of the potential circuit before the excessive current has imparted a dangerous velocity to the coils and index of the ducter.

The scale is 110 mms in length, divided by calibration into 50 nearly equal parts. The position of the index can be read quite easily to less than one-quarter of a division.

The ducter is compensated for temperature, and hence the scale reading gives the actual value which the test resistance has at the time the test is made, no matter what the temperature of the instrument itself may be.

In Fig. 2 the ducter is shown measuring the resistance of a metal strip *X*. The scale is 85, and the grade switch stands at multiplier 100, making the value 8,500 microhms or .0085 ohm. This is resistance of that part of the metal strip which lies between the potential contacts *G* and *H*.

For carrying the current to and from the resistance under test, and for making the necessary potential connections,

Fig. 1—Instrument for Measuring Low Resistances.

two twin flexible leads are provided, each having metal tabs at one end to fit the ducter terminals and terminating at the other end in an insulating handle. Projecting from each handle are two metal contact spikes of a novel kind, one to make the current connections and the other the potential contact. Each spike is a steel rod with an archime-

dean screw cut upon the inner end and arranged to screw freely in and out of the handle, the travel being limited by stops. Normally two spiral springs inside the handle force the rods to screw themselves outward against the outer stops, but when the handle is used to press the spikes into contact with the surface of any conductor the rods screw

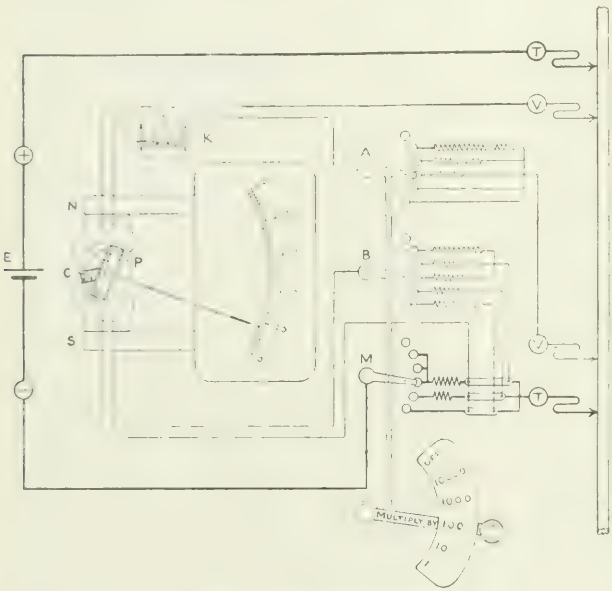


Fig. 2—Diagram of Connections.

round and recede more or less into the handle, at the same time compressing the spiral springs. In this way each spike is independently forced by its spring into contact with the conductor, no matter how irregular the conductor surface may be or at what angle the handle may be held. The contact end of each rod is a pyramid or square point, and the rotary motion imparted to it by the archimedean screw insures good contact even on a dirty or oxidized surface.

The testing current is provided by a small portable battery of four secondary cells contained in a substantial teak case and provided with a switch for coupling the cells either all in parallel to give 2 volts or all in series to give 8 volts.

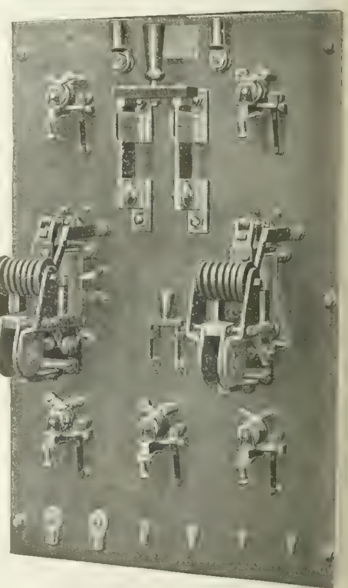
The readings of the ducter are very nearly independent of the strength of the testing current, which may vary within wide limits without causing any appreciable error.

The Evershed ducter is being placed on the American market by James G. Biddle, 1211 Arch Street, Philadelphia.

CRANE PANELS.

In the crane cabs of electrically operated cranes having three, four or five motors the knife-switches, fuses, circuit-breakers, etc., are mounted in various locations. The arrangement cannot always be the best, and renewing cartridge fuses is both costly and inconvenient. These conditions have brought about the need for a crane switchboard panel, one of which, manufactured by the Cutler-Hammer Manufacturing Company, of Milwaukee, is shown in the accompanying illustration. This particular panel, which is designed for a three-motor crane, combines all necessary switches, protective devices, etc., giving protection against overload, short-circuit and failure of voltage. A panel of this kind ... of wiring in the crane cab, makes installation easy and eliminates the cost, inconvenience and time required in renewing fuses.

The two single-pole, magnetically operated switches (standard contactor mill type), one in each side of the main line, and the over-load devices are the principal objects on



Crane Panel.

the panel. The contactor switches have copper and carb[on] auxiliary arcing contacts and blowouts and laminated co[p]per brushes for carrying the current. Two single-po[le] switcnes are used because of several advantages over t[he] double-pole type. If a double-pole switch should stick t[he] circuit would not be opened, whereas if either single-po[le] switch sticks the other will open the circuit. Also if t[he] overload remains on the line the one switch will be tripp[ed] as soon as the other is closed, which prevents quick su[c]cessive opening and closing, or what is known as "te[le]graphing."

The small knife-switch handles the control circuit [of] the above switches and provision is made so that a number of these safety switches can be used (connect[ed] in series) installed in various convenient locations so th[at] the operator can, from any of the points, open the ma[g]netic-switch circuits, which in turn open the feeds to motors on the crane. This safety feature prevents a[n] accidental starting of the motors when inspection or [re]pairs are being made.

There are two main over-loads and three motor-f[eed] over-load devices, one for each motor on the crane. Th[ey] are of special construction, having a vertical break and a wiping contact. They are accurately calibrated and [ca]n be adjusted without the use of an ammeter.

With the main-line switch and all safety switches clo[sed], the operator throws a "reset master" (which is provid[ed]) to position 1, which closes one of the magnetic switc[he]s and establishes the feed to the second switch, while thr[ow]ing the master to position 2 closes this second switch.

On grounded circuit two over-load devices for each mo[to]r on the crane are sometimes provided, and in some locat[io]ns inclosing cases are desired. These cases can be provi[de]d with means for operating the main knife-switch with[ou]t opening the case.

Industrial and Commercial News

The Week in Trade.

THERE has been but little change in trade conditions in the past few days, and [illegible] as has been made has been more noticeable in sentiment than in actual increase in the volume of business. The agitation that followed announcement of the federal suit against the United States Steel Corporation has subsided for the present, and recovery from the shock has been made in the stock markets and in general trade. Cooler weather has been responsible for a large proportion of the better tone prevailing in business circles, and sales of seasonable apparel and necessities have benefited retail and jobbing houses. Very little change has taken place in the cotton markets, owing to uncertainty of prices, and purchases are still confined to small lots. Stocks of goods of all descriptions are thought to be well below normal, and on this account the mild buying movement of the week gives promise of continuation. Equipment orders placed by the railroads during the week have been decidedly encouraging. The extensive car buying of the past few weeks has been followed by substantial increases in the number and size of rail orders and inquiries. Rail orders aggregating 100,000 tons are said to be pending. The pig-iron market is becoming quieter, and few contracts are being placed for first-quarter delivery. Opinions differ upon the immediate cause of hesitation in trade advancement, but there seems to be a general tendency at this time to wait a little longer and see what happens, rather than to take the initiative in business commitments. Business failures for the week ended November 2, as reported by *Bradstreet's*, were 200, as compared with 231 in the previous week, 179 in the corresponding week in 1910, 212 in 1909, 205 in 1908, and 225 in 1907.

The United States Circuit Court has approved the plan for reorganization of the American Tobacco Company. The plan as accepted does not include the proposal of Attorney-General Wickersham for a five-year probation period under federal supervision, nor does it carry out the wishes of the independent companies as regards stock control; but it is regarded as meeting the requirements of the Sherman law. It does not force the American Tobacco Company into a receivership, and this is regarded as a most favorable outcome of the case, since there is every reason to believe that the Supreme Court in rendering its decision wished to destroy only the method of doing business.

The Copper Market.

CONTRARY to general expectation, the October report of the Copper Producers' Association, issued on Wednesday, showed a decrease of 5,897,214 lb. in surplus copper stocks instead of the increase which most of the trade believed would be shown. In view of this result, the report as a whole is regarded as decidedly more favorable than the reports for several months past. Production was 118,225,442 lb., as against 115,588,950 in September, which with the surplus stocks at the beginning of the month made a total of 259,150,298 lb. of copper to be accounted for in October. Domestic deliveries were 64,068,307 lb., as against 57,311,584 lb. in the previous month, and exports were 60,084,349 lb., as against 50,824,011 lb. in September, making total deliveries of 124,152,656 lb. as compared with 108,135,595 lb. in the month before.

[illegible] Copper	Bid.	Asked.	[illegible] Price.
[illegible]	12.00	12.25	.....
[illegible]	[illegible]	12.15	12.10
[illegible]	[illegible]	[illegible]	12.12½
[illegible]	12.10	[illegible]	12.12½
[illegible]	12.15	[illegible]	[illegible]

London market, Nov. [illegible]

	Noon.	Closing.
		£ s. d.
[illegible] copper, spot	[illegible]	56 2 6
[illegible] copper, futures	[illegible]	56 17 6

[illegible] fluctuations for the [illegible]

	Highest.	Lowest.
[illegible]	[illegible]	11 [illegible]
[illegible] spot	£57 [illegible]	£53 7 6
[illegible] futures	[illegible]	54 6 0
[illegible] selected	[illegible]	57 5 0

This left stocks on hand [illegible], as given above, 5,897,214 lb. under the September surplus. The increase in domestic consumption, 7,000,000 lb. in excess of the September figure, was a surprising feature of the report, the deliveries into domestic hands being the largest since June. The gain in production, about 3,000,000 lb., is attributed to the extra day in October as compared with the preceding month, and this increase is offset by the gain in deliveries. The average daily deliveries to domestic consumers were 2,647,365 lb., as compared with 1,910,386 lb. in September. The average daily exports were 1,937,914 lb. Business has been very slack pending issuance of the report, consumers waiting to learn the results for the month and their influence on the price situation before committing themselves. There has been an effort made during the week to advance the price of electrolytic, and there were reports early in the week that the leading interests had advanced their price to 12⅝ cents. Most of the agencies have been willing to close contracts at 12.37 [illegible] cents. Second hands have been offering copper at concessions from these prices, but there has been very little interest taken in the market. Exports for the month including Nov. 8 aggregate 6,699 tons. The daily call on the Metal Exchange Nov. 8 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

Republic Railway & Light Company.—Through its subsidiaries, the Republic Railway & Light Company, 60 Broadway, New York City, now owns and operates about 150 miles of electric railway lines, three electric-lighting stations, and three gas plants, with which it is serving the rapidly growing industrial section in the valleys of the Mahoning and Shenango Rivers. In this territory, embracing an area of some 300 sq miles, are Youngstown, Ohio, and Sharon and New Castle, Pa., the total population being close to 200,000. Since its incorporation, on June 28, 1911, in New Jersey with a capital of $17,500,000, as mentioned in these columns July 1, the Republic Railway & Light Company has been making rapid progress in improving its properties. A new 4000-kw turbine is being installed in the station at Youngstown, the line to Idora Park, outside of Youngstown, has just been double-tracked, and a new fireproof substation of 1500 kw capacity has been completed at Niles, Ohio, where new carhouses are being erected. Various additions to the railway system in Sharon, Youngstown and New Castle are contemplated, and the transformation of cars to the prepayment type is also under consideration. Gross earnings of the subsidiary companies for the month of September were $196,875, a gain of 8.93 per cent as compared with those in September, 1910. Operating expenses and taxes were $106,208, an increase of 2.42 per cent, leaving net earnings of $90,667, which represents a gain of 17.68 per cent over returns in September, 1910. In the nine months ended Sept. 30, 1911, gross earnings were $1,705,105, as compared with $1,623,172 in the corresponding period last year, a gain of 5.05 per cent. Operating expenses and taxes were $975,839, as against $945,118, an increase of 3.25 per cent, and net earnings for the period were $729,266, as compared with $678,054, or a gain of 7.55 per cent for nine months of operation in 1911. Regular dividends of 6 per cent per annum are being paid on the $10,000,000 preferred stock. The company has no bonded indebtedness, and the subsidiaries have outstanding bonds amounting to $10,148,100. All Pennsylvania franchises of the company are perpetual. In Ohio the city franchises of Youngstown were recently renewed for twenty-five years, the legal maximum. The interurban franchises expire at various periods from 1945 to 1950.

Accidents on Electric Lines.—Accident Bulletin No. 40 just issued by the Interstate Commerce Commission, shows that the total number of railroad casualties of all classes for the year ended June 30, 1911, was 160,555. Of these 10,396 were fatal. During the year, as shown by accident reports, on electric lines carrying interstate traffic there were 410 persons killed and 3264 injured.

Livingston-Niagara Power Company.—At a meeting [illegible] 15. the following officers were elected: President, Merton E. Lewis; first vice-president and general manager, Quincy W. Hershey; second vice-president, Charles J. Brown; secretary, Henry G. Strong; treasurer, Henry C. Brewster; assistant secretary, Donald M. Lewis. Directors were elected for the ensuing year as follows: Merton E. Lewis, William W. Dake, Henry C. Brewster, Charles J. Brown, Quincy W. Hershey, Henry G. Strong and William C. Likly. Reports were submitted to the board of directors showing the progress of construction of a 2000-hp receiving station at Golah, N. Y., and transmission lines from Golah to the villages of Avon, Livonia, Lima, South Lima and Honeoye Falls. Niagara energy will be distributed in these villages, and numerous industrial concerns, taking advantage of the continuous service, are planning to install electric motors for the operation of their plants, The company is now planning additional transmission-line construction and hopes to furnish service for several other villages in the same locality in the near future. R. E. Bowen is the en[illegible] W. W. [illegible]cheron is superintendent [illegible]

Marconi Wireless Company Buys Lodge, Murihead Patents.—Control of the Lodge, Muirhead Syndicate's patents applying to wireless telegraphy has been purchased by the Marconi Wireless Telegraph Company, Ltd., thus settling the patent differences that have existed between these companies. John Bottomley, vice-president of the Marconi company, said this week that Sir Oliver Lodge will be associated with the Marconi company as scientific adviser, and that his broad experience in wireless telegraphy will be exceedingly valuable to the Marconi interests. Mr. Bottomley stated further that suit has been brought by the Marconi Wireless Telegraph Company, Ltd., against Siemens Brothers & Company, Ltd., the former company claiming that the system of the latter is an infringement of Marconi patent rights. The Vaniman airship, which will be used shortly in an attempt to cross the Atlantic, is equipped with a Marconi outfit designed especially for this service. It has a range of 500 miles and is installed in a lifeboat suspended from the body of the airship.

Manufacturers and Distributors of Rollinson Electrical Specialties Consolidate.—The Mohawk Electric Company, manufacturers of the Rollinson electrical specialties, formerly of Albany, N. Y., and the St. John Corporation, of 180 Broadway, New York City, general distributors of these products, have united under the name of the Mohawk Electric Company. The new company has been incorporated under the laws of New York and its officers and directors are as follows: G. St. John, Jr., president; E. H. Rollinson, vice-president; A. W. Hogeland, treasurer; M. L. Rollinson, recording secretary, and B. F. La Rue, financial secretary. After Dec. 1 the main office of the company will be at 64-66 Shipman Street, Newark, N. J., where its new factory is located. This building has twice the floor space of the old Albany plant, which has been shut down. Lamp-testing watt indicators, rectifying sets for charging storage batteries from alternating current, and toy transformers are among the specialties manufactured by the company.

Chicago Traction Merger.—The following plan of procedure, it is stated, has been agreed upon as a result of a conference between a sub-committee of the transportation committee of the City Council and representatives of the interests concerned with the proposed traction merger in Chicago: A commission of experts is to be selected by the city to value elevated properties, the basis of valuation to be agreed on between the committee and the elevated companies; a tentative unification ordinance is to be drafted by the railway companies with a representative of the city's legal department for submission to the general committee; all subway plans will be submitted to the general committee and the subway commission; a series of public hearings is to be held by the general committee for discussion of all questions.

Kings County (N. Y.) Electric Light & Power Company.—Followin[illegible] of the Kings County Electric Light & Power Company said: "October has shown the largest gains of any month in 1911 over the corresponding month of a year ago. The gain in volum[illegible] of business and [illegible] per cent. Expenses have not yet been compiled and the full monthly statement will be given out Nov. 20. At last the company has got away from the Coney Island comparison, which has been unfavorable on account of the Dreamland fire." The regular quarterly dividend of 2 per cent was declared on the capital stock, payable on Dec. 1 to stockholders of record Nov. 20. H. P. Erwin was elected secretary of the Kings County Electric Light & Power Company.

New York Traction Companies.—Summaries of the reports of earnings of the various traction companies in New York City for the year ended June 30, 1911, issued by the Public Service Commission for the First District of New York show decided increase in both subway and surface travel. Including all tunnels, elevated and surface lines in Greater New York, the total number of passengers carried was 1,617,-182,963, an increase of 73,620,813 as compared with the showing in the preceding year. Total operating revenue of all the companies was $84,424,435, which is an increase of $4,216,332. Only four of the smaller companies showed decreases, as compared with ten in the previous year.

Telephone Train Dispatching Extended.—The Louisville & Nashville Railroad recently placed an additional order with the Western Electric Company for forty-two selectors to dispatch its trains over a new line to run from Lexington, Ky., to Quicksand, Ky. The purchasers are now operating over 2200 miles of circuits by the telephone. The new line now being built will cover a total distance of 96 miles, and the dispatcher for it will be located at Lexington. A message circuit will parallel the train circuit on this line and will be equipped with the same number of stations.

Diesel Oil-Engines.—The Wellman, Seaver, Morgan Company, of Cleveland, Ohio, has ordered two 225-hp engines from Busch-Sulzer Brothers-Diesel Engine Company for direct connection to direct-current generators. One of these sets is to be installed in the pontoon crane being built by the purchasers for the United States Navy at the Boston navy yard and the other is for the Pearl Harbor navy yard, Hawaii Contracts have also been placed for two 225-hp Diesel engines and generators to be installed in the municipal electric-ligh plant at Thief River Falls, Minn.

Brooklyn Rapid Transit Company.—Protest against th increase of the special franchise tax assessment by the Stat Board of Tax Commissioners from $51,350,400 to $55,810,10 thus increasing the tax by $47,473, has been made by the Brook lyn Rapid Transit Company. The protest is on the ground that the assessment is based on over-valuation and is exces sive. Similar protest has been entered against the increase assessment of the Brooklyn Union Elevated from $19,619,00 to $25,406,800.

Salisbury & Spencer Railway Company.—Controlling in terest in the Salisbury & Spencer Railway Company, whic operates between Salisbury and Spencer, N. C., has been se cured by Coler & Company, of New York City, through Bir S. Coler, who is president of the North Carolina Public Servic Company, of Greensboro, N. C. In addition to its railwa business, the Salisbury & Spencer Company operates a ga plant at Salisbury and also does electric lighting.

Boston Elevated Company.—At the annual meeting [illegible] the Boston Elevated Railway Company it was voted to increa the number of directors from ten to twelve. The followir directors were re-elected: Frank Ayer, John J. Bright, Franc E. Peabody, James L. Richards, Robert Windsor, William [illegible] Bancroft, Samuel Carr, James M. Prendergast, and Willia S. Spaulding. Charles P. Hall, George P. Gardner and Euge V. R. Thayer were added to the board.

London Traction Merger Effected.—Amalgamation London's electric tubes and railroads and the London Gener Omnibus Company, which controls London street traffic, is sa to have been completed. The combined capital of the cor panies involved is in the neighborhood of $165,000,000. T railroads were reorganized largely through the efforts of t late Charles T. Yerkes, and much American capital is rep sented in them.

Allis Chalmers Company.—The annual meeting of t Allis-Chalmers Company will be held some time in April, [illegible] stead of in the early part of November as originally schedul This change is due to the change in the fiscal year of the co [illegible] June 30 to Dec. 31.

Financial.

The Week in Wall Street.

S[illegible] the filing of the [illegible] suit against the United States Steel Corporation prices in the stock market have been irregular, but have shown a general tendency to [illegible]. Stocks rose in price in [illegible] market under the leadership of Steel common, Reading and Union Pacific, and the tone was distinctly optimistic throughout the day. The feeling was broadened in a very large measure by the increasing interest shown in the market by the outside element. Commission houses are finding that business from this source is [illegible] somewhat better scale than it has been in recent weeks, [illegible] very cautious sentiment is still [illegible]. Following

NEW YORK.

	Oct. 31.	Nov. 8.	Sales. Sold		Oct. 31.	Nov. 8.	Sales. Sold
[illegible]	3*	3[illegible]	[illegible]	M[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10[illegible]	[illegible]	[illegible]	M[illegible]	[illegible]	[illegible]	30
[illegible]	52[illegible]	54	[illegible]	M[illegible]	[illegible]	73*	100
[illegible]	33[illegible]	33[illegible]	[illegible]	[illegible]	[illegible]	126*	300
[illegible]	32[illegible]	33	[illegible]	M[illegible] St. Ry.	[illegible]	1[illegible]	[illegible]
[illegible]	103*	102[illegible]	400	N.Y.&N.J.Tel..	[illegible]	[illegible]	[illegible]
[illegible]	78*	78*	———	Steel, com...	[illegible]	[illegible]	[illegible]
Am. T. & T..135		138[illegible]	8,452	Steel, pfd....	10[illegible]	[illegible]	[illegible]
[illegible]	74½	77[illegible]	15,400	W. U. T....	78	78	3,870
[illegible]	148[illegible]	151[illegible]	[illegible]	W[illegible]	63	65[illegible]	6,62[illegible]
[illegible]	14[illegible]	14	7,000	West[illegible], pfd	115*	115*	[illegible]

PHILADELPHIA.

	Oct. 31.	Nov. 8.		Oct. 31.	Nov. 8.
[illegible]	44*	44	P[illegible] R[illegible]	[illegible]	23[illegible]
[illegible] A.	11[illegible]	1[illegible]	P[illegible]	16	[illegible]
[illegible] Elec.	52	5[illegible]	P[illegible]	[illegible]	54[illegible]
[illegible]	30*	30	[illegible]	[illegible]	[illegible]

CHICAGO.

	Oct. 31.	Nov. 8.		Oct. 31.	Nov. 8.
[illegible] R.	186*	186*	Com. Edison.........	131	13[illegible]
[illegible] Rys.	27*	[illegible]	Chi. Subway.......	1	1
[illegible]. Rys., pf.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Nat'l Car.........	104*	104[illegible]
[illegible]	30[illegible]	34	[illegible]	[illegible]	[illegible]

BOSTON.

	Oct. 31.	Nov. 8.		Oct. 31.	Nov. 8.
[illegible] T. & T.	...135	[illegible]	M[illegible]	[illegible]	3
[illegible] Tel....	150[illegible]*	155	M[illegible]	[illegible]	[illegible]
[illegible]	292	29[illegible]	N[illegible]	144	145[illegible]
[illegible]	147[illegible]	15[illegible]	W[illegible]	[illegible]	[illegible]
[illegible] E. Ry.......	21	[illegible]	W[illegible] T. & T., pf.....	105	107¼
[illegible] Ry., pf	93[illegible]	[illegible]			

[illegible] quoted.

[illegible] week [illegible]

[illegible] general holiday on Tuesday, the market on Wednesday failed to maintain the standard of the preceding week, and a general decline in prices took place, with the Steel shares leading under heavy selling pressure. Much of the action of the day was explained by election results, but many of the traders expressed the belief that the period of high prices had run its course. A mild rallying tendency was shown in the later trading, but this was not of sufficient strength to recover the losses in the earlier part of the day. Very little attention was given to the news of the day, and this lack of interest was reflected by the trend of the market. Settlement of the Moroccan controversy had no apparent effect upon either the foreign or the local exchanges, and the latter took little interest in the favorable copper statistics or the government's semi-monthly estimate of cotton ginned from the crop of 1911 or in the estimate on the corn crop. An increase of 17,000,000 bushels over the October corn estimate was predicted, and the cotton report placed the number of bales of cotton ginned as of Nov. 1 at 9,968,000, which represents some 1,750,000 bales in excess of the best previous showing. Low prices in the bond market are attracting a fair amount of attention from conservative investors. Continuation of large loans to foreign interests indicates the present dullness in general business and the money market. Rates Nov. 8 were: Call, 2¼@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in the [illegible] are those at the close Nov. 8.

Financial Notes.

Virginia Railway & Power Company's Annual Report.—The second annual report of the Virginia Railway & Power Company, covering operations for the year ended June 30, 1911, has been issued and shows a profit and loss surplus of $579,-[illegible] as compared with $297,369 in the preceding fiscal year. Gross earnings were $2,244,589, as against $2,058,606 in 1910, and miscellaneous income was $46,296, as compared with $33,-161, these additions making total incomes of $2,290,885 and $2,091,767 respectively. Operating expenses, including taxes and depreciation, were $1,284,980, leaving a balance of $1,005,-905, as compared with $1,068,037 in 1910. Charges were $497,-655, as compared with $698,319 in 1910, and the surplus was $508,250, as compared with $369,718 in the preceding fiscal year. Preferred dividends were $228,652, as compared with $66,693, leaving a surplus of $279,598 for the year, as compared with $303,025 in 1910. This added to the previous surplus, $297,369, made a total surplus of $576,967, as compared with $303,025 in the preceding fiscal year. Other charges, made up of discount on sale of preferred stock and bonds, premium on bonds purchased by trustees for sinking funds, and miscellaneous charges, amounted to $51,497. Against this was a credit of $53,979 from adjustment of sinking fund instalments of underlying companies, and miscellaneous credit, making a net credit of $2,482, which was added to the surplus, as against a debit of $5,656 in the preceding year. This addition made a profit and loss surplus for the year of $579,448, as compared with $297,369 in the fiscal year ended June 30, 1910, as stated above. The general balance sheet as of June 30, 1911, showed as follows:—Assets: Property, plant, franchises and privileges, $20,674,313; new construction and betterments, $629,080; work in progress, $365,938; investments, $305,398; cash, $636,377; consumers' accounts receivable, $27,985; sundry accounts receivable, $99,080; notes receivable, $3,266; material and supplies, $179,017; prepaid accounts, $3,880; interest earned, $4,-790; deferred charges, $394,921; trustees' account, $1,217,421; total, $24,541,470. Liabilities: Common stock, $7,450,500; preferred stock, $4,700,000; bonds, $11,016,626; pay rolls and accounts payable, $111,719; dividends unpaid, $117,511; matured interest on bonds, $279,950; consumers' and employees' deposits, $9,352; unredeemed tickets, $2,576; sale of property, $55,219; accrued interest, taxes and rentals, $78,162; reserve for injuries and damages, $15,405; reserve for depreciation, $125,000; profit and loss surplus, $579,448; total, $24,541,470. The kilowatt-hours output for the fiscal year ended June 30, 1911, was 16,617,098, as compared with 15,880,205 in the preceding year, and the number of customers at the end of the fiscal year was 6173, as compared with 4984. The number of street arc lamps decreased from 1227, as of June 30, 1910, to 398 on June 30, 1911, and this decrease was due to the completion and operation of a municipal lighting plant in Richmond, Va. There were thirteen street incandescent lamps at the end of the fiscal year as compared with six at the end of the previous year. The total connected load as of June 30, 1911, was 20,501 kw, as against 18,486 as of June 30, 1910.

Central Colorado Power Company.—The condensed balance sheet of the Central Colorado Power Company, of Denver, Col., as of June 30, 1911, shows as follows:—Assets: Plant and property account, $34,136,676; securities of other corporations, $50,000; cash in banks, $24,331; accounts receivable, $384,-962; material and supplies, $26,006; prepaid and suspense accounts, $4,073; first-mortgage bonds in treasury, $135,000; second-mortgage bonds in treasury, $43,050; total, $34,804,099. Liabilities: Preferred stock, $7,500,000; common, $15,000,000; first-mortgage 5 per cent bonds due Dec. 1, 1946, $10,635,000; second-mortgage 5 per cent bonds, due Nov. 1, 1929, $1,350,-000; accounts payable, $228,508; bond interest payable, $29,067; customers' advances payable in power, $24,042; rebate and bad debt reserve, $6,162; maintenance and operation reserve, $7,120; surplus, $24,199; total, $34,804,099. The combined statement of earnings and expenses of the Central Colorado Power Company and the Leadville (Col.) Light & Power Company, all of whose capital stock is owned by the first-named company, for the twelve months ended June 30, 1911, shows gross earnings of $424,979, as compared with $265,393 in the corresponding period of the previous year; operating expenses of $234,994, as compared with $168,585, and net earnings of $189,-984, as compared with $96,807 for the twelve months ended June 30, 1910. G. H. Walbridge, 24 Broad Street, New York City, president of the Central Colorado Power Company, says that the status of property is highly satisfactory.

New Hampshire Water & Electric Power Company.—The authorized capital stock of the New Hampshire Water & Electric Power Company has been increased from $100,000 to $200,000.

Carolina Power & Light Company.—Boston interests are offering at 92½ and interest a block of the first-mortgage 5 per cent bonds of the Carolina Power & Light Company, of Raleigh, N. C., due Aug. 1, 1938. This company operates the street-railway, gas, electric-light and power service in Raleigh, the gas service in Durham, the light and power service in Sanford, Henderson and Jonesboro, and furnishes light and power service for manufacturing purposes in Fayetteville. The company is owned and operated by the Electric Bond & Share Company, New York City. Its capitalization consists of an authorized issue of $2,500,000 6 per cent cumulative preferred stock, of which $286,200 has been issued; $5,000,000 common stock, of which $4,350,000 has been issued; $5,000,000 first-mortgage 5 per cent gold bonds, of which $1,290,500 has been issued, and $273,500 ten-year 5 per cent convertible gold notes. There are $119,600 preferred stock and $202,500 gold notes outstanding, the balance being in the treasury. Gross earnings of the company in the twelve months ended Sept. 30, 1911, were $347,467, and net earnings, after deduction of operating expenses and taxes, were $127,021. The company has a hydroelectric plant at Buckhorn Falls, on the Cape Fear River, with an installed capacity of 3300 hp; a hydroelectric plant, held under indefinite lease, on the Neuse River, near Raleigh, rated at 530 hp; steam auxiliary plant at Raleigh, 5000 hp in capacity, and at Henderson, 300 hp in capacity; three substations, with an aggregate capacity of 7400 hp, and modern gas plants and distributing systems in Raleigh and Durham. It has 77.2 miles of high-tension transmission lines, and a street-railway system in Raleigh. The Carolina Power & Light Company controls all the outstanding capital stock of the Yadkin River Power Company. The latter company, as previously mentioned in these columns, has under construction a hydroelectric development on the Yadkin River, near Rockingham, N. C., which is to have an initial capacity of 32,000 hp and will, it is expected, be completed before April 1, 1912. The transmission lines are to be connected with those of the Carolina Power & Light Company and the Southern Power Company. The electric and gas lighting franchises of the Carolina Power & Light Company in Raleigh are without time limit, and that for the street railway extends to 1935.

American Light & Traction Company's Report Shows Improvement.—The statement of the American Light & Traction Company for the twelve months ended Sept. 30, 1911, shows gross earnings of $4,105,097, as compared with $3,692,475 in the corresponding period of the previous year. Expenses were $114,133, as compared with $116,495, and net earnings were $3,990,964, as compared with $3,575,980 in 1910, making, with the previous surplus of $6,444,253, a total surplus of $10,435,218, as compared with $9,198,662. Total dividends were $3,003,047, as compared with $2,754,409, and the profit and loss surplus was $7,432,171, which compared with $6,444,253 in the twelve months ended Sept. 30, 1910. The general balance sheet as of Sept. 30, 1911, shows as follows: Assets: Investment account, $27,701,394; temporary investment, $2,404,200; treasury stock (38,515 shares of common), $1; earnings of subsidiary companies, $5,406,077; bills receivable, $531,572; certificates of indebtedness, $602,899; accounts receivable, $77,511; manager's stock contracts, $163,600; interest and dividends receivable, $32,094; cash and call loans, $1,605,421; total, $38,524,774. Liabilities: Preferred stock, $14,236,200; common stock, $15,000,000; warrants, $21,022; deposits on manager's stock contracts, $18,299; taxes and expenses anticipated, $3,888; accounts payable, $53,114; miscellaneous, $7,527; dividends accrued, $770,968; contingent fund, $981,582; profit and loss surplus, $7,432,171; total, $38,524,774.

Fort Smith Light & Traction Company Preferred Stock Offered.—Chicago interests are offering 7 per cent cumulative preferred stock of the Fort Smith Light & Traction Company, of Fort Smith, Ark. This stock is part of an authorized issue of $5,000,000, of which $1,120,000 was outstanding on Sept. 30. The company has also bonds outstanding to the amount of $2,407,000 and common stock to the amount of $950,000 out of authorized issues of $6,000,000 and $1,500,000, respectively. For the year ended Sept. 30, 1911, the gross earnings of the company were $520,226, and the net earnings $222,846. After paying bond interest there remained $105,645 surplus, from which dividends on preferred stock amounting to $60,273 were paid. A majority of the stock of the company is owned by the Standard Gas & Ele[illegible]pany, [illegible] management of H. M. Byllesby & Company. The company owns the street-railway property in Fort Smith, as well as the electric-service and gas-distribution systems in Fort Smith and Van Buren. It has fifty-year franchises granted in 1905. On July 1, 1911, the company had 2679 electric customers and supplied energy for 226 stationary motors, aggregating 1454 hp, as well as 310 street-lighting arc lamps. The company receives $55 a year for each street lamp, and its contract for public lighting runs for six years.

Northern Ohio Traction & Light Company.—The statement of the Northern Ohio Traction & Light Company for September shows gross earnings of $246,015, an increase of $21,113 as compared with those in the corresponding month of the previous year. Operating expenses and taxes were $128,812, an increase of $10,955, and net earnings were $117,202, an increase of $10,158. Interest charges were $44,320, an increase of $929, leaving a surplus for the month of $72,882, or $9,229 larger than that in September, 1910. In the nine months ended Sept. 30, 1911, gross earnings were $2,019,746, an increase of $182,340 over the corresponding nine months in 1910. Operating expenses and taxes were $1,110,504, an increase of $100,646, and net earnings were $909,241, a gain of $81,694. Interest charges were $399,069, an increase of $8,908. The surplus for the period was $510,172, an increase of $72,785 over that in the nine months ended Sept. 30, 1910

El Paso Electric Company's Bonds.—First-mortgage collateral trust bonds of the El Paso Electric Company, of E Paso, Tex., are being offered by Boston interests at 99 an interest. The company operates a street-railway, electric-ligh and power business in El Paso and vicinity, serving a popula tion of about 55,000. Its outstanding $1,000,000 first-mortgag collateral-trust 5 per cent bonds are a closed mortgage issue They are followed by $500,000 6 per cent debentures, $1,000,00 6 per cent preferred stock and $1,000,000 common stock payin 5 per cent. Gross earnings of the company for the year ende Aug. 31, 1911, were $671,628.27. Operating expenses and taxe were $405,303.79, and net earnings were $266,324.48. Bond interest amounted to $50,000, leaving a balance of $216,324.48.

Massachusetts Electric Companies Earnings Increase.—Gross earnings of the Massachusetts Electric Companies i October show an increase of $10,200 as compared with those i October, 1910, which compares with an increase of $50,000 i September and a decrease of $11,000 in August, 1911.

DIVIDENDS.

American Telegraph & Cable Company, quarterly, 1¼ p cent, payable Dec. 1.

Federal Light & Traction Company, quarterly, preferre 1½ per cent, payable Dec. 1.

Federal Utilities, Inc., quarterly, preferred, 1½ per cen payable Dec. 1.

Kings County (N. Y.) Electric Light & Power Compan quarterly, 2 per cent, payable Dec. 1.

Mobile Electric Company, quarterly, preferred, 1¾ per cer payable Nov. 15.

Pacific Gas & Electric Company, quarterly, preferred, $1.! per share, payable Nov. 15.

United States Steel Corporation, quarterly, preferred, 1 per cent, payable Nov. 29.

REPORTS OF EARNINGS.

AMERICAN LIGHT & TRACTION COMPANY

Period			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges	Net Surpl
[illegible]	Sept.,	'11	$4,105,097	$114,133	$3,990,964	....	....
[illegible]	Sept.,	'10	3,692,475	116,495	3,575,980	...	....

DETROIT UNITED RAILWAY COMPANY.

Period			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges	Net Surpl
[illegible]		1911	$912,321	$595,253	$333,942	$177,196	$156,7
[illegible]		1910	846,298	540,052	317,390	178,802	138,5
[illegible]	Sept.,	'11	7,627,491	4,887,243	2,871,061	1,588,690	1,282,3
[illegible]	Sept.,	'10	7,027,978	4,485,425	2,655,761	1,511,120	1,144,(

LAKE SHORE ELECTRIC RAILWAY COMPANY.

Period			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges	Net Surpl
Sept.,		1911	$124,767	$62,608	$62,159	$34,713	$27,
Sept.,		1910	115,009	54,416	60,592	34,928	25,

NORTHERN OHIO TRACTION & LIGHT COMPANY.

Period			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges	Net Surpl
Sept.,		1911	$246,015	$128,812	$117,202	$44,320	$72,
Sept.,		1910	224,902	117,857	107,044	43,391	63,

REPUBLIC RAILWAY & LIGHT COMPANY.

Period			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges	Net Surpl
[illegible]		1911	$196,875	$106,208	$90,666	.	...
[illegible]		1910	180,740	103,696	77,044	. .	...

General News

Construction News.

[illegible]

PHOENIX, ARIZ.—The Arizona Construction & Finance Company, recently incorporated, contemplates the construction of an electric railway in this section. The company is capitalized at $2,000,000. The incorporators are: R. A. Lewis, W. B. Barr and S. D. Dunlap.

OSCEOLA, ARK.—The Board of Commissioners is contemplating the installation of a municipal electric-light plant and would like to correspond with parties relative to construction of and equipment for same. [illegible] J. Lamb is a member of the commission.

BEAUMONT, CAL.—It is reported that C. H. L. Ghreist, owner of the Newport Beach electric-light and power plant, is contemplating the installation of an electric-light plant in Beaumont. He also purposes to install an ice plant and steam laundry in connection with the electric [illegible]

DELANO, CAL.—The Delano-Linne Valley Telephone Company, recently incorporated, with a capital stock of $10,000, by Benjamin Thomas, [illegible] C. Rutledge, A. Villard, P. Girard and R. W. Lockridge, purposes to build a telephone system in Delano and Linne Valley.

FRESNO, CAL.—The construction of an electric railway from Fresno [illegible] the San Joaquin River, via the Bullard district, is under consideration. F. C. Forkner is reported to be interested in the project.

FRESNO, CAL.—The Fresno, Coalinga & Tidewater Railway Com- [illegible] electric railway from Fresno to Monterey, for which surveys are being made.

[illegible] —Investigations [illegible] San Joaquin [illegible] Electric Railway Company with a view of extending its line from [illegible] railway from [illegible]n to Modesto. M. S. Brackett is general manager.

[illegible]S ANGELES, CAL.—The Llewellyn Iron Works have been awarded [illegible]tract for the installation of four direct-connected electric freight elevators in the new building of the Haas Building Company, located [illegible] Alameda Street, at $10,950.

MARYSVILLE, CAL.—The contract for erecting seven arches to be used for lighting the business section of Marysville has been awarded to [illegible] Butte Construction Company, of San Francisco, Cal., for $6,100.

MODESTO, CAL.—The Western States Gas & Electric Company is planning to extend its transmission line from Stockton to Modesto to supply electricity in Modesto and other Stanislaus County towns.

NEWPORT BEACH, CAL.—The proposition to issue bonds to the amount of $60,000 for the installation of a municipal electric and gas plant will be submitted to a vote of the people at an early date.

OAKLAND, CAL.—The Sierra & San Francisco Power Company has notified the City Council that it proposes to supply electricity for lamps and motors in Oakland, subject to the ordinances of the city.

OAKLAND, CAL.—The Sierra Electric Power Company, recently incorporated, proposes to supply electricity for lamps and motors and also water for domestic purposes. The company is capitalized at $3,000,000 and the incorporators are: Charles Gross, J. E. Powers, E. A. Herman, L. Breed and M. S. Hamilton, all of Oakland, Cal.

[illegible]VILLE, CAL.—The Board of Trustees, [illegible] Gas & Electric Company [illegible] company has heretofore refused to sell the system.

[illegible]NTA ROSA, CAL.—The Clear Lake Telephone & Telegraph Com- [illegible] Sonoma Valley [illegible] Cal., which [illegible] for lamps and [illegible] Valley, have been consolidated. The headquarters of both companies will be located in [illegible] Rosa. Fred L. Wright is [illegible] company and C. T. Ryland, of Sonoma, is head of the Sonoma Valley Company.

TULARE, CAL.—The Tulare County Power Company is planning [illegible] push the work on its new power plant in Globe, in order to be able [illegible] install the machinery during 1912. The company also contemplates [illegible] an underground conduit [illegible]

WILLOWS, CAL.—The Sacramento Valley Power Company has purchased the plant and holdings of the People's Power Company, a local corporation, and will enter into competition with the Northern California Power Company in Glenn County field. The Sacramento Valley Power Company will make extensions to its holdings in this section which will involve an expenditure of $150,000. The rate offered by the Sacramento Company is 25 per cent lower than the present price asked by the Northern California Power Company.

WINTERS, CAL.—The Vallejo & Northern Railway Company, it is reported, is contemplating the construction of an electric railway to [illegible]

[illegible] the installation of a distributing system in connection with the new electric-light plant to Hendrie & Bolthoff, of Denver, Col., at $18,654. Bonds to the amount of $46,000 were voted at the last city election for the construction of a municipal electric-light plant. After the bonds had been sold, a site secured and other preliminary work done a legal question arose which changed the situation. The site selected is in the foothills above Lyons. It was contended that the city has no right to build a plant outside of the corporate limits and that the city has no right to the water for power purposes. To avoid complications a company was organized as the Public Service Company, capitalized at $50,000, and the stock disposed of among the citizens. The company has taken over the rights and titles held by the city and is to build the plant as proposed by the city and transmit energy to the city limits. The city will own and operate the distributing system. Under the terms of the agreement the city reserves the right to purchase the plant for its face value.

WASHINGTON, D. C.—An engineer connected with a contracting firm in Australasia, and who is directing work on a railway tunnel through certain mountains, informs an American consul that he would like to communicate with American concerns dealing in electrically operated rock-drilling machinery. He wishes descriptions of such machinery and also prices at which it could be furnished at the point of destination. Further information may be secured by addressing No. 7559, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—A report from an American consulate states that an electric company has recently been formed in his district, with an American electrical engineer as the managing director, which proposes to supply heat, light and power to the entire district. The company will be in the market for machinery and equipment for the entire plant, and also for all kinds of light, heat and power fixtures and appliances. The managing director would like to receive catalogs along the line mentioned with prices f.o.b. San Francisco, Cal. Further information may be obtained by addressing No. 7558, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

FAIRBURN, GA.—The City Council is reported to have awarded a contract to the J. B. McCrary Company, of Atlanta, Ga., for the construction of an electric-light plant, for which bonds to the amount of $10,000 have been issued.

MARSHALLVILLE, GA.—The City Council has awarded a contract to J. C. Walker, of Marshallville, to supply the town with water and electricity for street lighting. A stock company capitalized at $40,000 will be organized to construct the plant and carry out the contract.

PERRY, GA.—The City Council has contracted with J. H. and J. A. Davis, of Lakeside, for energy for the electric-light system for Perry. They agree to deliver electricity at a point east of the town, where it will be connected with the city system. Bonds to the amount of $6,000 have been authorized for installation of the system.

PRESTON, IDAHO.—Preparations are being made by the Idaho & Utah Electric Company for the construction of an electric plant, work on which will begin in the near future. The company proposes to extend its system to Franklin, Weston, Richmond, Whitney, Trenton and Smithfield soon. Energy for operating the system will be purchased from the Telluride Power Company. The cost of the plant is estimated from $12,000 to $15,000. H. E. Smoot is president and general manager.

TWIN FALLS, IDAHO.—The Mountain States Telephone & Telegraph Company will soon begin work on the erection of a telephone line from Twin Falls to Rogerson.

ALBION, ILL.—The Albion Electric Light & Gas Comany has commenced work on the construction of an electric-light plant in Albion. The company will apply to the Council for an extension of the contract with the city, in which it agreed to have the plant completed by Dec. 15, 1911.

BARRY, ILL.—The Electric Light & Power Company is planning to rebuild its transmission line from Barry to Kinderhook and to erect an extension from there to Hull. The company has entered into a contract with the village authorities in Hull to supply electricity in that place.

CARTHAGE, ILL.—The Carthage Electric Light & Heating Company has changed its name to Albert Sandt & Company. The capital stock of the company has been decreased from $50,000 to $10,000 and the headquarters changed from Carthage to Chicago.

CHICAGO, ILL.—W. O. Johnson, operating receiver for the Chicago & Milwaukee Electric Company, has been authorized by the United States District Court to purchase property for right-of-way in Willmette and Highland Park.

CHICAGO, ILL.—Plans are being considered by the Public Service Corporation of Northern Illinois, which is a consolidation of the North Shore Electric Company, Economy Light & Power Company, Illinois Valley Gas & Electric Company and others, for a bond issue covering the properties to retire existing bonds by purchase or ultimate exchange

[illegible] Municipal Tuberculosis Sanitarium, city of Chicago, Ill., Room 1514, Fort Dearborn Building, 105 West Monroe Street, Chicago, Ill., until Nov. 13 for the construction complete, including plumbing, sewage-disposal system, water-supply system, boilers, pumps, heating, steel tank, tile roofing, electric work, etc., of a power house and water tower for the Municipal Tuberculosis Sanitarium of the city of Chicago, located at North Fortieth and Bryn Mawr Avenues, Chicago. The cost of the proposed hospital is estimated at $800,000. W. A. Otis and Edwin H. Clark, 150 South Dearborn Street, Chicago, Ill., are architects.

KANSAS, ILL.—The property of the Embarras Telephone Company in Kansas is reported to have been purchased by Roy Hall, of Westfield, Ill. It is understood that the new owner will make improvements [illegible]

MONMOUTH, ILL.—The [illegible] Company has contracted with the Monmouth Public Service Company to supply electricity to [illegible]

NEWMAN, ILL.—The Newman Electric Light Company has decided to erect a new electric plant just east of the city. The company, it is said, will install an ice plant in connection with the electric plant. The power plant of the company was recently destroyed by fire, since which the town has been without electrical service.

ODELL, ILL.—Preparations are being made to install an ornamental street-lighting system in Odell. The present arc lamps will be replaced with four-cluster tungsten lamps.

ROCK ISLAND, ILL.—The City Commission has granted the People's Power Company permission to erect a transmission line to its dam at Sears.

ROCK ISLAND, ILL.—At an election held recently the voters defeated the proposition to grant a fifty-year franchise to the Tri-City Automatic Home Telephone Company. The voters also refused to approve the ordinance consenting to the sale of the Union Electric Telephone plant to the Central Union Telephone Company.

URBANA, ILL.—The capital stock of the Kankakee & Urbana Traction Company has been increased from $200,000 to $500,000.

WASHBURN, ILL.—The property of the Washburn Electric Company has been purchased by T. R. Voorhees, of Fairbury. The new owner, it is said, will make improvements to the plant and erect transmission lines to small towns in the vicinity of Washburn.

BEDFORD, IND.—The City Council has decided to adopt the tungsten street-lighting system under the new contract submitted by the Bedford Heat, Light & Power Company,. The arc lamps cost $80 each per year, while the tungsten lamps of 250 cp will cost but $50 each per year. The 40-watt lamps to be used at the street intersections will be supplied at $15 per lamp per year. The cluster lamp system, promoted by the Merchants' and Industrial Association, the standards to be equipped with one 60-watt and four 40-watt lamps, have been approved for the street corners, while the posts between will be equipped with one 60-watt and two 40-watt lamps. The three-lamp posts, the top lamp burning all night, will cost $25 each per year, while the five-lamp standards will cost $34 each per year. Notwithstanding that twenty arc lamps will be added to the number already in use and including the cluster-lamp system, it is estimated that the city will save about $265 per year under the new system.

CAMBRIDGE CITY, IND.—The Town Council is reported to have awarded the contract for the construction of the new municipal electric-light plant to Roy Kniese, of Cambridge, for $4,087.

GARY, IND.—The Gary & Southern Traction Company has filed an amendment to its charter increasing its capital stock from $10,000 to $300,000.

BURLINGTON, IA.—It is reported that the Chicago, Burlington & Quincy Railroad Company is contemplating the construction of an electric power plant in Burlington, for which an appropriation of $40,000 is said to have been made. The plant, it is understood, will be located near the Union Depot and will supply electricity for lighting the yards, depot, freight house and other buildings.

DUBUQUE, IA.—Extensive improvements and extensions are being made by the Union Electric Company, which will more than double the output of its plant. The company is now installing a 2500-kw, six-stage horizontal Curtis turbine.

FAIRFIELD, IA.—The City Council is reported to have entered into a contract with the Iowa Power Company, of Oakland Mills, whereby the company will supply electricity to the city at 3 cents per kw-hour. The present arc-lamp system will be replaced with cluster lamps.

GLIDDEN, IA.—It is reported that the proposition to issue bonds to the amount of $10,000 for the installation of an electric-light plant will be submitted to a vote at an election to be held this month.

MANCHESTER, IA.—The local electric-light plant, owned by E. W. Hoag, was destroyed by fire on Oct. 28, causing a loss of about $10,000. Arrangements have been made with the Manchester Light, Heat & Power Company to supply the patrons of the Hoag plant, which, it is said, will be rebuilt at once.

MUSCATINE, IA.—The Board of Supervisors has decided to install an electric-lighting system at the Muscatine County Farm. Improvements will also be made [illegible]

NEW SHARON, IA.—At a special election held recently the proposition to grant the Oskaloosa Traction & Light Company a franchise to supply electricity for lamps and motors in New Sharon was carried.

PILOT MOUND, IA.—At an election held recently the proposition to grant a franchise to install an electric-light and power plant was carried.

PRAIRIE CITY, IA.—The Colfax Electric Light & Power Company, of Colfax, Ia., has been granted a franchise to operate an electric-light and power plant in Prairie City for a period of twenty-five years. The company will erect a transmission line from Colfax to this city, to be completed by Jan. 1, 1912. A substation will be erected here.

VAN HORNE, IA.—Sealed bids will be received by P. R. Holler, town clerk, Van Horne, Ia., until Nov. 13 for furnishing and installing machinery, equipment and material for a complete electric plant, consisting of a 30-kw direct-current generator direct-connected to an oil engine, storage battery and switchboard. Separate bids will be entertained for furnishing and installing the storage battery complete. Alternate bids will be received on one 20-kw direct-current generator belted to an oil engine [illegible] one 10-kw direct-current generator belted to an oil engine, together with switchboard, all installed complete for operation. Plans and specifications may be seen at the office of the town clerk, or at the office of J. B. Hill, engineer, Iowa City, Ia. Copies of plans may be obtained on application to the engineer on payment of $3 to cover cost of the prints. William Baumgardner is Mayor.

EARL, KAN.—The City Council has granted to James Z. George, of Memphis, franchises to construct and operate an electric-light plant and to operate the water-works system in Earl. The city formerly owned the water-works, but sold the entire system to Mr. George, who proposes to enlarge and improve the same.

KANSAS CITY, KAN.—Business men on Minnesota Avenue between Fifth and Sixth Streets and Seventh and Eighth Streets are planning to erect ornamental lamp standards in the business district. It is proposed to erect ornamental lamp standards, each carrying five lamps along Minnesota Avenue.

LAWRENCE, KAN.—Sealed bids will be received at the office of the county clerk of Douglas County, Lawrence, Kan., until Nov. 13 for furnishing one gasoline-engine-driven electric generating set, gasoline system, storage set, storage battery, electric pumps, pressure tanks and necessary equipment for a water system for the County Home of Douglas County.

MANHATTAN, KAN.—Plans are being considered by J. J. Marshal, manager of the Marshall Theatre, for the installation of an isolated electric plant to supply electricity to light the entire building.

ROSSVILLE, KAN.—The question of erecting an electric-light and power plant at the mill dam north of Rossville is reported to be under consideration.

COVINGTON, KY.—Preparations are being made by the Chesapeake & Ohio Railroad Company for the construction of a new power station at its yards in Covington, to cost about $15,000, work on which will begin at once. The new plant will supply electricity to operate all the Chesapeake & Ohio Railway telegraph lines in this section of the company.

DONALDSVILLE, LA.—The City Council is reported to be contemplating the installation of a municipal electric-light plant and waterworks system in Donaldsonville.

LIVERMORE FALLS, MAINE.—The electric power station of the International Paper Company at Jay Bridge was destroyed by fire on Oct. 28, causing a loss of about $14,000. The plant had an output of 3000 hp and supplied electricity to operate the Otis Mills of the International Paper Company at Chisholm and for operating the lighting system of the entire plant of the company at that place. It is understood that the company is planning to erect a new station for which plans have already been drawn.

BALTIMORE, MD.—In the report submitted to the Board of Estimate by Superintendent McCuen the cost of lighting the streets for the coming year is estimated at $375,517, which includes 350 additional lamps. In addition $14,230 will be required for a system of ornamental lamps on Charles Street, between Twenty-ninth Street and University Parkway, between St. Paul Street and the city limits, also between Thirty-first Street and University Parkway after it has been built up.

HAVRE DE GRACE, MD.—The plant and holdings of the Havre Grace Electric Light Company have been purchased by James H. Harlow of Darlington, Md. Mr. Harlow owns the plant at Perryville and is interested in a plant at Belair, and it is understood that he proposes to merge the plants and supply power from one plant.

MIDDLETOWN, MD.—The citizens have authorized the burgess and commissioners to enter into a ten-year contract with the Frederick Gas & Electric Company, of Frederick, for lighting the streets of the town. It is proposed to use tungsten lamps erected on ornamental standards. It is thought that from fifty to sixty street lamps will be required. The company will erect a transmission line over the mountain from its power house to Middletown.

CHELMSFORD, MASS.—Preparations are being made by the Lowell Electric Light Corporation for installing a street-lighting system in Chelmsford. Under the terms of the contract the company is to erect not less than 342 tungsten lamps of 40 cp, to be located along the streets of Chelmsford Centre and of North, South, East and West Chelmsford, at a cost of $55.75 per month.

[illegible]LIN, MASS.—The Union Electric Light Company is install

[illegible] generator in its plant at [illegible] and emergency purposes.

HOLDEN, MASS.—[illegible] substation and other material [illegible] system to supply electricity in Holden has been awarded to the Western Electric Company, to cost approximately $9,700.

HOLYOKE, MASS.—It is reported that the American Thread Company is contemplating equipping its Holyoke plants for electric-motor drive.

PITTSFIELD, MASS.—E. D. Jones & Company have decided to utilize electricity to operate their foundry and machine shop, which will be supplied by the Pittsfield Electric Company. The steam plant will be dismantled at once.

SWANSEA, MASS.—The Fall River Electric Light Company is planning to extend its system to Swansea to supply electrical service in this [illegible]

WORCESTER, MASS.—Arrangements have been made whereby all gasoline lamps now in use in Worcester will be replaced by electric incandescent lamps by June 1, 1912. The contract for the gas lamps expires this month, but the Welsbach company has agreed to allow the city to use its lamps until the Worcester Electric Company is ready to supply [illegible]

[illegible]RAGA, MICH.—The Village Council has awarded contracts for in[illegible]g an eltctric-light plant and improvements to the water-works sys[illegible] [illegible] combination bids of the Central [illegible] Company, [illegible]sh, Wis.; the National Meter Company, of Chicago, Ill., and the [illegible] Equipment Company, of St. Paul, Minn., at a total amount of [illegible]28,676. The Village Council has decided to install sixty ornamental lamp standards with tungsten clusters to replace the present street-lighting [illegible]

[illegible]SSOPOLIS, MICH.—The Board of County Supervisors has ap[illegible] a committee to make investigations [illegible] installing [illegible]-lighting system in the county court house to replace the oil lamps [illegible]

[illegible]MAZOO, MICH.—Plans and [illegible] prepared for wiring, heating and ventilating the new addition to the Central High School building in this city, bids for which will be asked about Dec. 5. Ammerman, McCall & Anderson, of Detroit, Mich, are engi[illegible]

[illegible]ISHOLM, MINN.—It is reported that plans are being considered [illegible] McMillan, of Chicago, Ill., for the development of water-power [illegible] Sturgeon River, 20 miles north of Chisholm, to furnish ele[illegible]city to the mines in this vicinity.

[illegible]ERGUS FALLS, MINN.—The Otter Tail Power Company, it is re[illegible]l, contemplates extensive improvements and extensions to its plant, [illegible] an expenditure of about $250,000.

[illegible]SHWAUK, MINN.—Preparations are being made for the installa[illegible]n of an electric-light plant at the Hawkins Mine to supply electricity for lighting the mine, machine shops, office and residences at the Hawkins [illegible]ation. A large generator will be installed at the power house of the [illegible]ng plant. A telephone line is now being erected between the [illegible]s Mine and the washing plant, under the direction of H. E. [illegible], of Chicago, Ill., who will have charge of installing the switches [illegible] extending the wires for the electric-light system.

[illegible] RIVER FALLS, MINN.—The City Council [illegible] awarded a [illegible] the Northwestern Electric Equipment Company, of St. Paul, [illegible] for two 225-hp Diesel oil engines and two 150-kw direct-current [illegible] for the new municipal electric-light plant. The cost of the [illegible]omplete is estimated at about $50,000.

[illegible]REL, MISS.—The Laurel Electric Power & Light Company, re[illegible] incorporated with a capital stock of $75,000, is contemplating the construction of an electric-power plant and street railway in Laurel. P. [illegible] Saunders, Herbert Jones and S. M. Jones are the incorporators.

KANSAS CITY, MO.—The Municipal Art League, of Kansas City, has offered prizes for the best designs for lamp standards for the illumination of the business district. Designs are asked for an orna[illegible] standard, 14 ft. high, to provide for not less than [illegible] lamps [illegible]r an ornamental lighting bracket to be attached to the present [illegible] poles, to be not more than 6 ft. long and to provide for [illegible]ore than four lamps, designed to include an ornamental base for trolley poles at pavement level. Designers are referred to the lamp [illegible]ds now in use in Paris, Brussels, Berlin, [illegible] Los Angeles, Atlanta, Denver and Minneapolis. The Kansas City Advertising Committee has obtained permission from the property owners to install lamps for experimental purposes on one block on Walnut Street. [illegible] are to be submitted to the [illegible], Municipal Art [illegible]eue, 306 Studio Building, Kansas City, Mo., on or before Dec. 9.

KING CITY, MO.—Application has been made to the City Council [illegible] capitalists for a franchise to install [illegible] an electric-light plant in King City.

MARYVILLE, MO.—The Maryville Electric Light & Power Company, is reported, is contemplating extensive improvements, which will double the output of the plant and involve an expenditure of about $9,000.

ST. LOUIS, MO.—The Light & Development Company, of St. Louis, has increased its capital stock from $100,000 to $200,000.

COLUMBUS, MONT.—[illegible] reported, has been granted permission by the Secretary of Agriculture to construct dams on the upper Stillwater River and Woodbine Creek, the power to be utilized to generate electricity. It is estimated that 11,000 hp can be developed.

GLENDIVE, MONT.—The Glendive Heat, Light & Power Company, recently organized, has taken over the property of the Hughes Electric Company, including the local telephone exchange, electric-light plant and municipal heating plant. The company contemplates a number of improvements, including a new telephone system, for which orders for equipment have already been placed.

GREAT FALLS, MONT.—The City Council has accepted the bid of the Northern Idaho & Montana Power Company for street lighting. Under the terms of the franchise the company agrees to supply electricity for new electroliers at $48 per month. Suspended lamps will cost $4.50 per cluster and 60-watt tungsten lamps in the outskirts of the city $1.50 each per month.

LIBBY, MONT.—Preparations are being made for the construction of a large hydroelectric power plant at the Yakt Falls, 18 miles northwest of Libby, by the Milwaukee Power Company. It is proposed to develop 3400 hp in two units of 1700 hp each. A portion of the energy generated at the proposed plant will be used by the Lincoln Gold Mining Company, which owns the Sylvanite mines. J. H. Ehlers, of Spokane, Wash., is interested in the company.

POLSON, MONT.—The Flathead Power & Traction Company, recently incorporated, proposes to build an electric railway between Polson and Dixon, a distance of about 30 miles. F. L. Gray, G. R. M. Stritzel, T. R. Arnold, F. E. Faucett and A. W. Pipes, all of Poulson, Mont., are among the incorporators.

OMAHA, NEB.—Preparations are being made by the Nebraska Transportation Company for the construction of a steam power plant on the Elkhorn River, near Elk City, Neb. About 21,000 hp will be developed.

OMAHA, NEB.—The Bullock Public Service Company has changed its name to the Iowa-Nebraska Public Service Company. The headquarters of the company have been changed from Omaha, Neb., to Norfolk, Neb.

OVERTON, NEB.—Contracts have been awarded by W. H. Hill for the installation of an electric-light plant in Overton.

RENO, NEV.—Surveys have been completed by the Nevada Power & Transportation Company for power sites and ditches from the Truckee River east of Reno in connection with its proposed power development. The company has located two power sites on which it proposes to erect two power plants capable of developing 9000 hp. Work will soon bègin on construction of the system.

CANAAN, N. H.—Preparations are being made for installing an electric-light plant at the Goss mill. It is understood that the plant will supply electricity for lighting the town.

MANCHESTER, N. H.—The New Hampshire Water & Electric Power Company has applied to the Public Service Commission for permission to extend its transmission lines and engage in business in Fitzwilliam, Rindge, Richmond, Winchester and Peterborough.

TRENTON, N. J.—The Trenton-Mercer County Traction Company is planning to install a 1100-hp De Laval steam turbine at its power plant in Trenton.

AMSTERDAM, N. Y.—The plant and holdings of the Empire State Power Company were sold at a foreclosure sale on Oct. 28 by a representative of the New York Trust Company, which is trustee for the bondholders, to the Stone & Webster syndicate, of Boston, Mass., which also has taken over other properties controlled and operated by the Hudson River Electric Power Company. The price paid for the property was $615,000.

BINGHAMTON, N. Y.—At an election held recently the proposition to establish a municipal electric-light plant in Binghamton was carried.

CORTLAND, N. Y.—The contract for electric wiring and fixtures for the State Normal School, in Cortland, has been awarded to the conduit Electric Company, of Syracuse, N. Y., for $6,984.

KEESEVILLE, N. Y.—The Keeseville Electric Company has applied to the Public Service Commission, Second District, for permission to execute a mortgage for $200,000 on all its franchises and property to secure an issue of bonds of like amount.

ONEIDA, N. Y.—The Stone & Webster Management Association, which has taken over the property of the Madison County Gas & Electric Company, of Oneida, has submitted a proposition to the Board of Public Works offering arc lamps for street lighting at the rate of $75 each per year with all-night service and $50 per lamp per year to burn until 1 o'clock. The board is considering the installation of tungsten lamps.

SARATOGA SPRINGS, N. Y.—Bids will be received until Nov. 30 for lighting the streets of the city with gas or electricity for a period of four years. The present street-lighting system consists of 154 arc lamps, 180 incandescent lamps and 226 gas lamps.

ENFIELD, N. C.—The town of Enfield has authorized bonds to the amount of $10,000, the proceeds to be used for the installation of an electric-light system. Bids will be received for the bonds until Dec. 6, 1911. W. T. Clement is Mayor.

SANFORD, N. C.—The Carolina Light & Power Company, it is reported, is contemplating the installation of additional machinery at its plant, including a 500-kw transformer and lightning arresters. The volt-

[illegible]

BEXLEY (STATION R, COLUMBUS), OHIO.—Bids will be received by George E. Fry, village clerk, until Nov. 14 for furnishing [illegible]

CLEVELAND, OHIO.—Plans are being considered by Director Lea and the City Council whereby the city of Cleveland will supply electricity for lamps, heat and motors to the merchants in the vicinity of East 105th Street and Euclid Avenue. The pending franchise, granting Harvey Brothers the right to sell excess power to merchants in that vicinity, is under consideration and Director Lea proposes that the city purchase the energy and sell it at the same rate as is charged by the city for electricity supplied by the Collinwood and the South Brooklyn electric stations. The city will pay for the conduits and wiring with money earned by the municipal plants.

COLUMBUS, OHIO.—Sealed proposals will be received by S. H. Holton, director of public service, Columbus, Ohio, until Nov. 20 for furnishing material and labor for additions and alterations to the municipal electric-light plant, located on West Spring Street, in accordance with plans and specifications on file in the office of the director, in custody of Wirt S. Scott, superintendent of the municipal electric-light plant. Copies of plans and specifications may be obtained on application to the above office.

GUTHRIE, OKLA.—The City Council is considering the question of taking over the water-pumping plant of the Guthrie Light & Power Company. Under the terms of the contract the city has the option of terminating the contract on Dec. 1, 1911. To take over complete control of the plant this winter will require the purchase of part of the power equipment now in use at the station. Three years from now the contract may be terminated without the purchase of any of the equipment. The cost of taking over the plant is estimated at from $8,000 to $15,000.

KINGFISHER, OKLA.—Plans and specifications are being prepared by the Benham Engineering Company, American National Bank Building, Oklahoma City, Okla., for extensions to the municipal electric-light plant and water-works system, for which bonds to the amount of $30,000 have been voted.

PONCA CITY, OKLA.—At an election held Oct. 31 the proposition to issue bonds to the amount of $30,000, the proceeds to be used for the construction of a municipal electric-light plant, was carried.

TALIHINA, OKLA.—It is reported that a movement has been started in Talihina to install a municipal electric-light plant. The City Council has voted to issue bonds for a water-works system.

FLORENCE, ORE.—At an election held recently the citizens voted against the proposition to grant franchises to the Florence Electric Company to install an electric-light and power plant and the Florence-Mapleton Independent Telephone Company to operate a telephone system. The franchises were denied owing to the form in which they were drawn.

HOOD RIVER, ORE.—The Hydro-Electric Company has begun active construction on its power plant at the Tucker Bridge, about 5 miles from the city. The initial installation of 750 hp will be utilized in Hood River. Additional equipment will be installed to supply electricity at The Dalles, where the company has a franchise.

VALE, ORE.—The City Council requests proposals from any parties who will supply electricity for lamps and motors in Vale at lower rates than now charged. The Oregon-Idaho Light & Power Company has been asked to install a system. The Vale Light & Water Company now supplies electrical service in this city.

EBENSBURG, PA.—The Ebensburg Light, Heat & Power Company is contemplating extending its transmission lines to Loretto to supply electricity for lamps and motors. It is also proposed to supply electrical service to residences along its line between Ebensburg and Loretto.

JOHNSTOWN, PA.—The Johnstown & Altoona Railway Company is contemplating the purchase of two 750-kw turbo-generators, water-tube boilers with a rating of 1200 hp, with necessary condensers, piping and pumps. G. U. G. Holman, 52 Williams Street, New York, N. Y., is agent.

LEWISBURG, PA.—The capital stock of the Citizens' Electric Company has been increased from $15,000 to $40,000.

NEW CASTLE, PA.—Application will soon be made by the Connoquenessing Power Company for a charter for the purpose of building an electric-power plant on Slipperyrock Creek, 11 miles east of New Castle. The incorporators are: F. G. Ross, Arthur Barnes and J. H. Roelofs, all of Pittsburgh, Pa.

NEW CASTLE, PA.—D. M. Hosford, consulting engineer, of Cleveland, Ohio, engaged by the City Council to furnish an estimate of the cost of installing a municipal electric plant, has submitted two plans, one for a steam-driven plant, the cost of which is estimated at $193,000, and the other for a gas-engine-driven plant, which would cost approximately $185,237.

WAYNESBURG, PA.—Plans and specifications are being prepared by the Waynesburg & Blacksville Street Railway Company for the construction of a power plant in Waynesburg, bids for which will soon be asked for.

EDGEFIELD, S. C.—The J. B. McCrary Company, of Atlanta, Ga., has been awarded the contract to construct an electric-light plant in Edgefield, to cost $14,000.

SUMMERVILLE, S. C.—The Village Council has authorized the Mayor to enter into a contract with the Augusta-Aiken Railway & Light Company for street lighting. The contract calls for 200 tungsten lamps of 60 cp and eight or ten arc lamps. The town will be rewired throughout. Through oversight this item appeared under Summerville, Ga., in the issue of Nov. 4.

GARRETSON, S. D.—It is reported that J. A. Wiberg, of Luverne, Minn., has decided to install an electric-light plant in Garretson.

WHITE, S. D.—Application has been made to the Town Council by [illegible] Hanson for a franchise to establish an electric-light plant [illegible] White.

WINNER, S. D.—Application has been made to the Council by B. H Martin, of Dallas, for a franchise to install an electric-light plant i Winner.

CHATTANOOGA, TENN.—Application has been made by the Chat tanooga Traction Company for a charter to construct and operate a electric railway in Chattanooga under a franchise granted by the Cit Council several months ago. The company also proposes to build inter urban lines, of which the first will be to Dayton, Tenn., through Hamil ton and Rhea Counties. Another line will be built to the Georgia Stat boundary, the terminus of which will be at Ringgold, Ga. It is also pro posed to build a railway up Lookout Mountain. Electricity for operatin the proposed railways will be secured from a hydroelectric plant no being constructed near Chattanooga. The company is capitalized at $100 000. C. E. James, D. F. Beckhaw, J. L. Davies and Franklyn Harris a interested in the project.

KNOXVILLE, TENN.—Application has been filed with the Count Court for a charter for the Knoxville Light & Power Company. Th company will be capitalized at $500,000 and proposes to control th energy generated by the Eastern Tennessee Power Company, to be di tributed in this vicinity.

TRENTON, TENN.—The City Council has purchased a site on Nort Eaton Street, just east of the W. & O. railroad tracks, on which it wi erect an electric-light plant. The Council will issue warrants to the cit treasurer to defray the cost of the plant. The citizens recently voted t issue $12,000 in bonds for an electric-light system. Messrs. Keenan Wade enjoined the Council from issuing and selling the bonds. It is e pected to have the system ready for operation by the first of the year.

DALLAS, TEX.—The installation of an ornamental street-lightir system on Main Street is under consideration.

DALLAS, TEX.—Application has been made to the County Cor missioners by John T. Witt for a thirty-year franchise to construct ar operate an electric interurban railway over the West Dallas-Commer Street turnpike.

GALVESTON, TEX.—It is reported that the plant and holdings the Brush Electric & Power Company, of Galveston, Tex., have be purchased by the Newman interests, of New Orleans, La. The consi eration is said to be between $750,000 and $800,000.

GUFFEY, TEX.—The Beaumont Ice, Light & Refrigerating Co pany, of Beaumont, Tex., has extended its transmission lines to Spinc Top for the purpose of supplying electricity to operate the oil we there.

HOUSTON, TEX.—Plans are being considered for extensive impro ments and extensions by the Houston Electric Company to its street c system during the coming year, which will involve an expenditure about $750,000.

M'KINNEY, TEX.—The Union Telephone Company has purchased building on North Kentucky Street and will establish a long-dista and local telephone system in McKinney. The company will place wires underground in the business section. This city will be t headquarters of the company for this district.

TAYLOR, TEX.—The United Telephone Company is contemplati the installation of a new switchboard and other equipment in its lo exchange. E. A. Glass, of Austin, Tex., is general manager.

WACO, TEX.—The citizens of Waco have subscribed to $150,000 capital stock of the Dallas-Waco Interurban Railway, and negotiati have been closed for building the railway to Waco. In addition to tending the interurban line to Waco, the company has announced that will build a power plant near this city, to cost about $500,000.

ORLEANS, VT.—The town of Orleans has contracted with the No Troy Electric Light & Power Company, of North Troy, Vt., to sup electricity to operate the local electric-light system. The company erect a transmission line to Orleans. The contract is for a term fifteen years with the privilege of renewal for five or ten years. present contract with the town of Barton, which supplies electricity the local system, expires in December, 1912.

SPRINGFIELD, VT.—The Springfield Electric Company has c menced work on the construction of a new power house on the site the old building.

WAITSFIELD, VT.—The town of Waitsfield has awarded a contrac Moody & Almon, of Montpelier, Vt., to supply electricity for la and motors in this village and also to the farms along the route its transmission line. The town has also voted to exempt the p erty of the company for a period of ten years. The transmission will be extended from Moretown.

CHEHALIS, WASH.—Application has been made to the City Co il

[illegible] franchise to install a [illegible] telephone system in [illegible].

SEATTLE, WASH.—The [illegible] Railway Company, which recently [illegible] railway from [illegible] to Lake [illegible], has [illegible] corporation with a capital stock of $125,000. W. H. Murphy, L. I. [illegible] and D. L. Burkhart are [illegible].

WENATCHEE, WASH.—The Wenatchee Valley Power & [illegible] Company has awarded a contract to [illegible] for grading its [illegible] in this vicinity.

WHITE SALMON, WASH.—A bid has been submitted to the Mount [illegible] Electric Railway Company [illegible], Wash., offering to construct its proposed railway from a point near the Columbia River to White Salmon for $42,000.

NEW MARTINSVILLE, W. VA.—The plant and holdings of the New Martinsville Electric Light, Heat & Power Company have been purchased by the Sisterville Electric Light & Power Company for $20,150. The property was sold at public sale. The Sisterville company will supply electricity generated at its plant in Sisterville in New Martinsville as soon as improvements and extensions are completed.

PEWAUKEE, WIS.—The local electric-light plant and lighting contracts, with water privilege at Pewaukee, have been taken over by the [illegible] Electric Light & Railway Company, of Milwaukee. [illegible] power needed in Pewaukee will be furnished from the plant of the Milwaukee company at the Kilbourne dam on the Wisconsin River. The company has also been granted a franchise to erect transmission lines and electric railway on the streets and highways in Pewaukee.

WAUSAU, WIS.—Plans are being considered by the Wausau Street Railway Company, the Marathon Paper Mills Company and the Wausau [illegible] Company, of Mosinee, for the construction of a joint power [illegible] at Wausau.

WEYAUWEGA, WIS.—The property of the Weyauwega Electric Light Company, including water privilege, electric-light plant, flour mill, elevator and factory building, was sold at auction on Oct. 23 to Charles Peterson, of Weyauwega, for a consideration of $15,000. The property was appraised at the assignment at $60,000.

[illegible] MOT, WIS.—The installation of an electric-light plant is reported to be under construction. Power for operating the plant will be secured from the dam of the local mill.

[illegible]MONTON, ALTA, CAN.—The Council, it is reported, has de[illegible] to purchase a surface condenser for the municipal electric-light [illegible] as recommended by A. J. Latornell, chief engineer, bids for [illegible] will be called for. The cost of the condenser is estimated at [illegible] $5,000.

[illegible]NAIMO, B. C., CAN.—The British Columbia Company, of Vic[illegible] B. C., it is stated, has submitted a proposition offering to install [illegible]eet-railway system provided the Council will guarantee the interest [illegible] to the amount of $150,000. It is understood that a by-law is being prepared. A. G. Waters is city engineer.

ST. JOHN, N. B., CAN.—An agreement has been reached between the [illegible] Brunswick Hydro-Electric Company and the sub-committee of the [illegible]cil whereby the former will be allowed to enter the city and erect [illegible]tributing system to supply electricity for lamps and motors. It is [illegible]rstood that the terms of the agreement provide for a substantial [illegible]tion in rates to all consumers for both lamps and motors. If the [illegible]il approves of the agreement, the company will begin work at [illegible] on its proposed system.

[illegible]DEN, ONT., CAN.—The by-law authorizing an appropriation of [illegible] for the installation of a distributing system for utilizing electricity [illegible]den, supplied by the Hydroelectric Power Commission, was car[illegible]

[illegible]CEBRIDGE, ONT., CAN.—Tenders will be received by the [illegible] of Bracebridge, Ont., until Nov. 14 for the sale of $8,300 power [illegible]. A. C. Salmon is town clerk.

[illegible]MDEN EAST, ONT., CAN.—The Ontario Power Company, it is [illegible]ted, is contemplating a power development on the Napanee River, [illegible]mden East, which will involve an expenditure of about $200,000 [illegible] include the erection of three generating stations. The proposed [illegible] will necessitate rock cutting in river channel, several drains, etc.

[illegible]NGSTON, ONT., CAN.—New estimates, it is reported, have been [illegible]tted by the Hydroelectric Power Commission for furnishing to [illegible]ston, Brockville, Morrisburg, Cardinal and Prescott fom 3000 to [illegible] hp. Under the [illegible] the city of Kingston will pay [illegible] per hp for 3000 hp and $17.80 per hp for 10,000 hp. The price to [illegible]sburg is quoted at $13.07 per hp for 3000 hp and $11.46 per hp for [illegible]0 hp. The report does not state where the power will be supplied [illegible] but presumably from Waddington, N. Y., in view of the low [illegible] quoted for Morrisburg. It is a question whether Kingston will [illegible] the offer, as the proposition submitted by the Seymour Power [illegible]pany is a better one. In case [illegible] municipalities would be greatly increased.

MIDLAND, ONT., CAN.—The Canada Iron Corporation, Ltd., of Midland, Ont., it is reported, would like to communicate with electrical construction firms in connection with the erection of a short electric [illegible]nsmission line. For further information address A. C. Allen, Midland, Ont.

NORTH BAY, ONT., CAN.—The Town Council is considering the question of establishing a municipal electric-light plant and is negotiating with the North Bay Light, Heat & Power Company with that object in view. The franchise of the company has expired. The local company has been taken over by the Nipissing Power Company, which is controlled by Smith, Kerry & Chace, of Toronto. The Nipissing company has applied for a twenty-one-year franchise and offers very low rates if the franchise is granted. The Council is also considering the question of securing electricity from the Hydroelectric Commission, and a definite proposition will soon be submitted by the commission to the Council. It is said that the acceptance of the commission's proposition means the expropriation of the Nipissing Power Company's plant at South River, which will be the first action of this kind by the Hydroelectric Commission.

TORONTO, ONT., CAN.—The Barcelona Company, recently organized under the laws of Canada with a capital stock of $25,000,000, proposes to develop water-power of 250,000 hp and to build hydroelectric power plants to supply electricity for lamps and motors in the city of Barcelona and the northeast section of Spain. The company has also secured one of the tramways in Barcelona and valuable concessions for suburban railways. An expenditure of $25,000,000 is contemplated by the company. Dr. F. S. Pearson, Percival Farquhar and other Canadian and English capitalists are interested in the project. The head office will be located in Toronto, Ont.

WATERFORD, ONT., CAN.—A by-law will soon be submitted to the ratepayers to appropriate $7,000 for the installation of an electric-light plant in Waterford.

SASKATOON, SASK., CAN.—The government is planning to install an automatic telephone exchange, to cost about $250,000, work on which will begin at once.

New Industrial Companies.

THE AMERICAN SAFETY DEVICE COMPANY, of New York, N. Y., has been incorporated by Joseph L. Clueas, 30 Church Street; Calvin S. Hunter, 540 West 165th Street, New York, N. Y., and E. A. Denevellis, 91 Maple Avenue, Flushing, N. Y. The company is capitalized at $200,000 and proposes to manufacture appliances used in building and construction.

THE CHICAGO RAILWAY & MILL SUPPLY COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $5,000 to manufacture and deal in railway machinery and equipment. The incorporators are: A. W. Gillespie, C. B. Royal and J. S. Seeley.

THE DETECTOGRAPH COMPANY, borough of the Bronx, New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing machinery and apparatus to protect documents, etc. The incorporators are: J. W. Cameron, G. S. Miller and C. A. Lee, all of New York, N. Y.

THE GORDON ELECTRIC & MANUFACTURING COMPANY, of Chicago, Ill., has been incoporated with a capital stock of $15,000 by Hazel Jones, Otto W. Wermich and Max W. Zabel. The company proposes to manufacture and deal in electrical devices and supplies.

THE MECHANICAL ADVERTISING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture advertising machines and devices. The incorporators are: E. Callahan, of Hartford, Conn.; R. Butler and A. L. Friedberg, of New York, N. Y.

SUPPLIES, INCORPORATED, of New York, N. Y., has filed articles of incorporation, with a capital stock of $50,000, to manufacture and deal in electric lamps and electrical supplies; also to deal in office, hotel supplies, etc. The incorporators are: Harvey Descher, 334 West Fifty-eight Street; Harold R. Zeamans, 98 Morningside Avenue, and Victor R. Grieff, 160 West Seventy-ninth Street, New York, N. Y.

THE WAITE-HAYDEN COMPANY, of Syracuse, N. Y., has been granted a charter with a capital stock of $10,000 for the purpose of manufacturing watchmen's clocks, electric signals, alarms, etc. The incorporators are: Annie S. Waite, Wilbur M. Waite, 113 Lynhurst Avenue; Perry B. Hayden, 230 West Lafayette Avenue, Syracuse, N. Y.

New Incorporations.

MIAMI, ARIZ.—The Miami Electric & Power Company has filed articles of incorporation with a capital stock of $500,000. The incorporators are: C. W. Van Dkye and R. S. Van Dyke.

CHICAGO, ILL.—The Central Station Engineering Company has been incorporated by C. A. Gillham, B. T. Gifford and A. E. Durham. The company is capitalized at $50,000 and proposes to construct and operate public-utility plants.

CHICAGO, ILL.—The West Hammond Gas & Electric Company has filed articles of incorporation with a capital stock of $5,000 for the purpose of furnishing light, heat and power. The incorporators are: Harry W. Darling, George F. Borman and Jefferson L. Fulton.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed for the Alton & Southern Railway Company with a capital stock of $10,000 to construct an electric railway from a point on the Mississippi

[illegible] in St. Clair County [illegible] East St. Louis, Ill. The incorporators are: Arthur V. Davis and R. Mellon, of Pittsburgh, Pa.; Charles M. Hall, of Niagara Falls, N. Y.; C. B. Fox, of East St. Louis, Ill., and others.

HAMILTON, ILL.—[illegible] the Hamilton Railway Company by George Higginson, of Winnetka, Ill.; Joel D. Harvey, of Geneva, Ill.; Joseph L. Valentine, Hayne Wells, of Chicago, Ill., and A. W. O'Hara. The company is capitalized at $1,000,000 and proposes to build an electric railway from a point on the bridge over the Mississippi River, between Hamilton, Ill., and Keokuk, Ia.

MARISSA, ILL.—The Hamilton Water Company has been incorporated with a capital stock of [illegible] and William H. Hoppe. The company proposes to operate water, light and power plants.

SHIRLEY, IND.—The Shirley Telephone Company has been incorporated with a capital stock of $5,000 to operate in Hancock, Henry and Madison Counties. The incorporators are: W. W. Wilcoxen, T. [illegible] Wilcoxen.

TOPEKA, KAN.—The Kansas City & Fort Scott Electric Railway Company has been granted a charter to construct an electric railway from the terminus of the Metropolitan Street Railway in Rosedale via Stanley, Prescott, Fulton, Louisburg and Pleasanton to Fort Scott. The company is capitalized at $10,000 and the incorporators are: W. S. Quarles, of Stanley; M. M. Sweetman, of Kansas City, Mo.; D. E. Ainsworth, and T. W. Conboy, of Stilwell; W. H. Foster, R. J. Rogers, of Louisburg; M. Langan, of Paola, and others.

WINONA, MINN.—The Minnesota-Wisconsin Power Corporation has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $2,000,000, to construct and operate both electric and gas plants. The incorporators are: W. B. Parsons, C. P. Crangle and James Ritchie, of Winona, Minn.

ST. LOUIS, MO.—Articles of incorporation have been filed for the National Light & Power Company with a capital stock of $2,000 for the purpose of doing a general lighting and power business. The incorporators are: W. C. Morehead, A. B. Ewing, Jr., and Judson H. Boughton.

ENDICOTT, N. Y.—The Endicott Light, Heat & Power Company has been granted a charter with a capital stock of $5,000. The incorporators are: Perkins & Blakeslee, Lewis S. Nattoon, Isaac E. House and J. Winfield Tiffany.

MARSHALL, N. C.—Articles of incorporation have been filed for the Madison Light & Power Company with a capital stock of $10,000 by J. H. White, F. Shelton and others.

FINLEY, N. D.—The Finley Light & Power Company has been incorporated with a capital stock of $5,000 by J. A. Carlson, E. G. Quamme, O. Cummings, R. J. Sluggett, G. A. Montieth, F. E. Curry and others, all of Finley. The company proposes to construct and operate an electric plant to supply electricity for lamps and motors in Finley.

CLEVELAND, OHIO.—The Thompson Electric Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: Allison J. Thompson, Joseph Hidy, Joseph J. Klein, S. M. Davis and Edith A. Close.

COSHOCTON, OHIO.—The Coshocton Telephone Company has been incorporated with a capital stock of $150,000 for the purpose of taking over the property of the Citizens' Telephone Company and the Central Union Telephone Company in Coshocton. The incorporators are: Joseph L. Rue, L. P. Gallagher, Frank Pomerene and others.

MUSKOGEE, OKLA.—The Peabody Electric Company has been incorporated with a capital stock of $4,550 by F. H. Nebon, A. D. Peabody and W. R. Robinson, all of Muskogee, Okla.

CLEARFIELD, PA.—The Clearfield Electric Company filed articles of incorporation with a capital stock of $5,000. The directors are: John W. Wrigley, of Clearfield, Pa., treasurer; O. J. Harm, of Snow Shoe, Pa.; David Chambers, of Clarence, Pa., and A. W. Lee, and H. J. Thompson, of Clearfield, Pa.

NEW ALEXANDRIA, PA.—The New Alexandria Electric Company has been granted a charter with a capital stock of $5,000. The incorporators are: A. E. DuBois, of Wilkinsburg, Pa.; J. S. Tannehill, of Carnegie, Pa., and G. T. Smith, of Pittsburgh, Pa.

PITTSBURGH, PA.—The Wood Electric Company has been incorporated with a capital stock of $5,000 by H. V. Blaxter, Allen H. Kerr and S. K. Henderson, of Pittsburgh, Pa.

SALTSBURG, PA.—The Saltsburg Electric Company has been granted a charter by the State Department with a capital stock of $5,000. The incorporators are: H. A. Welland, of Bellevue, Pa.; E. DuBois, of Wilkinsburg, Pa., and G. T. Smith, of Pittsburgh, Pa.

RHEA SPRINGS, TENN.—Articles of incorporation have been filed for the Rhea Springs Light & Power Company with a capital stock of $1,000 by D. W. Hughes, J. C. Wasson, P. C. Chadwick and others.

COMMERCE, TEX.—The Commerce Ice & Power Company has been incorporated with a capital of $50,000 by C. A. and P. J. Struve and T. W. Smith.

FT. WORTH, TEX.—The Northern Texas Traction Company, of Ft. Worth, has been granted a franchise by the City Council of Polytechnic to extend its street railway to Ingleside Heights.

Personal.

[illegible] has been retained by the municipality of San Francisco to report on the city transportation system.

MR. HOWARD T. CASE, a graduate of Union University, Schenectady, has been appointed head of the department of publicity of the Hydroelectric Power Commission of Ontario.

MR. W. L. WATERS, of the Westinghouse Electric & Manufacturing Company, sailed November 4 on the *Kaiserin Auguste Victoria*, for a trip around the world. Mr. Waters expects to be away about six months.

MR. E. W. GOUGH, formerly assistant general manager for the New York & Queens Electric Light & Power Company, is now connected with the General Vehicle Company as superintendent of its service department, located at the works in Long Island City.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company and chairman of the executive committee of the Chicago Elevated Railways, has been elected a director and a member of the executive committee of the Chicago & Alton Railroad Company.

MR. JOSEPH H. SIEGFRIED, who has been in charge of the operating department of the United Missouri River Power Company, Helena, Mont., for the past four years, has been appointed superintendent of the Winnipeg (Can.) Municipal Light Plant, with headquarters at Point du Bois, Manitoba.

MR. HENRY C. EDDY, formerly general manager of the Northern Heating & Electric Company, of St. Paul, Minn., and now general contract agent of the American Gas & Electric Company, of New York, has been making a Western trip in the interest of the electric-service properties with which he is connected.

MR. J. R. ONG, superintendent of substations, has been appointed assistant electrical engineer of the Fort Dodge, Des Moines & Southern Railroad Company. Mr. Ong is a 1909 graduate of Purdue, and he has held various positions with the Indianapolis & Cincinnati Traction Company, Indianapolis, Columbus & Southern Traction Company, Chicago Lake Shore & South Bend Railway, and the Westinghouse Electric & Manufacturing Company.

MR. S. E. DILLON, formerly general manager of the Hot Springs Western Railroad before that line was taken over by the Iron Mountain System, has been appointed general manager of the Hot Springs Water Company, of Hot Springs, Ark., which controls the local central-station gas, water and street-railway utilities. Mr. Dillon fills the place formerly held by Mr. H. E. Martin, whose duties have been divided between Mr. W. C. Fordyce and Mr. H. J. Lehman. Mr Edward Hardin, who recently resigned as superintendent of the street-railway service, has been succeeded by Mr. J. H. Butterfield, formerly city clerk of Hot Springs and the son of a former general manager of the Hot Springs company.

MR. S. B. WAY, chief electrical engineer of Union Electric Light & Power Company, St. Louis, has been promoted to be assistant general manager of the Milwaukee Electric Railway & Light Company, to have charge of the electric-light and power and gas departments, as well as the generating departments. Mr. Way took charge Nov. 1. Mr. Way has been chief electrical engineer for the Union Electric Company and the Imperial Company in St. Louis for the last thirteen years. Before coming to St. Louis he was erecting engineer for the Electric Storage Battery Company, of Philadelphia, which he joined after graduating from the Drexel Institute in Philadelphia in 1896. Mr. Way is a member of the St. Louis League of Electrical Interests, the Rejuvenated Sons of Jove and various St. Louis commercial clubs. On Thursday evening, Oct. 26, the heads of departments of the Union Electric Light & Power Company—Messrs. H. Spoehr, secretary and treasurer; John Hunter, chief engineer of power plants; E. H. Shufro, purchasing agent; L. F. Philo, sales [illegible] commercial engineer, and C. E. Mich, manager automobile department—gave Mr. and Mrs. Way a dinner at the Jefferson Hotel and a theater party, at which time Mr. Way was presented with a traveling outfit. After the theater Mr. Way gave a supper to the gentlemen mentioned. On Saturday evening, Oct. 28, employees in Mr. Way's department gave him a farewell banquet at the City Club. Many of the other employees outside of Mr. Way's department also attended. Mr. Way was presented with a handsome golf outfit by his employees, and at the same meeting the company section of the N. E. L. A. gave Mr. Way a set of diamond cuff-links. On Monday [illegible] dinner was given to Mr. Way by a number of friends at the Mercantile Club.

Obituary.

FREDERICK [illegible] Company, [illegible] reason of his connection with [illegible] and the Boston Gas Light [illegible] Nov. 2, at the age of [illegible]

MR. B. G. McNABB, contract agent of the Montreal Light, Heat & Power Company, was accidentally killed by his own gun while duck hunting on Oct. 21. In attempting to draw his gun toward him in order to shoot a gull overhead the charges in both barrels were exploded with the fatal result noted. The deceased was born in St. Thomas, Ontario, on Nov. 19, 1882. He is survived by [illegible]

MR. DANIEL F. DRAWBAUGH, [illegible] figure in telephone litigation, died at Harrisburg, Pa., Nov. 3, at the age of eighty-four. In addition to his work in the telephone field, he invented pneumatic tools, hydraulic rams, folding lunch boxes, barrel faucets, measuring machines for use in wrapping goods, and corn [illegible] Mr. Drawbaugh claimed to have invented [illegible] telephone as early as 1869, and that in 1871 he improved the receiver, which was still further improved in 1874, when an instrument was made which is said to be still in existence. In 1881 the People's Telephone Company was formed to press the claims of Drawbaugh to the invention of the telephone. This led to a long litigation with the American Bell Telephone Company. The controversy ended in the courts upholding [illegible] patents and denying the main contentions of Drawbaugh.

Trade Publications.

PRINTING PRESS MOTORS.—Bulletin No. 85 of the Robbins & Myers Company, Springfield, Ohio, contains descriptions and illustrations of motors especially designed for the driving of flat-bed printing presses.

DIRECT-CURRENT SWITCHBOARD PANELS FOR SMALL MINING PLANTS.—The General Electric Company, in Bulletin No. 4877, describes direct-current switchboard panels, single polarity, for small mining plants. They are for use only in stations with a grounded negative. Connection and dimension diagrams are included in the bulletin.

INCLOSED FLAME-ARC LAMPS.—The General Electric Company [illegible] just issued Bulletin No. 4882 describing its inclosed flame-arc lamps. [illegible] lamp utilizes the impregnated or so-called plain carbon electrode, [illegible] gives remarkable illuminating efficiency and is so designed as to [illegible] of the use of any of the standard makes of flame carbons available. This line of lamp comprises designs suitable for all classes of commercial [illegible]

POWER STATION CONSTRUCTION.—The Stone & Webster Engineering Corporation has issued an attractive booklet listing its activities in power station construction work. It has completed or is working on steam stations aggregating 184,420 kw, hydroelectric developments aggregating 211,150 kw, railway work totaling 551 miles, substations of 83,825 kw capacity, and has thirty building construction contracts of various [illegible]

INSULATION.—The Okonite Company, 253 Broadway, New York [illegible] has published an attractive booklet entitled "Economy in Joint [illegible]ng, with Instructions." It contains information which should be [illegible] much in demand just at this season of the year, as now is the time [illegible] repairs in the [illegible] joints so that [illegible] short-circuits, with their accompanying troubles, may be avoided during [illegible] winter to come.

AUXILIARY CONTRACTOR EQUIPMENTS.—In Folder No. 4186, Westinghouse Electric & Manufacturing Company describes an auxiliary line switch for use on trolley cars equipped with ordinary drum-type controllers. The switch, which is mounted underneath the car, is electro-pneumatically operated and in effect is a very rugged circuit-breaker. [illegible] folder contains a complete description and photographic illustration [illegible] line switch and [illegible]

BRITISH INTERIOR WIRING CONDUIT.—The Sun Engineering [illegible], 120 Charing Cross R[illegible] [illegible] two [illegible]blets relating to its "Kalkos" system of interior wiring. In this [illegible]m specially drawn brass tubes turned inside and out are used, which [illegible] jointed by slip sockets and soldered. A universal outlet box is used, which a ceiling rosette or [illegible] advantages claimed for the brass conduit are absence of condensation and ease with which the conduit may be bent to curves.

DIRECT-CURRENT INTERPOLE GENERATORS.—Descriptive Leaflet No. 2371, issued by the Westinghouse Electric & Manufacturing Company, treats of Type Q engine-driven, direct-current interpole generators manufactured by it. The leaflet, which is letter-size and arranged to bind in with correspondence, gives illustrations of type Q generators assembled, and of the important component parts. Short descriptions of the complete machines and the parts are given that enable anyone interested to form an excellent idea of the characteristics and construction of the apparatus.

WARREN BEAUTIFUL.—With this title the Sterling Electrical Manufacturing Company, Warren, Ohio, has issued a reprint in handsome form of a paper read by Mr. William Coale, treasurer of the Sterling company, at a commercial session of the National Electric Light Association. A description is included, together with illustrations, of the series tungsten street lighting system of Warren, which city was the first to adopt the "Mazda" lamps for public lighting to the exclusion of arc and gas and gasoline lamps. The pamphlet also contains in full the contract of the city with the Warren Water & Light Company for street lighting.

SWITCHBOARD AND HIGH-TENSION RELAYS FOR ALTERNATING CURRENT AND DIRECT CURRENT.—The General Electric Company has recently issued Bulletin No. 4857, which thoroughly describes its switchboard and high-tension relays. Among these relays are those for circuit-opening, time-limit relays, inverse time-limit, definite time-limit, low-voltage, no-voltage and over-load reverse current, reverse phase, etc. Each type of relay is illustrated and described, and the publication contains general notes on the use of relays, including a diagram of modern power-house wiring and buses, and the location of relays.

POLYPHASE INDUCTION MOTOR.—A polyphase motor resembling in external appearance and operating characteristics its well-known self-starting, single-phase induction motor was developed for the market two years ago by the Wagner Electric Manufacturing Company, St. Louis, Mo. This motor operates during starting and at low speeds with a high-resistance secondary, while during running it operates with a low-resistance secondary. The change from high resistance to low resistance is brought about by a short-circuiting device operated by centrifugal force. A good description of the motor is given in Bulletin No. 95.

FURNACE STOKERS.—A new catalog of the Taylor stoker has just been issued by the manufacturers, the American Ship Windlass Company, Providence, R. I. The catalog is well illustrated, the stoker parts being named in several views. Other illustrations show well-known power plants, such as the New York Edison Waterside Station, the Christian Street Station of the Philadelphia Electric Light Company and stations of the Detroit Edison Company, the Everett Mills, of Lawrence, and the Oxford Paper Company, of Rumford Falls, Maine. An interesting cut is shown of the largest stokers ever built, these being the two fourteen-retort stokers for the Hartford Electric Light Company.

WESTINGHOUSE RAILWAY EQUIPMENT.—"Westinghouse Railway Equipment" is the title of Folder No. 4184 of the Westinghouse Electric & Manufacturing Company. The folder, which is time-table size with an attractive cover, describes the spider armature construction used by the Westinghouse company, its railway motor brush holders, armature and axle bearings and unit switch control systems, both for 600 and 1200 volts. Discussions are also given of the comparative advantages of interpole and non-interpole railway motors, and of box-frame vs. split-frame motors. Many photographic reproductions are given of modern interurban and street railway cars, and beside each is tabulated an outline specification for each car, indicating what electrical and mechanical equipment is used on it, and its dimensions.

A CLEVER BOOKLET.—The Dielectric Company, St. Louis, has issued an eight-page pamphlet, handsome in execution and particularly clever in design. The pages are artistically designed, and each—except the first and last—contains a single illustration accompanied by a single sentence of a few words. On the first two facing pages are, to the left, a view of the company's manufacturing plant with the caption "Our Plant," and on the other a view of articles and packages, with the caption "Our Product." Of the following two pages, one shows a large collection of letterheads, with the caption "Our Customers," and the other, views of various kinds of apparatus, the caption being, "Our Customers' Products." On the next facing pages are, on one page, views of a section of the Panama Canal and of a war vessel moored at a navy yard, with the caption "Our Government's Use of Our Product," and on the other, a curve showing "Our Growth." On the final page is a list of the dielectric products with the note, "We would like to receive inquiries for samples and prices."

BUSINESS NOTES.

UNDERGROUND WORK IN EAST ST. LOUIS.—The Postal Telegraph-Cable Company is placing its wires underground in East St. Louis, Ill. The Graner-Mahoney Contracting Company, of St. Louis, has the contract for installing the conduits.

H. W. JOHNS-MANVILLE COMPANY.—The Birmingham (Ala.) office of the H. W. Johns-Manville Company has been moved from 1220 Empire Building to 606 Chamber of Commerce Building. The office will continue to be under the management of Mr. W. H. Fleming, who was formerly connected with the New Orleans branch of the company for a considerable time. A complete line of electrical supplies and asbestos and magnesia products will be handled from this office.

PUMPS ON WARSHIPS.—The Blake & Knowles Steam Pump Works, 115 Broadway, New York City, have installed pumping equipment on sixty-five of the 108 vessels which last week took part in the naval review at New York. Nine of the remainder carry no steam pumps, including the submarines and one sailing vessel, and eight others, principally colliers, were built abroad. The number of pumps the above-mentioned company has installed on the fleet exceeds 1000, and their cost represents nearly $1,250,000.

[illegible] MORRISON MANUFACTURING COMPANY [illegible] United States Navy fleet colliers No. 9 and No. 10 with coal-loading and unloading [illegible]. The Newport News Ship Building & Dry Dock Company is building the colliers. The United States Navy collier *Cyclops*, built by the Cramp Ship Building & Engine Company, about one year ago, was equipped with the Mead-Morrison Manufacturing Company's coal-loading and unloading apparatus.

HEAVY DEMAND FOR PLANIA CARBONS.—H. M. Hirschberg, president of the Excello Arc Lamp Company and sole importer of Plania carbons, 32 East Twentieth Street, New York City, says that present conditions in both branches of his business are highly satisfactory. Sales of the Plania carbons, he says, are surpassing the highest expectations he held for them upon their introduction, and the factories turning out his products are crowded to capacity. The Plania carbons are the product of the Plania works, in Ratibor, Silesia.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 31, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,007,054. CEILING-ROSE AND THE LIKE FOR USE IN ELECTRIC CIRCUITS; F. G. Bazell, Coventry, England. App. filed Dec. 18, 1909. A base, body and cover of porcelain with terminal connections.

1,007,058. MECHANICAL MOVEMENT AND ELECTRIC-LIGHT SOCKET; T. A. C. Roth, New York, N. Y. App. filed June 2, 1911. Two-part porcelain block with rotary snap.

1,007,069. TREATMENT OF IRON OR STEEL TO PREVENT THE OXIDATION OR RUSTING THEREOF; T. W. Coslett, Birmingham, England. App. filed Nov. 25, 1910. A solution of zinc and iron phosphate. Action may be accelerated electrically.

1,007,125. ELECTRIC HEATER; C. P. Madsen, Chicago, Ill. App. filed July 9, 1910. For toasters, broilers, etc.

1,007,138. INSULATOR BRACKET; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed Oct. 26, 1910. A ribbed support and a channel-like bracket riveted in place.

1,007,151. ELECTRODE; E. C. Speiden, Niagara Falls, N. Y. App. filed May 17, 1910. A sectional hollow electrode for electrothermic work.

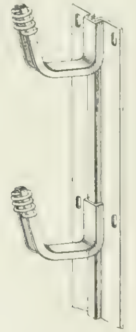
1,007,178. PRESSURE-RATIO ALARM; A. W. J. Billings, Havana, Cuba. App. filed July 21, 1909. A casing and diaphragm for determining the condition of a fire by pressure differences.

1,007,186. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed June 21, 1911. Dynamo and storage-battery lighting system.

1,007,188. WAX MELTER; J. G. Dickson, Chicago, Ill. App. filed [illegible]. A melting pot and electric heater for sealing wax.

1,007,192. MAGNETIC-CONTROL SYSTEM FOR RAILWAYS; A. H. Fox and A. W. Lenderoth, New York and Stapleton, N. Y. App. filed May 22, 1909. Armature sections in the roadbed and electromagnets on the cars for exerting automatic speed control.

1,007,211. ELECTRIC-ARC LAMP; M. Körting, Leutzsch, Germany. App. filed Nov. 22, 1909. When a lamp fails a compensating im[illegible] substituted.



1,007,138.—Insulator Bracket.

[illegible] FOR PIANOS OR THE LIKE; A. D. [illegible], Pa. App. filed May 14, 1909. Electromag[illegible] controlled by the pedal [illegible].

[illegible], Warsaw, Russia. App. [illegible].

1,007,265. METHOD OF AND MECHANISM FOR PRODUCING MUSICAL SOUNDS; G. Breed, Philadelphia, Pa. App. filed Sept. 23, 1909. Strings are vibrated electromagnetically by pulsating current.

1,007,284. ILLUMINATING DEVICE; A. J. Horner, Cleveland, Ohio. App. filed Dec. 3, 1910. A casing with a dry cell for illuminating [illegible].

1,007,291. CONTINUOUS ELECTRIC SWITCH; F. M. G. Johnson, Montreal, Quebec, Can. App. filed Dec. 26, 1908. Single button for making and breaking a lamp circuit, etc.

1,007,344. TELEPHONE-SYSTEM SIGNALING APPARATUS; J. Erickson, Chicago, Ill. App. filed Feb. 5, 1910. The line signal [illegible] by the subscriber [illegible] the operator.

1,007,358. CASING FOR LAMP SOCKETS; C. J. Klein, Milwaukee, Wis. App. filed Dec. 7, 1908. Interior catches for interlocking the cap and body are released by rotating an inner sleeve.

1,007,364. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; J. K. Lux, Jersey City, N. J. App. filed March 25, 1909. The cap and body of the shell have interlocking shoulders and guides.

1,007,370. SUSPENSION DEVICE FOR TROLLEY WIRES AND THE LIKE; G. A. Mead, Mansfield, Ohio. App. filed Nov. 12, 1906. A clip for engaging the messenger wire and a rod and clamp for the trolley wire.

1,007,373. BRACKET TELEPHONE; W. C. Moeller, Doon, Ia. App. filed Dec. [illegible], 1909. Lazy tongs with adjustable upright for the receiver and transmitter.

1,007,386. AUTOMATIC SWITCH; J. L. Polk, Troy, N. Y. App. filed Sept. 2, 1910. Movable in one direction by hand and returned by a spring and cushioned by a dashpot.

1,007,387. AUTOMATIC SIGNAL DEVICE; F. Porto, Baltimore, Md. App. filed April 27, 1910. Railroad block system automatically setting the brakes and signaling the engineer and tower operator.

1,007,388. ELECTROLYTIC METHOD OF REFINING IRON; A. S. Ramage, Buffalo, N. Y. App. filed March 7, 1911. The impure iron is electrolytically dissolved in an acid ferric liquor and the resulting liquid is electrolyized with insoluble anodes.

1,007,402. MOTOR-CONTROLLING DEVICE; L. L. Tatum, Milwaukee, Wis. App. filed Feb. 11, 1910. Starting rheostat for rear of switchboard use to cut out the motor regardless of the position of the controller.

1,007,419. PLURAL-LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July 27, 1906. Insulation of the parts of the cover, contacts, etc., by enamel.

1,007,435. HEADLIGHT; R. M. Dooley, Rockland, Tex. App. filed Jan. 27, 1910. Arc lamp with solenoid adjustment.

1,007,438. TROLLEY-POLE SUPPORT; A. Feja, St. Louis, Mo. App filed July 2, 1910. Notched wheel and pawl for affording yielding resistance to rotation.

1,007,441. ELECTRIC HEATER AND PROCESS OF CONSTRUCTING THE SAME; W. S. Hadaway, Jr., East Orange, N. J. App filed March 15, 1909. Sheets of asbestos are soaked in japan and baked, then redipped and assembled with the resistance elements.

1,007,446. ELECTRIC HEATER; A. F. Jacobson, New York, N. Y. App. filed Aug. 6, 1910. A shell and coils for a printing machine for preventing sheets of paper from cohering.

1,007,456. CONTROLLER FOR ELECTRIC MOTORS; F. W. Lacey, Bournemouth, England. App. filed March 2, 1910. A lock for the reverser drum of such type as Patent No. 611,465.

1,007,457. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINERY; B. G. Lamme, Pittsburgh, Pa. App. filed April 13, 1905. Bolts through the insulating block and the ends of a yoke to prevent warping of the coils.

1,007,469. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; F. S. Martin, Edgewood Park, Pa. App. filed Oct. 18, 1909. Superposed clamping rings seated in V-shaped notches in the commutator bars.

1,007,480. ALTERNATING ELECTRIC-CURRENT DISTRIBUTION SYSTEM; G. North and J. S. Peck, Manchester, England. App. filed April 12, 1909. Main and auxiliary transformers and a relay and switches for regulation.

1,007,482. ALTERNATING-CURRENT TRANSFORMER SYSTEM; J. S. Peck, Manchester, England. App. filed Oct. 7, 1909. A lamp or fuse for indicating a short-circuit in an auxiliary transformer.

1,007,506. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES; E. M. Tingley, Pittsburgh, Pa. App. filed Feb. 20, 1906. Multipart radial supports and coils interfitted around the core to prevent warping.

1,007,513. ELECTRIC PROCESS FOR DRYING TIMBER; A. [illegible] Alcock, Perth, Western Australia, Australia. App. filed Nov. [illegible] 1910. Liquid electrodes for the ends of logs, etc.

1,007,527. TELEGRAPH SYSTEM; M. J. Carpenter, La Grange, I[illegible] App. filed April 19, 1910. Composite telephone and telegraph system for train dispatching, etc.

1,007,544. POLICE SIGNAL SYSTEM; A. K. Dement, Pittsburgh, P[illegible] App. filed Oct. 12, 1910. Signal box with recorder; three-wire circuit with direct current and alternating current.

1,007,545. SIGNAL SYSTEM; A. K. Dement, Pittsburgh, Pa. App. filed March 17, 1911. Three-wire circuit, any wire of which can [illegible] grounded at the outer end.

1,007,562. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; F. C. Hanker, Wilkinsburg, Pa. App. filed Oct. 7, 19[illegible] Has side by side and oppositely disposed inclined brush guides.

1,007,575. TELEPHONE SYSTEM; H. F. Joeckel, Camp Point, I[illegible] App. filed March 16, 1911. Magneto local-battery talking set. Improvement on Patents No. 955,335 and No. 982,209.

1,007,617. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINERY; E. M. Tingley, Pittsburgh, Pa. App. filed April [illegible] 1905. An annular set of supports fits between and against the c[illegible] ends to prevent displacement of the coils.

[illegible] (Reissue) PULL SOCKET FOR ELECTRIC SWITCHES; F. Barr, New York, N. Y. Double break with new contacts and insulation. Original Patent No. 958,988.

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CONTENTS.

THE BEGINNINGS OF HIGH-TENSION TRANSMISSION.

We are glad to be able to present in the current issue the first instalment of an account of the great system which has grown up in the Colorado mountains about a little plant for mining purposes which is notable as one of the very early applications of alternating current to energy transmission, and undoubtedly the earliest commercial power plant employing alternating current in this country. It involved in the beginning no startling innovation in voltage, and was not even in the early days of its initiation properly to be classed as a high-voltage system; but it was a courageous application of sound theory and advanced practice to the solution of the great problem of long-distance transmission, and the improvements once started at Telluride never stopped, thanks to the energy of the Messrs. Nunn. In point of fact, the energy transmission at the Gold King mine, which was the seed, so to speak, from which the whole great Telluride system has sprung, started as the result of desperate conditions that must be met somehow. The cost of fuel was prohibitively high, and, a water-power being available at a distance of somewhat less than 3 miles, it was determined to utilize this and furnish electric energy to save the situation at the Gold King mills. To this end, two of the largest lighting machines manufactured by the Westinghouse company, machines of a type which had then recently been installed at the falls of the Willamette, near Portland, Ore., were pressed into service, one as generator, the other as motor. They were practically the first large alternators built in this country with iron-clad armatures having replaceable armature coils. Of the pair installed for the original Telluride plant, the generator was provided with a composite field and the motor was self-excited by means of an auxiliary winding. The frequency was 10,000 alternations per minute and the motor voltage was 3000. The synchronous motor was brought to speed by a single phase Tesla starting motor—the pioneer of its tribe—in which the starting torque was so feeble that the armature had to be pushed over by hand and the load thrown on later; but the system, hurriedly gathered, as it was, and in a sense experimental, went from the very start with a success that did much to encourage the growth of energy transmission in this country.

The plant was actually first put into regular work in June, 1891, and its record for steady running in the next year was one which even for considerably later days would have been considered creditable. The aggregate time of shut-down due to electrical causes was less than forty-eight hours in nine months. The results, in fact, were so satisfactory that the plant was soon enlarged, following precisely the same system of synchronous transmission. The rapid development of polyphase apparatus, however, prevented any considerable enlargement in the line of synchronous transmis-

sion. Synchronous plants were put in operation during the next year or two at Bodie, Cal.; Walla Walla, Wash., and one or two other points, patterned in general after the Telluride plant, but they proved to be the last of their kind, although Telluride itself was only changed to the polyphase system in 1896. The voltage employed in the later synchronous installations was no higher than that at Telluride, although about a year later than the starting of the Gold King plant the first real step ahead was made in the 10,000-volt, 28-mile transmission for lighting purposes from San Antonio Canyon to San Bernardino, and even this modest voltage was reached only by using a bank of twenty oil-insulated transformers in series. These details of contemporary history are given merely to show how timid engineers were in the matter of high voltage and how much real nerve it took to break away from precedents and go in for an alternating-current transmission at a voltage looked upon as precariously high for a revolving armature. The instinct for experiment has been strong in the builders of the great Telluride system, and a far more important service to the art of energy transmission was done three or four years later at Telluride when the first large experiments with pressures from 30,000 to 60,000 volts, now standard in transmission practice, were there conducted.

Concerning the growth of the system from these small beginnings, he who runs may read. It now reaches into three states, has eight power stations with a capacity of more than 40,000 hp, and has some 600 miles of transmission lines. Its operating conditions, situated, as it is, largely in a wild and mountainous country with high altitudes and severe climate, have always been difficult, and not a little of the important work on protective devices and high-voltage insulation under extreme conditions has been carried out on its lines. In these matters it has been compelled to do pioneer work, as it has done from the beginning; and it is only just to say that this work has been singularly successful and the system has compared in steady and efficient operation very favorably with many another working under far less strenuous conditions. The science and art of high-tension transmission would be much poorer but for the persistent courage and steady hard work which have characterized the management of the Telluride Power Company since its first bold step, now more than twenty years ago.

MEASUREMENTS OF CORONA LOSS OVER AERIAL LINES.

Since working voltages of over 100 kilovolts have come into practical use on alternating-current transmission lines, the question of the limiting dielectric strength of atmospheric air has become of industrial, instead of merely scientific, importance. It is now well recognized that when a pair of parallel cylindrical wires are supported in air from poles, by means of high-tension insulators, no appreciable in-phase electric current passes between the wires, through the air, until the impressed potential difference attains a certain critical value. If, for instance, the wires have each a diameter of 1 cm, and are separated, say, 3 m apart, then there will be no appreciable current through the air between the wires and in time-phase with the impressed neutral voltage, until the latter is raised to about 50 kilovolts. This does not mean that absolutely no loss of energy occurs through the air below the critical voltage. It means that any such infra-critical voltage loss is so small as to be practically negligible, and also so small as to be hard to locate, because all insulators leak to some extent, and when very feeble leakage exists it is difficult to say whether all of it occurs at the insulator or whether most occurs at the insulator and a small portion through the air. As soon as the critical voltage has been passed an in-phase component of current begins to develop, and energy begins to be dissipated in the air. The researches of Ryan, Mershon, Whitehead, Peek and others go to show that the loss does not begin uniformly all over the wire. It apears to start at small irregularities, or dirty points, on the surface. This is particularly noticeable when the wire is thick. Thin wires develop the energy-losing condition more promptly over their entire surfaces. A crackling sound begins to be heard emanating from the neighborhood of the wire, the odor of ozone may be detected, and a phosphorescent glow emanates from the wire, extending radially outwards to a distance depending on the supercritical voltage. This halo-like glow has given rise to the name of corona for all the associated phenomena.

The details of the process by which the energy is carried away from the wire in corona have not yet been made clear. There is, first, a direct leakage of electricity from the wire, the air particles in the neighborhood becoming individually charged at the expense of the wire, and these charged particles are repelled or pushed away convectively, the charge being thus either carried off to the ground or dissipated in the atmosphere. Such dissipated electric charges at high voltage necessarily carry away electric energy. Secondly, as has been pointed out by Russell, substances affected by cathode rays, such as zinc oxide, phosphoresce in the presence of corona. This indicates that electromagnetic radiation is being developed in the corona. Moreover, the glow of the corona itself shows that radiation, detectible by the eye, is being produced within the coronal region—presumably by the secondary effects of violent molecular bombardment. But whatever may be the details of the mechanism producing the energy loss, it is certain that the loss may amount to many watts per running meter of wire.

A short paper by Messrs H. Görges, P. Weidig and Jaensch has recently appeared in the *Elektrotechnische Zeitschrift* giving the observed magnitudes of coronal power-loss per kilometer of line, under various conditions of impressed voltage and separating distance. These curves, except near their lower ends, are approximately upbending parabolas. They, therefore, confirm the results given in the paper by F. W. Peek, Jr., read before the recent Chicago convention of the A. I. E. E., to the effect that the linear coronal power varies directly with the frequency, and with the square of the supercritical voltage. The effect at any one frequency, and any given geometrical disposition of wires, under assigned temperature and barometric conditions, is as though each wire had a definite leakage to ground; but that, instead of the entire impressed voltage developing power in this leak, only that portion of the entire voltage which is in excess of the critical value e-

velops such power. Thus, if the critical voltage for the assigned conditions happened to be 50 kilovolts and the impressed star voltage on each wire of a three-phase line was 60 kilovolts, then the power loss would be such as might occur in a ground leak of, say, 100,000 ohms to each kilometer of wire with 10 kilovolts working through it, that is, 1000 watts per wire-km. If, however, the impressed star voltage was raised to 80 kilovolts, the same 100,000 ohms leak on each kilometer would tap 30 kilovolts with a loss of 9000 watts per wire-km. The line loss thus increases rapidly as the impressed voltage rises above the critical value.

ISUAL ACUITY IN COLORED LIGHTS.

While it has already been established that monochromatic ·ght increases acuity above the values found for light ·aving an extended spectrum, there has been until now no atisfactory comparison of the visual acuity resulting from he use of monochromatic lights of different colors. In ther words, the variation of visual acuity with the wave-ngth of monochromatic light has not been well established. ·uch experiments as have been made on this subject have en decidedly discordant in their results. Most of them een carried on either with colored screens of some- uncertain character or with intensities far from the orking values in practical use. The very interesting and aluable paper by Mr. Luckiesh elsewhere in these columns oes far to fill up this gap in our knowledge of physiological tics. What Mr. Luckiesh has done is to measure the l acuity obtained with various pure spectral colors of photometric intensity. Furthermore, this intensity as well within the range of good practical illuminating lues, and the acuity was tested with the admirable acuity get of Ives, which, while it does not correspond rigor-ly to reading acuity, is absolutely definable and extremely sy of adjustment over a very wide range, making it par-ularly satisfactory in such an investigation as this. Mr. esh apparently has taken great pains to eliminate es of error, cutting out all questions of pupillary aper- by the use of a diaphragm, resting the eye and begin- observations at various parts of the spectrum to keep of difficulties due to varying adaptation, and eliminat- e matter of accommodation by focusing sharply for olor investigated. Rather contrary to what one would supposed, this last precaution seems to have been rela- unimportant within the range of colors employed, ly owing to the fact that they were all comfortably the range of accommodation of the investigator's eye.

upshot of these studies has been to show that there aterial, though not very great, variation of the acuity he wave-length of the monochromatic light employed. most interesting feature of the results, however, is that variation is not continuous in one direction. Acuity pears to have a well-defined maximum in the yellow and falls off when equally bright light of longer or shorter wave-length is used. In other words, at equal intensities it is the light of the highest intrinsic luminosity for the intensities used which seems to produce the sharpest definition. Lord Rayleigh's familiar theorem on the defining power of light of varying wave-lengths would call for an increase of acuity in linear relation to decreasing wave-length. In other words, if the eye be regarded simply from the standpoint of geometrical optics, one should see better by violet light than by green, yellow or red. Mr. Luckiesh's experiments show that with the eye as it is this relation does not hold. It seems quite unlikely that any experimental errors sufficient to cause this difference have affected Mr. Luckiesh's experiments, which seem to have been performed with singular care. Certainly, as he points out in the paper, no errors in the estimated photometric intensities are sufficient to account for the observed differences in acuity. To be sure, he used the equality-of-brightness method for comparing the intensities of colored lights, which always involves some little doubt; but as a photometrist of long experience he finds very close accordance between his own observations with the flicker photometer and with the equality-of-brightness instruments, so that he is justified in at least setting a limit beyond which this source of error cannot enter. Furthermore, the intensities of illumination used were within the range which has been shown by Ives to give good results with the equality-of-brightness comparisons. Beyond this, we may call attention to the fact that if such errors had entered they are not, according to ordinary experience, of a kind to result in showing an apparent maximum of acuity in the yellow or to account satisfactorily for the form of the acuity curve developed from Mr. Luckiesh's experiments.

The fact of the maximum of acuity in the yellow seems from this work to be established pretty conclusively, and the remaining question of scientific interest is why this should be the case in spite of the theoretically greater defining power of the short wave-lengths. In other words, why does the eye as a working organ display different qualities from those which one would ascribe to it regarded merely as a refracting system? The answer is probably to be found in the fact that Lord Rayleigh's theorem does not take into account errors in the refracting system, while the eye is notoriously very far from being a perfect optical instrument. In fact, it is an often quoted remark of von Helmholtz that if an instrument maker sent him an optical instrument as badly figured and corrected as the eye he would promptly return it. To discover the real bearing of the variation of the eye from a theoretically perfect instrument, on the variation of acuity with wave-length, will probably require a somewhat lengthy and intricate investigation, which we hope somebody will have the courage to undertake. As a mere suggestion for a possible direction of attack on this problem, it may be permissible to call attention to the possible effect of the chromatic difference of spherical aberration, which in a very short focus system uncorrected for color may have a very perceptible effect. It would be indeed an interesting fact in evolution if it should turn out that the eye had adjusted itself to give its best correction for spherical aberration in the yellow, which is the point of maximum luminosity on which vision chiefly depends. Speaking in broad terms, the refracting surfaces of the eye are not truly spherical, and neither is the retinal surface on which the rays are focused. All this, however, is merely a possible hypothesis to direct investigation. At all events, Mr. Luckiesh has done well in clearing up one of the outstanding problems in the theory of vision.

American Institute of Electrical Engineers Affairs.

At the regular monthly meeting of the board of directors of the American Institute of Electrical Engineers, held in New York on Friday afternoon, Nov. 10, it was voted to hold a smoker in the Institute rooms, on the tenth floor of the Engineers Building, after each monthly meeting, for the purpose of affording facilities for social intercourse among the members in attendance, and an appropriation not to exceed $50 per meeting was authorized for this purpose, beginning with the December meeting.

Forty-nine candidates for admission to the Institute as associates were elected, and 163 students were ordered enrolled. Upon recommendation of the sections committee a petition for authority to organize a branch at the Rose Polytechnic Institute, Terre Haute, Ind., was granted.

The special committee on the proposed Panama trip reported that the number of replies received from the membership to the preliminary circular was sufficient to justify undertaking the trip, and the committee further reported that, with the approval of the board, the date of departure from New York via steamer of the United Fruit Company will be Jan. 18, 1912, the steamer to arrive in New York on the return trip on Feb. 18. Another steamer will leave New Orleans on Jan. 20, arriving in New Orleans on the return trip on Feb. 6. The report was accepted and authority given to undertake the trip to the Isthmus under the conditions embodied in the report.

The invitation to the Institute of the National Waterways Commission of the United States Congress to take part in a hearing set for Nov. 21 on the development of water-powers was presented and considered, and was referred with instructions to the public policy committee.

A resolution was adopted citing that Mr. Edward D. Adams, to whom the Institute has in the past been indebted for many benefactions, has added to these a bronze bust of the distinguished physicist and mathematician Hermann von Helmholtz, which, in addition to testifying to the public spirit of the donor, carries with it associations of the friendly relations existing between the electrical engineers of Germany and those of America. The thanks of the Institute were tendered for the gift, and recognition was made of the influence of the work of von Helmholtz upon the practice of electrical engineering in America, the Institute expressing its deep appreciation of Mr. Adams' action in placing among its valued possessions the memorial of the German leader of scientific thought. The resolution also expressed appreciation of the courtesy of the Institute's sister society, the Verband Deutscher Elektrotechniker, of Berlin, in appointing and sending a representative to be present on the occasion of the presentation of the bust of von Helmholtz by Mr. Adams, which action was stated to be most happy because of giving opportunity for the recognition of the influence of von Helmholtz upon the practice of electrical engineering in the United States.

Upon invitation the president was authorized to appoint a representative upon the United States committee in connection with the proposed International Congress for the Prevention of Accidents and on Industrial Hygiene, in Milan, Italy, 1912.

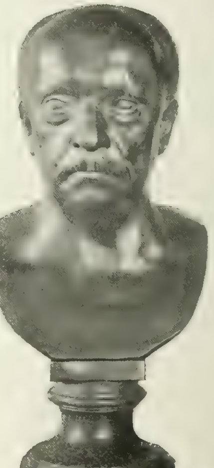
An invitation to the Institute to join the eighth International Congress of Applied Chemistry, to be held in September, 1912, was accepted, and the president was authorized to appoint a representative of the Institute to attend the congress.

Upon recommendation of the code of ethics committee, the president was authorized to appoint an advisory committee to the committee, consisting of men prominent in the electrical profession.

A communication was read from Mr. Oberlin Smith, suggesting that the Institute have on record the photograph of each member and the details of his career. The secretary was instructed to express to Mr. Smith the thanks of th board for his suggestions, and the communication was re ferred to the board of examiners.

Presentation of Bust of von Helmholtz to America Institute of Electrical Engineers.

An interesting event in the recent history of the America Institute of Electrical Engineers was the presentation la week to that body of a bust of the great German scienti and teacher, Hermann von Helmholtz, the donor being M Edward D. Adams, to whom the Institute is also indebte for generous gifts at various times to the Institute librar aggregating several thousand dollars, and for a bookpla which is one of the masterpieces of the late E. D. Frenc The bust is a reproduction in bronze of a marble origin



HELMHOLTZ.

by Adolf Hildebrandt, completed for Helmholtz's seventh birthday. Writing several years later and shortly be re the death of Helmholtz, his daughter said: "Day by he resembles more and more his bust, as if Hildebrandt foreseen his future appearance in expression and carria The present copy is the only one which the Helml family has permitted to be made.

President Gano Dunn in announcing the gift referre to the warm interest of Mr. Adams in the Institute an to his many notable gifts to the library during the perio of its formation. To the degrees of Doctor of Laws nd Master of Science with which he has been honored sh ild be added, Mr. Dunn suggested, that of engineer-finar er, as representing a double service which Mr. Adams ad rendered to electrical engineering development. Mr. C. Martin, chairman of the historical and museum comm tee of the Institute, accepted the bust in appropriate terms nd in conclusion urged the desirability of members co- er-

ating in the work of his committee in gathering, to hand down to posterity, in documents, in models, in relics, in vivid canvases and in animated busts, the records of these times and days which have done so much to produce great inventions and great men in the domain of electricity.

President Dunn then introduced Dr. Adolf Franke, of Berlin, director of the Allgemeine Electricitäts Gesellschaft, who had been commissioned by the Verband Deutscher Elektrotechniker to represent it on the occasion of the presentation of the bust, and who had been a student under Helmholtz. Dr. Franke extended the heartiest greetings from the members of the society which he represented, and said that the fact that American electrical engineers, who above all others have dealt with the largest problems of the industry in the last decade, are honoring Helmholtz shows that they fully realize that true science is at the foundation of their success. Referring to the period when he was a student under Helmholtz, he mentioned the vivid impressions received from the great scientist, and the mighty influence of his character and personality. His thoughts were so deep, his genius moved in such lofty heights, that it was sometimes difficult for the younger students to follow; but those who had already a knowledge of science received valuable inspiration from his teachings. Above all he had an intuitive insight into the principles common to different physical phenomena and a power of precise differentiation between theories of speculative character and actual laws. Referring to the original bust by Hildebrandt, Dr. Franke said that this was the result of a collection taken up by his friends and pupils in all corners of the world. The amount thus realized, however, was larger than was necessary for the specific purpose, and from the surplus provision was made for an etching of his ... by Jacoby, and a medallion by Teutenhyn, a reproduc... of which is awarded from time to time to prominent ...ntists.

President Dunn then called upon Mr. B. A. Behrend, who ... also been a pupil under von Helmholtz. Mr. Behrend ... that the bronze bust is an excellent likeness of the ... master, at whose feet he had gained inspiration, both from his lips and from his personality. Helmholtz, he said, ...es not belong to any one narrow branch of science. "His ...nius enlightened with new creative thoughts the entire ...ld of human knowledge. In medicine and in physiology, mathematics and in physical science, in philosophy and in ... physics, in each and all his genius was a beacon fire ... that of Newton and of Darwin. We unite with the ... of Newton our knowledge of the laws of motion; ... the name of Darwin, our knowledge of the law of ...tion and of natural selection; with the name of Helm... our knowledge of the law of the conservation of ...gy. Loftiest and broadest of human minds, there stands ...monumental intellectual figure of Helmholtz forever in ...annals of science. There is no need to inscribe 'His ...lency' upon his tomb; the name he bore runs no more ...of oblivion than that of Galileo or that of Newton. ...lo we honor the master by this memorial; we are ...d to accept this monument from the hands of one who ...elf has been a great furtherer of the art of electrical ...eering, for the advance of which this Institute was ...ed. The statue of Helmholtz will show future gen...ns who pass this entrance hall the man whose example ... must follow, if they wish to uphold the standard of ...nce where he placed it. And to me, who have known ... master, and who am the generous donor's friend, it is a pleasant privilege to be able to say these words on this occasion."

President Dunn then presented a resolution of thanks to Mr. Edward D. Adams, which was adopted with much enthusiasm. Although Mr. Adams had requested not to be called upon for remarks, he was compelled to defer to the insistence of the audience. Referring in his remarks to the course of progress of science, he said this differed from the progress of music, which had been from the equator to the northern countries. Science, on the other hand, has progressed from the East to the West, its course being from the Continent across England, to a lodging place here, where, through the activity of invention and research, and the audacity characteristic of our people, there is for it a future which in accomplishment we may hope has never been equaled in any of the countries of the older world. Referring to the development of electricity at Niagara, in which, as is well known the speaker played the leading part, he pointed out that at the time the plans were being prepared the alternating current figured most prominently as a means of executing criminals. In order to determine the market for electric power in the city of Buffalo, Mr. Edison, at the request of Mr. Adams, had a house-to-house canvass made, and reported that at least 50,000 hp could be used in that municipality and vicinity; Mr. Adams added that Mr. Edison so valued the chart of distribution and users which he had made that he declined a proposition of remuneration for his expenses in making the investigation, as he considered the record so valuable that he preferred to retain it as his own private property. Early in the Niagara investigations it was found that the state of the art was not adequately represented in print, and in order that the work at Niagara Falls should represent the most advanced state of the art as applied to industrial purposes, the services of leading scientists of the world were secured who formed the international "Niagara Commission." When the award of the first dynamo was given it was with the feeling that the design was in accord with the latest information, some of which had come by mail only a few days before. At no time since has there been any doubt as to the wisdom of the plans then adopted. The experience at that time taught the advantage of having the earliest information obtained from all sources, including information which may not appear in print for a year or several years. It was for this reason that in endowing a chair in Columbia University for physical research Mr. Adams provided in the deed of trust that the results of the researches made by scientists in different parts of the world should be promptly published and circulated.

Continuing, Mr. Adams remarked that the Niagara experience indicated that in industrial work those at the head are now much embarrassed in the employment of experts. It seems, he said, as though there had been a very great change since Lord Kelvin announced that an electrical engineer was nine-tenths mechanical and one-tenth electrical. Since then that statement has been modified by the growth of numerous specialties, and one is at a loss to conjecture how far the subdivision may proceed. It is estimated that the number of subdivisions of engineering to-day has reached more than 100. In many industrial applications for a single purpose it is often the case that four experts in that number of specialties must necessarily be consulted. While we find this subdivision in practical work satisfactory, we can certainly see the disadvantage that would result if we attempted to subdivide our common interest. Instead of there being subdivision there should be consolidation, at least in the sense that the Institute, while it has various departments representing the specialties of its membership, should seek the strength that comes from the aggregation of all the larger interests which its members represent.

President Dunn read communications received from the German Embassy in Washington and from the German Consul in New York, and also a congratulatory cablegram from the Verband Deutscher Elektrotechniker. A reply to the latter cablegram was sent as follows: "The American Institute of Electrical Engineers in meeting assembled sends heartiest greetings to the Verband Deutscher Elektrotechniker on the happy occasion of the visit of its delegate."

Rate Research for N. E. L. A.

The first meeting of the 1911-12 committee of the National Electric Light Association on rate research was held in the office of Mr. S. E. Doane, chief engineer of the National Electric Lamp Association, in Cleveland, on Nov. 10. The members of the committee present were Mr. E. W. Lloyd, Chicago, chairman; Mr. L. H. Conklin, Scranton; Mr. R. S. Hale, Boston; Mr. J. D. Lyon, Cincinnati, and Mr. Doane. As guests of the committee Messrs. M. E. Turner, Cleveland; Mr. W. J. Norton, Chicago, and Mr. G. S. Merrill, Cleveland, were also present. The work to be done by the committee before the next annual convention was outlined, and it was decided to hold the next meeting on Dec. 8 at the New York headquarters of the N. E. L. A. The committee will be glad to have its attention directed to any systems of charging which are novel or of unusual interest. The chairman, Mr. Lloyd, is general contract agent of the Commonwealth Edison Company, 120 West Adams Street, Chicago.

New York Public Service Commission Forbids Charge for Date and Originating Address in Telegrams.

The New York Public Service Commission, Second District, has decided that a charge made by the Western Union Telegraph Company to the Postal Telegraph Cable Company for the words constituting the originating address and date upon a telegram transferred by the latter to the former company is unjust, unreasonable and unduly discriminatory, and the Western Union is required to desist from the practice. The Postal Telegraph Company complained to the commission, asking for an order restraining the Western Union from exacting a charge for the originating address and date of a telegram transferred from the Postal to the Western Union. The Western Union accepts transferred messages for transmission and delivery from the Postal to points not reached by the Postal, and charges the Postal its ordinary local rate for the transmission of the message from the point of transmission to the point of destination plus an additional charge for the name of the originating point and date. The name of the originating point and date usually constitute, under the rules in force for counting, four or five words. The commission's conclusions from the facts brought out at hearings are as follows:

(1) The rate scheme of both companies has been constructed on the basis that the proper charge for the transmission and delivery of the message where one company both receives and delivers is ascertained by the number of words in the message.

(2) The fact that the Western Union does not charge for the name of the originating point and date on transferred messages originating at non-competitive points shows that it does not make the charge for these matters on transferred messages originating at competitive points in order to compensate itself for the expense of transmitting the name of the originating point and the date.

(3) The Western Union does not in the case of a transferred message transmit any more words than it would in the case of a message originating at the point of transfer. In other words, a message originating at the point of transfer would contain the name of the originating point and the date, and this would be transmitted free. The transferred message contains the name of the originating point and date, but is not transmitted free in case the originating point is competitive.

(4) The Western Union, receiving a transferred message, does add certain words to it, four or five in number, but it makes no charge whatever for these words. To all messages both companies add certain words for their own convenience in counting and otherwise, but for such added words neither makes any charge. The words added by the Western Union to a transferred message, although four or five in number, need not for any practical purpose be more than two, while the name of the originating point and the date always consist of four words and sometimes of five.

(5) The Western Union by this method of charging for the name of the originating point and the date of transferred messages necessarily receives more for its services than it would in the case of a message originating with i at the transfer point.

The commission, in an opinion prepared by Chairmai Stevens, says it is not possible to assign any reason fo this distinction except the desire of the Western Union t suppress competition at competitive points. The Posta assigns reasons why it desires to conduct its business a competitive points by the use of transferred telegram which are entirely satisfactory and legitimate from it point of view; it is obviously to the advantage of th Western Union, as is shown by the charge which it make and by the notices which it sends out, to prevent competi tion of the Postal at these points. The opinion continues

"The only question which the facts and the necessar conclusions therefrom seem to leave open to be determine by the commission is whether it is legitimate and reasoı able for the Western Union to make this charge for tl name of the originating point and the date because a tel gram originates at a competitive point. Its own practi determines that in other cases it is not reasonable, and seems to us that this practice determines the whole matte Clearly a public-service corporation must extend precise the same facilities to a competitor as it does to the enti world. It can make no distinction between those offeri it business. It must charge them alike and serve the alike. If it is its practice to serve the immense majority its business without a charge for the name of the ori nating point and the date, and it obtains its compensati for the service in fixing the rate for the words in the bo of the message at such an amount as will afford it a pro remuneration for transmitting all the message contai that rule must obtain the same with competitors as w ordinary individuals. No satisfactory reason has b offered in support of the rule."

The opinion further states that during the progress the case the Western Union changed its position, and later position expressly repudiates what it first admitt that the charge is for the extra words which it adds to message for its own convenience and purposes. T charge is a departure from its general and settled sc and as such must have a satisfactory reason for its ex ence. The burden was upon the Western Union to jus the exception, and it has failed to do so.

Chicago Traction Situation.

By order of the United States Circuit Court Mr. Sa el Insull was appointed receiver of the Chicago & Oak P rk Elevated Railway Company on Nov. 13. This road— old Lake Street line, the first elevated railway in Chica — has been operating at a loss for several years and p ıg up a deficit. When the Chicago Elevated Railways me er was formed the Metropolitan, South Side and Northwes rn elevated-railway companies were taken into the orga a- tion, but the Chicago & Oak Park was left out, as he Northwestern company is said to own 51 per cent o its stock. The minority stockholders endeavored to di se of their stock to the new management, but were told ıp- parently, that their holdings were only of nominal ue. The receivership, made on the application of the Ce ral Trust Company of New York, on a judgment for $13 5

will enable the majority and minority stockholders to settle their differences in court. Mr. Insull, the receiver, is chairman of the executive committee of the Chicago Elevated Railways.

In the negotiations with the city relative to the unification of the elevated railways under a new ordinance one of the first steps will be a valuation of the properties. It is proposed that this be done by the existing subway commission, consisting of City Engineer John Ericson, Mr. E. C. Shankland and Mr. J. J. Reynolds, to whom may be added Mr. George Weston, the city's representative on the Board of Supervising Engineers, Chicago Traction. The latter board supervises the surface lines.

It is said to be Mayor Harrison's idea to create a fund by the operation of municipally owned subways, the revenue to be derived from an operating company or operating companies on lease. The fund so created may be used for the purchase of the surface and elevated railways, as ultimate municipal ownership of all street railways is said to be the Mayor's hope. However, the situation is complicated by moves dictated by political or private-business strategy, so that the ultimate outcome cannot now be foretold.

Battery Locomotives for Railroad Terminal Electrification.

An undercurrent of discussion among a group of the steam-railroad electrical engineers attending the convention of their body in Chicago recently turned on the possibility of battery-driven locomotives for the electrification of large railway terminals such as those of Chicago. It has been known that several railroad officials and manufacturers have been devoting much attention to this means of heavy traction, and evidence that a good deal has already been accomplished in these lines is afforded by the number of battery-driven electric cars already in use on branches of Western roads as "feeders." One engineer cited sixteen such battery-driven cars employing the new Edison nickel-iron battery as already in use out of twenty-two on order. Several of these cars, he said, have made 150 miles or more a day, with a freshening charge during the noon hour. The high charge rate of the nickel-iron bat... has made it possible to put a large portion of the ...inal full charge into these batteries in even the period of an hour. In several places where these battery-driven motor cars are used on branch-line feeders energy is purchased from local central-station plants where the cars ...ver for the night. As the time of charging can be ...rred until the morning hours of light load on the sta... the electric companies have been able to make a low ... profitable rate for this service. The battery-driven ...r-car on auxiliary lines thus seems to have an im...ant future significance for the small central station ...h has a low load-factor.

...r terminal electrification, as in Chicago, where there ...uch interchange of cars between the many roads, an ...ficient and practical battery-driven locomotive, it was de...ared, would simplify the problem considerably. As was ...inted out, such locomotives could use the present tracks ...ithout any changes in running conductors, third-rails or ...tenary trolleys, or any alterations in track signals, etc., ... could interchange traffic without difficulty between ...ls and yards of different companies. To gain the same ...sult with the usual means of electrification, some uni...rm standard of equipment would be required for all such ...ads entering into electrification.

A storage-battery locomotive and its tender laden with ...kel-iron cells, it was estimated, would be about as large ... the present steam locomotive and would be capable of ...lling the ordinary 1000-ton train at a speed of 20 to 25 ...les an hour over the 15 to 20 miles of electrified tracks ...king up the terminal electrification. While the locomotive itself would be shorter, the tender required to contain the battery, it was said, would probably approximate the size of a box car, although of only about the weight of the present coal-and-tank tenders. Such a battery tender might be dropped off when discharged and a fully recharged tender substituted, keeping the locomotive in continuous service while its tenders were being charged. On the straight tracks clear of switching complications third-rails or other conductors might be installed, relieving the demand on the battery and even aiding in recharging it. Such storage-battery locomotives would offer an excellent off-peak charging demand for large metropolitan generating systems from which energy could doubtless be purchased at a very low rate under these conditions. In case the railroads installed their own plants the battery-charging load would also prove of advantage in filling up the valleys between the peaks of the train-operation demands.

Railroad officials are watching the performance of battery-driven cars with great interest, but, as one prominent official declared at the Railway Electrical Engineers' banquet, are generally holding off from adopting any given system of electrification for the present in the fear that rapid improvements as yet only indicated will be made.

The Electric Vehicle in Boston.

Scientific collection and interpretation of operating data received special attention at the meetings of the Electric Vehicle Club of Boston on Nov. 1 and 8, 1911. Mr. B. C. Tiffany, of the Rausch & Lang Company, presided at the former gathering, and Mr. Day Baker, of the General Vehicle Company, Boston, was chairman at the latter, being elected permanent chairman of the club at the conclusion of the usual luncheon in the Edison Building. Mr. Fred M. Kimball, of Lynn, Mass., was a speaker at the earlier meeting and touched upon the importance of the engineering data sheet in the sale of electric vehicles. Mr. H. S. Baldwin, of Lynn, spoke briefly at the second meeting upon the engineering aspects of the problem.

It was announced that four new charging stations have been opened in Waltham, Natick, Sharon and West Somerville, Mass. Mr. L. D. Gibbs, of the Edison Electric Illuminating Company of Boston, stated that efforts are under way to secure a uniform system of accounting for electric-vehicle performance and expenditures, to be sanctioned by the Electric Vehicle Association of America, the Association of Edison Electric Illuminating Companies and the National Electric Light Association. A model electric garage is under consideration for the Commercial Motor Truck Show, which is to be held in Boston in March, 1912. Active efforts are being pushed to increase the usefulness of the electric pleasure vehicle in the Boston shopping district by seeking additional parking facilities from private parties owning land close to the public thoroughfares. On Nov. 8 it was stated that the American Express Company would shortly establish an electric garage in connection with its wagon repair shop in South Boston. On account of the high twenty-four-hour load-factor a low unit rate for energy will be obtained through the regular schedule of Edison prices. Plans are afoot for the holding of a banquet on behalf of the electric vehicle at the Boston City Club in December, to which the Governor of Massachusetts, the Mayor of Boston and various state and municipal officers will be invited. The program includes stereopticon and moving pictures of the latest electric-vehicle developments. Mr. E. S. Mansfield, Boston Edison company, was elected permanent vice-chairman of the club at the meeting of Nov. 8, and following the resignation of Mr. L. D. Gibbs as secretary Mr. Leavitt L. Edgar was elected to the latter office. The next meeting was scheduled to be held at the House of Edison Light, Newton Center, Mass., on Nov. 15.

Magnetic Properties of Iron at High Frequencies.

At a meeting of the American Institute of Electrical Engineers held in New York on Nov. 10 Mr. E. F. Alexanderson presented a paper entitled "Magnetic Properties of Iron at Frequencies Up to 200,000 Cycles per Second." The paper contained a record of tests of hysteresis and eddy-current losses and skin effect in iron strips. The iron core tested consisted of a ring 2 in. in diameter, made up of ten turns of soft iron strip 0.003 in. thick and 0.75 in. wide. The layers of the strip were separated by thin paper. The core was wound with twenty turns of silk-covered wire. The measurements were made by means of hot wire ammeters and voltmeters, use being made of certain condensers and induction coils adjusted to obtain proper time-phase relations between the voltage and the current.

The skin effect measurements consisted in determining the apparent permeability of the iron at various frequencies and densities, by observing the volts and amperes at the terminals of the test coil. It was found that the real permeability of the iron was the same at 200,000 cycles as at 60 cycles per second, although the apparent permeability was only about one-tenth as large at the high frequency as at the low frequency. The decrease of the apparent permeability was found to be substantially in agreement with the change that one would expect from purely theoretical considerations due to the skin effect, the penetration of the magnetism into the iron being only 0.003 cm at 200,000 cycles per second.

A series of designs of a 5-kw transformer for various frequencies from 60 cycles to 200,000 cycles per second was shown in tabular form. The 60-cycle transformer weighed 19.5 kilograms, had an efficiency of 90 per cent and a magnetizing current of 5 per cent. The 200,000-cycle transformer weighed 1.5 kilogram, had an efficiency of 98.3 per cent and a magnetizing current of 1.3 per cent. The calculations showed that the 200,000-cycle transformer has a low weight and is very efficient, whereas the 60-cycle transformer, built on the same proportions, is too inefficient to be acceptable, although it weighs twelve times as much as the 200,000-cycle unit. In spite of the skin effect the 200,000-cycle transformer has a magnetizing current of only 1.3 per cent, whereas if the core were removed the magnetizing current would be about 40 per cent.

The high-frequency current was obtained from an alternator of the same general type as the 100,000-cycle machine described by the author in a paper before the American Institute of Electrical Engineers in June, 1909. (See *Electrical World*, page 96, July 8, 1909, and page 223, July 22, 1911.) This alternator was designed primarily for the purpose of wireless telegraph and telephone service. In comparison with the earlier unit it has 800 instead of 600 slots, but it operates at only 20,000 r.p.m., which is the same speed as used with the lower frequency unit. The increase in frequency above the value indicated by the product of the number of armature slots and the speed is obtained by means of an armature winding of special type. The machine is constructed with 1200 magnetic (600 projections) poles in the field structure, and the 800 armature conductors along the face of the armature are interconnected in such a way that the effective voltage has a frequency corresponding to 1200 poles, although its value is reduced from what would be obtained if there were 1200 slots. The machine generates 90 volts at no load, as compared with 110 volts delivered by the earlier machine.

Discussion.

The discussion was opened by Dr. Harold Pender, who stated that certain tests made at the Massachusetts Institute of Technology, where a frequency of 200,000 cycles per second was obtained by the electric-arc method, confirmed the results obtained by Mr. Alexanderson, in that the actual permeability of the iron was found to be practically independent of the frequency. At the high frequency the apparent permeability was, of course, much reduced, but the true permeability, after proper allowance had been made for skin effect, was not altered.

Mr. B. A. Behrend stated that, although the efficiency of a 200,000-cycle transformer may be much higher than that of the low-frequency transformer, yet the high-frequency apparatus is useless for practical purposes, because of its lack of regulative properties.

Dr. C. P. Steinmetz remarked that it is very difficult from the mere number to realize what 200,000 cycles means. This frequency is forty times as high as the highest frequency at which sound is audible. Moreover, the oscillograph fails to give any readable indication at frequencies even lower than 5000 cycles per second. When using a current of 200,000 cycles electricity flows into the conductor in one direction at one point, while only 2000 ft. away the current flows in the opposite direction, and it is zero 1000 ft. distant. In wireless telegraphy it has been considered desirable to employ air-core transformers, not only on account of the assumed lessening in the core loss by use of air rather than iron, but by reason of the assumed lessened attenuation in the air core as compared with the iron-core transformer. The attenuation is attributable to th dissipation of energy in the transformer, and hence varie inversely with the efficiency. The results of the tests re ported by Mr. Alexanderson showed that by using an iro core of proper proportions the efficiency is materially im proved, and hence there should be a marked reduction in th attenuation of the waves used in wireless telegraphy. H stated that there should be a material advantage in wireles telegraphy in using iron-core transformers instead of th air-core apparatus employed at the present time.

Steam-Railroad Electrical Engineers at Chicago.

The Tuesday morning opening session of the fourth an nual convention of the Association of Railway Electric Engineers at the Hotel La Salle, Chicago, was reported last week's issue. The convention continued in session un Friday noon, Nov. 10, when the election of officers for tl coming year closed the meeting.

On Tuesday afternoon Mr. F. E. Hutchinson, of tl Chicago, Rock Island & Pacific Railroad, presented t report of the committee on data and information, of whi he was chairman. Among the subjects treated in this rep were performance tests of a number of axle-lighting bel statistics of railroad cars lighted by electricity, settings f stop-charge voltage cut-offs, cost of equipping locomoti electric headlights, temperature data on headlight glass and reports of efficiency and failures of electric-light trains. The committee's report was discussed briefly Messrs. C. R. Gilman, Chicago, Milwaukee & St. Paul Ra road, and D. J. Cartwright, Lehigh Valley Railway.

VENTILATION.

A paper on the subject of "Ventilation," prepared by M E. M. Cutting, of the Southern Pacific Railroad, chairm of the committee on ventilation, was read by title only, committee being continued for another year with its p sonnel unchanged and asked to submit further data ventilation subjects. Mr. Cutting's paper reviewed various principles of ventilation, quoting largely from ports by Dr. W. A. Evans, of Chicago; Mr. William Lynch, of Chicago; Mr. Francis A. Bonner, and from a paper by Mr. S. G. Thompson on the Pennsylvania R roads systems of car ventilation, read before the West n Railway Club. In conclusion, Mr. Cutting showed that the condition of offensiveness of air may be almost in pendent of its chemical purity, and vice versa.

In discussing the subject of ventilation Mr. W. H. Lynch,

ventilating engineer, Chicago, declared that, while the railroads want proper ventilation of their cars, no settled system or policy has yet been determined upon and the initiation of such ventilation will come in the nature of something new. Many special problems of ventilation will require the use of electric power, as exhaust fans and cooling fans. The air intake is of even more importance than the exhaust. In general it may be said that vitiated air rises, owing to its higher temperature, and the problem should be attacked with this principle in mind. Pure, individual air is as important as the individual drinking cup, asserted Mr. Lynch, adding that the solution of ventilation problems with the minimum of air will largely save heating.

Dr. W. A. Evans, former health commissioner of Chicago, was next called upon, and declared that in his estimation the problems of ventilation are already practically solved, being in essence the methods adopted by the Pennsylvania Railroad and the Master Car Builders' Association. Dr. Evans urged the use of "a thousand times as many agitation fans" as are now employed on cars, declaring that these fans should be run twelve months in the year, for comfort in summer, but for health in winter. The speaker also referred to the intake of air through car floors and the possible application of electric discharges to remove the dust from this air. In answer to a question he gave as his opinion that the average ozone machine produces but a negligible quantity of O_3, and that ozone in quantities might kill odors without destroying the dangerous bacteria.

TRAIN-LIGHTING STANDARDS.

On Wednesday morning the report of the committee on standards was read by Mr. D. J. Cartwright, of the Lehigh Valley Railway. The committee recommended the use of a uniform data label on all electric-lighted cars, the use of three-wire train lines for head-end system operation, and uniform arrangements of batteries, charging receptacles, fuses, car switchboards, axle generators, conduit construction, pulley seats, etc. A nominal pressure of 60 volts was recommended for straight storage and head-end systems, and 30 volts, nominal, for straight storage and axle dynamo systems. Cars furnished by a foreign road for operation in electrically lighted trains, it specified, should be equipped with permanent or temporary train-line circuits. Electrically lighted cars furnished to foreign roads should be paid for at the rate of 75 cents per car per day for the use of electric equipment. For repairs made to electrical equipment 35 cents per hour, and materials at cost, should be charged. In addition to Chairman Cartwright, the report was signed by Messrs. F. R. Frost, Atchison, Topeka & Santa Fé Railway; A. J. Collett, Union Pacific Railroad; J. R. Sloan, Pennsylvania Railroad; C. R. Gilman, Chicago, Milwaukee & St. Paul, and A. J. Farrelly, Chicago & Northwestern.

Mr. W. J. Bohan, of the Northern Pacific Railroad, referred to the expense of temporary train-line construction for axle-lighted cars to be operated on head-end-lighted trains. Mr. A. J. Farrelly, Chicago & Milwaukee Railroad, said that the only objection to installing generally such train lines, composed of three No. 4-0 wires, is the cost, and that no car should be tendered to a road operating head-end systems without train-line equipment. Mr. N. E. Lemon, of the Pullman company, declared that the present tendency is toward axle equipment, for which the only connector apparatus needed are the light car-to-car jumper connections. Injustice would be done to roads using axle-lighting systems if they were asked to install train lines throughout all their cars, of which only a small number are interchanged with head-end systems. Considerable discussion followed on the use of battery fuses. Mr. Lemon considered that fuses in this position were of no service, while Mr. Gilman pointed out that in case of fire or wreck the absence of such fuses might result in expensive legal charges. Mr. Cartwright spoke of the welding of an automatic switch when called upon to open the battery circuit. Others who took part in the discussion were Mr. Joseph Andreucetti, Chicago & Northwestern; Mr. J. R. Sloan, Pennsylvania Railroad; Mr. W. J. Bohan, Northern Pacific Railroad; Mr. H. G. Myers, Santa Fé; Mr. E. W. Jansen, Illinois Central Railroad; Mr. F. R. Frost and Mr. A. J. Collett, Union Pacific Railroad.

Mr. C. R. Gilman said that at least 60 volts is required for head-end systems on account of the transmission losses with lower potentials. The head-end system he declared to be the cheapest and most efficient form of operation. Mr. D. J. Cartwright reported that there are fifty-five roads having 5900 cars equipped with axle-light systems, while twelve other roads, operating 3685 cars, use the head-end system. Mr. W. J. Bohan, of the Northern Pacific, said that 70 per cent of the cars in use are equipped with 60-volt or 110-volt systems, including axle-lighting, straight-storage and head-end systems. Mr. W. L. Bliss, of the United States Light & Heating Company, was called on to compare the advantages of 30-volt and 60-volt operation. Thirty-volt lamps, he said, are in general sturdier, while the use of half the number of cells reduces the labor and trouble of cleaning and handling. Mr. A. J. Collett, Mr. J. R. Sloan, Mr. E. W. Jansen and Mr. N. E. Lemon also took part in the discussion.

The report of the committee on improvements was next read by Mr. Edward Wray, Chicago, and gave a brief description of improvements in car-lighting and railway electrical devices brought out during the past year by the manufacturers.

SHOP PRACTICE AND MOTOR DRIVE.

On Wednesday afternoon Mr. A. I. Totten, Chicago, read the report of the committee on shop practice, in the absence of Chairman C. J. Causland, chief electrician of the Pennsylvania Railroad. The report considered the comparative advantages of alternating and direct current for shop drive, from the standpoints both of generation and transmission and of motor application and speed control of the tool. Under some conditions it will be found advantageous to use alternating-curent generation and transmission, with direct-current motors, supplied through synchronous motor-generator sets, for driving special tools. The committee concluded that alternating current used exclusively should apply to the small division railroad repair shops, direct-current drive being preferably used in the larger installations. The report concluded with a warning against the increasing use of compressed air in railroad shops, and recommended the substitution of electric power for compressed air wherever possible, on account of the greater economy of motor drive.

Mr. A. J. Farrelly spoke of the superior flexibility of alternating-current systems, and cited an instance where shop plans were several times changed, requiring complicated direct-current equipment which could have been avoided by simply raising the transmission voltage had alternating current been originally used. Mr. F. E. Hutchison spoke of the need for adjustable-speed control for long and short tool cuts, and Mr. Totten referred to the use of multi-speed motors which give 25 per cent speed range. Mr. Farrelly insisted that the variable-speed feature of machine-tool drive is actually seldom used, and cited an instance in the Beech Grove shops of the Big Four Railroad at Indianapolis where two brothers working on a piece basis on similar machines, one driven by an alternating-current motor and the other by direct current, turned out approximately the same work in the same time.

MOLDED INSULATIONS.

An account of recent advances in the art of manufacturing electrical molded insulations was next given by Mr. Kurt R. Sternberg. The speaker described the electrical characteristics of hard rubber, and discussed the possibility of synthetic rubber prepared artificially, the first step in which process seems already accomplished by the isolation

of the material isophren. This has been formed from turpentine, but experiments are being prosecuted to produce a cheaper product from acetylene. Mr. Sternberg then described the insulation characteristics of porcelain, iron gummi, isolast, vulkanasbest, stabilit, tenacit, ambroin, eburin, galalith, pulvolit, rhadoonit, impregnated paper, presspan, leatheroid, pilit, gummon and sternoid. The latest important inventions in the insulation field, he said, are bakelite and condensite. Bakelite, the invention of Dr. L. H. Baekeland, has already been described in detail in the *Electrical World*. Condensite was produced by Mr. A. H. Aylsworth, of Glen Ridge, N. J., a former employee of the Edison laboratories. Condensite is a high-grade plastic which may be molded readily when uncured. The curing is done under heat and pressure, and the finished product is similar to polished hard rubber, although mechanically far stronger. It has high dielectric resistance, withstands most acids, is non-hydroscopic, resists heat and can be easily machined. It is odorless, resilient and very light in weight. Mr. Sternberg urged the use of a test piece of standard dimensions for conducting comparison tests on electrical insulations.

SHOP LIGHTING AND CAR ILLUMINATION.

Opening the session of Thursday morning, a paper entitled "The Light for Safety," by Mr. F. R. Fortune, Pittsburgh, Pa., was read by Mr. George C. Keech, of Chicago. Mr. Fortune's paper described the advantages of the Cooper Hewitt mercury-vapor lamp for shop and foundry lighting, and pointed out the advantages of monochromatic illumination. The author also showed that the large illuminated surface of the tube and its low specific intensity have advantages for shop lighting over brilliant light sources which may produce glare and other painful results.

Mr. A. J. Sweet objected to the conclusions drawn from the table showing the relative brilliancies of the tungsten filament and the mercury-vapor tube, since, he declared, properly arranged tungsten lighting installations protect the eye from the direct vision of the filament. In answer to a question by Mr. D. J. Cartwright concerning the use of mercury-vapor lamps in connection with other types, Mr. Keech said that while such lamps should not be low enough to interfere with vision they had been used at heights of only 8½ ft. from the floor in cases of machine shops.

Mr. L. S. Billew, of the Baltimore & Ohio Railway, next read the report of the committee on train-lighting practice, of which Mr. A. McGary, chief electrician of the New York Central, is chairman. This report described head-end practices on a number of railroads, advocating this system where large trains, unbroken, make continuous runs of at least ten hours' duration. The report recommended the employment of special train electricians, instead of the baggagemen, to maintain the electrical equipment at its best efficiency. In conclusion, details of axle-lighting practice were discussed, and a complete system of records and reports was advocated. Trouble was also reported from standard inclosed fuses, which have failed to indicate when blown, seem to open-circuit without cause and blow at improper current values. Mr. Farrelly said that in the operation of head-end systems on the Northwestern Railway service is furnished by the battery barely 3 per cent of the time, and on no account is it considered necessary to shut off the engine when the train is ascending heavy grades. Mr. Cartwright discussed the use of common or separate steam hose connections to carry the train-lighting and train-heating steam lines. Mr. A. J. Collett said that in the operation of his head-end systems he had found difficulty in getting the operating department to place the dynamo car next to the engine, in order that a good steam supply might be assured. Mr. C. R. Gilman, on the other hand, testified that his trouble had been in getting the dynamo car placed behind the mail cars, since the latter are usually built with blind ends and when the dynamo car s and the train electrician is prevented from passing through the coaches to supervise his lamps.

On Thursday afternoon Mr. Gilman presented the report of the committee on illumination. The report opened with a discussion of the eye and the terms and units of illuminating engineering, calculation of illumination, factor of glare, etc. Detailed suggestions followed for the lighting of railroad stations, station approaches, waiting-rooms, baggage-rooms, company offices, yards, shops, dining-rooms, lunch counters, train sheds, freight houses, etc. Types of lamps were next specified in detail, and data were given on the three-voltage rating for various types of carbon, tantalum and tungsten lamps. Mr. B. F. Fisher discussed the ability of modern tungsten lamps to withstand severe vibration, and illustrated how the more expensive high-efficiency units may offer the lowest renewal costs even in the case of low energy costs. Mr. Alexander McGary testified that the use of regulators had largely reduced lamp-replacement costs on the New York Central. Messrs. F. E. Hutchison, A. J. Collett and D. J. Cartwright also discussed illumination subjects.

ACCOUNTS AND REPORTS.

The report of the committee on accounts and reports was next read by Mr. F. R. Frost, its chairman. A sample statement was submitted for the accounting of car-lighting costs on a uniform schedule, so that comparison might be made between roads interested. The committee recommended rates of 5 per cent to cover each of the items of interest and depreciation. While the arrangement used, it was explained, is not in agreement with that of the Interstate Commerce Commission, the schedule was prepared primarily for the benefit of the train-lighting engineers. Mr. A. J. Collett pointed out that for this reason separate accounts should be kept by the regular clerical force and the engineer. Mr. D. J. Cartwright observed also that division should be made between repairs and renewals resulting from wrecks and those necessitated by ordinary service.

Thursday morning's session was opened with a paper by Mr. T. V. Buckwalter, of the Pennsylvania Railroad, Jersey City, N. J., on the subject of "Industrial Trucks for Railway Service." Motor-driven trucks have been used (1) to replace box cars in transferring freight between adjacent stations, (2) to replace horse-drawn vehicles, and (3) to replace and supplement manual labor. Mr. Buckwalter reported the saving accomplished by the Pennsylvania's electric baggage and mail trucks, and described the method of control, frame construction, controller and brake apparatus, battery equipment, etc. The average yearly cost of operation of the 2-ton trucks used in the Long Island yards is $475 a year, of which $40 is for energy $100 for maintenance and repairs, $75 for depreciation o battery and $75 interest on the $1,250 investment.

In reply to questions, Mr. Buckwalter said that the freigh trucks can be charged at 30 amp for five hours, sufficien to operate them eleven hours. The Pennsylvania termina trucks, charged at 40 amp for four hours, receive enoug energy for forty-eight hours' use. The baggage truck make about 17 miles per day, while the freight trucks mak 9 miles per day. Twenty-four-volt equipment is used, sinc this requires fewer battery cells and reduces the shocks du to careless starting and handling.

ELECTION OF OFFICERS.

The convention was brought to a close Friday mornin with the election of officers. Mr. F. R. Frost, of th Atchison, Topeka & Santa Fé Railway, was unanimous elected president; Mr. D. J. Cartwright, Lehigh Valle first vice-president; Mr. C. R. Gilman, Chicago, Milwauk & St. Paul, second vice-president, and Mr. Joseph Andre cetti, Chicago & Northwestern Railroad, secretary. Mess L. S. Billew, Baltimore & Ohio Railway, and E. W. Janse

Illinois Central Railroad, were added to the executive committee, the other members of which are Messrs. A. J. Farrelly, H. C. Meloy, F. E. Hutchison and C. J. Causland. The place of the next semi-annual meeting was set for Atlantic City, N. J., the date preceding the convention of the Master Car Builders' Association. The next annual meeting will be at Chicago, at a date to be decided later. During a short business session at the close of the convention the constitution was amended so as to permit the transaction of business at all regular sessions, and the president was directed to appoint a committee on ball-bearing standards.

ENTERTAINMENT.

The entertainment features in connection with the Railway Electrical Engineers' convention began with an informal reception and dance in the Red Room of the La Salle Hotel, Monday evening. On Tuesday afternoon there was an automobile tour for the ladies, and on Wednesday afternoon a matinée party was given at a local theater. Wednesday evening the Car Lighting Club entertained the association at the La Salle Hotel, when Mrs. Morgan S. Woodward described her experiences during the siege of Pekin. The fourth annual banquet of the association, given by the Railway Electric Supply Manufacturers' Association, was held Thursday evening. Mr. Frederic P. Vose presided as toastmaster. Mr. W. L. Park, vice-president of the Illinois Central Railroad, and Mr. Frederic A. Delano, president of the Wabash Railroad, were the speakers. In referring to the possibility of electrification of railroads and railroad terminals, Mr. Park said that while the railroads realize the advantages of electrification they are disposed to wait until they are thoroughly convinced that the best method is obtainable. Mr. Delano said that he had observed with great interest the use of storage-battery cars now being applied for "feeder" service to steam roads, as well as the possibility of storage-battery locomotives for handling terminal service. While there are many advantages resulting from electrification, he frankly stated that the cost is yet too great for the railroads to consider.

Electric Welding.

At a meeting of the American Society of Mechanical Engineers held in New York on Nov. 14 the general subject of electric and autogenous welding was discussed in great detail. Mr. H. R. Cobleigh presented an introductory paper dealing with the general aspects of the subject, in which were described the origin and principles of each process and the apparatus used in each. He outlined the features of electric resistance welding, electric arc welding, thermit welding, oxy-acetylene welding and oxy-hydrogen welding. By means of numerous lantern slides the mechanical details of the apparatus employed in each system of welding were described. It was stated that each method possesses certain advantages and certain disadvantages, so that each system may be considered most advantageous for certain particular services.

Mr. G. E. Pelissier described the thermit process of welding, which depends upon the chemical combination of aluminum with oxide of iron, the resultant products being oxide of aluminum and iron. The chemical reaction takes place at a high temperature and leaves the iron in molten form, so that it may weld together metals between which the molten iron is allowed to cool. By the use of motion pictures the thermit welding of rails was shown in a striking manner.

Mr. C. B. Auel gave much interesting information relating to the Bernardos, Slavianoff and Zerener processes of electric welding. These processes differ according to the material used for electrodes. In the first-named process one electrode is formed by the metal to be welded, and the other electrode is of copper. In the second process the two metallic parts to be joined form the electrodes, while in the third process there are two carbon electrodes, with the metal forming an intermediate contact between these two electrodes. Much attention was devoted by the author to the Bernardos process, which he considered to be the most universally applicable. However, the Slavianoff process produces a stronger joint. In this process use is made of an arc of a length of about ¼ in., an emf of 25 volts and a current of 150 amp. In the Bernardos process the length of the arc would be about 1 in., the current from 160 amp to 700 amp, and the emf from 45 volts to 50 volts at the arc.

Mr. W. H. Brown described an electric welder acting according to the Zerener process, which he has found highly advantageous on account of the economy in operation, the consumption being 18 kw, as compared with 50 kw by other electrical processes.

The subject was further discussed by Messrs. W. H. Spire, J. D. Mooney, Henry Cave, W. R. Noxon, W. H. Lavin, W. J. Fritz, J. F. Springer, E. B. Katte and Dr. Lieber.

Some Electrical Aspects of the Signaling and Interlocking of a Great Railroad Terminal.

While modern railroad signaling and switch-operating mechanism is very largely dependent on electricity, the general subject of signaling and interlocking is one that appeals mainly to specialists and is not of direct interest to the main body of the readers of the *Electrical World*. Nevertheless, the important paper on "Signaling and Interlocking of the New Passenger Terminal of the Chicago & Northwestern Railway Company," read by Mr. J. A. Peabody, engineer of that company, before the Western Society of Engineers in Chicago on Sept. 20, is one that contains many facts of direct interest to electrical men, and what follows is a summary of some of the facts brought out in that comprehensive paper.

Inasmuch as the signaling and interlocking of a large railroad terminal are installed as much for the acceleration of traffic as for its protection, the means of receiving and giving information and of communication form a very important feature of the whole installation. This feature received attention from the designers of the new Chicago & Northwestern passenger terminal in Chicago. The various means of communication adopted in connection with various operations of train signaling, all of which require the use of electricity, are: Conductor-towerman-gateman system of annunciators, telautographs, various forms of automatic train annunciators and indicators, illuminated track diagrams, lamps over levers, telephones and "intercommunicating system."

The conductor-towerman-gateman system of communicating by lamp signals, whereby towermen, gatemen and conductors signal to one another at the time of the starting of trains, has been described briefly in this journal (*Electrical World*, Aug. 26, 1911, page 488). By means of this system the conductor in charge of the outgoing train, the gateman admitting passengers to the train platform and the tower director in charge of the interlocking signals are placed in communication with one another at the time of departure of the train by lamp signals operated electrically by push-button switches.

For the giving of information to all employees who should know about the probable and actual arrival of trains Gray telautographs were adopted. A single system of three transmitters and nineteen receivers was installed. The transmitters are placed in each of the two division dispatchers' offices and in the Lake Street interlocking tower. The receivers are placed in the office of the superintendent of passenger terminals, on the caller's balcony and in various other locations. A telephone has been installed

[illegible] telautograph receiver and connected to a telephone switchboard in the Lake Street tower. A number of other telephones are connected to this board, the number of stations being eighty-four. In addition, provision is made for the connection of portable telephones at each of the principal manholes and junction boxes throughout the signaling plant.

In addition to annunciators indicating the approach of trains to towermen and indicators for protector circuits, illuminated track diagrams have been placed in the Lake Street and Clinton Street interlocking towers. The front of these diagrams is made of ground-wire glass, and on it the tracks, signals, switches, etc., are indicated. Behind the glass face are small tin boxes, each containing a 4-watt, 14-volt lamp. By this means the light from each lamp is confined to a particular area of the diagram. The lamps are controlled in such a manner that when there are no trains in the plant the entire track layout is illuminated. But, as a train passes through the plant, its progress is shown clearly by the lamps going out as the train occupies the different track circuits, the light reappearing behind the train as the latter leaves the track circuits. The route lined up through each track switch is indicated by means of the lamps through circuit-breakers on the switch levers. The information is shown so clearly and completely by the illuminated diagram that it is possible at night and on stormy days to operate the terminal train movements without the towerman seeing the trains.

For giving information from one tower to another relating to train movements a push-button scheme has been developed and named the "intercommunicating system."

The track circuits for the interlocking plants are supplied by means of loops from 20-volt storage batteries in the towers. For the train-shed track circuits two motor-generator sets converting the 110-volt direct current from the main power-house lighting mains into 20-volt direct current were installed in a relay room under the station platform. These feed direct to the tracks, the sets being run successively in six-hour periods. By using these machines instead of a rheostat the main lighting circuits and the track circuits are kept separate and a ground on one system will not affect the other.

Electrical energy for signaling and interlocking purposes is obtained from the terminal power house, previously described in the *Electrical World* (Aug. 19, 1911, page 435). Except for the Lake Street tower, which is adjacent to the main power house, alternating current is transmitted at 6600 volts three-phase, for the signaling plant. The wires are laid in conduits. The energy is transformed to 220 volts, three-phase, for motors and to 220 volts and 110 volts, single-phase, for lighting. All transformers are of the subway type.

In order to show the varied character of electrical currents required for signaling at the Chicago & Northwestern terminal Mr. Peabody gives the following list:

[illegible]	Three-phase [illegible]
[illegible]	Three-phase power [illegible]
220-110-volt alternating current	Three-wire tower lighting.
[illegible]	Signal lighting.
55-volt alternating current	Locks on switch levers and lamps on levers.
14-12-10-volt alternating current	Lamps on illuminated diagrams.
220-110-volt direct current	Three-wire tower lighting.
[illegible]	Interlocking machines.
110-volt direct current	Telautographs.
20-volt direct current	Auxiliary circuits, emergency lever locks, telephone system, intercommunicating system.
16-volt direct current	Automatic signals.
12-volt direct current	Track circuit loop.
[illegible]	Individual track circuits.

Some statistics of the elaborate signaling equipment of the Chicago & Northwestern terminal may be of interest. There are in use in the signaling plant 553 electric motors, of which 235 are 1/6-hp signal motors and 288 are 1-hp track-switch motors; in addition, there are thirty motor-generators. Included in the installation are 531 cells of storage battery, 3056 incandescent lamps, [illegible] transformers, 1024 relays and 2,826,4[illegible] ft. of insulated wire.

Decision of the New York Commission in Queens Borough Case.

One of the most important cases decided by the New York Public Service Commission, First District, came before that body on an informal proceeding affecting the Queens Borough Gas & Electric Company. When the case was first brought before the commission the company stated that it had reduced its rates as rapidly as it could afford to do, and showed that in 1902 the rates for gas were a maximum of $1.80 per 1000 cu. ft. and a minimum of $1.60. These rates were reduced gradually to the figures of $1.30 maximum and $1.25 minimum, prevailing at the time the complaints were made. The rates for electricity from 1902 to Nov. 1, 1906, were a maximum of 20 cents per kw-hour and a minimum of 4.8 cents per kw-hour. These were reduced to the figures prevailing at the time of the complaint, 15 cents maximum per kw-hour and 3.5 cents minimum per kw-hour. The company offered to continue the reductions and to make the rates for general consumption in 1911 $1.25 for gas and 14 cents for electricity, and also to reduce the rates still further if the finances would warrant. The proposal was not approved and the case was allowed to proceed. The final decision was that the maximum rate for gas should be $1.20 per 1000 cu. ft. from July 1, 1911, to Jan. 1, 1912, and $1.15 per 1000 cu. ft. from the latter date to July 1, 1912, and that the maximum rate for electricity should be 13 cents per kw-hour from July 1, 1911, to July 1, 1912.

An appraisal of the physical property was made, which gave for the gas department $707,815 and for the electrical department $637,724, or a total of $1,345,539. In addition an allowance was made for engineering, supervision, contingencies, incidentals and a general contractor's profit of $136,345 for the gas department and $126,608 for the electrical department, or a total of $262,953. The company had asked for an allowance of 25 per cent upon every item in the net physical cost, amounting to a total of $336,000. It was held that if a general contract was let for the reproduction of the plant and overhead charges were figured at the usual rate, the total cost would probably be less than that given above. The allowance is based in part on piecemeal construction, and consequently the unit prices adopted are larger than a general contractor would charge.

The company has recently acquired for $21,000 two parcels of land which are not being used nor urgently needed for immediate use. This purchase was justified by the company on the ground that land in the vicinity is increasing steadily in value, and that it would be cheaper to purchase now than to wait and pay much higher prices when more land is actually needed. The commission held that until this new land is used for gas or electrical purposes and is necessary for efficient and economical management it should not be included as a necessary part of the property upon which the company is entitled to earn a fair return.

The commission held that the estimate of $130,000 for preliminary and development expenses is ample for all items except interest and taxes during construction, and that it would not be unfair to compute interest and taxes upon one-half reproduction cost plus the cost of land and other preliminary and development expenses. Upon this basis an allowance of $90,000 was made. For working capital an allowance was made of $30,000 for the gas department and $45,000 for the electrical department.

A representative of the company asked that in additic to the factors produced there should be added some cor siderable sum for "going concern" on the grounds (1 that the property has been adjusted, tried out and unifie (2) that the company has a clientèle, established conne tions and a name in the community; (3) that valuable e [illegible] and data regarding the business have been accum [illegible] that the early years wherein losses usually occ

have been passed. Taking up these points, the commission held (1) that the fact to be kept in mind is that the present case is a rate case, and that a fair value for condemnation is not necessarily a fair value for rate making; (2) some of the elements attributed to going value have already been allowed for liberally in preliminary and development expenses and in connection with the appraisal of physical property in the form of overhead charges; (3) much of the information and experience referred to is personal and does not go with the property. The fourth consideration is that many of the elements included in "going concern" are transitory or recurrent. Every new piece of machinery or plant must be tried out and adjusted, and all property, excepting possibly land, must be replaced from time to time. Thus the adjustment and adaptation involve continued expense. In so far as these elements are transitory and call for expenditures year after year, they should not be paid out of capital, but should be charged as a part of operating expenses. If the various expenses which go to make up "going concern" are to be charged to operation the company should be allowed to charge rates that would yield a sufficient income to pay them and allow a fair return upon a fair value of the property. If good management and foresight had been used in the initiation and conduct of the undertaking this statement would be sound, but it ordinarily happens that during the first few years of operation the company does not earn a fair return, and there are then two methods by which investors may be made whole.

One solution of the problem is to capitalize the losses or deficiencies below a fair return and all the other elements which are said to be included in "going concern." This would be accomplished by using the proceeds from the sale of stocks, bonds or notes to pay expenses for "going concern" and a fair return to investors. To use money from such sources would, the commission states, be absurd, dangerous and unjustifiable, and would probably result in bankruptcy and dissolution. The use of capital money to pay current expenses after operation has been begun is open to similar criticism. If the theory is sound that "going-concern" expenses are to be charged to capital, the wages or salaries paid to certain employees must be paid out of capital, and the question is asked, Who is to decide when this shall be done and when it shall cease after it has once been started? It is easy to fix a date when the construction period ends and operation begins, but it is asked how one may know when "going concern" expenses cease. The conclusion is that to follow this solution would open the door wide to over-capitalization, financial manipulation and misappropriation of funds.

The other solution is to charge all such expenses to operation, to attempt to make no fine-spun distinctions, and then to permit the company to charge in later years rates sufficient to offset its deficiencies below a fair return in the first few years. This method involves no question as to capitalization and cannot result in the inflation of securities. Ordinarily the company which is wisely managed follows this very course and works out an adjustment by itself. Questions only arise when the state, through some agency, is called upon to determine whether the rates are reasonable, and then the rate of return to be allowed upon the investment should be such as to offset losses in earlier years. The commission stated that this principle was adopted in the present case, and no further allowance was made for "going concern" in determining the fair value of the property.

The company had filed a statement of the requirements for improvements and betterments for the immediate future, of which $87,000 relates to electricity supply, $79,100 to gas and $8,500 to general property. These are divided by the commission into three groups, namely: (1) Repairs and replacements; (2) extensions and additions for future consumption; (3) additional plant to improve service. The decision states that the company is not entitled to capitalize or to earn a fair return upon the first group, for all repairs, renewals and replacements should be charged to earnings. The second group should also be omitted, for the additional consumption which these additions are to supply should, and doubtless will, provide a fair return upon new investment. Regarding the third group, the commission says that at the present moment the company does not have sufficient gas and electric plant to afford proper service, and allowance should be made for such additions as will be necessary to enlarge the business during the current year.

The final conclusion of the commission is that the company is entitled to earn a fair return upon $860,000 for the gas plant and $800,000 for the electric plant, or a total of $1,660,000. The standard set by the commission for determining a fair rate of return on this valuation is that the rate should be such that investors would be induced to provide the funds to construct and extend the gas and electric plant within the area in question. After considering all the facts the commission concluded that, in view of the circumstances surrounding the company and the character of the area within which it operates, a fair rate of return on both gas and electric undertakings for the purposes of the present case would not exceed 8 per cent. This rate would be equivalent to a dividend of 10 per cent upon stock equal to one-half of the fair value if bonds to the amount of one-half were financed upon a 6 per cent basis, or an 11 per cent dividend if bonds were on a 5 per cent basis. After consideration of operating results and costs and present local conditions the commission made the following estimate for the electrical department:

Cost of generating 4,150,000 kw-hours at 1.7 cents per kw-hour..	$70,550
Other operating costs (including taxes but excluding depreciation) 2,820,000 kw-hours sold at 2.8 cents....................	78,960
Depreciation and other reserves..............................	28,000
Return on fair value of property ($800,000 at 8 per cent) ..	64,000
Total	$241,510

Upon the other side of the account, excluding the energy supplied at the maximum rate, the following entries are made by the commission:

Street lighting, 800,000 kw-hours at 6 cents per kw-hour........	$48,000
Lighting municipal buildings, 20,000 kw-hours at 10 cents.......	2,000
Commercial metered power, 700,000 kw-hours at 4 cents.........	28,000
Electric jobbing, etc...	1,400
Rent of rooms in office building (one-half total)..............	1,000
Increase in value of land......................................	6,300
Total deductions..	$86,700

Subtracting this total from the cost of service, the commission obtains an amount of $156,210. Dividing this amount by the consumption at the maximum rate, 1,300,000 kw-hours, there is obtained an average of over 12 cents per kw-hour.

In explanation of the item of depreciation the commission states that experience has shown that the straight-line method for calculating depreciation produced a larger return than is necessary. First, some portion of the annual loss is made good by renewals and replacements regularly included in maintenance and already allowed for in operating expenses. So extensive, indeed, are the partial replacements and renewals usually included in current maintenance that many of the largest corporations under the supervision of the commission have taken the position that no special depreciation fund is required in their cases. The question whether depreciation is a proper operating charge is no longer open to debate. The opinion of Mr. Justice Moody in the Knoxville water case reflects the generally recognized rule that rates should be sufficient to permit current repairs to be made, parts to be replaced and other charges met, so that by one means or another the investment may be kept unimpaired. In order that this may be done every part of the property must be considered, and wherever there is a decrease in value provision must be made for an offset in one form or another.

The land owned by the company was taken by the com-

[illegible] called its fair value and not at its original cost, and annual appreciation of the land was ordered to be treated as a profit. If land or other property which generally appreciates in value is to be taken at its appreciated value, then an entry must be made in the estimated receipts equal to the annual average appreciation. The commission held that until this is done it is obvious that the consumer will be burdened with all the estimated decreases in assets and not credited with the increases in assets.

Public-Utility Commission Investigation in Illinois.

A committee of the Illinois Legislature, of which Senator John Dailey, of Peoria, is chairman, is investigating the subject of creating a public-service commission or commissions for that State. It has already made several trips, some of them out of the State, in gathering material on the subject, and now purposes to make a tour of Illinois to obtain first-hand information on the condition and requirements of public utilities. To this end the following itinerary has been announced:

Week of Monday, Nov. 13—Cairo, Marion, Carbondale, Murphysboro and East St. Louis; week of Nov. 20—Alton, Carlinville, Jacksonville, Quincy, Rock Island and Galesburg; week of Nov. 27—Peoria, Ottawa, Pontiac, Bloomington and Springfield; week of Dec. 4—Decatur, Mattoon, Champaign, Danville and Kankakee; week of Dec. 11—Joliet, Aurora, Elgin, Freeport and Rockford.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has received a complaint from Milford D. Whedon, of the village of Granville, Washington County, directed against the New York & Vermont Home Telephone Company, alleging that the charge of 50 cents per month made by the said company for an extension telephone is excessive and unjust and should be reduced to a maximum of 10 cents per month. The complaint states that the company has refused to permit the complainant to install an extension telephone and connect it with a telephone of the company in his office and residence at his own expense, and that this refusal of the company is an injustice, unfair and unreasonable, and that he should be allowed to install such an extension telephone at his own expense without rent or other charge therefor in addition to the regular charge for telephone service. The complaint has been served upon the telephone company and an answer required within twenty days.

OHIO COMMISSION.

In the case of the Tiffin Art Metal Company against the Tiffin Consolidated Telephone Company Judge William F. Duncan, in the Common Pleas Court at Findlay, Ohio, has ruled that the public utilities act passed by the Legislature last winter is constitutional. The Tiffin Art Metal Company asked for an injunction to prevent the telephone company from removing the telephone from its office when it refused to pay a rental of $3 per month after the City Council had fixed a rate of $2.50 by ordinance. Attorneys argued that because the telephone companies were not specifically mentioned in the bill they do not come under its provisions. The court, however, held to the contrary and declared that the City Council has authority under the new law to fix telephone rates. The injunction was granted.

Attorney-General Hogan has rendered an opinion to the Public Service Commission to the effect that it is the duty of that body to make a valuation of telephone plants before the owning companies are allowed to connect them up for interchange of service, lease, [illegible] Hogan also suggests in this opinion that after the commission has made a valuation it shall determine the rates, tolls, charges and rentals to be made under the contract, purchase or lease.

A. F. Herbele, of Cincinnati, has filed a complaint with the commission to the effect that the Union Gas & Electric Company is discriminating against manufacturers, real-estate owners and merchants who own their own plants for the production of energy. It is claimed that some large manufacturing concerns which operate their own electric plants close down in the evening when the plants are not in use, and that unless the Union Gas & Electric Company furnishes energy the offices and buildings are in darkness. This company, it is claimed, charges owners of these private plants $3 per kw per month, while the charge to others is $1. The company, it is said, claims that it cannot make the connections and furnish the small amount of energy thus used for less where the owners maintain a plant for motor and lighting service the remainder of the time. The commission has set Nov. 24 for a hearing in Cincinnati.

MARYLAND COMMISSION.

Persons interested in the Maryland Public Service Commission are speculating as to what action will be taken by the Legislature concerning the law and also the course that will be pursued by the new Governor in making appointments to the commission. The term of Mr. Philip D. Laird, of Montgomery County, will expire next May, and the term of Dr. Joshua W. Hering will expire in May, 1914. Chairman Ambler's term will not expire until May, 1916, when another governor will have been elected. The present members of the commission are all Democrats, as are most of the employees. The commission, with the approval of the Governor, names its chief counsel, assistant counsel, secretary and engineer, while it has full power to name all other employees. Mr. William Cabell Bruse is chief counsel, Mr. Albert C. Ritchie assistant counsel, Mr. Charles E. Phelps chief engineer and Mr. Louis Duvall secretary.

WISCONSIN COMMISSION.

In conformity with its established policy, the Wisconsin commission has deferred a favorable decision on the application of the People's Telephone Company for an increase in rates until the company's accounts are properly kept and the plant is put into shape to render efficient service. The People's Telephone Company owns and operates six local exchanges with a general rural and toll service. The petition alleges that the present rates are not high enough to yield a reasonable return after providing for depreciation and to maintain the plant in a satisfactory operating condition. An increase in rates was requested for three of the six exchanges. On account of the fact that the company had not properly apportioned the revenues and general expenses for rural and toll service, it was impossible to determine accurately the financial condition of each o the several exchanges. From an analysis based upon th available information, and computing depreciation at 6[illegible] per cent, it was evident that the rates in effect at two o the three exchanges were not ample. On the other hand the rates petitioned for were too high in consideration c the service rendered. According to the company's report for 1910, the average yearly operating cost per telephon for the three exchanges was $5.92. The commission wa very doubtful whether the utility could furnish adequat service at so low a cost. In this connection the engineerin staff reported that the complaints made of the service we due chiefly to the condition of the wire plant, and said th a thorough overhauling and repair were necessary ste toward the rendering of reasonable service. The investig tion showed that the company's financial condition in ge eral was good enough to warrant making the needed i provements in the service, with the possible exception of t two exchanges in controversy. In dismissing the applic tion the commission conceded that in the case of the t

weaker exchanges an increase in rates was justifiable, but held that this action must be postponed until the company gets the exchanges into condition to render good service and keeps its accounts in a manner prescribed by law.

Two complaints have been filed with the commission by the city of Green Bay, one alleging that the Green Bay Gas & Electric Company's rates for gas and electric service are excessive and unreasonable, and the other that the rates for electric service charged by the Minahan Building Company are unreasonably high. The Gas & Electric Company's present electric rates range from 12 cents per kw-hour for a monthly consumption of from 9 kw-hours to 24 kw-hours to 2.5 cents per kw-hour for energy used in excess of 1300 kw-hours, with a discount of 10 per cent for prompt payment. According to this schedule, the majority of the residence lighting is paid for at the maximum rate. The company distinguishes in its gas schedule between the same gas sold for lighting purposes and for fuel, which is contrary to the established practice as followed by the commission in all of its past decisions. The present electric rates of the Minahan Building Company range from 8 cents for the first 100 kw-hours to 2.5 cents for all energy used per month in excess of 1200 kw-hours, with a discount of 5 per cent for prompt payment. The motor service rates range from 7 cents to 2 cents for the same quantities. The Minahan Building Company supplies energy to a restricted area in the business district. Both hearings will be held next month.

The commission has served notice upon the city of Evansville that it will immediately proceed to investigate the rules and regulations of the municipal electric-light plant. This action was the result of a complaint registered against the municipality, in which it was alleged that the rules and regulations were unreasonable and that the rates for service were unlawful and discriminatory.

CURRENT NEWS AND NOTES.

Advertising Electrical Novelties.—In the article on page 1142 of the issue of Nov. 4 entitled "Advertising Electrical Novelties" credit for the illustrations used should have been accorded to the Louisville Lighting Company, which company owns the copyright of the pictures.

* * *

Proposed Hydroelectric Development on St. Lawrence.—According to reports from Ottawa, a company with capital of $100,000,000 is to be incorporated with a harter from the Dominion government for the purpose of eloping the Cedars, Cascades and Coteau Rapids in the Lawrence River, which are entirely in Canadian terri-. Sir Max Aitkens, a Canadian who is a member of the ish Parliament, is said to be at the head of the enter-

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ost-Graduate Instruction for Practising Engineers. he government of Bavaria has arranged for courses of ruction which all government technical officials are re-red to attend at intervals of some years. The reason en for this action is that engineers after graduation do have an opportunity while engaged in regular work keep up with all the developments in their branch of gineering knowledge and need a period of systematic intruction at intervals to bring them up to date.

* * *

Electrically Driven Dictaphones in Massachusetts Trial.—Motor-driven dictaphones are being used in a table capital case which is being tried in the courts of pringfield, Mass., to facilitate the rapid preparation of enographic reports of detail evidence and arguments. By is means the report of the case is kept within forty-five inutes of the proceedings in the court-room, and by 7 p. m. daily the complete corrected brief of each day's doings and sayings is available to the parties interested.

* * *

A. I. E. E. Smoker.—At the recent meeting of the American Institute of Electrical Engineers in New York it was announced by Mr. Harold W. Buck, chairman of the meetings and papers committee, that immediately following the next meeting of the Institute in New York a smoker would be held in the society's rooms on the tenth floor of the Engineering Societies Building. During the informal portion of the meeting ample opportunity will be given to members for the discussion of engineering topics.

* * *

Telephone Service for Isles of Shoals.—A submarine telephone cable has recently been placed in service between the Isles of Shoals, off the coast of New Hampshire, and the mainland. Wireless communication has been maintained across the 10-mile stretch of open sea separating these rocky outposts of civilization from the shore; but the requirements of speed and accuracy led to the demand for telephone connections. Soon after the installation of the cable a wreck occurred on Duck Island, and assistance was summoned from Portsmouth in record time. It is anticipated that the new service will be of the utmost value to summer residents as well as to denizens of the islands.

* * *

Electric-Vehicle Thesis Investigations at Boston.—In connection with the investigation of electric-vehicle problems which is being carried on by the electrical engineering department of the Massachusetts Institute of Technology for the Edison Electric Illuminating Company of Boston, Mass., a special study of the time-factors in urban freight handling will shortly be inaugurated. As a part of the required thesis work, an analysis will be made of the time required in handling shipments of freight in and about the large Boston railroad terminals, including the performances of horse-drawn trucks, gasoline trucks and electric commercial vehicles. Special efforts will be made to locate sources of inefficiency and, while the investigation will be pursued with entire absence of partiality, it is anticipated that some interesting and suggestive points on behalf of the electric truck will be forthcoming. The work is under the immediate supervision of Mr. H. P. Thompson, of the department of electrical engineering, who has lately visited all the large cities east of the Mississippi River in the quest of information upon the latest electric-vehicle practice and opportunities.

* * *

Brooklyn N. E. L. A. Company Section.—More than 400 members of the Brooklyn Company Section of the N. E. L. A. were present at the November meeting, held on Monday evening, Nov. 13. Mr. Alden W. Welch presented a very instructive paper on "Low-Tension Electrical Conductors," describing the reduction of copper into finished wire and the manufacture and characteristics of low-tension cables. Mr. James L. Wiltse presented an excellent paper on "Charging for Electric Service," covering the theory and principles of rate-making. Each of these papers was followed by lively discussion in which members from nearly every department of the company participated. After presentation of the papers, Mr. M. J. Shugrue, president of the section, introduced Mr. Frank W. Smith, secretary of the United Electric Light & Power Company, of New York City, the speaker of the evening. His topic was "Co-operation," and in a highly interesting address enhanced by humorous and pertinent anecdote he contrasted the advantages of co-operation with the results of individual effort and complimented his listeners upon the high degree of company spirit and co-operation that they had shown throughout the evening. Refreshments and moving pictures of current events, including a film showing Mr. Thomas A. Edison's recent trip through the Alps, brought the program to a close.

[illegible] York Section of the Illuminating Engineering Society to be held on Dec. 8 Dr. Ellice N. Alger will present a paper entitled "The Conservation of Vision."

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Baltimore N. E. L. A. Section.—The Baltimore Section of the National Electric Light Association has announced the following subjects for the lectures that will be given this coming season at the Johns Hopkins University by Dr. John B. Whitehead, professor of applied electricity at the university: Nov. 14, *Methods of Producing Power, Light and Heat;* Nov. 28, *The Value of Electricity as a Form of Energy;* Dec. 12, *Magnetism and Iron in Electrical Apparatus;* Jan. 2, *Dynamo-Electric Machinery;* Jan. 16, *Transmission and Distribution;* Jan. 30, *Electric Motors;* Feb. 13, *Transformers;* Feb. 27, *Electric-Lighting Devices;* March 12, *Principles of Illumination;* March 26, *Design of Illumination.*

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Philadelphia Section, N. E. L. A.—Among the principal speakers at future meetings of the Philadelphia Electric Company Section of the National Electric Light Association will be the following: Dr. C. P. Steinmetz, on Nov. 20, upon the subject "The Effect of Reactance on Alternating-Current Circuits and Apparatus"; Mr. A. H. Armstrong, on Dec. 18, his subject being "The Coming of the Electric Locomotive"; Dr. E. F. Smith, on Jan. 15, upon the subject, "How the Chemist May Use Electric Current"; Mr. Caryl D. Haskins, on Feb. 19, on the subject "The Electric-Lighting Industry, Past, Present and Future," and Mr. J. J. Carty, on March 18, and Mr. H. L. Doherty, on April 15, upon subjects not yet announced.

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Railway Electric Supply Manufacturers' Association.—At the annual meeting of the Railway Electric Supply Manufacturers' Association, held in Chicago on Nov. 9, during the convention of the Association of Railway Electrical Engineers, Mr. George H. Porter, of Chicago, was elected to the presidency, receiving a well-earned promotion from the vice-presidency. The full list of officers is as follows: President, Mr. George H. Porter, Western Electric Company; vice-president (East), Mr. H. G. Thompson, Edison Storage Battery Company; vice-president (West), Mr. W. F. Bauer, United States Light & Heating Company; secretary, Mr. J. Scribner, General Electric Company (Chicago office); treasurer, Mr. Edward Wray, *Railway Electrical Engineer;* executive committee (new members), Messrs. C. W. Bender, National Electric Lamp Association; J. G. Van Winkle, Safety Car Heating & Lighting Company; J. J. Schayer, Niagara Lead & Battery Company; W. C. Lawler, Gould Coupler & Storage Battery Company.

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Operation of Single-Phase Railway in Winter.—It is reported that the Spokane & Inland Empire Railroad Company, which operates an 11,000-volt single-phase line in the State of Washington, was the only one in the locality that maintained its regular scheduled service throughout the winter of 1909-10, which was the most severe ever experienced in that vicinity. On a railroad the ability of a steam locomotive to haul loads is actually reduced in cold weather because of the greater losses of heat from the locomotive. The reverse is true with an electric locomotive, because in cold weather the motors are maintained at a much lower temperature than in warm weather, hence their permissible outputs are increased. An additional reason for the success of the single-phase line has been that at the high voltage the current is so low that the voltage is maintained up to almost normal, even when the motors on the locomotives or cars are operating at large overloads. Upon an ordinary 600-volt road when the car "bucks" the snow the current consumption is so great that the line voltages usually drop to a value too low for effective operation.

Telephone Pioneers Convene at Boston.—Three hundred men who had been closely identified with the early days of telephony met in convention at the Hotel Somerset, Boston, on Nov. 2 and 3, to organize an association to be known as the Telephone Pioneers of America. Membership in the association is contingent upon a service of at least twenty-one years in the telephone field. Gen. Thomas Sherwin, of Boston, presided, and the following officers were elected: President, Mr. Theodore N. Vail, Boston; vice-presidents, Messrs. F. H. Bethell, New York; W. T. Gentry, Atlanta, Ga.; B. E. Sunny, Chicago, and E. B. Field, Denver, Col.; secretary and treasurer, H. W. Pope, New York; executive committee, Messrs. Thomas D. Lockwood, Boston; John J. Carty, New York, and Francis A. Houston, Boston. A feature of the convention was an address by Dr. Alexander Graham Bell, giving many interesting details of the invention and early service of the telephone. An elaborate exhibit of early telephone material and apparatus was displayed, including the first telephone switchboard, 2 ft. in length, parts of the original Bell telephone of 1875 and other priceless relics of the industry.

* * *

National District Heating Association.—The executive committee of the National District Heating Association met in Detroit, Mich., on Nov. 8 and 9, and after considering invitations from Niagara Falls, N. Y.; Rochester, N. Y.; Buffalo, N. Y.; Chicago, Ill., and Detroit, Mich., unanimously decided to hold the fourth annual convention in Detroit on June 25, 26 and 27, 1912. Papers upon the following subjects will be presented at this convention: "Depreciation in Underground Distribution Systems," "Operation of Turbines and Reciprocating Engines in Connectior with Steam-Heating Work," "Description of a Combinec Steam-Heating, Ice-Making and Electric-Power System," "Radiation Tests," "Heat Losses in Steam Distributing Systems," "Description of a Large Hot-Water-Heating System," "Quality of Steam Supply as Affected by Use o Superheat at Station," "Decentralized Heating Plants," "Relative Economies of One-Pipe and Two-Pipe Heatin Systems in Buildings," "Sources of Trouble in Customers Installations," "Thermodynamic Economy of Combine Power and Heating Systems" and "Different Systems o Underground Construction." One paper is to be presente by the Cleveland Electric Illuminating Company on a sub ject not yet announced. Mr. D. L. Gaskill, Greenville, Ohi is secretary.

* * *

A 1500-Volt Direct-Current Road in the Carolina —Nearly 150 miles of track will be equipped for 1500-vo direct-current operation, when the new system of the Pie mont Traction Company and the Greenville, Spartanburg Anderson Railway Company is completed in North ar South Carolina. The mileage electrified is one of tl largest high-voltage direct-current installations ever u dertaken, and the pressure, 1500 volts, is about 300 vol higher than has been heretofore employed. The equipme will include both passenger cars and locomotives for hau ing freight, the motors being of a special interpole ty connected permanently two in series on 1500 volts. secondary feature of this 1500-volt equipment will be t use of a dynamotor to drive the car compressor by mea of a friction clutch of a standard automobile type, t clutch being automatically cut in when the air press reaches a certain limit. The dynamotor ordinarily fu nishes power for the control circuits and lamps, but in t case it will serve also to operate the compressor. T dynamotor is arranged to operate on the 600-volt lines the regular speed, thus enabling the air pressure to be k up better than is possible where 1200-volt compressor m tors are used and operated at half speed or less on the lo voltage lines. It is also of interest to note that the 1500-v equipment will be furnished by the Westinghouse co pany.

HE WORLD'S PIONEER HIGH-TENSION TRANSMISSION SYSTEM.

IE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY.

olution from 100-hp Generator in 1890 to Eight Generating Stations Aggregating 40,000 hp and Supplying 600 Miles of Transmission Line in Three States.

the modern systems of high-tension electric transmission which are revolutionizing industrial conditions within economic radius of their generating stations, that of the Telluride Power Company occupies a place of unique interest. The organization enjoys the distinction of being the pioneer enterprise of its character in the world, the company having been the first to undertake commercially to transmit high-pressure energy, antedating the celebrated Frankfort-Lauffen experi- ... by about a year. In the light of modern trans- ...ssion practice, with its increasing reliability of service ... stribution areas covering in many cases thousands of ... miles of diversified country, the work of the initial pl...t at Ames, Col., seems to belong to the remote past, and ye...t is barely a score of years since the triumph of elec- ... n that remote mountainous district at the hands of ... L. L. and P. N. Nunn disproved the skepticism ... utside world and signalized the beginnings of the ... great dual systems of the company in Colorado, ... d Idaho, comprising eight power stations having a ... f over 40,000 hp, 35 miles of flume and pipe line, ... o miles of transmission lines, 400 miles of telephone ... l distributing networks. An outline of the operating ... ns of the system in Colorado and Idaho was given ... issue dated July 15, 1909.

... noteworthy that the original work at Ames was ... pon the necessity of supplying energy at a figure competitive with steam, the situation being acute on account of ...e prohibitive cost of coal in the San Juan district. In the ... days of operating economy it is easy to lose sight of ... t that the pioneers of hydroelectric transmission ... bliged to develop their markets through the most ... s competition with the established forms of motive ... nd to operate their systems with apparatus which ... rude and experimental to the last degree. That it wa...possible to attain commercial success in the face of suc... obstacles speaks volumes for the courage and ability of ...e financiers and engineers associated with the early hist...y of the art and encourages the belief that subsequent pro...ess is but the preliminary to a future development ... which the work of to-day will appear incomplete and probably as crude relatively as the original practice seems to the modern observer.

The history of the Telluride Power Company is a continuous record of independent research in the transmission field, and the organization has never sacrificed the lead which its management assumed in establishing the Colorado service of 1890. From the first experiments with 3000-volt synchronous transmission at Ames to the latest investigation of automatic relays suitable for operation in networks the company has maintained the spirit of scientific investigation within its organization, co-operating with the manufacturing companies, no less than determining its own advanced standards of equipment and methods. At its headquarters at Olmsted, Utah, the company to-day maintains a research laboratory which would do credit to any university, and the facilities there afforded for experimental study of transmission problems are unique in commercial power organizations.

EARLY DEVELOPMENT.

Only passing mention can be made of the company's early development in connection with a survey of the present systems. The initial plant was installed at Ames in order to meet a critical industrial situation at the Gold King mill, situated at an altitude of 12,000 ft. and in the heart of one of the richest and most rugged gold-bearing districts of the Rocky Mountains. On account of the excessive cost of steam service—soft coal selling at about $35 per ton at the mill—the property was confronted by an attachment, whereas its commercial success would have been assured with a substantial profit had it been possible to produce energy at $100 per hp-year. A stay of proceedings was secured and a generator and motor, wound for 3000 volts, single-phase, and rated at 100 hp each, were installed and connected by two No. 3 bare copper wires mounted upon short Western Union cross-arms and porcelain insulators, the line being 2.6 miles in length. The generator was installed in a rough cabin on the site of the present Ames station and belt-driven from a 6-ft. Pelton waterwheel operating under a head of 320 ft. The generator and motor were duplicate Westinghouse alternators, the largest machines manufactured at that time. The generator was separately excited, the motor being self-exciting. Each was provided with a twelve-part commutator and was slightly compounded through series transformers mounted upon opposite spokes of their armatures, the latter being of the iron-clad type, with twelve coils carried in fullerboard and mica cells. Circuits were closed with jaw switches and opened by arc-lamp plugs. Less than 5 per cent loss was encountered in the line and the cost of copper was only $700, compared with an estimated expense of $70,000 for copper with direct-current energy transmission. The motor was brought up to synchronous speed by a single-phase induction starting motor, the latter being turned initially by hand on account of its feeble starting

torque. The initial plant ran thirty days without a stop. Many difficulties were encountered and overcome, notably those arising from the severe lightning storms of the district, which comprises some of the most exposed mountain ranges in the United States. The use of T-toothed armatures with replaceable coils proved to be the plant's salvation, but the excessive number of burnouts led to the construction of various types of lightning arresters, leading to the development of the Wurts non-arcing equipment.

EXPANSION OF ORIGINAL SYSTEM.

The success of the Ames plant soon resulted in the expansion of the system, a 600-hp generator being installed in 1892, with transmission to a 250-hp motor 10 miles distant. In 1894 the transmission distance was increased to 14 miles, energy being supplied to motors in the famous Savage Basin, near Telluride. In 1891 the company's first lighting transformer was placed in service, and experience soon demonstrated the value of immersing the device in engine oil as a protection against lightning. Alternators were first paralleled by the company in 1893.

Even in these early days the value of technical education was appreciated by the company and special facilities were accorded station operators for the prosecution of daily study and shopwork, with a technical library and laboratory constantly at hand. In 1896 the Tesla induction motor system superseded the synchronous installations. In 1900 t company built a 1200-kw generating plant at Ilium, 6 mil below Ames on the south fork of the San Miguel Riv the machine being directly connected to two impulse whe operating under a 500-ft. head. Duplicate transmission lin were installed and among the contemporary improvemen effected were the use of masonry compartments for tran formers, the provision of line sectionalizing switches of t open-air type, the installation of junction houses at d tributing centers, use of recording instruments, inaug ration of a 10,000-volt underground transmission the Gold King mine, and in 1895 the institution of t celebrated experiments with transmission at potentials from 30,000 volts to abo 60,000 volts.

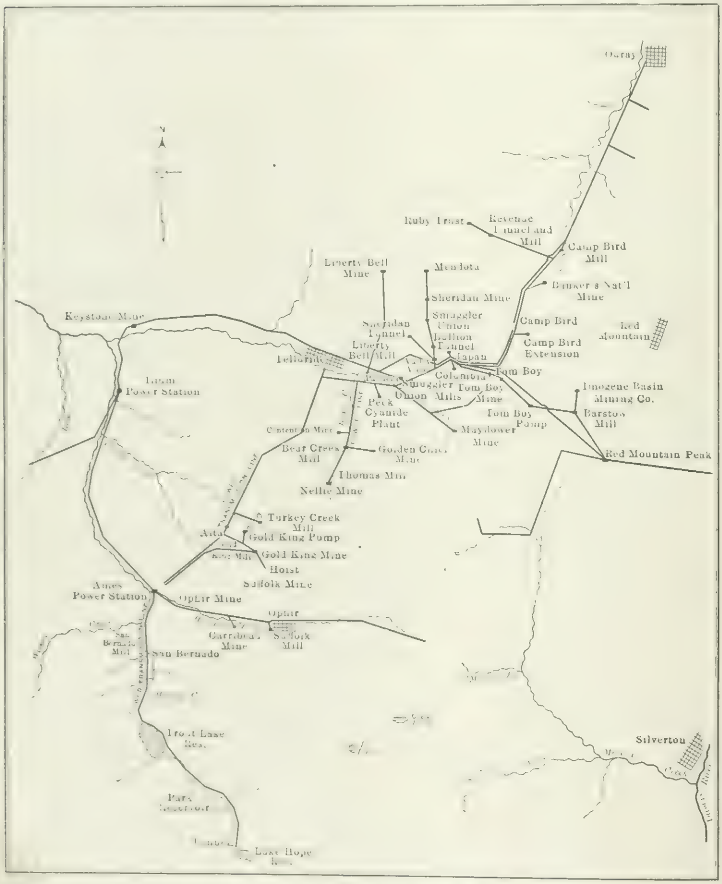


Fig. 1—Map of Colorado System.

The latter experime were undertaken to thr light upon the feasibility transmitting electricity ov larger areas from import water-power plants conte plated in Utah and Monta by the company.

The original plant Provo, now known as Nunn station, contained t 750-kw, 800-volt, 60-cy three-phase generators rectly driven by horizo twin turbines operat under a head of 125 From this plant energy transmitted over a single to Mercur, 32 miles dist at a pressure of 40,000 vo this being the first co mercial system operating the above potential, wh was at the time nearly th times the voltage previo employed by any transi sion company in its serv The Provo-type insulato triple-petticoated glass ou with double neck and serr bottom edge, was devel for this service, and some of the older port of the present system t insulators are still in although porcelain was since adopted as the c pany's standard. In 19 plant was installed at Lo Utah, containing two 1 kw revolving-field altern directly driven by w wheels operating under ft. head, this plant being to the Provo system by plicate lines over 100 miles long. A new station at sted, near Provo, was completed in 1905, this conta three 2400-kw generators directly driven by waterw el operating under 340 ft. head.

LATER DEVELOPMENTS.

The later growth of the system includes the additi of a 300-kw station at Ouray, Col., in 1905; the constructi of a 3600-kw station near the site of the original pla at Ames; the rebuilding of the Ilium station, and the do ing and extension of the transmission system in the Tel ide district, with the construction of new lines into the Red Mountain region and many additional branches to new con- sumers. Within the Utah department of the co any,

which operates a system having no electrical connection with that in Colorado, a plant at Jordan Narrows was purchased in 1906, its rating being 1300 hp; a plant at Battle Creek, a few miles from Olmsted, was built in 1906, with 2400-kw equipment; and in 1906-7 a new plant was built by the company at Grace, Idaho, the total rating of the generating units being 11,000 kw. This station is connected with the Logan plant by duplicate transmission lines and was designed for ultimate operation at 88,000 volts.

The Colorado department of the company serves a market situated in the rich mining districts of San Miguel and Ouray Counties, and within easy transmission distance of the San Juan district are fertile agricultural lands and promising towns. Apart from the mining load, which is extremely stable in this locality, the requirements of lighting, industrial motor service and irrigation are such as to indicate substantial increases in output in the future.

The Utah department serves a diversified market located in general within from 50 miles to 75 miles of Salt Lake City, including the supply of energy to the local central-station organizations at Salt Lake and Provo and to the noted mining camps of Bingham, Garfield, Eureka, Mercur, Topliff and to various important industrial organizations. All the electric railway systems in Utah now receive their energy wholly or in part from the Telluride Power Company. Important irrigation and pumping projects are also under consideration.

WATER RESOURCES, COLORADO DEPARTMENT.

The sphere of operations of the Colorado department lies within the so-called San Juan district, in the southwestern part of the State. About 6 miles southeast of Telluride an apex in the mountain range forms the divide of three watersheds draining into the following rivers: The Uncompahgre, flowing north into the Gunnison; the south and east forks of the San Miguel, uniting west of Telluride and flowing into the Dolores and later the Grand River; and the Animas River, flowing south into the San Juan. The Dolores also rises near the apex and flows southwest into the Grand River. Topographically the region is characterized by mountain peaks attaining elevations of from 13,000 ft. to 14,000 ft. above sea level, the mean elevation of the intervening valleys and basins being from 5000 ft. to 9000 ft. Heavy forest growths abound upon the western and northern slopes of the divide. In spite of the fact that the lowlands surrounding the headwaters are arid the precipitation upon the region near the divide is heavy, ranging from 40 in. to several times that amount at higher elevations. Perpetual snow is found on the higher portions of the range and the run-off is great on account of the rocky character of the basins.

The total drop from the highest lake on the headwaters of the south fork of the San Miguel River to its mouth, a distance of 12 miles, is about 4000 ft. The south fork is formed by two branches known as Lake and Howard's forks, which head near the summit of the divide. All the waters of the south fork are controlled by the power company. A system of three reservoirs holds a portion of the flood waters of Lake Fork for use during the period of minimum natural flow. Lake Hope, the highest reservoir, 11,700 ft. above the sea, has an area of 38 acres at spill level, with a very great depth, due to a crater formation. The surface of the original lake has been raised by a rock-filled dam, 20 ft. high, with rubble masonry on the water side, a water-tight face being formed by horizontal sheet-

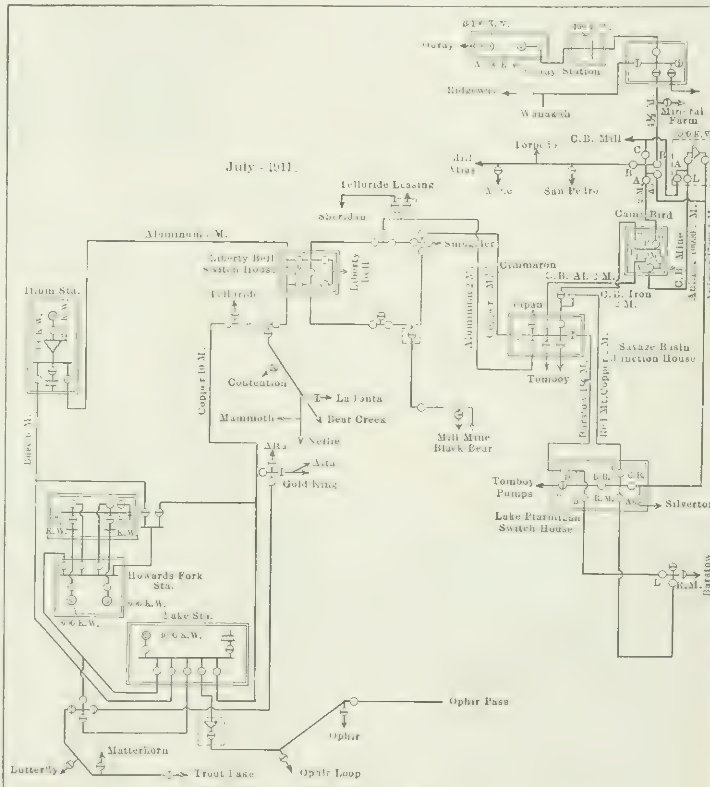


Fig. 2—Diagram of Colorado System.

ing spiked to timber embedded in the masonry. An outlet tunnel taps the lake 140 ft. below spill level, and the outflow is controlled by an 18-in. valve and pipe carried through a masonry bulkhead. The reservoir capacity is 140,000,000 cu. ft. Water from the lake flows through a natural channel 3 miles long into Trout Lake, a natural reservoir of 162,000,000 cu. ft. storage capacity, located at an altitude of 9700 ft. and having a surface area of 142 acres. Between Lakes Hope and Trout is situated a middle reservoir with a storage capacity of 30,000,000 cu. ft. The drainage area above the outlet of Trout Lake is 14 sq. miles, the total precipitation on which, less evaporation, is available for hydroelectric development. The high-water period lasts from about June 1 to Oct. 1. During the seven winter months stored water is necessary to supplement the natural stream flow.

[illegible] miles above Ophir [illegible] Lake Fork at Ames. All [illegible] advantage may be taken of the varying stream flow during the dry months by using the Lake Fork reservoirs to supply [illegible] the power demand.

The Uncompahgre River rises on the northern slope of the divide, several miles east of Telluride and about 8 miles south of Ouray, thence flowing northward through Ouray to the junction with the Gunnison River. The watershed is similar topographically to that of the San Miguel River, the slopes being rugged with steep sides and heavy forest growths. At Ouray the drainage area is about 24 sq. miles. The high-water season begins from one to two months earlier than in the Lake Fork watershed, making the watershed of more value than the minimum flow indicates. Between the points of diversion and return to the plant at Ouray the stream drops 470 ft. in a distance of 6200 ft.

NEW AMES PLANT

The Ames power station is located near Ophir, at the junction of Lake and Howard Forks of the San Miguel River. From Trout Lake an outlet pipe 42 in. in diameter taps the lake 30 ft. below the spillway, there being an intake well of concrete, 9.5 ft. x 12 ft. x 9 ft. inside dimensions. The flow is regulated by a 42-in. Chapman sluice gate. The outlet pipe discharges into a 24-in. x 30-in. wooden flume 13,000 ft. long and having a grade of 4.8 in 1000. The flume ends in a steel tank which provides peak load storage and assists regulation. From the regulating tank a steel penstock 2700 ft. long carries the water to the power house, the upper end being steel-riveted and the lower end lap-welded pipe, the diameter varying from 30 in. to 26 in. At the bottom of the penstock there is installed a "Y" with a gate valve in each branch, the arrangement permitting the use of the water in either the new or the old station at Ames. The water from Howard's Fork is carried about a mile along the mountain side from the point of diversion in a 24-in. x 30-in. wooden flume, terminating in a pressure box from which a penstock of riveted and lap-welded steel pipe 2000 ft. long and from 24 in. to 18 in. in diameter leads to the plant, terminating in a valved "Y" also allowing the use of the water in either the old or new sections of the station.

Fig. 3—View of Ames Station.

The Ames plant consists of two sections, one containing a 3600-kw generating unit with two waterwheels mounted upon a common horizontal driving shaft, and the other housing two 600-kw generators, each being directly connected to a waterwheel. The larger unit is installed in a new stone building known as the Lake station, and by the "Y" connections in the pipe lines above mentioned the generator may be driven either by a 5000-hp wheel drawing water under a head of 918 ft. from the Lake Fork system or in part by a 1200-hp wheel taking water from the Howard's Fork supply. This wheel is not shown in the station drawing, but the wheel-pit and generator-shaft extension for it are indicated. The station building is 58 ft. x 48 ft. over all, with standstone foundations laid in cement on concrete footings, the roof being of shingles carried on steel trusses with metal lath and plaster on the under side. The larger wheel is a Pelton outfit, with deflecting needle nozzle operated by a hydraulic cylinder under penstock pressure, the control being by pilot valve near the switchboard. The flow to the nozzle is controlled by a 24-in. hydraulically operated gate valve. The 1200-hp wheel is also a Pelton equipment, delivering its rating under a gross head of 626 ft. The nozzle is of the rigid needle type with stream deflector operated either by governor or by hand, the needle being controlled by hand wheel and gearing. The 3600-kw generator is a three-phase, 11,000-volt revolving-field machine of General Electric make, with a 75-kw, 125-volt exciter belt-driven from the shaft at a speed of 550 r.p.m.

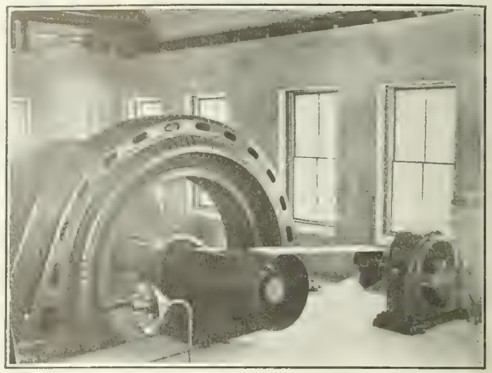


Fig. 4—Generating Unit at Ames Station.

ELECTRICAL FEATURES.

Energy from the generator is passed through an oil switch in the basement near the foundation and carried in 11,000-volt, rubber-insulated cables in fiber conduit along the basement ceiling to a bus structure mounted in concrete framing with asbestos barriers beneath the station switchboard, which is a four-panel installation located on the floor of the operating room, the latter being of reinforced concrete. On the main floor of the station five line switches of 15,000-volt rating are mounted in concrete cells and controlled from the switchboard by bell cranks. The switchboard contains one generator panel and three panels controlling two feeders each, with the usual instrumental equipment. On a reinforced-concrete gallery above the switchboard are mounted instrument transformers and protective apparatus consisting of spiral choke coils and electrolytic lightning arresters connected for the ungrounded neutral operation. Automatic overload relays are installed in connection with the oil switches on each of the outgoing lines, which leave the building through fiber concrete bushings set in sewer tile. In the operation of the station the Howard's Fork wheel of 1200-hp rating utilizes the [illegible] varying stream flow so far as possible, the

plant drawing upon the Lake Fork system merely for the rest of the demand. Three 400-kw transformers are installed in a corrugated-iron building outside the station for supplying energy at 17,500 volts to a feeder serving

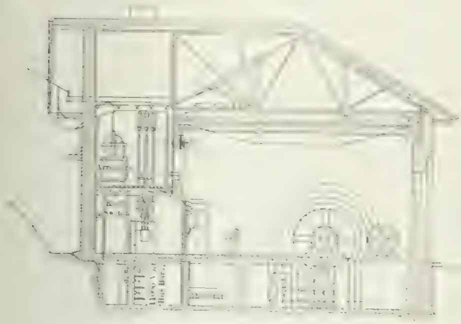


Fig. 5—Cross-Section of Ames Station.

Ophir Pass. Disconnecting switches are installed on each side of the feeder oil switches in the station.

OLDER AMES PLANT.

The older section of the Ames station illustrates the last remodeling of the company's earliest development in Colorado, utilizing the same waterways as the new section and serving mainly as a relay to the latter. The hydraulic equipment consists of two 900-hp Pelton wheels, each flexibly coupled to a 600-kw, 500-volt, two-phase Westinghouse generator operated at 327 r.p.m., the generators being of the revolving armature type. Each wheel is equipped with gate valves and deflecting nozzles, and one uses How-

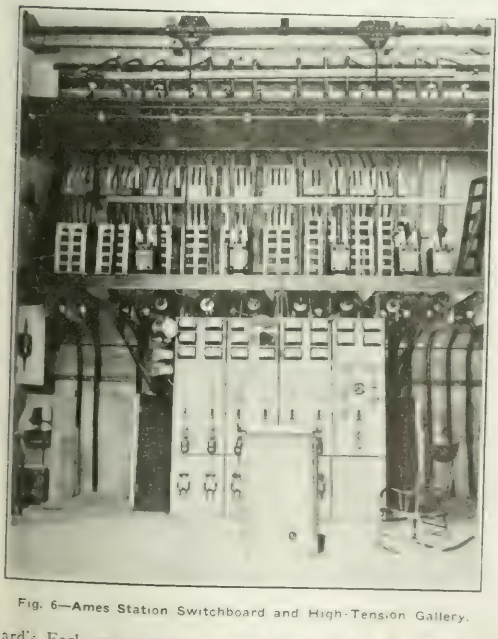
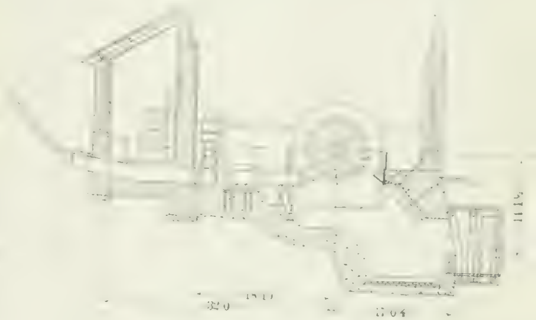


Fig. 6—Ames Station Switchboard and High-Tension Gallery.

ard's Fork water under a gross head of 626 ft., and the other Lake Fork supply under a gross head of 918 ft. Two 22.5-kw exciters are provided, each being belt-driven from the generator couplings. The generator leads are carried under the floor to a seven-panel switchboard, from which connection is made to [illegible] 375-kw transformers which raise the potential to 11,000 volts, three-phase, for the transmission of energy throughout the system. The outgoing leads are rubber-insulated cables carried on glass



[illegible]—Cross-Section of Ames Station.

insulators, connecting with fused air switches and line outlets. Spiral choke coils and Westinghouse type "C" lightning arresters are installed in the old station. The two sections of the plant are tied together on the high-tension side, the jumper line being carried out of the old building through paraffined oak bushings.

ILIUM PLANT.

The Ilium station is located about 5 miles below Ames on the Lake Fork of the San Miguel River. Water is supplied directly from the Lake and Howard Forks and also from the tailrace of the Ames plant, in addition to which several small creeks are diverted into the flume connecting the two stations. The waterway consists of 28,600 ft. of wooden flume, 42 in. x 32 in. in section, and 873.5 ft of pipe line. The lower end of the flume, 750 ft. long, is enlarged to a 12-ft. x 16-ft. section to provide peak-load storage. The penstock is of lap-welded steel pipe with flanged joints, the diameter varying from 32 in. to 28 in. The station building is an [illegible] rubble structure [illegible]

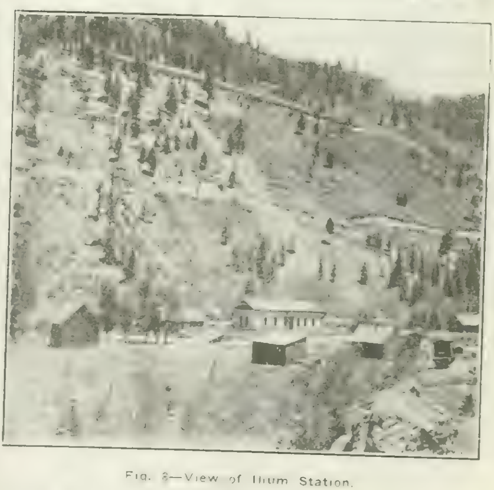


Fig. 8—View of Ilium Station.

[illegible], with a 12-ft. x 22 ft. shop under the same roof. Stone foundations are used; all floors are of reinforced concrete, and the roof is carried on a steel-truss installation. A 15-ton crane serves the operating room.

The generating equipment consists of [illegible] 1200-kw, 1050

volt, three-phase General Electric revolving-field alternator, running at 200 r.p.m. and directly driven on a horizontal shaft by two 8-ft. Pelton waterwheels. The lower end of the penstock terminates in a "Y-casting," to each branch of which is attached a 12-in. gate valve with a deflecting nozzle operated by a hand lever. The wheels deliver a total of 1600 hp under a head of 480 ft. net. On the inboard supply pipe a motor-operated needle is installed, the motor being a 2 hp, 220-volt induction equipment geared through a worm to the driving mechanism. A 25-kw, 125-volt exciter running at 1100 r.p.m. is belted to the coupling between the generator and the wheels. From the generator insulated leads are carried along the basement wall to an oil switch beneath the switchboard, which consists of two panels, one controlling the generator and the other two outgoing feeders. Overload relays are provided for disconnecting defective lines. At the end of the operating room three 400-kw, 1050-volt to 11,000-volt Converse transformers are installed in a bay below the operating-room floor level, the connections being delta on both the primaries and the secondaries. Beyond the transformers the outgoing leads are passed through two 15,000-volt oil switches to the lines, the connections being so made that lines may be looped through the station operating the generator, or if desired the latter may be operated on either or both of the incoming lines. Hourglass choke coils and electrolytic lightning arresters are installed, and the outgoing lines emerge from the building through Locke 15,000-volt outlet bushings. The usual disconnecting switches are provided on each side of the feeder switches. A 10-kw lighting transformer for station service at 110 volts is in service. In order to indicate the height of water in the pressure box use is made of a float with a mechanical connection to a rheostat arm in series with a voltmeter on one side of a 110-volt circuit. The voltmeter is calibrated in depths of water and shows the conditions at the pressure box by readings determined by the position of the float arm.

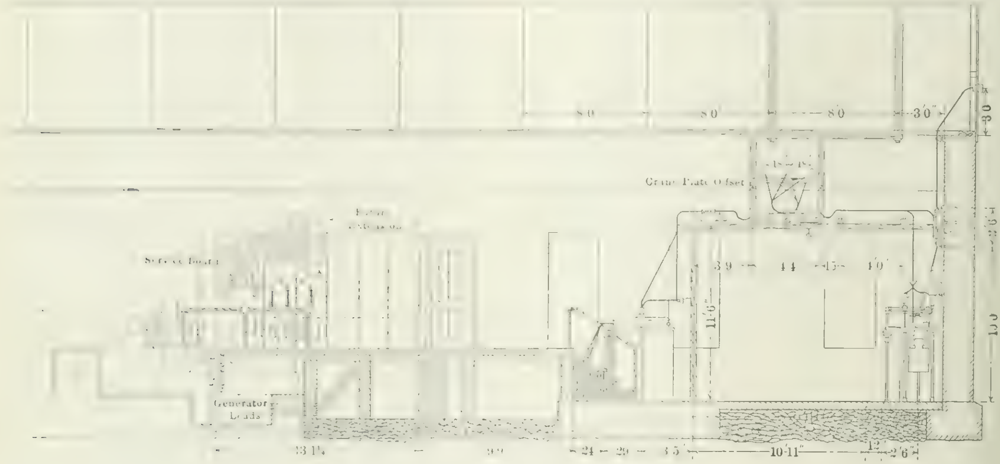


Fig. 9—Section of Ilium Tower Station.

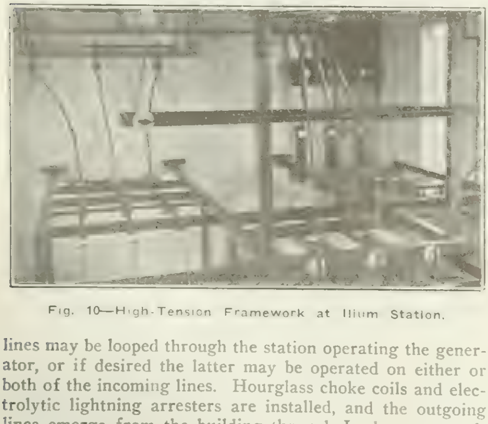


Fig. 10—High-Tension Framework at Ilium Station.

OURAY PLANT.

The Ouray station of the company is a plant of 300-kw rating, located in the town of Ouray, on the Uncompahgre River. About a mile above the station a dam of the rubble-masonry arched type, 85 ft. high, 75 ft. long and about 16 ft. thick, is in service between cliffs on each side of the river. From the dam a total length of 6200 ft. of riveted steel pipe, varying in diameter from 30 in. to 22 in., connects with the power house, the intake being about 8 ft. below the top of the dam. A single head gate regulates the flow. Air valves and expansion joints are included in the pipe line, and the total head from the reservoir to the shaft center is 440 ft.

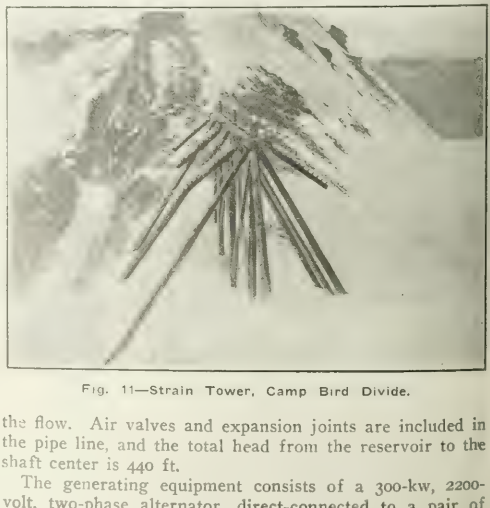


Fig. 11—Strain Tower, Camp Bird Divide.

The generating equipment consists of a 300-kw, 2200-volt, two-phase alternator, direct-connected to a pair of

'elton wheels, and a 185-kw, 2300-volt single-phase machine ›elted to the same prime mover and used for local lighting. Two Scott connected 200-kw transformers serve to contect the station to the transmission system.

COLORADO TRANSMISSION SYSTEM.

About 90 miles of three-phase, 10,000-volt, 60-cycle lines

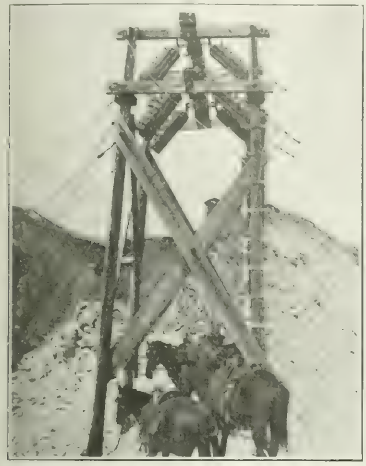


Fig. 12—10,000-Volt Transmission Tower at Camp Bird Divide.

comprise the transmission and distribution system of the company in Colorado. The principal center of load is at the Savage Basin, near Telluride, where a junction house has been erected near the Tomboy Mine, 12,000 ft. above sea level. Main lines extend from each power station on the system to this junction house, consumers being supplied with energy by feeders running from this junction house and by taps from the main transmission lines. A comprehensive system of loops, cross-overs and junctions forms an insurance of the service against line failures.

The system load-factor on a monthly basis is about 80 per cent and the power-factor about 78 per cent. The conditions are tending toward the gradual installation in the future of a 17,000-volt system, with shorter spans on the pole lines on account of the severe weather conditions encountered. Considerable difficulty has been experienced with the breakage of aluminum lines in the winter season and from swinging short-circuits in summer. In bad localities the transmission wires are frequently separated by a 4-ft. spacing, but in ordinary wooden-pole construction the spacing is somewhat less.

All power stations and important switching points are connected by a private telephone system, the operating headquarters of the company being at Telluride. The telephone lines are carried on separate poles at a safe distance from the main circuits.

GRAPHIC METERS.

The use of recording meters has attained a considerable development in both Colorado and Utah Departments. A typical curve from a mine and mill installation is shown herewith, the instrument showing the power fluctuations clearly as the various machines are thrown into and out of service. In the case in hand the mill demand was fairly constant at 35 kw; the operation of a 300-ft. hoist imposed an instantaneous peak of about 75 kw upon the system, with a demand of 55 kw when hoisting steadily, and the addition of a rock crusher and compressor imposed fluctuations calling for a total demand of from 120 kw to 150 kw. The graphic meter also shows the time required to operate the hoist through the different steps of its cycle, the effect of coasting down the shaft, period of emptying and the time consumed in hoisting, etc. These instruments are largely of the electric winding type and furnish invaluable records concerning the extent and periods of power demand upon the system.

Descriptions of the Utah system will follow in subsequent issues.

ELECTRIC FURNACE IN STEEL MAKING.

Addressing the Electric Club of Chicago, Mr. Charles G. Osborne, metallurgical engineer with the Illinois Steel Company, enumerated four methods of making steel, the Bessemer, open-hearth, crucible and electric-furnace processes. The last named is destined to be one of the most important of all, owing to its convenience in applying great heat. The United States Steel Corporation has three electric furnaces in its steel mills, one at Homestead, one at Worcester and one at South Chicago. Three large electrodes are used in each, and 25-cycle alternating current is used at a terminal emf of 55 volts or less. From the steelmaker's point of view forty arcs would be better than three, as that would afford a more uniform temperature. Steel made by the electric-furnace process is said by some to be better than other steels. The economy of production is about that of the crucible process in comparatively small quantities as now made, but would probably equal the open-hearth process if used as extensively.

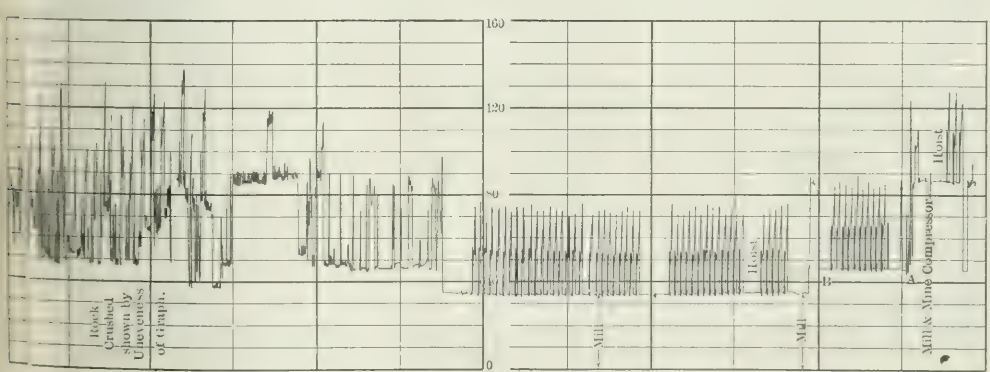


Fig. 13—Load Fluctuations in a Mill and Mine Installation.

PRUSSIAN-HESSIAN SINGLE-PHASE RAILWAY.

Single-Phase Commutator Locomotives for Passenger nd Freight Service.—10,000-Volt Trolley System, 60,000-Volt Underground Transmission, Single-Phase, 15-Cycle Generators.

DURING the present year an interesting 15-cycle, 10,000-volt, single-phase traction system receiving energy through underground cables at 60,000 volts was placed in experimental operation by the State Railways of Prussia and Hesse between Bitterfield and Dessau a distance of 16 miles. There are in use at the present time a high-speed passenger locomotive and a medium-speed freight locomotive, while orders have been placed for a special locomotive capable of operating in either high-speed passenger or moderate-speed freight service. These locomotives are of Allgemeine Elektricitäts Gesellschaft manufacture.

HIGH SPEED PASSENGER LOCOMOTIVE.

The passenger locomotive, which is illustrated in Fig. 1, is built for a speed of 68 miles per hour. It is driven through connecting rods by means of a single alternating-current commutator motor rated at about 1000 hp on the hourly basis. The speed of this motor is regulated by means of an ordinary contactor controller, which allows the voltage impressed upon the motor to be varied in several steps. Arrangement is also made so as to vary the ratio of turns of the exciting winding and the armature winding in accordance with the speed at which the locomotive is driven. The controller is provided with two cylinders, which can be revolved independently of one another. The position of the upper cylinder determines the torque, and that of the lower cylinder determines the adjustment for commutation. The operation of these two cylinders from the motorman's cab is effected by two hand-wheels placed one above the other. By means of a speed indicator the motorman is enabled to adjust the wheel to the correct position in order to obtain proper commutation under all conditions. The armature of the motor is short-circuited at starting, in order to convert the machine into a motor of the repulsion type under starting conditions.

The motor is placed vertically over an intermediate crankshaft located midway between the two driving axles. The intermediate crankshaft bearings are constructed in four parts, which are adjustable both vertically and hor zontally. These bearings being somewhat inaccessibl safety devices, in the form of fusible metal plugs, ar placed in the bearings and connected with the main a tank by means of pipes. These pipes lead to an alar whistle in the motorman's cab. If the bearing should b come hot, the plug would melt and the compressed a would operate a warning whistle. The locomotive equipped with one main transformer, which is located in ventilated shaft adjoining one of the cabs. The main switch is mounted above this transformer in such a wa that the switching-in and release handles project into tl cab. Two ball-bearing roller devices are used for cu rent collection. The collectors easily follow any alter tion in the height of the trolley wire. Use was first ma of the bow type of current collectors, but these proved u satisfactory for high speeds, in that they would not rema in position when under heavy wind pressure. It is report that the operating results obtained with this locomoti have been exceedingly satisfactory. It exerts a maximu tractive effort at starting of 21,000 lb.

Fig. 1—High-Speed Passenger Locomotive and Single-Phase Commutator Motor.

FREIGHT LOCOMOTIVE.

The freight locomotive has been constructed for a maximum speed of 43.5 miles per hour. The locomotiv equipped with a single-phase motor having an hourly ing of 800 hp. The method of regulating the torque of motor differs from that employed with the motor on passenger locomotive. The direction of rotation and torque are varied by mechanically shifting the bru The axis of the brushes is moved from the neutral pos to one side or the other according to the desired dire of travel, the brushes being shifted by means of a r driven by a screw mechanism. Additional torque re tion at high speeds is obtained by altering the impr voltage by means of a transformer. Good commutati all speeds is insured by regulating the ratio of the tur the main windings and in the compensating windings. is made of an intermediate crankshaft as is done o the passenger locomotive. However, the motor is not p ced vertically over the intermediate crankshaft, but is arr ged in such a manner that the driving rods form an an of 45 deg. with the horizontal.

SPECIAL LOCOMOTIVE.

A third locomotive which is now being built has een designed for drawing express trains at speeds up 68

miles per hour and heavy freight trains at lower speeds. The locomotive will be equipped with two motors, each having an hourly rating of [illegible] hp. This locomotive will differ appreciably from the other two designs, both in its external construction and in its system of control. Variation of the voltage impressed on the motor will be effected by an induction-type regulator instead of by a step-by-step regulator. There will be four driving axles arranged to permit the development of the maximum tractive effort. The motors will drive the axles by means of the parallel crank arrangement, the design being such that only one intermediate crankshaft will be required.

OVERHEAD-LINE CONSTRUCTION.

Use is made of a single overhead contact wire of hard-drawn copper wire, operated at 10,000 volts to ground. This wire is held in alignment by the usual catenary arrangement, the messenger cable being of galvanized steel. Special attention has been paid to the insulation of the messenger cables and contact wires. The contact wire is supported at intervals of about 20 ft. by hangers connected to the catenary messenger wire. The catenary bridges are placed about 246 ft. apart. The overhead line is sectionalized about every 3300 ft. The center of each section is rigidly anchored, while the two ends are kept taut by automatic tension devices, so that the supporting wires are under approximately the same tension at all temperatures. For this purpose use is made of tension-regulating weights, which are installed at the ends of the sections. At each catenary bridge and anchor bridge the insulation to ground is provided by two disk insulators placed in series. The brackets which carry the trolley wire are equipped with one bell and one grooved insulator, to secure double insulation from ground. The contact wire is staggered as much as 20 in. from the center line of the track, in order to insure uniform wear of the current collectors.

HIGH TENSION UNDERGROUND TRANSMISSION.

Energy for operating the railway is received at a substation in Bitterfeld at 60,000 volts, the emf being lowered to 10,000 volts by means of two 15-cycle, single-phase transformers rated at 1800 kva. The energy is generated which a choice will be made when the distance is increased to such an extent as to require the use of the higher voltage. For this purpose there have been installed three independent 60,000-volt, single-phase transmission lines between the generating station and the one substation thus far equipped. One of these is an aerial line and the other

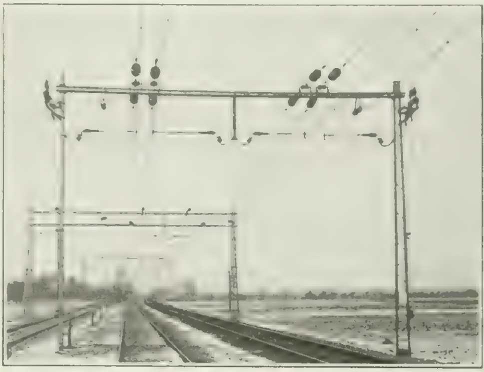


Fig. 3—Section Division on the Main Line.

two are underground circuits. Naturally the greatest interest centers around the underground circuits, which are unique in being operated at the highest voltage ever used commercially on underground cables.

Although delivering an emf of 60,000 volts, each individual cable is subjected to only 30,000 volts, two distinct single-conductor lead-covered grounded cables being used for the two conductors of each 60,000-volt, single-phase circuit. One set of cables was built by the Felten & Guilleaume-Carlswerk company and another by the Siemens-Schuckert company.

The conductors of the Felten-Guilleaume cables are of copper of 80,000-circ. mil cross section insulated with pre-

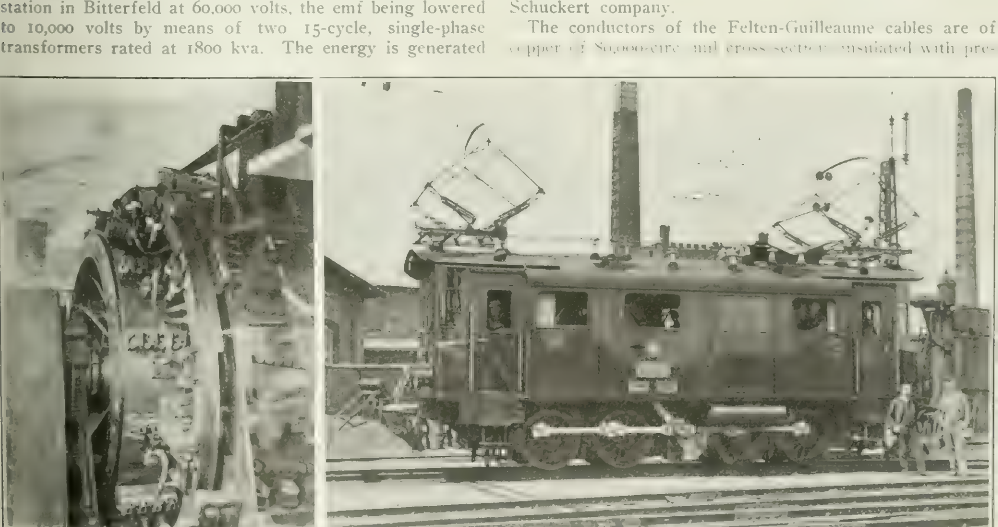


Fig. 2—Single-Phase Commutator Motor and Freight Locomotive.

in a station at Muldenstein, about 5 miles from the Bitterfeld substation. Although the very short distance of transmission would not require a transmission emf higher than the distribution value of 10,000 volts, yet it was considered highly desirable to use an emf of 60,000 volts in order to make investigation with several transmission systems from

pared paper. The cables were tested to 40,000 volts at 40 cycles. They showed the following characteristics: Insulation resistance, 3450 megohms per km (0.62 mile); capacity, 0.138 mfd. per km; circuit resistance, 0.308 ohm per km.

The Siemens-Schuckert underground circuit consists of

two single-conductor aluminum cables having a cross-section of 100 sq. mm (197,300 circ. mil, about equal to No. 4-0 B & S gage). The cable is of the lead-covered, paper-insulated type, but with a covering of insulating compound between the paper and the lead sheath and also between the lead sheath and the outer covering of asphalt-impreg-

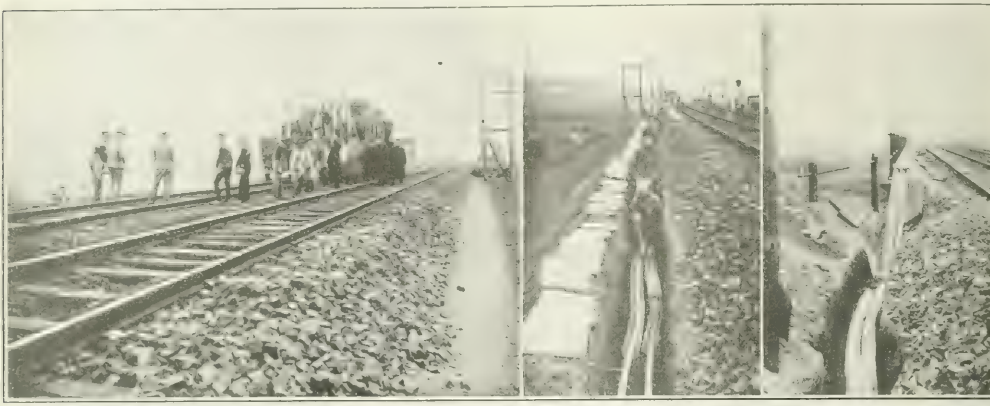


Fig. 4—Method of Laying Cable.

nated jute fiber. The cable was tested with 50,000 volts between conductor and sheath after completion; this emf corresponds to 100,000 volts between the outgoing and return conductors. The cable has an insulation resistance of 2580 megohms per km, capacity of 0.1695 mfd. per km, and circuit resistance of 0.268 ohm per km.

LAYING THE CABLE.

The individual lengths of the Siemens-Schuckert cable varied from 2130 ft. to 2700 ft. An interesting method was employed in laying the cable. The cable drums, weighing about 15,000 lb. including cable, were mounted on railroad flat cars equipped with wooden jacks so that the cable could conveniently be taken to the place where it was

Fig. 5—Cable Protection, Cable Junction, and Pot-Heads.

to be laid and reeled off as needed. The train was then moved slowly along and the cable was reeled off and lowered directly into the cable trench. Each day two lengths were laid side by side, as the trench could not be left open over night. The trench was dug about 26 ft. deep alongside of the outer track. The cables were laid in sections of two-part conduit clay piping which was filled with sand. This piping was not considered sufficient protection for the cables where installed on the land adjacent to the generating station, and for this reason a layer of thoroughly baked bricks was placed over the clay piping. The cable was carried over the railroad bridges in wooden cases having a packing of tar paper and filled with sand.

Five junction boxes had to be installed in each of the two cables laid in the trench. These boxes were mostly placed in the slope at the side of the roadbed. The junction boxes consist of a cast-iron case with conical ends which were soldered to the lead sheath of the cable. The aluminum conductors were connected by means of clamps which were covered with insulating paper of heavy texture. The junction boxes were then filled with an insulating compound. The joints were made inside of wooden shacks built over the junction places on account of the cold weather, the laying of the cable having taken place in November and December. Two layers of bricks were placed over the junction boxes to protect them from injury.

The places along the roadbed where the boxes were placed are indicated by enameled signs. The position of the cable is shown by indicators along its full length. The indicators consist of inverted cast-iron boxes which are laid almost flush in the ground. On the inside is attached a length of wire cable, and to the other end of this

a cast-iron cross, which is laid next to the cable and which acts as an anchor for the box.

Potheads are installed in the power plant and the substation. They consist of a cast-iron lower part and an upper part of porcelain with a metal cover. The metallic lower part is soldered to the lead sheath of the cable. A brass rod, passing through the cover of the pothead, is screwed onto the aluminum conductor, and to this are connected the conductors to the busbars. The entire pothead was filled with insulating compound after connections were made.

There were two objects in placing the transmission circuits underground, the principal one being the immunity from atmospheric disturbances and the other the desire to hide them from the view of any rioters or invading army in case of war.

OVERHEAD TRANSMISSION SYSTEM.

The overhead transmission line was erected to forestall delays through the possible failure of the underground cable lines and also to determine its influence on neighboring parallel low-voltage circuits. Use is made of both suspension-type and pin-type porcelain insulators and of both wooden and metal poles. The two wires of the single-phase circuit are mounted on either side of the poles in a horizontal plane, while a third grounded wire is placed along the tops of the poles. This wire is connected to all cross-arms and to eight iron plates buried in the earth. A grounding guard ring for protection from destructive arcs is placed around each pin-type insulator. All insulators were tested for punctures up to 100,000 volts and for arcing over during an artificial shower up to 80,000 volts.

SINGLE-PHASE GENERATION.

The station at Muldenstein contains at present only one generating unit, a 15-cycle, two-pole, 300-kw, 3000-volt Siemens-Schuckert single-phase generator directly driven at 900 r.p.m. by a 5000-hp Allegemeine steam turbine. There are at present four Stirling water-tube boilers operated at 125 lb. gage pressure and 375 deg. C. supertemperature. The completed boiler house will contain four more units of the same type and size.

The railway section now in operation is only 16 miles long, but the plans contemplate the electrical operation of the entire line, totaling 95 miles.

HOW FAR WILL A TROLLEY-CAR RUN?

By Nicholas Stahl.

The drop in trolley-car speed toward the end of a line fed from power house to substation and inadequately fed is familiar to every rider.

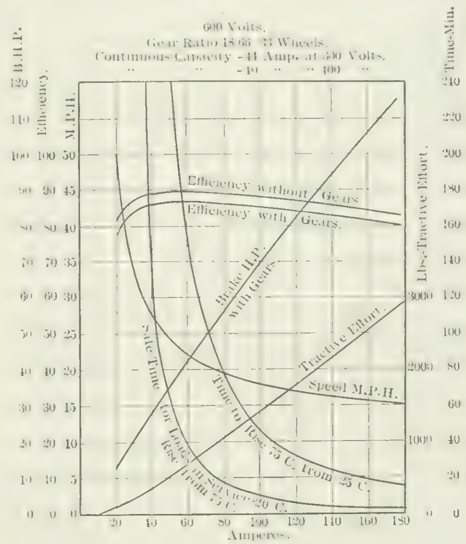
Those conversant with first electrical principles know the speed to be connected in some way with the amount of current passing through the motors and realize that the less the feeder copper the greater the line resistance and ohmic drop outside the motors for a given current through them. With a given frictional resistance to be overcome the required torque is understood to be proportional to the product of the armature current and the field flux, and this is roughly proportional to the square of the current in ordinary series railway motors.

The initial question is asked and the following example cited in the hope of bringing out more clearly the nature of the dependence of speed upon feeder-copper capacity and as suggestive of a means of attack upon the broad question of feeder distribution.

The question is, of course, meaningless until certain constants are determined. Let us assume then an ordinary interurban car, weighing 40 tons with its quadruple equipment and average load, runs past the power house at which 600-volt current is fed directly into a No. 3-0 trolley wire and 70-lb. bonded steel rails. No feeders are supplied. Thirty-three-inch wheels are used and a common gear ratio of 18:66. It is supposed that the track is level and straight and that the car on passing the power house has reached a steady speed, which under the assumed conditions and with modern railway motors rated at 60 hp at 600 volts would be about 25.3 miles per hour.

For every 1000 ft. from the power house there is interposed in the circuit 0.0618 ohm of resistance from the trolley wire, or 32.6 volts drop per mile per 100 amp in the circuit, and likewise the resistance added by the rails contributes 3.54 volts drop per mile per 100 amp, or a total drop of 36.14 volts.

The problem of finding how far the car will run without stalling is merely to find from any approved train-resistance formula the stalling torque, which divided by the number of motors on the car gives from a performance curve of the motor the amperes flowing per motor when the motor stops and there is no counter emf. This current multiplied



Operating Characteristics of Motor.

by the motor resistance gives the drop across the motor; the difference between this and the initial 600 volts, divided by the drop per mile for the current flowing, gives the distance to standstill.

A standard train resistance formula is Blood's, which gives resistance in pounds per ton weight

$$= A + BM + \left[C + \frac{D}{T}\right] M^{1.8}$$

where $A = 5.0$, $B = 0.12$, $C = 0.0014$, $D = 35$, $T =$ tons and $M =$ miles per hour. At stalling only the first term is left, or 5 ton x 40 ton total or 50 lb. per motor. The motor curve shown gives this tractive effort at about 12 amp.

The total resistance of the motor in question is 0.41 ohm, or motor drop $= 0.41 \times 12 = 4.92$ volts. The line and rail drop is then $600 - 4.92 = 595.08$. Assuming the full parallel arrangement of the control has been undisturbed, the total current is 48 amp, making the total drop per mile $36.14 \times \frac{48}{100} = 17.35$ volts, and so the distance traveled

$$\frac{595.08}{17.35} = 34.3 \text{ miles.}$$

[illegible] little actual dependence can be placed upon such figures, since the track conditions are entirely ideal and the curve of tractive effort has been exterpolated for the torque sought, but relative figures are often equally instructive. For example, had the more usual No. 4-0 trolley wire been used with the same rails the total drop per mile for 48 amp in line would have been 14.14 volts and the corresponding run to a standstill 42.1 miles, or an increase of 23 per cent nearly.

By a similar procedure and remembering to use all the terms involved in the train resistance formula, two other interesting questions are readily solved; first, what will be the speed at a certain distance from the power house and second, how far will the car have gone when its speed has become of a certain value?

The foregoing has purposely (and necessarily) taken no stops into account, so that, quite apart from any integrated or root-mean-square current versus speed considerations, a little calculation of this simple sort will frequently throw encouraging or disconcerting light on a proposed feede arrangement and will obviate propositions like one recently made, which involved on a 600-volt service, for current suf ficient to start a car on a level at the end of the line, a rai and line drop of 1625 volts.

Central Station
Management, Policies and Commercial Methods

BOSTON EDISON NEW-BUSINESS RECORD.

Statistics just gathered by the contract department of the Edison Electric Illuminating Company of Boston, Mass., show that the month of October, 1911, was the best in point of new business secured since the company was organized. The total new business connected in the record months of October in the past four years has been as follows, in 50-watt equivalents: 1908, 34,806; 1909, 68,091; 1910, 72,879; 1911, 75,315. In the month just closed 1811 new customers were secured and the installations of 960 customers increased in capacity, compared with 1519 new customers in October, 1909, and 642 increased installations at that time. The figures indicate that the development is along the lines of a greater popularization of electrical service, with a notable increase in the number of small users.

SHORT STRAW CROP PUTS PREMIUM ON BALE SHAVINGS.

The wood mills which have installed electric drive instead of the expensive power obtained from burning their wastes and shavings are this year especially profiting by the demand for baled shavings owing to the short straw crop. As a result of this partial failure a premium is already placed on shavings for bedding purposes.

Those mills which already have electric drive will therefore find a motor-driven baling machine just now an excellent investment. From the central-station standpoint the wood-mill load is a very desirable one on account of its long-hour use and summer load-factor. Mill operators who put in electric drive invariably find that they can sell their refuse at a profit over their electric bills, besides enjoying the freedom from plant operation and the many advantages of motor drive.

THE CENTRAL-STATION POWER ENGINEER BEFORE HIGH-SCHOOL PHYSICS CLASSES.

Much has already been said about educating the public on electrical matters, but the central-station operator who is looking ahead at the problem of popularizing electricity on the scale necessary for its fullest development will find good returns following a little time taken by himself or his motor-drive specialist for one or two talks before the local high-school classes in physics each year. The instructor will, usually, welcome such outside aid, and the students addressed are of an age and training to appreciate the practical subjects handled. The electrical man can give much information on simple circuits, motor ap plications, heating devices, etc., supplementing the theoret ical instruction of the teacher and giving an opportunity fo answering many questions which previous lessons hav stimulated. The benefit of such missionary work come later, of course, in the realization by the rising generatio of the possibilities of central-station service for light, hea and power. Several large companies are following ou this plan with much success.

PRIZE DESIGNS FOR STREET-LIGHTING FIXTURES.

The Municipal Art League of Kansas City, Mo., h offered prizes for the best designs for street-lighting fi tures in order to secure an effective and artistic illuminati system of the business streets. The Kansas City advert ing committee has obtained an agreement from proper owners to install equipment along one block on Waln Street as a demonstration. Prizes and terms in the conte are as follows: An ornamental lighting standard, 14 high, to provide not less than five lamps, first prize $: second prize $7.50; an ornamental lighting bracket to be a tached to the present steel trolley poles of Kansas Ci to be not more than 6 ft. long and provide not more th four lamps, design to include ornamental base for t trolley poles at pavement level, first prize $25, second pr $7.50. Designers are referred to the street-lighting f tures now in use in Paris, Brussels, Berlin, Des Moin Los Angeles, Atlanta, Denver and Minneapolis.

Drawings are to be submitted, unmounted, on one sh 14 in. x 20 in., with single-line border and plain print l tering and without mark of identification, on or before D 9, 1911.

PUBLICITY CAMPAIGN IN LOS ANGELES.

In connection with the construction of the Los Ange aqueduct and the development of an elaborate system t electric-energy transmission from plants to be built alo the route of the conduit, considerable discussion is tak g place locally in regard to the probable market for the o put of the aqueduct generating stations. In order to co serve the existing investment of private companies in d tributing systems in Los Angeles and secure the utiliza n of the aqueduct energy without costly duplications d ruinous competition, a publicity campaign is now being c ried on in the daily press of the city under the auspice of the principal central-station interests. The situation is being presented to the public by frequent bulletins, kn n as "Electric Talks," eight of which have now appeare at

intervals of a few days. The bulletins review the early development of electric lighting and motor service in the Los Angeles district, the scarcity of dividends in the pioneer years, former high cost of service in coal-burning stations, present economy of energy generated in hydroelectric plants and supplementary oil-burning steam plants, enormous growth of the physical systems of the present companies, efficiency of the existing distributing apparatus and circuits, and the financial aspects of the proposition to establish a municipal lighting and motor-service business. The evils of competition are reviewed, and the dual plans of a municipal leasing of the present systems of distribution and the sale of electricity to the existing companies for distribution under their present organizations are set forth. About twenty bulletins are to be published, with the object of facilitating a co-operative arrangement within the financial ability of the city for the sale of electricity from the aqueduct plants under conditions consistent with the protection of the existing private investments and the benefit of the general public from the aqueduct project.

ELECTRIC-SIGN CAMPAIGN IN ST. LOUIS.

As a result of a very active campaign carried on by the Union Electric Light & Power Company, of St. Louis, under the direct supervision of Mr. F. D. Beardslee, commercial engineer, there have been a large number of electric signs erected in that city during the last two or three months. The central-station company has been utilizing nearly every possible medium for the purpose of "boosting" the sign business, and at the present rate of progress it looks as though St. Louis will be pretty well covered before the campaign is over. It is said that there are now about [illegible] electric signs, containing 80,000 lamps, in St. Louis.

A feature of this campaign, and an unusual one, was the publication by the *St. Louis Republic* of Sunday, Oct. 29, of a special eight-page electric-sign section. This contained pictures and articles about the numerous electric signs of the city, based on the "illumination uplift" which has been apparent in that center within the last few years. The average electric sign, it is said, costs the advertiser in St. Louis from $2.50 to $3 a week, and therefore the expense [illegible] moderate one. One of the most elaborate designs [illustrated] is that of the Illinois Traction System, which [will] erect within a few weeks a striking sign over its new [passenger] terminal at Twelfth Street and Lucas Avenue. [The] central feature of this sign will be a representation of [an i]nterurban car and of the block-signal system which is [used] so extensively on the McKinley lines.

As a result of the great increase in the number of electric signs and the attention which has been attracted by them [a mo]vement is on foot to secure a modification of the city [ordi]nance relating to electric signs, which prohibits signs [fro]m extending more than 18 in. over the sidewalk. With [prop]er safeguards to secure safety it is thought that this [prov]ision may be amended to give a broader scope to the [elec]tric signs. It is pointed out that no one ever heard of [an e]lectric sign properly supported falling to the ground, [and] as these features add greatly to the brightness and [attra]ctiveness of the city there seems to be some demand [for] greater latitude in relation to projecting signs.

PROPOSED SIGN ORDINANCE IN PITTSBURGH.

A sign ordinance recently introduced into the City Council of Pittsburgh would very materially affect the electric-sign business. Every sign and signboard in the city is to [be] taxed $2, and a bond of $5,000 is demanded to indemnify [the] city against loss, damage or injury. Violations are subject to forfeits not exceeding $100, and default in payment will result in a sentence of thirty days in jail. It is further provided that before any sign shall be erected a permit must be secured from the Department of Public Safety. In addition to this, the owner must secure within ten days of the erection a maintenance permit, which must be renewed annually.

The portion of most interest to electrical men, however, is the provision which limits the distance any sign not an electric one may project over the sidewalk to 1 ft. Electric signs, however, when vertical may project 4 ft. beyond the building line, and horizontal ones may extend to the curb. If the two sides are exposed to public view, both must be illuminated. No more than two lines of letters are permitted, and each letter must be formed by electric bulbs not more than 4 in. apart and of not less than 4 cp each.

A further provision is that the border beyond the letters shall not exceed 3 in., and no sign shall be more than 2.5 ft. wide. The ordinance also provides that each and every bulb of the electric sign shall be lighted at or before darkness and shall be kept lighted until midnight, at least, on every day in the year, and each bulb thereon shall be renewed by a fresh bulb every time one burns out.

These provisions are very strict, and while in many cases they would be advantageous to the company supplying energy, yet in others they impose such restrictions on the sign owner that it is doubtful whether it would help the sign business. It is very doubtful if the ordinance will pass in its present form.

CHANGES IN ELECTRIC PLANT AT TRINIDAD, COL.

The Federal Light & Traction Company, of New York, has recently come into control of the Trinidad gas, electric light and traction properties and is operating these utilities under a local company—the Trinidad Electric Transmission, Railway & Gas Company. Chief Engineer W. A. Haller is spending some months completing the rebuilding of the main power plant and the installation of new equipment. The storage battery formerly used is now completely abandoned.

The power station when complete will consist of a boiler house, 95 ft. x 100 ft. by 50 ft. extreme height; an auxiliary room for boiler-feed pumps, draft fans, etc., 120 ft. x 40 ft., and the same height as boiler house; an engine-room, 30 ft. x 140 ft., extreme height 40 ft., and a transformer and switchboard room, 40 ft. x 140 ft., extreme height 40 ft. All sections are separately roofed, but communicate through doors, with large trussed opening between engine and switchboard sections. All roofs are of corrugated iron on unprotected steel trusses, spanning from 30 ft. in the engine-room to 140 ft. in the auxiliary room. Cranes are installed in engine and switchboard rooms and all supporting walls pilastered for roof truss and crane supports. The present engine-room equipment consists of a 500-kw, a 1000-kw and a 2500-kw Westinghouse-Parsons three-phase, 2300-volt turbo-generator units, with induction motor-driven Le Blanc jet condensers for the smaller units and turbine-driven Le Blanc condensers for larger units. The 2300-volt, 100-hp induction motor and one 100-hp Westinghouse marine engine drive the exciter units. Space is provided for two additional turbine units. The floor, its supports and its foundations are of reinforced concrete.

The switchboard comprises direct-control panels for generators, 2300-volt feeders and rotary converters with trolley feeders. Remote control panels are used for 22,000-volt oil switches, besides manual control on feeder switches. The switchboard-room is of fireproof construction with barriers for oil switches and separate wireways for different sets of feeders. The arresters are of the aluminum-cell

type on the high-tension feeders. The water-cooled, oil-insulated station transformers are isolated by concrete barriers from the switchboard division and arrangements are provided for rapid draining. They are at all times visible to the switchboard operator.

The boiler-room is provided with a coal and ash conveyor and a coal crusher, each operated by a 20-hp, 440-volt induction motor controlled from the boiler-room floor. Slack or mine run bituminous coal from neighboring coal mines is the fuel. The bunker storage capacity in twelve steel units under the roof of the boiler-room is 300 tons, hoppered discharge being provided to stokers. Four new 600-hp Parker water-tube boilers in two banks, equipped with Green stokers, engine-driven, are installed at the south end of the boiler-room. The old equipment on the north, which will also be provided with stokers, consists of four 250-hp Franklin and four 300-hp Taylor-Altman water-tube boilers, all with independent steam connections. Sturtevant engine-driven fans and self-supporting steel stacks handle furnace gases. The plant is wired in iron conduit, equipped with metal waste cans, metal lockers, tetrachloride fire extinguishers and represents the best steam power house construction in the Rocky Mountain region.

In addition to energy for local lighting and motor service and a traction line not yet self-supporting, the company will distribute energy to the coal-mining tipples, hoists, etc., which are very numerous and provide a very desirable and permanent character of load, partly for twelve hours per day and partly for constant duty.

SOME SELLING POINTS.

Men who sell electricity, like all other salesmen, are the recipients of much advice. Some of this advice is good, some rather platitudinous. To the former class, it is thought, belong the hints given in a paper entitled "Some Considerations Involved in Selling Light and Power," read by Mr. Egbert Douglas, sales manager of the Milwaukee Electric Railway & Light Company, at a recent meeting of the Milwaukee Company Section of the N. E. L. A. A few of these suggestions are given in the following paragraphs:

"The sale of electricity, while it is measured in units, is not like the sale of unit articles. It is distinctly a continuous service to go on year after year."

"There is no mystery about the arts of applied electricity, but there is a good deal of fogginess in the minds of people about them. It is up to us to clear this away."

"Remember that the susceptibility of man to new impressions is a variant, rapidly diminishing in its power with advancing years. So do not be discouraged with any 'prospect' who is slow coming over."

"If there is doubt as to the advisability of electrification, the salesman should carry his doubts to his superior, and if, after an office consultation, it is deemed that electrification is not an economical move, then the customer must be told so plainly. Your company wants no dissatisfied customer on its lines. While there are conditions prevailing in some plants where the purchase of energy is inadvisable, they are mighty few."

"In our hurried life there is a constant temptation to be rude and curt with people, particularly when the probability of future dealing with them is small. Consequently busy employees are prone to show scant courtesy to the public. Thus the industrious meter-reader may be interviewed by a customer with a definite complaint. If the meter man curtly informs him, 'That is not my business; you must see the company; my job is to report the meter reading,' the customer will have just reason to feel angry. The complaint should be received courteously and reported, but no effort should be made to adjust the matter."

"Where the service is sold in competition it is necessary to know the quality of the competitive service thoroughly well."

"Questions will arise as to the merits of respective propositions, and the salesman must be on his guard against 'knocking' the competitive commodity or service. It has its good points, or it would never have been adopted or come up for consideration. In discussing a competitive proposition the salesman should dwell upon the superior merits of the service he sells and endeavor to fill the prospective customer's mind with his viewpoint. Never begin a discussion of competitive service, nor allow yourself to be drawn into a discussion of it, except under pressure. The discussion, being forced, should be carried on with the kindliest expression toward the competitive point of view. Endeavor to put yourself in the position of the prospective customer. Frequently a prospective customer will say 'Now, Mr. Jones, you seem to know all about both of these propositions. Would you install electric service yoursel if you owned my factory?' Then comes the opportunity for the salesman to 'get in his work.' Rapidly he put himself in the position of the factory manager and suggest again the advantages of his proposition for his plant."

"Factory lighting is not attractive business. It is peak on our winter peak and does not usually exceed 50 hours' use per year."

"One of the most important things for a salesman t look out for when he gets a contract is to get it 'clean, so that it becomes unnecessary to make several trips bac and forth to the customer and unnecessary to confer abou it with other men in the company. The contract simpl takes its routine course through the office. That is what th system is for."

"Be on your guard against leaving a customer with er roneous impressions of what he is purchasing."

"When a manufacturer gets a 'black eye' in a given ter ritory, due to poor product or improper selling tactics, h may withdraw from that territory and begin his sellin effort in a virgin field. The central station cannot do thi Our customers are our neighbors, and we have to liv on terms of friendliness with them forever. Quarrel misunderstandings, rude treatment and unfair tactics mu be scrupulously avoided."

CENTRAL-STATION SERVICE AT CHEYENNE.

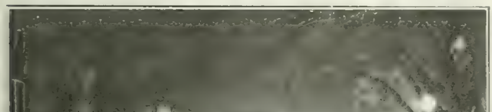
Electrical service is rapidly becoming popularized Cheyenne, the capital city of Wyoming, under the manag ment of interests identified with the Northern Colora Power Company. Cheyenne is a typical Western city close touch with the great grazing industry which form the chief occupation of the State, and it is an importa railroad and distributing center of about 11,000 inhabitant being located on the main line of the Union Pacific syste between Omaha and the Pacific Coast, about 106 mil north of Denver. Four miles south of the city is locat the important military post of Ft. Russell, whose popul tion approximates 4000, representing practically eve branch of the army service.

Central-station facilities in Cheyenne and Ft. Russell a supplied by the Cheyenne Light, Fuel & Power Compa from a steam generating plant located about ¼ mile fr the business center of the city, at the intersection of Re and Seventeenth Streets. At present there is no conn tion with the lines of the Northern Colorado Power Co pany, but with the extension of the latter system in c nection with electric irrigation work in the district no of Greeley and Ft. Collins it is probable that the two s tems will be brought into operating contact. The existi plant in Cheyenne was purchased about four years ago the present interests, and while the station contains

direct-connected steam generating equipment, it illustrates how an old plant can be improved and utilized in extending a successful service.

The plant is burning Colorado lignite coal costing about $2 per ton delivered at the boiler-room, the heating value of the fuel being 9500 thermal units per pound. The station is at an altitude of about 6000 ft. above sea level, and is equipped with six water-tube boilers, two units being 600-hp Franklins and four Babcock & Wilcox boilers having a total rating of 750 hp. The operating steam pressure is 160 lb., without superheating. Natural draft is employed, and there are three stacks of steel in service, one being 66 in. in diameter and 175 ft. high and the other two 60 in. in diameter by 125 ft. high each. The smaller stacks are provided with three sets of guys each and the large stack with five sets, ½-in. and ⅝-in. stranded steel cables being used for the purpose on account of the high winds prevalent in Cheyenne. Hand firing is employed, and feed water is purchased from the city mains. A 1000-hp Cochrane open feed-water heater is in service, and three feed pumps are installed, all being of Smith-Vaile manufacture. One pump is large enough to handle the service of the entire plant, the other two being each of half the capacity of the former.

The electric generating equipment is partly belt and partly motor driven. The service of the station includes the supply of direct current at 550 volts to the Cheyenne



Night View of Capitol Avenue, Cheyenne, Wyo.

Electric Railway Company, which operates twenty-four hours per day and consumes an average of about 1700 kw-hours in that period; lighting service within the business center of the city from a network of Edison three-wire, 110-220-volt mains; street lighting, three-phase, 2300-volt lighting and motor service throughout the entire district, and exhaust steam-heating supply within the center of the municipality. The normal service of the street railway company is handled by four cars, from twelve to fourteen cars being operated at times of heavy travel. The railway system imposes a maximum instantaneous load of about 275 kw, and about 10 miles of track is covered by the car service. The steam-heating supply is delivered to the city through a 14-in. main leading from the station to the center of distribution, the returns being brought back to the plant by a 6-in. main. A maximum steam pressure of about 5 lb. is required in the coldest season. In general, the steam-heating service covers all the principal buildings within a radius of 1 mile from the station, including hotels and mercantile establishments. The company's rates for steam heating have not as yet been finally established.

The engine-room equipment includes five Corliss engines of the simple, non-condensing type, four being rated at 300 hp each and the fifth at 750 hp, and also a 250-hp high-speed Chuse engine and a similar 150-hp Ideal engine. The electric generating apparatus consists of five 2300-volt alternators of belted type having a combined rating of 1200 kw, delivering three-phase, 60-cycle current; two 125-volt, 45-kw generators, and one 75-kw, 250-volt generator operated on the Edison three-wire system; two 55-kw, 125-volt generators directly driven by a 125-hp, 2300-volt synchronous motor; and for the railway service one engine-driven, 250-kw, 550-volt direct-current generator and two motor-driven synchronous generators having a total rating of 160 kw. Two steam-driven exciters having a combined rating of 105 kw are also in service, the engines being of Erie-Ball and Westinghouse make. The plant burns from 30 tons to 80 tons of coal per day, according to the season, and is operated by a total force of twelve men, divided into three eight-hour shifts per day. The shifts in the fire-room are even, but those in the engine-room overlap. The output of the plant is measured and controlled at a switchboard aggregating fourteen panels of dark-finished marble. The coal consumption is about 8 lb. per kw-hour, including steam heating.

The street-lighting service is handled by 4-amp magnetite arc lamps and by special ornamental post lighting in the center of the city. About 105 magnetite lamps are in service, two fifty-light constant-current transformers and mercury-arc rectifiers being installed at the station. The company has obtained a maximum of 292 hours burning per trim and a tube life from the rectifiers of 3000 hours, an unusually long service in each case. The ornamental lighting, which is illustrated in the accompanying illustration, consists of an installation of eight iron posts per block, the posts being set at the edge of the curb and carrying in each instance one 60-watt and four 40-watt multiple tungsten lamps which burn daily until 11 p. m. The 60-watt lamps are installed at the top of the posts and are about 12 ft. above the sidewalk, the smaller lamps being 10 ft. above the walk and hung at right-angled axes in a horizontal plane. Translucent globes of spherical shape surround each lamp. Energy for the ornamental lamp service is taken from the company's 110-volt secondary alternating-current network, and the price charged for the service is $3.75 per cluster per month. The standard block is 280 ft. long and four clusters are installed on each side of the street, the cost of the service being defrayed by abutting merchants who own the posts. About 110 clusters are now in service and twenty-five additional units are shortly to be installed. The ornamental lighting is switched in and out of service by the company's patrol, and the regular magnetite installation is made at street corners without interference from the tungsten clusters. The magnetite lamps used replace 550-watt direct-current open-arc lamps. The company is also planning to install about twenty-five series-tungsten lamps of 100-watt rating in the centers of alleyways between parallel streets to improve the illumination of these minor passageways.

Service at Ft. Russell is supplied over a three-phase, 2300-volt line of No. 4-0 copper connecting the steam plant of the company with a substation owned and operated by the government. The winter weak load of the fort is about 500 kw and the maximum energy consumption per month is about 50,000 kw-hours. The voltage of the fort feeder is controlled by a booster regulator at the power station. An extensive installation of motors in the fort operates machinery in the repair shops, laundry and other departments. A large amount of lighting service is also required at the fort.

Since the present management assumed control of the Cheyenne plant the station has been improved by the lengthening of the larger stack about 50 ft., thereby increasing the capacity of the boiler plant by over 150 hp; by the rewiring of the switchboard to secure greater simplicity of operation in times of emergency; by the installation of new governors on the engines to provide for the successful operation of belt-driven alternators in parallel, and by the determination of a new location for the feed-water heater at a height about 15 ft. above the feed pumps,

[illegible] either. [illegible] at a higher temperature at the boiler intake and avoiding the breakage of pumps through the accumulation of vapor.

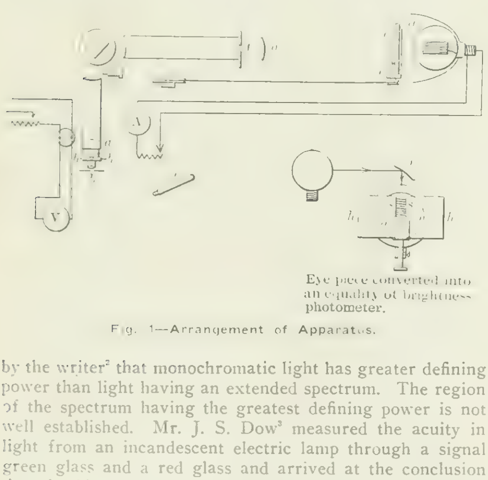
The company's regular commercial lighting rate is 10 cents per kw-hour for mercantile houses, the residential rate being 12 cents. The rate for electric power service is 5 cents per kw-hour plus a demand charge of $1 per horse-power per month. Sign and window lighting is carried on a flat-rate charge, netting the company about 5 cents per kw-hour. The motor service in Cheyenne is mainly of the smaller power type, although the company supplies energy to a brickyard just outside the city proper, the load being of the long-hour type of business and giving an average load on the plant of about 100 hp. Mr. A. G. Langenbach is local manager of the Cheyenne company, reporting to Mr. C. H. Williams, general manager of the Northern Colorado Power Company, Denver, Col.

Wiring and Illumination

THE DEPENDENCE OF VISUAL ACUITY ON THE WAVE-LENGTH OF LIGHT.

By M. Luckiesh.

The ability to distinguish detail depends very largely upon the spectral character of the light which enters the eye. This is due to the fact that the eye is not achromatic. It has been shown by Dr. Bell[1] and further substantiated



Eye piece converted into an equality of brightness photometer.

Fig. 1—Arrangement of Apparatus.

by the writer[2] that monochromatic light has greater defining power than light having an extended spectrum. The region of the spectrum having the greatest defining power is not well established. Mr. J. S. Dow[3] measured the acuity in light from an incandescent electric lamp through a signal green glass and a red glass and arrived at the conclusion that the blue-green end of the spectrum seemingly shows superior defining power for near vision. Mr. S. W. Ashe[4] used red, green, blue and clear glasses with an incandescent electric lamp as a source. He found acuity less for the red and increasing in the order—green, blue and clear glass for the same illumination. The spectrum through clear glass extends presumably over a greater range than the colored lights; therefore, owing to the chromatic aberration of the eye the acuity should be less if there were no other factors which largely influence the defining power of the light. According to Macé de Lépinay the more refrangible portion of the spectrum is less defining than the red region. Others have investigated the question, but to the writer's knowledge none has used monochromatic light of equal intensity throughout the spectrum.

Owing to the conflicting results mentioned and the fact that in most of the previous work the spectral character of the lights used is not stated, it seemed of interest to determine the defining power of various regions on the spectrum. In order to eliminate as far as possible the chromatic aberration of the eye a narrow portion of the spectrum was used, the light which entered the eye being therefore practically monochromatic. A diffraction spectrum rather than a refraction spectrum is to be preferred on account of the character of the dispersion of a prism. However, it is easier to obtain an intense spectrum by the use of a prism, and on account of the low luminosity values of the extremes of the spectrum it is necessary to start with the highest possible intensity.

The apparatus used by the author is shown diagrammatically in Fig. 1. A Hilger constant-deviation spectroscope was used and the various parts of the spectrum were viewed consecutively through the eye-piece, *a*. The width of the eye-piece slit could be varied at will by means of the slides *h h*, and a very narrow portion of the spectrum could be viewed. The Ives acuity object *c*, described in the *Electrical World* for April 14, 1910, was illuminated by a 500-watt tungsten lamp in a parabolic reflector. From this an illumination of 1700 ft.-candles was obtained at 1 ft. from the tip of the lamp. The light was directed on a ground glass *d* in front of the acuity-test object. The acuity object consists of two black line gratings placed face to face. When these are revolved relative to each other on axes perpendicular to their plane faces interference bands are obtained of varying width, depending upon the angle of relative displacement. The lines are always equal in width to the transparent spaces and therefore the total flux of light is constant regardless of the relative displacement of the two gratings. By revolving the drum *e* the width of the lines can be decreased until they become too small to be distinguished. These lines were focused on the collimator slit *f* by the lens *g*. The drum was actually turned by means of a pulley and belt, *k*. The position of the drum was read by means of the telescope *i*. These conveniences were added in order to eliminate the distraction arising from undue shifting of the head or body in taking observations. The drum readings are very approximately proportional to acuity. In the eye-piece there is a pointer, normally used as an index when the spectroscope is used for determining wave-lengths. On this pointer was cemented a small piece of magnesia-coated cardboard, which was illuminated by the light from the lamp *j*, reflected from the small mirror *o*. This cardboard formed one-half of the field of an equality-of-brightness photometer. The shape of the field is shown in enlarged detail in the lower right-hand corner of Fig. 1. *SS* represents the portion of the spectrum being viewed. Across this are seen the lines of the test object when the drum *e* is in such a position that the lines are coarse enough to be visible; *mm* shows the magnesia surface, whose top edge is inclined away from the observer, enabling it to receive light from the mirror *o*. The lamp *j* was all-frosted, producing, therefore, an even illumination on *mm*. The normal focusing distance for the writer's eye is about 14 in.

The procedure was as follows: The voltage of lamp *j* was set at a value which gave the desired illumination on the magnesia surface *mm*. This voltage was kept constant throughout one set of observations. The illumination on the test object was varied by varying the current through the 500-watt lamp. With the wave-length drum *n* set as far as practicable toward the extreme short-wave end of the spectrum and with a constant voltage on the comparison lamp several settings were made for equal brightness by varying the current through the 500-watt lamp. Current readings were noted for each setting and the mean value was used while the acuity readings were obtained. During

[1] *Elec. World*, May 11, 1911.
[2] *Elec. World*, Aug. 19, 1911.
[3] London *Illum. Eng.*, Vol. 2, p. 233.
[4] *Elec. World*, Feb. 25, 1909.

the settings for equal brightness the drum e was so turned that the lines of the test object were too small to be visible. The lamp j was extinguished while ten acuity readings were made by revolving the drum e until the lines just disappeared. Fatigue was eliminated as far as possible by resting the eye for some time after taking a number of observations at each wave-length and by starting at different points in the spectrum. A 2.5-mm artificial pupil was used.

The data obtained in this manner are shown in Fig. 2 by

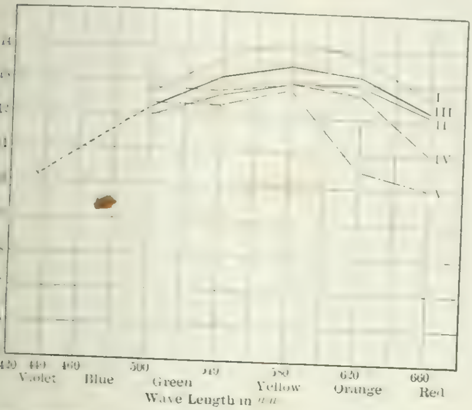


Fig. 2—Variation of Visual Acuity with Wave-Length of Light.

the curves which extend from 500 μμ to 660 μμ. The ordinates are proportional to visual acuity. The illumination on the magnesia surface was 4.2 ft.-candles. The resultant brightness was somewhat lower than that due to an illumination of 4.2 ft.-candles on a white surface, owing to the absorption of the eye-piece lenses and the 2.5-mm pupillary aperture. The writer obtained many curves of the same general character as I and II; however, they always fell within the limits of these two curves. Curves I and II were obtained in the morning and afternoon, respectively, of the same day, illustrating the fact that visual acuity is quite a variable function. Curve III is a mean curve for the writer's eye. This was plotted from mean values obtained by averaging about fifty observations at each point in the spectrum. These observations extended throughout a period of two weeks. Curves IV and V are those obtained by two other observers. They represent mean values of only ten observations at each point.

For extending the results into the violet region of the spectrum the best source available is the mercury-vapor lamp. A number of acuity readings were taken for the three bright lines 436μμ, 546μμ, 578μμ (double). These results are shown in Fig. 3. Curve VI was obtained by the [illegible] and curve VII by the observer who had obtained curve V. The absolute values of the visual acuity for points on curves VI and VII are approximately the same as for the same points on the curves shown in Fig. 2. [illegible] to a slight change in the apparatus the constants which reduce the ordinates of Figs. 2 and 3 to visual acuity differ slightly. If the writer's data obtained in the extreme blue end of the spectrum are reduced to fit his mean curve, III, it will extend the mean curve as shown by the dotted line.

It was at first thought that the difference in focus for red and blue rays would cause appreciable difference in the acuity settings if the lines were not focused at each point in the spectrum. This was tested out in the first part of the work by focusing the lines for red rays and taking acuity readings throughout the spectrum without refocusing. Next the lines were focused for blue-green rays (500μμ) and acuity readings taken. Finally the eye-piece was adjusted at each station throughout the spectrum and acuity readings were taken. In the three cases the same general result was obtained as far as could be determined. Of course, the natural fluctuations of the acuity function are so large that the possible effects due to difference in focus might have been masked. Throughout the work, however, care was taken to focus the lines at each station except in the series just described.

Justification for using the equality-of-brightness photometer is found in the fact that throughout a wide range of illumination visual acuity varies much more slowly than brightness. A large error in brightness settings would therefore be necessary to introduce appreciable change in the visual acuity measurements. The relative changes of acuity and brightness as determined are shown in the accompanying table. The unit of relative brightness is the

VARIATION OF ACUITY WITH BRIGHTNESS AT DIFFERENT WAVE-LENGTHS.

Wave Length in μμ	Relative Brightness	Relative Acuity.*
660	1.00	1.00
	.25	.85
620	4.00	1.05
	1.00	1.00
	.25	.93
580	4.00	1.05
	1.00	1.00
	.25	.95
540	4.00	1.08
	1.00	1.00
	.25	.88
500	4.00	1.08
	1.00	1.00
	.25	.82
	1.00	1.00
	.25	.83

* The values of relative acuity in the last column are comparable only with those in the same group. Groups cannot be compared with each other

illumination used throughout the work. It would appear from the data of the table that for equal variations in brightness visual acuity varies more rapidly at the extremes of the spectrum than it does in the middle region. At 580μμ a decrease in visual acuity of only 5 per cent is obtained when the brightness is decreased 75 per cent,

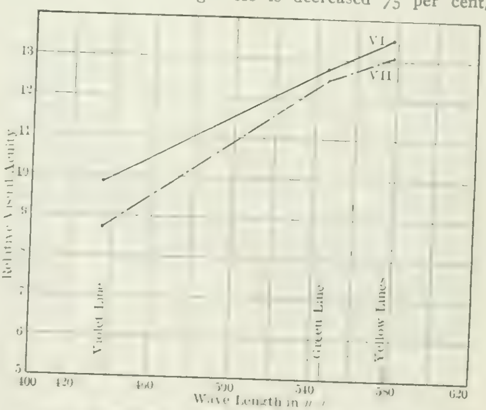


Fig. 3—Relative Acuity in Mercury Spectrum.

while at 436μμ the same change in brightness is accompanied by a 17 per cent change in visual acuity. In curve VII, Fig. 3, the brightness at 436μμ must be increased several hundred per cent in order to obtain the same acuity as at 580μμ. The data presented in the table are subject to the limitations necessarily imposed by the fact that each value of relative acuity was obtained from a mean of only ten readings by one observer. However, the data are sufficiently reliable to show that variations in acuity throughout the

spectrum cannot be considered due to errors in brightness measurements. Aside from the above argument, it might be said that the writer obtains at ordinary illumination practically the same results by the flicker and equality-of-brightness methods, and settings made with the latter method are quite consistent. The other observers have had experience in heterochromatic photometry.

In drawing conclusions more weight is given to curve III, which is a mean curve of several taken under identical conditions so far as they were under control of the observer. The curves obtained by the two other observers, while irregular owing to the fewer observations, show the same characteristics as shown by curve III. It is quite evident that visual acuity depends not only on the spectral character of the light, but also on the wave-length. The extremes of the visible spectrum show a lower defining power than the middle region, the maximum acuity appearing to be in the yellow region.

The writer realizes that the data presented are incomplete; however, the work was unexpectedly interrupted and postponed for an indefinite period, so that it was thought advisable to present the data which had been obtained. The investigation should be extended throughout a wide range of illuminations and with a number of observers.

The writer's thanks are due Dr. Herbert E. Ives and Dr. A. G. Worthing for their assistance in making some of the readings.

ADVANCED TYPE OF WAITING-ROOM SEAT LIGHTING.

The lighting of seats in the waiting-rooms of steam-railroad stations is one of the most neglected details of modern illumination practice, and not a few railroad terminals and way points otherwise admirably equipped have failed utterly in the matter of providing comfortable reading facilities. As shown in the accompanying photograph, the new Santa Fé station at Houston, Tex., constitutes a notable exception to the foregoing condemnation. In the main waiting-room of this building each seat is provided with an installation of twelve 16-cp incandescent lamps mounted on the under side of an inverted trough of translucent glass and located about 5 ft. from the floor level. The glassware and lamps are carried in a neat metal frame supported on short posts attached to the top of the seat back, and the shape of the reflecting surface and location of the lamps in a horizontal row centrally above the top of the seat backing enable a single row of lamps to provide light for the readers on each side. Each seat has eight compartments on each side, so that each row of twelve lamps provides lighting facilities for sixteen persons, in addition to the facilities for general lighting furnished through the aisles and main passageways of the waiting-room by overhead fixtures. The absence of glare is most striking, no less so than the comfort with which the traveler may read while waiting for the arrival and departure of trains.

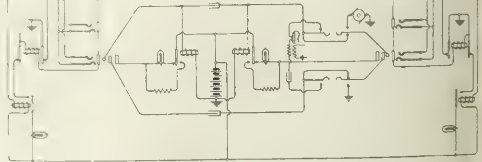
Seat Lighting at Santa Fe Station, Houston, Tex.

RECENT TELEPHONE PATENTS.

NEW CIRCUITS.

In trunking between two exchanges where one-way trunks are used and an order circuit is provided over which trunk assignments are passed each trunk line must be provided with certain automatic signals so that its condition may be known by the controlling operator. These signals are absolutely necessary, because this controlling or switching operator has no means of listening upon any of the trunks to note its condition. One of the necessary signals is a lamp which indicates when the desired subscriber has answered. This is the ringing signal, as when a ring is responded to this signal remains extinguished throughout the connection. Another is the disconnect signal, showing that the distant operator has disconnected from the trunk. A third signal is known as the guard and serves in case of momentary confusion, as it shows when the distant end of the trunk is being held while the near end has been taken down. It is this signal which guards against a reassignment of such a trunk. For a long time it has been customary to combine two of the signals in the same lamp, the interpretation depending upon whether the trunk is connected or disconnected at the controlling end. Common practice combines the disconnect and guard. Mr. A. D. T. Libby, of Elyria, Ohio, feels it better to combine the ringing and guard. He has therefore designed and patented trunk circuits to accomplish this. His patent is assigned to the Dean Electric Company.

A patent granted to Mr. C. S. Winston, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, describes a circuit system for a three-wire central-energy system. Cut-off and line relay are provided for each line, but the former severs the line lamp circuit but leaves the line relay connected. The cord circuit has a single supervisory relay, which in association with the line relay forms the battery-feed circuit. The diagram shows the details of the arrangement.



Central-Energy Telephone System.

NEW APPARATUS.

A receiver with sheet-metal shell is the subject of a patent issued to Mr. W. W. Dean, of Elyria, Ohio, and assigned to the Dean Electric Company. The specific feature is in the upsetting of the metal of the cap and body pieces where these are to meet so that there will be sufficient thickness of stock to permit of threading.

The patents granted to Mr. A. A. Jahnke, of Richmond, Cal., describe two transmitters. One is the usual type of transmitter save that it is designed for high currents and must have cooling devices. The electrodes are therefore made hollow and a circulation of liquid is arranged through them. The body wall of the granular button is of porous substance, and it at the same time serves as the inner wall of a hollow annulus. The space within this annulus is filled with liquid of a volatile nature, the fumes of which pass through the annulus to cool the granules. The second transmitter is of novel principle. The diaphragm drives the slide of a three-way cock which is arranged at the juncture of three liquid-conveying ducts. A high-resistance liquid approaches the cock in one duct. A highly conducting liquid approaches through a second duct, while the third duct conveys away the mixture. A conducting wire reaches almost to the cock in the first and third ducts. The cock is so arranged that the high-resistance liquid supply is reduced as the low resistance is increased. Thus the conducting path between the two wire terminals is varied in resistance to correspond to the vibrations of the diaphragm. The above patents are assigned to the National Wireless Telephone & Telegraph Company.

Mr. E. L. Persons, of Concord, N. H., is the inventor of a receiver support. An L-shaped arm is arranged so that if the receiver, held at the end of one arm, be pressed back by the ear of the riser, the short horizontal arm will throw the switch springs of the telephone set.

Letters to the Editor.

Visual Acuity and Light of Different Colors.

To the Editor of Electrical World:

Sir:—I have read with interest Mr. J. S. Dow's contribution on "Visual Acuity and Light of Different Colors," and your editorial in the issue of the *Electrical World* for Oct. 14, 1911, in which are suggested explanations of the difference in the results obtained by various observers in the work published by the writer in your issue of Aug. 19, 1911.

Mr. Dow calls attention to a well-known fact that for very near vision it is generally possible to focus the eye for blue rays while much difficulty is experienced in attempting to focus the eye for red rays. The reverse is true for distant vision. While this is true for extremely large and small distances of vision, differences in the ease of accommodation for red and blue rays become less marked for vision at intermediate distances. In fact, at a distance of 1 m, at which the writer and the two other observers viewed the test object, no noticeable difference in the ease of accommodation for red and blue rays appeared and none of the observers has experienced an abnormality in his power of accommodation. The particular results of the three observers referred to in your editorial were obtained with lights of exactly the same hue and would therefore come to a focus at the same point, thus eliminating any effect due to difficult accommodation. If lights of different color had been compared, the method of procedure would have tended to eliminate any difference in the ability to focus the eye for rays of different wavelength. The eye was focused on the lines of the test object and the lines were quickly reduced in size until they became invisible. This operation occupied but a very few seconds, and if the eye was fixed on the lines the reading was taken before the eye had time to relax.

The writer does not wish to appear as belittling Mr. Dow's remarks; however, in the work in which one observer obtained far different results from those of the writer and another observer differences in focus cannot account for the different results, because the focal planes of the two lights were identical. Mr. Dow's remarks apply when comparing lights of different color, although a method of procedure may be adopted which will largely eliminate the difficulty.

It appears to the writer that a satisfactory explanation of the differences obtained by the three observers is to be found, as suggested in the original paper, in the fact that the eye, having a dispersive power only slightly greater than water, forms an optical system tending toward achromatism when combined with a concave crown-glass spectacle lens. While it is true, as Dr. Bell has called to our attention, that the dispersion of the lens of the eye is near that of crown glass, the dispersion of the *total* eye system is only slightly greater than water.

More recent work of the writer* has shown—as far as the limited results can be accepted—that for near vision (14 in.) visual acuity is a maximum in the yellow-green region of the spectrum and falls off considerably for the blue and red rays. This work was done with practically monochromatic light of equal brightness for the various regions investigated. The difference in the ease with which the eye accommodates for different colors was carefully considered by the writer throughout the work, and the conclusion was reached that under the conditions of the experiment it was of little consequence. This conclusion was reached by determining the visual acuity in various parts of the spectrum with the eye-piece refocused at each point and then obtaining similar sets of data by focusing the eye-piece at only one point, making the readings in the other regions without readjusting the eye-piece. On comparing the data no consistent difference was found; that is, in all cases a maximum of acuity was found in the yellow-green region.

The writer, of course, agrees with Mr. Dow that if an eye cannot focus itself for a certain color no amount of light of that color will cause the observer to see distinctly; however, no difficulty of this sort was experienced by any of the observers.

In regard to Mr. Ashe's remarks in your issue of Oct. 28 the writer desires to say that there is no doubt that pupillary aperture affects acuity. However, the experiments of the writer referred to by Mr. Ashe were performed in a manner whereby pupillary aperture could in no way account for the greater acuity under monochromatic light.

Cleveland, Ohio. M. Luckiesh.

Large Generators in Cincinnati.

To the Editor of Electrical World:

Sir:—I have read with much interest the able article on Cincinnati's Plum Street station in your issue of Nov. 4. The author, who is very well informed, refers to a large 3200-kw, 60-cycle, three-phase Bullock alternator in the following words:

"Among the varied large apparatus in the newer engine-room, principal historical interest surrounds the 3200-kw, 60-cycle, 4500-volt, three-phase Bullock alternator, driven by a 42-in. by 88-in. by 60-in. vertical cross-compound Allis-Chalmers engine at 75 r.p.m. This alternator, the only one of the so-called 'Berlin' type in America, is also declared to be the largest 60-cycle engine-driven machine ever built. It was completed under the design of Mr. B. A. Behrend, then chief engineer of the manufacturing company at Cincinnati. The rotating flywheel field element is 31 ft. in diameter and weighs complete with its coils 190 tons.

"Adjoining the large alternator set is a generally similar engine, driving the huge 2500-kw, 300-volt direct-current Bullock generator, itself a record breaker in the direct-current class and the largest 300-volt continuous-current

*See page 1252 of this issue.

generator ever built. The flywheel with which it is provided alone weighs 100 tons and runs at 75 r.p.m. The armature is 30 ft. in diameter and the commutator 16 ft. across.

It may be of historic interest for me to add that at the time these large units were installed they were not only the largest of their kind as far as size was concerned, but also the largest as to rated output. The type adopted is not exactly the "Berlin" type, as the able author of the article mentions, but a type peculiarly developed for the conditions which had to be met by the problem in question. The mounting of ninety-six pole pieces on a large steel flywheel required a peculiar construction of the supporting frame of the armature, and a frame was developed which was later patented and which consisted virtually of two large segmental cast iron shields, almost 40 ft. in diameter, between which segmental punchings were mounted. A similar construction had been used by me previously for the 60-cycle flywheel-type generators installed in the municipal station of the city of Nashville, Tenn., where they have been in successful operation for many years.

The 300-volt, 2500-kw, direct-current generator was also one of the largest units ever built, though two similar gigantic units for 600 volts were later built under my supervision for the Boston Elevated Railway, where I suppose they will be the "last of the Mohicans" of this tribe, now fast vanishing from the field of heavy electrical engineering. We veterans of the profession enjoy the progress which leads to departures from the old types to which we gave life, form and existence.

B. A. Behrend.

Boston, Mass.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Homopolar Generator.—E. K. Scott.—An article illustrated by diagrams, in which the author points out that the homopolar generator has now a chance to succeed, as it is especially suited for driving by steam turbines. Curve A in Fig. 1 shows the speed of a line of homopolar generators that have been designed by R. H. Barbour, a sample

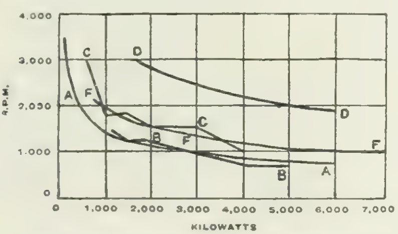


Fig. 1—Variation of Speed with Rated Output.

machine of which was exhibited at the recent Olympia electrical exposition in London. Curve B gives the lowest speeds of standard turbines by a certain maker. Curve C shows the speeds given by turbine builders as those at which they prefer the machines to run. Curve D represents the absolute limit of speed beyond which it would be mechanically impossible to run homopolar generators. Curve F shows speeds of homopolar generators having a peripheral velocity of about 16,000 ft. per minute, that is to say, about 25 per cent higher than Barbour's homopolar machine. As curves C and F almost always coincide, they prove that so far as speeds are concerned the steam turbine and homopolar machines are exactly suited to each other. Details are given of the Barbour homopolar generator, the construction of which has already been noted in the *Digest*. Considerable details are given about the brush construction, and comparisons are made with other special brushes. The brush consists of a flexible stranded copper core wound with an armoring of German-silver wire. This armoring has been found by experience to make better contact and give more consistent results as to friction, etc., than any other metal. Under actual test one of these brushes will collect 500 amp without any undue heating from a ring 14 in. in diameter and only ½ in. wide. With this brush the frictional loss is practically independent of the brush pressure and of the speed, but varies directly with the contact surface. Beyond a certain very moderate figure extra brush pressure has no effect on the contact volts. The current density found by experience to be suitable is about 100 amp per square inch, and the watts turned into heat per square inch of contact surface are 110 under these conditions. The watts per square inch in the case of ordinary slow-speed carbon brushes at the usual density of 40 amp per square inch are 116. The cost of manufacture of the homopolar machine is low. There is nothing in it except steel and a little copper and mica. There is no laminated structure. One interesting feature is the exceedingly easy way in which it can be compounded. All that is required is that the flexible connections from the brushes to the terminals shall be a little longer and be carried round in the same direction as the current that is flowing in the field coils. Then the current in the brush leads adds its ampere-turns, and by merely turning the brush leads the other way the compounding can be made differential.—Lond. *Elec. Review,* Oct. 27.

Single-Phase Commutator Motors.—F. Maguerre.—With reference to a former article by Gerstmeyer on the conditions of commutation of several types of single-phase commutator motors, the present author discusses the most important of these types with respect to starting performance and power-factor. The four systems under discussion are shown in Fig. 2. The chief results are as follows: At starting system *b* is superior to *c* in every respect. The power-factor in system *b* is also better near synchronism than in *c*, and the efficiency may also be somewhat better but this difference ceases the higher the speed above synchronism, and it is shown that for *b* with increasing speed the power-factor reaches a maximum and then decreases. With respect to commutation it is possible neither with system *b* nor system *c* to overcome the reactance voltage

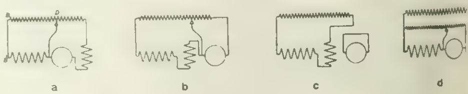


Fig. 2—Diagrams of Single-Phase Commutator Motors.

except by means of an interpole, but the easiest way of compensating the reactance voltage is provided by arrangement *d*. The article is illustrated by numerous vector diagrams.—*Elek. Kraftbetr. u. Bahnen,* Sept. 24.

Heyland Diagram.—H. J. S. Heather.—An article on the behavior of induction motors under the application of what is commonly called "reverse current," which in this connection really means polyphase currents so applied as to cause rotation of the resultant field produced by them in a sense opposite to that of the rotation of the rotor.

induction motor used for lowering loads with a winding engine can be safely and satisfactorily braked at any speed by the application of such reverse currents. The author shows how all problems arising from this class of work can be very simply solved with the help of the well-known Heyland diagram.—Lond. *Electrician*, Oct. 27.

Lamps and Lighting.

Incandescent Lamp.—A note on a recent British patent (23,332, Oct. 19, 1911) of the "Z" Electric Lamp Manufacturing Company, Ltd., and F. Hoge, relating to a method of mounting that part of the central rod of a lamp to which the filament-supporting wires are attached. A glass bead is slipped over the central stem near the bottom, and in it the supporting wires are embedded. The leading-in wires are connected, by twisting and welding, one to each of two of the supporting wires. These are double, the other part being atached to the filament, so that the bead, which is loose, is held in position on the stem and the leading-in wires form a resilient support for it.—Lond. *Elec. Eng'ing*, Oct. 26.

Electric Furnace for Treatment of Metallic Filaments.—A note on a recent British patent (8996, Oct. 19, 1911) of G. Ludecke and the Imperial Lamp Works, relating to an apparatus for decarbonizing and sintering new metallic filaments. The inner well of a carbon cylinder or other refractory metal whose conductivity is lower than tungsten is coated with a deposit formed by evaporating the chlorides or oxy-chlorides of tungsten and molybdenum within the cylinder. In a preferred form the cylinder is evacuated and brought to incandescence and tungsten hexachloride is evaporated within, the high temperature causing a uniform and dense coating of tungsten to form on the interior. An inner cylinder of tungsten and an outer of carbon may be produced, the latter forming a part of the resistor. The cylinder is held between cast-iron rings, which are connected to conductor terminals.—Lond. *Elec. Eng'ing*, Oct. 26.

Oxides for Arc Lamps.—J. Escard.—An article illustrated by diagrams on arc-lamp electrodes made from metallic oxides. The author first gives the characteristic features of an arc formed between oxide electrodes, and

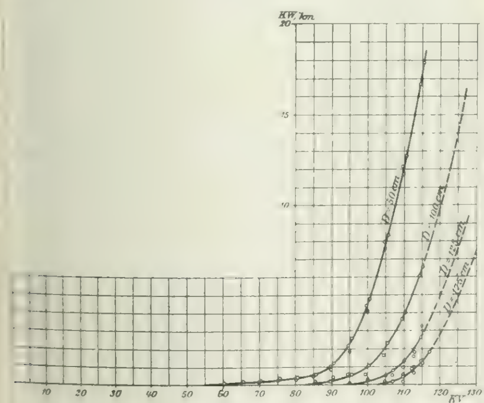


Fig. 3—Corona Loss in a Three-Phase High-Tension Transmission Line.

especially of the magnetite arc, and then deals with the composition of the electrodes and gives some details of the manufacture of the electrodes for the magnetite arc lamps.—*La Revue Elec.*, Oct. 27.

Nernst Lamp.—R. A. Houstoun.—In a continuation of his long illustrated serial on studies in light production the author deals with the Nernst lamp, giving figures of temperature and energy distribution curves.—Lond. *Electrician*, Oct. 27.

Generation, Transmission and Distribution.

Corona Losses in Overhead Wires.—H. Görges, P. Weidig and A. Jaensch.—The authors have made laboratory tests to determine the corona losses in high-tension wires with special reference to the 100,000-volt Lauchham-

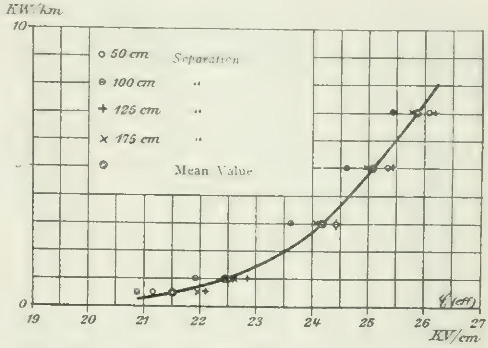


Fig. 4—Corona Loss Expressed in Kilovolts per Centimeter.

mer transmission plant. The tests were made with the size of conductors used in this transmission line, the conductor consisting of seven wires each of 6 sq. mm (0.009 sq. in.) cross-section. Hence the total cross-section of the conductor is 42 sq. mm (0.065 sq. in.). Two such conductors were stretched horizontally about 4.5 m (15 ft.) above the ground. The curve of the voltage applied was nearly sinusoidal. The frequency was 50 cycles per second. The losses were determined for four distances on the conductors from each other, namely 50 cm, 100 cm, 125 cm and 175 cm (or 1.64 ft., 3.28 ft., 4.1 ft. and 5.74 ft.) for voltages up to 115,000, and the losses were calculated for 1 km (0.62 mile) length, an atmospheric pressure of 750 mm mercury and a temperature of 17 deg. C. The results are given in Fig. 3. The four curves refer to the four distances be-

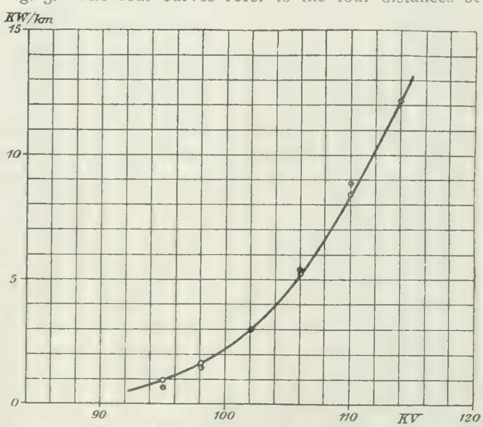


Fig. 5—Corona Loss in a Three-Phase System as Obtained from Calculation.

tween the conductors as indicated. The dotted parts of the curves are extrapolated. Since the results for the greatest distance of 175 cm (5.74 ft.), which is that of the Lauchhammer transmission plant, are somewhat uncertain, a checking calculation was made. If it is assumed that the corona losses occur essentially in close proximity to the wires, it may be concluded that these will be approximately

the same for different distances between the wires if only the electric field intensity (in volts per centimeter) at the surface of the wires is the same. To test this, the effective volts P were taken from Fig. 3 for different values of kilowatts per kilometer. Then the electric field intensity in effective volts per centimeter at the surface of the wires was calculated from the volts P from the formula $P \div [2\,r \log.\,(D/r)]$, where r is the radius of the conductor and D the distance between the conductors. As a result of this calculation the losses in kilowatts per kilometer are given as a function of the kilovolts per centimeter in Fig. 4 and are shown to be approximately independent of the distance between the conductors, thus confirming the above conclusion. Finally the results are used to calculate the corona losses for a three-phase system, if each conductor consists, as before, of seven 6-sq. mm wires and the distance between the conductors is again 175 cm. The results were calculated by two different methods, which gave practically the same results, as shown in Fig. 5, where the abscissas represent effective kilovolts.—*Elek. Zeit.*, Oct. 26.

Traction.

Single-Phase Locomotive.—J. Perrot and R. van Cauwenberghe.—An illustrated detailed description of the new single-phase locomotive built for the French Southern Railway. There are three 500-hp motors. For voltage regulation induction regulators are employed. The three 500-hp main motors are compensated series machines. Besides the excitation winding the stator has two parallel-connected compensation windings which also serve as commutation windings. The normal speed is about three times synchronism. Near synchronism the motor is connected as a repulsion motor. Since the French Southern Railway required electric braking so as to recuperate energy, the two compensated repulsion motors which drive the Westinghouse air compressor and the ventilators are provided with a special winding which is displaced by 90 space degrees against the main winding. When running down hill the main motors are excited as shunt generators from this winding so that an emf in time-quadrature with the excitation voltage and therefore almost exactly in time-phase with the network voltage is produced.—*Elek. Kraftbetr. u. Bahnen*, Sept. 24.

London Tramway System.—A long abstract of last year's financial report of the municipal London tramway system. The result of the year's working of the whole system is that the electrical system shows a surplus of $4,572,090 and the horse system a loss of $96,850. The electric cars ran 45,744,066 miles and the horse cars 2,357,504 miles, the number of passengers carried being 482,296,935 and 22,418,391 respectively. The traffic receipts from electric cars show a decrease of 0.42 cent per car-mile as against the previous year, while the receipts per car-mile from the horse lines show an increase of 0.12 cent. The fall in the receipts from the electric cars is due to the fact that the recently opened lines are unremunerative, and it will be a considerable time before these are fully developed. A diagram is given showing variations of the number of passengers carried throughout the year. The operating costs for electric traction were 12.72 cents per car-mile as against 12.70 cents last year. A sum, however, has to be added on account of special charges, making the total 12.96 cents per car-mile, compared with 12.84 cents a year ago. This increase is the result of fluctuations under every head. The total energy cost per kw-hour generated, including interest and sinking fund, is 0.7 cent. The total number of kw-hours used during the year was 111,527,301. The total capital investment for the whole tramway system is as follows:

Total electric traction ..	[illegible]
Horse and cable traction.	1,861,000
Obsolete capital (horse traction	[illegible]
	$58,094,200

If to the cost of energy generation given above the cost of distribution is added, with the corresponding capital charges, the total is 1.24 cents per kw-hour, no allowance being made for depreciation.—Lond. *Electrician*, Oct. 27.

Hamburg Suburban Road.—Freund.—Since the suburban road from Blankenese to Oldsdorf has introduced electric traction (the single-phase system being used), the traffic has enormously increased. This is due to the much greater number of trains during the day. While at the end of 1907 there were only 122 trains a day, the trains now follow each other every five minutes. The increased traffic has necessitated the building of twenty-five new motor-cars, which are at present being used for lengthening the trains. But in future the trains are to follow each other at intervals of two and one-half minutes. The construction of these motor cars is described and illustrated in great detail. The article is to be concluded.—*Elek. Zeit.*, Oct. 26.

Wires, Wiring and Conduits.

Fuses.—An illustrated description of several fuses exhibited at the recent Olympia Electrical Exhibition in London. The first is a bi-metallic fuse. It consists of a copper wire covered with a thick layer of tin alloy. The latter melts off before the fuse blows, so that there is no spluttering of tin, and, while not liable to oxidization and aging,

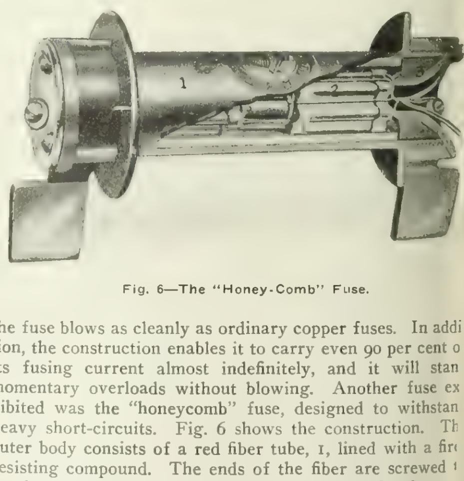


Fig. 6—The "Honey-Comb" Fuse.

the fuse blows as cleanly as ordinary copper fuses. In addi tion, the construction enables it to carry even 90 per cent o its fusing current almost indefinitely, and it will stan momentary overloads without blowing. Another fuse ex hibited was the "honeycomb" fuse, designed to withstan heavy short-circuits. Fig. 6 shows the construction. Th outer body consists of a red fiber tube, 1, lined with a fir resisting compound. The ends of the fiber are screwed receive contact ends, and the end caps or baffle plates, are of gun-metal lined with hard fiber. Inside is a cyli drical china body, on the outer surface of which are a num ber of cells, 2, in which the fuse wires are placed, whi through the center of this body there is a hole with tapered opening at either end. This central chamber serv as an expansion chamber. Round the center portion of t outer surface of the honeycomb cylinder is fixed a t "time-element band," which is connected to the termin by copper strands. In addition a number of small copp strands, varying in number from three to six, according the size of the fuse, run right through from terminal terminal. The action of the fuse is as follows: Running a small load, the copper "through strands" carry the b of the current, as their resistance is lower than that of tin band, but as the load increases the temperature of copper "through strands" rises, and the resistance of th strands becomes greater until a portion of the current shunted and carried by the central tin band. When load exceeds the maximum continuous rating of the f the temperature rises until the latter is melted. All the l is then thrown on the copper "through strands," which mediately fuse. It will be seen, therefore, that on ordin overload conditions the break takes place on the cop

through strands only, and consequently a comparatively small mass of metal only is volatilized. On a heavy short-circuit, however, the "fusible tin band" is as a rule left unfused, the connecting copper strands fusing instead.—Lond. *Elec. Eng'ing.*, Oct. 26.

Electrophysics and Magnetism.

Transverse Thermomagnetic Effect in Nickel and Cobalt.—A. W. Smith.—An account of an experimental investigation of the transverse thermomagnetic effect, or Nernst effect, in nickel and cobalt. The author investigated especially the variation with the temperature of the plate and its relation to the Hall effect and to the magnetic properties. The chief results are as follows: The relation between the Nernst emf and the magnetic field was examined in nickel at a number of temperatures between 56 deg. C. and 310 deg. C. For a given magnetic field it was found to increase with rising temperature until the critical temperature was reached. The rate of increase becomes greater the nearer the critical temperature is approached. In passing the critical temperature the Nernst effect decreases to a small fraction of its value at that temperature and then probably decreases with further rise of temperature. For any particular temperature below the critical temperature the Nernst emf is at first proportional to the magnetic field, but when the intensity of magnetization approaches its maximum there is a rapid deviation from this proportionality and the emf approaches a limiting value at higher magnetic fields. Since the maximum intensity of magnetization decreases with rising temperature, the fields necessary to produce saturation become less as the temperature is increased. At temperatures above the critical value the Nernst emf is proportional to the magnetic field. The study of the Nernst effect in cobalt between 56 deg. and 550 deg. showed that the Nernst emf is proportional to the magnetic field over that interval of temperature and over the range of magnetic fields in these experiments. In nickel the Nernst effect increases more rapidly than the Hall effect with rising temperature and in cobalt it increases less rapidly than the Hall effect. In this respect cobalt behaves like iron.—*Phys. Review*, October.

Units, Measurements and Instruments.

Electric Clocks.—An illustrated description of electric clocks exhibited at the recent Olympia Electrical Exhibition in London. An "earth-driven" clock is described, the current being obtained from a carbon plate and a zinc plate buried in the ground. A new astronomical clock is then described in which an impulse is given to the pendulum and a contact made every second. Several improvements over former arrangements are claimed. The pendulum releases the impulse lever while it is passing through the central one-tenth degree of its swing. Variations in the friction of the release do not, therefore, affect the time of vibration of the pendulum apart from producing an alteration in the arc. The impulse is delivered during the first one-quarter degree of swing after passing the center. This delaying of the impulse introduces an escapement error which decreases with increasing arc and thus compensates the increase in the circular error produced by increasing arc. The inevitable variations of arc due to change of density of the atmosphere and variations of friction are reduced to a minimum, since the impulse lever and pallet are so designed that an increase of arc automatically causes a decrease of impulse. During the whole of the time that the lever is giving impulses to the pendulum it is absolutely free, since the pallet leaves it before it comes into contact with the remontoire. The escapement mechanism being symmetrical, without duplication, an impulse is given and a contact made each half swing, that is, once per second, since a seconds pendulum is used. The contacts are of brief duration and perfectly clean, and owing to the introduction of a spring beneath one of the contact plates the kinetic energy of the impulse lever is stored instead of being wasted. This materially reduces the energy required to reset it. The self-induction and resistance of the circuit are so adjusted that under normal conditions a decrease in the current produces an increase in the throw of the remontoire. The movement is shown in Fig. 7. The impulse pallet is in the form of a small wheel *A*,

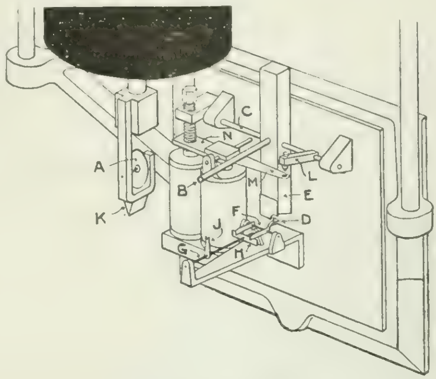


Fig. 7—Movement of the "Synchronome" Astronomical Clock.

mounted centrally on the lower end of the pendulum, and the impulse lever is in the form of a round steel rod *B*, pivoted at one end about the horizontal axis *C*, and placed so that the free end is immediately over and almost in contact with the top of the pallet wheel *A* when the pendulum is at rest. The lever is normally held in this position by the catch *D*, which engages with the end of the loading bar *E*, mounted vertically on the axis of the lever. This catch is pivoted about the axis *F*, parallel to the axis of the lever. The latter is released by means of the trip axle *G*, which carries at one end the small cross-bar *H*, engaging with the tails of the catch *D* in such a way that a small rotation of the axle in either direction lifts them and depresses the point of the catch. The requisite slight rotation is brought about each time the pendulum passes through its central position by means of the trip tail *J*, which is just hit by the agate knife edge *K*, attached to the bottom of the pendulum below the pallet wheel. The impulse lever being released when the pendulum is in its central position comes into contact with the pallet wheel then immediately below it, and as the pendulum continues its swing the lever runs down the edge of the wheel, communicating energy to the pendulum. The downward acceleration of the lever increases with the increasing slope of the plane of contact with the pallet until it becomes equal to the acceleration the lever would have were its motion unrestrained by the pallet. Since the acceleration of the lever cannot increase beyond its amount, the lever and pallet wheel then part company and the impulse of the pendulum terminates. The lever is allowed to travel some little distance further before the contact arm *L* comes into contact with the contact spring *M* attached to the armature *N* of the resetting electromagnet. The impulse lever is, therefore, absolutely free while giving impulse. If the arc of vibration increases slightly, the lever and pallet wheel part company sooner; that is, before the lever has traveled the normal amount. Consequently the impulse is reduced in value. Similarly a slight reduction in the arc enables the lever to remain in contact with the pallet for more than the normal distance, with a consequent increase in the value of the impulse. The impulse, therefore, exerts a governing effect on the arc of vibration. Any number of subsidiary dials indicating time second by second may be operated by this master clock, and the circuit may also

include chronographs or other seconds-indicating devices. —Lond. *Electrician*, Oct. 27.

Measurement of Gases.—C. C. Thomas.—A long illustrated Franklin Institute paper on the different formulas for calculating the flow of gases through pipes and on commercial meters for measuring this flow. The Pitot, Venturi and electric meters all give accurate and reliable results when properly used under favorable conditions and when observations are taken with a sufficient degree of refinement and method. The electric meter gives continuous results, either graphical or integrated, even under severe commercial conditions of operation, that compare most favorably with the best that can be obtained with other forms of direct-reading meters or by frequent observations on Pitot tubes and the use of tables and coefficients derived from the most thorough calibrations; and it gives these results directly in any standard units desired, regardless of the pressure and temperature of the gas flowing through the meter.—*Jour. Franklin Inst.*, November.

Telegraphy, Telephony and Signals.

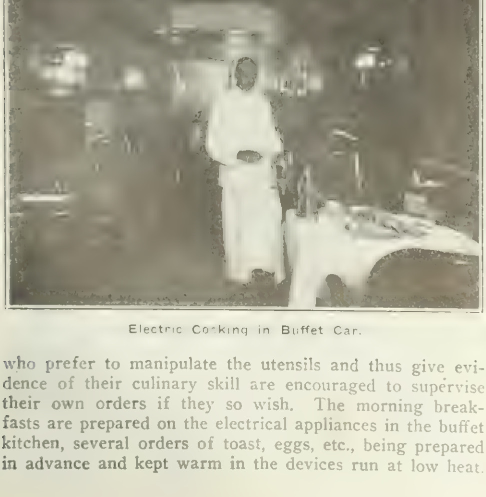
San Francisco.—S. G. McMeen.—A fully illustrated description of various features of the telephone system serving San Francisco and suburbs. The system consists of a wire plant of submarine, underground and aerial cables joined to ten groups of automatic switching apparatus housed in ten buildings. Five of the buildings are in San Francisco, four are in Oakland and one is in Berkeley. The author deals especially with some features of the work in San Francisco.—*Journal Western Soc. of Engrs.*, October.

Damping of Short Electric Waves.—M. Levitsky.—The author describes a new form of closed resonator for measuring the damping of short waves, which is particularly difficult in the case of open transmitters. The difficulty is mainly due to the rapidly increasing disturbance by neighboring conductors, and it is impossible to separate the decrement of the secondary from that of the primary. The difficulty may be overcome by choosing a receiver whose oscillations are practically undamped and sufficiently intense to give a well-marked resonance curve. An account is given of experiments showing that the resonator which he used was practically undamped, the decrements being those connected with the oscillator only.—Lond. *Electrician*, Oct. 27.

New Apparatus and Appliances

ELECTRIC COOKING ABOARD A LIMITED TRAIN.

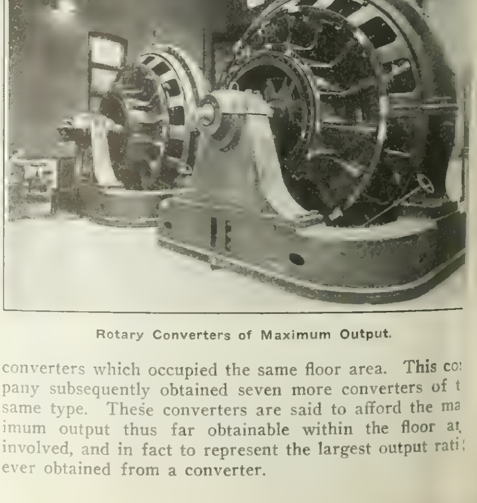
The fast limited trains of the Burlington route between Chicago and the Northwest are lighted by electricity furnished by a 110-volt head-end turbine generator. In the competition between several lines to make their own accommodations most attractive to travelers Mr. A. E. White, commissary for the road, has just installed cooking devices in the lounging and buffet cars of the principal trains on which all cooking is done electrically. Each car is equipped with a General Electric percolator, toaster, chafing dish, egg boiler, small frying-pan, tea-kettle and water heater. Each table is arranged with six outlets, from which as many appliances can be operated. For evening "snacks" the various appliances are brought directly to the table and the cooking is done under the eye of the guest. Ladies who prefer to manipulate the utensils and thus give evidence of their culinary skill are encouraged to supervise their own orders if they so wish. The morning breakfasts are prepared on the electrical appliances in the buffet kitchen, several orders of toast, eggs, etc., being prepared in advance and kept warm in the devices run at low heat. The percolator, however, is used directly on the table. The low voltages generally used in train-lighting systems have prevented the general adoption of electric cooking, but the 110-volt head-end system used on the Burlington permits the use of standard apparatus.



Electric Cooking in Buffet Car.

CONVERTERS OF MAXIMUM OUTPUT.

In the accompanying illustration are shown two rotary converters in a substation of the Brooklyn Rapid Transit Company, which are rated at 3000 kw each and are 25 cycle, six-phase, 600-volt machines. Two units of this same type, built by the Westinghouse Electric & Manufacturing Company for the Interborough Rapid Transit Company New York, a little over a year ago, replaced two 1500-kw converters which occupied the same floor area. This company subsequently obtained seven more converters of the same type. These converters are said to afford the maximum output thus far obtainable within the floor area involved, and in fact to represent the largest output ratio ever obtained from a converter.

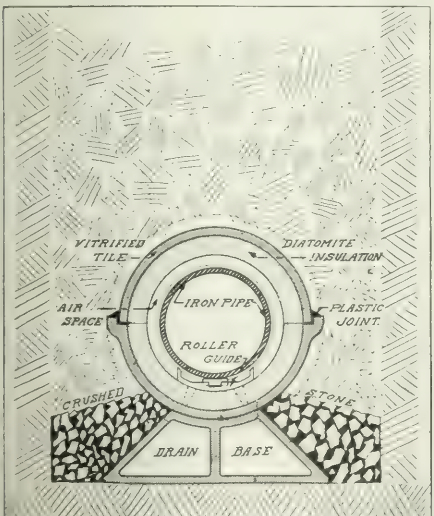


Rotary Converters of Maximum Output.

IMPROVED UNDERGROUND STEAM-HEATING LINE CONSTRUCTION.

A novel and patented adaptation of vitrified-tile conduit has been applied by Evans, Elmirall & Company, of New York and Chicago, to the improved construction of underground steam-heating mains and lines. The pipe itself, properly insulated, is carried within a split vitrified-tile conduit, which in turn rests on the hollow drain-base shown in the accompanying section. Both drain-base and conduit are made in sections of the same length, but are installed in break-joint arrangement, a recess in the center of each base section forming a lock for the bell of the conduit. This interlocked construction makes impossible a change in levels or separation of the joints. The flat bottom of the drain-base also gives the desirable firm foundation required for good underground work. Drainage water is free to enter the tile base at the joints, which are left open and are protected against the entrance of earthy matter by the crushed stone or gravel placed alongside, as shown in the illustration, this latter acting as a filter material.

The diatomite or kieselguhr insulation used inside the tile conduit consists of the fossil silica skeletons of minute diatoms, of which there are millions to a cubic inch, interspersed with numberless air cavities. These air cells give diatomite its heat-insulating qualities, while the mate-



Cross-Section of Trench, Showing Underground Steam-Heating Line Construction.

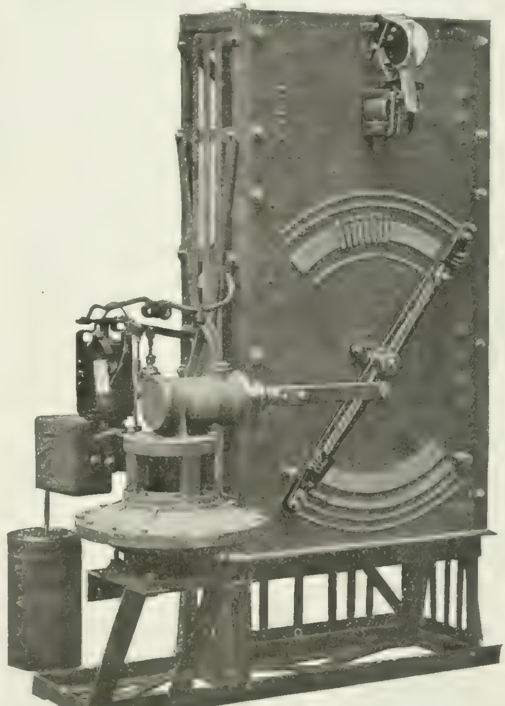
rial of the minute bodies is both insoluble in water and indestructible by acids. The wrought-iron pipe is supported on roller bearings, making it free to move between expansion joints. The weight of the bearing is borne by legs extending through the diatomite and resting on the tile.

In the process of making the tile conduit the longitudinal cuts on the sides, which divide it into an upper and a lower section, are not made entirely through the wall, enough material being left to keep the two halves intact for splitting on the job. Here they can be easily separated with the aid of a hammer and chisel. The lip running along the lower section of the longitudinal joint forms a groove for supporting the cement used to make a tight joint. The tile itself is made from a combination of stoneware clay, spar and fireclay, thoroughly ground and mixed, and is free from iron, lime or other injurious substances. All sections are salt glazed inside and out, making the tile waterproof.

AUTOMATIC STARTER AND SPEED REGULATOR FOR TWO MOTORS.

The Cutler-Hammer Manufacturing Company, of Milwaukee, is placing on the market a new pressure-controlled motor speed regulator, illustrated herewith, for use with two motors. This apparatus starts or stops either of two motors and varies their speeds as service demands. On boiler draft systems, where they are used to the greatest extent, they vary the mechanical draft and thereby maintain pressure in the boilers between fixed limits.

The controller shown was installed in connection with two motors of 3½ hp and 5 hp capacity, respectively, each driving a triplex oil pump feeding oil-fired boilers. The



Pressure-Controlled Automatic Starter and Speed Regulator for Two Motors.

oil is fed to the boilers under a pressure of about 35 lb. per square inch. The oil fed varies with the demand on the boilers. In this particular case the small pump takes care of ordinary operating conditions, and both are used only when heavy load conditions prevail.

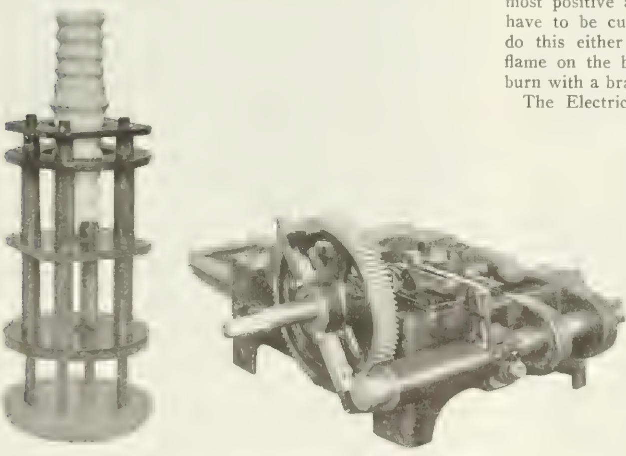
The small motor is started automatically and accelerated to normal speed and above this if necessary. If this does not supply the oil needed a clapper switch, shown at the top, closes the circuit to the large motor and this is brought up to the speed and varies it as required. When the demand on the boiler decreases so that the smaller motor can again do the work the larger one is cut out of the circuit. This controller, therefore, eliminates the need for an attendant and reduces power consumption to a minimum, accomplishing this result precisely and better than is possible by manual operation.

DEVELOPMENTS IN OIL-SWITCH DESIGN.

The introduction of the high-speed steam turbine for operating large generating units has brought about a demand for switching apparatus of high rupturing capacity, and, because experience has shown that the motor-operated type "H" switch is capable of rupturing large amounts of power, two new switches of similar design, but with greater rupturing capacity, have been developed by the General Electric Company. They will be known as the "H-6" and "H-7," and are identical except for a few details necessary to adapt them to different styles of cell construction. Both switches are designed for mounting the different phases in separate cells, but the "H-7" oil switch is so arranged that further separation is secured by the addition of barriers placed between the breaks of each phase.

The secondary contacts of the switches are, with slight modification, similar to those used in the previous types. For current capacities above 300 amp, however, additional contacts, known as primary contacts, are provided. These are shown in Fig. 1, and serve to carry almost the entire current while the switch is closed. In opening the switch they break contact before the cylindrical rod which opens the circuit and ruptures the consequent arc in oil. The movable primary contacts consist of double sets of contact fingers, made of drop-forged copper, fastened to a movable cross-head by flat springs fitted with copper laminations and reinforcing springs. The stationary primary contacts are wedge-shaped copper blades fastened to the top of the oil vessel. The diameter of the oil vessels has been increased from 8 in. to 10 in., giving a larger volume in the oil vessel. The larger oil vessels have also been made stronger by increasing the thickness of the steel walls.

By means of baffle plates the movement imparted to the oil by the expansion of the gases formed by the arc when the circuit is opened is checked and diverted in such a manner as to allow the gases to separate from the oil and escape, while the oil itself drops back into the oil vessel. Fig. 2 is an illustration of the baffle. The movement of the oil is away from and toward the center of the oil vessel on breaking the circuit, and the oil loses its velocity before it reaches the cover, thus reducing its tendency to be thrown out.



Figs. 1 and 2—Details of Oil-Switch Design.

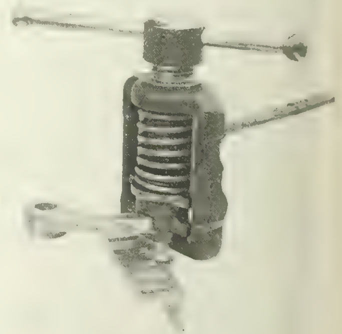
As in the other types, the switch is opened and closed by compression springs. The operating motor does not actually throw the switch, but serves merely to compress the springs. The weight of the movable parts of the switch is counterbalanced, so that when the switch operates the force of the compression springs closes the contacts by throwing the lever to approximately 1½ in. from the opposite position, after which the motor compresses the springs for the remainder of the distance. The switch closes and opens with equal ease. The operating springs are held in compression by the main operating toggle of the switch and by a dog bearing against a roller stop, which, when released, allows the switch to operate. The main operating toggle is slightly over center when the switch is at rest; thus the pressure of the dog against the roller stop is merely sufficient to overcome the tendency of the main toggle to buckle. The means of holding and releasing the dog insures positive operation of the switch. When the switch is operated it either closes or opens, as the case may be, in one single stroke and remains in that position.

The locking mechanism is an important improvement in the switch, and one which removes the chance of trouble which might occur with the old switches if the toggles were not properly set. Although primarily developed for the switches described, this feature will henceforward be embodied in the design of all switches of the "H" type. The switches are built in current-carrying capacities up to 4000 amp for voltages up to 15,000. They are also made for voltages up to 70,000, and will operate satisfactorily, it is claimed, on systems the combined load of which connected to the bus is not greater than 50,000 kw. They are made in two forms, one in which the poles are made in parallel sets of two, as in previous designs, and the other in which the poles are arranged in tandem.

VEHICLE STORAGE-BATTERY CELL DISCONNECTOR.

The individual cells in the various types of "Exide" batteries are joined together by connectors integrally burned to the strap post, which burned connection is the most positive and satisfactory. When one or more cells have to be cut out it has heretofore been customary to do this either by loosening the connector by putting a flame on the burn, over the post, or boring through the burn with a brace and bit.

The Electric Storage Battery Company has now per-



Storage-Battery Disconnector.

fected a connector puller, a device which mechanically ur couples the connectors by shearing, leaving both post an connector in perfect condition for reburning. In order t accomplish this it is necessary that the plunger which do the shearing be very accurately aligned and centered.

The connector puller fits the pillar strap of all types ("Exide" cells, including the "Ironclad-Exide," and is man factured in two sizes. One size fits all cells correspondir to the thirteen-plate "Exide" (5-in. jar) and smalle while the other fits those corresponding to the fifteen-pla "Exide" (5¾-in. jar) and larger.

Industrial and Commercial News

THE WEEK IN TRADE.

EXPANSION has taken place this week in the volume of business transacted throughout the country, and with this improvement in the turnover there has also been a decided growth in confidence for further improvement. Just how long this optimism will last cannot be predicted with any degree of certainty in view of the irregular trend of business in the past few months, but conditions seem unusually favorable at this time for a period of advancement in general trade. Stocks of various commodities are low, prices in general are attractive, and the various factors that have brought uncertainty and hesitation into business matters during the year are either being eliminated or are losing their force. While the plan for reorganization of the American Tobacco Company approved last week by the United States Circuit Court does not give entire satisfaction to independent tobacco interests or furnish a complete guide for reorganization of every corporation that may be charged with violation of the Sherman antitrust law, the fact that a solution of the matter was found, and the welfare of the company protected, helps to dispel much of the apprehension attendant upon the federal suits. Knowledge that the year's crops are abundant is another favorable influence upon the trade situation, for completion of harvesting will mean more purchasing in various sections and consequent expansion in a number of important industries. Low prices in the steel markets are bringing out substantial contracts for rails, cars, bridge equipment and other steel products, and activity at the mills is assured for some time to come. Indications that stocks of pig-iron held by large consumers will need replenishing are exceedingly good. Railroad earnings are becoming better and tonnage reports show that shipments of various commodities are increasing rapidly. Prices in the cotton markets are still too uncertain to induce buyers to commit themselves very far in the future. Business failures for the week ended Nov. 9, as reported by *Bradstreet's*, were 237, as compared with 200 last week, 207 in the corresponding week in [illegible], 221 in 1909, 267 in 1908 and 259 in 1907.

THE COPPER MARKET.

ATTEMPTS to advance copper prices in view of the apparently favorable statistics in the October report of the Copper Producers' Association have been moderately [suc]cessful, and domestic consumers entering the market have given 12.5 cents to 12.6 cents cash for electrolytic for November, 12½ cents to 12⅝ cents for December and January and [b]etween 12⅝ cents and 12¾ cents for later delivery. Foreign

Standard Copper:	Bid.	Asked.	Settling Price.
[illegible]	[illegible]	12.35	
November	12.20	12.35	12.27½
December	12.25	12.40	[illegible]
January	12.25	12.40	12.32½
February	12.30	12.45	12.37½

The London market, Nov. 14, was as follows:

	Nov. [illegible] £ s d	Closing. £ s d
Standard copper, spot	56 15 0	56 16 3
Standard copper, futures	[illegible]	57 10 0

[buy]ing has expanded slightly, and consumers abroad have paid [adv]ances of 5s. to 10s. for eltctroolytic. Consumers still be[liev]e in spite of the October statistics that the present rate of [p]roduction and the present outlook in general trade justify [co]ntinuation of the hand-to-mouth policy. Judging from the [co]ndition of the market in the past few months, either the [bu]ying movement will have to become greatly broadened and [m]ake substantial inroads upon surplus stocks or the rate of [pr]oduction will have to be greatly lowered before the consumer need be concerned with sharp advances in price. The [fr]actional advances that have just taken place savor of the professional and have had but very little influence in increasing the volume of sales. Standard copper in New York has revived slightly, following the lead of the London market, in which activity was quite marked after the October report was made public. Export business at present is at a rate slightly larger than that of October, and exports including Nov. 14 aggregate 12,131 tons. The daily call on the Metal Exchange, Nov. 14, quoted copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

General Electric Sales.—Recent orders received by the General Electric Company, Schenectady, N. Y., include the following: From the Haskell & Barker Car Company, which is remodeling its entire electrical equipment and changing from alternating-current to direct-current motor drive at its large car-manufacturing plant at Michigan City, Ind., for one motor-generator set, ninety-seven induction motors and a switchboard; from the Ingersoll-Rand Company, New York City, for four synchronous motors aggregating 1400 hp, four exciters, four synchronous panels and one black panel; from the Carnegie Steel Company, Pittsburgh, Pa., for one synchronous motor-generator set and a switchboard, for use at the Schoen Steel Works, McKee's Rocks, Pa.; from the Itaska Paper Company, Grand Rapids, Mich., which manufactures news paper and is equipping its mill electrically, for eight induction motors aggregating 725 hp; from the American Hide & Leather Company, Ballston Spa, N. Y., for five induction motors aggregating 150 hp, replacing steam-engine drive; from the Mark Manufacturing Company, Chicago, Ill., manufacturer of conduit, for three centrifugal air compressors, which will furnish air blast for oil-firing the ovens used in baking the conduit; from the Robert N. Basset Company, Shelton, Conn., which is installing individual motor drive, for three three-phase generators, one transformer, forty-eight induction motors, thirty-one direct-current motors and a switchboard; from the Bush Terminal Company, New York City, for four battery truck cranes for service at its terminal at Brooklyn, N. Y. The General Electric Company has recently sold mining locomotives as follows: One locomotive to Asker Coal Mining Company, for Dorothy, Ky.; one to Ben Franklin Coal Company, for Braeburn, Pa.; one to Inland Steel Company, for Crosby, Minn., and one gathering locomotive to Davis Colliery Company for Elkins Colliery Company, Bower, W. Va.

Meeting of the Jobbers' Association.—The Electrical Jobbers' Association held its quarterly meeting at the new Homestead Hotel, Hot Springs, Va., on Nov. 8, 9 and 10. The main theme discussed at the business meeting was efficiency methods to reduce the cost of conducting the business of jobbers and dealers in electrical supplies. The attendance of both jobbers and manufacturers was large, and the social features of the occasion absorbed even more attention than the business of the organization. There were tournaments in golf, tennis, billiards and pool, with cups and other trophies to make the several events interesting and zestful. The next meeting of the association will be held at St. Augustine, Fla., in February, 1912.

More Equipment Ordered for Appalachian Power Company.—Messrs. Viele, Blackwell & Buck, engineers for the Appalachian Power Company, of Richmond, Va., which is building hydroelectric stations and distribution systems in Virginia and West Virginia, as described in these columns Oct. 7, have awarded the contract for the transmission-line fittings to the Harrison Electric Manufacturing Company, of Brooklyn, N. Y.

Large Lamp Consumers.—At the recent Chicago convention of the Association of Railway Electrical Engineers the interesting statement was made in conversation that the Pennsylvania Railroad is the second largest consumer of incandescent electric lamps in the United States. The largest consumer is said to be the group composed of the associated Edison companies.

Western Electric Business Shows a Slight Decrease in October.—During the month of October shipments of the Western Electric Company showed a decrease of 5 per cent as compared with those in October, 1910. During September, as previously stated in these columns, the shipments of the company were 12 per cent larger than those in September of the previous year, and the difference between this gain and the decrease for October noted above is explained by the fact that the September increase was due in part to including with the September record shipments on orders placed earlier in the year. As the monthly records are compiled on a shipment and not on an order basis, the 5 per cent decrease in October does not indicate an equivalent decrease in sales. Sales of the company for ten months of 1911 represent an increase of about 3 per cent over those in the corresponding period last year. The gain has not been uniform throughout the various territories, and in a large measure improvement has been more marked in foreign than in domestic business. In this country in October all sections excepting the Pacific Coast showed decreases, and the greatest falling off was in the East. Considerable improvement has been shown thus far in the year in sales of motors, generators and lamps, and the telephone branch of the business has also shown expansion. The actual number of orders received in ten months of the present year is larger by some 7 per cent than those in the corresponding ten months last year, and this difference indicates a small decrease in the average size of order. From present indications the year's business will approach $66,000,000, in which case 1911 business will be exceeded only by that of 1906, which represented a total of $69,000,000.

American Blower Company Forms Canadian Sirocco Company, Ltd.—Application for a charter has been filed by the Canadian Sirocco Company, Ltd., of Windsor, Ont., the function of the company being the manufacture and distribution of the American Blower Company products in the Dominion of Canada. The full line of American Blower Company fans, blowers, heating, ventilating and drying apparatus, steam engines, etc., will be manufactured. The company will hold the exclusive patent rights to manufacture Sirocco fans and blowers throughout Canada. These patents are controlled in the United States, the United States' possessions, Mexico, Central and South America and in Japan by the American Blower Company, of Detroit, Mich., and in Europe by Davidson & Company's Sirocco Engineering Works, Belfast, Ireland, the home of S. C. Davidson, inventor of the apparatus. The Canadian Sirocco Company, Ltd., has acquired a tract of land comprising four and one-half acres on the Essex Terminal Railway from the city of Windsor, and it will proceed at once to erect upon this site a plant which, it is said, will be the finest and most comprehensive of its kind in the country. An erecting shop 50 ft. by 200 ft., of steel and concrete construction, is to be started at once, and this with the office buildings will be completed for occupancy this winter. A foundry building will be started in the spring and work upon the plate and pipe shop, machine shop and the remainder of the plant will be advanced as rapidly as possible.

Postal Telegraph Company.—The current issue of the *Postal Telegraph*, the monthly bulletin of the Postal Telegraph Company, contains an article assailing the Western Union Telegraph Company for combination with the American Telephone & Telegraph Company, alleging that this combination is in violation of the Sherman anti-trust law. Reference is made in the article to various statements of Theodore N. Vail, president of the Western Union Telegraph Company, that were to the effect that the close relation between the two companies is in the nature of a public benefit, and in attacking these statements the article says in part: "Mr. Vail says the purchase by the American Telephone & Telegraph Company of the stock of the Western Telephone & Telegraph Company is similar to the purchase some time ago of the Mackay Companies' holdings of telephone stock. The fact is that the Mackay Companies sold their telephone stock to avoid even the appearance of combination. This sale of Western Telephone stock is to complete a combination." The Western Union's statement to the effect that 80 per cent of the Postal's net profits were obtained from its cable operations is denied strongly, and the vast land lines of the company are pointed to in support of the denial. The bulletin contains further reference to the matter of the combination, saying that now that the Bell Telephone and Western Union have practically eliminated the natural competition between the telegraph and telephone, so far as these companies are concerned, they contemplate absolutely wiping out all competition whatsoever in hundreds and perhaps thousands of small towns in the United States.

Westinghouse Orders.—The Cleveland, Painesville & Eastern Railroad Company, of Willoughby, Ohio, which is enlarging its plant and changing the operating voltage from 13,200 volts to 22,000 volts, has ordered two 1500-kw and two 50-kw, 6600-volt turbo-generator units from the Westinghouse Machine Company. The Indiana County Street Railway Company, of Indiana, Pa., has ordered one 625-kva Westinghouse-Parsons turbo-generator, with Le Blanc condenser, for installation in its plant at Twolick, Pa. The turbo unit will feed into the 6600-volt, three-phase, 60-cycle lines the company is operating at the present time. A little over a year ago the Westinghouse company built and installed two 3000-kw, 25-cycle, six-phase, 600-volt rotary converters at substations of the Interborough Rapid Transit Company, New York, replacing two 1500-kw rotary converters. The 3000-kw machines occupy the same floor space as the smaller ones and the output of the stations has been doubled. Since these units were purchased seven more of the same type have been ordered by the Interborough company. The following 3000-kw rotary converters have either been shipped or are on order: For the Brooklyn Rapid Transit Company, Brooklyn, N. Y., three units; for the Chicago Railways Company, Chicago, two units; for the Philadelphia Rapid Transit Company, Philadelphia, Pa., two units, and for the Metropolitan Street Railway Company, Kansas City, Mo., one unit.

Meeting of Idaho Cedarmen's Association. — The Idaho Cedarmen's Association met on Nov. 7, in Spokane, Wash., and took action on several matters of interest, among others the adoption of a standard list of weights of poles. In the past it has been the custom for each concern to use its own weights, and it was deemed advisable to adopt a standard similar to that of the Eastern cedar dealers. A committee or publicity was appointed by the president, consisting of J. C Davis, of the Humbird Lumber Company; H. C. Culver, of the Sand Point Lumber & Pole Company, and R. L. Bayne of the Lindsley Brothers Company, to look into the matter o securing a greater publicity for the merits of the Westerr cedar poles. Pole consumers, especially those in the East anc South who have never used the Western poles, are un familiar with them and with the claims that the Westerr cedar is straighter, more symmetrical, has less butt rot and i stronger by tests made by the United States Forestry Servic than any other pole material on the market of equal lastin power. It is to correct this situation that the committee wa appointed, and steps will be taken at once to secure greate publicity for the merits of the Western pole.

Orders for Taylor Stokers.—The American Ship Winc lass Company, manufacturer of the Taylor stoker, reports re cent orders as follows: From the Hartford Electric Ligh Company, for two stokers; from the New York, New Haven Hartford Railroad Company (Bridgeport plant), for two stok ers; from the Solvay Process Company, for one stoker; fron the Columbia Shade Cloth Company, for three stokers for i plants at Chicago and Minetto, N. Y., and from the Fisk Rul ber Company, for one stoker. The first three of these ar repeat orders.

Field for Electrical Apparatus in Argentina.—The Ame ican Consulate-General at London states that a British publ cation reports a good demand in Argentina for all kinds o electrical apparatus in connection with lighting, heating, loc motion, telegraphy, telephony and motive power, particular for generators working at 110 volts and 65 volts. There a also good openings for continuous-current motors and far Further details can be obtained by applying to the Bureau o Manufactures, Washington, D. C., for Schedule 7563.

Panama Canal Motors.—A contract for trial motors f the miter gate-forcing machines to be used on the locks of t Panama Canal has been awarded to the Allis-Chalmers Cor pany. If these motors prove satisfactory upon test forty-tv additional machines may be purchased.

Terry Steam Turbine Company.—Among the forei orders recently received by the Terry Steam Turbine Compar 90 West Street, New York City, is one for three turbine-driv blowers for Chinese cruisers and one for a 15-kw turbo-ge erator set for Russia.

Financial.

The Week in Wall Street.

PUBLIC interest in the stock market is increasing steadily, due to growth of confidence in general business, with the result that conditions on the New York Stock Exchange are assuming a more cheerful aspect than has been the case for some weeks past. Prices are somewhat irregular, and the advances of the preceding week have not been sustained. There was very little in the day's news to stimulate the market on Monday, and a decline took place in both prices and volume of trading. Selling of Steel shares was the chief

NEW YORK.

	Nov. 8.	Nov. 14.	Shares Sold.		Nov. 8.	Nov. 14.	Shares Sold.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44	6,060
[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	54	[illegible]	91,670	Mackay C.,pf.	[illegible]	[illegible]	100
Am. D. T....	33⅛*	[illegible]	—	[illegible]	136*	135	215
[illegible]	33	[illegible]	[illegible]	[illegible]	15*	[illegible]	—
[illegible]	[illegible]	[illegible]	640	[illegible]	[illegible]	[illegible]	—
[illegible]	[illegible]	78	—	Steel, com...	[illegible]	62⅛	1,286,400
[illegible]	[illegible]	[illegible]	19,246	Steel, pfd....	[illegible]	109¼	26,900
B. R. T.....	77¼	[illegible]	26,430	W. U. T....	[illegible]	77¼	6,900
[illegible]	[illegible]	153	[illegible]	[illegible]	[illegible]	66	4,400
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100

PHILADELPHIA.

	Nov. 8.	Nov. 14.		Nov. 8.	Nov. 14.
[illegible] Rys.........	44	45	Phila. R. T...	[illegible]	23
El. Co. of [illegible]......	12	12	Phila. Elec....	[illegible]	16⅛
Elec. St. Bt'y......	[illegible]	53½*	Phila. Trac...	84⅜	[illegible]
Elec. St. Bt'y, pf	30*	30*	[illegible]	[illegible]	[illegible]

CHICAGO.

	Nov. 8.	Nov. 14.		Nov. 8.	Nov. 14.
[illegible]	186*	186*	[illegible]	[illegible]	[illegible]
[illegible] Rys.....	[illegible]	30	Chi. Subway........	1	¼
[illegible] Rys., pf..	[illegible]	93	Chi. Telephone......	122*	123*
[illegible]	98	[illegible]	Nat'l Car...........	104*	105*
[illegible]	34	33	Nat'l Car, pf	[illegible]	118*

BOSTON.

	Nov. 8.	Nov. 14.		Nov. 8.	Nov. 14.
[illegible] T. & T. ..	138	138¾	Mex. [illegible]	[illegible]	3*
[illegible] Tel.	[illegible]	152	Mex. Tel., pf...	[illegible]	[illegible]
[illegible]	[illegible]	291	N. E. Tel......	.145½	[illegible]
[illegible]	[illegible]	[illegible]	W. T. & T.....	[illegible]	[illegible]
[illegible] Ry......	[illegible]	21	W. T. & T., pf.	[illegible]	[illegible]
[illegible] E. Ry., pf....	[illegible]	[illegible]			

[illegible]ist price quoted.
[illegible] for the week [illegible]

feature of the day, and reports of growth of traffic earnings seemed to be the only topic of any importance, indicating improvement in general trade. Irregularity was the characteristic of Tuesday's market. Declines took place in the early [illegible] and were followed by partial recovery upon an[illegible]ncement of details of the Commerce Court's decision hold[illegible] the long-and-short-haul ruling of the Interstate Commerce [illegible]mission to be constitutional. The best prices of the day [illegible]e made toward the close. The extent to which tariff leg[illegible]ion and the Sherman law will be taken up by Congress is a [illegible]ing item of discussion in the Street. Demand for bonds [illegible]nproving, and many offerings are attracting the investing [illegible]ublic. Present conditions abroad indicate that the large for[illegible]ign banks will enter the local money market for short-term [illegible]ans before long, in order to meet large settlements that will [illegible]e falling due before the end of the year. There is compara[illegible]vely little demand made upon the local market for funds at [illegible]resent, and no appreciable change has taken place in rates [illegible] last week. Rates Nov. 14 were: Call, 2¼@2½ per cent; [illegible]ty days, 3@3½ per cent. The quotations in the tables are [illegible] at the close Nov. 14.

Financial Notes.

Public Service Company of Northern Illinois.—A notable [illegible]dition to the electric-service companies of the country has [illegible]en made by the appearance of the Public Service Company [illegible] Northern Illinois, incorporated under the laws of Illinois, [illegible]ich on Nov. 11 acquired the business and properties of a [illegible]mber of central-station companies operating within a radius [illegible] about 100 miles from Chicago. As announced in previous [illegible]ues of the *Electrical World*, the plan has been in contemplation for some time, and the new company was incorporated several weeks ago. The names of the companies absorbed and their capital-stock issues are as follows: North Shore Electric Company, $5,000,000; Chicago Suburban Light & Power Company, $2,300,000; Economy Light & Power Company, $3,000,000; Illinois Valley Gas & Electric Company, $4,013,000 (preferred, $763,000, common, $3,250,000); Kankakee Gas & Electric Company, $1,000,000. Thus the total capital stock of these companies was $15,313,000. In return for the stock holdings enumerated in the foregoing list the owners of the stock of the old companies received from the new company $763,000 of 6 per cent preferred stock and $9,062,500 of common stock, making a total issue of new stock of both kinds of $9,825,500. In addition to this, the Public Service Company has in its treasury $500,000 of preferred stock and $1,000,000 of common stock. The capital stock of the new company distributed to stockholders is $5,487,500 less than the combined issued capital stock of the acquired properties. This is a rather remarkable fact, as frequently in combinations of this character the new issue is larger than the old one. It should also be mentioned that all shares of stock of the old companies, held by 748 shareholders, were voted in favor of the plan carried out. The properties were purchased subject to the existing bond issues of the several companies, which issues will now be closed. It is understood that a new first and refunding mortgage will be placed upon the merged properties. The bonds ($1,250,000) on the Illinois Valley Gas & Electric Company's property and the short-time notes ($2,000,000) issued against the Chicago Suburban Light & Power Company's property will be retired, the former at once and the latter on Feb. 1, 1912. The new company has sold $4,500,000 5 per cent first and refunding bonds, which will be devoted to acquiring the Illinois Valley Gas & Electric Company's bonds and the Chicago Suburban Light & Power Company's notes, and $1,250,000 of the bonds of the North Shore Electric Company and the Kankakee Gas & Electric Company, so that the entire amount of first and refunding bonds now sold by the new company will be used for refunding purposes. It is expected that the immediate future financing necessary to develop the new company's business will be done by the issue of additional preferred stock. The new company is authorized to issue $10,000,000 of preferred stock and $15,000,000 of common stock. The main office of the Public Service Company of Northern Illinois will be at 137 South La Salle Street, Chicago, where the offices of the North Shore Electric Company have been located. The North Shore company operated in the suburban area and rural communities north, west and south of Chicago. The Chicago Suburban Light & Power Company, of Oak Park, has been affiliated with it. The Economy Light & Power Company had its headquarters in Joliet, while the Illinois Valley Gas & Electric Company was farther west and south, Streator being one of its principal cities. The Kankakee company gave service in Kankakee and vicinity, 56 miles south of Chicago. The North Shore and Illinois Valley companies were the results of the absorption of a large number of small properties. The great new company is the outgrowth of a combination of many small companies with limited credit into one large concern with excellent credit. Samuel Insull, who was president of the North Shore, Economy and Illinois Valley companies, is the man who has brought about this result, which seems to typify a modern economic tendency. The business of the new company extends over a large portion of northern Illinois and embraces the distribution of electrical energy, gas, water, heating and the operation of a small street railway. The company has steam generating stations at Evanston, Waukegan, Oak Park, Maywood, Blue Island, Joliet, Kankakee, Streator, Lacon, Henry, Grand Ridge and Cornell, and water-power plants at Joliet, Kankakee and Wilmington. It has gas plants at Kankakee, Streator, Ottawa and Morris; waterworks at La Grange, Harvey and Oak Park; heating plants at Oak Park, Evanston and Waukegan, and the local street railway at Streator. It operates in over 100 different cities and villages and serves a population of about 366,000 people. It is estimated that the business for the coming year will exceed $3,500,000. The directors of the Public Service Company of Northern Illinois are Messrs. Frank J. Baker, Henry A. Blair, H. M. Byllesby, Louis A. Ferguson, William A. Fox, John F. Gilchrist, Samuel Insull, Frank G. Logan, Charles A. Munroe, John L. Norton, Charles H. Randle, Edward P. Russell and Solomon A. Smith. The officers are as follows: President, Samuel Insull; vice-presidents, Frank J. Baker and Charles A. Munroe; assistant to the presi-

dent, John F. Gilchrist; secretary and treasurer, John H. Gulick; assistant secretary and assistant treasurer, E. D. Alexander; auditor, A. S. Scott; general superintendent, George H. Lukes.

Standard Gas & Electric Company's Bonds Offered.—New York interests are offering $7,500,000 convertible 6 per cent sinking-fund gold bonds of the Standard Gas & Electric Company, which was organized in 1910 by H. M. Byllesby & Company, of Chicago, and owns stocks, bonds and other securities of fourteen public-service corporations situated in various parts of the country. These companies, operating in the States of Washington, Oregon, Idaho, Montana, California, Colorado, North Dakota, Minnesota, Wisconsin, Iowa, Oklahoma, Arkansas and Alabama, are, for the most part, under the direction of H. M. Byllesby & Company. The bonds now offered are dated Dec. 1, 1911, are due Dec. 1, 1926, and are secured by deposit and pledge with the trustee of securities of the underlying operating companies, with an approximate market value of $20,000,000. The capitalization of the Standard Gas & Electric Company upon the retirement of its $3,000,000 convertible 6 per cent bonds dated May 2, 1910, and its $1,850,000 6 per cent collateral trust notes, dated June 1, 1911, both of which issues have been or will be called for redemption, will consist of an authorized issue of $30,000,000 6 per cent sinking-fund gold bonds (present issue), with $7,500,000 outstanding; $30,000,000 preferred stock, paying 8 per cent, with $9,196,800 outstanding, and $15,000,000 common stock, with $7,468,150 outstanding. The convertible 6 per cent sinking-fund gold bonds are convertible at any time before maturity at the option of the holder into preferred stock of the Standard Gas & Electric Company on a basis of $110 of bonds for $100 of preferred stock, and are redeemable as a whole or in part at 105 and accrued interest on any interest day on sixty days' notice. Net income of the operating companies for the year ended Sept. 30, 1911, applicable to the securities now held by the Standard Gas & Electric Company was equal to about three and one-half times the $450,000 interest on these bonds.

Milwaukee Electric Railway & Light Company to Issue $90,000,000 Bonds.—The North American Company, New York, which controls the Milwaukee Electric Railway & Light Company, has announced that the Milwaukee company will execute a mortgage to cover a $90,000,000 bond issue, the proceeds of which will be used as needed to meet payments on improvements made and contemplated by the company. The statement of the North American Company concerning these bonds is as follows: "The Milwaukee Electric Railway & Light Company has had under consideration for some time past the execution of a new mortgage having an authorized issue of $90,000,000, a part of which is to be reserved to retire underlying bonds as they may become due, and the proceeds from the balance of which are to be used in part payment for improvements recently made and to be made in the future. This authorized issue of bonds has no relation to any other company than the Milwaukee Electric Railway & Light Company, and it is not the intention to effect a consolidation with the Milwaukee Electric Railway & Light Company of the other Wisconsin properties in which the North American company is interested. The issue of bonds under the proposed mortgage is subject to the approval of the Railroad Commission of Wisconsin." About $2,500,000 of these bonds, it is said, will be issued by the company very shortly and will be offered for sale by New York bankers.

Earnings of Pacific Telephone & Telegraph Company.—Gross earnings of the Pacific Telephone & Telegraph Company for the nine months ended Sept. 30, 1911, showed a gain of $983,225 and the surplus showed a decrease of $109,835 as compared with the corresponding items in the nine months ended Sept. 30, 1910. The gross income for the period was $11,326,724, as compared with $10,343,499, and operating expenses were $8,720,168, as compared with $8,067,404. Net earnings were $2,606,556, as against $2,276,095. Charges for the period were $1,639,182 and those in the 1910 period were $1,204,136, leaving surpluses available for dividends of $967,374 and $1,071,959 respectively. Dividends were $815,250, as compared with $810,000, and the surplus for the period was $152,124, as compared with $261,959 in the nine months ended Sept. 30, 1910.

Cumberland Telephone & Telegraph Company.—James E. Caldwell, president of the Cumberland Telephone & Telegraph Company, of Nashville, Tenn., has announced that arrangements have been completed to exchange stock of the Cumberland company for that of the American Telephone & Telegraph Company. Since the latter has held 51 per cent of the Cumberland company's stock since its formation, absorption by the Bell interests is indicated. The Cumberland Telephone & Telegraph Company operates in Kentucky, Tennessee, southern Indiana, Mississippi and Arkansas, and has a capital of $20,200,000.

Macon (Ga.) Railway & Light Company Sold.—Controlling interest in the Macon Railway & Light Company, of Macon, Ga., has been purchased by A. B. Leach & Company, bankers, of 149 Broadway, New York City, who are the principal owners of the Central Georgia Power Company. The company has 12,000 shares of stock outstanding, of which 3000 are preferred. The purchasers gave $732,000 for 6100 shares. Most of these were owned by W. J. Massee, president of the Macon company; by M. F. Hatcher, its vice-president, and by J. T. Moore and J. N. Neel.

Rochester Railway & Light Company to Issue Bonds.—The Public Service Commission for the Second District of New York has authorized the Rochester Railway & Light Company to issue $1,998,000 of its 5 per cent gold mortgage bonds dated July 1, 1904, and due July 1, 1954. These bonds are to be issued in exchange, par for par, for 5 per cent bonds of the Rochester Gas & Electric Company, due Nov. 1, 1912, as such bonds can be acquired by the Rochester Railway & Light Company.

Montreal Traction Merger Effected.—The negotiations toward an amalgamation of the Montreal Street Railway Company and the Montreal Tramways, mentioned in these columns Oct. 21 and 28, have been successful and the application of these companies to consolidate under the name of the Montreal Tramways Company has been approved by the Public Utilities Commission at Montreal.

Boston Edison's October Business.—The report of the Edison Electric Illuminating Company of Boston for the month of October shows gross earnings of $478,310, as compared with $427,636 in October, 1910. Expenses were $194,395, as compared with $183,855, and net earnings were $283,915, as compared with $243,781 in the corresponding month in 1910.

Earnings of Ohio Traction Companies.—Gross earnings of all the traction companies in the State of Ohio in the year ended June 30, 1911, as shown in the report of the Tax Commission at Columbus, Ohio, were $35,739,794, as against $33,143,852 in 1910, an increase of $2,595,942.

DIVIDENDS.

American Railways Company, quarterly, 1½ per cent, payable Dec. 15.

Georgia Railway & Electric Company, quarterly, 2 per cent payable Nov. 20.

Northern Ohio Traction & Light Company, quarterly, three fourths of 1 per cent, payable Dec. 15.

St. Joseph (Mo.) Railway, Light, Heat & Power Company quarterly, one-half of 1 per cent, payable Dec. 1.

REPORTS OF EARNINGS.

Period	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus
BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.					
Sept., 1911	$92,974	$42,889	$50,085	$31,464	$19,6
Sept., 1910	89,614	42,577	47,037	30,380	16,6
COLUMBUS ELECTRIC COMPANY.					
Sept., 1911	$41,816	$20,682	$21,134	$10,262	$10,87
Sept., 1910	39,236	16,710	22,526	17,908	4,61
DALLAS ELECTRIC CORPORATION.					
Sept., 1911	$131,249	$83,301	$47,948	$25,605	$22,34
Sept., 1910	119,804	75,538	44,266	26,014	18,25
EL PASO ELECTRIC COMPANY.					
Sept., 1911	$56,962	$31,514	$25,448	$8,340	$17,1
Sept., 1910	54,846	30,383	23,463	8,215	15,2
GALVESTON-HOUSTON ELECTRIC COMPANY.					
Sept., 1911	$130,685	$75,550	$55,135	$25,468	$29,6
Sept., 1910	110,145	63,308	46,837	26,199	20,6
NORTHERN TEXAS ELECTRIC COMPANY					
Sept., 1911	$136,089	$71,382	$64,707	$25,399	$39,3
[illegible]	118,192	61,594	56,598	19,689	36,9
PUGET SOUND ELECTRIC RAILWAY.					
Sept., 1911	$152,034	$91,218	$60,816	$51,643	$9,1
Sept., 1910	160,544	98,607	61,937	51,974	9,9
SAVANNAH ELECTRIC COMPANY.					
[illegible]	$58,428	$40,119	$18,309	$18,307	
[illegible]	51,598	32,606	18,992	18,157	8
SEATTLE ELECTRIC COMPANY.					
Sept., 1911	$443,639	$241,132	$202,507	$115,627	$86,8
Sept., 1910	481,157	274,704	206,453	110,933	95,5
SIERRA PACIFIC ELECTRIC COMPANY.					
[illegible]	$49,384	$20,136	$29,248	$4,377	$24,9
[illegible]	47,544	14,325	33,219	6,020	27,1
TAMPA ELECTRIC COMPANY.					
Sept., 1911	$56,840	$30,182	$26,658	$6,384	$20,2
[illegible]	44,969	23,910	21,059	6,018	15,0

General News

Construction News.

[illegible]IRMINGHAM, ALA.—The S[illegible] R[illegible], it is re[illegible], is con[illegible] extending its te[illegible] system between Chattanooga and K[illegible], on the Kn[illegible] division, a distance of 111 miles. B. H[illegible], 1300 Pennsylvania Avenue, N. W., Washington, D. C., is chief engineer.

[illegible]LAND, ALA.—The B[illegible] has [illegible] to Frank M. [illegible] and associates franchises to install and operate an electric-light [illegible] plant, a [illegible] and [illegible] a street railway [illegible]. Mr. Morris is [illegible] his obligations. In return for the franchise he agrees to pay the town [illegible] per cent of the net income from all sources and also to furnish considerable free service in the way of electricity, fuel, etc.

VALDEZ, ALASKA.—Plans are being prepared by the Gold Bullion Mining Company for the erection of a large electric-power plant to supply electricity to operate its mines. William Bartholf is manager.

[illegible], ARIZ.—The Insp[illegible] Company is [illegible] to [illegible] telephone system [illegible] Creek [illegible], a distance of about 18 miles. C. H. Repath is consulting engineer.

PHOENIX, ARIZ.—James E. Barker, engineer, of Los Angeles, Cal., engaged by the City Council to investigate the local electric-light system, has submitted a report recommending the establishment of a municipal electric-light plant, purchasing energy from the high-tension system of the Reclamation Service at not over 2 cents per kw-hour. The city's contract with the Pacific Gas & Electric Company has expired, although the company still holds an agreement to install a street-lighting sys[illegible] cost of $20,000.

ASHDOWN, ARK.—The City Council has granted the Texarkana Ice Company a twenty-five-year franchise to operate an electric-light system in Ashdown. The council also agrees to contract for street lighting, to cost $1,000 per year. The rate for arc lamps will be $8 each per month. The rate for commercial lighting will be $1 per month for one lamp, $1.50 for two lamps and 75 cents per month for each additional lamp. The charge for meter service will be 15 cents per kilowatt for the first 50 kw, 12 cents for the next 50 kw and 10 cents for all over 100 kw, with a minimum charge of $1 per month.

EARLE, ARK.—The City Council has granted franchises to James Z. George, of Memphis, Tenn., to construct and operate an electric-light plant and water-works system in Earle. The city formerly owned the water-works, but sold the entire system to Mr. George, who proposes to enlarge and improve the same. Through oversight this item appeared under Earle, Kan., in the issue of Nov. 11.

BRAWLEY, CAL.—The Bernice Water Company, recently incorporated with a capital stock of $450,000, is preparing plans for the erection of a hydroelectric-power plant on the Alamo River. W. H. Best and Frank Salisbury are directors of the company.

COALINGA, CAL.—The Coalinga Water & Electric Company is planning to extend its transmission lines into the East Side fields, via Pleas[illegible] Valley district, to supply electricity for operating pumps for irri[illegible]g purposes.

[illegible]LTON, CAL.—The Southern California Edison Company has been [illegible]led the contract for street lighting in Colton.

[illegible]AIR OAKS, CAL.—The Stockton Electric Railroad Company, it is [illegible]rted, is contemplating extending its system into Fair Oaks.

[illegible]RESTVILLE, CAL.—The Petaluma & Santa Rosa Electric Rail[illegible] Company is contemplating extending its system from Forestville [illegible]aldsburg, a distance of about 15 miles.

[illegible]LLERTON, CAL.—The Standard Oil Company, it is said, is plan[illegible] to install an electric-light plant on its oil properties near Fullerton.

[illegible]OVELAND, CAL.—The installation of new electric hoisting ma[illegible]ery at the Slap Jack Mine is under consideration. Richard Pierce [illegible]anager.

HUNTINGTON PARK, CAL.—It is reported that an election will held on Nov. 28 to submit the proposition to issue $110,000 in bonds, proceeds to be used for the construction of a municipal electric-[illegible]t plant and water-works system and to provide for fire protection, [illegible] vote of the people.

[illegible]AKEPORT, CAL.—Preparations are being made by the Clear Lake [illegible]ay Company, recently incorporated, to construct an electric railway [illegible] Lakeport to Hopland, a distance of about 9 miles.

LOS ANGELES, CAL.—The Fire Commission has instructed its [illegible]perintendent to provide for the installation of a private telephone sys[illegible]n at San Pedro Harbor, to be used in connection with the salt-water [illegible]vice and fireboats.

LOS ANGELES, CAL.—The Pacific Light & Power Company has [illegible]en out a permit to make alterations and improvements to its power [illegible]nt on East Third Street. Contract for the work has been awarded [illegible] the Mersereau Bridge & Construction Company, of Los Angeles, Cal.

LOS ANGELES, CAL.—The Pacific Light & Power Corporation has filed papers with the county clerk authorizing a bond issue of $35,000,000. Of this amount $9,000,000 will be used to guarantee the underlying bonds of the company, and the remainder for the construction work in connection with its proposed power plant on Big Creek, San Joaquin Valley, and for extension of its transmission and distributing system in Los Angeles and vicinity.

MADERA, CAL.—The Pacific Telephone & Telegraph Company is planning to remove its poles on Yosemite Avenue from B to H Street and will install an underground conduit system, the cost of which is estimated at $10,000.

MADERA, CAL.—Plans are being considered by the Madera Canal & Irrigation Company for the installation of a hydroelectric power plant to supply electricity for operating pumps in connection with its large irrigation project. The cost of the work is estimated at $5,000,000. I. Tellman, of Fresno, Cal., engineer, is interested in the company.

NAPA, CAL.—Preparations are being made by the Napa Gas & Electric Company for extensive improvements to its system in Napa.

OAKLAND, CAL.—The Oakland & Antioch Electric Railway Company has executed a mortgage in favor of the Union Trust Company. The mortgage covers all the property of the company extending from Oakland to Antioch and Stockton. Bonds issued under this mortgage will be used for construction work.

ORANGE, CAL.—The Board of Trustees has entered into a contract with the Southern California Edison Company for the installation of 100 additional tungsten lamps in connection with the street-lighting system.

ORDWAY, CAL.—Preparations are being made to enlarge and improve the power plant of the Ordway Electric Light & Power Company, involving an expenditure of about $7,000. A twenty-four-hour service will be established soon after the first of the year.

POMONA, CAL.—Plans are being considered by property owners on South Thomas Street, between First and Fifth Streets, for the installation of an ornamental street-lighting system at their own expense.

PORTERVILLE, CAL.—Owing to the new regulations adopted by the Underwriters of the Pacific and the new regulations which have been made obligatory upon light and power public-service corporations through new legislation which went into effect Oct. 22, the Mount Whitney Power Company will be obliged to rebuild its entire distributing system within five years. The company is preparing to erect ornamental lamp standards on Sunnyside Avenue.

RED BLUFF, CAL.—The Sacramento Valley Power Company is contemplating extending its transmission lines from the Cofer district to Jelly's Ferry to supply electricity for dredging purposes.

SACRAMENTO, CAL.—The Board of City Trustees has granted the Sacramento Electric Gas & Railway Company a franchise to build an electric railway on Third, E, K and T Streets. Under the terms of the franchise the company is to pay the city 2 per cent of its gross receipts after the first five years. The agreement also calls for the erection of ornamental iron poles and grooved rails.

SAN BERNARDINO, CAL.—A deal has been closed whereby the Southern Sierras Power Company has purchased the property of the Lytle Creek Power Company in San Bernardino. The price paid for the plant is said to be $160,000. The Southern Sierras Power Company has awarded the contract for the erection of distributing lines in Riverside and San Bernardino Counties to H. M. French, of Los Angeles, Cal. It is understood that the system of the Lytle Creek Power Company will be used as a nucleus for a complete distributing system in San Bernardino and surrounding country.

SAN DIEGO, CAL.—The Home Telephone Company is contemplating the erection of three new trunk lines to El Cajon and four new lines to La Mesa.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded a contract for furnishing lighting fixtures for the Hall of Justice to Adams & Holopeter, of San Francisco, Cal., for $14,395.

SAN FRANCISCO, CAL.—The contract for electrical work for the new hotel and theater building for the Down Town Realty Company has been awarded to A. E. Brooke Ridley and the Metropolitan Construction Company, for $8,462.

SAN FRANCISCO, CAL.—The property of the San Francisco, Vallejo & Napa Valley Electric Railway Company was purchased at public auction on Oct. 30 by the bondholders' reorganization committee for $700,000. The company will be reorganized and will operate the system, which extends from Benicia to St. Helena, a distance of 30 miles.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company has announced that it proposes to enter into competition for lighting contracts in all the bay cities. The steam-power plant of the company at North Beach is said to have an output of $25,000 hp, while the auxiliary plant in Bryant Street generates 3000 hp. The hydroelectric plant on the Stanislaus River has an output of 48,000 hp and

[illegible] has recently invaded Berkeley and Oakland. The United Railroads of San Francisco takes 25,000 hp under contract. Both companies are subsidiaries of the United Railways Investment Company.

TAFT, CAL.—The San Joaquin Light & Power Company has signed contracts with the Maricopa Queen Oil Company and the Eagle Creek Company for the installation of electric light and power systems on their leases. Both companies will have their plants lighted throughout with electricity and arrangements are being made to operate the pumps with electricity.

TROPICO, CAL.—E. S. Ayres, Builders' Exchange, Los Angeles, Cal., is reported to have submitted a bid for the installation of an electric-light system in Tropico. It is expected that the Board of Trustees will vote favorably on the proposition.

VENICE, CAL.—Plans are being considered by the Council for the installation of an ornamental street-lighting system, with concrete standards. The standards will be manufactured by the city from designs made by City Engineer Lewis and sold to property owners at cost, which is estimated at about $9 each. Electricity for maintaining the lamps will be supplied by the city.

CANON CITY, COL.—Plans are being considered for organizing a new company under the name of the Arkansas Valley Railway, Light & Power Company, which, it is understood, will be controlled by interests connected with H. M. Byllesby & Company, of Chicago, Ill. It is stated that the company will have charge of the Cañon City property and other interests and plants in the Arkansas Valley. W. F. Raber, E. D. Spruill and F. W. Insull are interested in the project.

FORT LUPTON, COL.—The question of operating the pumps at the new water-works station by electricity instead of a gasoline engine is under consideration. It is now thought that the present engine will not be able to furnish sufficient power.

GREELEY, COL.—The Greeley Hydro-Electric Company, recently incorporated, has taken over the electric-power plant located near the Poudre River and used for boring the Laramie-Poudre tunnel. The new company is capitalized at $700,000 and will utilize 500 hp available from the Laramie River tunnel flow and the natural flow of the Poudre River to supply electricity in Greeley and surrounding territory. At present the plant has an output of 400 hp. The transmission line will be 70 miles in length and will cost $900 per mile. It is expected to have the plant completed by April, 1912. D. A. Camfield, A. J. Condon, D. R. McArthur, W. D. Miller, Frank Abbott, C. A. Fitch and John Camfield are the incorporators.

IDAHO SPRINGS, COL.—Plans are being considered for the construction of an electric-power plant at the Dorritt mine, to supply electricity for lamps and motors for the mine. F. L. Patrick is manager.

ROCKY FORD, COL.—Preparations are being made by H. M. Byllesby & Company, of Chicago, Ill., owners of the Pueblo, Rocky Ford and La Junta electric plants, for the erection of a high-tension transmission line, which is to extend down the valley. F. Y. Lowe is chief electrical engineer of H. M. Byllesby & Company. T. C. Roberts is superintendent of the Pueblo plant.

NEW HAVEN, CONN.—A permit has been granted to the Connecticut Company to construct additions to its power house on Grand Avenue. The additional space will be used as an engine-room. Several new engines and boilers will be installed. The cost of the work is estimated at about $25,000.

SOUTH NORWALK, CONN.—The annual report of the municipal electric-light plant shows a gross profit of $26,417 for the year. A substantial reduction will be made in the rates for both lamps and motors with the beginning of the new fiscal year. The Electric Light Commission is contemplating replacing arc lamps with tungsten lamps in order to extend and improve the street-lighting system without being obliged to make extensions to the plant, which has almost reached the limit of its capacity to generate electricity for the street-lighting service.

BUNNELL, FLA.—An electric-light plant is being installed in Bunnell, which will supply electricity for the entire town. It is expected to have the system in operation within sixty days.

ST. AUGUSTINE, FLA.—The St. Johns Electric Company, recently incorporated, will take over the property of the St. Johns Light & Power Company, including the local electric-light and power plant and street-railway system. It is expected that the new management will make improvements to the power plant and extensions to the street car service. The officers of the new company are: W. M. Bostwick, Jr., of Jacksonville, president; O. H. P. Fant, of St. Augustine, vice-president, and B. E. Dyson, of St. Augustine, secretary and treasurer.

BAXLEY, GA.—The $15,000 bond issue recently voted by the citizens for the installation of a municipal electric-light plant has been validated. The Lyon Electric Company, of Jacksonville, Fla., has been engaged to supervise the work.

LA FAYETTE, GA.—The Georgia Power Company is contemplating erecting a transmission line to Lyerly, Summerville, La Fayette and Chickamauga.

MACON, GA.—The Georgia Light, Power & Railways Company is reported to have purchased the controlling interest of the Macon Railway & Light Company, the property of the Central Georgia Power Company, and will also own the stock of the Central Georgia Gas Company. Application has been made to the Council for a franchise. The company is also planning to erect a transmission line for the Georgia power company from its present terminal in Griffin, Ga., into Atlanta.

MARSHALLVILLE, GA.—The contract for the installation of an electric-light plant and water-works system in Marshallville has been awarded to J. C. Walker.

TOCCOA, GA.—It is reported that the Capps Cotton Mill Company is contemplating the construction of another dam on upper Toccoa Creek for power purposes. The company purposes to equip its plant for electric-motor drive. It is understood that motors have already been purchased.

BOISE, IDAHO.—The Idaho-Oregon Light & Power Company has taken over the property of the Boise Valley Railway Company. The transaction is said to involve about $1,000,000. Interests representing the Beaver River Power Company and the Telluride Power Company are said to be identified with the interest backing the consolidation.

BOISE, IDAHO.—Proposals will be received by the Crane Falls Power & Irrigation Company for construction of dam, power house and pumping station on the Snake River in Southern Idaho until Dec. 10. Plans and specifications may be seen after Dec. 1 at the offices of Smith, Kerry & Chace, Lewis Building, Portland, Ore., and Winch Building, Vancouver, B. C., and also at the office of the company at Boise, Idaho. The company will arrange for its representative to accompany responsible contractors to the site of the works near Mountain Home and Caldwell.

DIXIE, IDAHO.—The Idaho Realty, Power & Mines Company is contemplating the installation of an electric-power plant in Dixie, with a local distributing system. S. R. Gayton is manager.

WALLACE, IDAHO.—The Washington Water Power Company is extending its transmission line to the Sunset country. It is believed that the line will eventually be extended to Murray and the north side. The company has commenced work on clearing its right of way for its proposed transmission line into the Cœur d'Alene district. The line will be 130 miles in length and will serve many of the mining properties in this district.

ALEDO, ILL.—The Central Union Telephone Company is contemplating the erection of a toll line between Aledo and New Boston. A. J. Beverlin, of Rock Island, Ill., is manager.

BATAVIA, ILL.—The Chicago Telephone Company, it is reported is contemplating the construction of a new exchange building in Batavia, at a cost of $40,000, and the installation of a new switchboard, costing $16,000.

CHAMPAIGN, ILL.—The City Council has ordered a special electior to be held Dec. 12 to submit to a vote of the people the proposition tc issue $35,000 in bonds, the proceeds to be used for the installation o t new electric-light plant to be owned and operated by the municipality

DIXON, ILL.—The Lee County Lighting Company has announced a reduction in rates for electricity to take effect from Nov. 1, amountin; to practically 20 per cent. Under the new schedule the rate for the firs 100 kw-hours is 12 cents per kw-hour; the second 100 kw-hours, cents, and the third 100 kw-hours, 7 cents. Some alterations to th service will be made. A contract has been tentatively agreed upo between the City Council and the company which calls for the installa tion of 60-watt tungsten lamps in the residence district and new mag netite direct-current, 4.4-amp. arc lamps in the business section. Unde the terms of the contract the city will pay $70 each per year for a lamps and $16 per year for tungsten lamps, with all-night service. Tl contract is for a period of five years and will necessitate the rebuildi of many circuits.

GALESBURG, ILL.—The Purington Paving Brick Company, it is r ported, will install electric transfer trucks throughout its entire plan

GENEVA, ILL.—The City Council has authorized the city clerk advertise for bids for equipment (60-cycle system) for the municip electric-light plant. The proposed apparatus will include a new engin boiler and generator, to cost approximately $18,000.

GENEVA, ILL.—F. B. Kendrick, of the MacMillan Company, h notified the City Council that it will not be able to utilize more th 150 hp of the 250 hp to be developed by the water-power at its facto and has asked the city to aid in disposing of this surplus, either by taki it for municipal use or by granting the company a franchise to s electricity. The MacMillan Company has employed City Engineer We to make a survey of the city streets with a view of seeking a contr to supply energy to light the streets of the city.

GEORGETOWN, ILL.—The Georgetown Electric Light Company l petitioned the City Council for a ten-year extension of its franchi which has five years to run. The company is contemplating substitut tungsten lamps for the arc lamps now in use for lighting the streets.

LA SALLE, ILL.—The report submitted by D. W. Mead, of Madis Wis., engineer, engaged by the City Council to investigate the munici electric-light plant, states that the plant is antiquated and its operat inefficient and unsatisfactory, and also that the whole electrical generat equipment and the arc lamps must be replaced at an early date by m modern apparatus. He recommends the installation of magnetite lamps and the erection of ornamental lamp standards carrying tungs lamps for the main streets. Two generators and one new engine changes in the wiring will be necessary. The cost of the arc-lamp eq ment is estimated at $13,424 and that of the incandescent lighting tem at $7,700.

MACOMB, ILL.—[illegible] & Power Company contemplates extending its transmission line to Colchester to supply electricity in that town. The plant of the Colchester Electric Light & Power [illegible] recently [illegible].

MATTOON, ILL.—The City Council has authorized the light committee and the Mayor to purchase one new 4-amp Brush arc generator, [illegible] lamps [illegible] cost of $[illegible] each [illegible] been received.

NORMAL, ILL.—[illegible] contract with [illegible] & Normal [illegible] for lighting the [illegible].

PEKIN, ILL.—Plans are being considered for the installation of an ornamental street-lighting system in the business district of the city. Seibert Brothers are interested in the project.

PEORIA, ILL.—The Peoria Gas & Electric Company contemplates [illegible] Washington [illegible] Mackinaw [illegible].

PEORIA, ILL.—A proposition has been submitted to the City Council by the River and Lakes Commission of the State of Illinois offering to [illegible] electricity in Peoria at a much reduced rate. The scheme is con[illegible] deep waterway on the Illinois River and the [illegible] commission contemplates the transmission of [illegible]lectricity within a radius of 160 miles from the principal power house. It is estimated that energy can be supplied in Peoria at from $15 to $20 [illegible].

PEORIA, ILL.—The Peoria Gas & Electric Company has secured a [illegible]rmit to erect a transmission line across the Pekin and Lamarsh drain[illegible] to supply electricity in Pekin. The company has also entered into a [illegible]ct with the Lamarsh Drainage Commissioners to supply power to [illegible]te the pumping station across the river when the Pekin plant is [illegible]able to supply the service. Owing to the increasing demand for elec[illegible]rical service the Citizens' Gas & Electric Company has made arrange[illegible]ments to secure additional power from the Peoria company.

[illegible], ILL.—The Mississippi Valley Power Company [illegible] purpose [illegible] establishing a substation in the Walton Heights [illegible]on to Quincy for the distribution of electricity generated at the [illegible]eokuk dam in Quincy and vicinity.

SAYBROOK, ILL.—The local telephone system has been purchased [illegible] Brothers, who operate [illegible] exchange [illegible]. The [illegible]wo systems will be connected.

[illegible]INGFIELD, ILL.—The City Commission [illegible] to the [illegible]eral Electric Company, of Schenectady, N. Y., a contract for two [illegible]ransformers and fifty magnetite arc lamps, at $2,800.

STREATOR, ILL.—Plans are being considered for the installation of a new street-lighting system in Streator. Two propositions have been submitted by the Illinois Valley Gas & Electric Company. One is to [illegible] magnetite arc lamps in the business portion of the city and [illegible]ngsten lamps for the residential sections. The other plan is to use [illegible]etite arc lamps throughout the city.

[illegible]AZIL, IND.—Preparations are being made by the Terre Haute, [illegible]napolis & Eastern Traction Company for the installation of orna[illegible]l cluster lamps in Brazil. The company recently secured the [illegible]ct to light the streets of the city.

JONESBORO, IND.—The Town Board is considering the question of [illegible]hanging the present street-lighting system. At present arc lamps are [illegible]sed. The franchise of the Marion Light & Heating Company expired [illegible]1, and the question of granting a new franchise and street-lighting [illegible] is under consideration. The franchise for furnishing elec[illegible] for private consumers in Jonesboro is separate from the street-[illegible]g franchise and will not expire for a number of years.

[illegible], IND.—It is reported that [illegible] are being made for the [illegible]ion of cluster lamps, six to a block, in the business district. Elec[illegible] the lamps will be supplied free of charge from the [illegible]ipal electric-light plant.

[illegible]TERSBURG, IND.—The Evansville Gas & Electric Light Company [illegible]ubmitted a proposition to the City Council asking that the company [illegible]nted the franchise which the city will let early in 1912, in return [illegible]ich the company agrees to supply electricity to the town at rates [illegible]ill mean a saving of $22,500 in ten years. The Petersburg Electric Company now has the franchise, and if it will offer as favorable [illegible] as the Evansville company it will be granted the franchise for [illegible] years.

[illegible]LASKI, IND.—The Central Indiana Water, Light, Heat & Power [illegible]npany has purchased the dam and water rights in Pulaski. It is [illegible]oposed to rebuild the dam. The power station will be erected a short [illegible]stance up the river from the Pulaski mill. Electricity generated at [illegible] plant will be transmitted to Star City, Francesville, Medaryville and [illegible]onon. An auxiliary power station will be built at Francesville. The [illegible]mpany is capitalized at $125,000

RISING SUN, IND.—Steps have been taken toward the promotion of [illegible] traction line to connect Rising Sun with Aurora on the Ohio River, [illegible]th the ultimate destination of Louisville, Ky., and Cincinnati, Ohio. [illegible]cal capitalists have been asked to subscribe to $10,000 in capital stock. [illegible]ymond Zeisler, of Chicago, Ill., is said to be interested in the project.

SALEM, IND.—The Salem Electric Light & Artificial Ice Company [illegible] increased its capital stock by $15,000, the proceeds to be used for [illegible]rs, enlarging the plant and installing new equipment.

BOONE, IA.—The Boone Electric Company is reported to have been [illegible] plant in Boone.

BOYDEN, IA.—The City Council is reported to have granted a franchise to T. H. and J. J. Veenschoten to install an electric-light plant in Boyden.

BURLINGTON, IA.—The power plant of the People's Gas & Electric Company was damaged by fire on Nov. 5. The lighting system was wrecked and the street-car traffic was suspended.

FORT DODGE, IA.—Plans are being considered to erect a hydroelectric power plant on the Des Moines River, about 15 miles below Fort Dodge. The project is being promoted by Geis Botsford and Mr. Martin, who propose to supply electricty generated at the plant to the city of Fort Dodge. It is estimated that a minimum of 4000 hp could be developed by a 40-ft. dam. The cost of the plant, including an auxiliary steam plant for use in emergencies and during the low-water periods, is estimated at about $600,000.

GLIDDEN, IA.—At an election held Nov. 10 the proposition to issue $10,000 in bonds, the proceeds to be used for the construction of an electric-light plant, was carried. O. B. Moorehouse is clerk.

PILOT MOUND, IA.—The Twogood Construction Company has been granted a franchise to construct and operate an electric light and power plant in Pilot Mound.

VILLISCA, IA.—The Lee Electric Company, of Clarinda, Ia., has applied for a franchise to furnish electricity for lamps in Villisca.

SOLOMON, KAN.—The proposition to issue $30,000 for the installation of an electric-light plant and water-works system was defeated. The bonds were voted last year, but were irregular and declared void.

FALMOUTH, KY.—At an election held recently the citizens voted to establish a municipal electric-light plant in Falmouth.

SOMERSET, KY.—It is reported that the United Water & Light Company is contemplating the installation of an additional engine in its electric-light plant.

HOMER, LA.—The electric-light plant which the town purchased from E. G. Sawyers has been removed to the power house of the water-works company.

DOVER, MAINE.—The Greenville Light & Power Company, which recently purchased the property of the Dover & Foxcroft Light & Heat Company, it is understood, will discard the flat-rate system and install meters in all places where electricity is used in both towns.

FREEPORT, MAINE.—Orders have been placed by the Portland & Brunswick Street Railway Company for a motor-generator set so as to utilize electricity from the Brunswick plant to opèrate the Freeport system.

LEWISTON, MAINE.—The Merchants' Association is considering the question of installing an ornamental street-lighting system in the business district of the city.

BALTIMORE, MD.—The city, it is reported, is contemplating the installation of a plant in the high-pressure pipe-line station on South Street to supply electricity for lighting, heating the city hall and court house. The cost of the plant is estimated at $70,000. H. K. McCay is city engineer.

AMHERST, MASS.—The Amherst Gas Company has applied to the Massachusetts Gas and Electric Light Commission for permission to issue $50,000 in additional capital stock.

GREENFIELD, MASS.—The County Commissioners have approved of the plans for two of the dams to be built by Chace & Harriman on the Deerfield River, subject to the recommendations of James L. Tighe, consulting engineer. The plans approved are for the construction of Dams Nos. 2 and 4, the former to be built 2½ miles down the river from Shelburne Falls, and the latter in the vicinity of Shelburne Falls, between Buckland and Charlemont.

HAVERHILL, MASS.—The Haverhill Electric Company has placed an order for a Westinghouse-Parsons 3350-hp steam turbo generator set for its power plant, located on Water Street.

MALDEN, MASS.—The Malden Electric Company has notified the Street and Water Commission that a reduction will be made in the price of street lamps pending the approval of the new ten-year contract between the city of Malden and the Malden Electric Company. The price of arc lamps is reduced from $100 to $96 each per year, and that of incandescent lamps from $20.30 to $18.30 each per year. This rate applies to the lamps now in use only. The new street-lighting contract has been referred to the Massachusetts Gas and Electric Commission.

WAREHAM, MASS.—Application will be made to the town to appropriate funds for an extension of the electric-lighting system from South Wareham to Haggerty's Corner at Briggs' Lane above Tremont Village.

MENDON, MICH.—At an election held recently the citizens voted to accept the proposition submitted by the town of Sturgis to supply electricity to operate the local system. In 1908 the town voted to appropriate $10,000 to purchase the Parkville dam and water-power, located 6 miles west of Mendon. After spending most of the appropriation in erecting a transmission line and putting in a new flume it was found that sufficient power could not be developed to light the town. It was decided to appropriate an additional $1,000 to complete the project, which was voted down at a special election held about a year ago. It costs about $100 per month above the revenue to operate the present steam plant,

[illegible] over the plant and holdings of the Harris Electric Company on the first of January. The price paid for the property is understood to be about $25,000. It is expected that the new owners will make improvements and extensions to the system.

MUSKEGON, MICH.—Plans are being considered by the business men on Western Avenue to install cluster lamps on Western Avenue between Pine Street and Union Depot. It is proposed to erect sixty-four clusters between these two points at a cost of about $2,500, the expense to be borne by the business men. The city will be asked to maintain the lamps.

BRAINERD, MINN.—[illegible] is contemplating extending the electric-lighting system to the mill district.

CLARE CITY, MINN.—Application has been made to the City Council by H. Schmidt, of the Peterson-Tetrun Electric Lighting & Battery system, of Dawson, Minn., for a franchise to install an electric light and power plant in Clara City.

FRANKLIN, MINN.—The Wherland Electric Company, of Redwood Falls, Minn., has been granted a franchise to supply electricity in Franklin. It is understood that the company purposes to extend its lines to Franklin in the spring.

HIBBING, MINN.—The Water Power, Light and Building Commission favors acquiring the Brooklyn water mains and the electric-light distributing system owned by A. P. Silliman. The cost of the Brooklyn water mains, etc., is estimated at $13,600 and that of the electric transmission line at $4,000. These estimates do not include the Brooklyn power plant, owned and operated by Mr. Silliman. The commission does not contemplate the purchase of the power plant, but simply to purchase the water mains and electric lines and connect them with the Hibbing system. The total cost of the project is estimated at about $[illegible] Brooklyn is an incorporated limits of Hibbing, having been annexed to this town in April, 1910.

MINNEAPOLIS, MINN.—A proposition has been submitted to the public lighting committee of the City Council by the Minneapolis General Electric Company offering to install at its own expense 150 ornamental street lamps in the railroad passenger-station district, provided the city gives a contract to supply electricity to maintain the lamps at $48 each per year, and that the minimum number of ornamental lamps shall be not less than 565.

RED LAKE FALLS, MINN.—The Red River Power Company is reported to have applied for a new franchise in Red Lake Falls.

SWANVILLE, MINN.—John Stroming, of Swanville, is reported to have purchased the P. W. Blake private telephone line in Lastrup. It is understood that the line will be extended 15 miles.

WINONA, MINN.—Application has been made to the City Council by Howard Morris, receiver of the Winona Railway & Light Company, for permission to make new direct water connection to the company's plant to assure a sufficient water supply at all times. It is proposed to build two large intake mains, at a cost of about $25,000.

LAUREL, MISS.—The Laurel Electric Light & Power Company, recently incorporated with a capital stock of $75,000, will take over the local electric-light plant and street-railway system. P. H. Saunders, S. M. Jones and Herbert Lampe are among the incorporators.

GRANT CITY, MO.—The local electric-light plant is reported to have been purchased by George B. Wilson.

LAMAR, MO.—It is reported that bonds to the amount of $70,000 have been voted, the proceeds to be used for the construction of an electric-light plant and water-works system.

DILLON, MONT.—The City Council is considering the question of installing a new street-lighting system, using cluster lamps in the business district. It is estimated that seventy-lamp standards will be required. The Union Electric Light Company agrees to install the system, provided the property owners furnish the standards. If the system is satisfactory the lamps will be extended to the residence section. At present arc lamps are used.

KALISPELL, MONT.—Contracts have been awarded for the construction of the first section of the Flathead Interurban Railway.

BLADEN, NEB.—Work has commenced on the installation of an electric-light plant in Bladen. Electricity for operating the system will be obtained from the plant in Blue Hill.

GOLDFIELD, NEV.—The Goldfield Belmont Mining Company is planning to install electric hoisting machinery.

RENO, NEV.—Plans are being considered by the Reno Traction Company to build an extension of its electric railway from Sparks to the [illegible] Wedekind district.

TONOPAH, NEV.—The Tonopah Mining Company, operating the Aurora mines, is contemplating the installation of new electric pumping machinery.

ASHUELOT, N. H.—The Public Service Commission has authorized the Ashuelot Electric Company to issue $140,000 in capital stock and has given it permission to purchase the property of the Keene Gas & Electric Company in Ashuelot.

ATLANTIC CITY, N. J.—Plans are being considered by the Atlantic Coast Electric Railroad Company for extending its system through the western part of the State encampment grounds at Sea Girt for the purpose of connecting Manasquan and Sea Girt.

NEWARK, N. J.—Sealed [illegible] Education of Newark, N. J., until Nov. 21 for furnishing energy-transmission machinery and gymnasium apparatus for various school buildings, etc., in accordance with specifications on file in the office of the department of supplies. R. D. Argue is secretary.

WAGON MOUND, N. M.—The Ranchers' Telephone Company, recently incorporated, is planning to install a telephone system in this district. R. K. Odell, S. M. Reiland and S. Foutz are incorporators. Mr. Odell is manager.

ALBANY, N. Y.—Sealed proposals will be received by the Board of Contract and Supply, City Hall, Albany, N. Y., until Nov. 20 for furnishing three 15-kw direct-current turbo generators for the Bureau of Water. Forms of proposals and specifications can be seen at the above office. Isidore Wachman is secretary of board.

BOLTON LANDING, N. Y.—The Bolton Light, Heat & Power Company has received authority from the Public Service Commission, Second District, to issue capital stock to the amount of $12,500, the proceeds to be applied for extensions and improvements to its plant and distributing system.

BUFFALO, N. Y.—The Chippewa Business Men and Taxpayers' Association is considering the question of improving the street-lighting system on Chippewa Street.

DUNDEE, N. Y.—At a special election held recently the citizens voted against the proposition to increase the cost of street-lighting to $2,000 per year. For the last two years the town has paid $1,800 for the service. E. L. Bailey, owner of the local plant, has threatened to discontinue the street-lighting service unless a new contract is made.

LAKEWOOD, N. Y.—The Public Service Commission, Second District, has authorized the Western New York Electric Company to exercise franchises granted it by the village of Lakewood and to begin work on construction of its electric-light plant in that village.

LESTERSHIRE, N. Y.—Steps have been taken by the Board of Aldermen for the installation of a new street-lighting system in Lestershire. The various corporations operating overhead wires have agreed to place them underground on Main Street.

LITTLE FALLS, N. Y.—Two propositions have been submitted to the City Council for lighting the streets of the city by N. R. Holmes, of Troy, N. Y., and H. P. Jones, electrical engineer, of Bennington, Vt. One calls for the city owning its own distributing system, for which they would supply electrical energy at the rate of $30 per lamp per year. The cost of the system is estimated at about $20,000, which would make the street lamps cost about $58 each per year. They also offered to supply street lamps at that price. The Utica Gas & Electric Company recently submitted a bid offering to supply street lamps at $82.13 each per year.

LYONS, N. Y.—Plans are being considered by the Rochester, Syracuse & Eastern Railroad Company to change the location of the pumping station of the power house in Lyons, the cost of which is estimated at about $40,000. The change is made necessary by the barge-canal plan, excavating for which in the vicinity of the power house will soon begin. A temporary station will be erected north of the present power house for use while the permanent station is being built. Ralph Kennard, of Brookline, Mass., electrical engineer, is in charge of the work.

PEARL RIVER, N. Y.—The Rockland Light & Power Company, of Nyack, N. Y., is extending its system to the Pearl River lighting district. It is expected to have the system in operation by Dec. 1.

PULASKI, N. Y.—The corporation having in charge the development of the water-power of the Salmon River has acquired the plant and holdings of the Pulaski Electric Light & Power Company, including valuable water-power. It is understood that the new company will make extensive improvements to the system. H. Clayton Burkett, present manager of the plant, will be retained.

SENECA FALLS, N. Y.—The Central New York Electric Company is installing an auxiliary plant in Seneca Falls, for use in case of emergencies.

SYRACUSE, N. Y.—The Rochester, Syracuse & Eastern Railroad Company is planning to change the location of the pumping station of its power station located in Lyons.

ELIZABETH CITY, N. C.—The Elizabeth City Electric Light Company is contemplating making improvements to its plant and installing additional machinery. R. E. Lewis is manager.

ANETA, N. D.—The citizens have voted to grant a franchise for the installation of an electric-light plant in Aneta. It is understood that work will begin at once on construction of the proposed plant.

DEVIL'S LAKE, N. D.—At an election held recently the proposition to issue bonds to the amount of $33,000 to be used as a basis for the establishment of municipal light and water plants was carried.

OAKES, N. D.—It is reported that F. L. Kempf, of McVille, N. D., is contemplating the installation of an electric-light plant in Oakes, to cost about $12,000, for which a franchise was recently granted.

PORTAL, N. D.—The Town Board of North Portal is contemplating the installation of an electric street-lighting system.

CLEVELAND, OHIO.—At an election held Nov. 7 the proposition to issue $2,000,000 in bonds for the erection of a municipal electric-light plant was carried.

COLUMBUS, OHIO.—The contract for furnishing iron lamp standards [illegible] lighting system has been awarded to O'Brien Brothers

[illegible] Foundry Company [illegible] awarded the contract [illegible]

CONVOY, OHIO.—The installation of an electric-light plant to be owned and operated by [illegible]

DEFIANCE, OHIO.—Steps have been taken by T. T. Ansberry to organize a public utilities company to purchase electricity from the Auglaize River Power Company for distribution in Defiance City and nearby towns. The Auglaize River Power Company expects to develop about 10,000 hp, which it purposes to sell in large quantities to large manufacturing plants or public utilities companies.

[illegible] OHIO [illegible] Electric [illegible] & Power Company [illegible] The proceeds will be used to erect a transmission line from Greenville to [illegible], Eldorado, West M[illegible]

SALEM, OHIO.—The question of issuing $20,000 in bonds for the installation of an electric distributing system is under consideration.

WILLOUGHBY, OHIO.—The Cleveland, Painesville & Eastern Railway Company is enlarging its power plant [illegible] the operating voltage from 13,200 to 22,000. Orders have been placed by the company [illegible] Westinghouse Machine Company [illegible] two [illegible] kw [illegible] two [illegible] kw, 6600-volt turbo-generator units. The new equipment will furnish energy for the street and interurban system of the company.

OKLAHOMA CITY, OKLA.—Plans are being considered for replacing arc lamps at every other street intersection with tungsten lamps. By this change it is hoped to make a large reduction in the cost of street lighting. The cost of the present system is $32,400 per year and it is expected that the use of tungsten lamps will reduce the cost to about [illegible] per year.

PONCA, OKLA.—Henry A. Braun, of Guthrie, Okla., it is reported, is contemplating the installation of an electric-light plant in Ponca.

BEND, ORE.—The Arnold Irrigation Company contemplates the construction of a telephone system to serve the entire territory in which it operates. W. J. McGillvray is interested in the company.

CRESCENT, ORE.—The Oro del Norte Mining Company is planning to install the Heinz electric flotation process for the extraction of fine gold from sand. The cost of the plant is estimated at $75,000.

EUGENE, ORE.—Bids will be received by the city recorder of the city of Eugene, Ore., until Dec. 11 for the purchase of $57,000 light, power and water bonds. R. S. Bryson is recorder.

GRANT'S PASS, ORE.—M. J. Anderson is at the head of a corporation which proposes to erect a large hydroelectric power plant on the Coquille River in Coos County. A transmission system will be erected [illegible] the entire territory. The cost of the project is estimated at $1,000,000.

HOOD RIVER, ORE.—The Hydro-Electric Company has submitted an offer to the City Council offering to furnish electricity to light the streets of the city at a rate 50 per cent less than that now charged by the Pacific Power & Light Company, provided the city will enter into a ten-year contract. The company is erecting a large electric plant at [illegible]'s Bridge, about 6 miles from the city. It is expected to have the plant ready for operation by the first of the year.

LAKEVIEW, ORE.—The Lakeview & Pine Creek Telephone Company [illegible] the rural telephone systems at Moss, Chandler, Bunting [illegible] Dent. Plans are being made by the company to erect a new line [illegible] Goose Valley, a distance of about 20 miles.

MAPLETON, ORE.—Preparations are being made for the erection of a large hydroelectric power plant on the lower Siuslaw River at Swiss Home, about 6 miles above Mapleton, which, it is expected will be completed early next year. Electricity generated at the plant will be transmitted to Mapleton, Florence, Acme and Glendale, where application, it is said, will be made for franchises. Joaquin Miller, George Miller and James Miller are interested in the project.

NEWBERG, ORE.—The County Court has granted the Tualatin Valley Electric Company permission to erect transmission lines along the county road leading from Newberg to Portland, from the crossroads east of Newberg easterly to the county line.

NEWBERG, ORE.—The Yamhill Electric Company has been granted permission by the County Court to erect transmission lines along the Dayton-Portland road from the corporate limits of Newberg to the county line, and along other public roads leading from and into Newberg for a distance of three-quarters of a mile outside of the city limits.

PORTLAND, ORE.—The Ladd Estate Company is planning to install an electrolier lighting system on the new viaduct in the Eastmoreland district.

PORTLAND, ORE.—M. J. Lee, manager of the Canby Canal Company, is at the head of a project to construct an electric railway from Molalla Valley to Portland, via Canby, a distance of about 30 miles. It is proposed to build a large hydroelectric power plant on the Mollalla River.

SALEM, ORE.—The Portland, Eugene & Eastern Railway Company is reported to be contemplating the construction of an electric railway from Salem to Stayton.

CASSANDRA, PA.—The Borough Council has granted the Penn Central Light & Power Company a franchise to erect and maintain transmission lines throughout the borough.

INDIANA, PA.—A contract has been placed by the Indiana County Street Railway Company with the Westinghouse Machine Company for one 625-kva Westinghouse-Parsons turbo-generator set and one No. 5 Westinghouse Le Blanc condenser to be installed in its plant at Twolick, Pa. This unit will be used to supplement the present equipment [illegible] D. H. [illegible] president of the company, and Frank [illegible]

McKEE'S ROCKS, PA.—Preparations are being made by the Pennsylvania Light & Power Company to supply electrical service in McKee's Rocks. The company was recently granted a franchise to supply electricity in this borough.

NATRONA, PA.—Plans are being considered by the Pennsylvania Salt Manufacturing Company for improvements to its plant, including an addition to power plant, reconstruction of the muriatic acid department a new office building, a laboratory, etc., to cost approximately $100,000.

NEW BALTIMORE, PA.—Norman Tupper, owner of the distillery and grist mill, who has installed an electric plant, has decided to offer to furnish electricity to light the town for two months free of charge. The plant will be operated by water-power from the grist mill.

PHILADELPHIA, PA.—Chief McLaughlin, of the Electrical Bureau, in a report to be made to the Director of Public Safety, will recommend that the Councils appropriate $350,000 for improving the lighting system of the city hall and the installation of more modern and safe electric equipment. He will also recommend that during the next five years the city shall annually appropriate $500,000 to replace the obsolete telephone and telegraph equipment connecting police and fire stations.

WHITE, S. D.—The Town Council has granted a franchise to E. A. Harseim, of White, to construct and operate an electric-light system in White for a period of twenty years. Under the terms of the franchise the city reserves the right to purchase the plant at the expiration of five years and each two years thereafter. The system will be installed at once.

CHATTANOOGA, TENN.—Plans are being considered by the City Council to install a conduit system to be rented to public-service companies operating wires on the streets. A. N. Sloan is commissioner of the department of streets.

HELENA, TENN.—The State Mission Board, Tennessee Baptist Convention, it is reported, contemplates the construction of an electric light plant to supply electricity to light its school building and possibly to the town. The proposed plant will be operated by water-power. For further information address W. L. Riogan, of Helena, Tenn.

SPARTA, TENN.—The plant and holdings of the Sparta Electric Light & Power Company have been purchased by the Anderson-Tubb Power Company. The latter company has been furnishing power to operate the plant of the former for some time. Owing to the City Council and the Sparta Electric Light & Power Company being unable to come to an agreement the city has been without street-lighting service for some weeks.

BEAUMONT, TEX.—It is reported that the Stone & Webster syndicate, of Boston, Mass., is negotiating with the Beaumont Ice, Light & Refrigerating Company for the purchase of the electrical properties of the latter. The consideration is said to be $600,000.

DENISON, TEX.—A special election will be held on Dec. 20 to vote on the proposition to grant a twenty-year franchise to the Southwestern Telegraph & Telephone Company. The company agrees to pay a bonus [illegible] per year and also a franchise tax.

SALT LAKE CITY, UTAH.—The Mountain States Telephone & Telegraph Company is contemplating an issue of capital stock to the amount of $2,000,000, the proceeds to be used for further development of its system in this territory. E. B. Field is president of the company.

BURLINGTON, VT.—Plans are being considered for the installation of an isolated electric-light plant of 100 hp in the Hotel Vermont, in Burlington.

BURLINGTON, VT.—In order that the Electric Light Commission may purchase a new 750-kw turbine for the municipal electric-light plant the city has asked that the injunction brought by the Burlington Light & Power Company may be modified so as to allow the purchase of the machinery needed. Last January the Board of Aldermen adopted a resolution authorizing an expenditure of $27,000 for repairs to the municipal plant. The Burlington Light & Power Company immediately brought an injunction restraining the city from expending further money on the plant. Unless new machinery is installed at once part of the city will be without street lights and there will be no power to operate the high-pressure pumps on the hill for fire protection. Dr. W. S. Vincent is chairman of the city light department.

CHASE CITY, VA.—The local electric-light and ice plants were destroyed by fire recently, causing a loss of about $25,000.

CHATHAM, VA.—The Town Council is reported to have awarded F. L. W. Bryant, of Thomasville, N. C., a franchise to install and operate an electric-light system in Chatham.

LEESBURG, VA.—The capital stock of the Leesburg Telephone Company is reported to have been increased from $10,000 to $25,000.

ABERDEEN, WASH.—Plans are being prepared by the Gray's Harbor Railway & Light Company for the construction of an electric railway from Cosmopolis to a point on Willapa Harbor. The company also proposes to make extensions to its systems in Aberdeen and at Hoquiam. H. B. Zimmerman is manager.

CHELAN, WASH.—The East Side Telephone Company is contemplating improvements and extensions to its local and suburban systems.

[illegible] development on the Sultan River. The dam, it is said, will be built across the canyon, about 17 miles east of Sultan. An electric railway, it is understood, will be built in connection with the power plant.

[illegible] street-lighting system will be installed. It is proposed to replace the arc lamps now in use with incandescent lamps and extend the street-lighting system in the residential portion of the town.

GOLDENVALE, WASH.—The Klickitat Irrigation & Power Company, of Seattle, Wash., has started work on its Horse Haven irrigation project, which will involve an expenditure of about $16,000,000 and will irrigate 300,000 acres of land in the Klickitat, Yakima and Benton County districts. L. M. Rice, Central Building, Seattle, Wash., is engineer.

LYLE, WASH.—The Superior Court has granted the Northwest Electric Company, of Portland, Ore., permission to condemn property for the right-of-way for its transmission line from its new power plant on the Klickitat River, now in course of construction.

PASCO, WASH.—Arrangements are being made to begin work on the construction of the new power station in Pasco. The first unit to be installed will cost about $80,000. James H. Moore, of Portland, Ore., is engineer in charge.

PROSSER, WASH.—The Pacific Power & Light Company is contemplating extending its transmission line into the Euclid and Byron districts. The proposed line will be extended from the substation at Prosser along the Euclid Road for about 6 miles west of the town, where it will be carried across the river to Byron, making in all about 7 miles of line. [illegible] is local manager.

PUYALLUP, WASH.—The City Council, it is reported, will ask the Light Department of the city of Tacoma and the Tacoma Gas Company to submit bids for street lighting. The present contract will expire within the next twelve months, and it is proposed to call for bids soon so as to give prospective bidders ample time to make estimates, etc. The city pays the Pacific Coast Power Company $252 per month for the present service. The rate is $6 each per month for arc lamps, $1.25 each per month for 32-cp incandescent lamps and 75 cents each for lamps [illegible] 16-cp.

RINGOLD, WASH.—The Pacific Power & Light Company has closed a contract with the land owners of Ringold Bar to furnish electricity for irrigation and domestic purposes. The company will erect a high-tension line from the Prosser substation to Ringgold.

SEATTLE, WASH.—The electric-power plant of the Schwager & Nettleton Lumber Mill Company was recently destroyed by fire, causing a loss of [illegible] $5,000.

SEDRO-WOOLLEY, WASH.—The State Board of Control has extended the time for receiving bids for machinery for the new power plant at the Northern Hospital for the Insane from Nov. 6 to Nov. 30. Plans and specifications may be obtained at the office of Saunders & Lawton, Alaska Building, Seattle, Wash.

SPOKANE, WASH.—The Washington Water Power Company is contemplating the extension of its transmission lines to the North Hill district.

TACOMA, WASH.—The Board of County Commissioners is contemplating the installation of an electric tramway system at the Nisqually power plant at La Grande, the cost of which is estimated at about $18,000.

VANCOUVER, WASH.—Articles of incorporation are being prepared for filing for the Washington Trunk Railway by the General Development Company. The subsidiary company will be capitalized at $5,000,000 and will construct an electric railway from Vancouver to North Yakima and Ellensburgh. The building of an electric railway to Portland, Ore., is also contemplated. Lawrence Harmon is interested in the project.

PARKERSBURG, W. VA.—The contract for the construction of the power house at the government dam No. 19, below Parkersburg, has been awarded to the M. Laird Construction Company, of Philadelphia, Pa. The cost of the work will be about $40,000.

DE PERE, WIS.—The Green Bay Gas & Electric Company has applied to the City Council for a franchise to supply this city with gas.

MILWAUKEE, WIS.—The Council's street lights committee has recommended for adoption the resolution to purchase machinery for the proposed municipal electric-light system. As yet no provision has been made to erect a building or install wires.

SHULLSBURG, WIS.—The citizens have voted to grant the Interstate Light & Power Company, of Platteville, Wis., a franchise to construct and operate an electric-light system in Shullsburg. The company will extend its transmission line from the Hazel Green substation to this town.

SUPERIOR, WIS.—Arrangements have practically been completed by the Great Northern Power Company for the construction of a transformer station, to be located at Elmira Avenue and Twenty-eighth Street, into which wires of the new transmission line on the Wisconsin side of the river will run. The transmission line will extend from the power plant at Thompson to Superior. It is understood that the company has secured the right-of-way for the proposed line for the entire distance. The cost of the station and other improvements will be approximately $200,000.

NIAGARA FALLS, ONT., CAN.—Extensive additions are being made to the power house and plant of the Ontario Power Company. The new building being added to the power house below Table Rock will give approximately from 100 ft. to 150 ft additional space to the plant, providing room for the installation of two units of 24,000 hp, which will increase the total output of the plant to 148,000 hp. The company, which has just completed the construction of a second pipe line, has obtained permission from the Queen Victoria Park Commission to add 150 ft. to its line to permit the development of an additional 24,000 hp

SOUTHAMPTON, ONT., CAN.—Tenders will be received by Bowman & Conner, consulting engineers, Berlin, Ont., Can., for a small electric-driven pumping unit for the Southampton water-works system.

MOOSE JAW, SASK., CAN.—Tenders will be received by W. F. Heal, city clerk, Moose Jaw, Sask., Can., until Dec. 4 for supplying the fire department of the city with one pumping engine, with a capacity of 800 to 850 gal. per minute. Tenders are invited for motor-driven pumping engines, motor-propelled steam engines and horse-drawn steam pumping engines.

New Industrial Companies.

THE AEROCUTTA COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of manufacturing electrical machines, etc. The incorporators are: Samuel Lewis, Andrew Anderson, Jr., William A. Winter and Louis F. White.

THE BOWLES PHOTO & ENGRAVING LAMP COMPANY, of Evansville, Ind., has been incorporated with a capital stock of $50,000 by John C. Nutt, Emil Weil and William Gleichman. The company proposes to manufacture an electric lamp for photographic and other engraving work.

THE CENTRAL AUTO MANUFACTURING COMPANY, of Indiana Harbor, Ind., has been incorporated by Clifford C. Robinson, Francis E Stephens and Boyd S. Gardiner. The company purposes to manufacture and deal in all kinds of automobiles, mechanical and electrical supplies A plant will be established by the company to carry on its business.

THE CHICAGO MIXING & CONVEYING COMPANY, of Chicago Ill., has filed articles of incorporation with a capital stock of $10,00[illegible] to manufacture mixing and conveying machinery. The incorporators are George Gillett, R. T. Elwell and Russell P. Fisher, of Chicago, Ill.

THE IDEAL POWER GENERATOR COMPANY, of Raymond, Cal. has been incorporated with a capital stock of $500,000 by G. A. Krohn A. B. C. McGilvary, J. C. Krohn, J. W. Francis and E. M. Arreagad[illegible] The company purposes to manufacture a tubeless boiler.

THE WILLIAM JACKSON COMPANY, INC., of Camden, N. J has been incorporated by W F. Jackson, C. M. Morrison, of Philadelphia, Pa., and S. M. Roberts, of Camden, N. J. The company is capitalized at $125,000 and purposes to do a general mechanical engineerin[illegible] business.

THE KRUPP MOTORS COMPANY has filed articles of incorporatio[illegible] under the laws of the State of Delaware with a capital stock of $250,00[illegible] The incorporators are: D. Morgan, G. H. Anderson and J. McMorran, [illegible] Pittsburgh, Pa.

New Incorporations.

CEMENT, CAL.—The Cement, Tolenas & Tidewater Railroad Compa[illegible] has been incorporated with a capital stock of $500,000 to build an ele[illegible] tric railway from Cement to Tidewater, a distance of 6 miles. The i[illegible] corporators are: R. B. Henderson, A. D. Plaw, W. T. Barnett, Paul McCarthy and F. D. Madison, all of San Francisco, Cal.

LOS ANGELES, CAL.—Articles of incorporation have been filed f[illegible] the International Lighting Company by G. Tufts, Jr., G. F. Zimmer a[illegible] C. M. Taylor. The company is capitalized at $25,000.

MODESTO, CAL.—Articles of incorporation have been filed for t[illegible] Modesto & Empire Traction Company by T. K. Beard, W. H. Frazi[illegible] J. M. Waithall and L. L. Dennett. The company is capitalized at $20,0[illegible] and purposes to build an electric railway from Modesto to Empire.

MANITOU, COL.—The Scenic Incline Railway Company has be[illegible] incorporated by J. Frank Campbell, Oliver D. Dick and D. H. Rupp [illegible] build a cable railway to the top of Pike's Peak.

PAXTON, ILL.—The Consumers' Electric Company has been gran[illegible] a charter to construct and operate an electric light, heat and power pla[illegible] The company is capitalized at $50,000. The incorporators are: H. Stevens, C. E. Bengston and C. A. Nordgren, all of Chicago, Ill.

Personal.

MR. FRED B. COREY, formerly engineer with the General Elec[illegible] Company, has been appointed engineer in charge of the inspection [illegible] partment of the Union Switch & Signal Company, of Swissvale, Pa.

MR. D. F. SHEARER, associate member A.I.E.E., has been ele[illegible]

[illegible] general manager [illegible] company [illegible] greetings in the exchange of courtesies which has distinguished these [illegible]

[illegible]

MR. WILLIAM G. WALKER, who was formerly with the Philadelphia Electric Company and with the Leeds & Northrup Company, Philadelphia, and more recently with Machado & Roller, New York, has accepted a [illegible] with the New York [illegible] standardizing laboratory.

MR. ARTHUR BESSEY SMITH, formerly professor of telephone engineering at Purdue University, and now with the Automatic Telephone Company, Chicago, [illegible] the Purdue Association of Chicago, on Nov. 9, on the subject of "Human [illegible] vs. Mechanical [illegible]"

MR. H. THURSTON OWENS, consulting engineer, New York City, has been invited to lecture before the Empire State Gas & Electric Association on Nov. 22, at Syracuse, N. Y. Mr. Owens will describe the various public lighting installations of note in this country and Europe, illustrating them by stereopticon views.

MR. F. C. CHAMBERS has resigned his positions as chief engineer for the Springfield (Ill.) Light, Heat & Power Company and engineer of power stations for the Springfield Consolidated Railway Company, and will be associated on railway-franchise work with Mr. Emil G. Schmidt, formerly vice-president and general manager of the last-mentioned company.

MR. [illegible] WHITEHEAD has been made [illegible] plant superintendent of the Western Union Telegraph Company, with headquarters in Chicago. Mr. Whitehead, who was born in New York City in 1872, is a graduate of Yale University and the Sheffield Scientific School. [illegible] telephone companies and was more recently division plant superintendent of the Western Union Company at Denver.

MR. WILLIAM J. HAGENAH, of Chicago, has been engaged to prepare the testimony of the Union Electric Light & Power Company, of St. Louis, in the rate case which is now pending before the Circuit Court of St. Louis County. An injunction was secured recently by the company restraining the city of St. Louis from enforcing the rate schedule based on the maximum rate fixed by the Public Service Commission. In the preparation of the case Mr. Hagenah is making a valuation of the property of the company and a complete audit of the accounts. The case will probably not be called for a hearing for several [illegible]

[illegible] has been appointed chief electrical engineer and superintendent of distribution of the Union Electric Light & Power Company, of St. Louis, [illegible] Mr. S. E. Way, who resigned to [illegible] of the electrical department of The Milwaukee Electric [illegible] & Light Company. Mr. [illegible] was graduated from the [University] of Missouri at Columbia City, Mo., in 1898, with the degree [illegible] in E. E. [illegible] he was connected with the [illegible] Missouri-Edison Company, the Laclede Power Company, and [illegible] the Union Electric Light & Power Company, [illegible] assistant electrical engineer in active charge of much of the work [illegible] electrical department for several years.

[illegible], manager [illegible] has resigned [illegible] Heat & Power Company and the Montgomery Traction Company, [illegible], Ala. [illegible] station managers of the Central West, and many friends in Iowa [and Ill]inois will view his departure with regret while congratulating the [illegible] companies [illegible] of both the Iowa Electrical Association and the Iowa Street & [Interurba]n Railway Association, and he is a well-known [illegible] of electric [illegible] [ha]d a wide and varied public-utility experience, and he made a fine [record] in Dubuque, where he had charge of a combined electric-service [and] street-railway property. His work at Montgomery [illegible]

Obituary.

MR. EDGAR WOOD MIX, well known in electrical engineering circles from his connection with the early Thomson-Houston Electric Company, was drowned in the English Channel on the night of Nov. 12. The conditions surrounding his death are unknown, as he was alone when he disappeared from a Channel steamer. Mr. Mix was born near Columbus, Ohio, Feb. 4, 1867. He graduated from the Ohio State University with the degree of B. S. in [illegible] entered the employ of the Thomson-Houston Electric Company in the department devoted to the manufacture of watt-hour meters. In 1890 he [illegible] established there a factory for building watt-hour meters for the Thomson-Houston International Electric Company. He occupied the position of chief engineer of this firm until the first of the present month, when he resigned to become manager of the European division of the General Motors & Export Company, of Detroit. Mr. Mix was elected an associate of the A. I. E. E. in 1889 and transferred to the grade of member in 1895. In recent years he had been much interested in aeronautics, and he was a member of both the Aero Club of France and the Aero Club of America. On Oct. 5, 1909, he won the international balloon race at Zurich, Switzerland, and he had been chosen delegate to the international aviation conference which will open in Rome on Nov. 25, 1911. Mr. Mix was unmarried.

Trade Publications.

INCANDESCENT LAMPS.—The engineering department of the National Electric Lamp Association has issued Bulletin 8-C on "Miniature Carbon Lamps" and 12-A on "The Electric Lighting of Automobiles." These bulletins are revised editions of former publications on the same subjects.

PLUNGER PUMPS.—Bulletin No. 101 of the Goulds Manufacturing Company, Seneca Falls, N. Y., contains much information concerning the constructive details and operating characteristics of single-acting, triplex plunger pumps. These pumps are designed for work under pressures varying from 130 lb to 200 lb per square inch.

BRUSH TESTING.—The National Carbon Company, Cleveland, Ohio, has issued an instructive booklet relating to the testing of brushes on electrical machines. The book contains an outline of a standard method of making tests, and brief descriptions of the rigid inspection and thorough test to which the brushes are subjected subsequent to manufacture and before they are shipped.

DIRECT-CURRENT MACHINERY.—Bulletin No. 1011 issued by the Ideal Electric & Manufacturing Company, Mansfield, Ohio, contains a complete discussion of the details of construction and operation of direct-current motors and generators. Test curves of this type of motor and generator are included, and some of the details of construction are illustrated by special drawings.

BUSINESS NOTES.

THE INDEPENDENT ELECTRIC MANUFACTURING COMPANY, of Milwaukee, has appointed the Lamb Electric Company, of Grand Rapids, as its agent in that city. A complete line of motor starters and controllers will be carried at the Grand Rapids agency.

THE WHEELER CONDENSER & ENGINEERING COMPANY.—Mr. George F. Pond has been appointed manager of the Philadelphia territory for the Wheeler Condenser & Engineering Company, and Mr. Walter G. Stephan has been made manager of the Cleveland territory for this company.

THE CONTINENTAL CAR & EQUIPMENT COMPANY, of Highland Park, Ky., near Louisville, has begun the manufacture of electric commercial trucks. Plans have been matured for building these vehicles in 5-ton, 3½-ton, 2-ton, 1-ton and 1000-lb. sizes. Mr. McKinley Boyle, of New York, is president of the company and Mr. A. B. McKinley is vice-president and general manager.

THE ELECTRIC STORAGE BATTERY COMPANY.—The sixth convention of the engineering staff and sales department of the Electric Storage Battery Company was held in Philadelphia on Nov. 6, 7, 8, 9 and 10. This convention was attended by the managers and salesmen from offices in Philadelphia, New York, Chicago, Boston, Cleveland, St. Louis, Denver, Detroit, Atlanta and San Francisco.

THE TRIUMPH ELECTRIC COMPANY.—The following is a partial list of recent sales reported by the Triumph Electric Company, Cincinnati, Ohio: Sixteen generators aggregating 1650 kw; one 35-kw turbo-alternator; one 100-kw motor-generator set; 135 motors aggregating 2175 hp, and 35 transformers of various sizes. The new line of Triumph alternating-current generators and transformers recently placed on the market are reported to be much in demand.

PANAMA CANAL CABLE.—At the recent convention of the Association of Railway Electrical Engineers in Chicago the Kerite Insulated Wire & Cable Company displayed a piece of the cable manufactured for the Panama Canal. This is a four-conductor submarine cable, 50 miles long, connecting Colon and Panama. It was put into service three years ago, lying partly on the ground and partly underground, but as the work is completed the cable will be placed in the canal itself.

TREATING CEDAR POLES.—The Lindsley Brothers Company, of Spokane, Wash., specialist in Idaho poles, has just installed a treating plant at its Priest River (Idaho) yard for the treating of poles with avenarius carbolineum by the open-tank process. The plant has a capacity of 300 poles a day, and the company has just completed the shipment of a large order of treated poles from this plant to Colorado points. This plant makes the second one operated by the Lindsley

... paving-block plant located in Spokane. It has recently completed the treatment of 40,000 ties for the Washington Water Power Company and has a number of contracts on file for spring delivery.

MOORE TUBES FOR COLOR MATCHING.—Shipments of complete factory built units of the white Moore tubes to textile and dyeing establishments for color matching have been made recently to the following: Bradford Dyers' Association, Bradford, Eng.; Belding Paul Corticelli, Ltd., Montreal, Can.; Dunn Worsted Mills, Woonsocket, R. I.; the Felters Company, Millsbury, Mass.; Conshohocken Dye & Finishing Works, Philadelphia; Hind & Harrison Plush Company, Clark Mills, N. Y., and to the Glenlyon Dye Works, Saylesville, R. I. The company states that demand for the white light is broadening in a very ... due to its color-distinguishing advantages and to ... adaptability of the self-contained factory-exhausted types for express shipment.

THE AMERICAN SHIP WINDLASS COMPANY, builder of the Taylor stoker and marine equipment, is moving its factory from Providence, R. I., to Philadelphia, where the company already had a large plant. A large foundry has also recently been erected in Philadelphia. This company was established fifty-four years ago by Messrs. Frank S. and Joseph Marston, who had much to do with the invention of the ship windlass. From the manufacture of the ship windlass the company branched out and added marine machinery, and in 1905 began the manufacture of the automatic stoker invented by Mr. E. E. Taylor, of Boston. This stoker, which is of the underfeed type with an inclined fuel bed, is extensively used in boiler plants requiring a large output in a small space, and in cases where it is necessary to burn soft coal without smoke.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 7, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,007,671. SAFETY SIGNAL FOR VEHICLES; G. F. Buente and H. C. Fling, New York, N. Y., and Spring Lake, N. J. App. filed Feb. 11, 1909. Electric tail-lights for automobiles to indicate change of course and speed.

1,007,674. ARC LAMP; K. Cosiolkofsky, Vaals, Netherlands. App. filed Aug. 13, 1908. Inclosed arc.

1,007,683. PROCESS OF FORMING OXIDS OF NITROGEN; C. Ellis, Montclair, N. J. App. filed July 29, 1911. Air is passed concentrically but not helically about an arc.

1,008,002.—Carbon Electrode.

1,007,684. TELEPHONE-RINGING DEVICE; H. N. Faris, Kansas City, Kan. App filed Feb. 13, 1909. Galvanic battery and an inductive transformer for energy.

1,007,694. VAPOR CONVERTER; P. C. Hewitt, Ringwood Manor, N. J. App. filed March 20, 1908. Hollow metallic electrodes.

1,007,705. ELECTRIC BRAKE FOR ELECTRIC MOTORS; M. Kallmann, Berlin, Germany. App. filed April 23, 1907. Variation resistance is heated to incandescence.

1,007,741. LINE-JOINT TESTER; H. H. Simpson, Pilot Grove, Mo. App. filed Oct. 24, 1910. A number of contacts on one handle for testing telephone and telegraph lines.

1,007,770. LIGHTNING ARRESTER; W. E. Butler, David City, Neb. App. filed Sept. 23, 1910. Mercury electrodes in a vacuum chamber.

1,007,791. LAMP SOCKET; Morey & Brogden, Syracuse, N. Y. App. filed July 9, 1909. Pull switch with inclines and a ratchet member.

1,007,802. SWITCH BOX; C. N. Sachs, Hartford, Conn. App. filed Aug. 31, 1905. The box cover constitutes the switch arm.

1,007,869. ELECTRODE FOR FLAMING-ARC LAMPS; C. W. Hill, Lakewood, Ohio. App. filed Sept. 21, 1910. Different color-producing elements are incorporated in the electrode.

1,007,876. EXPLOSION-PROOF CARTRIDGE CUT-OUT; W. Klement, Neu Finkenkrug-Falkenhain, Germany. App. filed Aug. 5, 1910. Fusible elements of different lengths.

1,007,883. TELEPHONE TRANSMITTER; C. T. Mason, Sumter, S. C. App. filed July 5, 1910. Insulation features for the diaphragm.

1,007,886. ELECTRO-MECHANICAL SWITCHING DEVICE; R. R. Miller, Pueblo, Col. App. filed Dec. 13, 1909. Trolley-controlled railroad switch.

1,007,893. COMMUTATOR SHORT-CIRCUITING DEVICE; C. S. Reno, Cincinnati, Ohio. App. filed Nov. 5, 1909. Centrifugal devices for short-circuiting.

1,007,897. ELECTROLYTIC APPARATUS; G. O. Seward and F. Von Kugelgen, Holcomb's Rock, Va. App. filed April 23, 1906. An annular chilled salt-incrusted partition surrounding the cathode in a sodium-reduction process.

1,007,902. COMMUTATOR SHORT-CIRCUITING DEVICE; L. H. Thullen, Cincinnati, Ohio. App. filed April 1, 1910. Centrifugally operated tumblers.

1,007,948. SWITCH; B. Haskins, Milwaukee, Wis. App. filed April 27, 1910. Single-break rotary double-throw oil switch.

1,007,990. METHOD OR PROCESS FOR THE REDUCTION AND SMELTING OF ORE AND ARRANGEMENT THEREFOR; F. Tharaldsen, Trondhjem, Norway. App. filed May 31, 1911. Ore is fed into the top and the reducing agent is fed in lower down to protect the electrodes and the furnace lining.

1,007,998. ELECTRIC SWITCH MECHANISM; H. F. Whalton, Key West, Fla. App. filed Jan. 12, 1911. A cup with mercury and contacts to control solenoids for actuating steering vanes of aeroplanes, etc.

1,008,000. RHEOSTAT; G. H. Whittingham, Baltimore, Md. App. filed March 19, 1909. The hand-operated arm has a lock and key.

1,008,002. CARBON ELECTRODE; M. W. Allen, Lakewood, Ohio. App. filed Sept. 12, 1910. Sectional carbons with graphite inset blocks and threaded graphite dowels.

1,008,012 MANHOLE SWITCH; S. B. Condit, Jr., and A. E. Greene, Boston, Mass. App. filed May 14, 1909. Water-tight oil switch.

1,008,030. CAR-TRUCK CONSTRUCTION FOR ELECTRIC RAILWAY SIGNAL SYSTEMS; G. B. Gray, Pittsburgh, Pa. App. filed July 16, 1909. Insulat... ...s for a signal ... like Patent No. 909,083.

1,008,087. INSULATOR; J. M. Sweeney, Howell, Fla. App. filed July 17, 1911. A porcelain cleat for holding telephone wires, etc.

1,008,122. TELEPHONE CASING; W. W. Dean, Elyria, Ohio App filed June 8, 1910. The metallic cap and insulating member are secured together.

1,008,172. AUTOMATIC SIGNALING SYSTEM; D. J. McCarthy Wilkinsburg, Pa. App. filed March 5, 1910. Alternating-current railway system for three-position signals.

1,008,189. BRAKING APPARATUS; A. Sundh, Yonkers, N. Y. App filed Sept. 23, 1905. Elevator driven by an alternating-current motor and a direct-current generator acts as a brake. (Forty claims.)

1,008,216 PARTY-LINE TELEPHONE SYSTEM; E. Stout and J. S Kupka, Martinsburg, Ia. App. filed July 19, 1910. Lockout mechanism; interparty busy signals.

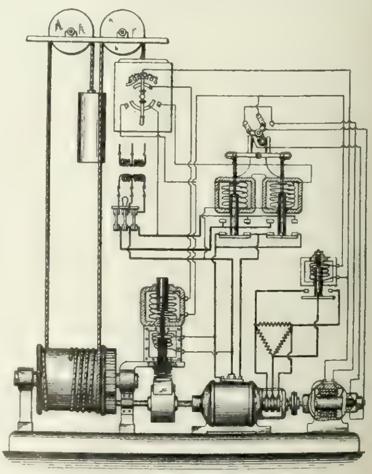
1,008,232. TELEPHONE TRUNKING SYSTEM; C. S. Winston, Chicago, Ill. App. filed Dec. 4, 1907. A disconnect signal to central even when the subscriber immediately tries to get a second call.

1,008,243. ELECTRIC REGULATION; J. L. Creveling, New York N. Y. App. filed Nov. 21, 1910. A voltage coil and a current coil and automatic means for determining which shall regulate the generator of a storage-battery generator car-lighting system.

1,008,244. ELECTRIC REGULATION; J. L. Creveling, New York N. Y. App. filed June 21, 1911. Car-lighting system with automatic regulation.

1,008,270. REACTANCE COIL; W. O. Jacobi and C. Harris, Chicago Ill. App. filed May 4, 1908. To give a steady arc in hand-fed alternating-current lamps

1,008,282. SELECTIVE TELEPHONE SIGNALING SYSTEM; C. H North, Cleveland, Ohio. App. filed Oct. 11, 1907. Alternating currents of non-interfering frequencies such as 30, 42 and 54 cycles.



1,008,189.—Braking Apparatus.

1,008,287. ACETYLENE-GAS LIGHTER; H. Van Hoevenberg, Lake Placid Club, N. Y. App. filed March 22, 1910. Movable sparking contacts.

1,008,293 TRANSFORMER SYSTEM; H. C. Caldwell, Fort Mills, Corregidor, Philippine Islands. App. filed Sept. 9, 1910. A controller for shifting from one unit to another.

1,008,294 ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Nov. 21, 1910. Car lighting by storage battery and generator.

13,307 (Reissue). PROCESS OF RECOVERING FINE GOLD; J. Alling, Columbia, Cal. App. filed Feb. 1, 1910. The ore is mixed with a chlorine compound and electrolyzed so that nascent chlorine is set free to attack the gold. Original Patent No. 947,957.

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NEW YORK, SATURDAY, NOVEMBER 25, 1911.

CONTENTS.

CHARGING CURRENTS OF THREE-PHASE TRANSMISSION LINES WITH ONE CONDUCTOR GROUNDED.

In the case of alternating-current lines operated at a pressure of two or three kilovolts, as in primary systems of distributing mains, the charging current of the lines is ordinarily unimportant. Only in cases where extensive primary distributing systems are operated, especially in underground conduits, does the charging current of the system, at, say, 2 kilovolts pressure, come into prominence. When, however, high-pressure transmission systems are employed the charging currents of the systems under no load may be nearly as great as the working components of current under maximum load. Any dissymmetry of charging current on the lines of such a high-pressure system may give rise to unbalancing of voltages, either in the generator or in the lines themselves. The charging currents of such systems, in their regular operation, thus assume considerable importance. Any symmetrical three-phase system, if not connected directly to ground at its generating neutral point, may be regarded as having zero potential at that point and as being virtually grounded there so long as the system remains insulated and balanced. Consequently, each wire is virtually operated at star voltage against ground and the other two wires jointly. That is, the presence of the ground, as a conducting sheet, somewhat disturbs the charging potentials and currents of the three lines. If the towers carrying the wires were indefinitely high, so as to keep the ground surface at an indefinitely great distance away from the line, the three line wires remaining spaced equidistantly on the vertices of an equilateral triangle, the three charging currents should have exactly equal strength. In any actual case the vicinity of the ground causes the charging currents of the lower wires to exceed that of the higher wire or wires. It is interesting to note that Clerk Maxwell, long before the day of electric energy transmission, and even of alternating-current development in any of its phases, disclosed the general formula by which the charging current might be computed in any given case.

In an article we publish this week Mr. George S. Humphrey computes the potentials and currents of a set of three aerial three-phase lines under various conditions of grounds and grounding. He shows that when the three wires are each of No. 0 gage, on 6-ft. upright equilateral-triangle vertices, the base being 25 ft. from the perfectly conducting ground, the charging currents in the lower wires are greater than that in the top wire, owing to the presence of the ground, to the extent of 0.1 per cent. The addition of a grounded wire of 0.25 in. diameter, 3 ft. vertically above the top line wire, as is sometimes adopted for lightning protection, adds 1 per cent to the charging current of the bottom wires and 2 per cent to that of the top wire.

If, however, one of the bottom wires is grounded, the charging current of that wire is reduced, being diverted in considerable measure to the ground; but, on the other hand, the charging current of the two other wires is increased about one-third and the charging current system becomes distinctly unbalanced. The case is also considered of the three wires placed on the same level cross-arm of a pole, at a spacing of 1 ft., and all at a level 40 ft. above the ground. Such a charging system is essentially unbalanced for geometrical reasons, the middle wire receiving the greatest charging current. The grounding of one of the side wires is then shown to reduce the charging current of the grounded wire, but to increase that of the two other wires by about a third, a charging current being also communicated to the ground; so that the total charging current on the grounded line terminal is about double the normal. Outside of the arithmetical details of each case considered, the article shows that when a three-phase aerial line system is insulated the effect of the ground's vicinity on the charging currents of the lines is negligible at ordinary line elevations. When, however, one line of the system is grounded, either at generator terminals or at some point along the system, the charging current doubles up on the generator terminal that takes the ground, while those of the other two lines increase each about one-third.

THE MAGNETIC PROPERTIES OF STALLOY.

As noted in this week's *Digest,* our British contemporary *The Electrician* has recently printed, in abstract, a paper by Messrs. H. R. Hamley and A. L. Rossiter, read before the Royal Society of Victoria (Australia), on the magnetic properties of stalloy, a special brand of iron alloy prepared for the purpose of maintaining good magnetic permeability, with as low electric conductivity as possible. It appears from the tests reported that stalloy behaves differently in the annealed and unannealed conditions, the behavior when annealed being much the better for practical purposes. Annealed stalloy is stated to compare very favorably with the best soft iron in regard to permeability and hysteretic coefficient, while its electric resistivity is some four times as large as that of soft iron. The result claimed for stalloy is, therefore, a reduction in total iron losses of about one-third by comparison with ordinary transformer-core iron. Several different brands of iron have recently been produced looking toward the same purpose as stalloy. Eventually we may hope to be able to dispense with laminations in armature and transformer cores, casting them solidly in the form of cylindrical rings, with ventilating ducts permeating the mass. It must be confessed, however, that we are still a long distance away from this much to be desired goal.

MAGNETIC PROPERTIES OF IRON AT ABNORMAL FREQUENCIES.

It is only a little while since a frequency of 10,000 cycles per second was looked upon as enormously high in an alternating-current generator, and, of course, it must be so by comparison with the industrial frequency of 60 cycles per second. But within the last two or three years alternators have been built and put into operation at a frequency of 100,000 cycles per second. At the last meeting of the American Institute of Electrical Engineers, however, this record was raised, and the paper of the evening, by Mr. E. F. Alexanderson, dealt with the magnetic properties of iron at frequencies up to 200,000 cycles per second. That is, alternators of 5 kva are now built for this highest machine frequency. The most important application of these highest frequency machines is to wireless communication. The speed of the wave propagation, over land and sea, being generally admitted to be 300,000 km per second, a frequency of 100,000 cycles per second produces a wave-length of 3 km. If the sending antenna were vertical and unloaded, it would have to be approximately one-quarter of a wave-length in height, or 750 meters high, in order to be tuned to this frequency. Loading the antenna with reactance, however, enables a much shorter antenna to resonate to this frequency. With the mechanical generation of 200,000 cycles per second, the wave-length becomes reduced to 1500 meters and the free height of an unloaded resonating air-wire to about 375 meters. It becomes, of course, still easier to load an air wire of, say, 90 meters in height to resonance with this frequency, so as to keep it in full oscillation and radiation.

It has always been a matter of debate whether at frequencies such as these iron behaves in essentially the same manner as at ordinary electric-lighting frequencies. Of course, the skin effect, or imperfect magnetic penetration, becomes greatly exaggerated at these frequencies, even with the thinnest sheets or wires of soft steel that can be worked. In other words, it is impracticable to obtain or handle sheets or wires of steel so thin that the alternating magnetism can permeate them, even to 50 per cent of the full steady value, so that the thinnest iron that can be used is mainly non-magnetic material under such conditions, with a thin layer of magnetic material on each surface. However, allowing for the proper depth of available magnetic layer, the results which Mr. Alexanderson has obtained go to show that the working layer of iron acts magnetically substantially in the same manner and to the same extent as at customary low frequencies. In fact, the results show that an alternating-current transformer, if properly designed, has a higher efficiency and a higher specific output at 200,000 than at 60 cycles per second though the increase in output is far below that corresponding to the frequency ratio. Of course, the regulation behavior of the high-frequency transformer would be very poor by comparison with that of the low-frequency transformer.

A NEW SOUND-RECORDING AND SOUND-REPRODUCING APPARATUS.

We are so accustomed to the already existing types o sound-reproducing apparatus that a new type comes to u as a surprise. We refer in our *Digest* to a new sounc recording and reproducing apparatus recently exhibited a the French Académie des Sciences and invented by M. S

Lifschitz. In the recorder an arc-light beam is reflected onto a rapidly moving sensitized cinematograph strip from a mirror supported before the transmitter diaphragm. Speaking to the transmitter, its diaphragm vibrates, and this in turn vibrates the little mirror, which in turn vibrates the reflected light beam. A tremulous wavy line is thus photographed on the strip. A final record strip is then produced, with holes or serrations etched out photographically, in conformity with the original photographic record. The final strip with the holes is now run over the surface of a block provided with a slit aperture from a compressed-air chamber. As the holes in the strip pass over the slit the air escapes in a rapid succession of puffs or impulses, as in the siren disk, except that, whereas in the ordinary disk siren the holes come at regular intervals and produce a more or less musical steady note, in the phonographic band siren they come at less regular intervals and reproduce vocal sound. Listening to the apparatus is thus listening to the voice of the siren, in a manner not contemplated or claimed by the original poet. One advantage of the apparatus, in spite of the relative intricacy of the recording process, is the visibility of the sound record.

NULL METHODS IN ALTERNATING-CURRENT MEASUREMENTS.

One of the papers on electrical measurement read at the International Electrotechnical Congress of Turin was by Messrs. Barbagelata and Emanueli, on null methods in alternating-current measurements. In all electrical testing laboratories direct-current measurements are made, as far as possible, by null methods. For instance, the measurement of resistance by Wheatstone's bridge owes its precision and convenience to the fact that it is a null method, the adjustment of resistance being made in the test until the galvanometer shows no current. Similarly, the potentiometer of Poggendorf and Latimer Clark, as ordinarily used for the direct-current measurement of voltages or current strengths, owes its popularity likewise to being a null method. In alternating-current measurements there have been two difficulties to contend with in the past when seeking to apply null methods. The first difficulty has been to find a sensitive and yet convenient form of alternating-current galvanometer to reveal the presence of very feeble currents, or alternating currents when nearly reduced to zero. The second difficulty has been with phase differences of potential.

As regards the first difficulty, the ordinary D'Arsonval type of galvanometer was manifestly useless for alternating-current purposes. Moreover, instruments of the electrodynamometer type were not available as ordinarily used, because, their deflections being proportional to current squares and not to currents in simple proportion, their sensibility to very feeble currents was necessarily very low. The telephone was available, of course, as a substitute for a galvanometer; but for frequencies below 100 cycles per second the telephone is practically useless for accurate work, owing to insensitiveness, notwithstanding its extraordinary sensitiveness to alternating currents of frequencies from 500 cycles to 2500 cycles per second. It was not until the vibration galvanometer was developed that a satisfactory degree of sensitiveness to low-frequency alternating currents could be obtained. There are a number of types of vibration galvanometer, but all employ the principle of mechanical resonance, whereby a suspended system is tuned into synchronism with the alternating current, and is then acted upon electromagnetically by the current. A very small alternating deflection produced by the current on the suspended system thus soon builds up a powerful resonant vibration. As regards the second difficulty of phase differences, it is evident that we might make up a Wheatstone bridge with two non-inductive ratio-coils, a third arm containing a condenser, and the fourth containing an inductance. We might then supply alternating currents to the bridge and use a vibration galvanometer; but the current through the galvanometer could never be brought to zero, owing to the difference in phase of the potentials on the two sides of the bridge.

Any general null method of the potentiometer type applicable to alternating currents must, therefore, be capable of reducing to zero the phase of potential applied to the galvanometer before attempting to reduce the current strength to zero. The paper above referred to discusses the general plan of making such alternating-current null methods, and describes the particular apparatus already in use. One general method is to use a rotating-field transformer, so that, by changing the position of the secondary coil in the rotating field, the secondary emf can have its phase varied at will. The phase of the potential difference to be measured is thus adjusted into coincidence with that produced in the secondary coil of the transformer, after which the magnitudes of potential difference can be adjusted into equality, by opposition, through a vibration-galvanometer. The second method produces the required coincidence of phase by the addition of a perpendicular component instead of by the rotation of the plane of a secondary coil. The paper describes several types of vibration galvanometer, some of which are especially sensitive to low-frequency alternating currents, while others are particularly sensitive to alternating currents of telephonic frequencies. It also discusses the separate excitation of the electrodynamometer, so as to secure a relatively high sensibility with that instrument. The sensibility to feeble low-frequency alternating currents which can be obtained without difficulty in vibration galvanometers is wonderful. In fact, they are often so sensitive that the alternating stray fields from wires in their neighborhood may affect them seriously. In such cases it may become necessary to employ compensating alternating-current electromagnets, supported at an adjustable distance away from the galvanometer. Since the phase of the alternating magnetism thrown out by such compensating magnets may not be sufficiently near to that of the disturbance to be eliminated, it is shown in the paper that a rotating-field compensating electromagnet can be used, in which case not only the distance but also the azimuth of the device must be adjusted with reference to the vibration galvanometer in order to obtain complete compensation.

Seattle N. E. L. A. Convention.

A meeting of the transportation committee of the National Electric Light Association was held in New York City Nov. 22. Mr. C. H. Hodskinson, chairman, announced that the Transcontinental Passenger Association had authorized reduced round-trip fares on account of the Seattle meeting as follows: From Chicago, $65; from St. Louis, $62.50; from Missouri Gateways (Omaha to Kansas City inclusive), $55; from St. Paul, $55. Dates of sale for tickets under reduced fares were authorized as follows: May 27 and 28 and June 3 to 6 inclusive, the final return limit being July 27, 1912. Application has been made to the Eastern passenger associations for a fare and a half to the gateways of the Transcontinental Passenger Association, and as soon as an official tender is received from these associations complete details regarding the cost of transportation to the convention will be announced.

Details regarding special tours to Seattle were discussed and plans were formulated for several different tours, one of which is a *tour de luxe* embracing all the scenic wonders of the West. Another is a direct tour to Seattle with choice of returning routes. A third tour calls for a fast schedule from the Atlantic seaboard to Seattle and return for the benefit of members of the association whose time is limited. Detailed itineraries are in the course of preparation and will be distributed to the membership at an early date. The committee is making a special effort this year to make the trip to the convention the most elaborate, comfortable and interesting that has ever been afforded to the members.

The committee was most fortunate in having in attendance Mr. W. J. Grambs, of Seattle, who came all the way to participate in the conference. Mr. Grambs has accepted the responsibility of making all the arrangements on the Pacific Coast for the comfortable return after the convention to their respective destinations of members who have not made arrangements for the special trains. Members will be enabled to transact all their business with regard to transportation in a suite of offices engaged at Seattle by the transportation committee in the convention building, where representatives of the railroads will be present.

Provisions for exhibits at the Seattle meeting are now being made by a committee of Class D members. Plans are being drawn and spaces platted, and detailed information will be available for manufacturers by Jan. 1. It is believed that the manufacturers of apparatus and material used by lighting companies will take advantage of the opportunity that will be offered to show their apparatus in the western part of the country, and it is the desire to make the exhibit not only very interesting but typical of Western conditions.

Manufacture of Electrical Machinery, Apparatus and Supplies.

A preliminary statement of the general results of the thirteenth census of establishments engaged in the manufacture of electrical machinery, apparatus and supplies has been issued by the Bureau of the Census. The manufacture includes dynamos and dynamotors, transformers, motors, storage and primary batteries, arc and incandescent lamps, searchlights, transmitters and receivers, rheostats and resistances, electric welding and therapeutic apparatus, electric switches, signals and attachments, and similar machinery, apparatus and supplies.

The general summary shows increases in all the items at the census of 1909 as compared with that for 1904.

The number of establishments increased 29 per cent; capital invested, 54 per cent; the gross value of products, 57 per cent; cost of materials, 62 per cent; value added by manufacture, 52 per cent; average number of wage earners employed during the year, 44 per cent; amount paid for wages, 55 per cent; number of salaried officials and clerks, 69 per cent; amount paid in salaries, 82 per cent; miscellaneous expenses, 32 per cent; primary horse-power, 51 per cent.

There were 1009 establishments engaged in this industry in 1909 and 784 in 1904, an increase of 29 per cent.

The capital invested as reported in 1909 was $267,844,000, a gain of $93,778,000, or 54 per cent, over $174,066,000 in 1904. The average capital per establishment was approximately $265,000 in 1909 and $222,000 in 1904.

VALUE OF PRODUCTS.

The value of products was $221,309,000 in 1909 and $140,809,000 in 1904, an increase of $80,500,000, or 57 per cent. The average per establishment was approximately $219,000 in 1909 and $180,000 in 1904.

The cost of materials used was $108,566,000 in 1909, as against $66,837,000 in 1904, an increase of $41,729,000, or 62 per cent.

The value added by manufacture was $112,743,000 in 1909 and $73,972,000 in 1904, an increase of $38,771,000, or 52 per cent. This item formed 51 per cent of the total value of products in 1909 and 53 per cent in 1904. The value added by manufacture represents the difference between the cost of materials used and the value of product after the manufacturing processes have been expended upon them. It is the best measure of the relative importance of industries.

GENERAL SUMMARY, 1909 AND 1904.

	Census 1909	Census 1904	Per Cent of Increase, 1904–1909
Number of establishments	1,009	784	29
Capital	$267,844,000	$174,066,000	54
Cost of materials used	$108,566,000	$ 66,837,000	62
Salaries and wages	$ 69,574,000	$ 42,933,000	62
Salaries	$ 20,193,000	$ 11,091,000	82
Wages	$ 49,381,000	$ 31,842,000	55
Miscellaneous expenses	$ 23,630,000	$ 17,949,000	32
Value of products	$221,309,000	$140,809,000	57
Value added by manufacture (products less cost of materials)	$112,743,000	$ 73,972,000	52
Employees:			
Number of salaried officials and clerks	17,905	10,619	69
Average number of wage-earners employed during the year	87,256	60,466	44
Primary horsepower	158,768	105,376	51

The miscellaneous expenses amounted to $23,630,000 in 1909 and $17,949,000 in 1904, an increase of $5,681,000, or 32 per cent.

SALARIES AND WAGES.

The salaries and wages amounted to $69,574,000 in 1909 and $42,933,000 in 1904, an increase of $26,641,000, or 62 per cent.

The number of salaried officials and clerks was 17,905 in 1909 and 10,619 in 1904, an increase of 69 per cent; the salaries increased to $20,193,000 from $11,091,000, or 82 per cent.

The average number of wage earners employed during the year was 87,256 in 1909 and 60,466 in 1904, an increase of 44 per cent; their wages increased to $49,381,000 from $31,842,000, or 55 per cent.

A Correction.

In the report printed on page 1225 last week of the presentation by Mr. Edward D. Adams of a bust of Helmholtz to the American Institute of Electrical Engineers it was erroneously stated that Dr. Adolf Franke, representing the Verband Deutscher Elektrotechniker, is a director of the Allgemeine Electricitäts Gesellschaft. It should have been stated that Dr. Franke, who was a pupil of Helmholtz, is a director of the Siemens & Halske Aktien Gesellschaft

Meetings of Boston Electric Vehicle Club.

The regular weekly meeting of the Boston Electric Vehicle Club was held at the House of Edison Light, in Newton Center, Mass., at noon on Nov. 15, forty-five persons being present as the guests of the Edison Electric Illuminating Company of Boston, the host being General Superintendent W. H. Atkins. The party formed at the Edison Building, on Boylston Street, Boston, and were conveyed 8 miles in twenty-four electric automobiles through the Back Bay to Newton Center, no gasoline machines or other means of conveyance being employed. The movement of so many electric vehicles through the streets in order attracted much attention, and extended newspaper accounts of the affair were published on the following evening and morning. All of the seventeen agencies for electric vehicles in Boston were represented. Luncheon was served shortly after the party arrived in Newton Center, where full opportunity was had to inspect the bungalow.

At the conclusion of the luncheon Permanent Chairman Day Baker, General Vehicle Company, Boston, presided over the business meeting. Brief addresses were made by Mr. Converse D. Marsh, New York, and Mr. Frank J. Stone, Boston. The latter is chairman of the committee on the banquet to be given by the Electric Vehicle Club in December to various state and municipal authorities at the Boston City Club, and he announced that at this dinner an address will be given by Mr. Hayden Eames on "The Electric Vehicle," amply illustrated. A feature will be the exhibition of two photographs of a street section, showing the same traffic handled by horses and by electric vehicles, with emphasis upon the great reduction in congestion and space required brought about by the electric vehicle. The view is to be taken from the top of a high building downtown. Mr. P. R. Moses, manager of the Boston 1912 Electric Show, announced that the Electric Vehicle Association of America will maintain a model garage in the Mechanics' Building during the exhibition, and it was also stated that the Boston Edison Company had offered a complimentary headquarters space to the Electric Vehicle Club. The offer was accepted by unanimous vote. Mr. George D. Luther, Denver representative of the Edison Storage Battery Company, described the recent development of the electric vehicle in the Colorado capital, touching upon the popular interest aroused in the recent parade, in which 300 electric conveyances were in line, even the police officers forsaking their usual mounts in favor of the electric runabouts.

Electric Vehicles in Front of the House of Edison Light at Newton Center, Mass.

On Wednesday, Nov. 22, a meeting and luncheon of the Electric Vehicle Club were held at the Edison Building, with Mr. Day Baker in the chair. About fifty members and guests were present, and the principal feature of the gathering was an extended discussion of the widening scope of the electric automobile, as evidenced during recent long-distance tests in the East and Middle West. Mr. E. S. Mansfield suggested the desirability of establishing a motor mart for electric vehicles only in the Back Bay district of Boston to facilitate the examination of such machines by prospective purchasers. The plan was received with favor, and a committee was appointed to investigate the question.

An interesting discussion followed the reading of two logs of trips by electric automobile from Boston to New York. One was made in 1903 in four days five hours one way and two days thirty-two minutes the other. The second and recent trip was made by Mr. W. H. Francis, purchasing agent of the Boston Edison company, and Col. E. W. M. Bailey, of the S. R. Bailey & Company electric-vehicle organization, Boston, and extended over forty and one-half hours' total time, the actual running being at the schedule speed of 20 miles per hour for the 244 miles. The machine made the trip on 2.59 amp-hours per car-mile. As a result of the successful trip, combined with other investigations, the Boston Edison company has ordered six additional electric machines of the same model, to replace gasoline cars. Mr. Francis emphasized the fact that the Edison company found itself obliged to secure an electric automobile which would make an average speed of 20 miles per hour on roads typical of those in the Boston district, in order to discard the gasoline cars and high-priced chauffeur service required for suburban operation.

Mr. H. H. Rice, president of the Waverley company, Indianapolis, Ind., addressed the club at length upon the proper sphere of the electric pleasure and mercantile vehicle. He cited a run made through four states in the Middle West, in which an electric vehicle made 1400 miles in twelve days, finishing only a day or two behind the gasoline touring cars for which the run was primarily planned, and pointed out that such tests are chiefly of value in indicating the durability, reliability and speed capabilities of the electric machine. At the same time he contended that the electric machine is as yet unsuited for touring-car service in the hands of the public, and urged that care be taken to avoid giving the impression from such long-distance tests that the electric vehicle had become the last word in cross-country travel. He commended the policy of the Boston Edison company in standing behind the campaign in Massachusetts, and said that in his opinion Boston is the center of a great revival of electric-vehicle applications.

Mr. W. H. Blood, Jr., president of the Electric Vehicle Association of America, reviewed the transactions of the board of directors at the New York meeting of Nov. 21. He exhibited a broken steering shaft which had just come to hand as an object lesson of the need of improved designing and construction. Mr. Converse D. Marsh, New York, conceded the need of better construction, but contended that the gasoline car is in far worse straits, judging from close observation of equipment failures in garages in many parts of the country. In closing, Mr. Blood urged the publication of a vest-pocket card map of the State, showing the location of charging stations—information which is lamentably absent so far as most vehicle owners are concerned. Mr. Alexander Churchward, New York, called attention to the progress of the industry as evidenced in the fact that the vehicle which made the Boston-New York run in 1903 was equipped with two 1200-watt motors,

while the [illegible] which made the tour was driven by a single motor of 1500 watts rating. He argued that the electric vehicle has now reached the point where it can surpass the small gasoline car in economy of operation for the commercial traveler's service, in spite of the fact that the first cost of the electric may be twice that of the gasoline machine.

On account of the moderate speed which is required, the maintenance of the electric machine will be less than that of the gasoline; the opportunity for excessive depreciation through "joy riding" is absent on account of the limitations of battery service, and speeds are now sufficient for all reasonable purposes. Mr. Baker pointed out that the electric automobile will now maintain the maximum safe speed at which cars can properly be operated on the public highways, and predicted a great increase in its use as legal restrictions on fast service become more pronounced. Mr. Marsh, in closing, called attention to the attractive field for small electric-vehicle operation in central-station utility service.

Meeting of Electric Vehicle Association of America.

The regular monthly meeting of the Electric Vehicle Association of America was held in the Engineering Societies Building, New York, Nov. 21. The topic considered and discussed was "Has the Electric Vehicle Fully Arrived?" a paper on this subject having been prepared by Messrs. T. C. and K. G. Martin.

From the result of a canvass made by one of the authors it was apparent that only a small percentage of the central stations are encouraging a business from which they might and could derive a large increase of gross and net income. Judged on this basis, the authors confess that the electric vehicle has not yet got fully started, much less fully arrived. They cited the splendid evolution of the gasoline machine and the rewards attending the pioneer work undertaken by the builders of such machines as indicative of the results which should come from similar endeavors on the part of electric-vehicle builders. The latter, however, could profit by noting the scrap-heap of the former.

Citing numerous faults in design or rather in detail which they had personally experienced, the authors still proclaimed their faith in the ultimate triumph of the electric machine. In this they were encouraged by the performance of commercial cars characterized by wheel-steer, single-motor and double side-chain drive. Vehicles of this type have been in service for two years under heavy overloads, and the total average cost of tires, batteries and energy per mile was 6.58 cents, the energy being purchased at 4 cents per kw-hour. The authors drew attention to the need for a convertible vehicle offering weatherproof protection which is instantly available at any time. They also touched upon the advantages of standardization, and lamented the absence of data and curves in regard to any other feature of the industry except battery input and output.

Although authentic government figures will not be available until 1914, inquiry shows the value of electric-vehicle output at the present time to be $40,000,000, while some authorities place the figure in excess of $50,000,000. While this indicates a healthy and steady growth worthy of warmest admiration, it does not in the estimation of the authors engender a belief that the electric vehicle has fully arrived.

The paper was well received and the discussion following was participated in by Messrs. Frank Smith, United Electric Light & Power Company; H. H. Rice, Waverley Company; H. F. Thomson, Massachusetts Institute of Technology; C. Y. Kenworthy, Rauch & Lang; Thomas Appleton, Acme Garage, New York; E. S. Foljambe, *Commercial Car Journal;* W. E. Curtis, Jr., General Vehicle Company, and W. P. Kennedy, consulting vehicle engineer.

Electric-Motor Control.

Five patents recently issued to Mr. H. Ward Leonard relate to electric-motor control, and are notable for the early date of application and the breadth of claims. The principal patent of the group is based on an application filed in 1901, while another patent rests on a division of this application. The other applications were filed in 1905 and 1906. There are eighty-eight claims in the patent based on the earliest application, and 62, 30, 88 and 111 claims respectively in the other four.

The patents include broad claims on regenerative methods, especially for alternating currents, on single-phase traction and on multiple locomotive control; also on various systems of voltage speed control applying to the operation of reversible rolling mills, mine hoists, turret turning, etc.

The earliest patent in date of application includes a claim on regeneration, covering the case of the moving load producing electrical energy of different emfs, which are transformed into electrical energy of practically constant emf; also a claim on a method of accelerating and retarding a moving vehicle, supplying while accelerating alternating-current energy at practically constant emf, deriving therefrom electrical energy at variable emf, the speed of the vehicle being varied by varying the variable emf supplied to at least one element of electric motors located in different vehicles of the train, the retardation being accomplished by transforming the energy represented by the moving load into alternating-current energy and supplying said energy to an energy-consuming device.

Another claim in this patent is on a method of operating an electric motor at varying speeds, which consists in supplying its armature from a generator, exciting the field of the generator from a separate source of emf, and varying the emf of said separate source. A broad claim is on a method of operating an electrically propelled train comprising one or more vehicles, consisting in generating high-tension single-phase energy, conducting the same upon the train and there transforming it into energy of sufficiently low tension to be regularly commutated, dividing said energy and supplying each division to at least one element of its respective electric motor, commutating the current of each division and varying the speed of the train by varying the net effective emf of the low-tension energy. One claim relates to a method of controlling an electrically propelled train comprising a plurality of vehicles, consisting in producing on one of the vehicles an emf for producing a current in a controlling circuit, transmitting the current to another of the vehicles, and controlling from that vehicle the current in the circuit, and thereby controlling the movement of the train. A broad claim relates to a method of operating a train consisting in generating electrical energy at a stationary source, transmitting the same to the train, leading it upon the train by means of moving contacts, transforming the energy into a plurality of divisions on different locomotive units of the train, supplying said divisions of the energy to at least one element of the respective locomotive units and simultaneously controlling the transformed energy to control the train.

Another claim is on the method of controlling a plurality of motors acting on a common load, which consists in simultaneously controlling a plurality of inductively acting voltage regulators in series with each of the motors respectively. Still another claim is on the method of controlling a plurality of electrically propelled vehicles in a train, consisting in generating alternating-current energy, accelerating the vehicles by energy derived therefrom, generating alternating-current energy to retard the vehicles and supplying this energy to the circuit, transmitting controlled energy along the train and controlling the latter for producing the acceleration or retardation. One claim is on a method of electrically controlling a multiple train, consisting in generating electrical energy upon each of a plurality

of the locomotive units, dividing the total duty of each of the locomotives between a plurality of motor armatures, and varying the energy supplied to each of the motors by varying the controlled energy supplied to the plurality of units. Electropneumatic and hydraulic control are included in two general claims, one of these being on a method of multiple train control, which consists in transmitting controlled energy along the train, said energy having a variable factor, and varying the value of said factor of the controlled energy upon each of the units to vary the speed of the train.

A patent for which application was filed July 12, 1905, relates largely to the use of auxiliary voltages. One of the claims is on a method of varying the emf of a work circuit, consisting in successively impressing upon said circuit a plurality of different voltages and supplementing said impressed voltages by auxiliary voltages variably and uninterruptedly from approximately zero to approximately the potential difference of said impressed voltages. Another claim is for a system of control for electrical apparatus, including a source of multiple voltage energy, a regulating auxiliary gradually variable emf-producing device, and a means for including said regulating device in the circuit of the electrical apparatus in changing from one voltage to another. Still another claim is on a subdivided transformer, an emf-producing device and a translating device, together with means for connecting said device between points of subdivision of the transformer, for connecting the same in series with a portion of the transformer winding, and for cutting the latter device out of the circuit of the translating device.

In a patent granted on application filed Dec. 7, 1905, methods are claimed for controlling an electric motor, consisting in generating a plurality of different emfs and subjecting the motor directly to each of these and to intermediate emfs by developing in series with the motor a variable and reversible emf; on producing two unequal emfs in series with each other, and successively impressing each of these upon a circuit containing a translating device and further controlling the energy in the circuit by variable emf; on a combination of a multiple voltage system, the voltages between each successive pair of mains being different, a translating device, an auxiliary source of variable emf, a means for connecting the translating device successively to the supply circuit of the multiple voltage system and to the auxiliary source jointly; on the combination of means for unsymmetrically dividing the source of electrical energy so as to produce different emfs, the means comprising a winding producing by magnetic induction a variable emf, an electric motor, and a means for connecting the armature of the motor to said winding in series with each other, so as to be subjected to either or both of said different emfs.

In a patent granted on an application filed March 16, 1906, there are claims on a method of controlling a plurality of electric motors, which consists in supplying multiple voltages in series with each other and connecting the motor armatures in series and in parallel across the different voltages; on a method of controlling a plurality of electric motors acting on a common load, which consists in supplying field-exciting currents in parallel with each other, varying the strength of the currents and supplying armature currents in series, in multiple series and in multiple; on the combination of a plurality of motors acting on a common load, and means for connecting the motors in series, connecting certain of the motors in parallel, and for causing certain of the motor armatures to generate current to retard the load. A broad claim is on a stationary alternating-current source of energy, an electrically propelled vehicle supplied with energy therefrom through two moving contacts, means on the vehicle for developing a plurality of different voltages, a plurality of propelling motors, and a means for connecting one element of certain of the motors across the different voltages for controlling the movement of the vehicle. Still another claim of this character is on the combination of a high-tension source of electrical energy, a moving vehicle supplied with energy therefrom through moving contacts, a multiple voltage system supplied from said source and carried by the vehicle, a plurality of propelling motors, and a means on the vehicle for connecting the windings of said motors across the different voltages of said system and for transferring said windings from one voltage to a higher voltage.

A patent based upon a division of an application filed Jan. 24, 1901, is on a multiple-control system. One of the claims is on a motor-control system, comprising a source of alternating-current energy, an alternating-current circuit leading therefrom, an electric motor, energy-transforming means adapted to receive energy from said circuit and deliver energy to a winding of the motor, a control circuit, separate source of emf supplying said control circuit, and a means for changing the emf supplied by said source to said circuit. Another claim is on a system of motor control, comprising a motor, a generator supplying the armature of said motor, an exciter for the generator field, and means for varying and reversing the field strength of the exciter. Still another is on an alternating-current supply circuit, electric motor, transformer supplying energy to a winding of said motor, and a motor-controlling means comprising an additional energy transformer.

New Mexican Hydroelectric Plant.

One of the largest electric power projects in Mexico is that of the Compañia Hydro-Electrica Mexicana, S. A., which was recently formed with a capital stock of $30,000,000. It proposes to install hydroelectric plants upon the Rio Blanco in the States of Nuevo Leon and Tamaulipas and on the Rio de los Marangos in the State of San Luis Potosi, the company having already acquired concessions from the federal and state governments for these proposed plants. It expects to develop about 60,000 hp, which it will transmit to Monterey, Tampico, San Luis Potosi, Victoria, Montemorelos, Linares and other towns, covering a big scope of territory in northern and central Mexico. This electricity will also be used to operate electric railways in Monterey, San Luis Potosi and Tampico. Tentative contracts for the use of this power have already been made with many industrial plants in the different towns that are to be served. The surveys for the necessary dams and transmission lines are now being made. The officers of the company are: President, Mr. Thomas Makinson Sanders; vice-president, Mr. Frederick James Robinson; treasurer, Mr. Thomas Phillips; manager, Mr. José Romero, and secretary, Mr. Manuel Migoni. It is stated that construction work will be started on the different plants within the next few weeks and that it is expected that electric energy will be available within the next twelve to eighteen months.

Electrical Engineering Future Possibilities.

The Schenectady Section of the A. I. E. E. held its first regular meeting for the season of 1911 and 1912 at Redmen's Hall, Schenectady, on the evening of Nov. 8, 1911, at which time Mr. Henry M. Hobart, consulting engineer of the General Electric Company, read a paper entitled "Some Simple Dormant Possibilities in Electrical Engineering."

Mr. Hobart, in referring to the increasing use of induction generators and motors for very high speeds, called attention to the difficulties encountered in the design of 60-cycle steam turbo-driven synchronous generators above 3000-kva or 4000-kva output, which difficulties are greatly modified when the induction generator is used. Synchronous generators and motors are specially suitable for

low speeds, while induction generators and motors are high-speed machines.

The advantages were pointed out of winding generators for low voltage and employing step-up transformers between generators and transmission-line or cable systems, this practice being the outgrowth of the successful manufacture of cables for voltages above 11,000 volts and the difficulty in insulation and mechanical support of end connections in high-voltage generators. The paper showed the advantage of employing 60-cycle static rectifier substations instead of 25-cycle rotary converter substations for electric railway operation, thus rendering feasible the use of 60-cycle transmission, and referred to the possibilities of decreasing the capital cost and at the same time improving the "all-year" efficiency of rotary-converter substations by increasing the average load on the rotary per rated horse-power. Other points brought out were in relation to improved methods of cooling electric machinery by the use of ducts parallel to the shaft through the core, through which air is forced which carries a large quantity of water in suspension; the advantages from the use of the internal-combustion engine for isolated plants as contrasted with the present practice of large centralized plants, with the unavoidable large layout of capital for transmission; gasoline-electric propulsion, and electric propulsion of ships.

The paper of Mr. Hobart was discussed by Messrs. D. B. Rushmore, E. A. Baldwin, F. W. Peek, A. H. Kruesi, L. R. Robinson, F. P. Coffin, C. J. Hixon, C. McMillan and J. R. Werth.

Shop Testing of Electrical Apparatus.

At a meeting of the Pittsburgh Section of the A. I. E. E. on Oct. 14 a paper on the shop testing of electrical apparatus was read by Mr. E. M. Olin, who has charge of the testing department of the Westinghouse Electric & Manufacturing Company.

The author emphasized the importance of testing and its value to both user and maker, saying that tests are made primarily for two reasons, namely, to demonstrate the design and to prove the quality and workmanship of the apparatus. The design of electrical apparatus is based primarily on theoretical formulas, but the designer would be helpless without the use of constants derived from and based on extensive tests under actual operating conditions. Tests have been conducted over a period of many years, and it would seem as if they would become so standardized that it would not be necessary to repeat them, but designs change so frequently that it is necessary to continue tests and make new ones all the time. As an example of this may be mentioned the commutating pole, which is rapidly rendering the non-interpole machine obsolete and has revolutionized testing direct-current machines. Turbo-generators have produced the same results.

The expense of operating a testing department is an important item and one which is often not appreciated by the management as a part of the production costs, which it really is. It costs about ten times as much to correct errors in the field as it does on the test floor, and thereby the testing department often pays for itself many times over.

The speaker stated that it is the policy of the Westinghouse Electric & Manufacturing Company to test every piece of apparatus as nearly as possible under actual operating or service conditions in an endeavor to ascertain its behavior under these conditions. A company frequently suffers not only financial loss but loss of prestige by failure of apparatus which might have been prevented by thorough tests. The range of output, voltage, speed and frequency in the apparatus to be tested means a large expense to secure and maintain. As an example it may be necessary to test an 80-volt direct-current vehicle motor and at the same time a three-phase, 6600-volt synchronous motor. It is, therefore, necessary to have available direct current at all emfs from 0 to 1500 volts and alternating current of all frequencies, phases and voltages.

Electrical apparatus is sold under guarantees, and the object of the test is to see that it meets these guarantees. Temperature, efficiency, power-factor and similar guarantees must all be proved by the test. Temperature calculations are made either by the fall-of-potential or the bridge method. Tests by thermometers, however, are usually preferred by engineers when it is possible to make them, and this is borne out by the recommendation of the standardization committee of the A. I. E. E.

Mr. Olin described briefly the methods used for testing generators, motors, transformers and various other types of apparatus. He stated that 95 per cent of the troubles experienced with direct-current machines are with the commutators, and they are the most difficult to overcome from a mechanical standpoint owing to the high bars, soft spots and other faults. To correct these, they are run on short-circuit—often external heat is applied—and then the bolts are tightened, the commutator is trued up and the machine again run at normal speed. This process is often repeated six or eight times and is, naturally, a very expensive operation. It often seems, said the speaker, that direct-current machines are like individuals and are subject to good and bad spells and must be treated accordingly.

The testing department is different from all the other departments and is usually the last one to handle the apparatus, and as a result it is usually "between the devil and the deep blue sea" of the producers on one hand and the salesmen on the other. Factory tests are indispensable to engineers, for new problems are being worked out every day, as, for example, the determination of the brush setting of interpole machines.

Much trouble that is experienced in the field might be avoided if complete and accurate information as to service conditions was supplied to the manufacturers at the time of placing the order.

The paper was very widely discussed by the members present, among those taking part being Messrs. P. M. Lincoln, A. M. Dudley, A. W. Copley, R. L. Wilson and M. C. Turpin.

Ions and the Kinetic Theory of Matter.

Evidence that the kinetic theory of matter and the atomic state of electricity have received such rigorous experimental proof as to lift them out of the class of unsubstantiated hypotheses, placing them among demonstrable scientific facts, was related by Prof. R. A. Millikan, of the University of Chicago, in his lecture at Fullerton Hall, Chicago, Nov. 16, which was one of a course of winter Thursday evening addresses by Chicago University professors on "Frontiers of Science."

After pointing out the evidence contributed by the simple laws of electrolysis supporting an atomic conception of electricity, since the material transported across an electrolytic cell is proportional to the atomic weight of the element involved, Professor Millikan described briefly his own classic series of experiments in which individual atmospheric ions were isolated and their values found to correspond with the electrochemical quantity already observed. An account of this method was given in the *Electrical World* of Oct. 20, 1910, and other issues. Of the billions of billions of molecules in a cubic centimeter of air, from two to ten break up each second, probably under the action of radioactive materials in the rocks of the earth. There are thus three to four ions per cubic millimeter, and upon their presence in the air depend the phenomena of atmospheric electricity, discharges, etc. In the formation of these ions the molecules themselves are not broken up or shattered, but only a single ion "knocked off" each molecule. Th

was demonstrated by observing minute oil drops in artificially ionized fields, where in no case more than a single charge alighted on the drop at a time. The so-called Brownian movements observed in small particles in liquids ...e already been thought to be attributable to molecular ...ardment, according to the kinetic theory of matter. ...fessor Millikan has subjected to very low pressures the oil drops in his apparatus used to isolate ions and finds that these drops take up a dancing motion as they are im...l to and fro by collisions with the flying molecules of ... tenuated gas. Negative ions are all alike, said the speaker, and weigh about one-seventeenth hundredth of the hydrogen atom. The positive ions, differing among themselves in size, are much larger, the greatest being of about ... weight of the hydrogen atom. In size there is reason ...eve that the negative ions are about one-one hundred ...undth of the diameter of the atoms. To keep the ...ry 16-cp electric lamp aglow, about three billions of ...s of electrons per second course through its incandescent filament.

Cost of Power.

About 100 mechanical engineers, central-station men and others interested in the cost of power production convened Nov. 15 at the new Mason Laboratory of Mechanical ...ering, Yale University, New Haven, Conn., to participate in a discussion of this topic, celebrate the opening of the laboratory and listen to an illustrated lecture by Prof. Charles F. Scott, of the department of electrical engineering, on "The Development and Public Service of the Hartford Electric Light Company." The meeting was ...l under the auspices of the New Haven branch of the ...can Society of Mechanical Engineers, Mr. E. S. ...y, of the Connecticut Company, New Haven, being in the chair. Prof. Lester P. Breckenridge, of the department of mechanical engineering, acted as host on the part of the University, and at an evening session Col. E. D. Meier, president of the American Society of Mechanical Engineers, delivered a short address on the larger aspects of engineering co-operation through sectional work in different parts of the country.

The new laboratory is a handsome brick and steel structure recently erected at a cost of about $200,000, and its architectural features are unusual through their adaptation to a site adjoining that of a large church. Special attention has been given to the use of electricity for lighting and power in the new building. The main laboratory, about ... ft. x 35 ft., is lighted by twenty-two 250-watt tungsten lamps hung about 35 ft. above the floor, there being about 0.7 watt per square foot available for the illumination of the testing floor, which is served by a 10-ton Shaw electric crane running from end to end. Other electrical features include a 75-kw Curtis turbo-generator, an ash conveyor driven by a 3-hp motor, a motor-driven sump pump, an electric elevator installation, and tungsten lighting in lecture-room, office, research-room and other sections. All wiring is in conduit, and the electric drive is used in the operation of a 100,000-lb. testing machine and other equipment of ... and moderate power.

DISCUSSION OF COST OF POWER.

Three papers were presented on the cost of power production. Mr. A. W. Honywill presented figures covering the operation of a 45-hp gas producer plant in New Haven factory service. The first cost of the plant was $3,500, the producer being of the anthracite suction type and the engine a ...-cycle Backus equipment running at 160 r.p.m., with water-cooled cylinder, head and valves. The author found the cost of operation to be $5.55 per day with coal at $4.50 per ton, including 15 per cent for interest, depreciation and repairs. No test was made to determine the average load upon the engine, but a study of the power requirements and service of the woodworking machinery driven by it indicated that the average output for a ten-hour day did not exceed 18 hp, representing a 40 per cent load-factor. Mr. F. P. Pfleghar, New Haven, gave the results of operation of a 27-in. x 33-in. oil engine rated at 125 hp and operated by oil costing about 4 cents per gallon. The daily cost of operation was $9.68, or $43 per hp-year when fixed charges were added. The engine cost about $6,000, and 10 per cent was allowed for interest and depreciation. On account of the importance of maintaining constant service the writer stated that it was necessary to run a 90-hp steam engine in the plant at a yearly cost of $62 per horse-power, including operating expenses and fixed charges. The third paper was a discussion of the status of the small steam turbine, by Mr. W. J. A. London, of the Terry Steam Turbine Company, Hartford, Conn. The author emphasized the increasing usefulness of this type of machine in driving power-plant auxiliaries, its simplicity and efficiency under a wide range of conditions. He brought out the point that the water rate of a small turbine is not a vital consideration in view of the general use of exhaust steam for feed-water heating and the cost of even small improvements in economy when referred to the turbine design. Simplicity of operation and low maintenance costs were the chief issue.

ARGUMENTS FOR CENTRAL-STATION POWER SERVICE.

In the discussion of the foregoing papers a number of points were brought out by various speakers which tended to emphasize the benefits of central-station electric service in handling small power situations. It was shown that a lower rate had been offered for electric power at the woodworking plant operated by the producer-gas engine, the difference being about $150 per year below the total cost of service as given in the paper. It was also stated that about two hours were required for starting the producer and engine plant from the cold state, whereas the electric drive is always ready for instant service. In the case of the oil-engine plant the owner stated that great trouble had been experienced on account of the expansion and contraction of the metal in the engine, requiring frequent replacements of caps of cylinders, two or three per year, and at a high cost. Twenty minutes is required for heating the engine before placing a load upon it; the cost of maintenance is higher than with steam, and the direct connection of the engine and generator results in a service at the motors which is rather uneven on account of the jar of the engine operation. From four to five hours are required for cleaning out the interior, and if anything goes wrong nothing can be done until the machine has cooled down. Trouble has been experienced with the muffler, and the owner has never been able to obtain over 90 hp from the engine, which is less than its normal rating. The cost of the steam reserve is also serious. The point was also made that the installation of electric motors to replace the foregoing equipment would mean reliable service in any quantity required by the plant expansion, and at a rate of depreciation which would add merely a nominal cost to the total running expenses.

DEVELOPMENT OF HARTFORD ELECTRIC LIGHT COMPANY.

Professor Scott reviewed the physical changes in the plants of the Hartford Electric Light Company from 1883 to date, showing the types of equipment which were tried out at various periods and the growth of the business and earnings. Many diagrams were given showing the changes in rates, expenses, revenues, generating and distribution methods. Since 1901 the company's earnings from residence lighting have increased 500 per cent; from commercial power sales, 410 per cent, and from commercial lighting, 210 per cent. In 1902 the total annual output was 11,000,000 kw-hours, and in 1910 35,000,000 kw-hours. The maximum meter rate has dropped from 17 cents in 1894 to 10 cents at present. In 1901 the proportions of the total earnings were as follows: Street lighting, 17 per cent; residence lighting, 7 per cent; power, 22 per cent; commer-

cial lighting, 54 per cent. In 1910 these proportions were 6.5, 13.5, 36 and 44 per cent respectively. The average earnings of the company were 4 cents per kw-hour in 1901, compared with 2.6 cents at present. Meter rates for power now run from 6 cents to 1.33 cents, the lowest rates being given to installations of about 300-hp capacity or over, operating at about this load for at least ten hours daily. In 1895 the company had twenty-four generators rated at 1050 kw total, compared with ten rated at 16,500 kw to-day. Professor Scott stated that practically every isolated plant in Hartford has yielded to the superior economy of central-station service. About 6000 homes are supplied with light by the company, half of these being served at 60 volts on a flat rate. The pioneer experiments of the company with fireless cookers were touched upon, and the speaker closed with a high tribute to the consistent progressive policy which has been maintained for twenty-five years by President A. C. Dunham in the development of a central-station service quick to make use of advances in the art, careful to secure the benefits of economical operation and alert to give the public a better commodity for its money than was available before the central-station organization attained its present status.

Turin International Congress—III.

Instruments and Methods of Measurement.

In Section III of the Turin International Electrical Congress fifteen papers were presented, dealing with instruments and methods of measurement. Abstracts of these papers follow:

WATT-VOLT-AMPERE METERS.

By producing a certain phase displacement between the shunt and series currents of a wattmeter Prof. Riccardo Arnò obtains an instrument which gives the approximate product of volts and amperes. In order to make this instrument practicable he divides all commercial circuits into two classes, namely, lighting circuits with a power-factor from 1 to 0.85 and motor circuits with a power-factor from 0.9 to 0.5. He then chooses an average phase displacement for each class of measurement and provides a means of shifting the wattmeter circuits from one to the other.

Mounting two wattmeters in one case with their pointers crossed and one wattmeter adjusted to read volt-amperes while the other reads watts, the intersection of the pointers is an indication of the power-factor, and a suitable scale enables power-factor to be read directly.

THE ROTATING ELECTRIC-CURRENT FIELD.

Dr. A. E. Kennelly describes in detail the method for producing alternating-current vector diagrams experimentally which was outlined in an article in our issue dated March 30, 1911. In appendices were discussed methods for estimating the error in the current-sheet distribution due to the fringe of connecting wires on each edge; the conditions for maximum precision in measuring an impedance vector diagram on the conducting sheet, and methods for the determination of the current locus of balance points on the rotary-current sheet with diametral taps to a coil and variable additional resistances in its circuit.

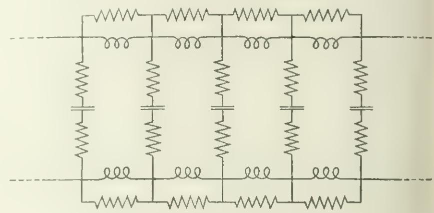
USE OF POLAR DIAGRAM IN DETERMINING THE MEAN EFFECTIVE CURRENT.

In a comprehensive paper on the subject of determining the mean effective curent Mr. C. O. Mailloux called attention to the time and labor saving incident to the use of the polar diagram and demonstrated its value by actual examples relating to unidirectional currents.

HIGH-FREQUENCY SURGES.

After briefly reviewing the methods of propagation of high-tension oscillations along a transmission line Mr. Gino Campos pointed out various practical ways of dissipati harmlessly the energy of such oscillations.

Basing his assumptions on experimental work done telephony and wireless telegraphy, he expressed the a tenuation constant in terms of the line resistance, the lea age conductance, the line capacity and the line inductan



Arrangement of Protective Circuits.

according to the usual equation, and then proceeded modify these different quantities so as to dissipate hi frequency energy but not disturb the low-frequency ene being transmitted over the line.

High-frequency current being forced toward the peri ery by skin effect, it is practicable to cover the wire w a very thin layer of high-resistivity metal and thus incre the high-frequency resistance enormously. Experiments the Reichsanstalt showed that a wire covered with a la of nickel 0.07 mm thick offered four times as much sistance to 300,000-cycle current as did a bare wire of same size.

Another method is to use an inductance coil in se with the line and shunt it with a resistor. The normal l current will pass through the inductance coil, while high-frequency currents will take the shunt path and bec largely dissipated in resistance. This arrangement tested with favorable results at 450,000 cycles per sec A third method seeks to increase the dissipation of ene by connecting condensers in series with resistors ac the line. However, the most effective method results f a combination of the foregoing as in the diagram. arrangement of this sort should be placed at points al the line where protection is desired. The values of sistance, leakage conductance, capacity and inductance so proportioned as to eliminate reflection of the wave any frequency.

Tests on an arrangement of this kind showed that surge potential decreased to one-third at 50,000 cycles 7 per cent at 100,000 cycles; to less than 1.3 per cen 200,000 cycles, and to about 0.5 per cent between 500 and 1,000,000 cycles.

Much of this high-frequency energy is also dissipate electromagnetic radiation, but little is known of the sistance and conductance of radiation, so that no atte has yet been made to utilize this phenomenon for prote purposes. The author suggested that it would be desir to construct a miniature line for the study of these nomena much as Steinmetz did in studying surges prod by switching.

The paper was discussed by Messrs. del Buono, Fac Olivetti and Gola.

PROTECTIVE DEVICES.

Mr. Guglielmo Neuhaus described an apparatus for tecting low-tension circuits from dangers incident to cr with high-tension circuits. Protection of the user of tension apparatus demands that in event of a cross the high-tension circuit must be opened and the low-te circuit grounded.

The apparatus described was for a three-phase sy but it may be adapted to any number of phases. In the low-tension three-phase system there are five fuses nected, one from each wire to ground and the other two between one wire and the other two. The operatic of

these fuses actuates a relay which closes a transformer circuit, which in turn furnishes current to open the high-tension circuit and ground the low-tension circuit as well as sound an alarm.

In a second paper the same author called attention to the fact that, while considerable progress had been made in the development of apparatus for protecting machines, practically no thought had been given to the protection of life in case of breakage of wires or crossing of high-tension wires with low-tension wires. He then described an apparatus for short-circuiting the line in event of breakage of a wire.

METHODS IN ALTERNATING-CURRENT MEASUREMENTS.

Messrs. A. Barbagelata and L. Emanueli reviewed present practice in zero methods of alternating-current measurement. They distinguished two fundamental methods: (1) Those methods in which the phase of the potentiometer current is adjusted until it coincides with that of the potential difference to be measured: (2) those methods where the unknown potential difference is balanced against two adjustable emfs in quadrature with each other.

The phase shifters used in the first method may be of the resistance or of the induction type. The latter is preferable because the angles of mechanical displacement and phase displacement are almost identical, and there is little to fear from wave distortion.

The characteristics of various forms of current detectors are then taken up. Among the types discussed are the telephone receiver, the vibrating galvanometer, the electrodynamometer and the ordinary galvanometer with a current rectifier. The telephone is, of course, the cheapest and for frequencies between 500 and 5000 cycles per second it is extremely sensitive, but at low frequencies such as are used in the industries its sensibility is greatly reduced. The vibration galvanometer and the electrodynamometer are treated in detail, and it is shown that an electrodynamometer with its fixed coil excited by current in phase with the current in the movable coil is extremely well adapted to the purpose, having great sensibility and being easy to manipulate.

The second method of balancing may be accomplished with an adjustable mutual inductance for furnishing the component in quadrature with the potentiometer emf, or system of two-phase emfs may be employed. In dis- ing the applications a special study was made of the nce of the form of the current wave. All the methods the magnitude and phase of the fundamental; never- s the authors demonstrated that the result is correct making power measurements on a circuit having ically sinusoidal emf. When using electrodynamome- for power measurements the results are always accu- provided the exciting current in the fixed winding ie same form as that in the movable coil.

to choice of method the authors expressed preference he mutual inductance and the telephone receiver for encies above 500, while for ordinary industrial frequencies they preferred the use of a phase shifter and an electrodynamometer. In conclusion they described a Drysdale-Tinsley potentiometer and equipment in the electrotechnical laboratory of the Polytechnicum at Milan and gave examples illustrating its application in calibrating voltmeters and wattmeters and in testing instrument transformers.

MEASUREMENT OF INSULATION RESISTANCE OF ALTERNATING-CURRENT LINES.

A method of determining the insulation resistance of a circuit from tests made while in operation was communicated to the congress by Mr. Alberto Dina. The author briefly reviewed the work of several others on the same subject and showed the limitations of their methods. He then proceeded to develop various graphic methods which are perfectly general in their application. The first series of methods assume that the capacity to earth is known. Examples are given for single-phase and three-phase currents using two different methods. One method assumes that the measurements are made with an electrostatic voltmeter and the other that they are made with a voltmeter which consumes current. Following the discussion of these methods, the case where the capacity is unknown is taken up. These methods require one electrostatic voltmeter and one current-consuming voltmeter, one electrostatic voltmeter and a resistor, or two current-consuming voltmeters having different constants. Examples are given for each method.

In every case the charging current of the electrostatic voltmeter is assumed to be negligible in comparison to the leakage current through the insulation. In cases where the error introduced by this assumption is objectionable the author suggested that a suitable impedance coil be connected between the line under test and the earth, and that a correction factor in terms of the inductance and resistance of the impedance coil be applied.

PREVENTION OF OSCILLATIONS DUE TO SWITCHING.

In a second communication Mr. Alberto Dina described two methods of preventing large rises in voltage due to oscillations produced by manipulation of the main switches. In the first method, assuming a single-phase system, a resistor in series with a spark-gap is connected across the line side of the switch, and the junction between the resistor and the gap is connected to an auxiliary switch mechanically locked with the main switch and electrically connected in series with one side of the main switch. In operation the auxiliary switch closes first, thus connecting the resistor and cable network in parallel, and when the main switch is entirely closed the auxiliary switch is open, thus disconnecting the resistor from the circuit but leaving it always in series with the discharge gap across the line.

The approximate value of this resistance is determined by neglecting the inductance of the cable system and assuming the capacity to be concentrated at one point; then to avoid oscillations upon closing the circuit, the value of the resistance should not exceed the critical value

$$R_c = \tfrac{1}{2}\sqrt{\frac{L}{C}}$$

wherein L is the inductance of the generator and C the capacity of the cable system. However, the fulfilment of these conditions only meets the requirements of the first part of the operation. Upon closing the switch completely, a short-circuit across the spark-gap is opened and oscillations will be established unless

$$R > 2\sqrt{\frac{L_c}{C}}$$

wherein L_c is the inductance of the cable circuit (neglected before) and C the capacity of the cable.

In some cases both conditions cannot be perfectly met, but the value of R is allowed to exceed R_c. The author showed a curve giving the first and second maxima of the emf rise as a function of R/R_c, and according to this for $R/R_c = 2$ the first maximum would be about 15 per cent above normal and the second would be entirely negligible. However, the increase is very rapid and for $R/R_c = 5$ the first maximum reaches 50 per cent, while the second is 15 per cent. This same connection is also well adapted to main switches in substations between the cables and the transformers.

Mention is also made of special switches which are provided with a series resistor that is first connected in circuit and then short-circuited. These switches are used both in generator-feeding cable systems in overhead lines and also in substations between the line and the transformers.

INTEGRATING METERS.

Beginning with the legal requirements as to the accuracy

of meters in different European countries, Mr. A. Durand discussed the errors in different types of watt-hour meters and ampere-hour meters, calling attention to the shortcomings of the various types and suggesting how they may be improved.

Meters should always be tested with their covers on, since the temperature of the working points is due more to the heating action of the losses in the meter than to outside causes. The permissible losses in France are high, namely, .4 watts per 10 volts in the shunt winding and 1 volt drop across the series winding of commutator meters. Therefore the total loss in a 110-volt, 10-amp meter is about 15 watts at full load. The shunt winding alone will produce a temperature rise of 10 deg. C., and when operating at full load the temperature rise may reach 25 deg. C. The rise in temperature decreases the driving torque and also the damping torque; therefore, theoretically the error can be eliminated, but in actual practice it seldom is less than 1 per cent per 10 deg. rise, and may even reach 4 per cent. Induction meters are affected to a much less degree by temperature changes than are commutator meters when the damper and the exciting winding both react upon the same disk. The error in such meters is about 1 per cent per 10 deg. C. Friction due to brushes, pivots or both presents a serious difficulty. Tightening the brushes may cause an error of 10 per cent at one-tenth load, and a short-circuit between two bars may cause a retardation of 10 per cent at full load and stop the meter entirely at light load. Relatively heavy movable systems and high speeds cause rapid wear and increase in friction. Cases were cited where jewels had to be changed once a month.

Much trouble experienced with meters is laid to dirt, and the author intimated that a perfectly dirtproof case would do much to improve the performance of the instruments. The effect of external fields is often quite considerable. An instance was cited of two 300-amp Thomson watt-hour meters placed on 9½-in. centers. When one operated at full load the other showed an error of 10 per cent at one-tenth load and 20 per cent at one-twentieth load. Induction meters are much better shielded from the action of external fields.

In discussing the effects of short-circuits oscillograms of tests under various conditions are shown. The demagnetizing effect of the short-circuit current may be lessened by properly designing and placing the magnets. The use of a shield is not advisable, since the shield itself becomes magnetized and reacts upon the movable coil.

The use of shunts is recommended for direct-current meters, care being taken to compensate for temperature errors. Shunts for alternating-current meters must have the same time constant as the winding they are connected across. Creeping may be caused by fluctuation in emf, by external magnetic effects, or by action of a shield magnetized by a short-circuit. Considerable errors were noted in induction meters subjected to variable frequency and bad wave distribution. Variations of 5 per cent in the frequency produce an error at one-half load of from 1 per cent to 2 per cent. An instance is cited where a meter registered correctly when the circuit was supplied from a certain generator and showed an error of 15 per cent when a generator of different wave-form was connected to the line.

Low power-factors tend to make Thomson meters run fast. Induction meters can be almost perfectly compensated for power-factor. Defective construction is largely responsible for the necessity of testing meters in position. The author stated that at least half of the commutator meters record too little at light loads. Tests in position are less accurate than in the laboratory, and therefore the permissible errors are about double the laboratory values in both France and Germany.

Of all the meters that have been tested at the Laboratoire d'Électricité, 14.3 per cent of the commutator watt-hour meters, 40 per cent of the commutator amp-hour meters and 47 per cent of the induction watt-hour meters satisfied the official tests. The rest had to be adjusted or changed in order to bring them within the limits. The author concluded by deprecating the practice of standardizing laboratories in issuing certificates of accuracy to within one-ten thousandth or even one-one thousandth. The methods of measurement, and above all the meters themselves, do not permit this degree of accuracy.

PRACTICAL CALCULATIONS OF ELECTROSTATICS.

In a communication entitled "Practical Calculations of Electrostatic Fields" Prof. Vladimir Karapetoff declared himself in favor of the Giorgi system of units on the ground that it is more logical and that it facilitates the physical interpretation of formulas. After briefly reviewing Faraday's conception of the electric field, he adopts the terms "permitance," "elastance," "permitivity" and "elastivity," introduced by Heaviside, to replace "capacity," "specific capacity" and their reciprocals. The unit of elastance is denoted as "daraf," which is "farad" reversed, being the reciprocal of "farad." Having adopted these units and this nomenclature, the author proceeds to write the equations for permitance, elastance and other quantities dealt with in electrostatic calculations, following which he gives numerical examples of practical calculations tha serve to demonstrate the simplicity and convenience o the system.

ELECTRICITY METERS.

Dr. Clayton H. Sharp presented an outline of America meter practice, which has been influenced by certain im portant factors that have tended to differentiate this prac tice in some respects from that of other countries. Th practice at the present time is the result of co-operativ effort on the part of the meter manufacturers and the com mittees of the National Electric Light Association and th Association of Edison Illuminating Companies. Confi dential information and technical data are freely exchangec to the great advantage of both the manufacturing companie and the electrical associations. The manufacturing com panies become intimately acquainted with operating con ditions and with such shortcomings of existing apparatu as develop in practice, and are thereby better able to intro duce improvements in their products, while the operatin companies gain a valuable insight into the problems an conditions of manufacture and the requirements of stanc ardization. As a result of this co-operation there has bee brought out by the committees of the two associations standard code comprising sections on general topics c measurements, on specifications for acceptability of type of meters and of auxiliary apparatus, and on methods c installation, tests and maintenance of meters. Certain c the improvements which have been introduced in mete during the last few years were outlined. There exists the present time a very strong demand for a meter low i first cost and maintenance and which has at the same tin great reliability in operation and a reasonable degree accuracy. This condition indicates the possible return the ampere-hour meter in some form which may be four to meet the requirements of the case. At the present tim however, for the purpose of metering the direct-current e ergy sold, the watt-hour meter of the motor type has pra tically universal sway. The moving element has been grea ly reduced in weight, to the advantage of permanent acc racy of registration. By the use of aluminum instead copper disk, and by the use of a spherical armature, d signed to give the highest torque per unit weight, the resu is that with 25 per cent less copper there is 35 per cent mo torque. The most important improvement has been in t jewel used in the step bearing. Cut diamond jewels pr duced by automatic machinery are used very extensive in the direct-current meters. For alternating-current e ergy measurement the induction type of meter is more

liable and satisfactory than the commutator meter which has been employed to some extent for this purpose. For metering polyphase energy use is made of a single meter consisting of two metering elements, which are for all practical purposes independent of each other. The size of meters selected for any installation is chosen rather too small than too large. Meters in use are very carefully tested periodically in the laboratories and on the customers' premises and are thereby maintained in a state of satisfactory efficiency, the expense incurred being more than returned by the increased revenue derived from the accurate meters.

The paper was discussed by Mr. Torchio, who gave some statistical data from the Edison Illuminating companies.

HIGH-TENSION SWITCHING PHENOMENA.

In a paper by Mr. G. Faccioli were described a series of tests performed on the 100,000-volt transmission lines of the Central Colorado Power Company for the purpose of studying line oscillations produced by the operation of high-tension oil switches. The results showed that each switching operation may produce several complex successive oscillations. The over-voltages produced were found never to exceed 40 per cent of the normal maximum value of the emf, which result is in conformity with theoretical considerations. An element of danger to high-tension apparatus was found in the possibility of producing local high-frequency, high-voltage stresses.

The author claimed that the common method of protecting transmission systems, by lightning arresters connected in series with a spark-gap, does not safeguard the apparatus from high-frequency impulses, although it is effective when a high difference of potential is produced between the phase conductors and between conductors and the ground. High-tension switching, which gives origin to the high-frequency impulses, should be avoided or reduced as much as possible.

When a new line is to be energized two methods of switching may be followed : First, the high-tension line, which is open at the distant end, is connected to the transformers at the generating station, and then the step-down transformers are connected to the distant end of the line. According to the second method, the step-down transformers are connected to the end of the dead line, and then the step-up transformers are connected to the generator at the power house. The second method is preferable to the first, in that it produces only one oscillation similar to the less severe of the two oscillations produced by the first method. The tests discussed in the paper were first described in a paper presented by the author before the American Institute of Electrical Engineers, as noted in our issue dated March [illegible]

The report was discussed by Messrs. Pizzuti, Campos, Dina and Kennelly.

TRANSIENTS IN ELECTRICAL ENGINEERING.

Dr. C. P. Steinmetz presented a paper in which were given complete mathematical analyses of transient phenomena in transmission circuits. He stated that an electrical transient is the phenomenon by which, when a change of circuit conditions is brought about, the stored magnetic and dielectric energies of the electric system readjust themselves to the changed circuit conditions. There are two general classes of transients, namely, single-energy transients and double-energy transients. Single-energy transients exist in those circuits in which energy is stored in only one form, usually as magnetic energy, and the transient can consist only of an increase or a decrease of the stored energy. Double-energy transients exist in those circuits in which energy is stored in two different forms, as magnetic and as dielectric energy, in which case, in addition to an increase or decrease of stored energy, there may be a transformation of the stored energy from one form to the other, the transformation usually being periodic.

In electric-lighting circuits of 110 volts, railway circuits of 600 volts, and even in primary distribution circuits of 2200 volts, the stored dielectric energy is so small as compared with the stored magnetic energy that it can be neglected, so that the circuit can be treated as storing energy in only one form. In overhead electric circuits of 30,000 volts and in underground cable circuits of 10,000 volts the dielectric energy is of the same magnitude as the magnetic energy, and such circuits cannot be treated as storing only one form of energy. An important relation in such circuits is the ratio between the self-induction and the capacity of the circuit. The square root of this ratio has the properties of an impedance, and may be called the natural impedance of the circuit. In overhead transmission lines this impedance is usually between 200 and 600 ohms. It is much smaller in underground cables and much larger in coil circuits, such as the high-potential windings of the transformer. One can calculate the voltage of an oscillation, surge, impulse or traveling wave from its current, or the current from the voltage, by means of the known value of the natural impedance of the circuit. Thus, if the natural impedance is 400 ohms and the maximum emf 120,000 volts, the maximum discharge current is 300 amp. A study of the value of the natural impedance is of great industrial importance in indicating the action which different circuit sections exert upon each other in either protecting or endangering each other.

Dr. Steinmetz showed that in circuits comprising sections of different character, such as transmission lines, transformers, load connection, etc., the energy surge is a combination of standard wave and traveling wave. At the transition point between successive circuit sections there is a transformation of voltage and current, with a transformation ratio which is the square root of the ratio of the natural impedance of the two circuit sections. When a traveling wave coming from one circuit section enters into a circuit section of higher natural impedance the voltage is increased, while when it enters a section of lower natural impedance the voltage decreases. The voltage transformation at a transition point means that the wave-crests of the voltage distribution in the one circuit section are higher than in the other circuit section. At the transition point a change of phase angle occurs, so that at this point both sections have exactly the same voltage, but the different sections have different potential distribution of the traveling wave.

PROTECTIVE CONDITIONS OF ELECTRICAL APPARATUS.

An outline of the theory relating to disturbances in electrical apparatus was given in a paper by Prof. E. E. F. Creighton. The author discussed the nature and source of electrical surges, the characteristics of insulation and construction, the characteristics of protective apparatus and certain practical and commercial adaptations. Attention was called to the fact that there can be no hard and fast rules to cover the subject of protection in general. However, a description was given of specific practices which are gradually crystallizing into definite form. It was stated that for potentials above 30,000 volts there is at present no available good arrester except that of the aluminum type. For transformers operated at emfs less than 30,000 the multi-gap arrester is cheapest and gives excellent results, although aluminum arresters give a higher degree of protection. For the protection of transformers on circuits of 2300 volts all of the conditions are favorable to the use of the multi-gap arrester. For the protection of generating-station apparatus the cost of protective apparatus is of relative insignificance, and the important requirement becomes reliability. For this service the aluminum arrester is the best.

First and foremost in the protection of transmission lines is the insulator, which should be selected with due regard to the relation between the potential to puncture and the potential to arc around the insulator. In lightning-infested localities transmission lines should be equipped with over-

head grounded wires. Bessemer-steel wire has been found unreliable for this purpose. Standard wires of open-hearth steel are best. Overhead wires should be grounded at every support. Two separate overhead wires are better than one, but to just what extent they are better no one is able to state. Metal guards around insulators are valuable on circuits carrying enormous power, but are usually not necessary under other conditions. The only protector to the service as well as to the insulator that is available to-day is the arcing ground suppressor, which involves a relay device by means of which the circuit is grounded for only sufficient time to suppress any arc that may have formed.

Public-Policy Topics Discussed at Credit Men's Banquet.

At the sixteenth annual dinner of the Electrical Credit Association of Chicago, held at the Chicago Athletic Club on Nov. 16, the list of toasts embraced two subjects of much present-day interest. Mr. William J. Hagenah, the public-utility expert formerly connected with the Wisconsin Railroad Commission, was first on the program of set speeches. His remarks on "Regulation of Public Utilities" showed a deep study of the subject. He pointed out that the regulation of railroads and the establishment of the Interstate Commerce Commission grew out of the grangers' movement of 1873. In the last few years there has been a similar wave of public scrutiny of the affairs of the public-utility corporations, and these utility problems are now perhaps to be regarded as acute.

Investigation shows that the idea that rates are generally excessive in order to pay dividends on watered stock is an exaggerated notion. The condition of affairs is due less to premeditation than to the frequent changes made necessary by the development of the art, supplemented perhaps by some carelessness in management. In studying the subject such matters as appraisals, scientific accounting, standards of service, rates and franchise provisions must be considered. Service is the first requisite of the public utility. After this come rates, and the speaker here analyzed the factors entering into the establishment of a reasonable rate. The difficulties of appraisal and inventory were set forth, and then the subject of intangible values was taken up.

Mr. Hagenah does not believe that any corporation can capitalize the value of franchises issued by the public; neither does he believe that natural monopolies can capitalize "good-will" value. But there is an intangible value of a public-utility property; there is a certain value above the simple physical value. This is called "going value." In explaining this the speaker pointed out that it is fair to make allowance in valuation for the losses in developing a business. On the other hand, it is equally fair to credit to that valuation the excess over a certain fair base rate of return in prosperous years. If 7 per cent be accepted as this rate return, it should apply from the first day of doing business and deficiencies or excesses should be charged or credited properly. That is the plan of the Wisconsin commissioners.

Courts of law and other authorities differ on the question as to what is a reasonable rate of return and figures varying from 6 to 8 per cent have been mentioned. The way to meet the great public-utility problem, to study it and to adjust it, is to constitute a body of experts provided by law for the purpose. These experts should be men of high character appointed for a long time, and should receive large salaries, with ample funds at their disposal to make the necessary investigations.

Mr. Harry A. Parkin, special assistant United States district attorney in Chicago, spoke on "The Sherman Act in Business." He took pains to say that his views were given personally and not officially. The main purport of the Sherman act, passed in 1890, is simple. It holds that every combination in restrain of trade is illegal, and its purpose is the fostering of free competition. Mr. Parkin recalled that one of the first applications of the Sherman act was when Debs was indicted in 1894 under that law for inciting a strike in restraint of trade. He sketched other cases and interpretations of the courts which have arisen since that time, paying particular attention to the Standard Oil and American Tobacco cases. The decisions in these cases were analyzed, and it was stated that the Supreme Court held that the mere size of a corporation, or the character of its business, or the ultimate end to which the corporation's activities tend, is not to be considered an element in contravention of the Sherman act. The point seems to be that if a corporation is organized with the intent to absorb other corporations, so that business is stifled, with the eventual result of increasing prices to consumers, this intent constitutes a violation of the Sherman act.

Mr. Parkin touched on the "rule of reason," stated by the Supreme Court to be necessary in interpreting the law. This "rule of reason" seems to be the use of common sense to ascertain if the purpose of the defendant or defendants is to establish a monopoly. "Calamity howlers" have hurt the business of this country far more than the Sherman act has. It is to be remembered that the Sherman act has not been changed since its enactment over twenty years ago, but as a matter of fact the manner of carrying on trade and commerce has changed. If the old method of doing business in this country and encouraging free competition is better than the "big-business" monopolistic idea, then the Sherman act as it stands does not need amendment. Mr Parkin urged his hearers not to condemn the Sherman law without a thorough understanding of it, and above all no to be "calamity howlers."

Mr. A. O. Kuehmsted presided at the dinner and Mr. A A. Gray was toastmaster. Mr. Julius Reynolds Kline gave an eloquent speech on "The Measure of a Man," and Mr Harry A. Antram recited some Hoosier poems. Mr. F. P Vose was master of ceremonies and Mr. Warren Ripple led the singing.

Financing Public-Service Corporations.

Mr. Andrew Cooke, vice-president of the Harris Trus & Savings Bank, addressed the Electric Club of Chicag on "Financing Public-Service Corporations" on Nov. 1[illegible] The speaker, among other things, said that capital shoul be reimbursed for the risks involved in any business, an he referred to the radical legislation in Iowa as hamperin the public-service development in that State. In makin valuations difficulty is often occasioned by theoretical ap praisals; that is, appraising the value of a public-servic property at its exact reproduction cost without taking int account the greater actual cost due to piecemeal constru tion as the property has grown.

Mr. Cooke made a plea for conservative financing, an remarked that the fixed indebtedness on the property oug not to exceed 80 per cent of its actual value. The stoc should have a real value. This will remove or diminish th danger of foreclosure, because if the property is attacke the company can conserve its resources for a time by pas ing dividends. The speaker thinks that a return of 10 pe cent on the stock is not too large, as in the present unsettle state of public opinion there should be some incentive purchase the stock of the average public-service co poration.

One point emphasized by Mr. Cooke was that dividen should not be paid out of the property; that is, there shou be ample allowance for depreciation. The speaker co mented on the number of failures of small public-servi corporations, and said that in small towns it is almost i possible to return the investment at the end of twenty-fi years and at the same time make rates reasonable enou

to attract business. The mortgages of the bank with which Mr. Cooke is connected are drawn so that in making betterments only the difference between the cost of the old and the new apparatus is charged to capital account; the value of the old apparatus must be charged off to depreciation. A telephone company was mentioned where 33 per cent of the value of the property is allowed annually for maintenance, repairs and depreciation.

As a comparison it was shown that depreciation in public-utility plants is like the reserve fund in life insurance; it must be provided at all hazards. Another point usually insisted upon by the banks is that the company shall earn at least twice the bond interest charge, this charge being based on an indebtedness not exceeding 80 per cent of the value of the property. Financial houses discourage floating indebtedness. The liabilities of the company should be almost entirely in the bonds and stock. In case the property is attacked by demagogues coolness is needed perhaps more than courage. In time the pendulum will swing in the other direction, for in the end the rights both of the public and the investors must be preserved.

Municipal Regulation of Public Utilities.

Mr. Leslie C. Smith, superintendent of the water department of the city of Cleveland, read a paper at a recent convention of the League of American Municipalities, held at Atlanta, Ga., Oct. 6, on the subject of "Regulation of Public Utilities." In reference to the monopolistic character of public utilities, Mr. Smith said that the principle of competition had become so interwoven with benefits in commercial dealings that it had come to be understood as the only lever by which a commodity may be secured for a less price. No more fallacious claim can possibly be made in its application to any enterprise coming under the head of public utility. The question of finance is always one of vital import to a city, and that there can be economic results from the duplication of plants and the entering into open competition with intrenched capital is impossible. Wherever government authority may restrict the expenditure or the income of a corporation it faces immediately the alternative of lesser service. It seems to be an assured fact that whenever the speculative element is removed from the investor's outlay of money the desire on the part of the investor for improvement and development of his interests ceases.

In reference to the franchise ordinance under which the Cleveland Railway now operates, Mr. Smith said that it is evident that since the amount allowed by the city to the company for expenditures in operation is definitely fixed and the items to be included enumerated, any excess in such operating expenses must come from some other source. It is equally apparent that the first expenditure from the interest fund established will be the 6 per cent allowed the stockholders upon their investment. To maintain this latter amount intact it seems thoroughly axiomatic that the interest fund will not be depleted below an amount necessary to secure such dividends. The answer is then settled that if the return allowed for operating expenses be insufficient to guarantee necessary expenditures inferior service must of necessity arise.

In his conclusions on the subject of regulation Mr. Smith said that regulation or ownership can be made successful, but there must come some radical advancement in the laws which place the utilities at the mercy of varying administrations. Whether this be fixed in concession or actual interest return is of less importance than that it be just.

Mr. Smith also took up the question of the proposed municipal electric-lighting plant in Cleveland, and said that under the statutes there is no way of driving the existing company from its territory, and to compete with it the city must duplicate its distribution facilities. The experience of the past shows that it has taken the city five years to attain in one of its present small municipal plants the maximum usage of 1500 kw, and this is practically without competition. The establishment of a two-million-dollar plant under conditions even 100 per cent more favorable than those encountered heretofore would mean that much of the investment must lie idle for many years. The momentous question arises as to whether or not the gain to be achieved, if there be gain, will equal the loss to the people in interest, depreciation, obsolescence and other such elements as must of necessity exist and accrue if the large outlay is made before the development of the business justifies it.

Regulation of Public Utilities.

The twenty-third annual convention of the National Association of Railway Commissioners was held in Washington, D. C., on Oct. 10 to 13. While this association considers principally subjects relating to railways, it also takes up various questions affecting generally the regulation of public utilities.

Among the committee reports presented was one on railway capitalization. The chairman of this committee was Mr. Martin S. Decker, a member of the New York Public Service Commission, Second District. This report stated that in the issue of these securities the public is primarily concerned that they shall be sold for their full value and the proceeds applied to the construction or improvement of railway property. Secondarily, the general public has a strong interest in the proportion of stock to bonds and in the improvement of railway properties without unnecessary additions to the bond interest or a fixed charge account.

The report adds that in the absence of governmental regulations the interests of holders of stock and bonds and of the people as compulsory customers of the railways have not been protected in any reasonable degree. That such regulation is indispensable to the conservation of the true interest of the corporations, its shareholders and creditors, and the interests of the general public, is fast coming into general recognition.

Taking up the subject of regulation of the railways in New York State, the report says that the policy of the commission in regard to new companies authorized to build a railway is to make such allowance for preliminary work and organization as seems reasonable in each case. The commission allows full and even ample compensation for such services as may be shown. This fully recognizes valid claims, but prevents exploitation.

On the subject of additions and betterments the report says that after long operation the railroad company should be able to decrease rather than increase its mortgage debt, or at least be paying a substantial percentage of the costs of betterments and improvements from income without issuing bonds to cover such percentage of betterment or improvement cost. It should do this while accumulating at the same time a surplus available for use in times of sparse traffic.

The ever-swelling fixed charge, except as met by increased traffic returns, tends constantly to diminish net corporate income. The real test of the commercial value of a railroad property is found in its net earnings. It is encouraging, the report adds, to note that banking interests are not oblivious to the situation and that in the case of many smaller companies they have insisted that new mortgages shall contain a clause that future improvements and betterments shall not be made from mortgage bonds beyond a stated per cent of their cost. A similar safeguard might well be inserted in the mortgages of all companies.

The report of the committee was discussed at length by various delegates. Mr. O. P. Gothlin, Public Service Commission of Ohio, said that, notwithstanding that the law creating that commission had been in effect but three

months, many problems had been considered. Promoters had tried to ascertain the attitude of the commission as to what proportion of stock in a new property would be allowed for promotion services. Interurban railways and other utilities have come to the commission in cases where their existing indebtedness was so large that net earnings were not entirely sufficient to meet the interest requirements or the net earnings were barely sufficient and money was needed for extensions and improvements. The companies wanted in these cases to issue more bonds to "tide them over."

It appeared almost certain, Mr. Gothlin said, that this practice only meant the addition of further burdens and that the relief was only temporary. What was the commission to do in a case of that kind? Backers of new enterprises would appear before the commission to ask about the issue of stock and bonds for construction of the utility plant or railway.

Mr. Decker said it was a fact that many improvements did not begin to earn revenue until a number of years had passed, and some of them never earned revenue. It was not always easy to determine the exact compensation which was due the promoter—that is to say, the value of the service. The commission took testimony upon the subject, inquiring how long the promoter had been engaged in the work, what he had done and what expenses he had had. In that way a fair approximation of the value of services could be made. These were to be termed "preliminary expenses." The engineering services in preliminary surveys came under the same general designation. The cost of acquisition of rights-of-way would be included under the general term "preliminary expenses," but the commission did not lump all the expenses and say, "You are entitled to 50 per cent of this bond issue, or 50 per cent of the stock issue." It tried to determine a just compensation for the services rendered.

Continuing, Mr. Decker said that, while undoubtedly promoters who had been used to the practice of obtaining all or very large parts of the stock issue were disappointed by careful, reasonable state regulations, he did not think there was any wide discontent if the new policy was applied in a reasonable and considerate way. There was not in New York. There was discontent on the part of those who would like to have the old order continue, who would be willing, so long as they got their profits, to launch upon the public a corporation that was bankrupt from the start. In Mr. Decker's judgment, however, there are men engaged in the promotion of these enterprises who are of the highest character and who are acting with the view of getting legitimate returns from their efforts.

Mr. John E. Benton, New Hampshire, said that one of the difficult questions which confront the commission of that State was that of determining what increase in capitalization should be allowed to a utility which purchases a plant of a competing utility where the plant purchased is in large part a duplication of the other plant.

Mr. B. H. Meyer, Interstate Commerce Commission, stated that the Wisconsin statute provides that the securities of the consolidated company shall not exceed in the aggregate those of the constituent companies. The Wisconsin commission generally had taken the position that, even though the aggregate of the securities outstanding might exceed the value of a plant double the size in first-class condition, what the public required was good service. To give that service the company must have money and the commission must do whatever it reasonably could to put the company in a position where it could get money. It was one of the functions of the state commission to see that the money actually went into the property. Mr. C. A. Radcliffe, Public Service Commission of Ohio, said that promoters of new enterprises told the commission that it was impossible to sell stocks at any price. The only securities they could market were bonds.

Mr. H. Warner Hill, Georgia Railroad Commission, said that the primary purpose of conferring jurisdiction regarding stock and bond issues on state commissions was to prevent overcapitalization. This was a benefit to the corporation issuing the securities, because when such securities were issued with the approval of the commission it was understood that they had a definite value.

Mr. Meyer said that if a commission, as a regulating body, authorized the issue of $100,000 of stock and bonds by a public-service corporation all that the commission could say was that such amount had gone into the property. It was to be hoped that the property would be worth $100,000 to-morrow, but the commission could not say to anyone that it might be worth $200,000 or $150,000 or $90,000. No one could guarantee the investor a continuation of values he believed he acquired. The public authority could see to it that what the investor bought represented substantially what had gone into the property. When that was seen perhaps all was done that could reasonably be done.

Mr. Franklin K. Lane, Interstate Commerce Commission, suggested the wisdom of going slowly in agitation of control of capitalization and finding first if it was possible to achieve every result desired by publicity and exact and official ascertainment of the fact that the money raised went into the property.

The report of the committee on railroad taxes and plans for ascertaining the fair value of railroad property was written by Mr. Edward M. Bassett, formerly a member of the New York Public Service Commission, First District. This report stated that one rule for determining a fair rate of return that had considerable merit was to allow a rate that would be adequate at the present time to induce investment in a new enterprise of similar character. If it is decided that a public utility should be taxed on its total value as a going concern—that is to say, its commercial market or sale value—then franchise and going value would be included. If, on the other hand, the utility plant was to be taxed precisely as other real estate, the cost of reproduction, less depreciation, would be the basis. There is no inherent inconsistency in using one method of valuation for tax purposes and another for rate purposes. The replaced or partially obsolete plant or road is the one that causes greatest difficulty in valuations for any purpose. The books of the company, kept from the start in accordance with a correct accounting system, would show a capital account that would be closer to what seems a just, fair value for rate purposes than any other single basis.

Mr. Hill, of Georgia, presented the report of the committee on telephone and telegraph rates and service. The report considered the elements that should be taken into consideration in the determination of rates and referred to the activities of the various commissions which have jurisdiction over telephone and telegraph companies. So far as the committee is advised, only one commission, the Louisiana commission, has adopted tariffs and rules governing telephone companies.

The following officers were elected for the ensuing year: President, Mr. Charles F. Staples, Minnesota Railroad & Warehouse Commission; first vice-president, Mr. O. Gothlin, Public Service Commission of Ohio; second vice-president, Mr. H. Warner Hill, Georgia Railroad Commission; secretary, Mr. William H. Connolly, Interstate Commerce Commission; assistant secretary, Mr. William Kilpatrick, Illinois Railroad & Warehouse Commission.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has prescribed a uniform system of accounts for telephone corporations in the State of New York. A public hearing was held

on Oct. 4, at which time representatives of the telephone companies had an opportunity [illegible] the subject. The tentative scheme of accounts issued in July, upon which the hearing was held, has been modified in a few minor particulars, and as revised is now made the subject of an order by the commission to become effective on Jan. 1, 1912. Copies of the order will be served upon all telephone corporations subject to the commission's jurisdiction as soon as the pamphlet can be had from the State printers, in whose hands it now is.

The commission has served upon the Buffalo General Electric Company and the Cataract Power & Conduit Company the complaint of the Mayor of the city of Buffalo asking for an investigation regarding the prices charged the city of Buffalo for electricity used for the purposes of light, heat and motor service. The complaint alleges that the prices charged by the two companies are unjust and unreasonable and asks that the commission fix a maximum price to be charged. The companies have been required to answer the complaint within twenty days.

The Public Service Commission, Second District, has authorized the A. L. Swett Electric Light & Power Company to exercise franchises granted by the town of Somerset in the village of Barker, Niagara County, which provide for the erection and operation of an electric-lighting system in these localities.

The Public Service Commission, Second District, has authorized the Rochester Railway & Light Company to issue its consolidated 5 per cent gold mortgage bonds dated July 1, 1904, and due July 1, 1954, to the aggregate amount of $1,998,000. The bonds are to be issued in exchange par for par for Rochester Gas & Electric Company's 5 per cent twenty-year gold bonds issued under a mortgage dated Nov. 1, 1892, and due Nov. 1, 1912, as such last-mentioned bonds can be acquired by the Rochester Railway & Light Company.

The Public Service Commission, Second District, has authorized the Elmira Water, Light & Railroad Company to merge all the property, rights and franchises of the West Side Railroad Company of Elmira and transfer all franchises held by the West Side company to the Elmira company. The Elmira Water, Light & Railroad Company is the owner of all the capital stock of the West Side Railroad Company, and all the property of the West Side Railroad Company is leased to the Elmira Water, Light & Railroad Company for the term of its corporate existence.

MASSACHUSETTS COMMISSION.

The Board of Gas & Electric Light Commissioners has received a petition from the Mayor of the city of Malden contending that the price of electricity charged the city by the Malden Electric Company should be reviewed by the commission.

Decisions have been handed down by the board in the petitions of the Buzzards Bay Electric Company and the Marion Gas Company for authority to extend their lines and carry on the business of selling and distributing electricity in the Bourne and Sandwich district of Cape Cod. Both companies desired to enter the town of Bourne in order to supply electricity to groups of summer residents. The board points out that the town covers a considerable territory and includes several distinct villages. The attitude of the municipal authorities was one of apparent indifference as to which company should supply electricity, so long as an adequate supply at reasonable prices was furnished. The board states that under all the circumstances both companies may well be restricted to those sections of the town which they respectively can most conveniently and economically reach. The Buzzards Bay company is therefore authorized to carry on its business in the towns of Barnstable and Sandwich, and in so much of the town of Bourne as lies within a specified area between Back River and the Plymouth boundary; and the Marion company is authorized to supply electricity in a specified adjoining area within the town.

The Seekonk Electric Company has petitioned the board for the right to issue new stock to the amount of $5,000, in order to purchase so much of the property of the Narragansett Electric Lighting Company, of Providence, R. I., as lies within the town of Swansea, Mass.

Among matters pending before the commission is a resolve requiring the board to report to the Legislature of 1912 upon the operation of demand meters, and to determine whether or not it is expedient to regulate or prohibit the use of such meters, the finding to be submitted by Jan. 15. At the final hearing recently Mr. E. W. Burdett, of Boston, appeared on behalf of the Massachusetts Electric Lighting Association and emphasized the increasing use of such indicators outside the system of the Boston Edison company. He stated that the Tenney companies, operating in Malden, Haverhill, Revere, Fitchburg, Salem and other cities, are beginning to take up the demand indicator as a possible improvement on former methods of estimating the characteristics of the consumer's load at particular periods. The contention was urged that parties opposed to the demand indicator should offer something better in its place, and that the commission should sanction the general principle of its commercial application. Mr. Burdett argued that the central-station interests of the State are anxious to have demand meters put under official supervision, so that all loose talk about bills being inaccurate can in some measure be stopped. The opposition claimed that demand indicators as at present used are unreliable, but introduced no testimony of an engineering character to prove the assertion. The public appears to fail to grasp the importance of ascertaining the demand as a means of determining the cost of serving specified classes of consumers. An attempt was made at the hearing to involve the question of differential rates, but the scope of the resolve confines the investigation to the use and regulation of demand meters rather than the adjudication of broad methods of charging for electrical energy.

NEW JERSEY COMMISSION.

A decision was rendered by the Board of Public Utility Commissioners of New Jersey on Nov. 14 in a case affecting the rates of fare of the Trenton & Mercer County Traction Corporation and involving consideration of the financial affairs of this company. The complainants in this case were located on lines of the company on which double fares are charged. The length of ride allowed for a single fare on these lines is shorter than the length of ride allowed on other lines of the same company. The commission held that differences in the length of ride afforded upon different lines of the same company for a single fare are not necessarily discriminatory. It also decided that one circumstance which may warrant a disparity in charge is greater density of traffic upon lines affording the longer ride for one fare. The corporation acquired by lease last year properties of other companies. In connection with the entire plan an issue of bonds was made to provide funds for rehabilitation. The board did not have at that time the powers which it now holds in respect to the issue of securities. The board, however, in the present proceeding decides that in case of doubt, based upon past experience in operation, as to whether earnings suffice to provide for operating costs and a fair return upon actual investment lower rates ought not as a rule to be imposed, unless their probable effect will be to stimulate a demand for service sufficient to offset the reduced price per unit. It was also held that the fact that the various lines of the system had shown a paper profit in past years was unfortunately no evidence that such profits were really earned. The board is disposed to think that if the property had been maintained in proper physical condition the dividends, or the greater part thereof, could never have been declared or paid.

OHIO COMMISSION.

[illegible] mission has been greatly handicapped because of the amount of money necessary properly to organize and operate the office. The expense limit of $75,000 a year has been found inadequate, scarcely sufficient to give proper attention to an important case that may come up, should the corporation affected put impediments in the way. This amount is but little more than was required when the office had supervision of the railroads and interurban lines only. The members of the commission are the same as when the office was thus operated, and to make it effective it is believed by many that experts are needed for the heads of departments to take charge of other utilities, and investigators and examiners are needed for different purposes. Such men cannot be employed without funds. Valuations are to be made in the case of proposed consolidations and in changing or fixing rates, except in the case of street railways alone, and how this work is to be done is a question that is facing the commission. To make matters worse, many trivial questions are brought before the commission which require much time and cannot be overlooked. Without the proper organization, the members of the commission must look after these matters themselves. Whether true or not, it is said by some that the opposition was so powerful against the bill which created the commission that the funds for its support had to be thus limited in order to secure its passage in the Legislature, and it is even hinted that this was a plan to secure its failure in practical operation. It is believed that the next Legislature will be compelled to change the limit of expenditures and allow a sufficient amount of money to make the office a success.

CURRENT NEWS AND NOTES.

American Institute of Consulting Engineers.—An informal dinner meeting of the American Institute of Consulting Engineers will be held at the Aldine Club, New York, on Dec. 1.

* * *

Doll with Electric Light Trimmings.—At a forthcoming charity bazaar in Chicago an attraction in one of the booths will be a handsomely dressed doll brilliant in a necklace of electric lights. A battery concealed in the flowing drapery supplies electricity to a number of 6-volt miniature lamps, and by means of an unobtrusive switch the current may be turned on or off.

* * *

Electric Lighting in the Desert.—It is suggested that where long electric transmission lines cross desert regions, as in some parts of California, for instance, arrangements may be made to provide electric beacons or lamps at dangerous road crossings where travelers are apt to get off the beaten line of travel at night. The proposal is in line with the suggestion that signboards be placed at intervals along routes of travel in a desert country for the benefit of travelers.

* * *

Regulated Art in Pittsburgh.—The Mayor of Pittsburgh has appointed an art commission for the purpose of securing uniformity of design in all public buildings and other structures with a view to beautifying the city. The commission is vested with large powers, though it cannot enforce its recommendations. The members serve without compensation. All designs for bridges, lighting and structures to be erected by public-service corporations must be approved by the commission.

* * *

Electric Cooking at Illinois Penitentiary.—Experiments being begun with electric cooking for the wardens' mess kitchen of the Illinois State Penitentiary at Joli may be followed by such cooking on a larger scale for t inmates. The State purchases its energy from the Sanita District of Chicago, whose hydroelectric plant is only short distance away from the prison, obtaining this ele tricity at the low rate of 1 cent per kw-hour. The wo in the penitentiary kitchens is all done with convict he and specially heavy electric cooking appliances are to used to withstand the careless handling by the inmates.

* * *

Philadelphia Section of I. E. S.—At a meeting of t Philadelphia Section of the Illuminating Engineering S ciety held Nov. 17 two papers were presented for disc sion. The first speaker of the evening was Mr. E. J. Bra who read a paper on "A Comment on the Application Photometric Data to Interior Illumination." This pap while short, proved very interesting. The second pa was read by Mr. George S. Barrows, on "Natural Gas: Productions and Utilizations." This paper, which w profusely illustrated with lantern slides, proved of gr interest to those present. The papers were discussed Messrs. C. O. Bond, I. N. Knapp, George B. Muth, P fessor Rowland and others. The meeting was attended 122 members and 66 guests.

* * *

Public Utility Regulation in New York City.— pamphlet on the subject of "State Regulation of Pul Service Corporations in the City of New York" has b issued by the commission for the First District. T pamphlet was written by Mr. James Blaine Walker, ass ant secretary of the commission, and was distributed to public at the recent budget exhibit in New York City. contains a summary of the changes and improveme made in the service and property of the various pul service corporations in New York City since the creation the Public Service Commission in 1907. It also gives abstract of the public service commissions law, and scribes the regulation and rapid-transit work of the c mission. One chapter is devoted to gas and electric c panies. It shows that from Aug. 1, 1907, to June 30, 1 2217 electric meters were tested. In the period from Jul 1907, to June 30, 1911, 1,378,625 gas meters were tested.

* * *

Electrical Code in Pittsburgh.—The Electrical Bo ers' Club, of Pittsburgh, is taking an active part in struggle now being waged in that city over the adoptio the National Electrical Code by the city Bureau of E tricity. The Board of Fire Underwriters has prefe charges against the bureau concerning the fire-alarm tem, claiming that the rules for electrical wiring are a quated and the fire-alarm system inadequate and defect At a hearing before the councilmanic committee on lic safety an agreement was reached that the bureau w accept the national code with certain modifications, though the Underwriters insisted that the code be ado in its entirety. Some of the councilmen insisted tha the national code were adopted it should mean a reduc in insurance rates. While the representatives of the Un writers would not agree to this, they admitted that the p ent regulations were one element that made the basis o high rates charged in Pittsburgh.

* * *

Block Lighting Plant.—In Chicago, as in other c es there are a number of "block" electric-lighting plants a sell electricity within the confines of a city block, c some cases to buildings outside the block where the pla is located. Such an installation is the Herman Koenig F ture Company, to which the City Council of Chicago as granted a twenty-year ordinance permitting it to wires in, along and above the east-and-west alley in the block bounded by West Chicago Avenue, North C en

Street, West Superior Street and North Sangamon Street for the purpose of supplying electricity in that portion of the block lying between West Chicago Avenue and the alley mentioned. The company, like other central stations, must pay the city 3 per cent of its gross receipts as compensation.

* * *

Practical Applications of the Gyroscope.—Prof. G. M. Wilcox, of Armour Institute, Chicago, lectured on "Practical Applications of the Gyroscope" on Nov. 21 before a joint meeting of the Armour Branch of the American Institute of Electrical Engineers and the mechanical and civil-engineering student societies.

* * *

Electricity in Orchard Work.—To protect orange orchards from injury by frost a dense smoke is produced by smudge pots. In the case of a sudden decline of temperature it was sometimes found impossible to light all of the pots in a large orchard before damage was done. To obviate this risk a means has been devised whereby all pots may be lighted almost simultaneously, consisting of a priming fuse immersed in fuel oil in the smudge pots.

* * *

Inventors' Periodical.—On Nov. 1 the publication was commenced of a monthly journal called *The Inventors' Outlook*, having for a purpose to represent the interests of inventors, including the advocacy of laws to protect their rights. The publication is issued monthly at a subscription price of $1 per year. The address is *Inventors' Outlook*, Provident Savings Bank Building, Washington, D. C. This item as previously printed was rendered unintelligible by a printer's error.

* * *

Electrolysis Report in Chicago.—Mr. L. L. McGann, commissioner of public works of Chicago, transmitted to the City Council on Nov. 20 the report of Mr. Ray Palmer, consulting engineer, who had been retained by the city to make an investigation and report on the damage to water pipes and other metallic structures due to electrolysis set up by escaping electricity, mainly from street-railway returns. The report was ordered published and referred to the water department committee.

* * *

Electric-Lighted Railroad Cars in the United States.—Of the 50,000 passenger cars in use on the steam railroads of the United States, 11,017 are electrically lighted, according to the report of the committee on data of the Railway Electrical Engineers' Association. The forty-eight roads, including the Pullman company, which operate these cars have 33,634 other cars not electrically lighted. The systems used number as follows: Straight storage, 1372 cars; head-end, 192 turbine-generator cars and 3185 cars lighted; axle-generator cars, 5900. The Pullman company operates 2400 electrically lighted cars out of its 4264 cars in service, using the axle-generator system exclusively.

* * *

Mexico A. I. E. E. Meeting.—The Mexico Section of the American Institute of Electrical Engineers held a successful meeting on Nov. 10. About thirty members and guests gathered at supper in the Triangle Inn in the city of Mexico at 8 o'clock, and at the conclusion of the repast the meeting was held in one of the Y. M. C. A. meeting-rooms. A paper was presented by Mr. W. B. Hale on the recently completed installation of an underground telegraph cable in the city of Puebla, which is the longest and most important telegraph cable of its kind in Mexico. Mr. P. M. Bennett gave an interesting description of the laying of electric-service and telephone cables in the same city. Considerable discussion followed the reading of these papers, after which election of officers took place. Mr. W. H. Fiske, chief engineer of the Mexico Tramways Company and Mexican Light & Power Company, was elected chairman, and Mr. H. S. Foley, superintendent of distribution of the same companies, was elected secretary for the coming year. The chairman is to appoint an executive committee of three members, whose names will be announced at the next meeting of the section.

* * *

Percentage of Losses to Sales in Electrical Merchandising.—In comparing notes at a recent conference of credit men of electrical houses one of the gentlemen present, representing one of the large concerns of the country, which sells nearly all kinds of electrical goods to customers of all sorts, said that during the last fiscal year the company's losses in bad debts were 0.42 of 1 per cent of total sales. More interesting still was his classification of losses by different groups of customers. The ratios of losses to sales are given in the following list: Railways, both steam and electric, 0.04 per cent; central stations, 0.09 per cent; telephone companies (Independent), 0.16 per cent; miscellaneous, 0.38 per cent; isolated plants, 0.51 per cent; contractors, dealers and jobbers (principally contractors), 1.24 per cent.

* * *

Schenectady A. I. E. E. Section Meeting.—The Schenectady Section of the American Institute of Electrical Engineers recently opened the 1911-12 season by an informal smoker which was held at the Mohawk Golf Club, of Schenectady. After an overture by the section's orchestra, Mr. E. B. Merriam, chairman of the local section, made a short address and then introduced in turn Mr. Ralph W. Pope, honorary secretary of the A. I. E. E.; Mr. W. B. Potter, engineer of railway and traction department General Electric Company, and Dr. Charles P. Steinmetz, who responded and outlined the advantages of membership in the Institute. Following the address, the Jest and Song Club, of Schenectady, gave a minstrel show abounding in witicisms and humorous references to well-known engineers who were present. At the conclusion of the entertainment refreshments were served, during which the Union College Glee Club rendered selections, and then the members of the section and their guests joined in singing the choruses of popular songs, the words of which were by the means of a stereopticon thrown on a screen. The smoker, which was successful in every way, was attended by approximately 400 people.

* * *

Automatic Telephone Service in Chicago.—Thirty thousand automatic telephones are now in use in Chicago, according to the receivers of the Illinois Tunnel Company, who are operating this new system. Additional automatic telephones are being installed in Chicago at the rate of 75 to 100 a day, it is said. Toll-line connection has now been obtained with points in Illinois as far as Springfield, and it is expected shortly to complete the gap between that city and St. Louis, which will open up the large Independent field of Missouri and adjoining states for Chicago connection. Another line is being built to connect Chicago with South Bend, Ind., which will give Chicago connections to all Indiana and Michigan points. To points reached by its toll lines the automatic company offers five-minute connection at the same rate heretofore charged for three minutes' conversation, while a discount of 40 per cent is allowed off the regular day rate for long-distance calls between 6 p. m. and 7 a. m. An interesting feature of the automatic telephone service in Chicago has been the large number of Chinese subscribers obtained. The Chinese have trouble in calling numbers over the manually operated switchboards, it is declared. Chinese subscribers of the Illinois Tunnel Company are provided with special calling dials having both the ordinary figures and their Chinese equivalents. A Chinese directory has been printed especially for the benefit of these subscribers, who can thus reach their own countrymen directly, as well as any other automatic telephone in the city.

[illegible] has been started toward connecting the more important universities and colleges of the country by wireless telegraph. When the distance between colleges is too great for direct communication a message would be relayed from one or more intermediate college stations.

* * *

[illegible] ventilation has been applied to the motors of a number of large electric locomotives, its first use on motor-car equipment on a large scale has been tried out during the past year on the suburban service of the Pennsylvania and Long Island railroads. A pair of small motor-driven blowers is mounted beneath the truck bolster so that one blower furnishes air to each of the nominal 220-hp car motors, permitting their continuous operation at a rating much higher than would be otherwise possible. The air for this purpose is taken from well up the side of the car to avoid drawing dust into the motors.

* * *

Comparison of Street-Lighting Systems at Worcester, Mass.—In connection with a movement to secure additional illumination on the business streets of Worcester, Mass., a trial installation of thirteen 6-amp magnetite arc lamps has been placed in service in the Mechanics' Hall district, in addition to the ordinary system of 4-amp magnetite lamps used in the city for general street lighting. The lamps are installed on short temporary standards for comparison with a plan of tungsten cluster lighting proposed by the local merchants' association. At a recent view by the lighting committee of the City Council a preference was expressed for the use of low-hung arcs on inverted goosenecks instead of tungstens.

* * *

Producer-Gas Investigations.—The Department of the Interior, Bureau of Mines, has published in convenient form a résumé of producer-gas investigations extending from Oct. 1, 1904, to June 30, 1910. The tests were made by the United States Geological Survey at St. Louis, Mo., and Norfolk, Va., and later at Pittsburgh, Pa., and the investigations are now being continued by the Bureau of Mines, to which this branch of the work of the Geological Survey has been transferred by act of Congress. Besides the tests on the pressure-producer installations at St. Louis and Norfolk and the down-draft producer at Pittsburgh, there is an excellent bibliography on the subject, covering some twenty pages.

* * *

Institute of Operating Engineers.—Colonel Goethals Branch (Yazoo City, Miss.) of the Institute of Operating Engineers started its regular bi-monthly meetings the last part of September. In this branch it has been decided to conduct a full course in which papers will be presented covering the subject "The Boiler-Room and Its Special Attachments" and all the problems connected therewith that an operating engineer should know. At each meeting the members are given a subject for discussion at the next meeting. The New York branch held a meeting on Oct. 20 and voted to name the branch after Mr. J. C. Jurgensen, the founder of the Institute. In this branch it has been decided to give a course of lectures during the winter on power-plant accounting. A new educational bulletin will be ready for distribution Nov. 20, which will give the announcement of special rates secured from the correspondence schools for students who wish to take up the I. O. E. work by the correspondence method.

* * *

Street-Lighting Extension in Chicago.—The Sanitary District of Chicago is under contract to install and operate 10,000 additional arc lamps for street lighting in the city of Chicago. But some of the aldermen think that this not enough, and the finance committee of the City Counc is considering propositions that this number be doubled (even increased to 30,000. The number of street arc lam now in regular service is about 12,200. The 10,000 ne lamps, or a large proportion of them, will be 10-am flaming arcs, and about 100 lamps of this type are no under service test in the central business district, being many cases attached to the elevated-railway structure (the Union Loop. The lamps being tested were furnish by the Stave Electrical Company and the General Electr Company. The contract for the initial order of 4000 flan ing-arc lamps depends on the result to be shown by th service test.

* * *

Hawthorne Men's Club.—Employees at the Hawthor Works (Chicago) of the Western Electric Company ha organized a club to be known as the Hawthorne Men's Clu Membership is open to all employees at Hawthorne, a about 1500 have been enrolled. The club has been orga ized for the purpose of bringing the employees of t various departments into closer association with one a other and to promote good fellowship. It is planned have suitable entertainments, lectures on various subjec especially those relating to industrial work, and to stim late the entertainment and athletic activities of the e ployees. The second floor of the new restaurant buildin recently completed, will be used as the club headquarte At the preliminary meeting held to launch the club and formulate a method of procedure for effecting a perman organization Mr. H. F. Albright, general superintendent the company, addressed the members. In accordance wi the plan adopted at this meeting nominees for the vario offices were named at a primary election, and at the el tion held a week later the following candidates were electe President, Mr. T. R. George; vice-president, Mr. W. Hosford; secretary, Mr. G. B. Hallett; treasurer, Mr. L. Jonathan. A committee on constitution and by-laws w be appointed, and a meeting of the club will be held soon act on the committee's recommendations.

* * *

Motor-Operated Stoney Spillway Gates for T Gatun Dam, Panama.—The water levels behind the Gat and Miraflores dams at Panama will be maintained at co stant heights by twenty-two motor-operated Stoney ga mounted in the concrete spillway sections. The Gat spillway has a total length of 808 ft. on the arc of circle 280 ft. across, and discharges into the old bed the Chagres River, against whose flood periods it is signed to protect the dam structure. Each steel ga 46 ft. wide, 19 ft. high, and weighing 43 tons, is to be s pended between concrete piers 115 ft. high, above sea-le and will seat on the spillway crest. Extending throu the center of the dam structure is the tunnel contain the gate-operating mechanism. The motor shaft for e gate operates the worm-nuts engaging the bronze scre by which the gates are moved. These screws with th swivel chains are counterweighted so that the motors relieved of any lifting effort and have only to overco friction. Each gate can be lifted through its entire tra in ten minutes, and at the ends of its path is equip with limit switches which shut off the motor in the rection of its travel. The motor can, of course, be versed at any point of its travel. Seepage water collect in sump pits within the dam will be removed by the portable pumping sets, each comprising a vertical cent ugal pump direct-conected and built into an inclo waterproof induction motor, the complete outfit being signed to operate beneath 30 ft. of water if necess These pumps will deliver 45 gal. a minute against 32 head.

HILLSIDE STEAM-TURBINE STATION AT CRAWFORDSVILLE, IND.

Twenty-Year-Old Reciprocating-Engine-Driven Equipment Replaced by Modern Turbo-Alternators.

Coal Discharged Into Sloping Concrete Bunkers from Dump-Bottom Cars on Railroad Track 85 Ft. Above Level of Creek from Which Water Supply Is Taken—Tunnel for Removing Ashes.

COAL delivery from a railroad track on the top of an 85-ft. bank, condensing and boiler water supply from a stream at the base of the bluff, and the foundation of a turbine power plant on the side of this alluvial slope, were among the conditions imposed in the design of the new station of the Crawfordsville Electric Light & Power Company, just completed at Crawfordsville, Ind. In the arrangement of its hillside coal bunkers, water-circulating system and general equipment, as well as in the low unit cost of the stations, the Crawfordsville plant is therefore of unusual interest among similar small stations [illegible].

The building, which sits on a level shelf 21 ft. above [illegible]r Creek and 64 ft. below the top of the alluvial bluff, is of concrete, brick and steel, measuring over all 71 ft. x [illegible] ft. in plan. The boiler-room occupies a floor space 71 ft. x 40 ft., and the engine-room 54 ft. x 34 ft. At the north end of the latter a 14-ft. space extending across the room is divided by a 7-ft. hall into the plant office and the lavatories. Overhead on the small second story thus formed is space for a laboratory for carrying out plant tests. Behind the boiler-room and extending up the slope are the concrete coal bunkers 64 ft. wide, and 90 ft. in length measured along the 40-deg. slope.

HILLSIDE COAL BUNKERS.

Dump-bottom coal cars from a spur of the Monon railroad track are run out over the trestle in Fig. 2, which is carried by four steel piers above the bunker, and discharge their contents onto the sloping floor beneath. The steel truck piers are seated on heavy concrete footings carried into the side of the hill, and in the central panel provision is made for a future motor-driven coal crusher. The floor of the bunker is a continuous 8-in. concrete slab carried on stepped pedestals seated on horizontal bearing surfaces of the sandy material of the bluff. The lowest 17-ft. section of the bunkers is especially reinforced for the storage of coal and will hold 500 tons in the pile as the coal lies. The bulkhead wall separating the bunkers from the boiler-room is reinforced by internal concrete buttresses erected in the bunkers, which buttresses also serve to separate and direct the coal into the chutes leading to the stokers. The concrete bunkers are to be roofed to prevent wetting of the coal by weather, and are drained of rainwater by vitrified-tile conduits leading from their lowest sections.

Fig. 2—Hillside Coal Bunkers, Showing Trestle and Roof of Boiler-Room.

From the bunkers coal enters the boiler-room by gravity through 12-in. circular openings, one for each boiler. Each opening is provided with a cut-off valve operated by a pull-rod from the floor. It is also planned to equip each of these thimbles with a propeller-type coal meter for measuring the quantity of fuel burned in the plant. The chutes connecting the entry thimbles with the hoppers of the Roney automatic stokers are now temporarily constructed of wood, as shown in the accompanying illustration. After the best form of these chutes has been found by experiment permanent steel inclines will be erected.

Fig. 1—General View of Turbine-Room.

BOILER ROOM EQUIPMENT.

Three of the four 350-hp Stirling water-tube boilers are now installed, being fired by automatic Roney stokers, as already mentioned. The flue gases from the furnaces are led through a breeching at the rear of the 150 ft. Kellogg stack, 7 ft. in interior diameter, at the south of the plant.

The provision for the handling of ashes at the Crawfordsville station is rather unique, consisting of a concrete tunnel 4 ft. wide and 6 ft. high, through which run hand-operated ash cars on an industrial-gage track. The ashes are dumped directly into the cars through 18-in. chutes and swing doors leading from the bottoms of the ash pits of each boiler. There is also a 12-in. vertical opening from the combustion chamber to the center of the tunnel ceiling, which can be used for cleaning out dust and material that

collects in this space. As the ash cars are filled they are run out by hand and the ashes used to fill waste bottom lands near the plant. The Hoppes feed-water heater and hot-water tank are mounted on a steel structure above the boiler-feed pumps between the middle boiler settings. The

Fig. 3—Boiler-Room, Showing Chutes from Hillside Bunker.

feed-water heater receives the condensation from the turbine-driven exciter, stoker engine and boiler-feed and service pumps.

Steam produced by the boilers, at 175 lb. pressure per square inch, is delivered through 7-in. lines to the main 10-in. header, paralleling the partition wall inside of the boiler-room. From this header the two 4½-in. steam lines leading to the turbines are taken off, the Cochrane steam separators with which each is equipped being mounted in the boiler-room directly beneath the main header, whose condensation they also serve to catch. Through extension hand-wheels all steam valves as well as exhaust valves in the plant are operable from the main-floor level.

TURBINE GENERATORS.

The present two units installed in the station are 625-kva Curtis-General Electric horizontal turbo-alternators, delivering 2300-volt, 60-cycle, three-phase energy. Provision is made at the north end of the turbine-room for a future 1250-kw unit of similar type. All bearings of the present units are water-cooled. The turbines exhaust through 24-in. lines, fitted with expansion joints, into the Alberger jet-type condensers located in pits in the basement beneath the turbine-room. These condensers are designed to give a vacuum of 28 in. with cooling water at 70 deg. Fahr.

Injection water for the condensers is taken from Sugar Creek, which flows in front of the plant, through a 4-ft. 6-in. concrete intake tunnel. The water is now freed of entrained and floating material by temporary screens, but later a permanent screen house is to be erected near the water's edge. Both the intake and discharge tunnels can be reached through a concrete-lined well outside the plant, and both tunnels are large enough to admit a man to enter for inspection or repair. The water circulation to the condensers is handled through 10-in. pipes, both intake and discharge, and the condenser vacuum pumps are driven by 35-hp, 2300-volt, three-phase induction motors. A 3-ft. dam in the condenser discharge tunnel forms a hot-well 15 ft. in length and 5 ft. 8 in. wide, the tunnel being widened at this point, and from this hot-well the steam-driven service pumps take their supply, which is delivered to the feed-water heater and the hot-water tank already mentioned. These pumps are also provided with an auxiliary suction line from the intake tunnel, which can be used in case the hot-well is emptied for any reason. The steam pumps, which are mounted in the pits, are also arranged with a sump intake for clearing their own space in case of flood or back water from any cause. At a point just below the power house a low dam has been erected forming a pond in the creek, 100 ft. wide and 3 ft. deep extending a distance of ¼ mile upstream, and insuring an ample source of condensing water for the plant, even under conditions of diminished flow in the stream. The outlet tunnel emerges 100 ft. distant and downstream from the inlet passage, so that in case of low water in the creek the contents of the pond can be circulated as a cooling basin. The discharge tunnel, which is the higher of the two conduits, has its center line 8 in. below the water level.

AUXILIARY ELECTRICAL EQUIPMENT.

Excitation for the turbo-alternators is furnished by one 25-kw Curtis turbine-driven direct-current generator running at 3600 r.p.m. and one 25-kw induction-motor-generator set, both mounted on the floor of the turbine-room. These exciters like the main turbine units were furnished and installed by the Fort Wayne Electric Works. Control of the station is centralized in a black slate switchboard

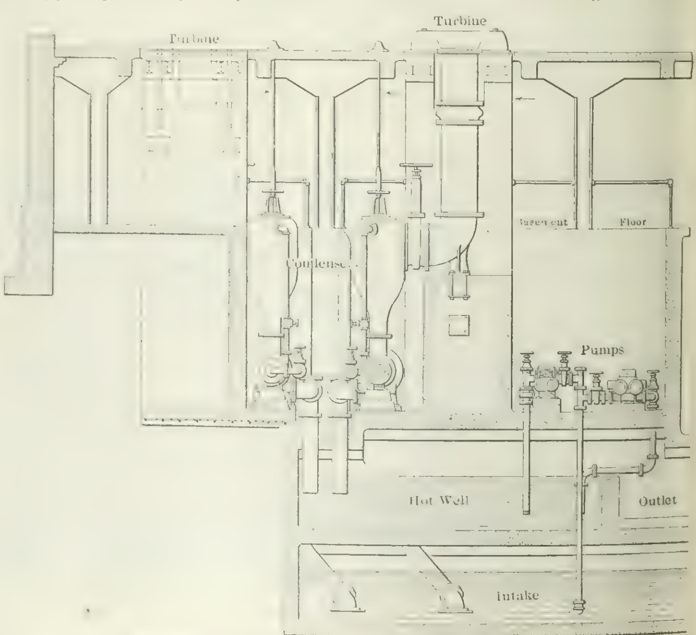


Fig. 4—Section Through Condenser Pit, Water Tunnels and Pumps.

22 ft. long, paralleling the west wall of the turbine-room and containing the following sections: One regulator panel equipped with Tirrill induction regulator, two exciter panels, two generator panels, two feeder panels, one arc-feeder panel and five rectifier panels, four of which are

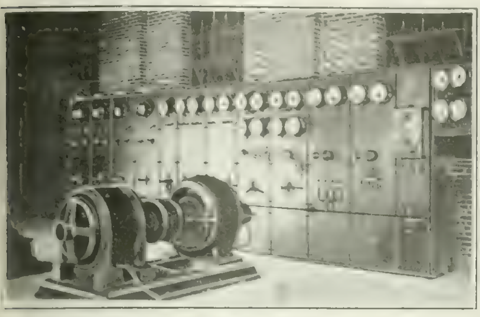


Fig. 5—Switchboard and Motor-Driven Exciter.

each equipped for controlling the four fifty-lamp Westinghouse 4-amp metallic-flame rectifier sets in the basement. Besides the usual complement of wattmeters, ammeters, voltmeters, etc., there are provided a synchroscope, a frequency-meter and watt-hour meters for registering the consumption of the arc and commercial circuits, all the instruments, like the switchboard, being of Westinghouse manufacture. The arc-rectifier panels and main oil switches are all provided with alarms which cause the continued ringing of a bell in case there is automatic opening of any circuit.

On the boiler-room division wall of the turbine-room is mounted a recording steam-pressure gage and a manometer for registering the draft of the stack. The entire turbine-room floor can be reached by the hook of the hand-operated -ton Whiting crane.

Installed in the basement, directly below the switchboard, are the four fifty-lamp 4-amp Westinghouse metallic-flame rectifier sets, alongside the chain-operated generator field rheostats which are also installed in the basement. These rectifier sets are controlled entirely from the switchboard above, even the starting of the tubes being manipulated by ting chains from handles in the overhead panels.

DISTRIBUTION TO CUSTOMERS.

From the power house on overhead pole lines there radiate, besides the arc circuits, four 2300-volt, three-phase feeders, one of which is reserved for service to motor customers and the other three for lighting. An accompanying illustration shows one of the pole lines leaving the station, which carries both arc and commercial feeder circuits. This line is built over a particularly rough creek-bottom profile, and the photograph reveals the excellent alignment of the construction in spite of the fact that the irregularity of the country necessitates the use of poles from 40 ft. to ft. in length.

The new station was started up July 23, 1911, the local service being converted at the same time from single-phase, 1100-volt, 133-cycle, to three-phase, 2300-volt, 60-cycle operation. This change was accomplished in six days, both plants being kept in operation during that time so that no customers were without service for more than an hour's time during daylight. The old plant replaced by the station above described contained 250 kw in reciprocating engine-driven equipments and three fifty-light open-arc machines, and had been in operation continuously almost twenty years since Aug. 21, 1891.

There are 1150 consumers of electricity in Crawfordsville, which has a population of 9700. Nearly 900 kw in transformer capacity is installed, and there is a connected load of 193 hp in motors. The major portion of the customers' services—1053, to be exact—have meters.

The cost of the completed new station with its present equipment was $111,929, of which $2,500 is due to real estate. When the plant was started it was intended to install only two 350-hp boilers and one 300-kw and one 500-kw turbine, the cost of the station with this equipment being estimated at $93,000. Enlarging this estimate by the same proportion as the increase in rating finally installed brings the estimated cost of the station within $600 of the amount actually expended in its construction. These figures are especially noteworthy on account of the peculiar requirements imposed by local conditions and the large quantity of concrete used in the construction of the station, foundations, tunnels and coal bunkers. Excluding the 200-lamp metallic-flame arc equipment, which is of the nature of substation apparatus, and completing the equipment of the station to its designed capacity with two 650-kva and one 1250-kva turbine, the total unit cost of the plant will be well under that usual for such stations.

The Crawfordsville Electric Light & Power Company, which is the name under which the local business is carried on, is a municipal corporation owned by the citizens of Crawfordsville and administered since 1903 on business principles by a board of three trustees, one of whom is elected yearly for a three-year term. Mr. M. W. Bruner is president of the board, Mr. G. B. Luckett secretary, and Mr. G. F. Huggans treasurer. Mr. J. R. Thomas, the present manager and superintendent of the plant, who is a technical graduate of progressive ideas, has served in

Fig. 6—Main Feeder Line.

this capacity since July 13, 1903, several months in advance of the taking over of the station by the trustees. Mr. Elby Shelly is chief engineer of the power station. The plant was designed and its construction supervised by the Esterline Company, Lafayette, Ind.

THE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY—II.

Six Generating Stations in Utah and Idaho Furnishing Energy to All Electric-Railway Systems in Utah, to Local Central-Station Organizations, Mining Camps, Pumping and Irrigation Projects, Etc.

IN a previous article the early history of the Telluride Power Company, from the first experiments with a 3000-volt transmission in 1890 until the present time, was told. An outline of the Colorado system and descriptions of its various generating stations and transmission lines were also given in the same issue. In the present article there is given the first part of a description of the Utah system of the company.

WATER RESOURCES, UTAH DEPARTMENT.

The water supply of the Telluride Power Company in Idaho and Utah is derived from the Wasatch Mountain drainage area of the so-called Great Basin of the continent lying at the west of the Rocky Mountains. Topographically this interior drainage area is characterized by isolated, narrow mountain ranges, trending north and south and separated by broad valleys varying considerably in altitude, the general elevation of the northern area being from 4000 ft. to 5000 ft. with mountains sometimes attaining elevations of from 10,000 ft. to 13,000 ft. The chief rivers of the Great Basin rise in the mountains which form the eastern and western borders, and the water supply is derived largely from melting snow. The maximum stream discharge usually occurs in the late spring or early summer, after which the flow decreases to a minimum reached in the winter.

The Wasatch Mountains drainage area includes the western half of Utah and small portions of Idaho and Wyoming, the streams heading either in the mountains or plateaus to the south and discharging into Great Salt Lake or Sevier Lake. The principal rivers are Bear, Logan and Weber, discharging into Great Salt Lake, and Provo, American Fork, Hobble Creek and Spanish Fork, discharging through Utah Lake and the Jordan River into Great Salt Lake, with Sevier River, discharging into Sevier Lake.

The hydraulic resources of the company are very extensive and include the possible development of at least 132,000 continuous hp between existing points of diversion and return on the Bear, Logan and Provo Rivers, Battle Creek and Jordan River, including extensive developments in the Bear Lake district under rights secured from the government in 1907.

GRACE PLANT.

The largest and most recently completed plant on the system is located at Grace, Idaho, on the Bear River. This stream rises on the northern slope of the Uinta Mountains in Utah and after a circuitous route through Wyoming and Idaho it discharges into the Great Salt Lake. The annual high-water period occurs between May and July. At Grace 500 cu. ft. per second have already been developed, with a gross head of 513 ft. The plant is located on the edge of the river at the bottom of an escarpment, the river winding through a plain in a lava-walled chasm varying from 50 ft. to 250 ft. in depth. Mountains rise several thousand feet above the plain on both sides, forming the so-called Gentile Valley.

Water is diverted from the Bear River about 5 miles above the plant, at a point where the cliffs are low, the diversion being effected by a timber crib dam 38 ft. high, 75 ft. wide and 340 ft. long, with a 160-ft. spillway. Abutment walls extend 8 ft. above the crest. The forebay and intake are adjacent to the spillway on the east side of the dam, the former being formed by a recess in the river bank. A curtain wall parallel to the direction of the flow shuts in the forebay, deflecting ice and débris to the spillway. The curtain wall extends 15 ft. below the surface of the water and the forebay is covered by planking to afford protection against freezing.

INTAKE AND FLUME.

The intake, including a screen box, is cut into the dam with its bottom 15 ft. below the crest, and it terminates in a tapered intake pipe varying in diameter from 11 ft. 5 in. at the head to 8 ft. 6 in. at the lower end, the length being

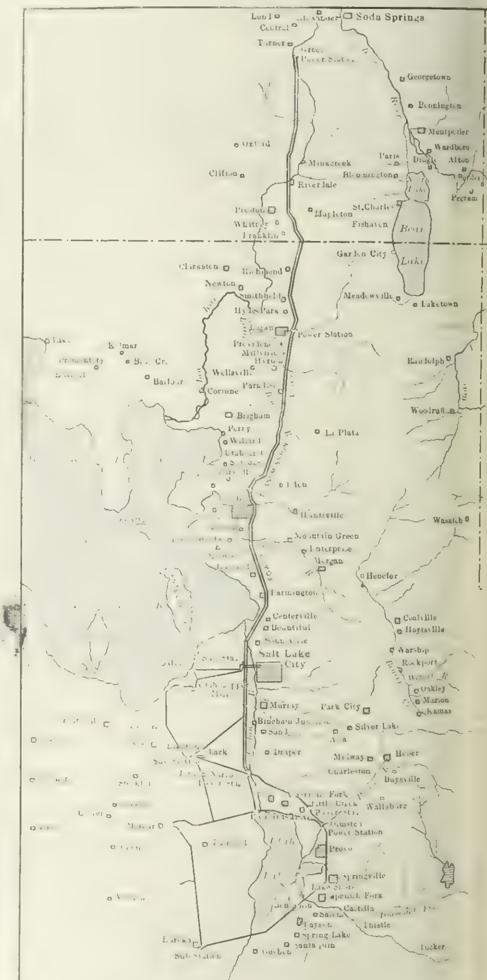


Fig. 14—Map of Utah System.

40 ft. The intake proper is about 33 ft. long x 15.5 ft. wi[de] x 24 ft. high, the screen being made up in four sections [of] 1-in. x 6-in. planed lumber, with 1-in. spacers betwee[n]. The intake pipe connects with a flow line having a tot[al] length of 23,221 ft., terminating in a 50-ft. x 76-ft. stan[d]pipe above the power plant. The upper 4157 ft. of the flo[w] line is of wooden-stave construction, the pipe being [of] circular cross-section and 8.5 ft. in inside diameter, t[he] material being Oregon fir. The stave line was built up

the ground, the typi[...] consisting of forty-six staves from 3¼ in. to 3½ in. hooped by ¾-in. rods spaced on the average 8 ft. apa[...]he stave line is supported on 6-in. x 8-in. timber chairs [s]et 6 ft. apart. The rest of the flow line is composed of riveted steel pipe varying in diameter from 7.5 ft. to 8.5 ft., all piping being of ¼-in.

Fig. 15—Grace Dam and Wood-Stave Pipe.

Fig. 16—Grace Steel Flow Line.

[s]teel plate. At each high point on the flow line a 10-in. air [v]alve is installed, seven being required on the entire run. [F]our drain valves are installed at the low points of the line, [t]hese being from 8 in. to 10 in. in diameter and housed in [c]oncrete chambers with suitable wasteways.

The penstock is of steel, the diameter varying from 7.5 ft. [a]t the upper end to 6.5 ft. at the lower, the plates being [f]rom ⅜ in. to 1 1/16 in. thick. The net head under full-[lo]ad conditions is 440 ft. and the amount of water required [to] develop the full rating of the plant is 380 cu. ft. per [se]cond. The penstock terminates in a "Y-casting," from [wh]ich branches lead to the turbine equipments, each branch [be]ing controlled by a 48-in. hydraulically operated gate [va]lve. The tailrace is carried in a concrete tunnel under [th]e middle of the station building.

TYPICAL STATION DESIGN.

The Grace power plant illustrates the company's standard [hy]droelectric generating station design when unrestricted [by] local conditions limiting the [siz]e and arrangement of the [insta]llation. The general plan [is] to place all apparatus in a [se]quence, carrying the output [of] the equipment through the [...] in as nearly a straight line [as po]ssible and proceeding from [the w]aterwheel intakes to the [outgo]ing transmission circuits [with l]ittle or no reversal of di[rectio]n. In addition, each gen[eratin]g unit and its correspond[ing e]lectrical equipment and [wirin]g, with switchboard con[tro]l and high-tension apparatus, [con]stitutes a complete station in [its]elf, and can be operated [eith]er independently from or in [mu]ltiple with the other appa[rat]us in the plant. This ar[ran]gement also permits the sym[met]rical expansion of the plant [whe]n the load conditions de[ma]nd enlarged facilities, and th[e] absence of complications in arrangement tends to si[mp]lify the labor problem and render the installation m[uc]h safer to operate than one in which the machinery and wi[r]ing are unsymmetrical.

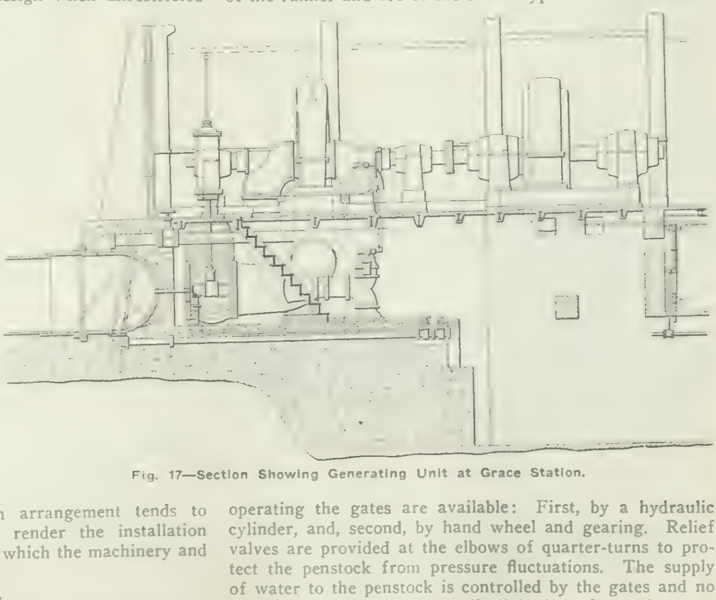


Fig. 17—Section Showing Generating Unit at Grace Station.

BUILDING.

[Th]e Grace station building is of concrete fireproof construction, 60 ft. x 140 ft. inside, the north half being devoted to turbines, generators, low-tension apparatus and switchboard and the remainder to transfomers and high-tension apparatus. A 25-ton hand-operated Whiting crane serves the entire station. The foundations are of masonry carried to bed rock, and the foundations of the generating units are of concrete. The walls are braced by heavy buttresses on a 14-ft. spacing, and the roof, which is of ferro-inclave, cemented outside, is carried on steel trusses. Floors, stairways and internal division walls are all of concrete.

GENERATING UNITS.

Two turbo-generators are installed, each unit consisting of a 5500-kw, 2300-volt, three-phase, 60-cycle Westinghouse revolving-field alternator, directly driven on a horizontal shaft at 300 r.p.m. by an inward-flow Allis-Chalmers reaction turbine, the runners being of the double quarter-turn discharge type. Each turbine is rated to deliver 8500 hp under a head of 440 ft., with a discharge of 204 cu. ft. per second. Each runner is provided with two draft tubes, which are joined under the spiral casing of the machine and which discharge horizontally into the tailrace, 20 ft. beneath the center of the shaft. The guides form the gates of the runner and are of the swivel type. Two methods of operating the gates are available: First, by a hydraulic cylinder, and, second, by hand wheel and gearing. Relief valves are provided at the elbows of quarter-turns to protect the penstock from pressure fluctuations. The supply of water to the penstock is controlled by the gates and no governors are installed, as all slight load fluctuations are

handled at Olmsted and Logan. Two 100-kw, 125-volt Westinghouse exciters are installed at the plant, each being provided with a 37-in. Pelton waterwheel for direct driving, the latter being served with water through a 10-in. pipe tapped into the "Y-casting" at the foot of the penstock. The permissible output of either exciter is more than 70 per cent greater than is needed for the two generators.

SWITCHING.

The plant has no main panel switchboard, pedestal equipments being used instead. From the generators the low-tension leads are carried between concrete barriers on the basement ceiling to the usual bus structure and switching equipment, the latter located on the operating-room floor. The leads are insulated with varnished cambric and carried on porcelain insulators. Five 3300-volt Westinghouse oil switches are provided, these being solenoid operated and fitted for remote control from the switching pedestals. Either generator may be operated upon a corresponding set of line transformers or paralleled on a common bus. Three control pedestals are installed, with corresponding instrument stands, one for each generator and corresponding line and a third for exciters and ordinary instrumental service. A small local-service switchboard of the panel type is in operation. The rheostats of the generators and exciters are operated by hand wheels in front of the control pedestals. The plant is provided with two water rheostats for maintaining the speed regulation in case of trouble on the system, these being lowered into the tail race for operation, and the two being capable of absorbing the total output of the station. Hand-wheel control, beside the pedestals, is provided for this apparatus.

HIGH-TENSION WORK.

Six 1833-kw transformers, with a seventh reserve unit, are installed on the basement floor level to raise the potential from 2300 volts to about 51,000 volts for the transmission of energy to the Logan station. The transformers of the water-cooled type are delta-connected on the low-tension side and star-connected on the high-tension side, and are arranged to allow operation at 88,000 volts. The high-tension equipment of the station has been designed and installed with this ultimate voltage in mind. Three 100-kw local-service transformers are also installed. High-tension leads and buses are insulated with varnished cambric and carried in tubes of fiber conduit supported on porcelain insulators and paraffined wooden pins set into varnished wooden framing. The high-tension leads from the transformers are carried about 8 ft. above the bushings to disconnecting switches mounted horizontally beneath the timber framing, and thence the leads drop to the oil-switch installation, which includes five 88,000-volt, remotely controlled equipments, located beyond the transformers on the basement floor and mounted in concrete cells. Disconnecting switches are also provided on the outer sides of the oil switches, and the company's standard practice is to locate all disconnectors on a horizontal axis inside stations,

Fig. 19—Low-Tension Switches at Grace.

in order to avoid tical section parallel tc the falling open of the switch, with the thick, eflecting ge of being able to open the circuit under crt. T exte ditions, as in the event of trouble arising in lightnir. s OFresters. Electrolytic lightning arresters and choke coils are provided between the oil switches and the outlet bushings of the station. The choke coils are of the solenoid type, consisting of a No. 3

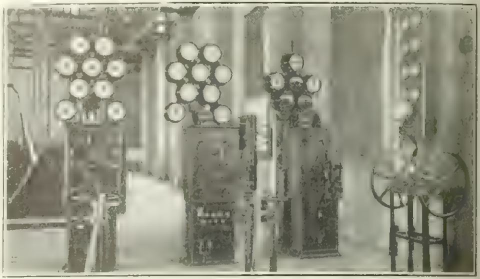


Fig. 20—Control Pedestals at Grace Station.

rubber-covered wire wound upon a cylinder of fiber conduit 12 ft. long x 5 in. in diameter. The disconnecting switches have a 6-ft. break in each case. On the high-tension side of the station two oil switches control the outgoing lines; one switch controls each transformer, and the fifth is a tie switch for multiple operation of the two halves of the station. The high-tension lines leave the building through glass windows 4 ft. square, each wire being carried in a 2½-in. fiber conduit bushing with ozokonite filling, there also being an outer bushing 4 in. in diameter. A grounding device is installed outside the station, provision being made for the short-circuiting of each phase to the earth through a lever, bell-crank shaft and rotating-knife switch equipment operated from below. A galvanized-iron canopy extends outward from the station wall above the outgoing leads for a distance of about 6 ft., to deflect rain and snow from the outlet bushings.

In following issues will be described other generating stations of the Utah system as well as the transmission systems.

THE CHARGING CURRENTS OF THREE-PHASE TRANSMISSION LINES.

Analysis of the Variations of Charging Currents When One Conductor Is Connected to Earth.

By George S. Humphrey.

THE usual formulas for calculating the charging currents of three-phase transmission lines are derived on the assumption that the conductors are placed a the vertices of an equilateral triangle and that the voltage to ground are balanced and equal. For any other arrangement of conductors or for any abnormal voltage condition a solution can be reached only by resorting to fundamenta principles. It is the purpose of this article to point out method for calculating the charging currents when one conductor is grounded and to compare these values with th normal charging currents for certain common types c construction.

The ordinary formula for calculating the electrostat capacity of a three-phase transmission line is

$$C = \frac{0.03883}{\log_{10}\left(\frac{d}{r}\right)}$$

where C is the capacity in microfarads between one wi

nst the charge on c' is $-2Q_c \log \frac{ac}{ac'}$.
bove a' is the resultant work done
charges, or $V_{aa'} = 4Q_a \log \frac{aa'}{r}$
$\frac{ac'}{ac}$. Now $V_{ao} = \frac{1}{2} V_{aa'}$.

and solving for V_{bo} and V_{co} in the

$$\cdot + 2Q_b \log \frac{ab'}{ab} + 2Q_c \log \frac{ac'}{ac} \quad (1)$$

$$\frac{b'}{b} + 2Q_b \log \frac{bb'}{r} + 2Q_c \log \frac{bc'}{bc} \quad (2)$$

$$+ 2Q_b \log \frac{bc'}{bc} + 2Q_c \log \frac{cc'}{r} \quad (3)$$

ident equations can be used to solve n charges if the voltages to ground al or otherwise known. This is not less the system is operated with a t the voltages between lines can be equal, and the charges can be deter- oltages instead of voltages to ground. pression for the potential of a above om b to a. Proceeding as before and

$$\cdot 2Q_b \log \frac{r}{ab} \frac{ab'}{bb'} + 2Q_c \log \frac{bc}{ac} \frac{ac'}{bc'} (4)$$

$$2Q_b \log \frac{bc}{r} \frac{bb'}{cb'} + 2Q_c \log \frac{r}{bc} \frac{bc'}{cc'} (5)$$

$$\cdot 2Q_b \log \frac{ab}{cb} \frac{cb'}{ab'} + 2Q_c \log \frac{ac}{r} \frac{cc'}{ac'} (6)$$

there are three unknown quantities, nly two independent equations, since lines must add up to zero, and any tions can be derived from the other harges must also add up to zero, so

$$Q_b + Q_c + \ldots = 0. \quad (7)$$

ether with any two of equations 4, 5 e to solve for Q_a, Q_b and Q_c.

$\frac{b'}{b'}$, etc., in the equations above are

unity and may be so considered for Thus treating them does not lessen nvolved in the computations, however. ences and charges in the equations pressed in fundamental electrostatic coulombs per mile take logarithms to the results obtained from the equa-

when V is expressed in volts.

inbalancing in voltage, etc., resulting iductor it is necessary to know the the charging current as well as its solving a problem it is most con- complex expressions for the vector al results are more easily interpreted trigonometric form.

for any three-wire, three-phase cir- t any conductor grounded, can be selection and combination from these illustrate the method the solution of ll now be presented.

Suppose the conductors arranged as spacing; a and c each 12 ft. from b; nds of No. 8 B. & S.; all conductors

grounded. Normal. Use equations

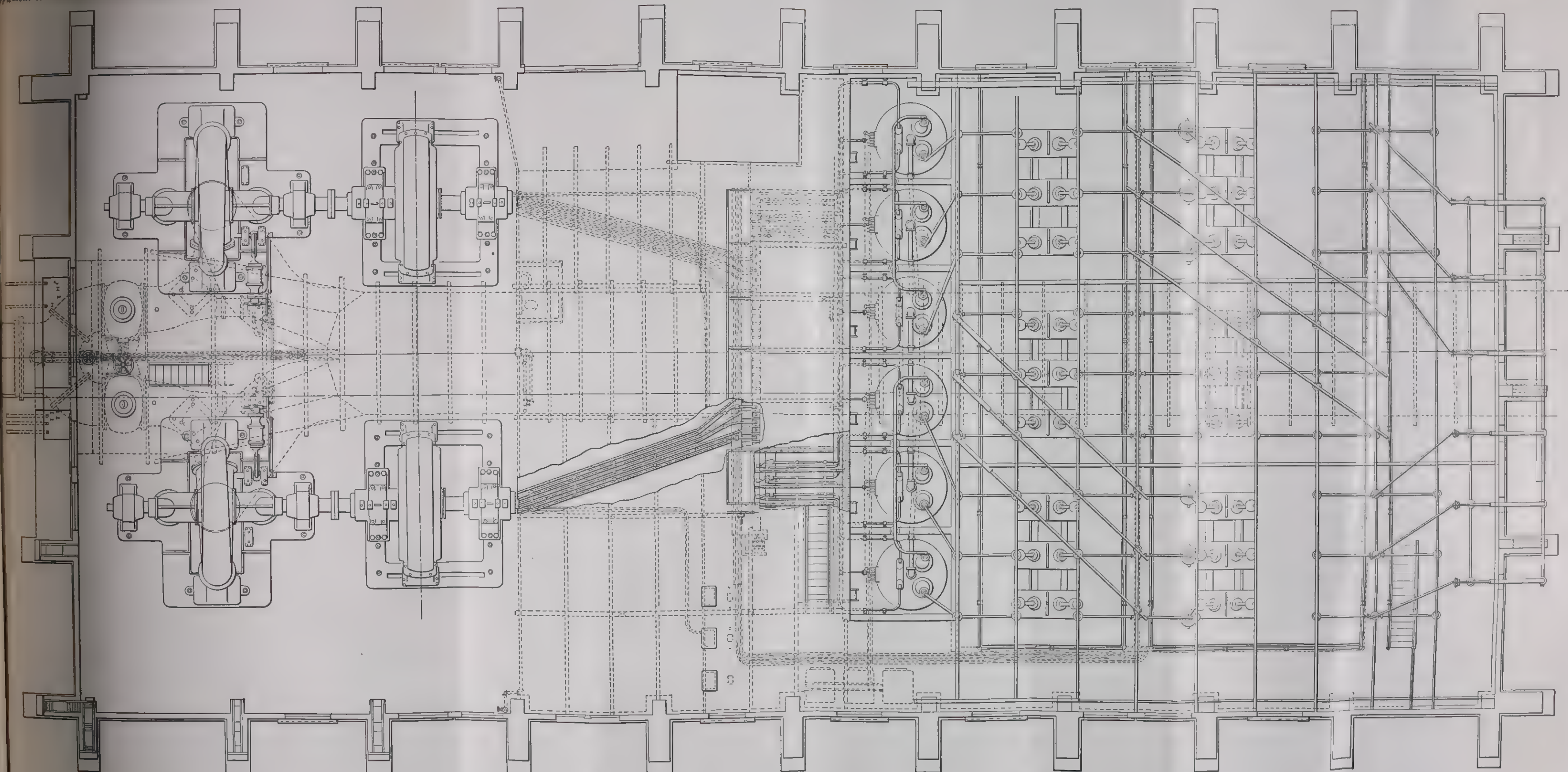


Fig. 18—Plan of Grace Power Station.

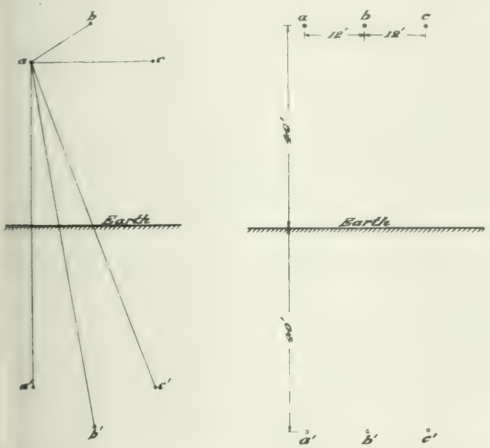
and ground per mile of line, d is the distance between the centers of the conductors, and r is the radius of the conductors. The charging current I per mile for each conductor is then

$$I = \frac{2\pi f C E}{10^6 \sqrt{3}}$$

where f is the frequency and E the line voltage.

Derivation of Equations.—The difference of potential between two points is defined as the work which must be done on a unit positive charge of electricity in moving it from the point of lower to that of higher potential. The work which is thus done on a unit charge against any neighboring charge Q is numerically equal to $2Q$ times the natural logarithm of the ratio of the initial to the final distance of the unit charge from Q.

Consider a three-phase transmission line with conductors a, b and c, as shown in Fig. 1. The distribution of potential in the field above the earth is the same as would exist if the earth were replaced by conductors a', b' and c' vertically under a, b and c, as far beneath the earth's surface



Figs. 1 and 2—Mechanical Arrangement of Real and Image Conductors.

as the latter are above it, and the charges on a', b' and c' were equal and opposite to those on a, b and c respectively. In the following discussion the earth will be replaced by three "images" of the real conductors, and the system treated as though it consisted of six conductors.

Let the distance from a to $b = ab$.
Let the distance from a to $b' = ab'$, etc.
Let the charge on conductor $a = Q_a$.
Let the charge on conductor $a' = -Q_a$.
Let the charge on conductor $b = Q_b$, etc.
Let the charging current for conductor $a = I_a$.
Let the charging current for conductor $b = I_b$, etc.
Let the potential of a above ground $= V_{ao}$.
Let the potential of b above ground $= V_{bo}$.
Let the potential of a above $b = V_{ab}$, etc.
Let the radius of each conductor $= r$.

The expression for the potential of a above ground, or V_{ao}, may be derived as follows: Move unit positive charge from a' to a. The work done against the charge on a is $2Q_a \log \frac{aa'}{r}$; against the charge on a' is $-2Q_a \log \frac{r}{aa'}$, against the charge on b is $2Q_b \log \frac{ab'}{ab}$; against the charge on b' is $-2Q_b \log \frac{ab}{ab'}$; against the charge on c is $2Q_c \log \frac{ac'}{ac}$; and against the charge on c' is $-2Q_c \log \frac{ac}{ac'}$. The potential of a above a' is the resultant work done against all of the charges, or $V_{aa'} = 4Q_a \log \frac{aa'}{r} + 4Q_b \log \frac{ab'}{ab} + 4Q_c \log \frac{ac'}{ac}$. Now $V_{ao} = \frac{1}{2} V_{aa'}$.

Dividing $V_{aa'}$ by 2 and solving for V_{bo} and V_{co} in the same manner,

$$V_{ao} = 2Q_a \log \frac{aa'}{r} + 2Q_b \log \frac{ab'}{ab} + 2Q_c \log \frac{ac'}{ac} \quad (1)$$

$$V_{bo} = 2Q_a \log \frac{ab'}{ab} + 2Q_b \log \frac{bb'}{r} + 2Q_c \log \frac{bc'}{bc} \quad (2)$$

$$V_{co} = 2Q_a \log \frac{ac'}{ac} + 2Q_b \log \frac{bc'}{bc} + 2Q_c \log \frac{cc'}{r} \quad (3)$$

These three independent equations can be used to solve for the three unknown charges if the voltages to ground are balanced and equal or otherwise known. This is not the case, however, unless the system is operated with a grounded neutral. But the voltages between lines can be taken as balanced and equal, and the charges can be determined by using line voltages instead of voltages to ground. In order to get an expression for the potential of a above b move unit charge from b to a. Proceeding as before and reducing results

$$V_{ab} = 2Q_a \log \frac{ab}{r}\,\frac{aa'}{ba'} + 2Q_b \log \frac{r}{ab}\,\frac{ab'}{bb'} + 2Q_c \log \frac{bc}{ac}\,\frac{ac'}{bc'} \quad (4)$$

$$V_{bc} = 2Q_a \log \frac{ca}{ba}\,\frac{ba'}{ca'} + 2Q_b \log \frac{bc}{r}\,\frac{bb'}{cb'} + 2Q_c \log \frac{r}{bc}\,\frac{bc'}{cc'} \quad (5)$$

$$V_{ca} = 2Q_a \log \frac{r}{ca}\,\frac{ca'}{aa'} + 2Q_b \log \frac{ab}{cb}\,\frac{cb'}{ab'} + 2Q_c \log \frac{ac}{r}\,\frac{cc'}{ac'} \quad (6)$$

In these equations there are three unknown quantities, Q_a, Q_b and Q_c, but only two independent equations, since the voltages between lines must add up to zero, and any one of the three equations can be derived from the other two. However, the charges must also add up to zero, so that

$$Q_a + Q_b + Q_c + \,.\,\,. = 0, \quad (7)$$

and this equation, together with any two of equations 4, 5 and 6, makes it possible to solve for Q_a, Q_b and Q_c.

The fractions $\frac{aa'}{ba'}$, $\frac{ab'}{bb'}$, etc., in the equations above are very nearly equal to unity and may be so considered for all practical purposes. Thus treating them does not lessen very much the work involved in the computations, however.

All potential differences and charges in the equations given above are expressed in fundamental electrostatic units. To reduce Q to coulombs per mile take logarithms to base 10 and multiply the results obtained from the equations by $\frac{3.883}{2} \times 10^{-8}$ when V is expressed in volts.

In calculating the unbalancing in voltage, etc., resulting from a grounded conductor it is necessary to know the relative time-phase of the charging current as well as its numerical value. In solving a problem it is most convenient to employ the complex expressions for the vector quantities, but the final results are more easily interpreted when converted to the trigonometric form.

A complete solution for any three-wire, three-phase circuit, with or without any conductor grounded, can be reached by a proper selection and combination from these seven equations. To illustrate the method the solution of a few typical cases will now be presented.

Illustrations.—(I) Suppose the conductors arranged as shown in Fig. 2. Flat spacing; a and c each 12 ft. from b; conductor, seven strands of No. 8 B. & S.; all conductors 40 ft. above ground.

(a). No conductor grounded. Normal. Use equations (4), (5) and (7).

$$V_{ab} = 3.883 \times 10 \;(2.87Q_a - 2.87Q_b - 0.287Q_c) = e \sin\theta \qquad (4)$$

$$V_{bc} = 3.883 \times 10 \;(0.287Q_a + 2.87Q_b - 2.87Q_c) = e \sin(\theta - 120^\circ) \qquad (5)$$

$$Q_a + Q_b + Q_c = 0 \qquad (7)$$

where V is in volts and Q in coulombs per mile. Solving

$$Q_a = 0.737 \times 10^{-8}\, e \sin(\theta - 27^\circ)$$
$$Q_b = 0.809 \times 10^{-8}\, e \sin(\theta - 150^\circ)$$
$$Q_c = 0.737 \times 10^{-8}\, e \sin(\theta - 273^\circ)$$

Since it is usually desired to know the relative amount by which normal quantities are changed under abnormal conditions, and charging current is always the thing of most immediate interest, all final results will be expressed as the ratio of the true charging current to the value it would have under normal conditions as computed from the ordinary formulas.

According to the formula for electrostatic capacity $C = 0.0135$ microfarad per mile. $Q = CE$. Therefore $Q_a = Q_b = Q_c = 0.0135 \dfrac{e}{\sqrt{3}} = 0.780 \times 10^{-8}\, e$ coulombs per mile, each charge being in time-phase with its corresponding voltage to neutral.

Dividing the real values of Q_a, Q_b and Q_c by $0.780 \times 10^{-8}\, e$

$$Q_a = 0.94 \sin(\theta - 27^\circ)$$
$$Q_b = 1.04 \sin(\theta - 150^\circ)$$
$$Q_c = 0.94 \sin(\theta - 273^\circ).$$

The charging currents are changed in the same ratio as the charges and lead them by 90 deg. Hence

$$I_a = 0.94 \sin(\theta + 63^\circ)$$
$$I_b = 1.04 \sin(\theta - 60^\circ)$$
$$I_c = 0.94 \sin(\theta - 183^\circ).$$

Thus under normal operation the charging current of the middle conductor is 10 per cent greater than that of the side conductors. It is 4 per cent more than would be shown by the ordinary formulas, while that of the side wires is 6 per cent less than would thus be indicated.

From equations (1), (2) and (3) the voltages to ground may be found by using the values of Q_a, Q_b and Q_c just obtained. Expressing these voltages as the ratio of the voltage to ground to the balanced voltage to neutral:

$$V_{ao} = 0.98 \sin(\theta - 32^\circ)$$
$$V_{bo} = 1.03 \sin(\theta - 150^\circ)$$
$$V_{co} = 0.98 \sin(\theta - 268^\circ)$$

The middle conductor has a voltage to ground 5 per cent greater than the side conductors.

(*b*) *Conductor a grounded.* The ground and conductor a now form one plate of the system of condensers, while b and c form the other two plates. Let Q_g represent the charge on the ground. The equations which must be used to express the physical conditions are:

$$V_{ab} = \ldots\ldots = e \sin\theta \qquad (4)$$
$$V_{bc} = \ldots\ldots = e \sin(\theta - 120^\circ) \qquad (5)$$
$$V_{ao} = \ldots\ldots = 0 \qquad (1)$$
$$Q_a + Q_b + Q_c + Q_g = 0 \qquad (7)$$

Solving and expressing final results as before:

$$I_a = 0.38 \sin(\theta + 71^\circ)$$
$$I_b = 1.35 \sin(\theta - 79^\circ)$$
$$I_c = 1.31 \sin(\theta - 161^\circ)$$
$$I_g = 1.64 \sin(\theta + 58^\circ)$$
$$I'_a = I_a + I_g = 2.02 \sin(\theta + 61^\circ)$$

I'_a is the total charging current which must be supplied to the grounded conductor on the generator side of the ground. From these results it is seen that when one of the side conductors is grounded its charging current on the side of the point at which it is grounded away from the generator is 38 per cent of normal. The charging current of the ungrounded side wire is 1.31 normal, and of the middle wire is 1.35 normal. The charging current supplied to the ground is 1.64 times the normal charging current of one conductor, and the total current supplied to the grounded wire at the generator end is 2.02 normal. The phase angles between the various charging currents are very much distorted. The charges on the ground and on the grounded wire are not in time-phase, because a is not placed symmetrically with respect to b and c.

(*c*) *Conductor b grounded.*—In this case the ground and conductor b form one plate of the system of condensers, while a and c form the other two plates.

$$V_{ab} = \ldots\ldots = e \sin\theta \qquad (4)$$
$$V_{bc} = \ldots\ldots = e \sin(\theta - 120^\circ) \qquad (5)$$
$$V_{bo} = \ldots\ldots = 0 \qquad (2)$$
$$Q_a + Q_b + Q_c + Q_g = 0 \qquad (7)$$

Solving and reducing:

$$I_a = 1.37 \sin(\theta + 85^\circ)$$
$$I_b = 0.50 \sin(\theta - 60^\circ)$$
$$I_c = 1.37 \sin(\theta - 205^\circ)$$
$$I_g = 1.73 \sin(\theta - 60^\circ)$$
$$I'_b = 2.23 \sin(\theta - 60^\circ)$$

When the middle conductor is grounded its charging current on the side of the point of ground away from the generator is 50 per cent of normal, and the total charging current which must be supplied to it at the generator end is 2.23 normal, as compared with 2.02 normal when a side wire is grounded. The charging current of the side wires is 1.37 normal, and that to ground is 1.73 times the normal charging current of one conductor. The charge on the ground is in time-phase with that on the grounded wire, since b is placed symmetrically with respect to the other two conductors.

To show the results for two other common types of construction and also to illustrate the effect of an overhead ground wire, two other arrangements of conductors will now be considered, namely, equilateral triangular spacing, with and without an overhead ground wire.

(II) Equilateral triangular spacing. Conductors 6 ft. apart and No. 0 B. & S.; vertex upward; base of triangle 25 ft. above ground.

The equations used in the preceding problem apply in the corresponding cases here. Only the results will be given.

(*a*) *No conductor grounded. Normal.*

$$I_a = 1.001 \sin(\theta + 9.9^\circ)$$
$$I_b = 1.000 \sin(\theta - 60.0^\circ)$$
$$I_c = 1.001 \sin(\theta - 179.9^\circ)$$
$$V_{ao} = 0.99 \sin(\theta - 31^\circ)$$
$$V_{bo} = 1.02 \sin(\theta - 150^\circ)$$
$$V_{co} = 0.99 \sin(\theta - 269^\circ)$$

(*b*) *Conductor a grounded.*

$$I_a = 0.52 \sin(\theta + 61^\circ)$$
$$I_b = 1.29 \sin(\theta - 78^\circ)$$
$$I_c = 1.32 \sin(\theta - 162^\circ)$$
$$I_g = 1.43 \sin(\theta + 59^\circ)$$
$$I'_a = 1.95 \sin(\theta + 60^\circ)$$

(*c*) *Conductor b grounded.*

$$I_a = 1.33 \sin(\theta + 79^\circ)$$
$$I_b = 0.53 \sin(\theta - 60^\circ)$$
$$I_c = 1.33 \sin(\theta - 199^\circ)$$
$$I_g = 1.47 \sin(\theta - 60^\circ)$$
$$I'_b = 2.00 \sin(\theta - 60^\circ)$$

(III) Same as (II) with a 0.25-in. ground wire strung 3 ft. vertically above conductor b.

The fundamental equations must now be revised to include the effect of the charge which is on the ground wire. Denote the ground wire by s and its radius by R_s. The equations are derived in the same manner as before, and when reduced are as follows:

$$V_{ao} = 2Q_a \log \frac{aa'}{r} + 2Q_b \log \frac{ab'}{ab} + 2Q_c \log \frac{ac'}{ac} + 2Q_s \log \frac{as'}{as} \qquad (8$$

$$V_{bo} = 2Q_a \log \frac{ab'}{ab} + 2Q_b \log \frac{bb'}{r} + 2Q_c \log \frac{bc'}{bc} + 2Q_s \log \frac{bs'}{bs}$$

$$V_{co} = 2Q_a \log \frac{ac'}{ac} + 2Q_b \log \frac{bc'}{bc} + 2Q_c \log \frac{cc'}{r} + 2Q_s \log \frac{cs'}{cs} \qquad (10)$$

$$V_{ab} = 2Q_a \log \frac{ab}{r}\frac{aa'}{ab'} + 2Q_b \log \frac{r}{ab}\frac{ab'}{bb'} + 2Q_c \log \frac{bc}{ac}\frac{ac'}{bc'}$$
$$+ 2Q_s \log \frac{bs}{as}\frac{as'}{bs'} \qquad (11)$$

$$V_{bc} = 2Q_a \log \frac{ca}{ba}\frac{ba'}{ca'} + 2Q_b \log \frac{bc}{r}\frac{bb'}{cb'} + 2Q_c \log \frac{r}{bc}\frac{bc'}{cc'}$$
$$+ 2Q_s \log \frac{cs}{bs}\frac{bs'}{cs'} \qquad (12)$$

$$V_{so} = 2Q_a \log \frac{as'}{as} + 2Q_b \log \frac{bs'}{bs} + 2Q_c \log \frac{cs'}{cs} + 2Q_s \log \frac{ss'}{Rs} \qquad (13)$$

$$Q_a + Q_b + Q_c + Q_g + Q_s = 0 \qquad (14)$$

(*a*) *No conductor grounded. Normal.*

The proper equations are:

$$V_{ab} = \ldots\ldots = e \sin \theta \qquad (11)$$
$$V_{bc} = \ldots\ldots = e \sin (\theta - 120°) \qquad (12)$$
$$V_{so} = \ldots\ldots = 0 \qquad (13)$$
$$Q_a + Q_b + Q_c = 0$$
$$Q_s + Q_g = 0$$

Solving and reducing results to the usual form:

$$I_a = 1.01 \sin (\theta + 60.5°)$$
$$I_b = 1.02 \sin (\theta - 60.0°)$$
$$I_c = 1.01 \sin (\theta - 180.5°)$$
$$I_s = 0.13 \sin (\theta - 240°)$$
$$I_g = 0.13 \sin (\theta - 60°)$$

The addition of the ground wire has increased the charging current of the side wires by 1 per cent and of the middle wire by 2 per cent. Without the ground wire the charging current of the side wires is a little more than that of the middle one, while the reverse is true when the ground wire is added. It is interesting to note that the current in the ground wire is 13 per cent of the charging current of a line conductor and is opposite in time-phase to the charging current of the middle wire. The ground wire and the ground together form a conductor on which charges are induced by the charges on the line conductors.

To find the voltages to ground, substitute the values of Q_a, Q_b and Q_c just found in equations (8), (9) and (10).

$$V_{ao} = 1.02 \sin (\theta - 28°)$$
$$V_{bo} = 0.97 \sin (\theta - 150°)$$
$$V_{co} = 1.02 \sin (\theta - 272°)$$

(*b*) *Conductor a grounded.*

$$V_{ab} = \ldots\ldots = e \sin \theta \qquad (11)$$
$$V_{bc} = \ldots\ldots = e \sin (\theta - 120°) \qquad (12)$$
$$V_{ao} = \ldots\ldots = 0 \qquad (8)$$
$$V_{so} = \ldots\ldots = 0 \qquad (13)$$
$$Q_a + Q_b + Q_c + Q_g + Q_s = 0$$

Solving and reducing:

$$I_a = 0.45 \sin (\theta + 59°)$$
$$I_b = 1.44 \sin (\theta - 81°)$$
$$I_c = 1.35 \sin (\theta - 159°)$$
$$I_s = 0.53 \sin (\theta + 74°)$$
$$I_g = 1.19 \sin (\theta + 56°)$$
$$I'_a = I_a + I_s + I_g = 2.17 \sin (\theta - 61°)$$

(*c*) *Conductor b grounded.*

$$V_{ab} = \ldots\ldots = e \sin \theta \qquad (11)$$
$$V_{bc} = \ldots\ldots = e \sin (\theta - 120°) \qquad (12)$$
$$V_{bo} = \ldots\ldots = 0 \qquad (9)$$
$$V_{so} = \ldots\ldots = 0 \qquad (13)$$
$$Q_a + Q_b + Q_c + Q_g + Q_s = 0$$

Solving and reducing:

$$I_a = 1.35 \sin (\theta + 80°)$$
$$I_b = 0.44 \sin (\theta - 60°)$$
$$I_c = 1.35 \sin (\theta - 200°)$$
$$I_s = 0.30 \sin (\theta - 60°)$$
$$I_g = 1.33 \sin (\theta - 60°)$$
$$I'_b = I_b + I_s + I_g = 2.06 \sin (\theta - 60°)$$

Without the ground wire the maximum charging current with a grounded conductor is 2.00 normal and occurs when the middle wire is grounded. With the ground wire the maximum charging current is 2.17 normal and occurs when a side wire is grounded.

Increasing the number of conductors involved adds greatly to the complexity of the equations, but the same theory applies in any case.

Summary.—A grounded conductor produces about the same relative effect for all types of construction which are used in practice. In general, with one conductor grounded the charging current of the two ungrounded conductors becomes approximately 1.35 normal and that of the grounded conductor on the side of the ground away from the generator approximately 0.50 normal; the total charging current which must be supplied to the grounded conductor is approximately 2.10 normal.

THICKNESS OF ELECTRIC AND THERMAL INSULATION.

Determination of the Relative Thicknesses of Insulation for Different Cores in Order to Retain the Same Resistance and Same Dielectric Strength.

By Carl Hering.

When a wire of circular section is covered with a layer of insulation problems concerning the so-called insulation resistance may involve the calculations of the resistance of the insulation, hence of a tube or hollow cylinder from the inside cylindrical surface to the outside one. The length of the path of the current, therefore, is the thickness of the insulation, and the cross-section of the path is a cylindrical one varying from the smaller inside surface to the larger outside one; that is, it is not constant, but flares. The same problem occurs in the thermal insulation of steam pipes, cylindrical boilers, cylindrical electric furnaces, etc.

The question therefore arises, What shall be taken as the correct average cross-section in the calculations? It can readily be shown that the usual rough rule, to take the ordinary arithmetical average between the inside and outside, is not rigidly correct, and in fact is quite erroneous when the flare is great, as, for instance, in the case of a thick insulation on a small wire. It should be used only for thin layers on large diameters, and even then it is only approximate.

Owing no doubt to the fact that the correct formula is not readily found in books and that, as given by physicists, it involves so-called natural or Naperian logarithms, which are troublesome and not readily available, calculations of this kind are not made as often as they ought to be in order to proceed more intelligently in making specifications, and the lack of such calculations may at times lead to quite erroneous conclusions. For instance, in a recent case in the writer's practice a specification was found to call for two sizes of rubber-covered wire. The thickness of insulation of the larger one was required to be 40 per cent greater than that of the smaller one, and this greater thickness was supposed to give it a correspondingly better insulation, as the insulation called for was also about 40 per cent greater. The same quality of insulation was implied because the mechanical test was the same for both. Calculations with the correct formula, however, showed that, notwithstanding the greater thickness of the rubber, the insulation resistance would not only not be greater but would be actually less than with the thinner one. The explanation is in part that the surface of the core of the larger wire was considerably more than 40 per cent greater; hence this more than counteracted the increased thickness of insulation. This shows that it is sometimes advisable

to make the correct calculations, as the conditions may be deceptive.

The purpose of the present article is to point out and discuss some of the results obtained from the rigidly correct formula, and to show those who may shrink from attempting to use formulas containing unfamiliar factors that it is not at all a difficult one to use.

The rigidly correct formula for such cylinders, as deduced by the physicist, is

$$R = \frac{r}{2 \pi L} \text{ nat. log. } \frac{D}{d}, \qquad (1)$$

in which R is the total resistance in ohms, r the specific resistance (resistivity) in ohms per centimeter or inch cube, L the axial length of the cylinder, D the outside diameter and d the inside diameter, all three in centimeters or inches. Of course, either inches or centimeters must be used consistently throughout. R and r may both be in megohms or in thermal ohms* in the case of thermal insulation.

As tables of the common logarithms are generally more readily accessible and more familiar to work with, this formula is best reduced to the following simple form:

$$R = 0.366468 \frac{r}{L} \text{ com. log. } \frac{D}{d}. \qquad (2)$$

For routine calculations this could be further reduced to avoid uncomfortably large numbers. The fraction D/d will always be greater than unity, hence will never involve the troublesome negative coefficients. The last factor "common logarithm D/d" merely means that the logarithm of the quotient of D/d should be used and not the quotient itself. This, of course, requires to be found from tables. Those familiar with logarithms will subtract the log. of d from the log. of D, and the result will be the desired figure. Many useful deductions can, however, be made without using logarithms at all.

For instance, if two wires of different sizes are to have the same insulation resistance per mile, or if two different steam pipes are to be equally well insulated thermally, so that the loss of heat is the same—that is, if R remains the same, as well as r and L—it follows from the formula that the quotient of the outside diameter of the insulation divided by the inside diameter must always be the same. Fig. 1 shows graphically how greatly the thickness of the insulation must therefore increase when the cores increase in diameters from 1 to 2, 3, 4 and 5, the smaller one representing about 13/64 in. thickness of insulation on a No. 10 B. & S. core, the outside diameter being therefore five times that of the core; hence $D/d = 5$. For convenience the deductions will here be given in terms of the diameter of the smallest wire taken as unity. Although the thickness of the insulation of the larger one is five times as great as that of the smaller, the insulation resistance is only the same. This shows that it becomes very expensive to insulate the larger wires to the same insulation resistance as the smaller ones.

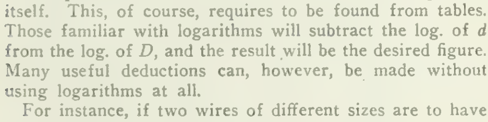


Fig. 1—Relative Thickness of Insulation for Same Megohms per Mile.

In order to show how rapidly the cost of the insulation increases let it be assumed that the insulation of the larger wire is made 25 per cent less. Then, from the formula, log. D/d must be 25 per cent less. Originally $D/d = 5$ hence log. $5 = 0.69897$; three-quarters of this is 0.52423, hence this is the log. of D'/d, in which D' is the new diameter. As $d = 5$, add the log. of 5 to this latter log., giving 1.22320; the number for which this is the log. is 16.72, which is therefore the outside diameter when the insulation is 25 per cent less. This is shown in the outer dotted circle in Fig. 2, the outside diameter having formerly been 25. The thickness of insulation has therefore been reduced from 10 to 5.86, or nearly as much as one-half.

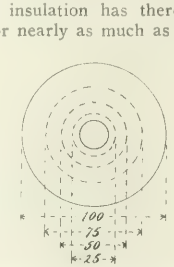


Fig. 2—Relative Diameters for Various Percentages of Insulation.

But the saving in amount of insulation material is far greater. The cross-sectional areas of the insulation in the two cases are 471.4 and 198.9; the former is therefore 237 per cent of the latter. Hence this 25 per cent dilfference in insulation resistance requires much more than double the material of the lower resistance wire. Or, in other words, to allow a reduction of only 25 per cent in the resistance reduces the required insulation material to considerably less than half. This slightly higher insulation is therefore dearly bought.

Making these same calculations for one-half the original resistance reduces the outside diameter to 11.18, as shown by the middle dotted line in Fig. 2. The thickness of the insulation is then reduced from 10 to 3.09, or to less than a third; and the section of the insulation will then be 78.6, or just one-sixth. That is, there is a saving of five-sixths of the insulation material if the insulation resistance is reduced to one-half; or, in other words, it takes six times as much material to double the insulation resistance of that wire.

Again, repeating the calculations for a reduction to one-quarter of the original gives an outside diameter of 7.48, as shown by the smallest dotted circle. The thickness is then reduced from 10 to 1.24, or to one-eighth, and the cross-section to 24.2, or to nearly one-twentieth of the original. That is, to increase the insulation by 300 per cent requires twenty times the amount of insulation material in this case.

In view of the above it seems to be unnecessarily extravagant to specify the same high insulation for larger wires as for smaller ones when the insulating material is expensive, like rubber. The leakage of energy through such high insulation is certainly not worth such expense to save, hence it cannot be the criterion. For a 20-mile circuit of No. 6 cable of 2000 megohmns per mile, with 6000 volts, the leakage loss is only about one-third of a watt.

If it is thought that this leakage gradually deteriorates the insulation and should therefore be small, then it would

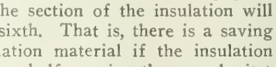


Fig. 3—Relative Diameters for Same Leakage Density or Break-Down Voltage.

be more rational to allow the same leakage current per square inch of inside surface of the insulation for large and small wires. This would mean approximately the same thickness of insulation for all sizes and would reduce the allowable insulation resistance very greatly for larger cables. In fact, the insulation would then actually be slightly thinner for the larger wires. On this basis the insulation would be about as shown in Fig. 3.

*"Thermal Resistance and Conductance; the Thermal Ohm and Thermal Mho." By Carl Hering. [illegible] Jan., 1911, p. 13.

For high voltages it would seem that the thickness of insulation of large wires would be governed more by the breakdown test than by the insulation resistance, and in that case the thickness of insulation would again be equal for large and small wires for the same voltage, as in Fig. 3.

If mechanical considerations govern the thickness, it may be cheaper to strand the wire, or if stranded to use thinner strands, so as to make it more flexible.

In the thermal insulation of steam pipes the only two factors are the value of the energy of the steam saved and the cost of the insulation necessary to save it. When the present writer published a discussion of this and other similar rigid formulas some years ago a foreign steam engineer in applying them to the customary practice in steam-pipe insulation in this country found the commercially interesting fact that the insulation was too thick, as the steam energy saved by the excessive thickness did not warrant the cost; that is, a somewhat thinner insulation would be more economical when both the factors were considered.

Returning again to Fig. 1, the current-carrying capacities of the cores may be assumed to be proportional to their cross-sections. Dividing the cross-sections of the insulation by that of the wire, in each of those five cases, gives a constant, in this case 24; that is, the volume of the insulation is twenty-four times that of the wire core. This means that when the insulation resistance is the same for different sizes of wire the amount of insulation increases in the same proportion as the cross-section of the wire; that is, for a given insulation resistance the weight of insulation per circular mil of the core is the same for all sizes. It can be shown mathematically that this follows directly from the above formula. There is therefore no insulating material saved by using one large wire instead of two smaller ones which together equal the larger one in cross-section of copper.

When, however, the thickness of insulation is the same for all sizes of core, as shown in Fig. 3, in which it is governed not by the megohms per mile but by equal breakdown voltages or by approximately equal current densities of the leakage through the insulation, as above described, then there will be very considerable savings of insulation material as the wire becomes larger. The amount of insulation then increases approximately as the diameter (accurately it increases slightly less than the diameter), hence as the square root of the circular mils. A wire of twenty-five times the section, as in Fig. 3, would therefore require only about five times the weight of insulation, instead of twenty-five times, as in Fig. 1.

Another use which can be made of the above rigid formula is to find the correct specific resistance (resistivity) of the insulation material from the megohms per mile of a wire of given size and insulation thickness.

One has merely to substitute the known values for, say, 1 mile or 1 ft. and solve for r.

For instance, a No. 10 B. & S. okonite wire with 5/32-in. insulation is said to have an insulation resistance of 5300 megohms per mile. Hence, using megohms for both R and r, and inches for the length: $R = 5300$, $L = 5280 \times 12 = 63{,}360$; $D = 0.4144$; $d = 0.1019$; common log. $D/d = 0.60959$. Hence: $r = 5300 \times 63{,}360 \div (0.36647 \times 0.60959) = 1{,}500{,}000{,}000$ megohms for a cube of the material having sides 1 in. in length.

Central Station
Management, Policies and Commercial Methods

USING ELECTRICITY ECONOMICALLY.

The Union Gas & Electric Company, of Cincinnati, in its new magazine bearing the curious title *?—and the Answer*, makes a point of educating its customers in the economical use of its service. Following are some of the pertinent phrases used as running heads across the pages: "Every lighted lamp not actually utilized robs you." "Always extinguish lamps when leaving the room." "Neighbors can't remedy your complaints; tell us." "When a lamp gets smoky renew it." "An unoccupied room needs no lighted lamp." "Don't bore your friends with complaints; tell us." "It's easy to turn off a lamp and it saves money." "Bring your troubles to use; others can't help you."

DECORATIVE STREET LIGHTING IN LOUISVILLE.

The marked success which has been secured by those interested in the erection of ornamental illuminating standards in the business district of Louisville has created much enthusiasm among the merchants. A permanent organization of retailers along Market Street, from Second to Seventh Street, upon which the standards are now being erected, following their adoption on two blocks of Jefferson Street recently, is to be formed, and a celebration of the opening of the Market Street "white way" is being planned. An electric carnival has been suggested, and it is expected that this idea will be taken up in a definite way in the near future. The desire on the part of the merchants to improve their thoroughfare, which was created by the "white way" project, has extended to other branches of work, and the questions of street-railway facilities, better paving, etc., are now being discussed as well.

PORTABLE CENTRAL-STATION SERVICE.

A resident of Brooklyn, N. Y., whose factory is supplied with energy from the mains of the Edison Electric Illuminating Company lives in one of the suburban districts of the city at a considerable distance from the present lighting mains. In order to have electric light from the company this enterprising customer goes to his office each day in his electric runabout, puts spare batteries on charge on the central-station system until the day is over, and then hastens home in the electric vehicle, connects the batteries to the house-wiring system, and sits down to enjoy the evening in his electrically lighted home.

WHY THE MOTOR SAVED OVER THE GAS ENGINE.

The owner of a grain elevator at Mount Morris, Ill., which had been operated by a gas engine, found himself suddenly in need of additional power, and Mr. L. R. Spaulding, the local electrical manager, was asked to estimate the cost of installing and operating a motor. He was told that the 7½-hp gasoline engine was run continuously ten hours each day, but when he submitted his motor estimate based on this performance the elevator operator objected that the cost of electric drive was out of the question in view of the cheaper operation of the gas engine.

Unable to understand the difference, the central-station man went down to look over the outfit. To his surprise he found that the actual load involved lasted only three minutes at a time, at long intervals. But on account of the difficulty of starting the engine was perforce allowed to run continuously during the day. Correcting the first estimate, a new proposition was then submitted to the elevator owner,

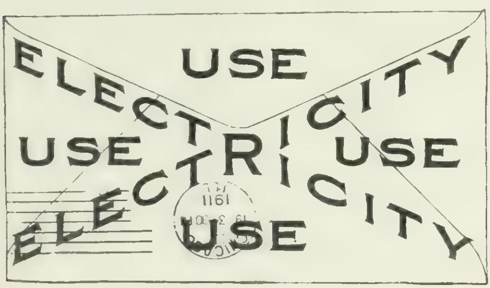
who authorized the installation of a 15-hp motor. While this machine is perhaps unnecessarily large for the load it carries, its surplus rating is often of value for starting a stalled or jammed load on the elevator. The cost of operating this 15-hp motor just about equals the cost of the kerosene formerly burned in stoves to keep the gas-engine outfit warm enough to run.

CENTRAL-STATION ELECTRIC TRUCK.

The Kentucky Electric Company, of Louisville, has purchased and is putting into service a 1-ton electric truck, manufactured by the Kentucky Wagon Manufacturing Company, of Louisville. The truck is equipped with an express body and will be used by the distribution department for lamp deliveries and general emergency purposes. As it is one of the few electric trucks in Louisville, it is believed that it will serve as an advertisement for the electric vehicle generally and indirectly develop new business for the company. The equipment of the truck for use in trouble calls is somewhat out of the ordinary, including a blower operated by an independent motor attached to the storage battery of the vehicle, the blower being taken into manholes for the purpose of supplying fresh air and driving out foul air during the operations of the workmen. This is expected to prevent accidents and to increase the efficiency of the workmen. Electric lamps lighted from the storage battery will be carried into manholes.

"USE ELECTRICITY."

Mr. W. E. Clement, contracting agent for the New Orleans Railway & Light Company, does not let an opportunity pass to remind even those to whom he addresses



Back of Envelope Used for Advertising Purpose.

business correspondence to "use electricity." Herewith is reproduced the back of the envelope used by the commercial department of the New Orleans company, which tells its own story in big red letters.

A LARGE PUMPING MOTOR LOAD FOR THE OMAHA COMPANY.

The Omaha Electric Light & Power Company, of Omaha, Neb., is now negotiating with the Union Stockyards Company, of South Omaha, for electric pumping of its water supply, offering a rate for this service that will effect an enormous saving over the present cost of purchasing water from the city. The packing industries in the Union Stockyards district use about 11,000,000 gal. of water daily, at the present time paying the city 4.5 cents 1000 gal. The central-station company offers to deliver this quantity of water from wells, against a total head of 300 ft., at 1.35 cents per gal.

The source of this water supply will be sixty or seventy wells, 40 ft. to 60 ft. deep, from which the water will be lifted by compressed air into a low-level compensating reservoir. About 200 hp in motor-operated compressors will be required to furnish the compressed air for these air-lifts. From the compensating reservoir at the level of the river bank three or four direct-connected, motor-operated centrifugal pumps will thence raise the water through a vertical height of 250 ft. to the distributing reservoir on the hilltop, from which it will be supplied to the stockyards consumers by gravity. The pumping station will have a capacity for delivering 7000 gal. of water per minute, and will require a total equipment of 750 hp in motors.

NEWSPAPER CENTRAL-STATION PUBLICITY.

Several electric companies in Tennessee have been using more than an average amount of newspaper publicity in creating general good-will and securing new business. Among the prominent companies which are doing advertising work are the Chattanooga Railway & Light Company and the Nashville Railway & Light Company.

The former used recently a page display in which the work of the company was discussed and the various phases of its service referred to. The company stated that it is now lighting 5500 homes in Chattanooga. The development of electric specialties is indicated by the fact that 2200 electric irons are in use. Ninety electric signs are installed, all lighted by the company, and electric power is being served to the extent of 3340 hp. One manufacturer recently contracted for 800 hp. The Nashville central station featured in a recent display advertisement the fact that President Taft, during his recent visit to Nashville, turned the current into a big sign which carries the legend "Nashville Offers Opportunity," which has been adopted as the official slogan of the business organizations. In this connection it exploited the value of electric signs from a publicity standpoint. "The electric sign identifies your place of business—it burns your name into the minds of the people," the company declared.

ONE CENTRAL STATION'S "UPLIFT" POLICY AMONG ITS FARMER FRIENDS.

As already noted in these columns, the Liberty Light & Power Company furnishes electric-lighting service from its 32 miles of 13,200-volt and 6600-volt transmission lines to a number of farmers in the vicinity of Richmond and Liberty, Ind.

As the result of his experience with this class of service, Mr. Robert S. Ashe, president and manager of the company, declares that the farmer is hardly to be regarded as a profitable customer, since, indeed, such service has not paid its way financially even when the farmer furnishes all construction material, transformers, etc. The farm owners in the neighborhood of Liberty and Richmond are very prosperous, but at this time they are using their electric service only for lighting. Their characteristic thrift and economy apply equally well to their consumption of kilowatt-hours, and as a result their bills usually run quite low. The company makes a minimum "transformer-loss" charge of $1 a month for each customer. During the winter months, however, some of the farm bills average $2 to $2.50, the rate for energy being 13 cents per kw-hour. Tungsten lamps are used for general illumination in the farmhouses, the commoner carbon lamps being employed in the barns and outbuildings.

While the lines of the Liberty company were not built especially for the supply of electricity to farmers, Mr. Ashe has been disposed to take the broad and altruistic viewpoint that, to accommodate his farmer friends, connection wherever it is possible shall be made to his lines. "In doing this," he says, "we have brought great comfort and happiness to many people, and we feel that our reward is ample in the relief of so many of our friends from a part of the drudgery with which their lives are so fully surrounded.

"When we have the lighting business well developed in the towns which we serve we hope to devote a part of our time to the farms, because of the general uplift it will be to the entire community which we serve."

ELECTRIC HEATER AIDS PRINTER ON RUSH JOBS.

For drying "rush" work rapidly so that it can be delivered or made ready at once for printing on the other side without offsetting, the Bradley & Gilbert Company, printer, of Louisville, Ky., makes use of a drying cabinet containing a 770-watt Quartzlite heater. This heater sits in the lower compartment of the 5-ft. x 3-ft. case, and above it, on a light tray of wood slats, the sheets to be dried are placed. Work which would require lying undisturbed twenty-four hours at ordinary room temperatures is thoroughly dried in the cabinet in thirty to sixty minutes and is then ready for handling of any kind. Twenty-five or fewer sheets may be laid on top of each other without offsetting in the drying cabinet and, of course, this drying space could be increased without additional expense by multiplying the number of trays.

So much printing work is required on a rush basis that such an electric drying cabinet would seem to be a valuable addition to any but the smallest shops. And with such a dryer even the little job-work man might establish a reputation for quick delivery that would make his cabinet a paying investment. The Louisville application was suggested by Mr. A. T. Macdonald, general traffic manager of the Louisville Lighting Company, whose attractive monthly, *Chained Lightning,* is printed in this shop.

DES MOINES MODERN FIREPROOF CENTRAL-STATION STOREHOUSE.

Not a single stick of wood or other inflammable substance has entered into the construction of the modern new fireproof storehouse of the Des Moines Electric Company, completed this year at a cost of $35,000. The building is of brick, steel and concrete, and even the window sash, frames and doors are entirely of metal. This building, like several others recently described in the *Electrical World,* is significant of the increasing attention given to the proper storing of supplies and materials. In many plants some ill-adapted corner of the power house, or perhaps a former stable, is often utilized for this important purpose, but central-station operators are now coming to recognize the position of the storeroom as being second only to that of the plant and offices.

The Des Moines storehouse building is three stories in height, but is designed for two additional floors. The rear of the lower stories is occupied by the substation. As shown in Fig. 1, the front of the building has been made attractive by the use of white-tile ornamentation to set off the brick. The arch shown has been prepared with the future possibility in view of converting this opening into a plate-glass store front, should it later become desirable. To this same end the floors and ceilings are of unit concrete construction, and can be unbolted and removed to form a fourth story if desired. Similar provision is made for enlarging the substation at the rear. For the accommodation of a third motor-generator set (space is already left for the second, yet uninstalled) the tile partition can be moved

Fig. 1—Modern Fireproof Central-Station Storehouse in Des Moines.

forward 20 ft., the steel work being already in place for the continuation of the overhead-crane runway.

The building is entered from the street through the doorkeeper's office and also through a driveway opening. The latter areaway is separated from the storeroom by a partition of heavy wire netting. This partition, like those on the other floors, is built in sections bolted in place and can be taken down or changed as desired. On the first floor are stored line material, hardware, hangers, conduit, etc. The shelves are all of steel sheeting supported on steel angles, and are built in 10-ft. lengths, so that they can be shifted or moved as required. On the same floor are a toilet and the lockers for the men. These lockers, built of

Fig. 2—Interior Second-Floor Storeroom, Des Moines Electric Company.

sheet steel on angle sections, with screen backs for ventilation, measure 14 in. wide, 12 in. deep and 6 ft. high. They are assigned to the storehouse employees, trouble men and gang foremen.

The upper stories are reached by both a steel stairway and a freight elevator, each inclosed in a separate brick well

with fireproof steel doors opening upon the floors. The elevator is especially spacious, measuring 6 ft. x 10 ft., and has a capacity for lifting three tons. It is completed through to the future fourth story.

The second-floor storeroom is occupied by motors, starters, heating appliances, meters, arc lamps, incandescent lamps and glassware. A large stock of direct-current motors is carried, and about 500 meters are continually kept on hand. The racks for this material are all of steel, built in 10-ft. lengths on the floor below. The corner pieces are 1½-in. x 1½-in. x 3/16-in. angle steel, across which are bolted 1-in x 1-in. x 3/16-in. angles as framing for the No. 16 sheet iron forming the shelves. There are six shelves per rack, each 16 in. high and 20 in. deep. The glassware racks are similarly constructed, but are 40 in. deep. The arc lamps are hung on 1¼-in. pipes carried on 1½-in. x 2-in. x 3/16-in. angle framing. These racks are similarly in 10-ft. sections, 4 ft. wide, the pipes being at distances of 1 ft., 2 ft. and 1 ft. respectively, at levels 3 ft. and 6 ft. above the floor.

The front of the room is used for drafting, and alongside the elevator are a toilet and shower bath for the use of the men.

On the third story are the arc-lamp and meter-test rooms, separated by a screen partition from the storage section for unbroken-package material, transformers, etc., which extends over the substation occupying the floors below.

The substation contains a 1000-kw, 6600-volt synchronous motor-generator set, producing 230-volt direct-current energy for the three-wire system, the neutral point of which is established by a balancer set near by. The substation interior is attractively finished in light tile and is served by a hand-operated crane. Beneath the station is a brick-lined tunnel conveying the cables from the alley conduit, and also containing the machine rheostats, remote-controlled oil switches, etc. The building is heated by a low-pressure steam boiler in the basement. The lighting is done by 60-watt tungsten lamps with refracting shades. All wiring is in conduit, which is laid in the concrete of walls and ceilings.

Mr. P. B. Sawyer is general manager of the Des Moines Electric Company. The various features of the new storehouse that have been described in this article were designed by him.

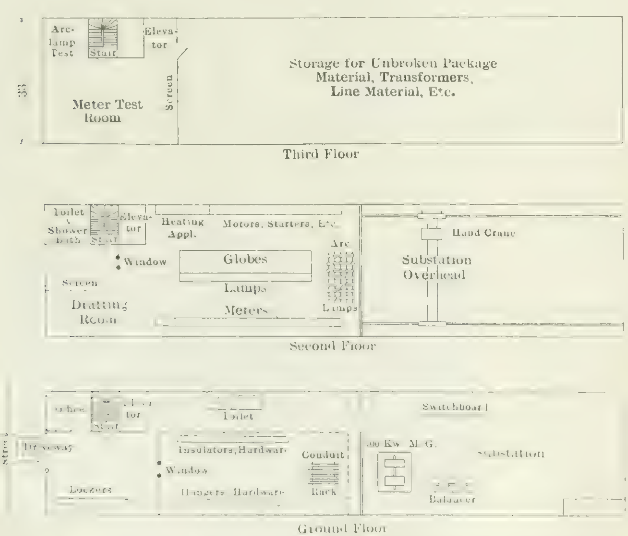


Fig. 3—Arrangement of Floors of Central-Station Warehouse at Des Moines.

Wiring and Illumination

THEATER LIGHTING.

Mr. Francis A. Vaughn, of Milwaukee, presented an elaborate paper on "Theater Lighting" at the meeting of the Chicago Section of the Illuminating Engineering Society on Nov. 16. Mr. Vaughn was assisted by Mr. G. H. Cook in the preparation of the paper, which was a general survey of the requisites of theater lighting, both for exterior and interior illumination. It was illustrated by a large number of photographs and drawings.

Referring to exterior illumination, Mr. Vaughn contrasted the handsome, dignified exteriors of the principal theaters of the continent of Europe with the more meretricious, sign-studded theater buildings in this country. He said that in the United States there is possibly a tendency toward obnoxious glaring treatment of this subject.

Exterior lighting consists of what is termed "attraction" lighting, decorative lighting and utility lighting. As far as the decorative effects are concerned it would seem to be better to use concealed-light sources illuminating the architectural features rather than lamp-studded designs. The "Butterfly" theater in Milwaukee was referred to as an example of elaborate exterior design in electric lamps, and the speaker intimated that a more effective and artistic result might have been obtained, perhaps, by a more subdued treatment, still retaining the "Butterfly" design.

Foreign and domestic examples of interior theater lighting were considered, and many things were found to be criticised in the lighting of the average theater, more especially the placing of light sources in the direct line of vision. The author devoted a considerable portion of his paper to a description of the recently installed lighting equipment of the Pabst Theater in Milwaukee. This is not a very large theater, but the lighting is notable because the indirect system is used throughout. The theater was built several years ago, so that the indirect lighting fixtures had to be adapted to existing conditions. The inverted-dome type is used largely and care had to be exercised in placing the fixtures in such a manner that the lamps inside of any of the fixtures could not be seen by the occupants of the highest row of seats in the gallery Cove lighting is used in the foyer, supplemented in this particular part of the building by a little direct lighting. A large indirect-lighting fixture unit containing a number of lamps is hung from the center of the domed ceiling, 55 ft from the floor. Above this are reflecto disks utilizing an opening in the ceiling made at the time the original chandelie was placed in position.

As in other indirect lighting illumina tion, there is at first some impression o dimness in this theater, but after this ha worn off, for it is more apparent tha real, general satisfaction is expresse with the lighting, which is attended with less foot-candle in tensity than with other systems. Mr. Vaughn spoke another theater where it is planned to use the semi-indire system of lighting throughout.

Exit lamps, so-called "panic" lamps, stairs, passage a fire-escape illumination all need careful attention. Worl ing lamps for attendants are also provided in theaters, a in some cities there is a municipal requirement that the

shall be some dim lighting in the theater interior during dark periods. A gradation of intensity of lighting in different parts of the house is arranged in some cases.

Stage lighting, with its many accessories, combinations, spectacular effects, etc., forms a voluminous subject in itself. The switchboards now provided are elaborate and make possible a large number of different combinations. It is to be remarked that the introduction of tungsten lamps has brought about some new studies in the introduction of controlling resistance for dimmers in stage lighting. The performance of dimmers on alternating-current circuits supplying only tungsten lamps must be studied afresh. The manner of varying the intensity of light on the stage was touched upon by the speaker and also the different characteristics of the light from tungsten and carbon lamps. The interesting statement was made that any actor who "made up" in a dressing-room by the light of carbon lamps might present quite a different appearance when judged on the stage by the light of tungsten lamps.

Moving-picture machines, stereopticons, spot lighting, illuminated program announcers, dressing-room lighting and other features of theater lighting which must be taken into account by the illuminating engineer were touched upon briefly.

In the discussion Mr. J. R. Cravath said that the question of indirect lighting in theaters involves the question of detrimental effects of glare from light sources. He classified these effects under two separate headings. One of these is the reduction of ability to see clearly caused by glare in the field of vision. This seems to be closely akin to halation in photography, which tends to blur the plate when there is too much exposure of the latter to light sources. This effect is probably largely physiological. The other effect of glare is annoyance, or the distracting effect on the eye, which is largely psychological. The former effect has been investigated by Mr. A. J. Sweet, who was the first to make definite measurements of it.

Mr. A. J. Sweet emphasized his belief that discomfort as caused by glare and the effect of glare on clear vision or depression of visual function are two distinct phenomena. He expressed the belief that indirect lighting offers a more comfortable method of illumination than that commonly used and also that the absence of sharp shadows with indirect lighting is decidedly pleasing in its artistic effect. As to whether there is less depression of visual function by indirect lighting he expressed serious doubt. He thought that the annoyance and discomfort caused by glare are largely a matter of the intrinsic brilliancy of the source of light.

Mr. Cravath suggested that discomfort caused by glare is due not to the absolute intrinsic brilliancy, but to the intrinsic brilliancy of the light source compared to its surroundings. A certain lamp may be very annoying amid dark surroundings where it would be almost unnoticed amid much lighter surroundings.

The resignation of Mr. A. L. Eustice as secretary of the Chicago Section was announced. Mr. Eustice is about to leave the city to engage in business for himself.

"NIGHT IN NEW ORLEANS."

"Night in New Orleans" is the title of a souvenir booklet just issued by a local publisher, showing a collection of after-dark street scenes and panoramas in which the extensive electric lighting of the city appears to advantage. Besides many scenes in the modern business section, several views relate to the interesting old French quarter, where the background for modern electric illumination is furnished by such relics of the past as the old Hotel Royale, the historic Cabildo, the famous "haunted" home of an early slave-owner, and the house that was prepared for Napoleon in connection with an attempt to rescue him from St. Helena by New Orleans admirers.

NOTABLE INDIRECT ILLUMINATION OF A LARGE DINING-ROOM FROM FLOOR PEDESTALS.

An installation of indirect lighting really notable for its pleasing effect and comfortable quality has just been completed in the illumination scheme of the newly redecorated north café of the Congress Hotel, Chicago. This beautiful room, with its cream-colored walls and ceiling, done in the Louis XIV style, is lighted by reflection from a number of concealed high-power tungsten lamps carried in alabaster floor pedestals or vases, mounted above the plane of vision.

Entering the room without previous information, even the technical visitor fairly familiar with the tricks of the lighting art is likely to spend a puzzled moment searching out the source of the uniform, brilliant illumination with which the room is flooded. There are no visible lighting fixtures nor even the usual dark bowls of indirect reflectors to mar the unflecked ceiling. At a casual glance, the eight graceful, unobtrusive pedestal-vases among the tables on the floor appear to be only part of the elaborate decorative scheme of the room, and from no position do they give any direct evidence of the flux of light which they project on the ceiling. The whole room is thus bathed in a flood of

Indirect Lighting of Hotel Congress Dining-Room from Floor Pedestal Reflector.

brilliant illumination, uniformly distributed over the ceiling and walls, and the sense of relief that is gained by the absence of visible mechanical fixtures or trappings of any kind must be experienced to be appreciated.

The room itself measures 37 ft. by 95 ft., with a ceiling 20 ft. high, divided by 3-ft. beams into seven equal panels. In the walls, opposite each ceiling panel, are the recesses containing the tapestried windows and wall areas, the curtains being red, while all of the wall and ceiling surfaces are of cream white. The café is carpeted in a rich red with green figures, although the white cloths of the tables make up nearly a third of the lower light-receiving surface.

The lighting standards themselves are of a pure-white alabaster-like cement, molded in graceful designs with ornaments founded on the Greek and wreathed at their rims with garlands of flowers in colors. The tops of the bowls measure 8 ft. 6 in. above the floor and are 30 in. in internal diameter. Each contains four 400-watt tungsten units set vertically in individual "X-ray" reflectors. There are eight of these pedestals, aggregating 12,800 watts for the total indirect illumination of the room, which is equivalent to an expenditure of nearly 3.6 watts per square foot. The intensity of the lighting thus verges on the spectacular, and it is likely that its brilliancy will be decreased later. In arranging this unique installation, however, it was the pur-

pose of the architects, Messrs. Marshall & Fox, to provide at least ample illumination, and a large factor of safety was accordingly allowed in preparing the specifications from the original computations.

Ranged on the sixteen golden candelabra fixtures on the walls of the room are groups of ten frosted 25-watt tungsten lamps, each lamp being shielded from direct vision by an elliptical shade of red fabric. These direct-lighting fixtures are, however, not commonly used in the illumination of the room, for which the reflector units are relied upon entirely.

PORTABLE PLATFORM FOR CLEANING CHICAGO BOULEVARD LAMPS.

The last of the 165 ornamental tungsten standards which border both sides of Michigan Avenue, Chicago, from Randolph Street to Twelfth Street, has now been put into place, making this lake-front boulevard one of the best-lighted thoroughfares in the world, perhaps. As already mentioned in these columns, the cast-iron posts are of the unusual height of 19 ft. 6 in., carrying at their tops clusters of six 100-watt multiple tungsten lamps inclosed in 12-in. Alba globes.

On account of the unusual height of the posts and also the position of the lamps and globes on extended arms, an ordinary ladder cannot be used for cleaning the glassware or renewing lamps. The Board of South Park Commissioners accordingly had constructed the portable platform shown in the accompanying illustration. The structure is in the form of an equilateral tripod, measuring 8 ft. across at the base, and carries its 4-ft. circular platform at a dis-

Portable Platform Used for Cleaning Ornamental Lamps.

tance of about 13 ft. above the sidewalk, bringing the lamps to about the height of a man's shoulder. The framework is of 1½-in. steel tubing, cross-braced with steel guy wires. One of the three legs of the tripod is made double and forms the ladder by which the platform is reached. Each leg is fitted with a 10-in. rubber-tired wheel, the leading wheel of the three being attached to a small tongue, by which the platform can be pulled along the sidewalk. To place the scaffold in position it is pushed up against the post, the 4-ft. platform completely inclosing the standard except for the 12-in. entry slot. The pole is also engaged by a similar slot in the lower part of the base, a pin being provided for closing this gap and so locking the structure in place before the platform is ascended. A box for tools and repair parts is also firmly attached to the steel framework of the platform. As the result of its construction of steel tubing, the complete platform is very light, weighing less than 300 lb., and can be easily pulled along the sidewalk and lifted over curbs by the cleaner.

RECENT TELEPHONE PATENTS.

CIRCUIT SYSTEMS.

If lamp signals are to be used with the magneto-type system, the devices responsive to the magneto current must not only close the lamp circuit but they must be provided with some locking device which will cause the lamp circuit to be maintained until the proper response is made. It is with this kind of system that the patent granted to Mr. J. Erickson, of Chicago, is concerned. He provides a three-wire jack with a line and cut-off relay. The jack springs are normally disconnected from the line while the line relay is connected. When a current is generated by the subscriber station magneto the line relay responds and its armature becomes mechanically locked by a latch piece. The line lamp circuit is thus maintained until the operator responds. This energizes the cut-off relay, which in operating cuts off the line relay from the line and establishes the jack-spring connection. At the same time the latch is withdrawn, the line relay armature falls back and the line lamp circuit is broken. This patent is assigned to the Automatic Electric Company.

A patent granted to Mr. H. F. Joeckel, of Camp Point, Ill., describes a system in which more than one station is connected intermediate of the switchboards at either end. At one end the grounded drop is connected to one side of the line, while at the other end the grounded drop is attached to the second side. This is done to have as nearly as possible a balanced condition. The intermediate stations are bridged and are equipped with keys so that either metallic or suitably directed grounder currents may be generated.

NEW APPARATUS.

Mr. W. C. Moeller, of Doon, Ia., is the inventor of an extension-arm desk set of new design. The arm takes the form of lazy-tongs, while the transmitter support is a vertical tube expanded to a cylindrical box near the middle of its length. This box has its ends or flat sides vertical and the hook-switch lever projects through one flat face, the springs, pivot and wiring terminals being within.

The contour of the usual receiver cap is such that if this cap be made of sheet metal the space between it and the diaphragm will not be such as to produce good transmission. For the best effect a thin, flat air space must be provided in front of the diaphragm. This can be accomplished with the pressed-metal cap by mounting a flat circular piece within the cap. In the receiver casing recently patented by Mr. W. W. Dean and assigned to the Dean Electric Company this disk is made of insulating material and the edge of the sound orifice of the cap is drawn down to project through the disk. The latter is then finally secured by spinning the metal rim back over it.

LETTER TO THE EDITOR.

Loading of Telephone Circuits.

To the Editor of Electrical World:

SIR:—I have been exceedingly interested in reading M Frank B. Jewett's letter appearing in your issue of Sept. criticising my article on "The Loading of Telephone Cab

and Open-Wire Circuits" (July 15), as it tends to show what an erroneous impression may be formed by the superficial perusal of any article. To correct any erroneous conclusions to which his criticism of the article under discussion may give rise I wish briefly to discuss the points in the article to which Mr. Jewett takes exception.

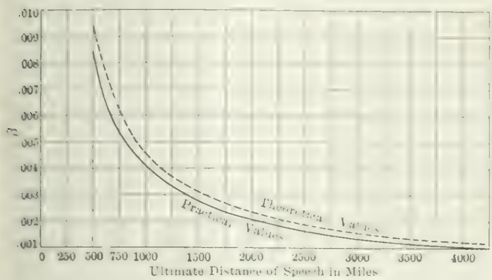


Fig. 1—Theoretical and Practical Values of β for Ultimate Speech Distance in Aerial Circuits.

He states that "a perusal of the article . . . indicates that the author appears to have an erroneous conception of the theory of neutralizing the effect of capacity in telephone circuits by the introduction of lumped inductance in accordance with the Pupin system," and goes on to state that "on page 167 the author computes the inductance necessary to neutralize completely the capacity of a circuit at 800 frequency. He does this as though the capacity and the inductance were simply lumped in a series circuit, and speaks of the impedance of the circuit as being equal to $[R^2 + (L\omega - 1/C\omega)^2]^{1/2}$."

"As is well known, this method of computing the line impedance does not apply to a circuit containing capacity and inductance distributed along its length in the manner of a loaded telephone circuit."

By referring to the article Mr. Jewett will see that I state, "to find the balancing inductance of any circuit, by treating the speech wave as a simple alternating current having a frequency of 800 cycles per second, etc." . . .

From this it will be seen that I am not dealing with a loaded circuit, and that the equation for the impedance stated above is correct for the case in which it is used, as I am treating the speech impulse as a simple alternating current of 800 cycles propagated along a circuit in which capacity and inductance are both present. The reason for treating the speech impulse in this way was to show in as simple a manner as possible why it was impossible to get a distortionless telephone circuit, even though loading by Pupin's system was adopted, and also to show why for any given amount of added inductance the relative improvement in transmission is much greater for a cable than for an open-wire circuit.

With regard to the next point to which exception is taken, namely, the working out of Example II, page 167, I must plead guilty to a typographical error, in which the figures 4 and 8 have been transposed, and the error carried through the rest of the working; but it is not, as stated by Mr. Jewett, "an arithmetical mistake . . . of simple proportion," as the equation is given correctly, the mistake being as stated above. I do not, however, consider this mistake of vital importance, as no attempt has been made, as Mr. Jewett seems to consider, "to explain the result by process of reasoning which leads to the remarkable conclusion that although loading improves the articulation it reduces the volume of sound or amplitude." No process of reasoning whatever is based on the result, as it is merely used as an example illustrating how to determine the values of L and the distant end amplitude. The "remarkable conclusion" to which Mr. Jewett takes exception is based on the deduced result $L = (R + R_c)^2 C/4\beta$, or $\beta = (R + R_c)/2\,(C/L)^{1/2}$.

From this it will be seen that the value of β increases rapidly with R_c (the impedance of the loading coil), reducing the amplitude, proving, as stated, that "although loading improves the articulation (by reducing the distortion), it reduces the volume of the sound (by increasing the attenuation)." This is graphically illustrated by the βL curve (Fig. 2).

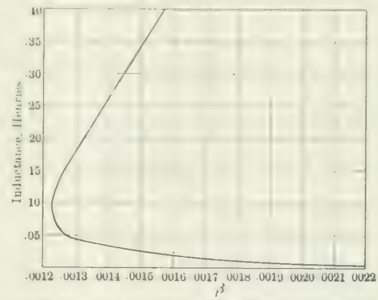


Fig. 2—Curve Showing Inductance Required to Give Values of β for No. 8 Circuit (3.95 Ohms for Loop-Mile).

Continuing to the next point raised, by referring back to page 165, column 2, we have this sentence: "Attenuation in itself is not harmful if not carried too far, as a receiver will convey an intelligible conversation when the amplitude is reduced to 1 per cent (of the transmitting end amplitude) if there is no distortion of the wave form." This is the recognized absolute limit of transmission; therefore, when the transmitting end amplitude is reduced to 1 per cent the value of βd is 4.60511, or $e^{-\beta d} = 100$, which is the absolute limiting point at which loading is commercially of value. This explains the method used in arriving at the value of βd to six significant figures.

The last point raised is in regard to taking the practical value of βd to five significant figures after stating "this value has to be reduced *approximately* 10 per cent to allow for extraordinary losses . . . which *cannot be calculated.*"

As Mr. Jewett is aware, a curve cannot be plotted with an approximate value, so some definite value had to be assigned to βd to get Curve 2, Fig. 1. I took the value of these losses as exactly 10 per cent (which I considered a very fair estimate) in order to arrive at the points on the curve. By taking it to five significant figures it was obvious that this value of $\beta d = 4.1446$ was exactly 10 per cent less than that used in determining the value of Curve 1, and I thought that this method would save a lengthy explanation in the article, showing how this second value of βd was arrived at, which would have been necessary if I had only taken the result to, say, two significant figures.

Taking the letter as a whole, I fail to see from the points raised how Mr. Jewett substantiates his contention that the article indicates "that the author appears to have an erroneous conception of the theory of neutralizing the capacity in telephone circuits by the introduction of lumped inductance in accordance with the Pupin system," as the main points to which exceptions are taken can hardly be said to affect the theory of loading.

Mr. Frank F. Fowle, in his letter on the same article in your issue of Aug. 12, raises another point, namely, in regard to Fig. 2 (reproduced herewith) and states that "Fig. 2 does not appear to be derived from the expression for β in terms of R, L and C" (this figure shows that there is a loss of efficiency where loading above 0.1 henry per mile is adopted), and seems to base this conclusion on the fact that "* * * aerial lines have been loaded with coils having 0.25 henry each spaced 2 miles apart, or more than 0.1 henry per mile, and there is no observed loss of effi-

ciency by heavy loading." This is misleading, as Mr. Fowle does not state the loop resistance per mile of the circuit on which this loading was used. By referring to page 169 it will be seen that it is definitely stated that this figure (as well as Fig. 3) applies only to a circuit having a loop resistance per mile of 3.95 ohms strung under the stated conditions, and that for other circuits a similar curve should be plotted. A similar curve plotted for a circuit having a loop resistance per mile of 6.51 ohms shows that the critical point is not reached till 0.15 henry per mile has been added, showing that it is quite possible to have coils of 0.25 henry spaced 2 miles apart without a loss of efficiency being observed due to heavy loading.

Winnipeg, Man. SAMUEL R. PARKER.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Vibrating Rectifier.—The vibrating rectifier of Villard depends on the movement of a small plate actuated by the alternating current to be converted. It needs, however, readjusting when it is to be used for another frequency, as it can only be used for the frequency for which it is tuned. Later Soulier devised a rectifier based on the fact that the diaphragm of the telephone receiver accommodates itself to all the different frequencies of the human voice. Soulier thus devised a rectifier which would operate without previous adjustment on all ordinary frequencies. However, his rectifier made use of only one half-wave of the alternating current. The other half-wave was suppressed. Soulier has now invented a system of connections by which both half-waves can be utilized. The arrangement is shown in Fig. 1. Two vibrating diaphragms stretched between two points 1′ and 2′ respectively can vibrate like the diaphragm of a telephone receiver. Each of these is provided at the center with a contact piece which makes contact with the pieces 5 and 5′. A soft-iron core is magnetized by a coil 11 by means of a source of direct current (in the present case the storage battery *B*, which is to be charged from the alternating-current supply shown at the bottom of the diaphragm). At the two ends of the soft-iron core there are two other magnetizing coils 4 and 4′ supplied with the alternating current from the supply network. The electromagnet, which is polarized in this way, gives to the diaphragms a movement in synchronism with the alternating current. The diaphragms are in absolute synchronism even when the frequency changes, and the movements of the diaphragm are exactly in phase with the current wave, so that the closing and opening of the contacts occur always when the current wave passes through the zero point. For this reason the wear and tear of the contacts has been negligible in practice during five years.—*La Revue Elec.*, Oct. 27.

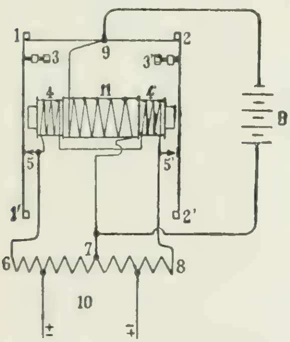


Fig. 1—Vibrating Rectifier.

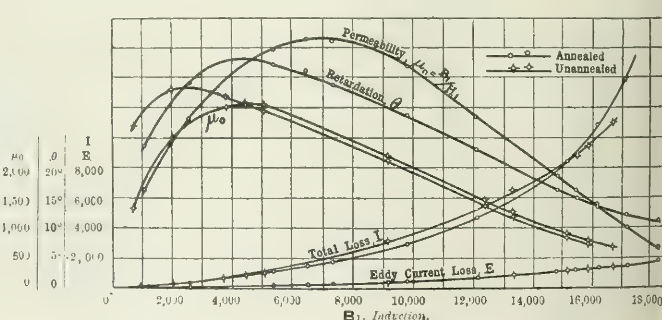


Fig. 2—Diagram Showing Magnetic Properties of Stalloy.

Magnetic Properties of Stalloy.—H. R. HAMLEY AND A. L. ROSSITER.—A paper read before the Royal Society of Victoria, giving an account of extended experiments on the magnetic properties of stalloy, a special alloy steel for use in transformers, employing both direct current and alternating current of different frequencies. Three different tests were made, namely, (1) statical tests; (2) tests on the effect of variation of frequency on magnetic hysteresis, and (3) tests on the effect of annealing upon each of the above. The usual statical experiments were made for inductions extending up to about 14,000. From these results were calculated the hysteresis losses and Steinmetz coefficients, using as exponent in the usual formula the value 1.6, which was found to be approximately correct for this substance. The alternating-current experiments were divided into three series, of "periods 0.07, 0.035, 0.02 respectively," probably corresponding to 14.3 cycles, 28.6 cycles and 50 cycles per second. At each of these the period and wave-form of the magnetic current were kept as nearly as possible constant as the magnetic density was increased. Stalloy in the unannealed state is magnetically unstable, but this is changed by annealing. The other chief results of annealing are to increase the permeability and to lower the hysteresis loss. The values of the permeability did not rise to nearly the values obtained by other observers. For unannealed stalloy the maximum is 2660 at a magnetic density of about 4000 lines per square centimeter, and in the annealed samples it rises to 3500 at a density of about 6000. Some of the results of the tests are given in Fig. 2, which show clearly the effect of annealing. The total loss *I* in the stalloy is a distinct improvement over that for iron. For all inductions and for all frequencies the total loss is found to be less for stalloy than for ordinary iron of the same thickness. A very fair impression of the stalloy total losses is obtained by taking two-thirds of the corresponding values for ordinary iron at all magnetic densities. Further, these losses are greatly reduced by annealing. This reduction is not very appreciable for densities below 5000, but above that there is a marked difference. However, the curves intersect where the density is 15,500; for higher densities the annealed losses increase very rapidly. From a practical point of

view Fig. 3 is perhaps the most interesting. In this figure the values of the total hysteresis and eddy-current losses are given for the annealed ring. These curves show an almost proportional increase of I and E with increase of frequency. That this should be so for E is evident, but on examination it is found that I is given approximately in terms of n and B for values of densities up to 11,000 by the Steinmetz analogue proposed by Lyle for iron—namely, for the annealed ring

$$I = (0.00106 + 0.0000220n) B.$$

and for the unannealed ring

$$I = (0.00184 + 0.0000331n) B$$

These forms agree fairly well with experiment, except in a few isolated cases occurring chiefly in the unannealed sample. The value of the exponent for each case is re-

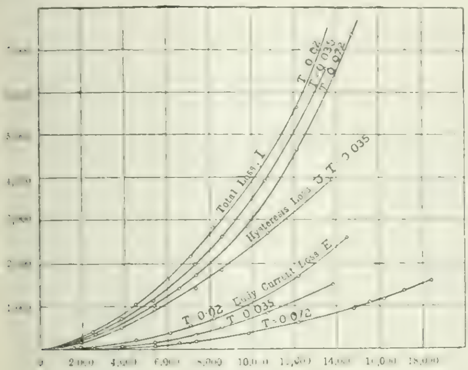


Fig. 3—Variation of Losses with Magnetic Density.

markable, for it seldom falls below 1.57 for iron. A fair average equation for transformer iron is found to be

$$I = (0.00175 + 0.000027n) B^{1.67}.$$

The value of the specific resistance was found to be slightly higher than that given by other experimenters, but ,000 may be taken as a fair working value. These disks, which are much thicker than those actually used in iron-work, show an eddy-current loss much less than that calculated for iron of only half the thickness, the value being about one-quarter of the total loss. Seeing that for stalloy the total loss I is itself less than for iron, the former must be considered admirably suitable for transformer work. The values of the eddy-current loss E increase rather considerably with increase of frequency, the relative increase being greater than for I. This fact will be seen in the illustration, which gives all the losses to the same scale. Perhaps the most remarkable results are those obtained for the hysteresis loss U. The values for the middle frequency (035) only are plotted in the illustrations; but the values for the other frequencies practically coincide with those from which the graph is plotted. Results for ordinary iron show an increase of U with frequency which, although small, is still much greater than the maximum variation for stalloy which occurs between the periods 0.035 and 0.02. The values of U for periods 0.07 and 0.035 are practically identical. For stalloy, therefore, U seems to be independent of the frequency and only about half the magnitude of that obtained for ordinary iron.—Lond. *Electrician*, Nov. 3.

Three-Phase Commutator Machine.—R. Moser.—A long theoretical paper illustrated by diagrams in which the author gives the theory of the three-phase commutator machine when running exactly in synchronism. The discussion is made under the following heads: Fundamental for of synchronous commutator machine; arrangement of brushes; load diagram; rotor current; brush current; copper losses and brush losses; brush voltage; comparison between direct-current excitation and synchronous polyphase excitation; commutation; effect of irregularity of the rotary field on commutation; effect of irregularity of the rotary field on the rotor voltage; the damping winding, and the load diagram taking account of the ohmic drop and the iron losses in the stator.—*Elek. u Masch.* (Vienna), Oct. 8 and 15.

Magnetic Losses in Dynamo Armatures.—G. Vallauri.—The author first gives the theory of the magnetic losses in dynamo armatures without and with slots. He shows that it is advantageous to base the calculation of the magnetic armature losses on the figure of the mean tangential induction and then to apply a correction factor. After developing the theory the author gives results of tests of a special machine built for this purpose.—*Elek. u. Masch.* (Vienna), Oct. 1 and 8.

Current Diagram of the Three-Phase Series Motor.—A. Thomälen.—Rüdenberg has shown how the performance of the three-phase series motor may be represented very simply by means of voltage diagrams. The author shows how by a simple change of scale the voltage diagram may be immediately transformed into a current diagram.—*Elek. Zeit.*, Nov. 2.

Lamps and Lighting.

Moore-Tube Lighting Installation.—G. Hilpert.—An illustrated description of a three-phase Moore-tube lighting installation in the lecture-room of the electrical laboratory of the Institute of Technology in Breslau in Germany. The tubes are arranged in star connection. The mean illumination of the lecture-room is 120.9 lux (hefner lumens per square meter) or about 10 ft.-candles. The illumination is very uniform, as may be seen from the fact that the ratio of the maximum lux to the minimum lux is 2.45. Such low values of this ratio are otherwise obtained only by purely indirect illumination. The specific consumption is 0.442 watt per lux per square meter, which agrees well with former measurements.—*Elek. Zeit.*, Nov. 2.

Metallic-Filament Lamp.—A note on a recent British patent (1544, Oct. 26) of the W. C. Heræus Company and C. Trenzen. A process of sintering partly decarbonized metallic filaments consists in placing them in a tube of pure iridium, which is heated to a temperature between 1400 deg. and 1600 deg. C. by passing currents up to 1500 amp through it in the presence of a reducing gas.—Lond. *Elec. Eng'ing*, Nov. 2.

Mercury Air-Pump.—S. R. Williams.—An illustrated description of a mercury pump constructed on the principle of the chain and bucket water-pump.—Lond. *Electrician*. Nov. 3.

Electrophysics and Magnetism.

Pressure of Radiation.—D. Owen.—A review of our present knowledge of the subject under the following headings: Thermodynamics of radiation; interaction of ether and matter; astronomical applications of radiation pressure of sunlight.—Lond. *Electrician*, Nov. 3.

Poynting's Theorem.—J. F. H. Douglas.—A simple elementary proof of Poynting's theorem on the flow of electrical energy through space.—*Phys. Review*, October.

Installations, Systems and Appliances.

Electric Heating and Cooking.—Ph. Steuer.—The design of electric cooking and heating apparatus has been so improved as to give efficiency of 90 per cent or more. But the real problem is to devise a suitably low rate in order to make electric cooking and heating economical. The cost of generating electrical energy consists of the fixed cost (interest and amortization) and the variable cost of operation. In general 80 per cent of the total cost is fixed costs. Since progress in electric heating and cooking would not require an increase in the equipment of the central station, the author recommends that the rate for electric heating and cooking shall be so chosen that only the variable cost, not the fixed cost, shall be paid for. The author favors a

combination of flat rate and meter charge and proposes to make a distinction between the energy used for lighting, motor service and heating and cooking purposes. The present high price of electric heating and cooking apparatus is also a disadvantage, and it may be more economical to cheapen the apparatus even if they are less efficient. —*Elek. Zeit.*, Nov. 2.

Electricity in Aeronautics.—R. CHASSERIAUD.—While electric motors have been used on dirigible balloons, this is not the case with aeroplanes. The reason is that they have too great a weight, not so much the motor itself as the storage battery required. The author then discusses the use of auxiliary electric motors in connection with devices for the purpose of insuring stability of the aeroplane.—*La Lumière Elec.*, Oct. 28.

Units, Measurements and Instruments.

Pyrometers.—R. S. WHIPPLE.—The author describes some improvements which he believes will add largely to the value of pyrometers in industrial work, both as to their suitability for particular processes and to the scientific accuracy of the results. They include Peake's patent compensating leads; cold junction control; Peake's scale-control box, and a thermocouple potentiometer.—Lond. *Electrician*, Nov. 3.

Telegraphy, Telephony and Signals.

A New Phonograph.—An illustrated description of a new sound-recording apparatus exhibited by the inventor, S. Lifschitz, at a recent meeting of the Academy of Sciences in Paris. The inventor uses a small mirror M (see Fig. 4) hinged so as to vibrate by the action of the telephone diaphragm D. A beam of light is thrown on the mirror from an arc lamp through a lens, and is reflected so as to give a spot S on the screen. A band of sensitized photographic paper is used and is driven between a pair of rollers by an electric motor so that the film travels very rapidly. In actual practice, however, Lifschitz uses a narrow band of light instead of a spot, as represented at EF (Fig. 5). When this band vibrates in the same way as the spot, with an up-and-down movement as the sensitive film passes under it, a certain surface is covered by the light from the beam, as shown by the shaded portion G, and the form of this surface depends as before on the particular sound impressed on the diaphragm. By developing the film the part G can thus be produced in black upon a transparent film.

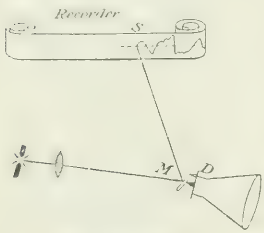


Fig. 4—Recorder.

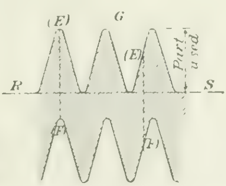


Fig. 5—Wave Made by Beam Having the Form of EF.

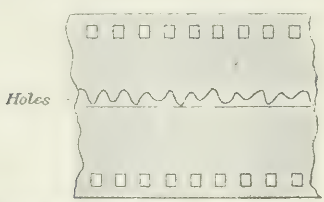


Fig. 6—Specimen of Record Band Holes Formed in Final Record Strip (Letter T, Long).

A standard cinematograph film is used, as it is the most convenient. This is printed as a negative upon a second film of the same kind, the latter being formed of bichromated gelatine, so that by printing and washing in the well-known way the parts unacted upon by the light appear on this second film as holes, thus producing a band as seen in Fig. 6, with the holes corresponding to the shape of the waves. It is not necessary to use the whole of the surface G, but only the part lying above the dotted line RS (Fig. 5). To produce the original sound from the present record a current of air passing through the openings in the band is employed. For this purpose the small air chamber H (Fig. 7) is used. This is fed with compressed air from any convenient source, such as a small storage tank or steel bottle. The film JJ is mounted between a pair of rollers which are driven by an electric motor so that it passes rapidly over the curved surface of the chamber. A narrow slit W allows the air to escape through the openings in the band, and the length of the slit is adjusted so that it corresponds to the maximum height of the openings; that is, to the highest point on the waves. The slit is therefore fully opened at such maximum points and entirely closed at the zero points. Between these limits the air delivery depends on the shape of the waves, and thus sounds are produced by the rapid succession of air emissions so obtained. These sounds correspond to those spoken into the mouthpiece, so that there is proper reproduction.—Lond. *Electrician*, Nov. 3.

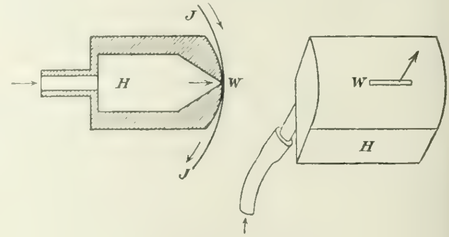
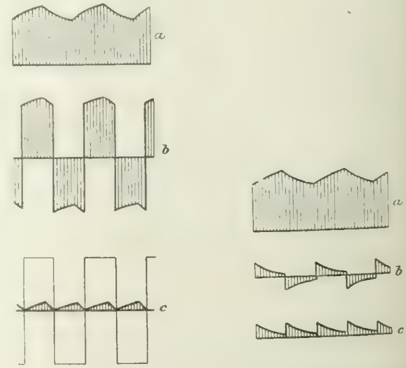


Fig. 7—Sound Reproducer.

Overcoming the Inertia of Selenium Cells for Transmission of Pictures.—BOHUSLAV ZAVADA.—It is well known that the rapid variations in the illumination of a selenium cell are well reproduced by corresponding variations of resistance and current. For uses in which the absolute valu of the current and its low changes are of no account th selenium cell is, therefore, well suited. For the trans mission of pictures the author proposes not to use con tinuous illumination of the selenium cell as varied only b



Figs. 8 and 9—Curves Showing Current Established in a Seleniur Cell by the Rapid Variation of Light.

the greater or smaller darkness of the different portions of the picture to be transmitted, but to use intermittent illumination and to place a commutator on the axle of the disk which interrupts the light. The effect is shown in Fig. 8, where *a* is the current in the selenium cell with intermittent illumination and *b* is the current after commutation. The curve *b* may be resolved into two curves, as shown in *c*. If in the receiving station a direct-current instrument is used, only the small variations (indicated in *c* by the shaded areas) have an influence on the instrument. Since there is no advantage in sending a large inactive current through the receiving instrument the endeavor should be to reduce it as much as possible. Several means for this purpose are described. One is to transform the current through the selenium cell by means of a transformer and to commutate only the secondary current, as is shown in Fig. 9, in which *a* is the current through the selenium cell with intermittent illumination, *b* is the current after transformation and *c* is the transformed current after commutation.—*Elek. Zeit.*, Nov. 2.

Wireless Telegraphy.—L. Zehnder.—The author discusses the question whether electromagnetic waves over the ocean (as used in wireless telegraphy) are propagated with the speed of propagation in air or with the speed of propagation in water. The author believes the latter is the case. He suggests an experiment by which this question could be settled. He further discusses the reason why in general the distances to which wireless messages may be transmitted are greater at night than during the day. He believes the reason has to do with the change of refraction coefficient of the atmosphere and the surface of the earth. He finally suggests a secret code for wireless telegrams which could not be deciphered by ordinary methods.—*Elek. Zeit.*, Nov. 2.

High-Speed Cable Telegraphy.—Bela Gati.—The author has formerly discussed the theory of high-speed telegraphy. Telegraph engineers have stated that with such high speeds as suggested by him the signs would run one into the other or overlap. However, the author maintains that this is the case only with direct-current telegraphy, and not with alternating-current telegraphy, and gives oscillograms to prove his point that the lengthening of the signs occurs only with direct-current telegraphy. He finally maintains that with ocean cables having a self-induction of 10^{-3} henry per kilometer high-speed telegraphy is certainly possible.—*Elek. u. Masch.* (Vienna), Oct. 15.

Book Review.

Der Edisonakkumulator. By Meno Kammerhoff. Berlin: Julius Springer. 182 pages, 94 illus., 20 tables. Price, 4 marks.

An excellent practical treatise on the construction, characteristics, theory and cost of the Edison storage battery from the standpoint of the engineer and electric automobile maker or operator. Numerous tables of weights, sizes and outputs accompany the text and many arithmetical examples are given of applications for this excellent modern type of storage cell. The backwardness of electrotechnical book literature in English is illustrated by the appearance in the German language of this book, dealing with a distinctively American development. A translation in English is much to be desired.

New Apparatus and Appliances

LARGE HIGH-TENSION SUBMARINE CABLE.

The Habirshaw Wire Company has just completed a notable cable for the New York Edison Company, which will be laid in the Harlem River. The cable is in four lengths of 800 ft. each and consists of three thirty-seven-strand conductors, each of 350,000 circ. mils. Each conductor is insulated with a 13-64-in. wall of 30 per cent Para compound overlaid with tape. The three conductors are laid up in clover-leaf form with fillers consisting of tape, 1-64-in. rubber jacket of 30 per cent Para tape, ⅛-in. lead sheath, jute bedding, an armor of thirty-eight No. 4 galvanized-steel wires and covered finally with two layers of jute and tar. The cable is to be operated under 13,000 volts working pressure and was tested for 25,000 volts for one-half hour between conductors and conductors and ground. It is about 4 in. in diameter and the shipping weight of each length of 800 ft. is about 18,000 lb.

AN IMPROVED LOW-TENSION INSULATING COMPOUND.

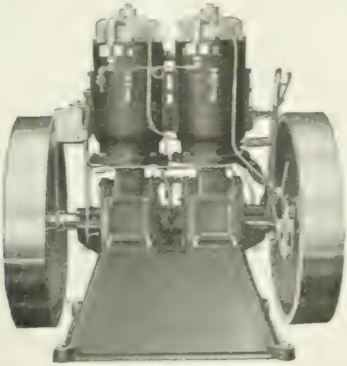
Based on its experience in producing insulating compounds of high grade for high-tension insulation, the Minerallac Electric Company, Chicago, has recently developed an improved insulation for low-tension use where voltages below 2000 volts are involved. This minerallac No. 20, as it is designated, has a dielectric strength of 700 volts per mil; a high melting point, 260 deg. Fahr.; a high flash point, 650 deg. Fahr., and a coefficient of specific inductive capacity of only 1.98, taking air as unity. It is declared to be absolutely non-hygroscopic, and to be free from impurities injurious to rubber, copper, paper, cloth or other material used in electrical construction. No disagreeable fumes are given off when it is heated, so that it can be used without objection in manholes or other closed places. The new compound can be molded into any desired form and retains its shape after the removal of the mold. On account of its freedom from absorbing water or occluding air bubbles, minerallac No. 20 can be relied upon to give a definite insulating strength for a given thickness, while its low specific inductive capacity is of particular advantage in telephone work.

AN IMPROVED MOLDED INSULATION.

Under the name of Stern-Condensite the Dickinson Manufacturing Company, Springfield, Mass., is introducing an improved molded insulating material, the invention of Mr. J. W. Aylsworth, for years research chemist of the Edison laboratories. Condensite is a phenol-formaldehyde product which is soluble in alcohol and can be used as a varnish or shellac. Upon simple heating the material is converted into the plastic form in which it can be molded easily, setting without air holes. When molded Stern-Condensite presents a highly finished appearance like polished black hard rubber, although mechanically, according to the manufacturer, it is far stronger than rubber. It possesses high dielectric resistance, withstands acids and weathering, does not break down under its own fatigue, is non-hygroscopic even when boiled in water, resists temperatures up to 350 deg. Fahr. without softening and can be molded into any shape, inclosing metal parts if desired. Stern-Condensite can be machined, tapped, drilled or sawed easily, and when molded leaves the mold in a finished state. It is odorless and tasteless, but is resilient, though lighter than hard rubber, with which it is declared to compare favorably in price.

INTERNAL COMBUSTION ENGINE.

The fuel-oil engine of the Remington Oil Engine Company, Stamford, Conn., involves a principle of vaporizing and igniting heavy oils which, it is claimed, is entirely new and unused by oil-engine builders. The company's engineer has devised a method of atomizing, vaporizing and burning fuel oil whereby the process of vaporization does not separate the heavy hydrocarbons of the oil into their constituent parts, thereby giving a deposit of carbon. Vaporization is effected without the "cracking" of the oil and



Two-Cylinder Stationary Engine.

with a clean exhaust. The irregularities of vaporization and ignition in oil engines have in the past made it necessary to construct excessively heavy machines in order to insure steady running and establish small limits of variation of angular speed. By this method of vaporizing and burning heavy oils a regularity of operation is said to be obtained which allows the engine to have only medium weight. The result is that the engine operates with excellent speed regulation from full load to no load and with no deposit of carbon in the cylinder even though operation be carried on for long periods at no load. This, the manufacturer claims, has never before been accomplished without the use of high pressure. The fuel consumption of the engine in sizes as small as 15 hp is stated to be not over 0.6 lb. of fuel oil per brake-hp. The consumption is less in the larger sizes, and, as fuel oil of a density from 25 deg. to 28 deg. Baumé has about 18,500 heat units per pound, it is apparent that the thermal efficiency of this type of engine is high even in the smaller units.

ELECTRIC SOLDERING TOOL.

The use of the ordinary soldering tool has two drawbacks—the impossibility of keeping it hot continuously and the rapid wasting away of the copper. The development of the electric soldering iron obviated the former, furnishing the mechanic not only with a tool which stayed uniformly hot all the time but also with one in which the heat intensity could be easily regulated by the mere turning on or off of the electricity. The second fault—that is, the rapid wasting away of the copper—still remained, to a large extent, necessitating frequent renewals, and consequently making no reduction in the cost of maintenance. As a result of many experiments made in the research laboratories of the General Electric Company to mitigate this fault, there has been developed a process of treating the copper which renders the latter non-oxidizable under high heats and non-corrodible by the acids used in soldering. Furthermore, it reduces to a minimum the dissolving action of the molten tin, with which the working tip must always be kept coated. It is claimed that this "calorizing" method of treatment does not merely coat the surface of the copper with a thin layer of non-oxidizable or non-corrodible substance, liable to scale off under the effects of heat and acids, but it actually changes the characteristics of the copper to an appreciable depth. Thus the durability or practical working life of the copper is increased to such an extent as to provide a soldering tool of maximum economy and effectiveness.

NEW CUTLER-HAMMER CANOPY SWITCHES.

In the first canopy switches made by the Cutler-Hammer Manufacturing Company, of Milwaukee, split porcelain bodies were used. Since then the company has developed a fireproof and waterproof insulating material which is used

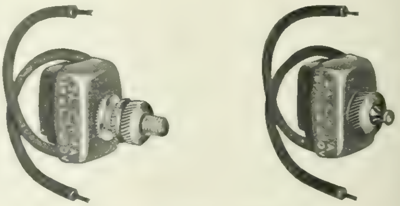


Fig. 1—Canopy Switches.

for the bodies of new switches. This material, which can be molded with unusual accuracy, is tough and at the same time insures permanent alignment of the operating parts.

In the switch illustrated herewith, which is entirely new, the push button is replaced by a threaded stem. This switch has been developed to be installed in the bottom shell of ceiling fixtures. It is operated by pushing and pulling the bottom knob of the fixture as screwed on the

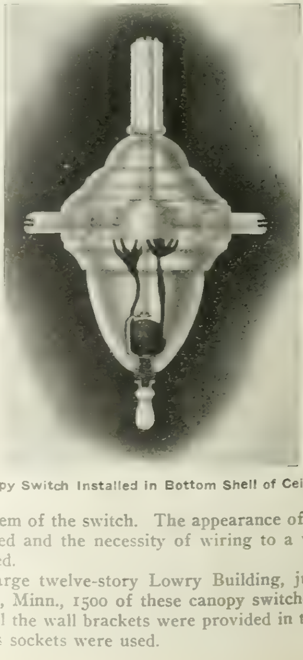


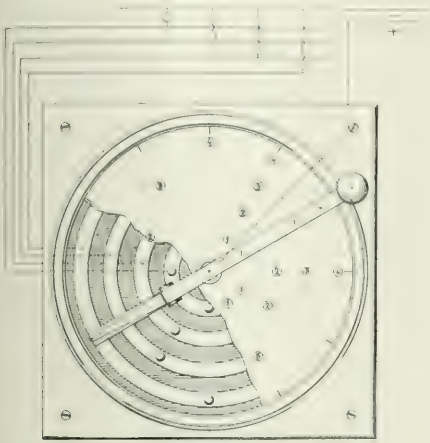
Fig. 2—Canopy Switch Installed in Bottom Shell of Ceiling Fixture

threaded stem of the switch. The appearance of the fixture is unchanged and the necessity of wiring to a wall switch is eliminated.

In the large twelve-story Lowry Building, just finished in St. Paul, Minn., 1500 of these canopy switches were installed. All the wall brackets were provided in this manner and keyless sockets were used.

A RING-SWITCH FOR DOMESTIC LIGHTING CIRCUITS.

A new type of ring switch has been devised by Mr. F. W. Kurtz, of Manhattan College, New York City, which permits the lighting of any group of lamps, or several groups, or all of them at the same time. This is effected, as shown



Ring-Switch.

in the accompanying illustration, by moving an arm over a series of studs inserted in a number of concentric copper rings which are themselves connected with the different lighting circuits. The device is handy and reliable in operation; it is simple in construction and saves a considerable amount of the wiring usually employed.

A SIMPLE SIGN FLASHER.

The motor-driven flasher shown in the illustration is intended for signs having few lamps or for window decorations and displays. The machine is compact and low-priced and is said to be more flexible and of larger range

Sign Flasher.

han the so-called automatic flashers. The worm shaft uns on roller bearings, and the outfit is provided with aminated brushes, which are adjustable. The flashers f the type illustrated constitute an entirely new line and re made in sizes ranging from 5 amp to 12 amp per witch, and they can be equipped with any number of witches. The machine is adapted for a number of purposes, as flashing first one side and then the other side of a sign, or flashing first the border and then the reading matter, or various color combinations, or spelling out a word letter by letter, etc. It is said by the manufacturer, the Reynolds Electric Flasher Manufacturing Company, of Chicago, to cost but little more than an ordinary fan motor.

ELECTRICAL BUSINESS MEN DISCUSS CREDITS.

About eighty representative electrical business men from Chicago, St. Louis, Cleveland, Minneapolis, St. Paul, Milwaukee, Detroit, Cincinnati and other cities of the Central West attended the sixteenth annual meeting of the Electrical Credit Association of Chicago, which was held at the Chicago Athletic Club on Nov. 16. Mr. A. O. Kuehmsted, of Chicago, vice-president, occupied the chair, as President Frank M. Pierce, of the same city, was unable to be present. Mr. Kuehmsted presented the president's annual report, and Mr. James Wolff, of Chicago, made a brief report as the official representative of the association in the National Electrical Credit Association. Mr. Frederic P. Vose, of Chicago, presented an interesting report as secretary-treasurer. He showed that the association has 211 company members and that the number of claims reported to the association in 1911 was 4389, representing an indebtedness to members of $355,357. The total number of claims settled during the year was 2398, amounting to $180,124. About 51 per cent in cash was collected of the total amount reported. The total amount collected since the establishment of the association in 1896 was $1,588,873. The estimated amount of claims settled during the life of the association in all forms is $3,093,757.

Greetings were presented from the Philadelphia and New York associations, and it was announced that in the future the annual meetings of the Chicago association would be held on the third Thursday in November. By a vote the national association was requested to withdraw what is known as "operative resolution No. 41," which relates to the guaranteeing of the accounts of delinquent debtors by third persons.

On the report of the nominating committee officers were elected as follows: President, Mr. S. E. Kennedy, Central Electric Company; vice-president, Mr. A. O. Kuehmsted, Gregory Electric Company; national representative, Mr. James Wolff, New York Insulated Wire Company; secretary-treasurer, Mr. Frederic P. Vose, Marquette Building, Chicago; executive committee (new members), Messrs. Charles E. Ummach, W. S. Edwards Manufacturing Company; William A. Browne, M. B. Austin & Company; R. M. McConnell, Westinghouse Electric & Manufacturing Company. A vote of thanks was extended to the retiring officers and members of the executive committee.

The greater part of the afternoon was devoted to the reading and discussion of papers. Mr. Kuehmsted was first with a paper on "Disputed Accounts and the Executive Committee," and he was followed by Mr. W. J. Burton, of the Frank Adam Electric Company, of St. Louis, who read a paper prepared by Mr. W. A. Brady on "Keeping Faith." This was followed by the paper of Mr. F. D. Van Winkle, of the Post-Glover Electric Company, of Cincinnati, on "Forms and Model Letters," after which Mr. Kennedy, the new president, read a paper entitled "Does the Association Pay?"

Mr. E. R. Gilmore, of the Western Electric Company, was next with a paper entitled "Contractors as Credit Risks." In the course of this paper the writer declared that the small electrical contractors are possibly the poorest risks in the electrical business. The remedy should be to exercise some discrimination and help the worthy ones as they start in business by educating them in bookkeeping and methods of doing business so that they may develop into well-rounded

business men. Mr. T. I. Stacey agreed with this, and Mr. W. E. Stephenson, of Minneapolis, remarked that perhaps 80 per cent of the "grief" of electrical credit men comes from the small contractor. He made the amusing statement that perhaps every electrical contractor in Minneapolis and St. Paul has an automobile while hardly one jobber can boast of such a luxury. Mr. Wolff, Mr. Frank Horton, of Chicago, and others took part in the discussion.

The discussion on reporting municipal delinquents was opened by Mr. Vose, and Mr. Stephenson and others participated in it. After some debate it was recommended to the national association that information should be distributed to the members of the association stating when municipalities are paying by warrant rather than in cash, but municipalities paying by warrant should not be described as delinquent debtors.

NEW ST. LOUIS-MADE ALTERNATING-CURRENT DEVICES.

At a meeting of the St. Louis League of Electrical Interests on Nov. 14 Mr. W. A. Layman, vice-president and general manager of the Wagner Electric Manufacturing Company, of that city, was to have addressed the society on "Some New Alternating-Current Apparatus Made in St. Louis." Mr. Layman was called out of town unexpectedly at the last moment, and his place was taken by Mr. F. N. Jewett, sales manager of the Wagner company, who spoke on the same subject.

The St. Louis League of Electrical Interests has shown its devotion to the interests of its city in several ways. For one thing it raised a fund sufficient to build and maintain electric signs advertising the city of St. Louis and placed them in five large Eastern cities. Believing that members of the league are interested in knowing what a representative electrical manufacturer of St. Louis is doing, and believing also that the advance in the electrical art has been so great that some people are prone to think that further progress is unlikely, Mr. Jewett pointed out that three new and original electrical devices have been produced in the home city within the last year. The speaker insisted that these devices are not merely improvements of hitherto existing types, although to outward appearance two of them might be so considered. On careful examination, however, it will be seen that each one of the appliances is a real invention and a new contribution to the electrical art.

Fig. 1—Single-Phase Converter.

The three devices described are the Wagner alternating-current rectifier, the Wagner single-phase converter and the Wagner unity-power-factor single-phase motor. It was pointed out that the great number of automobile, motor-boat and other small gas and gasoline engines has developed a large field for small storage batteries to provide energy for ignition purposes. To provide a small, compact, portable rectifier for the many owners of such storage batteries in alternating-current sources of supply the Wagner company developed an ingenious and radically new device to suit the requirements. This rectifier consists essentially of a vibrating armature in connection with an electromagnet, the outfit including a small transformer and a resistance to limit the flow of charging current. The device has been described heretofore in this journal.

Mr. Jewett remarked on the fact that the mutual dependability of motor and storage battery has been so improved that the electric vehicle is now used to a much greater extent than ever before and is rapidly coming to the front in the automobile field. The Wagner company believes that it has discerned the need for a simple, compact and durable machine for converting alternating current into direct current for the charging of vehicle batteries, in addition to the various rectifying and converting appliances now available for this purpose. Therefore, it has brought out a single-phase converter which in a single unit is the mechanical equivalent of a motor-generator set operating on single-phase alternating-current supply and producing direct current. The machine possesses the outward characteristics of a standard single-phase motor, and, indeed, it may be used as a motor if desired. The speaker described the machine in detail and said that it should be useful for domestic purposes as at once affording a means of charging vehicle batteries and driving small machinery such as is frequently used about the household or in a private garage.

In conclusion Mr. Jewett spoke of the importance of the maintenance of high power-factor by central-station companies in selling and distributing alternating current. This brought him to the new unity-power-factor motor made by the Wagner company, which has been described heretofore in these columns. The talk was followed by an interesting discussion, the speaker of the day answering a number of questions.

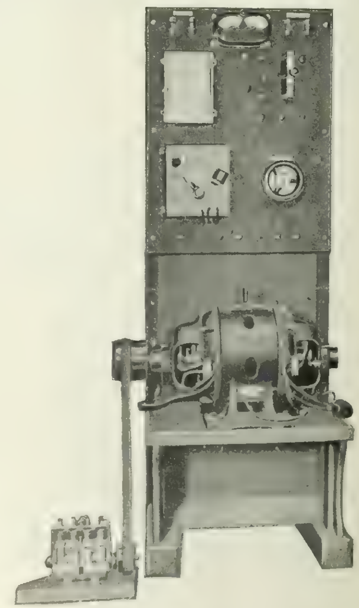


Fig. 2—Converter Driving Tire Pump.

Industrial and Commercial News

The Week in Trade.

GAINS made in recent weeks, although moderate in volume, have served to bolster up the business outlook and impart to it a more cheerful view. Market sentiment was undoubtedly favorably affected by the position which Mr. Roosevelt took with respect to the government's suit against the Steel Corporation, and because of this and various other reasons improvement in prices prevailed. A larger volume of business is noticeable in the West, with further buying for the future. The seasonable weather and the approach of the holidays are imparting activity to the retail trade. The October exports were greater in value than those of any other October in the history of the export trade and the imports show an increase over those of the corresponding month of last year. An active demand for foundry and pig iron or low grade is reported to be developing in the East. The tonnage of steel rails placed for shipment this winter or as specified during 1912 during the past few weeks now totals about 175,000 tons, and actually pending inquiries total approximately 150,000 tons. Car builders are operating to greater capacity at present than at any other time during the year, and a shortage of cars threatens the West due to business improvements and to run-down equipment. The cotton-ginning figures issued by the Census Bureau Tuesday were in a measure disappointing, but showed by far the largest number of bales ever ginned up to Nov. 14. It is expected that this year's crop will reach 14,000,000 bales. Business failures for the week ending Nov. 16 as reported by *Bradstreet's* were 238, as compared with 237 last week, 248 in the corresponding week of 1910, 232 in 1909, 273 in 1908, and 265 in 1907.

The Copper Market.

THE price of copper continues to advance both here and abroad. Sales of electrolytic were reported on Tuesday as high as 13 cents a pound, and this continues to be the minimum quotation of the leading selling agency. The demand according to the producers continues to be good, exports showing up better than domestic shipments. Domestic consumers are not clamoring for copper, the consumption of the metal in this country being less than usual, and the prices are advancing under speculative influences. Consequently buying has been said to be in excess of melting requirements and several million pounds more of January and December electrolytic contracts were placed Nov. 21. European business as well as American business trade was mainly in December and January

Standard Copper	Bid	Asked	Settling Price
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

	Noon.	Closing.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]

	Highest.	Lowest.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

shipments. Estimates place the country's increase in new copper next year between 200,000,000 lb. and 250,000,000 lb. The first half of November showed a decline of 5,352,000 lb. in visible and 4,121,600 lb. in foreign stocks, leaving the world's visible stocks not greater than 268,000,000 lb. There is a suspicion, however, that copper in both refined and crude form is undergoing accumulation. The total exports from New York since Nov. 1 and including Nov. 21 aggregate 21,331 tons, which compares with 21,904 tons cleared in October for the principal North Atlantic ports. At the present rate exports for November will be around 65,000,000 lb., the greatest since last August. The daily call on the Metal Exchange Nov. 21 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

Westinghouse, Church, Kerr & Company's Engagements.—Engineering work being carried on at present under direction of Westinghouse, Church, Kerr & Company includes the design and construction of a 2000-kw steam turbo-generator plant for the Harmony Mills at Cohoes, N. Y. This work includes the design and construction of the power-house building and stack, the installation of boilers, coal-handling equipment, electric-light and power wiring and switchboard, the construction of a bridge for heating and electric-transmission service between the power house and mills, together with the design and construction of a 2800-hp modern horizontal turbine water-power plant arranged for rope transmission to various parts of the mills and the design and installation of plumbing and other service facilities. Contracts have been placed for all material required for the above, and for the twenty-four-stall roundhouse, machine shop, storeroom, oil storage-room, power house and office building which the Westinghouse company is constructing at Champaign, Ill., for the Illinois Central Railroad. The power house will accommodate four 150-hp boilers, three of which are being installed at the present time; one 1000-cu. ft. air compressor and boiler-washing equipment, eight motor-driven deep-well pumps, three cinder pits, one inspection pit, a green-sand storage bin and sand-dryer house and equipment, lighting, heating and service equipment for the above-mentioned buildings, yard lighting, power wiring, yard-trench system, sanitary sewer and septic tank, one 1000-gal. water tank, two locomotive water columns and complete system of fire protection in yards and buildings. The work also includes the design and installation of service piping between the power house and various other buildings and the erection and equipment of a transformer house. Electric current is furnished by the local electric-light company. Space has been left in the power house for the future installation of generating units when desired.

Kansas City Telephone Service Restored in Ninety-eight Hours After Fire.—When the Missouri & Kansas Telephone Company's Fairmount Exchange at Kansas City, Mo., was completely destroyed, on Sunday, Oct. 22, at 3 a. m., by a fire which is believed to have been caused by an explosion of gas in the house adjoining that in which the central office was located, the telephone company at once communicated with the Western Electric Company, and the work of restoring service to the subscribers was begun at 9 o'clock on the same morning, when a dozen men from the electric company's local installing force appeared upon the scene. The Hawthorne factory of the Western Electric Company was called upon by long-distance telephone to make an emergency shipment, and responded by sending forward the necessary apparatus by express the evening of the day on which the fire occurred, thus supplementing without delay the work which was being done by the local house in rushing material to the building in which the new exchange was to be housed. The new switchboard equipment consisted of several sections from the telephone company's stock, and some from an addition which was to be installed at the Rosedale Exchange, on account of the increasing business in that district. Twenty-six installers reported for work on Monday morning, Oct. 23, and from that time until the new board was cut into service at 5 a. m. Oct. 26, with a full equipment of 800 subscribers' lines, day and night crews were at work continuously. Taking into consideration the fact that the work was done under high-speed conditions, in order that the subscribers might not be inconvenienced for an extended period, it is worthy of note that the trouble reports issued as a matter of routine by the telephone company indicate that the work of the Western Electric Company's installing force was so well done that a minimum of trouble was experienced after the new equipment was cut into service.

Hoskins Manufacturing Company Absorbs International Electric Meter Company.—The Hoskins Manufacturing Company, of Detroit, maker of the "Hoskins" electric furnaces, pyrometers and heating appliances, has purchased the business of the International Electric Meter Company, of Chi-

cago. The manufacture of the "International" instruments will be continued by the Hoskins company at its Detroit plant, with the same production organization that during the past seven years has made the "International" a line of established merit. The "International" measuring instruments comprise ammeters and voltmeters of portable and switchboard types in a variety of designs for alternating-current and direct-current circuits.

Block-Signal Practice.—The Ft. Dodge, Des Moines & Southern Railroad, which operates about 125 miles of track extending northward from Des Moines, Ia., to Ft. Dodge and Rockwell City, has contracted with the General Railway Signal Company, of Rochester, N. Y., to install continuous-track automatic block-signal protection on 18½ miles of track. This road formerly was operated by steam and now is operated by 1200-volt overhead trolley. Passenger cars are run in single units and freight trains are hauled by 40-ton electric locomotives, the ruling grades permitting handling a 1600-ton train with a two-unit locomotive. The block-signal installation is novel in that, while it conforms strictly to the automatic block-signal practice of steam railroads so far as circuits, relays and minor apparatus are concerned, the day as well as night indications will be given by lamp signals rather than semaphores. Each signal post will carry at its top a cast-iron box containing one red and one green lens, each 8½ in. in diameter. The lenses will be illuminated by 80-watt tantalum lamps placed in front of parabolic reflectors. By this means the intensity of illumination is sufficient to give an arrestive daylight signal indication at distances between 1500 ft. and 2000 ft.

New York Edison Company Seeks Review of Long Acre Case.—The New York Edison Company obtained a writ of certiorari from Supreme Court Justice Seabury Nov. 21 to review the determination of the Public Service Commission of the First District of New York, which grants the Long Acre Electric Light & Power Company permission to issue $10,000,000 of preferred stock and $50,000,000 of bonds. The petition states that the Edison company has invested millions in its plant and equipment, and has furnished electricity at reasonable rates, whereas the Long Acre company has a franchise which has never been operated according to law, has a floating indebtedness of $275,000, and property worth only $20,000, against which it has issued bonds of $1,000,000 to pay for its franchise. The petition states, moreover, that there is no public necessity for a competing company, and insists that the State of New York has adopted a policy of regulated monopoly in place of competition and that the New York Edison Company cannot be subjected to competition, but has a right to demand that it be protected against competition under the law as now interpreted.

Remy Electric Company.—The Remy Electric Company, of Anderson, Ind., manufacturer of magneto ignition and lighting devices for all types of gas engines and gasoline-motor-driven vehicles, which recently absorbed the American Electric Headlight Company and now makes the American electric headlight for steam locomotives, has purchased outright all patents, designs, good-will and manufacturing rights of the Peters electric headlight for steam locomotives. The locomotive headlight departments of the R. G. Peters Company, of Grand Rapids, Mich., have been moved to Anderson, and the Peters light will be owned, manufactured and sold by the Remy Company. New buildings will be erected at the Anderson plant to care for the increased production of the Peters lighting apparatus. The Remy company has taken over the leading men employed by the Peters company in its headlight department, and this addition to the corps of inventors and electric-headlight engineers puts the Remy company foremost in the development and perfection of the art of locomotive electric headlight designing and manufacturing.

Rebuilding of the Northern Ohio Traction & Light Company.—Due to the increasing load on the existing plant, and a desire to centralize the power generation, with its attendant economies, the Northern Ohio Traction & Light Company has decided to renew completely the electrical equipment of the greater portion of its system. It is the intention to install a new steam turbine and hydroelectric generating station at a point north of Akron, and to distribute energy from this station to substations located at Bedford, Town Line, Kent, South Akron, Barberton, Springfield Lake and New Berlin. The generating equipment will comprise three 60-cycle, three-phase, 7000-kva turbo-generators, two 150-kw turbo-generator exciters, nine 1100-kva oil-insulated, water-cooled transformers, one 20-kw motor-generator set, three 55-kva transformers, one main switchboard and the outgoing lines. The substations will contain the necessary step-down transformers and rotaries, the latter aggregating 6500 kw. The contract for the entire electrical equipment has been awarded to the Westinghouse Electric & Manufacturing Company.

Hydroelectric Development in Pachuca, Mexico.—The Pachuca Railway Company, which is constructing an electric railway from Pachucha to the Real del Monte mining district, will soon have the line finished. It will be about 12 miles long and in some respects is an interesting and unique piece of engineering work, owing to the rough character of the country. The company has adopted plans for extensive enlargement of its hydroelectric plant and service. It is already furnishing 1500 hp of electrical energy for mines and industries, and this is to be brought up to about 7500 hp. It has applied for concessions from the government for the construction of three large dams which will afford a water-storage capacity sufficient to generate the additional power that is required. Transmission lines will be constructed to the different mines and outlying industrial plants. The headquarters of the company are at Tepeji del Rio, in the Tula district of Pachuca. It is expected that the introduction of cheap electric power into the mining camps will greatly stimulate development operations of the mines.

Third Avenue Reorganization Plan Wins.—The litigation between the Public Service Commission of the First District, New York, and the Third Avenue Railroad Company was ended Nov. 21, when the Court of Appeals reversed the decision of the Public Service Commission and declared the reorganization plan legal. The decision is of moment, as upon it depends not only the reorganization of the Third Avenue Railroad, but also that of the Metropolitan Street Railway Company, a plan for the reorganization of which will be presented in the near future. It is expected that the Public Service Commission will ask the next Legislature to grant additional power so it will have jurisdiction in reorganization matters. It is doubtful, however, if this law can be effected in time to interfere with the reorganization of the entire street railway system of New York.

Bell Interests Acquire the Cumberland Telephone & Telegraph Company.—The American Telephone & Telegraph Company has accepted the offer made by the president of the Cumberland Telephone & Telegraph Company to sell to the former all of the latter's stock in the latter company at 160 and accrued dividends in bonds of the Cumberland Telephone & Telegraph Company. The bonds will become a mortgage on the property for twenty-five years at 5 per cent taken at par, with the option of taking American Telephone & Telegraph Company stock par for par if preferred. The bonds will be dated Jan. 1, 1912, and the total issue will not exceed $15,000,000. They will be subject only to a prior mortgage securing bonds now outstanding amounting to $750,000.

Reorganization of Milwaukee Electric Railway & Light Company.—The active management of the Milwaukee Electric Railway & Light Company has been placed in the hands of three department heads, so as to relieve Manager J. D. Mortimer of much detail work. The three heads are Messrs. R. B. Stearns, S. B. Way and R. N. Duffy. The first is in charge of the railway department, the second in charge of the light and power department, and the last will have supervision of the accounting, purchasing and stores, printing and advertising and publicity departments. Mr. Egbert Douglas has resigned as commercial engineer and has been made sales manager, and Mr. T. D. Crocker, general superintendent of the Milwaukee Central Heating Company, has been appointed commercial engineer.

Kelvin Engineering Company.—The Kelvin Engineering Company, 78 Wall Street, New York, has been incorporated for the purpose of doing a general engineering and contracting business, to make plans, specifications and estimates, to investigate and report, and to supervise and manage railway, industrial and electric plants. Its technical staff will be headed by Messrs. G. Lobo and J. H. Shearer, both engineers of professional training and long experience.

Electric Mules for Panama Canal.—The General Electric Company was the lowest bidder for the forty electric mules for pulling ships through the Panama Canal. These locomotives were described in a recent issue. The total contract aggregates about $500,000.

Financial.

The Week in Wall Street.

THE conditions in Wall Street cannot be said to be assuming a cheerful aspect, for sharp contractions accompanied by recessions in prices marked the opening of the exchanges on Monday; and although stocks rose a trifle on Tuesday, trading reached its lowest ebb since Oct. 26. The market remained firm, however, in the face of inactivity. The decision of the Court of Appeals reversing the Public Service Commission on every point of its objections to the reorganization plans of the Third Avenue Railroad created a favorable impression in the financial district, although the stock dropped; the bonds, on the other hand, advanced in price. The announcement of increased earning by Brooklyn utilities was offset by the raise in rates from 5 cents to 7 cents announced by the Hudson & Manhattan Railroad on the subway leading uptown. On the whole, the recovery from last week's decline failed to develop a sufficiently broad demand for stocks to offer any effective offset to such pressure as the market encountered. From Friday of last week to Monday approximately $11,000,000 in gold was withdrawn from the banks, but the outflow did not introduce any unsettling factor. Such surface indications as rising prices in copper and increased exports are supposed to have contributed to the betterment which the market afterward experienced. The bond market apparently is in good shape and attracting investors, for an issue of over $10,000,000 offered by one banking house on a public utility Monday was taken up before the market closed on Tuesday. The money market experienced little change. Rates Nov. 21 were: Call, 2⅜ @ 2½ per cent; ninety days, 3¼ @ 3½ per cent. The quotations in the tables are those at the close of Nov. 21.

NEW YORK.

	Nov. 14.	Nov. 21.	Shares Sold.		Nov. 14.	Nov. 21.	Shares Sold.
[illegible]	[illegible]	[illegible]	[illegible]	Int. Met., pf.	44	[illegible]	11,050
[illegible]	[illegible]	[illegible]	[illegible]	Mackay Cos.	85½*	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	73	100
Am. D. T.	33⅛*	[illegible]		Man. Elev.	135	[illegible]	310
[illegible]	[illegible]	36	1,600	[illegible]	[illegible]	15*	—
[illegible]	[illegible]	[illegible]	100	N.Y.&N.J.Tel.	139½*	[illegible]	—
Am. Tel. & C.	78*	[illegible]	—	[illegible]	[illegible]	63¾	1,110,650
[illegible]	[illegible]	140	11,270	Steel, pfd.	109¼	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	26,580	[illegible]	[illegible]	[illegible]	2,300
Gen. Elec.	153	[illegible]	2,100	West'h, com.	66	66	3,200
Int. Met.	14½	[illegible]	8,700	West'h, pfd.	115*	115*	—

PHILADELPHIA.

	Nov. 14.	Nov. 21.		Nov. 14.	Nov. 21.
[illegible]	45	45¼	Phila. R. T.	23	[illegible]
[illegible]	12	[illegible]	Phila. Elec.	[illegible]	16
[illegible] St. Bt'y	[illegible]	[illegible]	Phila. Trac.	[illegible]	[illegible]
Elec. St. Bt'y, pf.	[illegible]	30*	Union Trac.	[illegible]	51¾

CHICAGO.

	Nov. 14.	Nov. 21.		Nov. 14.	Nov. 21.
[illegible]	[illegible]	186*	Com. Edison	[illegible]	133½
[illegible]	30	30*	Chi. Subway	[illegible]	[illegible]
Chi. Elev. Rys., pf.	93	94*	Chi. Telephone	123*	[illegible]
Chi. Rs., Ser. 1	[illegible]	[illegible]	[illegible]	105*	105*
Chi. Rs., Ser. 2	33	33*	Nat'l Car, pfd.	118*	118*

BOSTON.

	Nov. 14.	Nov. 21.		Nov. 14.	Nov. 21.
[illegible] T. & T.	138¾	140	Mex. Tel.	[illegible]	3*
[illegible] Tel.	152	155	Mex. Tel., pf.	6½*	[illegible]
[illegible]	291	[illegible]	N. E. Tel.	148⅛	150
[illegible]	153½	[illegible]	W. T. & T.	[illegible]	[illegible]
[illegible]	21	[illegible]	W. T. & T., pf.	107¼*	[illegible]
Mass. E. Ry., pf.	[illegible]	[illegible]			

*Last price quoted.
Shares sold for the week Nov. 13 to Nov. 18.

Financial Notes.

Ironwood & Bessemer Railway & Light Company's Bonds Offer.—New York and Boston bankers are offering $1,344,400 first-mortgage 5 per cent sinking-fund gold bonds of the Ironwood & Bessemer Railway & Light Company, which is a consolidation of the Ashland Power Company, Ashland, Wis., and the Gogebic & Iron Counties Railway & Light Company, of Ironwood, Mich. The Ashland Power Company, through ownership of the majority of the stock of the Ashland Light, Power & Street Railway Company, of Ashland (1007 of 2000 shares), gives the Ironwood & Bessemer Railway & Light Company control of the electric-light, power, street-railway and gas business of the city of Ashland. The Gogebic & Iron Counties Railway & Light Company, through ownership of all of the bonds and stock of the Twin City General Electric Company, of Ironwood, and through ownership of all of the stock of the Gogebic Electric Company and the Gogebic Street Railway Company, of Bessemer, Mich. (these companies have no bonds), gives the Ironwood & Bessemer Railway & Light Company control of the electric-light, power and street-railway business in and between the two cities, serving a population of over 20,000 in one of the largest iron-ore-producing communities in the United States. The capitalization of the Ironwood & Bessemer company consists of an authorized issue of $2,500,000 first-mortgage 5 per cent sinking-fund gold bonds, with $1,344,400 issued; $200,000 6 per cent preferred stock, all of which has been issued, and $500,000 common stock, all of which has also been issued. The bonds which are offered for sale are dated Feb. 1, 1911, and are due Feb. 1, 1936. The price is 93½ and accrued interest, to net 5½ per cent per year. The bonds are secured by a first mortgage on all of the property of the Ironwood & Bessemer Railway & Light Company in the State of Wisconsin and by a first mortgage on all of the property of the company in the State of Michigan, through ownership of all of the bonds and stock of the Gogebic & Iron Counties Railway & Light Company, of Michigan, as mentioned above, which are deposited with the American Trust Company of Boston and held as security for the bonds of the Ironwood & Bessemer Railway & Light Company. The amount of bonds issued and outstanding is absolutely controlled by the Board of Railroad Commissioners of the State of Wisconsin, and new bonds may be issued with its permission for 75 per cent of the cash cost of new property, but only when the net earnings of the previous full year equal one and one-half times the interest charges on all of the bonds then outstanding and to be issued. The statement of earnings of the consolidated companies for the year ended Dec. 31, 1910, showed net earnings of $153,895, interest charges, assuming all bonds authorized are outstanding at the end of the year July 31, 1912, of $67,220, and a surplus of $86,675 available for dividends at the rate of 6 per cent on the preferred stock. These amounted to $12,000, leaving a surplus of $74,675 available for the common stock, which represents 14 per cent on that issue. The officials of the Ironwood & Bessemer Company estimate that in the year ending July 31, 1912, on the most conservative basis, the net earnings of the company will exceed $175,000, at which time the extensions and additions being made by the company will be completed.

Earnings of Public-Utility Companies Show Improvement.—The following public-utility companies showed increases in gross and net incomes for the month of September: Detroit United Railways, $66,023 and $10,822; United Railroads of San Francisco, $17,460 and $8,175; Northern Ohio Traction & Light Company, $21,133 and $10,158; Fairmont & Clarksburg Traction Company, $12,721 and $6,809; American Cities Company, $62,423 and $25,270; Cumberland Telephone & Telegraph Company, $51,153 and $9,457; Sao Paulo Tramway, Light & Power Company, $51,911 and $33,040; Rio de Janeiro Tramway, Light & Power Company, $135,902 and $86,635; Toronto Railway Company, $39,234 and $25,715; Dallas Electric Corporation, $11,445 and $3,682. The Keystone Telephone Company showed an increase in gross income of $3,232 and a decrease of $749 in net. The Mexican Tramways Company showed a decrease of $63,368 in gross and $32,701 in net. The Mexican Light & Power Company showed a decrease of $92,028 in gross and $37,314 in net. These large decreases shown by the Mexican companies are attributed to the unsettled conditions prevailing in the past months in the territories in which these companies operate.

Niagara, Lockport & Ontario Company's Earnings.—The report of the Niagara, Lockport & Ontario Power Company, Buffalo, N. Y., for the nine months ended Sept. 30 shows substantial increases in gross and net earnings as compared with those in the corresponding period of 1910. The returns from the sale of power were $800,742, as compared with $745,494, and the cost of power was $390,442, as compared with $362,430. Deduction of these expense items left balances of $410,300 and $383,064 in the periods ended Sept. 30, 1911, and Sept. 30, 1910, respectively. Operating expenses were $132,647, as compared with $134,541, and the amortization was $20,608, as compared with $15,826. The net earnings in the period ended Sept. 30, 1911, were $257,045, and other receipts were $17,197, making a total net income of $274,242, which compares with $245,068 in the corresponding nine months of 1910. The interest on first-mortgage bonds amounted to $187,500, leaving a balance of $86,742, which compares with $57,568 in the nine months ended Sept. 30, 1910, or an increase of 50.68 per cent.

Toronto Power Company to Spend Millions for Enlargements.—At a meeting of the board of directors of the Toronto Power Company presided over by Sir William MacKenzie last Saturday in Toronto, Ont., it was tentatively decided to expend approximately $3,000,000 on the system. The generating station at Niagara Falls, Ont., will be enlarged and machines installed to utilize the maximum amount of water allotted to the company by the treaty. This means that in addition to the three 8500-kw units now being installed four more will be added, making eleven in all. The completed project will then be capable of developing 125,000 electrical horse-power. In addition to the duplicate transmission line between Niagara Falls, Ont., and Toronto it is purposed to install another transmission line designed for an 85,000-volt circuit. The other line which now transmits at 60,000 volts will probably be modified to suit the higher potential. The plant and system of the Toronto Electric Light Company will be thoroughly overhauled and placed in excellent shape. Incident to these changes there has been a reorganization of the personnel of the companies, details of which have not yet become available. It is understood that the engineering work will be in charge of Mr. L. J. Hirt, who is associated with Dr. F. S. Pearson, of New York. Much of the energy will be required by the new railways projected by the MacKenzie interests in Ontario.

Kansas City Railway & Light Company's Year.—The report of the Kansas City Railway & Light Company for the year ended May 31 shows gross earnings of $7,727,680, which represents an increase of $566,639 over those of the previous year. Operating expenses and maintenance amounted to $4,450,535, an increase of $297,286, and the net income from operations was $3,277,145, an increase of $269,353 for the year. Other income amounted to $45,492, an increase of $28,094, making total net earnings of $3,322,637, or $297,446 more than those in the year ended May 31, 1910. Total charges amounted to $2,398,889, an increase of $240,928, and were made up as follows: Taxes, $585,864; interest on bonded debt, $1,475,434; bond discounts and commissions, $236,391; reserve for doubtful accounts, $30,425; interest on floating debt, $15,760; miscellaneous charges, $15, and bond sinking fund, $55,000. Deductions of charges left a net income of $923,748 available for preferred dividends, which amounted to $352,782 and were $117,594 less than those of the previous year. The surplus was $570,966, which was an increase of $174,112 over the surplus for the previous year.

Montreal Tramways.—New York, Boston and Chicago banking houses offered $10,445,000 first and refunding 5 per cent gold bonds of the Montreal Tramways Company, dated July 1, 1911, and due July 1, 1941. The company was organized under the special charter granted by the Province of Quebec, and has acquired the property rights and franchises of the Montreal Street Railway Company, and either the property rights and franchises or the entire capitalization of its affiliated companies, thus owning and controlling the street railway system of the metropolis of the Dominion. The bonds are secured by a first mortgage on a portion of the property, including the company's new power station, and on the remainder of the property subject to the underlying bonds, which mature in 1922. The proceeds of the bonds will be used as part payment for the properties acquired, the acquisition of which properties was authorized by the Quebec Public Utilities Commission. The bonds were all sold the day after the announcement.

Susquehanna Railway, Light & Power Company's Report.—The annual report of the Susquehanna Railway, Light & Power Company, of New York, which owns the entire common stock of the United Gas & Electric Company, the Lancaster County Railway & Light Company, and which controls the Wilkes-Barre Company, for the twelve months ended Sept. 30, 1911, shows a surplus of $383,073. Its subsidiary company, the United Gas & Electric Company, owns and controls the Colorado Springs (Col.) Light, Heat & Power Company, the Elmira (N. Y.) Water, Light & Railroad Company, the Lockport (N. Y.) Light, Heat & Power Company, the Leavenworth (Kan.) Light, Heat & Power Company, the Richmond (Ind.) Light, Heat & Power Company and a number of gas companies. The surplus is equivalent to 5 per cent of the $4,198,000 outstanding common, and an additional 2 per cent on the combined common and preferred stocks.

Iowa-Nebraska Public Service Company.—Bankers in Chicago are offering for sale at par first-mortgage, 6 per cent gold bonds of the Iowa-Nebraska Public Service Company to the amount of $350,000. This company owns and operates central stations in Missouri Valley, Ia., and Beatrice and Norfolk, Neb. It furnishes twenty-four-hour electric service in these cities and also transmits energy to neighboring communities. The authorized capital stock is $1,250,000, of which $775,000 is outstanding. The total issue of bonds is limited to $1,000,000, of which $650,000 is held by a trustee under restrictions, leaving $350,000 of outstanding bonds. The most recent report shows the annual revenue to be $122,987.85 gross, and $51,866.94 net after deducting taxes and other expenses.

Oil and Gas Merger in Arkansas.—H. M. Byllesby & Company, Chicago, have consolidated the General Pipe Line Company, the Ft. Smith & Little Rock Gas & Oil Company and the Arkansas Territorial Oil & Gas Company, whose combined capital approximates $2,000,000, with the General Southwestern Gas Company, a local Ft. Smith concern with a paid-up capital of $5,000,000. The General Southwestern Gas Company filed a $5,000,000 mortgage on Nov. 21, the proceeds of which will be used to prospect for oil and gas in Oklahoma and Arkansas.

Kings County Electric Company's Statement.—The report of the Kings County Electric Light & Power Company, Brooklyn, for the month of October shows gross earnings of $411,685, as against $355,238, and a surplus, after charges and depreciation, of $83,516, as against $69,736. The gross earnings for the year ended Oct. 30 showed an increase of $353,476 over the corresponding period of 1910.

Rio de Janeiro Tramway, Light & Power Company Stock Sold.—Advices from Montreal state that the Rio de Janeiro Tramway, Light & Power Company has sold $5,000,000 new stock to a London syndicate at 105. It is further stated that the stock will be offered to shareholders first at the same price, and such stock as is not taken up will be turned over to the London syndicate.

Detroit Edison's Stock Increase Ratified.—Stockholders of the Detroit Edison Company have ratified the proposal mentioned in these columns Nov. 4, to increase the capital stock of the company from $9,000,000 to $15,000,000.

DIVIDENDS.

Chicago Elevated Railways, quarterly, preferred, 1½ per cent, payable Dec. 1.

Cities Service Company, monthly, preferred, one-half of per cent; common, one-quarter of 1 per cent, both payable Dec. 1.

General Electric Company, quarterly, 2 per cent, payable Jan. 15.

Laclede Gas Company, quarterly, common, 1¾ per cent, preferred, 2½ per cent, payable Dec. 15.

Norfolk Railway & Light Company, semi-annual, 2½ per cent payable Dec. 8.

Northern Ohio Traction & Light Company, quarterly, preferred 1¼ per cent, payable Jan. 2.

Philadelphia Electric Company, quarterly, 1½ per cent, payable Dec. 15.

Rochester Railway & Light Company, quarterly, preferred 1¼ per cent, payable Dec. 1.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
CAPE BRETON ELECTRIC COMPANY, LTD.					
Sept., 1911........	$30,314	$14,454	$15,859	$5,034	$10,8
Sept., 1910........	28,8[illegible]	13,112	15,722	5,006	10,7
EDISON ELECTRIC ILLUMINATING COMPANY OF BROCKTON, MASS.					
Sept., 1911........	$30,102	$18,444	$11,658	$4,118	$7,54
Sept., 1910........	25,701	14,582	11,119	4,241	6,87
HOUGHTON COUNTY (MICH.) ELECTRIC LIGHT COMPANY.					
Sept., 1911........	$22,806	$9,085	$12,977	$5,622	$7,35
Sept., 1910........	21,558	9,820	11,069	3,928	7,14
JACKSONVILLE (FLA.) TRACTION COMPANY.					
Sept., 1911........	$45,098	$24,052	$21,046	$11,345	$9,70
Sept., 1910........	45,994	27,156	18,838	8,408	10,42
LOWELL (MASS.) ELECTRIC LIGHT CORPORATION.					
Sept., 1911........	$31,007	$16,770	$14,236	$4,425	$9,81
Sept., 1910........	34,302	19,868	14,434	4,274	10,16
MINNEAPOLIS GENERAL ELECTRIC COMPANY.					
Sept., 1911........	$127,157	$46,129	$81,028	$36,633	$44,3
Sept., 1910........	115,901	39,781	76,119	32,350	43,76
PADUCAH (KY.) TRACTION & LIGHT COMPANY.					
Sept., 1911........	$22,801	$12,133	$10,667	$7,166	$3,5
Sept., 1910........	21,251	11,263	9,987	7,026	2,9
PENSACOLA (FLA.) ELECTRIC COMPANY.					
Sept., 1911........	$24,667	$14,148	$10,519	$5,862	$4,6
Sept., 1910........	23,264	13,959	9,305	5,206	4,0
WHATCOM COUNTY (WASH.) RAILWAY & LIGHT COMPANY.					
Sept., 1911........	$32,911	$16,998	$15,913	$9,530	$6,3
Sept., 1910........	33,781	17,331	16,449	9,083	7,3

General News

Construction News.

[illegible]ERTA, ALA.—It is [illegible] plant in [illegible] is [illegible] [illegible] has not [illegible]

EUFAULA, ALA.—The City Council has awarded contracts for the construction, equipment and distributing system of the new municipal electric-light plant, to cost approximately $25,229.

PIEDMONT, ALA.—The [illegible] for construction of the proposed municipal electric-light plant is reported to have been awarded to the J. B. McCrary Company, of Atlanta, Ga.

RAGLAND, ALA.—Preparations are being made by the Ragland Water Power Company for raising its dam and the construction of a water-power plant on the Coosa River at Lock No. 4, plans and specifications for which are being prepared by Martin H. Lide, of Birmingham, Ala. Contracts will be awarded as soon as plans are ready and bids re[illegible]

TALLADEGA, ALA.—The Alabama Power & Light Company, it is reported, has acquired the necessary property and is making arrangements for the construction of its proposed hydroelectric power plant at Jackson Shoals, near Talladega. The company expects to develop from 2000 to 3000 hp. Electricity generated at the plant will be transmitted to Talladega and Anniston. The cost of the plant is estimated at about $200,000. R. A. Mitchell, of Gadsden, Ala., is [illegible]sident of the company.

TUSCALOOSA, ALA.—The City Commissioners, it is reported, have granted a franchise to F. G. Blair and Henry B. Foster to construct and operate an electric plant, gas works and an electric railway in Tuscaloosa.

PARKER, ARIZ.—Plans are being considered by the New State Construction Company for the erection of a telephone system with a central exchange at Parker. The cost of the system is estimated at $10,000. W. [illegible] Tharpe is general manager.

[illegible]NIX, ARIZ.—The Salt River [illegible] Railway Company [illegible] granted a franchise by the City Council to construct and [illegible]rate an electric railway in Phœnix for a period of twenty-five years. [illegible] railway will be [illegible] in length and will connect [illegible]nix, Scottsdale, Tempe, Mesa, Chandler, Alhambra, Glendale and [illegible]

SAFFORD, ARIZ.—The Gila Valley Electric, Gas & Water Company [illegible]ying a water-distributing system in Safford and will pipe the supply [illegible]n Mount Graham, which has a latitude of 11,500 ft. and is situated [illegible]t 12 miles from Safford.

TUCSON, ARIZ.—The Federal Power & Water Company has filed [illegible]e of appropriation of 10,000 cu. ft. of water in Sabino Canyon and [illegible] cu. ft. in Bear Canyon. Plans are being considered by the company [illegible] the construction of a dam near the junction of the canyons for im[illegible]nding 5,000,000 cu. ft. of water and for the erection of a hydro[illegible]tric power plant at that point. H. W. Roche is president of the [illegible]pany and C. H. Ross secretary.

WICKENBURG, ARIZ.—The Big Blue Mining Company, operating [illegible] the Hassayampa River, is preparing plans for the erection of a hydroelectric power plant. The company proposes to supply electricity for its mines and other mining properties in this section. Robert H. Browne is [illegible] charge of the work.

JONESBORO, ARK.—The Jonesboro & Nettleton Interurban Railway [illegible]pany has awarded a contract to Hemingway & Company for the con[illegible]tion of its proposed railway between Jonesboro and Nettleton, a [illegible]nce of 5 miles.

ALAMEDA, CAL.—Bids will be received by F. E. Browning, clerk of the Council, until Dec. 5 for the erection of iron-pipe lamp-posts, conduits and wiring on Ninth Street from Pacific Avenue to Bay, Weber Street from Central Avenue to Bay, and Caroline Street from [illegible]nta Avenue to Bay, in accordance with plans and specifications on [illegible]n the office of the clerk.

BAKERSFIELD, CAL.—The San Joaquin Light & Power Company, it is reported, is planning to double-track its street railway system in [illegible]field.

DORRIS, CAL.—The Board of Trustees has granted the Siskiyou Electric Light & Power Company a franchise to erect and maintain transmission lines for the distribution of electricity in the town [illegible] Dorris.

EL CENTRO, CAL.—Plans are being considered by the Imperial Val[illegible]y Telephone Company for the erection of a telephone line from El Centro to Seeley, via Imperial and Dixie. New stations will be estab[illegible]

FRESNO, CAL.—The Board [illegible] of Fresno County has [illegible] the Pacific Light & Power [illegible] of Los Angeles, Cal., a [illegible] year franchise to erect and maintain electric transmission lines from the east bank of the San Joaquin River to the Sierra National Forest Reserve, and to other points in the county, for which the company paid $100. The company will erect a transmission line from its proposed Big Creek power plant to Los Angeles, a distance of about 275 miles, the cost of which is estimated at about $10,000,000.

M'KITTRICK, CAL.—The Kern River Oil Company is installing new electric pumping machinery at its works.

NORDHOFF, CAL.—A movement is under way for the installation of an electric-light plant in Nordhoff by S. S. Beaman. It is proposed to enlarge the isolated electric plant, owned by H. H. Cockley, if sufficient patronage is guaranteed to justify the expenditure.

OAKDALE, CAL.—Plans are being considered by the Sierra Power Company for the installation of a new street-lighting system in Oakdale.

OROVILLE, CAL.—A petition is being circulated by the Monday Club to enforce an ordinance for placing all wires underground in the business district of the city.

OROVILLE, CAL.—Plans have been completed by the Oro Electric Company for beginning active construction work at Humbug early in the spring. One of the first developments will be on Yellow Creek. The company proposes to assemble the water in a 1700-acre storage reservoir in Yellow Creek Valley, from which point it will be dropped by means of pipe lines to the mouth of Yellow Creek on the north fork of Feather River, where the power house will be located.

OXNARD, CAL.—The installation of a municipal electric-light plant in Oxnard is under consideration by the City Trustees.

PLANADA, CAL.—The San Joaquin Light & Power Company is planning to install a distributing system in Planada. The company has completed its transmission line from Madera to Firebaugh, Dos Palos, Los Banos and Gustine, and has also installed distributing system in these places. The line will carry 30,000 volts and will be put into service Nov. 25.

POMONA, CAL.—The Southern California Edison Company contemplates rebuilding the street-lighting system in Pomona. It is proposed to erect twenty-six arc lamps in the business district and to furnish an all-night service. The present incandescent street-lighting system will be replaced with tungsten lamps. A mercury-arc rectifier will be installed in the substation on Second Street, to provide for the service in the downtown district.

PORTOLA, CAL.—The Reno Mill & Lumber Company, which recently secured the water rights and franchises of the Portola Light & Power Company, is planning to construct a dam on Grizzly Creek to furnish power to generate electricity in the town of Portola. The cost of the proposed plant is estimated at $40,000.

SACRAMENTO, CAL.—Preparations are being made by the Sacramento Electric, Gas & Railway Company for the erection of a new building at Eleventh and K Streets, bids for which are being asked.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company has awarded the contract for the erection of its transmission line from San Bernardino to Riverside, a distance of 70 miles, to M. D. French, Grosse Building, Los Angeles, Cal., at $159 per mile.

SAN DIEGO, CAL.—The San Diego Electric Railroad Company is contemplating the installation of a steam-heating system in San Diego. The company will soon apply to the City Council for a franchise to lay steam pipes on certain streets for distribution of same.

SAN FRANCISCO, CAL.—The Forestry Department has rejected the application of the Nevada-California Canal & Power Company for a right-of-way across the public domain in Mono County.

SAN FRANCISCO, CAL.—Plans are being prepared by the engineering department of the City Electric Company for the erection of a substation which is to be locatd on Folsom Street east of Sixth Street, to cost approximately $10,000.

SAN FRANCISCO, CAL.—The contract for electrical and steam work in the new hotel building to be erected on Mission and Seventh Streets by Josephine Dupuy has been awarded to the John G. Sutton Company, of San Francisco, Cal., at $6,450.

SAN JOSE, CAL.—The Board of Supervisors has accepted the bid of the Great Western Power Company for a franchise to erect a transmission line in this county. The price paid for the franchise [illegible]

SAN RAFAEL, CAL.—Sealed bids will be received by Robert E. Graham, clerk of Board of Supervisors, until Dec. 3 for the installation and maintenance of a complete electric street-lighting system in the Corte-Madera lighting district.

SELMA, CAL.—Plans are being made by the Pacific Telephone & Telegraph Company for extensions and improvements to its local system, including the installation of an underground conduit system in the business district. A. Terkell is district commercial agent.

STOCKTON, CAL.—At an election held Nov. 14 the proposition for the installation of a municipal underground electrolier street-lighting system was carried.

[illegible] for the [illegible] power plant at [illegible] county hospital, for which bids have been called for. Eugene D. [illegible]

TOCALOMA, CAL.—Plans are being considered for extensive improvements to the Tocaloma Hotel, recently purchased by Anthony Tosy, which will involve an expenditure of about $10,000 and include the construction of a large concrete dam on the river and installation of a waterwheel and generator to supply electricity for the hotel and ranch, owned by Mr. Codoni.

VISALIA, CAL.—The Board of County Supervisors has awarded the Tulare County Power Company a franchise to erect transmission lines in certain sections of Tulare County for the transmission and distribution of electricity. The price paid for the franchise was $100.

BOULDER, COL.—The power plant and mill of the A. K. R. Gold Mining Company, located near Boulder, were recently destroyed by fire. It is understood that the plants will be rebuilt.

GEORGETOWN, COL.—The Boston-Idaho Electrical Company has erected a transmission line from Idaho Springs to Georgetown. It is understood that the company proposes to supply electricity in this city, for which application will soon be made to the City Council. The Boston-Idaho Electrical Company controls four plants in Clear Creek County, two of which are located at Idaho Springs, one at Alice and one at Georgetown. The latter was recently purchased from the Two American Sisters Mining Company. W. E. Renshaw, of Idaho Springs, is manager.

LONGMONT, COL.—A temporary injunction restraining the city of Longmont from proceeding with the construction of the municipal electric-light plant authorized by the voters at the election in April, 1911, has been issued by Judge Harry P. Gamble of the District Court on the application of the Northern Colorado Power Company, which has begun suit to secure a permanent injunction against the city building a municipal lighting plant.

PUEBLO, COL.—The Pueblo & Suburban Traction & Lighting Company has purchased a site at the intersection of Union Avenue and Main Street, on which it proposes to build a new office building.

SUGAR CITY, COL.—The Ordway Electric Light & Power Company, of Ordway, Col., which operates the local electric plant, announces that a twenty-four-hour service will be established beginning Jan. 1, 1912. Orders have been placed for new equipment.

WALSENBURG, COL.—Arrangements are being made by the Trinidad Electric Transmission, Gas & Railway Company, of Trinidad, for the construction of another power plant near Walsenburg. About 4000 kw will be developed, which will be supplied to mines in this vicinity.

TAKOMA PARK, D. C.—No bids were submitted for lighting the streets of Takoma Park, Md., the electric lighting companies claiming that a two-year contract is too short to justify the outlay for installation of the system. The installation of a municipal lighting plant is now under consideration. The bids called for 100 electric lamps of at least 40 cp. Benjamin G. Davis, 110 Oak Avenue, Takoma Park, D. C., is clerk and treasurer.

WASHINGTON, D. C.—The Bureau of Manufactures is in receipt of a communication from a business man in India stating that he desires to purchase from American manufacturers dynamos, motors, oil engines and machinery, and would like to receive as soon as possible catalogues and full particulars from such manufacturers. For further information address No. 7594, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—The American vice consul-general at Santo Domingo has forwarded a translation of the basis for specifications calling for bids for the installation of a new electric-light plant to supply electricity for lighting the city of Santo Domingo, Dominican Republic, bids for which will be received until Dec. 15. The specifications call for a privately owned plant, the present municipal plant being inadequate and unsatisfactory. Proposals are to be addressed to the office of the secretary. Copy of notice and translation can be obtained on application to the Bureau of Manufacturing, No. 7596, Department of Commerce and Labor, Washington, D. C.

FORT BARRANCAS, FLA.—It is reported that A. M. Lockett & Co., of New Orleans, La., has secured the contract for furnishing pump and other work in connection with the power plant at Fort Barrancas, Fla.

MADISON, FLA.—The City Council has accepted the proposition of the Madison Electric Power Company to sell its plant to the town, subject to the approval of the voters. An election will soon be called to submit the proposition to vote of the people.

ATLANTA, GA.—The Appalachian Power Company has filed amendments to its charter changing its name to the Appalachian Electric Power Company. Investigations are now being made by the company of its five properties in North Georgia to determine on plans for developments. The company proposes to supply energy in Toccoa, Ga., and Walhalla, Seneca and Westminster, S. C. A franchise has already been granted the company in Toccoa.

ROME, GA.—The Chattanooga Traction Company has applied for a franchise to construct and operate an electric railway in Rome.

HONOLULU, HAWAII.—The Island Investment Company has awarded a contract to the Von Hamm-Young Company for the hydroelectric plant which it is building between Wailuku and Kahului on Maui, for the purpose of supplying electricity for lamps and motors to these towns. The equipment is for the steam-power plant and California oil will be used for fuel.

CALDWELL, IDAHO.—The Idaho-Oregon Light & Power Company, of Boise, Idaho, has applied to the Council for a franchise to construct and operate an electric railway over certain streets in the city.

BOISE, IDAHO.—The Long Valley Light & Power Company, recently organized, it is said, proposes to supply electricity to six cities in west central Idaho.

HORSE SHOE BEND, IDAHO.—Plans are being prepared by the Pacific Power & Light Company for the installation of an electric-light system at Horseshoe Bend to the Wahkiacus Heights district. The company will extend its transmission line from its power plant on the little Klickitat River, a distance of about 5 miles.

SALMON, IDAHO.—The Lemhi Telephone Company is contemplating the erection of a telephone line along the Lemhi River, 60 miles in length. W. A. McCutcheon is president of the company.

ALTON, ILL.—The Madison County Light & Power Company has secured a franchise to supply electricity for lighting the villages of East Alton and Woodriver. It is understood that the company will soon apply to the City Council of Alton for a franchise to operate in this city. The power house of the company is located in Venice, Ill.

ALTON, ILL.—Frank L. Butler, receiver for the Alton, Jacksonville & Peoria Interurban Railway Company, has filed a report with the Madison County Circuit Court at Edwardsville in which he recommends that the plan for the railway to generate electricity be abandoned, and that a 300-kw rotary converter be purchased and installed in a substation, which would be erected at a point 16 miles north of Alton, at a cost of about $6,000. It is proposed to purchase electrical energy to operate the railway from the Alton Gas & Electric Company.

ARCOLA, ILL.—Orders have recently been placed by the Arcola Electric Light Company for a new engine and generator, to cost $5,500, preparatory to establishing a twenty-four-hour service. The company is negotiating with the City Council of Arthur to furnish electricity for lighting the streets of the city. The company offers to supply four street lamps at $1,000 per year. If this proposition is accepted a transmission line will be erected to Arthur, which would probably be extended to Chesterville. The erection of a transmission line to Hindsboro is also under consideration.

CHICAGO, ILL.—The Public Service Company of Northern Illinois has increased its capital stock from $1,000 to $25,000.

CHICAGO, ILL.—The capital stock of the West Hammond Gas & Electric Company has been increased from $5,000 to $15,000.

CHICAGO, ILL.—Application has been made to the City Council by the Chicago City Railway Company for a franchise to double-track and extend several of its lines in Chicago.

CHICAGO, ILL.—Plans are being considered by the Dearborn Street Improvement Association for erecting ornamental lamps on Dearborn Street between Polk and East Lake Streets, which will involve an expenditure of about $50,000. It is proposed to erect standards similar to those on Michigan Avenue in the downtown district.

DECATUR, ILL.—The contract for excavation work for main building and power plant at the Decatur and Macon County Hospital has been awarded to Cope & McDonald.

FRANKFORT, ILL.—It is reported that plans are being considered for organizing an electric-light company in Frankfort by the local business men.

GEORGETOWN, ILL.—The Georgetown Electric Light Company has applied to the City Council for a ten-year extension to its franchise. The company was originally granted a twelve-year franchise seven years ago. The city is considering the question of changing the arc lamp street-lighting system for tungsten lamps. Under the present contract the city has thirty arc lamps, for which it pays $75 each per year.

LITCHFIELD, ILL.—Bids will be received by the city clerk of Litchfield, Ill., until Dec. 18 for lighting the streets of the city. The specifications call for eighty-five lamps to burn all night. The contract with the local company expires Jan. 1, 1912.

MANHATTAN, ILL.—The Economy Light & Power Company, of Joliet, Ill., is extending its transmission lines to Manhattan to supply electricity for lighting the town.

MOKENA, ILL.—The Economy Light & Power Company, of Joliet, Ill., is negotiating with the village officials for a franchise to supply electricity in Mokena and a contract for lighting the streets of the village. The company asks for a fifty-year franchise and a ten-year contract for street lighting. It is estimated that twenty-two three-unit cluster lamps and fifteen single street lamps will be required to light the streets. It is proposed to erect a transmission line from Joliet to Mokena.

PEORIA, ILL.—Orders have been placed by the Illinois Traction System with the General Electric Company, of Schenectady, N. Y., for one 750-600-volt rotary converter, three H-25-kw transformers and a switchboard for its Bondsville station.

PEORIA, ILL.—Preliminary steps have been taken by the Peoria Gas & Electric Company to extend its service to Eureka, Roanoke and [illegible], Ill. The company has secured a contract to supply power [illegible] Eureka plant. The company will extend its transmission [illegible]

from Washington. The cost of the proposed extension is estimated at $15,000.

QUINCY, ILL.—The light committee of the City Council is asking for bids for the installation of eighteen ornamental lamp standards and lamps to be installed in and around Washington Square.

RUSHVILLE, ILL.—Sealed proposals will be received at the office of the city clerk, Rushville, Ill., until Dec. 4 for furnishing material and labor for improvements to the municipal water-works system, consisting of approximately 2400 ft. of 6-in. class B cast-iron pipe; 500 ft. 10-in. class C cast-iron pipe; 23,700 ft. 10-in. 75-lb. pressure wood-stave pipe; 3300 ft. 10-in. 125-lb. pressure wood-stave pipe; 1300 lb. special castings; 16 ft. x 20 ft. brick building; one 250-gal. per minute horizontal multi-stage turbine pump driven by a 30-hp, 200-volt, 60-cycle, single phase motor; one 450-gal. per minute horizontal, single-stage turbine pump driven by a 20-hp, 220-volt, 60-cycle, single-phase motor; one 250-gal. per minute horizontal multi-stage turbine pump driven by a 30-hp internal combustion engine; one well 22 ft. deep and 12 ft. in diameter, and a 6600-volt transmission line about 29,000 ft. in length. Plans and specifications may be seen at the office of the city clerk, Rushville, Ill., or in the office of the Fuller-Coult Company, engineers, Chemical Building, St. Louis, Mo. Extra sets of plans and specifications may be procured upon payment of $3 to cover cost of printing same.

TALLULA, ILL.—The local electric-light plant has been purchased by [illegible] Brothers, of Petersburgh, Ill. The new owners have been granted a fifty-year franchise to operate an electric-lighting system in the village and a contract to light the streets of the village for a period of [illegible] years. Sixty incandescent lamps of 50 cp will be installed. The new owners will overhaul the plant at once.

VIRDEN, ILL.—The electric plant of the Virden Electric Light Company has been leased to W. M. Stowell and B. F. Tucker, of Decatur, Ill., who will operate the same.

WASHBURN, ILL—The plant and holdings of the Washburn Electric Company are reported to have been purchased by Messrs. Hollenback & Vorhees, of Fairbury. It is understood that the new owners will make extensive improvements to the system and establish a twenty-four-hour service.

ANDERSON, IND.—The Board of Public Works has notified the merchants that the city will erect on all streets in the business section of the city lamp standards for cluster lamps, the posts to be 25 ft. apart. The city will agree to install the ornamental street-lighting system and prorate the cost in monthly instalments on the merchants' bills for electricity for lamps.

ANGOLA, IND.—It is reported that the plant of the Angola Railway & Light Company will be rebuilt. The property was purchased by Pittsburgh capitalists at a receiver's sale for $33,000.

KENDALLVILLE, IND.—The City Council has appropriated $5,000 for the installation of a boulevard lighting system. Standards for the new system have been ordered.

SOUTH BEND, IND.—The Chapin Park Improvement Association is contemplating the installation of new cluster lamps on Park Avenue from Navarre Street to the Cutter residence, Riverside Drive. It is understood that the necessary funds have been procured.

CEDAR RAPIDS, IA.—Plans are being considered for extensive improvements to the local power plant of the Rock Island lines which will involve an expenditure of about $49,000. It is expected that work will begin on the improvements next year. H. U. Mudge, of Chicago, Ill., is president of the company.

CORYDON, IA.—Bids will be received by the town of Corydon, Ia., until Dec. 5, for the reconstruction of the electric-light plant, including boilers, engine, generator and electrical apparatus. The Iowa Engineering Company, of Clinton, Ia., has charge of the engineering work. J. J. C. Bower is town clerk.

FAIRFIELD, IA.—The Commercial Club has submitted a proposition to the City Council relative to the installation of an ornamental street-lighting system in this city. It is proposed to have the citizens pay for the lamp standards and lamps and the city supply electricity and maintain same. Plans are also being considered to place the wires underground. The present plans call for the erection of 100 standards, each carrying five lamps.

KEOKUK, IA.—Plans are being considered to replace the arc lamps now in use on Main Street with electroliers, each carrying five lamps. If the change is made the city will bear part of the expense.

MANCHESTER, IA.—Work has begun on the erection of the new power house of the E. W. Hoag light and power plant, which was recently destroyed by fire. Orders have been placed for new machinery and electrical equipment.

MOUNT VERNON, IA.—W. S. Tasker, who has been granted franchises to install and operate electric-light systems in Mount Vernon, Lisbon, Springville and Stanwood, has paid into the treasury of Mount Vernon $4,000, the balance due on the $5,000 which he agreed to pay the town for the franchise. Work will soon begin on the installation of the system and connecting up various towns.

KANSAS CITY, KAN.—Bids will be received by G. B. Little, city clerk, City Hall, Kansas City, Kan., until Dec. 5 for furnishing all material and labor for erection upon foundations furnished by the city of an arc-lamp equipment called for in specifications and for furnishing 50 arc lamps, f. o. b. cars Kansas City, Kan.

LEAVENWORTH, KAN.—The report submitted by Burns & McDonald, Kansas City, Mo., consulting engineers, engaged by the city commissioners to prepare the plans for the pumping station, provides for the installation of a combined electric-light plant and pumping station, to cost approximately $800,000. The plans submitted provide for a water plant of about twice the capacity needed at present, a filter system and an electric-power plant with sufficient output to provide for lamps for the entire city.

WICHITA, KAN.—Plans are being considered for the installation of an ornamental street-lighting system in Wichita, 3 miles in length, at a cost of $10,126, the expense to be borne by the city at large.

CAMPBELLSVILLE, KY.—The electric plant of the Campbellsville Electric Light Company was destroyed by fire on Nov. 15, causing a loss of about $30,000. The company carried no insurance. Many improvements had recently been made to the plant.

AUGUSTA, MAINE.—The American Volsam Company, recently incorporated with a capital stock of $100,000, proposes to dig, mine or quarry clays, earths, minerals, etc., and also proposes to generate and sell electricity as an auxiliary to its principal business. E. J. Pike is president and L. J. Coleman treasurer of the company.

LEWISTON, MAINE.—The City Council has contracted with the Holyoke Machine Company, of Holyoke, Mass., for a new waterwheel and accessories. The improvements will cost about $1,500 and will increase the output of the plant by 150 hp.

MONSON, MAINE.—The Greenville Light & Power Company, of Greenville, Maine, is erecting another substation at the Portland-Monson slate quarry, near the one erected about a year ago.

SOUTH BREWER, MAINE.—The Eastern Manufacturing Company, of Bangor, Maine, is preparing plans to enlarge its pulp plant in South Brewer, work on which will begin next spring. The company has contracted with the Bangor Railway & Electric Company for electrical energy to operate its entire plant. The contract calls for 3000 hp.

BOLTON, MASS.—Plans are being considered for the installation of an electric-lighting system in Bolton.

BOSTON, MASS.—The Boston Finance Commission has reported adversely to the Mayor on the proposition to build a central power plant at Deer Island, to cost approximately $180,000. The commission stated that the fire risk from the present plant is not excessive and would not be greatly reduced by a new plant.

EASTON, MASS.—The Board of Selectmen has granted the Edison Electric Illuminating Company, of Brockton, Mass., a franchise to erect its transmission lines in certain parts of the town, including the village districts of North Easton, Unionville and Easton Centre.

GROVELAND, MASS.—Plans are being considered for extensions to the municipal electric-light plant to provide for the increasing demand for street and commercial lighting. An appropriation of $900 will be asked for.

LEICESTER, MASS.—The Selectmen have signed a contract with the Worcester Electric Light Company for lighting the streets of the town for a term of three years. Under the terms of the contract the company will furnish 40-watt tungsten street lamps at the rate of $16 each per year, which is a reduction of $2 per lamp paid under the old contract. The company will supply electricity to the town for other purposes at 15 cents per kw-hour.

NORTHAMPTON, MASS.—The Northampton Street Railway Company has been granted a franchise to extend its system in Northampton.

SEEKONK, MASS.—The Seekonk Electric Company, recently incorporated, has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue $25,000 in capital stock for the purpose of establishing an electric-light plant to supply electricity in the towns of Seekonk and Swansea. The company, it is said, proposes to take over the property of the Narragansett Electric Light Company. Extensions will be made as necessary to furnish the towns of Swansea and Somerset with electrical service.

TAUNTON, MASS.—The East Taunton Street Railway Company is planning to build an electric railway from Middleboro to Kingston, via Plympton, where it will connect with a railway from Plymouth to Brockton and Whitman.

DETROIT, MICH.—At a meeting of the stockholders of the Detroit Edison Company held Nov. 15 the stockholders voted to increase the capital stock of the company from $9,000,000 to $15,000,000. At an early date $1,500,000 of the new stock will be offered to the stockholders, pro rata, at par.

MUSKEGON, MICH.—The United States Circuit Court has affirmed the decision of the lower court in the case of the Muskegon Traction & Lighting Company against the city of Muskegon in favor of the city. The company served an injunction against the city to prevent it from issuing $75,000 in bonds voted by the citizens for the installation of a municipal electric-light plant.

PONTIAC, MICH.—The large power plant of the Rapid Motor Vehicle Company was recently sold by the General Motors Company to the Pontiac Power Company. The plant was built by the General Motors Company, and was intended to supply light, heat and power to the Rapid and Carter car factories.

ANNANDALE, MINN.—The installation of an electric-lighting system in Annandale is reported to be under consideration.

[illegible] issue carries, it may result in the purchase of the plant of the Duluth [illegible] a substantial reduction in rates.

FOLEY, MINN.—The Battery Company, of Milwaukee, Wis., is reported to have received a franchise to install an electric-light plant in Foley. Otto Jensen is local manager.

GILBERT, MINN.—The School Board has decided to install an electric-power plant to supply electricity for lamps and motors for the new high school and the grade school. The cost of the plant is [illegible]

MINNEAPOLIS, MINN.—Following a conference between representatives of the Minnesota River Improvement & Power Company and Congressman R. C. Stevens, of St. Paul, Minn., a definite proposition for maintaining with the government's aid a 4-ft. channel as far as Morton will be made. The new depth will admit of utilization of power at certain points by the company.

FULTON, MO.—The City Council has granted the Buffum Telephone Company, which operates the local exchange, a new franchise. The company, it is understood, is contemplating the construction of a new plant in Fulton, to cost approximately $40,000.

KIRKSVILLE, MO.—The Kirksville Gas, Heat & Electric Company has increased its capital stock from $50,000 to $100,000.

LAMAR, MO.—Bids will be received by the city clerk of Lamar, Mo., for $70,000 water-works and electric-light bonds.

ST. CHARLES, MO.—The St. Charles Electric Light & Power Company has asked the City Council to consider an extension of its franchise for twenty years. The company's franchise expires in 1914 and the company offers a reduction in the price of electricity if granted the extension asked for. A special election will have to be called to submit the proposition to the voters.

ST. JOSEPH, MO.—Plans are being considered to enlarge the municipal electric-light plant to provide for commercial service. A committee has been appointed to look into the proposition of equipping the plant for commercial lighting. It is said that Eugene H. Spratt, president of the Public Utilities Commission, is in favor of the project.

ST. JOSEPH, MO.—The St. Joseph Railway, Light & Power Company has submitted a form of contract to the Board of Public Works for the installation of sixteen additional blocks of ornamental street lamps in the business district of the city. Under the terms of the contract the city is to pay $8,000 for conduits, the company is to install and maintain the lamp standards, and the property owners and tenants are to bear the expense of electricity for maintaining the lamps. The contract is for a term of five years.

MOORE, MONT.—The Citizens' Electric Company, of Lewiston, Mont., is installing a new street-lighting system in Moore. Motors will also be installed in the near future to operate the pumps of the municipal water-works system, which will soon be ready for operation. The electric company is contemplating a number of improvements to the local system. It expects to complete its transmission line into Hilger early in the spring.

ELY, NEV.—A movement is under way for the construction of a new electric light and power plant to supply electrical service in this city by E. K. Hutchinson and C. F. Rose, of Ely. It is proposed to lease the power station and distributing system owned by the Ely Light & Power Company.

SEARCHLIGHT, NEV.—Plans are being considered by the Marion Mining Company for the installation of electric-hoisting machinery.

WINNEMUCCA, NEV.—The Board of County Commissioners of Humboldt County has engaged Burns & McDonald, of Kansas City, Mo., consulting engineers, to prepare plans and specifications for the installation of an electric-light plant and water-works system at Winnemucca.

CONCORD, N. H.—Plans are being considered for the installation of an ornamental street-lighting system in Concord to replace the arc lamps now in use in the business section.

FITZWILLIAM, N. H.—The New Hampshire Electric Light Company, which recently purchased the plant and holdings of the Troy & Jaffray Electric Light Company and assumed its contracts, has applied to the Selectmen of Fitzwilliam for a franchise to erect a transmission line in Fitzwilliam to supply electrical service in this town. The company is planning to erect a transmission line from a point on the Connecticut River Company's line at Gardner through Winchendon to Fitzwilliam, Richmond and Winchester, N. H.

WINCHENDON, N. H.—The property of the Troy & Jeffrey Electric Light Company has been purchased by the New Hampshire Electric Light Company, recently incorporated. The new company has a contract with the Connecticut River Power Company for electrical power. It proposes to erect a transmission line from some point on the Connecticut Company's line at Gardner, through Winchendon, Fitzwilliam, Richmond and Winchester. The New Hampshire Electric Light Company has applied to the Selectmen of Winchendon for a franchise in this town.

KINGSTON, N. H.—The Public Service Commission has authorized the Exeter & Hampton Electric Company to engage in business in th town of Kingston.

MANCHESTER, N. H.—The Central New Hampshire Power Com pany has secured a right-of-way for the erection of a transmission lin across Hillsboroough County, passing through Goffstown, Bedford, Mer rimack and Hudson to the state line.

PLAISTOW, N. H.—The Plaistow Electric Light & Power Compan has been granted permission by the Public Service Commission to con struct and operate an electric plant to supply electricity for lamps an motors in Plaistow, and also to issue $1,500 in capital stock.

BLOOMFIELD, N. J.—The Town Council has authorized the Mayo and clerk to enter into a contract with the Public Service Electri Company to light the streets of the municipality for a period of fiv years. The Council has abandoned the project of establishing a mu nicipal electric-light plant for the present.

NEWARK, N. J.—Proposals will be received at the office of th Board of Education of Newark, N. J., until Nov. 27 for furnishin labor and material to erect complete the regular and special lightin fixtures for the Central Commercial and Manual Training High Schoo Blank proposals may be obtained at the construction department of th Board of Education, 9-11 Franklin Street, Newark, N. J., where con tract and drawings and specifications may be examined. R. D. Argu is secretary of the board.

LAS CRUCES, N. M.—The Mountain States Telephone & Telegrap Company, recently granted a franchise to operate a telephone syste in Las Cruces, is planning to erect an exchange building, to cost abou $10,000.

WILLARD, N. M.—Plans are being considered for the installatic of a large electric power plant to supply electricity to operate pum for irrigation purposes in Willard, N. M. The proposed plant will co approximately $125,000. Harry Curtin, of Clarksburg, W. Va., is i terested in the project.

DUNDEE, N. Y.—Owing to the Board of Trustees and E. L. Baile proprietor of the local electric-light plant, being unable to come to agreement, the street-lighting service has been discontinued. The tru tees are now unable to pay as much for the service as has been pa for the past two years, and the service offered at the new price, $1,60 was unsatisfactory to the board. Mr. Bailey offered to exchange t 80-cp lamps which are now used, or furnish the 80-cp lamps with midnight service. The company has been receiving $1,800 for the pa two years, which is more than the village should pay on the ratio its tax. It is said that Mr. Bailey proposes to submit the matter the Public Service Commission.

GREENE, N. Y.—A special election was held Nov. 23 to vote the proposition to purchase new electrical equipment for the munici electric-light plant, including one 50-kva, 1200-volt, single-phase, 60-cy Westinghouse generator; one 75-kw exciter, one switchboard pan with necessary instruments complete, and a new set of field coils f the Westinghouse generator now in use.

LITTLE FALLS, N. Y.—The Utica Gas & Electric Company h submitted a new bid to the Council for lighting the streets of the ci The company offers to supply arc lamps at the rate of $75 per lamp year for a period of five years, with provision that if the city shou establish a municipal lighting plant inside of one year the contr would terminate at that time. The company submitted a bid a sh time ago offering to supply the service at $82.13.

MEDINA, N. Y.—The Public Service Commission, Second Distri has authorized the A. L. Swett Light & Power Company, of Medi N. Y., to exercise franchises granted by the town of Somerset in village of Barker, which provide for the erection and operation an electric-light plant in those localties.

NEW YORK, N. Y.—Sealed bids will be received by Patrick Whitney, commissioner of correction, until Nov. 28 for furnishing lal and material for rewiring buildings known as the kitchen and laun in the Boys' Reformatory and warden's house on Hart's Island, N York, N. Y. Blank forms and further information can be obtained plans and drawings may be seen at the office of the Department Correction, Borough of Manhattan, 148 East Twentieth Street, N York, N. Y.

ROCHESTER, N. Y.—The residents of South Fitzhugh Street considering the question of installing a new lighting system on streets between Spring and Troup Streets.

ST. JOHNSVILLE, N. Y.—The substation of the East Creek E tric Light & Power Company, at the western end of the village, recently damaged by fire.

WARSAW, N. Y.—The plant and holdings of the Warsaw & Electric Company have been purchased by Edmond D. Hamlin, Avon, N. Y.; Ellis L. Phillips, of New York, N. Y., and George Olmstead, of Ludlow, Pa. It is said that new owners have purcha the plant at Perry, and are also negotiating for another plant i nearby town.

CONCORD, N. C.—A deal has been closed whereby Bird S. Co of Coler & Company, New York, N. Y., and president of the No Carolina Public Service Company, Greensboro, N. C., has secured controlling interest in the Piedmont Carolina Railway, of Conc N. C. This company operates the Greensboro, High Point and o traction properties. It is understood that the Concord railway later be extended to Salisbury as part of the interurban system.

SHELBY, N. C.—The Lily M[illegible] & P[illegible] [illegible] N. C., has awarded contract for the [illegible] for use in emergencies and during low-water periods. The building will be about 32 ft. x [illegible] ment will have a generating capacity of about 300 hp.

CLEVELAND, OHIO.—Bids will be received at the office of the Director of Public Service, City Hall, Cleveland, Ohio, until Nov. 28 for furnishing arc lamps with necessary transformers, regulators and converters or rectifiers for the municipal electric-light plant. A. B. [illegible] is director of public serv[illegible]

DAYTON, OHIO.—The capital stock of the National Light Company has been increased from $50,000 to $100,000.

TOLEDO, OHIO.—The Toledo & Indiana Traction Company is preparing to extend its railway from Bryan, Ohio, to Angola, the eastern terminus of the Bucklen line.

[illegible] NO, OKLA.—The [illegible] Interurban Railway Company [illegible] the construction of a new substation at Banner. The [illegible] will consist of one [illegible] kw rotary converter, three [illegible]ers and switchboard.

SULPHUR, OKLA.—The city of Sulphur, it is reported, has accepted the proposition of the Tecumseh Interurban Railway Company, under which the city is to give the company as a bonus a site for depot [illegible] and a franchise to operate the city line from the Artesian Hotel to Bromide Spring. Work is to begin on the proposed railway within six months.

CRESWELL, ORE.—Plans are being prepared by the Eugene Belt Line & Interurban Railway Company, recently incorporated, for the construction of an electric railway in Creswell. The citizens have raised a bonus of $25,000. P. C. Lavey is president of the company. The office of the company is located in Eugene, Ore.

ECHO, ORE.—Work has commenced on the installation of a street-lighting system in the business district of the city.

EUGENE, ORE.—Plans have been adopted for ornamental lamp standards for the street lamps on Willamette Street. Instructions have been given to order tne necessary material. The first installation will require 110 standards, each carrying five 60-cp tungsten lamps. The Water Board proposes to extend the tungsten lamps through the entire city as soon as possible.

MEDFORD, ORE.—The Siskiyou Electric Company, which recently purchased the property of the Rogue River Electric Company, it is said, is planning to construct two new plants, one at Fall Creek, which will develop 4000 hp, and the other on the Klamath River, where 10,000 hp will be developed. The company proposes to combine all the plants in the same system, which, with the new Prospect plant and the plant at Gold Ray, will give the company a combined output of 27,000 hp. Announcement is also made that the company proposes to add two more units of 10,000 hp each to the Prospect plant. The Prospect plant is located in the mountains on the Crater Lake road, 50 miles from [illegible]rd.

NYSSA, ORE.—The Idaho-Oregon Light & Power Company has been granted a franchise to supply electricity in Nyssa. The company is planning to extend its transmission line from Boise to Weisner and the line will pass through this city. Several large pumping plants to be operated by electricity are being installed by the company in this [illegible]n.

PORTLAND, ORE.—The River Mill dam and power house of the Portland Railway, Light & Power Company at Estacada was put into operation on Nov. 6. The plant when completed will generate about [illegible],000 kw.

ELIZABETH, PA.—The West Penn Electric Company, it is reported, [illegible] contemplating the construction of a large power plant on Cheat River.

JOHNSTOWN, PA.—The Southern Cambria Railway Company is planning to build a line to Colver and Carrolltown, a distance of about [illegible] miles, as soon as its extension from Johnstown to Ebensburg is com[illegible]

SPRING CITY, PA.—Proposals will be received by the Board of Trustees of the Eastern Pennsylvania State Institution for the Feeble-Minded and Epileptic, care of Philip H. Johnson, architect, 1824 Land [illegible] Building, Philadelphia, Pa., until Nov. 27, for the erection, fur[illegible] and equipping of a power house and laundry for the Eastern [Penn]sylvania State Institution for the Feeble-Minded and Epileptic, at [Sprin]g City, Pa. Plans and specifications and form of contract may [be se]cured on application to Philip H. Johnson, architect, 1824 Land [Ti]tle Building, Philadelphia, Pa., for which a deposit of $100 will be [req]uired, which will be refunded on return of plans.

FLANDREAU, S. D.—At an election held recently the citizens voted [to] grant a franchise to C. Ladd to construct and operate an electric-[lig]ht plant in Flandreau.

CHATTANOOGA, TENN.—The Chattanooga, Rome & Atlanta Rail[wa]y Company, recently organized, proposes to build an electric inter[urb]an railway from Chattanooga through Fort Oglethorpe, Rome and [th]e cities to Atlanta, in the heart of Georgia. The capital stock of [th]e company in Tennessee is nominally placed at $100,000. The com[pan]y will be chartered under the laws of Georgia, with a capital stock [of] $2,000,000. It holds franchises through Chickamauga Park secured [by] S. W. Divine years ago from the federal government. John H. [illegible] and associates are interested in the new company.

COWAN CITY, TENN.—It is reported that plans are being considered for the installation of a municipal electric-light plant in Cowan City.

AUSTIN, TEX.—Plans have been prepared for the construction of a 15-ft. dam across the Colorado River, a few miles below Austin, and for the installation of a small hydroelectric power plant for furnishing electricity for operating machinery for the farmers in that section and for irrigating several thousand acres of valley land. The cost of the proposed enterprise is estimated at about $50,000. D. B. Matthews, Charles Jones and Goodwin Jones are interested in the project.

BEAUMONT, TEX.—The Beaumont Electric & Power Company has been organized by the Stone & Webster Engineering Corporation, of Boston, Mass., which recently acquired the electric plant of the Beaumont Ice, Light & Refrigerating Company. The new company is capitalized at $880,000 and proposes to make extensive additions and improvements to the plant. It is reported that the company also proposes to build an electric railway from Beaumont to Port Arthur. The directors are: C. W. Kellogg, Jr., of Dallas, Tex.; Marshall Phinney, of Boston, Mass.; E. J. Emerson, of Beaumont, Tex.; L. C. Bradley, of Galveston, Tex.; David Daly, Harry L. Harding and W. A. Stevens, of Houston, Tex.

CALDWELL, TEX.—New equipment is being installed at the electric and ice plant of Womack & Nelms, including a 125-hp tubular boiler. A 75-kw generator has recently been installed, doubling the output of the plant.

DALLAS, TEX.—Arrangements are being made to double the output of the power plant of the Dallas Electric Light & Power Company, to provide for the increasing demand for electrical service. The present plant has a generating capacity of 5800 kw. The output of the plant will be increased by 5000 kw. It is understood that improvements will be made to the local street-railway system. The Dallas station will also supply energy to operate the Dallas-Waxahachie Interurban line, which will begin operation next year. Two substations will be erected, one near Lancaster and the other near Waxahachie.

DECATUR, TEX.—The City Council has purchased the local electric-light plant and water-works system, owned by J. F. Cooper, of Ft. Worth, Tex., for $10,000. The purchase is contingent upon the ratification of a bond issue sufficient to pay for the plant and to put the system in running order. Since the fire the town has been without electrical service. The water-works system is in operation.

GREENVILLE, TEX.—The City Council has granted a franchise to Joseph F. Nichols to construct an electric railway through the city. This railway, it is said, is part of an interurban line which Mr. Nichols and associates are interested in.

GREENVILLE, TEX.—Plans are being prepared for the construction of an electric railway between Blue Ridge and Gainesville, via Greenville, a distance of about 75 miles. It is expected that work will begin on the road about Jan. 1. A. Ralph Nicholson is interested in the project.

GEORGETOWN, TEX.—Extensive improvements are being made to the local water and light plant, which will involve an expenditure of about $50,000. An increased water supply has been secured by sinking a well.

HARLINGEN, TEX.—The City Council has engaged Randall, Lovegrove & Wyman, of Houston, Tex., to take charge of the construction of the proposed electric-light plant and water-works system, for which bonds were recently issued.

SAN ANTONIO, TEX.—The San Antonio Traction Company is planning to extend its South Flores street-car line to the irrigated gardens owned by F. F. Collins and others, a distance of about 1 mile.

SAN BENITO, TEX.—Plans have been adopted for the extension of the San Benito & Rio Grande Railway Company to Santa Maria. This extension, it is said, is to be completed by the first of the year. Plans are being considered for other extensions next year. Samuel Robertson, engineer and contractor, is at the head of the company.

SHERMAN, TEX.—Plans are being prepared for the installation of pumps and other machinery in the municipal electric-light and water plant in Sherman. Harvey McDuffie is superintendent.

TEXARKANA, TEX.—The Texarkana Gas & Electric Company is reported to have been given a bonus of $5,000 to build an extension of its railway from its present terminus in Rose Hill on Seventh Street to Westmoreland Heights.

TIMPSON, TEX.—The local electric-light plant, owned by Mrs. Warren Victory, has been purchased by George M. Bliss, of Warrensburg, Mo.

TIOGA, TEX.—The Tioga Traction Company, recently organized, contemplates the construction of an electric railway from Tioga to Gainesville, via McKinney, a distance of about 50 miles. J. P. Mason, M. Bradley, of Tioga, and others are interested in the project.

BURLINGTON, VT.—The court has modified the injunction brought by the Burlington Light & Power Company against the city whereby the city may make improvements to the municipal electric plant, the cost not to exceed $30,000. It also prohibits the city from entering into any further contracts for commercial lighting beyond those now existing until further order from the court.

ATTALIA, WASH.—The Pacific Power & Light Company has been granted a fifty-year franchise to erect transmission lines over the streets and alleys in Attalia. The Grinnell Company, which recently

. [illegible] ...cation project, is planning to install an electric [illegible]

CENTRALIA, WASH.—The Washington Union Coal Company is planning to build an electric-light and power plant at its coal properties at Tono, Wash., to cost about $250,000.

HUNTSVILLE, WASH.—The Pacific Power & Light Company has applied to the County Commissioners of Columbia County for a franchise to erect and maintain transmission lines for the transmission and distribution of electricity and also to operate telegraph and telephone lines over and across the streets in Huntsville.

MILWAUKEE, WIS.—According to the present plans electricity for lighting the city hall will be supplied from the municipal incinerator plant after Feb. 1, 1912.

SHOSHONI, WYO.—The City Council has granted the Boysen Power & Irrigation Company a franchise to supply electricity in Shoshoni for lamps and motors for a period of twenty-five years.

NELSON, B. C., CAN.—Preparations are being made by the Athabasca Development Company for the installation of an electric plant at its mines in the Nelson district, near Nelson, B. C. It is expected that electrical equipment will be installed during the winter. Charles J. Riley is manager of the company.

OTTAWA, ONT., CAN.—Sealed tenders will be received by C. J. Desbarats, deputy minister of naval service, Department of the Naval Service, Ottawa, Ont., Can., until Nov. 28 for supply of copper and brass sheets, bars, tubes and copper wire for electrical circuits. Forms of tender and further particulars may be obtained on application to the above office.

OTTAWA, ONT., CAN.—Plans are being considered for developing three rapids in the St. Lawrence River, entirely in Canadian territory, the Cedars, Cascades and Coteau. Sir Max Aitken, who organized the Canadian cement trust, is at the head of an English syndicate which proposes to organize a company to be capitalized at $100,000,000 with a charter from the Dominion government. The project is supposed to be an enlarged merger of several companies already interested in power enterprises along the St. Lawrence River above Montreal.

PORT COLBORNE, ONT., CAN.—It is reported that plans are being considered by the Niagara, St. Catharines & Toronto Railway Company to extend its railway from Port Colborne to Fort Erie, and from there to Niagara Falls.

TORONTO, ONT., CAN.—The City Council is considering the question of submitting to the ratepayers on Jan. 1, 1912, a by-law to appropriate $1,500,000 for the completion of the municipal electric-light plant. The original amount voted by the ratepayers was $2,750,000, making the total cost of the system $4,250,000.

AGUA CALIENTE, SONORA, MEX.—Preparations are being made by C. W. Phillips and associates for the installation of a 100-ton electrostatic plant and electric transmission line at their Penn-Sonora mine at Agua Caliente.

IXTLAN, MEX.—The Navidad Mining Company is reported to have made application to the federal government for a concession to build a hydroelectric power plant upon the Navidad River, near Ixtlan. The company proposes to construct a dam across the river and erect a transmission line from the power plant to its mines.

VERA CRUZ, MEX.—It is reported that the local electric street-railway system has been purchased by American capitalists. It is understood that the new owners will make extensive improvements to the property and construct new lines.

New Industrial Companies.

THE BONFORD MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $25,000 to manufacture and sell motor vehicles, etc. The incorporators are: George Brauburger, 1026 Lafayette Street, Elizabeth, N. J.; Edward I. Kleinfeld, 502 West 173d Street, and Morris Klein, 80 East 116th Street, New York, N. Y.

THE ELECTRIC ENGINEERING COMPANY, of Sioux City, Ia., has been incorporated with a capital stock of $10,000 by E. L. Snyder, Harry J. Ryan and Ralph A. Oliver.

THE ENOS & WATKINS COMPANY, of New York, N. Y., has been incorporated by Alanson T. Enos, 120 East Seventy-fourth Street, New York, N. Y.; Howard E. Watkins, 15 Blackburn Road, and Francis K. Nelson, 11 Blackburn Road, both of Summit, N. J. The company proposes to manufacture gas and electric fixtures.

THE HULBERT ELECTRIC-STEAM MANUFACTURING COMPANY, of San Francisco, Cal., has been chartered with a capital stock of $50,000 by A. C. Hulbert, G. H. McKissick, C. E. Freshour, C. V. and N. J. Caruso.

THE LIGHTING STUDIOS COMPANY, of New York, N. Y., has been incorporated by L. W. Young, G. V. Kent, of New York, N. Y., and S. Dickson, of Hoboken, N. J. The company is capitalized at $40,000 and proposes to manufacture and deal in electric fixtures, chandeliers, etc.

New Incorporations.

PUEBLO, COL.—The Arkansas Valley Railway, Light & Power Company has been incorporated with a capital stock of $10,000,000 by W. F. Raber, T. H. Devine, and F. W. Insull. The company proposes to build an electric railway connecting Pueblo with the towns and cities in the Pueblo Valley. The company plans to penetrate the agricultural region along the Arkansas Valley and erect transmission lines on both sides of the river to supply the farmers with electricity for irrigation purposes.

WILMINGTON, DEL.—The Southern Idaho Water Power Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000. The incorporators are: F. H. Shive, S. E. Roberson, Harry W. Davis, all of Wilmington, Del.

NEZ PERCE, IDAHO.—Articles of incorporation have been filed for the Lewis County Electric Company with a capital stock of $200,000 for the purpose of operating an electric-light and power plant. C. F. Cunningham is agent of the company.

Personal.

DR. EDWARD G. ACHESON delivered an address, by special invitation, before the Society of Chemical Industry, London, on Nov. 7, o[n] the subject of "Deflocculation."

MR. J. A. WALLS, chief engineer of the Pennsylvania Water & Power Company, Holtwood, Pa., who has been ill from overwork fo[r] the past three months, has returned to his post at McCall's Ferr[y] greatly improved in health.

MR. R. L. THAYER, well known in the electrical field in the West, i[s] now manager of the electrical department of the Lester-Hiland Com[-] pany, dealer in specialties for steam and electric railways, with offic[es] in the Railway Exchange, Chicago.

MR. K. B. THORNTON, chief engineer of the operating departmen[t] of J. G. White & Company, New York, has resigned to accept the pos[t] of chief engineer and operating manager of the Canadian Light & Power Company, of Montreal, Quebec.

MR. J. L. ROBERTSON, formerly the general manager of the Elec[-] trical Installation Company, of Baltimore, has joined the Consolidate[d] Gas, Electric Light & Power Company, of Baltimore, and will hav[e] charge of its house and store wiring department.

MR. W. L. MANN, superintendent of operation of the Shawiniga[n] Water & Power Company, Montreal, Quebec, has severed his con[-] nection with that company and entered the employ of the York Have[n] Water & Power Company, York Haven, Pa., as general manager.

MR. R. G. BLACK, superintendent and chief electrician of the Toront[o] Electric Light Company, Toronto, Ont., sailed on the S.S. *Baltic* fro[m] New York, Nov. 15, for a three months' sojourn in Europe in que[st] of health. Mr. Black has been ailing for some time and will consu[lt] eminent specialists on his case.

MR. FREDERICK B. EAVES has accepted a position on the comme[r-] cial staff of the Bryant Electric Company in New England and New Yor[k] State. He had previously been connected with Stone & Webster and th[e] Boston Edison Company and more recently with E. W. Ham, o[f] Worcester, Mass., in which position he acquired very valuable experienc[e].

MR. FRED W. HULME, formerly with Rumsey Brothers, of Phil[a-] delphia, has joined forces with the Triumph Electric Company in [its] sales department and will be attached to the New York office. Mr. Hulm[e] will specialize on motor application for machine-tool drive work and pa[r-] ticularly on the new line of Triumph alternating-current motors for el[e-] vator service, etc.

MR. L. R. SCHNEIDER, secretary to Mr. David Daly, general man[-] ager of the Houston Electric Company, of Houston, Tex., met with [a] fall of 100 ft. from an aeroplane piloted by Aviator Bonney at Housto[n] on Nov. 15. Both men were buried beneath the wreckage of the machi[ne] but managed to escape unhurt. The arrangements of the aviation me[et] were in charge of Mr. Daly as chairman of the committee.

MR. H. L. PARKER has resigned as illuminating engineer of t[he] Consolidated Gas, Electric Light & Power Company, of Baltimore, [in] which capacity he had charge of store-lighting and electric-sign ca[m-] paigns and organized a house-wiring department. Upon his depart[ure] Mr. Parker was tendered a farewell supper by the commercial depa[rt-] ment of the company. Mr. Parker will soon take up another line [of] work, and until then his address will be Geneva, Ohio.

MR. RICHARD P. READ has been appointed manager of the ne[w] business department of the Montreal Light, Heat & Power Compa[ny,] Montreal, Quebec, vice Mr. B. G. McNabb, whose death from accid[ent] was noted in these columns Nov. 11. Mr. Read was born in N[ew] York City, May 19, 1881, and graduated from Cornell in 1901. [For] eight years he was engaged in advertising and sales-promotion w[ork] in New York, and for the past two years he has been located in Montr[eal] with the gas and electric interests.

MR. GLENN C. WEBSTER, manager of the engineering departm[ent] of the National Electric Lamp Association, Cleveland, started Fri[day,] Nov. 17, on an extended Western trip. On Friday afternoon he g[...]

an address on the "Value of Co-operation in Modern Business Enterprises" at the banquet of the [illegible] Manufacturers' Association, at Toledo. He is now on his way to Los Angeles, where he will have general oversight [illegible] Association's exhibit at the electrical "Fiesta" exposition. Mr. Webster expects to make a study of industrial conditions in San Francisco and other Coast cities, returning to Cleveland late in December.

GEN. GEORGE H. HARRIES, president of the Louisville Lighting Company and the Louisville Gas Company, was tendered a testimonial banquet at the Willard Hotel in Washington, D. C., by the citizens of that community, which he served in various capacities for many years. He received a number of handsome gifts, including a silver service from the citizens and another from the Washington Railway & Electric Company; a smoking outfit and table from the baseball team of the Board of Trade, and a portfolio of testimonials from business men. Toasts to General Harries in his various capacities of newspaper man, soldier, civic worker, citizen and constructive genius [illegible] by many prominent guests, including Mr. H. M. [illegible], of Chicago.

MR. G. LOBO, who has joined the technical staff of the Kelvin [illegible] Company, recently incorporated, and with offices at 78 Wall Street, New York, is a full member of the A. I. E. E., and has been doing engineering work in New York City since the beginning of this year. Previous to that time he was located in Mexico [illegible] where he was a member of [illegible] & Company, in the general electrical contracting and machinery business. Mr. J. H. Shearer, who has joined the same company, has been connected with various enterprises the last three years in the South, and more lately in New York. Previous to that time he was in the contracting business in the city of Mexico, under the name of the Shearer Electric Construction Company.

MR. JAMES G. POMEROY, for seventeen years manager of the Chicago office of the Adams-Bagnall Electric Company, will be sales manager of that company with headquarters in Cleveland ,after Jan. 1. Mr. Pomeroy made his entrance into the electrical business with the old Electrical Supply Company of Chicago in 1888. In 1891 he went with the Brush Electric Company, and three years later he engaged with the Adams-Bagnall company. Few electrical men in the West have a wider circle of acquaintances than "Jim" Pomeroy, as he is called by his intimates, and his record has been one of success. He was one of the organizers of the Electric Club of Chicago, of which he was a member of the board of managers for two years and treasurer for one year. He is also an associate of the American Institute of Electrical Engineers, and a statesman-at-large of the Sons of Jove. His promotion is well deserved.

MR. JACQUES ABADY, M. I. M. E., a director of the English firm of Alexander Wright & Company, Ltd., engineers and manufacturers of measurement and control apparatus, sailed for London via Quebec, Nov. 17, after a two weeks' visit with Alexander Wright & Company's American branch, the Precision Instrument Company, of Detroit. In addition to his business activities, Mr. Abady is a barrister, chairman of the works committee of the Council of Westminster, and is the author of "Abady's Gas Analyst's Manual," published in this country; "Coal and Common Sense," "The A B C of Combustion," and other contributions to technical literature. He is one of the co-inventors of the Simmance-Abady combustion recorder, Simmance-Abady vacuum and pressure gages and other apparatus for testing various conditions of steam, gas, water and air. His visit was partly with the object of discussing several new inventions, which have passed the experimental stage and which will shortly be on the market for general use in steam and gas plants.

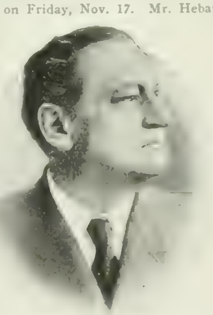
MR. L. R. POMEROY, New York, N. Y., has resigned as chief engineer of the railway and industrial division of J. G. White & Company, New York, to open an office as a consulting engineer in New York. Mr. Pomeroy will make a specialty of the design of railway and industrial plants, the rehabilitation of shops and the analysis of machine-tool [illegible]tion with relation to electric and effective operation, and will prepare reports and appraisals of railway and manufacturing properties. In [illegible] line of work Mr. Pomeroy has had a long experience and has become [illegible]. He was assistant general manager of the Schenectady Locomotive Works from 1899 to 1901. From 1901 to 1908 Mr. Pomeroy [illegible] representative of the railway department of the General [illegible] Company, where he specialized in the electrification of steam [illegible]ls, railway shop applications, etc. For the two years following he was [illegible]ant to the president of the Safety Car Heating & Lighting Company, and in 1910 he resigned from that company to join J. G. White & Company, Inc. Mr. Pomeroy will have his office at 50 Church Street, New York.

MR. PHILIP S. DODD, director of publicity of the National Electric Lamp Association, has just returned from an extended trip to the Pacific Coast, made in behalf of the Commercial Section of the National Electric Light Association, of which Mr. Dodd is secretary. The trip was made with the particular idea in mind of meeeting the necessities of the commercial man's problems in every section of the country. Mr. Dodd visited in turn Denver, Salt Lake City, Reno, San Francisco, Portland and Seattle, returning through San Francisco, Reno, Denver, Minneapolis and Chicago. Following the Jovian convention at Denver, Mr. Dodd was appointed national statesman of that order. In Seattle, in conjunction with Mr. H. M. Winters, the energetic manager of the sales department of the Seattle Electric Company, a lunch club was formed to effect a co-operation of the electrical interests of the city, to devise ways and means for assisting the local committee in the entertainment of the delegates to the Seattle convention of the National Electric Light Association, to promote the work of the commercial section in that part of the country, and to work toward the introduction of a people's electrical page similar to that conducted by the electrical interests in other sections. At San Francisco a complimentary luncheon was given to Mr. Dodd by Messrs. John F. Britton, T. E. Bibbins and E. B. Strong, at which he referred incidentally to the value of co-operative effort in various sections of the country and emphasized the very satisfactory results which had followed the introduction of the "Co-operative Electrical Page" in other cities. A lunch club was also formed at San Francisco to carry on a work similar to that indicated in the case of Seattle. Mr. Dodd will stay for a short time in Cleveland, and will then go to New York to organize the central bureau of the commercial section, and on Dec. 1 will open an office at 29 West Thirty-ninth Street, where the work will be carried on in close connection with the office of Secretary Martin.

Obituary.

MR. GEORGES D'INFREVILLE died last week in New York City. Mr. d'Infreville was born Feb. 23, 1846, at the Château de Creullet, near Caen, Normandy, France. By his paternal grandmother he was a direct descendant of the Marquis de Dupliex, the celebrated governor of French India, and another ancestor, the Marquis d'Infreville, was superintendent of the French navy under Cardinal Richelieu. Mr. d'Infreville had the right to bear title, which, however, he disclaimed, stating on one occasion that as an American citizen he did not believe in titles. He received a collegiate education and was appointed to the Military Academy of St. Cyr, receiving upon graduation a commission in the Fench army. He served as an officer during the Franco-German war, being preesnt at the battles of Borny, Rezonville and Gravelotte. Mr. d'Infreville came to America in 1872, and soon afterward invented a successful duplex system of telegraphy, selling the right of use to a number of telegraph companies and to the Pennsylvania Railroad Company, the patent finally being purchased by the Western Union Telegraph Company. He also invented a telephone call system, which was sold to the Bell Telephone Company. Mr. d'Infreville was chief electrician of the Atlantic & Pacific Telegraph Company, and later, for five years, dating from 1881, was chief electrician for the Western Union Telegraph Company. During this stage of his career he frequently appeared in the courts as an expert in electrical and telegraphic litigation. After leaving the Western Union Company he took up the manufacture of batteries for telegraph use.

MR. GEORGE W. HEBARD, acting vice-president of the Westinghouse Electric & Manufacturing Company, died at his home in New York City on Friday, Nov. 17. Mr. Hebard was born in Barre Center, N. Y., in 1845, and was therefore sixty-six years of age. He had been in poor health for some time previous to his death. Mr. Hebard was identified with the early history of the manufacture of electrical apparatus, becoming president of the United States Electric Lighting Company of Newark in 1882, and had associated with him, as directors, Messrs. Marcellus Hartley, Anson Phelps Stokes, Charles R. Flint, Henry B. Hyde, Charles F. Brooker, Leonard Curtis, and other well-known men. Mr. Hebard was connected with the early history of the generation and distribution of electricity for lighting in New York City as a director



GEORGE W. HEBARD.

and stockholder of the United States Illuminating Company. In this position he had to do with the equipment of the Weston lighting system on the Brooklyn Bridge, parts of which are still in service. Later, as president of the United Electric Light & Power Company, he was closely affiliated with the introduction of the alternating-current system in New York City by means of the overhead system. He was active later on in the change of the distribution system from the overhead to underground. The improvement of the system of distribution from the standpoint of the central station was also one of his most successful labors. At the time the United States company was taken over by the Westinghouse company, Mr. Hebard was president of the United company, and in the re-organization he was made vice-president of the Westinghouse company, and in 1888, when this company took over the Sawyer-Man company, Mr. Hebard received charge of the newly acquired organization. Besides his active participation in his chosen profession, Mr. Hebard was also very active in social, religious and philanthropic work in New York. He was a member of the Tompkins Avenue Congregational Church, Brooklyn, having been superintendent of the Sunday school for some time. He was a man of genial disposition, keen judgment, and a business man with a wonderful grasp of affairs. He was a member of the Union League, the Lawyers', the Engineers', and several other clubs.

Mr. H[illegible] a widow and two sons, Charles R., who is [illegible] who is in the [illegible] engaged prior to entering the electrical profession. The funeral took place from the Tompkins Avenue Congregational Church on Monday, Nov. 20.

MR. CARYL DAVIS HASKINS, [illegible] of the lighting department of the General Electric Company, died in Salt Lake City on Nov. 18, [illegible] Mr. Haskins was born in Waltham, Mass., in 1867 and obtained his early education in the public schools of Philadelphia and Dedham. In 1879 [illegible] Rugby and [illegible] dale schools, devoted to the preparation of boys for military and engineering work. Later he studied under the London University tuition system for about a year, but finally gave up the idea of a university course and returned to the United States, where he took up the study of biology. This was in 1887, and in the same year he again returned to England and entered the employ of Haskins, Davis & Company, of London and Boston, Mass., from which engagement the commencement of his technical work dates. After about six months, during which time he specialized on gas-engine work, Mr. Haskins entered the shops of S. Z. de Ferranti. Commencing at the lowest round of the ladder, he was advanced to the meter department, of which he became foreman. During this period he was also connected with some of the early work at the old Grosvenor and Deptford stations. Returning again to the United States, in 1889 Mr. Haskins entered the employ of the Thomson Electric Welding Company, at Lynn, Mass., in the capacity of designing draftsman, but was almost immediately transferred to the Thomson-Houston Electric Company as assistant foreman of the meter department at Lynn. Shortly afterward he was transferred from the shop and given charge of the company's outside meter interests. The consolidation resulting in the formation of the General Electric Company gave Mr. Haskins another promotion and placed him at the head of the meter interests of the consolidated company. In 1893 he was given, in addition, charge of the company's instrument department. In 1900 his responsibilities were again enlarged by including the switchboard department, which appointment necessitated his removing his office from Boston to Schenectady. While Mr. Haskins is professionally best known as a meter expert, he was an inventor in several branches. Among a score of patents granted to him are included the subjects of steel refining, meters, transformers, switches, circuit-breakers, time relays, etc. Perhaps his most important invention, as well as the most ingenious, is an auto-dirigible torpedo. For obvious reasons the principles of this torpedo have never been described in print. Mr. Haskins refused advances from foreign powers relative to this invention. During odd hours Mr. Haskins found time to devote to literary work. In 1892 he became the author of a book on transformers, which answered an excellent purpose in its day when printed information on this subject was very meager and eagerly sought. Of an entirely different nature is a book entitled "For the Queen in South Africa," a work of fiction consisting of six war stories. Since 1898 he had been in demand as a lecturer before the various army and navy institutes, and he had lectured and prepared papers for the War College, Washington; the School of Submarine Defence at Fort Totten, the Signal Corps School at Fort Leavenworth, Kan., and the Franklin Institute. He was scheduled to deliver an address on Feb. 19, 1912, before a local section of the National Electric Light Association on "The Electric-Lighting Industry, Past, Present and Future." Mr. Haskins was a contributor to the *Transactions* of the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illuminating Companies, the American Street Railway Association, the Northwestern Electrical Association and other electrical organizations. He also contributed many articles to the periodical press. When the rupture with Spain seemed probable Mr. Haskins promptly volunteered his services to the United States government. Having submitted a plan for raising a volunteer corps for submarine mining, coast and harbor defense, he was summoned before the chief of engineers, and his plans were approved. Upon his return to Boston he raised a battalion of electricians, numbering 160 men, immediate command of which body was given to him. This battalion was the first volunteer organization called out for military duty in connection with the Spanish War and was quietly at work some ten days before war was declared. Among other things, it mined Boston Harbor, installed searchlights in the harbor system of fortifications, erected and cared for a system of range and position finders, put up telephone and telegraph lines and planted submarine mines. At the conclusion of the war Mr. Haskins resumed his position with the General Electric Company. He had made a special study of electricity as applied to offense and, particularly, defense in time of war and was considered an authority on this subject, and after the close of the war he frequently acted in an advisory capacity to the government in matters of this nature. Mr. Haskins was a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the National Electric Light Association and was an associate member of the Military Service Institute and the United States Naval Academy. Mr. Haskins was very prominent in Schenectady society, being a member of the Mohawk Golf Club, the Mohawk Club, local branches of various engineering societies and the Antlers' Golf Club of Amsterdam. He was also a member of the Engineers' Club of New York and the Massachusetts Society of the Sons of the Revolution. He was greatly beloved by all his associates and had an unusually wide circle of friends who will long cherish the memory of his charming versatility and brilliant intellect. He is survived by a widow and one son, who were with him at the time of his death. Temporary interment of the body was made at Schenectady, where a brief funeral service was held on Nov. 22.

CARYL D. HASKINS.

IN MEMORIAM. CARYL DAVIS HASKINS.

The profession of electrical engineering has lost a beloved and distinguished member and his country a stanch patriot in the demise of Caryl Davis Haskins, who died of pneumonia in Salt Lake City, Saturday, Nov. 18. The bereavement is doubly poignant in that he was suddenly stricken down in the flower of his manhood with his career of distinguished achievement ever opening wider before him.

He was born in Waltham, Mass., May 22, 1867, and came by his intellectual power of good right, since he was the son of John S. Haskins, who in his youth had been John Ericsson's chief constructor on the *Monitor*, was later one of the engineers in charge of boring the Hoosac Tunnel and a generation ago was a conspicuous figure in mechanical engineering. The son, a victim in his childhood of a terrible fall which checked his stature but could not quell his physical activities or his splendid intellectual powers, went as a boy with his father to England and received his education mainly in English schools, including London University.

At one-and-twenty he was an electrical engineer with Ferranti in the beginning of the first great experiments with alternating-current lighting. Returning to his native country in 1889, he joined the forces of the Thomson-Houston company at Lynn and soon received charge of the electric-meter department, which he steadily built up for the next decade. A firm believer in the inherent equity of metering electrical energy, he devoted his great ingenuity to the improvement of the meter as an instrument, and labored assiduously and successfully to bring it into universal use in central-station supply. His inventions in the art of metering electricity and in kindred matters were numerous and important and his papers on the theory and practice of metering were no small factor in the steady growth of the art.

His mind was singularly versatile and the scope of his technical activities extremely wide. He early became intensely interested in the problems of national defense, especially with reference to torpedo warfare, and did some immensely interesting work in the development of dirigible and auto-dirigible torpedoes. The premonitory symptoms of the Spanish-American war found him with these very problems uppermost in his mind. He realized fully both the need for coast defense and the terrible state of unpreparedness in which the country groveled during the gloomy weeks that followed the destruction of the *Maine*. Finding that Boston was then practically without means of defense, and that the Corps of Engineers had neither sufficient men nor adequate material with which to extemporize defenses, he set himself the task, weeks before the outbreak of hostilities, of organizing a volunteer corps composed of trained engineers in various lines of activity, who could be put at the disposal of the United States Corps of Engineers to carry on its work efficiently and quickly. So assiduous and successful in this work was he that a three-company battalion of engineers was organized, officered and put in close touch with the United States engineers a month before the war broke out. It was ready for service at an hour's notice fully organized, had its entire program of work laid out for it and was in fact the first volunteer organization of any kind actually put into service for the war, for it was called out and set to work on the submarine defenses of Boston Harbor, laying cables for communications, loading and laying mines, building signal and range-finding stations, before there was any authority under which it could be mustered in as a military body and two weeks prior to the firing of the first gun. Mr. Haskins was in chief command of this organization and during its term of service carried the responsibilities and did the work of a major of engineers.

From the experience thus gained his interest in national defense was even more keenly aroused than before, and he devoted much energy to the development of submarine mining apparatus, so that the system now used in the United States service is in no small measure of his personal devising, and since that time he had been closely affiliated with the military and naval organizations, being a member both of the United States Naval Institute and of the Military Service Institution.

Shortly after the war the scene of his activities was transferred to the Schenectady works of the General Electric Company, where his widening sphere of influence soon made itself felt, and with his increasing responsibilities in other fields ended his more intimate association with electric metering. In later years he had charge of the immense lighting business of the General Electric Company, and no one was better known or more cordially liked by the central-station men of the country, whose friend and adviser he was to an extent that it is hard fully to realize. No man in the profession had more or warmer friends, and by them his death is most acutely felt.

His energy was [illegible] the [illegible] and observing [illegible] and with an alert imagination, [illegible] and his occasional short stories, [illegible] [illegible] into a volume, [illegible] sketches, [illegible] than these [illegible] literature. An enemy [illegible], a warm and loyal friend and a man whose ideals of patriotism and righteousness never wavered, his loss is greatly to be deplored.

He leaves behind a sister, a devoted wife, from whom in life he was inseparable, and a young [illegible] sympathy of a host of friends is extended.

[illegible]

Trade Publications.

ALTERNATING-CURRENT GENERATORS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued Bulletin No. 1075, devoted to [illegible]-type alternating-current generators. The machines described are rated at from 50 kva to [illegible] kva.

EXPULSION FUSES AND FUSE HOLDERS.—The General Electric Company has just issued Bulletin No. 4899, illustrating and describing its expulsion fuses and fuse holders. These are for use on circuits having voltages up to and including 110,000.

ELECTRIC SHEET STEEL.—[illegible] Brothers Company, Liberty Street and Second Avenue, Pittsburgh, Pa., has prepared for distribution curve sheets showing tests upon [illegible] electrical steel. The data shown on the curves relate to the loss in watts per pound for various thicknesses of sheets at different densities in lines per square centimeter. [illegible] are also given relative to the magnetizing force required for [illegible] the different magnetic densities.

LIGHTING FIXTURES.—The Federal Sign System (Electric), Chicago, has just issued a bulletin covering the entire Federal line of fixtures, steel shades, lock clamp sockets and bushings, and supplies. An interesting new line of porcelain-enameled steel fixtures is one of the features of the bulletin. A complete line of porcelain-enameled steel shades of new design is another feature of the bulletin, including shades of both concentrating and diffusing types that can be used to make a [illegible] of effective steel units. A new low-priced line of art glass [illegible] wall lamps and pedestals occupies several pages. The bulletin, as a whole, makes a complete and handy catalogue for the fixture dealer, central-station salesman or any electrician interested in the subject of illumination.

BATTERY TRUCK CRANE.—The General Electric Company has just placed on the market a new piece of apparatus known as a battery truck crane, which the company describes in its Bulletin No. 4872, recently issued. The machine is a [illegible] heavy storage-battery vehicle [illegible] mounted on its forward end a swinging crane, the hook of which is raised and lowered by [illegible] operated from the vehicle [illegible]. The vehicle is used in [illegible], hauling and unloading trailers [illegible] and unloading cars, [illegible] on the hook [illegible] or barrels, and for stacking. The running of the vehicle, hoisting and carrying are controlled by one man. The crane is equipped with special attachments to suit the carrying on of the work contemplated, and the height can be made to suit local conditions. The bulletin contains illustrations of the truck and crane in use and describes also [illegible].

BUSINESS NOTES.

MR. A. C. WILES, who formerly represented the A & W Sign Company in Baltimore, has taken charge of the company's Albany office. The Blumenthal-Kahn Electric Company has taken over the Baltimore agency for the sign company.

THE VALENTINE-CLARK COMPANY, of Minneapolis, has opened a sales office at St. Marie's, Idaho, for the handling of Northern and Western cedar poles in all points west of the Dakota-Montana line, in the State of Colorado and west thereof, and also in Texas. The office has been placed in charge of Mr. Neil Burrell and Mr. L. H. Clark.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has recently opened a district office in the Farmers' Bank Building, Pittsburgh. Formerly the Triumph company was represented by the Doubleday-Hill Electric Company in that territory, but the rapidly increasing business made it seem advisable to have direct representation in this important center. Mr. D. D. Gill will be in charge of the new office.

PRINTING-PRESS CONTROL.—Mr. C. B. Callow, London representative of Kohler Brothers, of Chicago, is in the United States and has been spending a little time in Chicago. Mr. Callow is engaged in the business of selling the system of electric printing-press control originated by Kohler Brothers, the foreign rights of which are still controlled by that firm, although the apparatus is made and sold in the United States by the Cutler-Hammer Manufacturing Company. It is reported that there has been an excellent foreign demand for this ingenious control.

BRUCE-MACBETH GAS ENGINE SALES.—A long list of recent sales by the Bruce-Macbeth Engine Company, Cleveland, Ohio, of vertical multo-cylinder gas engines, aggregating twenty-six engines, ranging from 35 hp to 350 hp, includes a number for electrical generation, as follows: To the Prospect Garage, Cleveland, 35-hp engine for storage-battery work; Patapsco (Md.) Electric & Manufacturing Company, 300-hp engine for municipal lighting; Exide Battery Depot, Cleveland, 135-hp engine, a second order; city of Canal Dover, Ohio, for municipal lighting, 300-hp engine, a second order; Hotel Southland, Dallas, Tex., 250-hp engine for elevators and lighting.

THE AMERICAN MILKING MACHINE COMPANY.—In the issue of April 20 an electrically driven milking machine was described which in its working principles departs materially from any other invention in this line. The American Milking Machine Company, which was recently formed for marketing this machine, has established offices at 29 Broadway, New York City. Mr. G. P. Wern is the president of the company and Mr. A. E. Sylven is general manager. Machines have been in actual service at several farms for some months past and the result is reported to be very satisfactory. At the recent Land and Products Show at Madison Square Garden, New York, the company had an interesting exhibit showing the machine in [illegible].

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 14, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,008,313. FIRE-ALARM SYSTEM FOR TELEPHONE EXCHANGES; W. L. Denio, Rochester, N. Y. App. filed April 5, 19[illegible]. Alarm [illegible] sends code number to central operator.

[illegible]. PULL-CHAIN GUIDE; [illegible] H. [illegible], N. J. App. filed June 21, 1911. [illegible] body.

[illegible]. ELECTRIC-CURRENT-SHUNTING DEVICE; R. W. W[illegible], Los Angeles, Cal. App. filed Oct. [illegible]. [illegible] resistance and slidable short-circuiting elements.

[illegible]. AUTOMATIC FIRE ALARM; [illegible] R[illegible], [illegible]. App. filed Dec. [illegible] grooved carrier.

1,008,383. PROCESS FOR CONVERSION OF LOWER OXIDES OF NITROGEN TO HIGHER OXIDES OF NITROGEN; [illegible], Wilmington, Del. App. filed Sept. 7, 1907. Electrolysis of the residual acids derived from nitration of cellulose and glycerine.

1,008,391. METHOD OF CONTROLLING VAPOR ELECTRIC APPARATUS; P. H. Thomas, East Orange, N. J. App. filed Feb. 9, 1904. A red-ray-supply gas is introduced and the vaporization of the mercury is retarded.

1,008,392. ELECTRIC SWITCH MECHANISM; G. S. Tiffany, Summit, N. J. App. filed Oct. 28, 1907. A plurality of [illegible] keys for a number of circuits.

1,008,408. TELEPHONE-RINGING DEVICE; H. N. [illegible], Kansas City, Kan. App. filed March 2[illegible]. A relay changes a direct ringing device into an inductive ringing device on an overload.

1,008,4[illegible]. SAFETY DEVICE FOR ELECTRICALLY HEATED IMPLEMENTS; H. A. H[illegible], Grand Rapids, Mich. App. filed Nov. 9, 1908. A fuse device for sadirons, etc.

1,008,423. ELECTRICAL CONDUCTOR; H. L. McIntyre, New York, N. Y. App. filed March 27, 1906. Polycircuit cable for telephones, etc.; untwisted but segregated mates to prevent cross-talk.

1,008,452. SELECTIVE SIGNALING SYSTEM; V. Durbin, Brookline, Mass. App. filed May 16, 1910. Train-dispatching telephone system; synchronizing apparatus. (Fifty-three claims.)

1,008,453. CONTROL SYSTEM FOR ELECTRIC MOTORS; A. C. Eastwood and H. F. Stratton, Cleveland, Ohio. App. filed March 18, 1910. For slow-speed lowering of hoisting systems.

[illegible]. ELECTRIC CONTROLLER; A. C. Eastwood, Cleveland, Ohio. App. filed Sept. 24, 1910. Separately actuated magnetic starting switches with means for holding the main switch in case any cut-out switch remains closed.

1,008,482. CONSTANT POTENTIAL ELECTRICAL SYSTEM; D. R. Lovejoy, Freneau, N. J. App. filed May 7, 1910. Resistance for adapting a high-voltage current to operating telephones, bells, etc.

1,008,495. CONTROL SYSTEM FOR ELECTRIC MOTORS; J. F. Schnable, Cleveland, Ohio. App. filed March 18, 1910. Safety device; permits the load to be lowered without a mechanical brake.

[illegible]. PROTECTIVE DEVICE; E. O. Schweitzer and N. J. [illegible], Chicago, Ill. App. filed April 12, 1910. A fuse under tension of a spring in a solution of carbon tetrachloride.

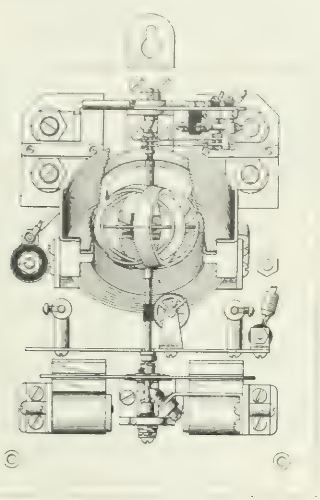
1,008,506. TROLLEY-WHEEL SUPPORT; C. A. Welsbacher and J. [illegible]

1,008,514. ELECTRIC SWITCH MECHANISM; R. W. Armstrong, New York, N. Y. App. filed Oct. 26, 1907. Pivoted key switches for switchboard.

1,008,521. ELECTRIC BLOCK-SIGNAL SYSTEM; W. J. Bell, Los Angeles, Cal. App. filed Dec. 2, 1908. Double-track trolley railway [illegible]

1,008,522. MOUTHPIECE FOR TELEPHONES; F. O. Beuermann, New York, N. Y. App. filed Nov. 11, 1910. Porcelain bell with metallic attaching ring.

1,008,525. SECONDARY BATTERY; C. J. Coleman, Rockaway, N. J. App. filed Oct. 7, 1903. Has a marginal insulating packing frame between the plates.



1,008,617.—Electric Meter.

1,008,535. MOLDED CONDUCTOR; E. G. Gilson, Schenectady, N. Y. App. filed March 7, 1910. Iron and graphite for a dynamo-electric machine brush.

1,008,543. TROLLEY; F. H. Howard, Reading, Pa. App. filed April 8, 1911. Removable ball-bearing wheel.

1,008,549. ELECTRICAL MEASURING INSTRUMENT; W. Klinckert, Berlin, Germany. App. filed April 8, 1908. D'Arsonval type, the magnetic element being readily dismounted.

1,008,560. SUPPORT FOR THIRD RAILS; W. B. Potter, Schenectady, N. Y. App. filed Oct. 21, 1905. A laterally extending bracket carries a yoke which supports the rail.

1,008,561. DYNAMO-ELECTRIC MACHINE; H. G. Reist, Schenectady, N. Y. App. filed May 19, 1909. Field-magnet structure with distributed winding.

1,008,562. ELECTRIC-MOTOR DRIVE; R. H. Rogers, Schenectady, N. Y. [illegible] Motors for driving the different sets of rolls of a paper-making machine.

1,008,571. HOLDING AND RELEASING DEVICE FOR ELECTRICAL INSTRUMENTS; H. B. Taylor, Albany, N. Y. App. filed Aug. 16, 1910. For protecting the parts of an incased instrument during shipment.

1,008,572. PROCESS AND APPARATUS FOR INSULATING ELECTRIC CONDUITS; C. Thibodeau, Cambridge, Mass. App. filed March 26, 1910. A tank with bath compound and a heated stripping die.

1,008,577. HIGH-FREQUENCY ALTERNATOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed April 26, 1909. A solid magnetic inductor is driven at high speed between the faces of the laminated stator rings.

1,008,580. ELECTRIC LOCOMOTIVE; A. F. Batchelder, Schenectady, N. Y. App. filed April 30, 1909. Two-truck type with separate motors, the wheels of each truck being connected.

1,008,581. ELECTRIC LOCOMOTIVE TRUCK; A. F. Batchelder, Schenectady, N. Y. App. filed Nov. 13, 1909. Two-truck type with universal hinge between the trucks.

1,008,582. ELECTRIC LOCOMOTIVE; A. F. Batchelder, Schenectady, N. Y. App. filed April 30, 1909. [illegible] motor armature and the shaft.

1,008,588. FILAMENT; W. D. Coolidge, Schenectady, N. Y. App filed Aug. 1, 1906. A tubular slitted filament of tungsten.

1,008,[illegible]7. ELECTRIC [illegible] App. filed Jan. 14, 1910. Compensating mechanism.

1,008,[illegible]2. ELECTRIC HE[illegible], Swampscott, Mass. App. filed March 18, 1909. A high-speed motor operating at its greatest ineffici[illegible] system for absorbing distributing the heat.

1,008,623. TRANSFORMER; M. O. Troy, Schenectady, N. Y. App. filed Feb. 2, 1911. Submerged terminal board.

1,008,625. MOTOR-CONTROL SYSTEM; H. E. White, Schenectady, N. Y. [illegible] June 19, 1909. Power and dynamic brake control.

1,008,628. BOILER CONSTRUCTION AND MEANS FOR MAKING THE SAME; C. A. Brown, Hinsdale, Ill. App. filed Aug. 1, 1910. The flues are welded to the heads.

1,008,629. FUSE ATTACHMENT FOR ELECTRIC LIGHTS; J. M. Cummings, Evansville, Ind. App. filed Jan. 31, 1911. In the handle of a portable lamp.

1,008,701. RHEOSTAT; L. Crump, Centralia, Mo. App. filed Nov. 23, 1910. A fluid of high resistance with immersed terminals.

1,008,728. VACUUM-TUBE ELECTRIC APPARATUS; D. McF. Moore, Newark, N. J. App. filed Feb. 7, 1906. Gas fed into the tube at a number of points for uniformity.

1,008,729. TENSION ADJUSTMENT FOR PULL SWITCHES; C. D. Platt, Bridgeport, Conn. App. filed Dec. 21, 1910. Frictional adjusting device for lamp sockets.

1,008,756. SELF-SWITCHING ALARM; B. Uhlmann, Garfield, N. J. App. filed July 26, 1910. Spring pressed push-button for doors.

1,008,806. METALLIC FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS, K. Farkas, New York, N. Y. App. filed Aug. 9, 1909. Tungsten power with a glutinous organic binder is heated in aluminum oxide and cerium oxide.

1,008,807. METALLIC FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS; K. Farkas, New York, N. Y. App. filed Aug. 9, 1909. Treatment as in Patent No. 1,008,866, but first in vacuo and then in oxygen.

1,008,811. STARTER AND REGULATOR FOR COMPOUND MOTORS; W. H. Caulke, Milwaukee, Wis. App. filed Feb. 6, 1911. Combined armature and field-current regulator.

1,008,852. STORAGE-BATTERY ELECTRODE AND PROCESS OF MAKING IT; W. Morrison, Des Moines, Ia. App. filed Sept. 29, 1911. Lead-peroxide plate bonded by celluloid.

1,008,853. STORAGE-BATTERY ELECTRODE AND PROCESS OF MAKING IT; W. Morrison, Des Moines, Ia. App. filed Sept. 29, 1911. The active material is bonded by rubber.

1,008,854. STORAGE-BATTERY ELECTRODE AND PROCESS OF MAKING IT; W. Morrison, Des Moines, Ia. App. filed Sept. 29, 1911. The active material is bonded by the solid reaction products of lead oxide, a chromium salt and gylcerine.

1,008,860. ELECTROLYTE FOR ALUMINUM CELLS; F. W. Peck, Jr., Schenectady, N. Y. App. filed Feb. 5, 1909. Contains a borate and a tartrate of ammonium and glycerine.

1,008,870. THERMOSTATIC SWITCH; B. J. Smith, Modesto, Cal. App. filed April 5, 1911. For adjusting incubators, etc.

1,008,879. ELECTRIC CONNECTION PLUG; R. B. Wolcott, East Cleveland, Ohio. App. filed Feb. 19, 1910. Two-piece socket plug.

1,008,800. TELEPHONE REPEATING CIRCUITS; C. Adams-Randal, New York, N. Y. App. filed Dec. 20, 1910. Independent main-line circuits inductively related through local relay circuits.

1,008,881. TELEPHONE REPEATING SYSTEM; C. Adams-Randal New York, N. Y. App. filed Dec. 20, 1910. A plurality of inde pendent sending and receiving main-line circuits related inductively by a single relay.

1,008,882. CIRCUITS FOR TELEPHONE REPEATING SYSTEMS C. Adams-Randal, New York, N. Y. App. filed Jan. 3, 1911. In volves a relay connected from one side of one of the main lines to the ground.

1,008,913. COLLECTOR FOR TRAVELING CRANES AND THE LIKE; E. L. Hoofring, Vandergrift, Pa. App. filed April 5, 1909 The grooved collector bar is readily detachable from its support.

1,008,922. SOLDERING TOOL; H. P. MacLagan, Park Ridge, Ill. App filed June 20, 1910. The heating coil is in a shell which carries the soldering tip.

1,008,933. INCANDESCENT LAMP; S. D. Washburn, Boston, Mass App. filed Jan. 11, 1908. Two connected conical spirals.

1,008,937. ELECTRIC LOCOMOTIVE; A. F. Batchelder, Schenectady N. Y. App. filed April 30, 1909. Spring suspension system for the truck frames.

1,008,938. RAILWAY SWITCH SIGNAL; W. J. Bell, Los Angeles Cal. App. filed Dec. 2, 1908. Electric block system for trolley roads.

1,008,955. FIRE-ALARM BOX; F. W. Cole, Newton, Mass. App. filed April 25, 1908. Visual signal when the box needs rewinding.

1,008,959. BOND-WIRE-RETAINING NUT LOCK; W. E. Davin McKee's Rocks, Pa. App. filed March 7, 1911. Spring washer plat with a retaining finger.

1,008,960. FIRE-ALARM SYSTEM; W. L. Denio, Rochester, N. Y App. filed April 5, 1909. Thermostatic system with means for tes ing.

1,008,968. TROLLEY; H. Jolly, Pittsburgh, Pa. App. filed Jan. 1[illegible] 1911. Three rollers in the harp which can rock on the pole.

1,008,977. WAVE DETECTOR; T. H. Lyon, Renfrew, Pa. App. file Oct. 12, 1911. Cerusite.

1,009,008. ELECTRIC DENTAL HEATER; W. & D. Asch, Berlin Germany. App. filed Dec. 22, 1910. Hollow tongs for hardenin cement fillings in teeth.

1,009,013. ELECTRIC APPARATUS FOR TRANSMITTING AN RECEIVING SIGNALS; A. Barr and W. Stroud, Leeds, England App. filed Jan. 28, 1907. Step-by-step system for sending and ind cating gun ranges in artillery fire control.

1,009,015. ELECTRIC-SIGNAL-ACTUATING MECHANISM; W. Bell, Los Angeles, Cal. App. filed Feb. 13, 1911. Pivoted trolle actuated device.

13,312 (Reissue). CARTRIDGE FUSE; A. F. Daum, Pittsburgh, P App. filed June 14, 1910. Detachable end caps. Original Patent N. 961,716.

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CONTENTS

THE NATIONAL WATER-POWER SITUATION.

The present discussion of the whole water-power situation before the National Waterways Commission is an event of no small public importance, since upon the decisions reached will rest in large measure the policy of the next few years with reference to the utilization of the hydraulic resources of the country for the benefit of its people. It was a wise and proper thing for the commission to invoke the counsel of the American Institute of Electrical Engineers, in the hands of whose members rests for the most part the evolution of hydroelectric systems. The Institute, as President Dunn pointed out, is not a commercial body, but an organization for scientific and professional ends, and hence its suggestions could not properly take cognizance of the political and legal questions which are conspicuously to the front in the present discussion. Its proper function was merely to define the situation from the standpoint of those whose work it is to utilize the national hydraulic resources in the fullest and most complete way for the service of the public. Looking at the matter in its largest aspects, the great fundamental fact is that every cubic foot of water which tumbles seaward unutilized represents definite monetary loss to the nation. More than this, it implies continuing depletion of the coal supply, upon which the inroads of industry year by year are growing more and more formidable. It is no place here to discuss the magnitude of the total coal supply or the probable date of its complete destruction. It is enough to realize, as every thinking person must, that at the rapidly increasing rate of consumption now evident the cost of fuel must probably even in the lifetime of persons now living be very seriously increased by the combined effects of scanty supply, increasing distance of transportation and exigencies of deep mining. Hence the prompt utilization of water powers running to waste must be looked upon in the light of a public necessity. Therefore, it is the plain duty of the government to avoid obstructive measures. To delay the utilization of water powers for a generation means loss and not gain, for these powers will be none the greater through enforced idleness for a quarter or half a century. The Secretary of the Interior in addressing the National Waterways Commission the other day laid proper emphasis on these facts and called for a speedy agreement on a general policy that will encourage developments.

The brief submitted by the committee of the American Institute of Electrical Engineers is a specially valuable contribution to the discussion in that it calls attention to the nature of hydroelectric enterprises, and especially to the all-important fact that in such undertakings the capital charges are the chief and controlling items of expense. By reason of this fact any regulations that increase the

difficulty of getting capital at a reasonable rate of interest, that decrease its security when invested, or that hamper it with restrictions which compel large charges for sinking fund and similar expenses, are certain to increase the necessary price of electrical energy to consumers and may even, from the competition due to fuel, actually check developments altogether. The balance as between power derived from hydroelectric installations and that generated in modern steam plants is sometimes a rather delicate one, easily overset by even comparatively small additions to the fixed charges, which already represent a very large percentage of the possible earnings. The consumer does not care who is the ultimate owner of a water-power, but is interested only in securing a reliable power supply at a moderate cost. We take it that the chief function of the Waterways Commission is to formulate regulations insuring certainly to the people such utilization of water-powers as shall bring them precisely this advantage. So long as this end is secured we do not see the least reason for statutory enactments to prevent a large number of water-powers being utilized by the same enterprising persons. Electric supply is not a naturally competitive business, particularly if from hydroelectric plants, since it is perfectly certain as a matter of engineering that two hydroelectric systems operating in the same territory independently could be worked more economically by a physical consolidation, avoiding unnecessary duplication of lines and gaining the well-known advantages to be derived from operating a group of stations as a dynamical system.

A natural monopoly doing public service in virtue of public franchise is admittedly a proper subject for governmental regulation and control, and if this is properly exercised the consumer has no reason to fear the results. Nor is there any reason for granting franchises limited to a relatively short term if the right is reserved by the government of complete regulation, including adjustment of price at not infrequent intervals. A lease the value of improvements upon which may be extinguished in twenty-five or fifty years by limitation implies in some form extra fixed charges which must ultimately come out of the consumer, and if the government possesses the right of regulation and control of price, it makes not the slightest difference either to the government or to the consumer over whom these rights are actually exercised. Admitting such control, no one is the gainer by change of ownership or the loser by its continuance. As the ultimate object of control is to secure moderate and equitable prices to the consumer, the furthest length to which, in our view, the government is justified in going in the control and regulation of the sources of capital involved is to take rigorous measures to insure that water-powers shall not be exploited for speculative purposes and thereby burdened with interest charges on a fictitious capitalization. It must be admitted that the danger of this is considerable and that the government is fully justified in making stern regulations against it. If the ostensible investment in a particular proposition is $10,000,000, the apparently necessary fixed charges will be at least double those incurred if the actual capital is but $5,000,000, and the money necessary to pay the additional charges is necessarily derived from the consumer. In the interest of the public, therefore, the government is fully justified in insisting that its lessee shall build so as to keep their fixed charges down instea of piling them up.

The only conspicuously weak spot in the brief of th American Institute was the tacit assumption that water powers should be financed as they very commonly hav been in the past, the constructions being wholly on bor rowed money and no profit being ostensibly received unt a fair rate of interest on the entire capital investment ha already been paid. We do not believe it to be wise fo the government to encourage a method of exploitatio which expects to derive from the lease ample interest o double the real investment, unless the total interest charge are limited to a sum which is a fair return on the invest ment, considering the circumstances under which it made. Everybody realizes that industrial investments in volve risks, some of which were admirably pointed out i the Institute brief, and deserve a more liberal return tha one would expect to get, for instance, on government bonc or high-grade railway securities. On the other hand, man a plant now in existence ought to be reckoned as financiall prosperous if it is paying, with a comfortable margin fc sinking fund and renewals, 6 per cent interest on its bond ing issue, which very likely represents at least 25 per cer to 40 per cent more than the necessary actual expenses c the development. In other words, the question may legit imately arise as to whether those people who have real invested money in such a plant can reasonably expect mor than 8 or 10 per cent. It does not make any particula difference in the long run by what devices a reasonab rate of profit is secured, but it is certainly the duty of th government to see that the rate is open and above-boar and fair to all parties concerned.

As regards consolidations, it seems to us that the go ernment should pursue a very liberal policy so long as has the ultimate control. As we have many times show physical consolidations uniting isolated enterprises into coherent network are a very great benefit and ought to b encouraged. Consolidations involving common ownersh without competitive union are, assuming government reg lation, entirely harmless and at times beneficial. The on form of consolidation which the government should loo out for and suppress is such corporate consolidation unites plants, not so much for the purpose of economic administration, as to furnish a basis for the flotation additional securities, the interest charges of which mu be saddled on the consumer whom the government is u dertaking to protect. It is not a good thing for the pub if the earnings of the prosperous members of a consolid tion must be kept up at the expense of the community give a fictitious value to the securities issued on the ca and dogs of the organization somewhere else. In short, t more the government encourages legitimate consolidatio free from the taint of high finance the sooner will t hydraulic resources of the country be properly and efficie ly developed. The substance of the whole matter is th the government ought to adopt the most liberal policy w respect to leases and ownership, while holding with th utmost tenacity to its power of control and of regu tion.

STREET-LIGHTING TABLES FOR 1912

TWENTY-THIRD YEAR

These schedules are based on local mean time. Where standard time is used, and it varies considerably from sun time, the proper deduction or addition must be made.

Time from noon until midnight is in bold-face type; that from midnight until noon in light type. The light type shows time for the morning following the date of the night indicated.

January, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting	Light	Exting
1	5:15	6:20	4:30	6:20	5:15	12:00
1					4:30	6:20
2	5:15	6:20	No	light	5:15	12:00
3	5:15	6:20	No	light	5:15	12:00
4	5:15	6:20	No	light	5:15	12:00
5	5:15	6:20	5:15	7:00	5:15	12:00
6	5:15	6:20	5:15	8:20	5:15	12:00
7	5:20	6:20	5:20	9:40	5:20	12:00
8	5:20	6:20	5:20	10:55	5:20	12:00
9	5:20	6:20	5:20	12:05	5:20	12:05
10	5:20	6:20	5:20	1:15	5:20	1:15
11	5:20	6:20	5:20	2:20	5:20	2:20
12	5:25	6:20	5:25	3:30	5:25	3:30
13	5:25	6:20	5:25	4:35	5:25	4:35
14	5:25	6:20	5:25	5:40	5:25	5:40
15	5:25	6:15	5:25	6:15	5:25	6:15
16	5:25	6:15	5:25	6:15	5:25	6:15
17	5:30	6:15	5:30	6:15	5:30	6:15
18	5:30	6:15	5:30	6:15	5:30	6:15
19	5:30	6:15	5:30	6:15	5:30	6:15
20	5:30	6:15	5:30	6:15	5:30	6:15
21	5:30	6:15	6:05	6:15	5:30	6:15
22	5:35	6:15	7:10	6:15	5:35	6:15
23	5:35	6:15	8:15	6:15	5:35	6:15
24	5:35	6:15	9:20	6:15	5:35	6:15
25	5:40	6:10	10:30	6:10	5:40	6:10
26	5:40	6:10	11:35	6:10	5:40	6:10
27	5:40	6:10	12:50	6:10	5:40	6:10
28	5:40	6:10	2:10	6:10	5:40	12:00
28	...	..	...	..	2:10	6:10
29	5:45	6:10	3:25	6:10	5:45	12:00
29		....	....		3:25	6:10
30	5:45	6:10	4:35	6:10	5:45	12:00
30				..	4:35	6:10
31	5:45	6:05	No	light	5:45	12:00

February, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	5:45	6:05	No	light	5:45	12:00
2	5:45	6:05	No	light	5:45	12:00
3	5:45	6:05	5:45	7:30	5:45	12:00
4	5:45	6:05	5:45	8:30	5:45	12:00
5	5:50	6:00	5:50	9:45	5:50	12:00
6	5:50	6:00	5:50	11:00	5:50	12:00
7	5:55	6:00	5:55	12:10	5:55	12:10
8	5:55	6:00	5:55	1:15	5:55	1:15
9	5:55	6:00	5:55	2:25	5:55	2:25
10	5:55	5:55	5:55	3:30	5:55	3:30
11	6:00	5:55	6:00	4:30	6:00	4:30
12	6:00	5:55	6:00	5:30	6:00	5:30
13	6:00	5:55	6:00	5:55	6:00	5:55
14	6:05	5:50	6:05	5:50	6:05	5:50
15	6:05	5:50	6:05	5:50	6:05	5:50
16	6:05	5:50	6:05	5:50	6:05	5:50
17	6:10	5:50	6:10	5:50	6:10	5:50
18	6:10	5:45	6:10	5:45	6:10	5:45
19	6:10	5:45	6:10	5:45	6:10	5:45
20	6:10	5:45	7:15	5:45	6:10	5:45
21	6:10	5:45	8:20	5:45	6:10	5:45
22	6:10	5:40	9:30	5:40	6:10	5:40
23	6:15	5:40	10:40	5:40	6:15	5:40
24	6:15	5:40	11:55	5:40	6:15	5:40
25	6:15	5:35	1:00	5:35	6:15	12:00
25			....	....	1:00	5:35
26	6:15	5:35	2:20	5:35	6:15	12:00
26					2:20	5:35
27	6:15	5:35	3:25	5:35	6:15	12:00
27	..		...	....	3:25	5:35
28	6:20	5:30	4:15	5:30	6:20	12:00
28					4:15	5:30
29	6:20	5:30	No	light	6:20	12:00

March, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting	Light	Exting.
1	6:20	5:30	No	light	6:20	12:00
2	6:20	5:30	No	light	6:20	12:00
3	6:20	5:30	No	light	6:20	12:00
4	6:25	5:25	6:25	8:35	6:20	12:00
5	6:25	5:25	6:25	9:45	6:25	12:00
6	6:25	5:20	6:25	10:55	6:25	12:00
7	6:25	5:20	6:25	12:05	6:25	12:05
8	6:25	5:20	6:25	1:15	6:25	1:15
9	6:30	5:20	6:30	2:20	6:30	2:20
10	6:30	5:15	6:30	3:20	6:30	3:20
11	6:30	5:15	6:30	4:15	6:30	4:15
12	6:30	5:15	6:30	5:00	6:30	5:00
13	6:30	5:10	6:30	5:10	6:30	5:10
14	6:35	5:10	6:35	5:10	6:35	5:10
15	6:35	5:10	6:35	5:10	6:35	5:10
16	6:35	5:05	6:35	5:05	6:35	5:05
17	6:35	5:05	6:35	5:05	6:35	5:05
18	6:35	5:05	6:35	5:05	6:35	5:05
19	6:40	5:05	6:40	5:05	6:40	5:05
20	6:40	5:00	7:20	5:00	6:40	5:00
21	6:40	5:00	8:30	5:00	6:40	5:00
22	6:40	4:55	9:45	4:55	6:40	4:55
23	6:45	4:55	11:00	4:55	6:45	4:55
24	6:45	4:55	12:10	4:55	6:45	4:55
25	6:45	4:55	1:15	4:55	6:45	12:00
25	...	....	....	....	1:15	4:55
26	6:45	4:50	2:10	4:55	6:45	12:00
26	...	....			2:10	4:55
27	6:45	4:50	2:55	4:55	6:45	12:00
27	...	....	....	....	2:55	4:55
28	6:50	4:50	3:30	4:50	6:50	12:00
28				....	3:30	4:50
29	6:50	4:45	3:55	4:45	6:50	12:00
30	6:50	4:45	No	light	6:50	12:00
31	6:50	4:45	No	light	6:50	12:00

April, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	6:50	4:45	No	light	6:50	12:00
2	6:55	4:40	6:55	8:35	6:55	12:00
3	6:55	4:40	6:55	9:45	6:55	12:00
4	6:55	4:40	6:55	10:55	6:55	12:00
5	6:55	4:35	6:55	12:05	6:55	12:05
6	6:55	4:35	6:55	1:10	6:55	1:10
7	7:00	4:35	7:00	2:05	7:00	2:05
8	7:00	4:30	7:00	2:55	7:00	2:55
9	7:00	4:30	7:00	3:35	7:00	3:35
10	7:00	4:30	7:00	4:05	7:00	4:05
11	7:00	4:25	7:00	4:25	7:00	4:25
12	7:05	4:25	7:05	4:25	7:05	4:25
13	7:05	4:25	7:05	4:25	7:05	4:25
14	7:05	4:20	7:05	4:20	7:05	4:20
15	7:05	4:20	7:05	4:20	7:05	4:20
16	7:05	4:20	7:05	4:20	7:05	4:20
17	7:10	4:15	7:10	4:15	7:10	4:15
18	7:10	4:15	7:30	4:15	7:10	4:15
19	7:10	4:15	8:50	4:15	7:10	4:15
20	7:10	4:10	10:05	4:10	7:10	4:10
21	7:10	4:10	11:10	4:10	7:10	4:10
22	7:15	4:10	12:10	4:10	7:15	4:10
23	7:15	4:05	12:55	4:05	7:15	4:05
24	7:15	4:05	1:30	4:05	7:15	12:00
21	.	.	.	....	1:30	4:05
25	7:15	4:05	2:00	4:05	7:15	12:00
25	...	..	...	....	2:00	4:05
26	7:20	4:05	2:25	4:05	7:20	12:00
26		..	..	....	2:45	4:05
27	7:20	4:00	2:45	4:00	7:20	12:00
27	...	...	..	...	2:45	4:00
28	7:20	4:00	3:00	4:00	7:20	12:00
29	7:20	[illegible]	No	light	7:20	12:00
30	7:20	[illegible]	No	[illegible]	7:20	12:00

May, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting
1	7:20	4:00	No	light	7:20	12:00
2	7:20	4:00	7:20	9:50	7:20	12:00
3	7:25	3:55	7:25	10:55	7:25	12:00
4	7:25	3:55	7:25	11:55	7:25	12:00
5	7:25	3:55	7:25	12:45	7:25	12:45
6	7:25	3:50	7:25	1:30	7:25	1:30
7	7:25	3:45	7:25	2:05	7:25	2:05
8	7:30	3:45	7:30	2:35	7:30	2:35
9	7:30	3:45	7:30	3:00	7:30	3:00
10	7:30	3:45	7:30	3:20	7:30	3:20
11	7:30	3:45	7:30	3:40	7:30	3:40
12	7:30	3:45	7:30	3:45	7:30	3:45
13	7:35	3:45	7:35	3:45	7:35	3:45
14	7:35	3:45	7:35	3:45	7:35	3:45
15	7:35	3:40	7:35	3:40	7:35	3:40
16	7:35	3:40	7:35	3:40	7:35	3:40
17	7:35	3:40	7:35	3:40	7:35	3:40
18	7:40	3:40	9:00	3:40	7:40	3:40
19	7:40	3:40	10:00	3:40	7:40	3:40
20	7:40	3:40	10:55	3:40	7:40	3:40
21	7:40	3:35	11:33	3:35	7:40	3:35
22	7:40	3:35	12:05	3:35	7:40	3:35
23	7:45	3:35	12:30	3:35	7:45	3:35
24	7:45	3:35	12:50	3:35	7:45	3:35
25	7:45	3:35	1:10	3:35	7:45	12:00
25	...		.	....	1:10	3:35
26	7:45	3:35	1:30	3:35	7:45	12:00
26				...	1:30	3:35
27	7:45	3:35	1:55	3:35	7:45	12:00
27	.			....	1:55	3:55
28	7:45	3:35	2:20	3:35	7:45	12:00
29	7:45	[illegible]	No	light	7:45	12:00
[illegible]	7:45	[illegible]	No	light	7:45	12:00
[illegible]	7:45	[illegible]	[illegible]	[illegible]	7:45	12:00

June, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting.
1	7:50	3:35	7:50	10:40	7:50	12:00
2	7:50	3:35	7:50	11:25	7:50	12:00
3	7:50	3:35	7:50	12:05	7:50	12:05
4	7:50	3:35	7:50	12:35	7:50	12:35
5	7:50	3:35	7:50	1:00	7:50	1:00
6	7:55	3:35	7:55	1:25	7:55	1:25
7	7:55	3:35	7:55	1:45	7:55	1:45
8	7:55	3:35	7:55	2:00	7:55	2:00
9	7:55	3:35	7:55	2:20	7:55	2:20
10	7:55	3:35	7:55	2:40	7:55	2:40
11	7:55	3:35	7:55	3:05	7:55	3:05
12	7:55	3:30	7:55	3:30	7:55	3:30
13	7:55	3:30	7:55	3:30	7:55	3:30
14	7:55	3:30	7:55	3:30	7:55	3:30
15	7:55	3:30	7:55	3:30	7:55	3:30
16	7:55	3:30	7:55	3:30	7:55	3:30
17	8:00	3:30	9:30	3:30	8:00	3:30
18	8:00	3:30	10:05	3:30	8:00	3:30
19	8:00	3:30	10:30	3:30	8:00	3:30
20	8:00	3:30	10:55	3:30	8:00	3:30
21	8:00	3:30	11:05	3:30	8:00	3:30
22	8:00	3:30	11:40	3:30	8:00	3:30
23	8:00	3:30	12:00	3:30	8:00	3:30
24	8:00	3:30	12:25	3:30	8:00	3:30
25	8:00	3:30	12:50	3:30	8:00	3:30
26	8:00	3:30	1:25	3:30	8:00	12:00
26		....	....	....	1:25	3:30
27	8:00	3:30	No	light	8:00	12:00
28	8:00	3:30	No	light	8:00	12:00
29	8:00	3:30	No	light	8:00	12.00
30	8:00	3:30	8:00	10:05	8:00	12:00

July, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	8:00	3:30	8:00	10:35	8:00	12:00
2	8:00	3:30	8:00	11:05	8:00	12:00
3	8:00	3:30	8:00	11:25	8:00	12:00
4	8:00	3:30	8:00	11:45	8:00	12:00
5	8:00	3:30	8:00	12:05	8:00	[illegible]
6	8:00	3:30	8:00	12:25	8:00	12:25
7	8:00	3:30	8:00	12:45	8:00	12:45
8	8:00	3:30	8:00	1:05	8:00	1:05
9	8:00	3:35	8:00	1:30	8:00	1:30
10	8:00	3:35	8:00	2:05	8:00	2:05
11	7:55	3:35	7:55	2:55	7:55	2:55
12	7:55	3:35	7:55	3:35	7:55	3:35
13	7:55	3:35	7:55	3:35	7:55	3:35
14	7:55	3:40	7:55	3:40	7:55	3:40
15	7:55	3:40	7:55	3:40	7:55	3:40
16	7:55	3:40	8:30	3:40	7:55	3:40
17	7:55	3:45	9:00	3:45	7:55	3:45

August, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting	Light	Exting
1	7:40	3:55	7:40	10:10	7:40	12:00
2	7:40	3:55	7:40	10:30	7:40	12:00
3	7:40	[illegible]	7:40	10:45	7:40	12:00
4	7:40	[illegible]	7:40	11:10	7:40	12:00
5	7:35	[illegible]	7:35	11:30	7:35	12:00
6	7:35	[illegible]	7:35	12:00	7:35	12:00
7	7:35	[illegible]	7:35	[illegible]	7:35	[illegible]
8	7:35	[illegible]	7:35	[illegible]	7:35	[illegible]
9	7:30	4:15	7:30	[illegible]	7:30	[illegible]
10	7:30	4:15	7:30	[illegible]	7:30	[illegible]
11	7:30	[illegible]	7:30	4:05	7:30	4:05
12	7:30	4:05	7:30	[illegible]	7:30	4:05
13	7:25	[illegible]	7:25	4:05	7:25	4:05
14	7:25	4:10	7:25	4:10	7:25	4:10
15	7:25	4:10	7:25	4:10	7:25	4:10
16	7:25	4:10	8:05	4:10	7:25	4:10
17	7:20	4:10	8:30	4:10	7:20	4:10

September, 1912

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	7:00	4:25	7:00	9:35	7:00	12:00
2	7:00	4:25	7:00	10:05	7:00	12:00
3	6:55	[illegible]	6:55	10:35	6:55	12:00
4	6:55	[illegible]	6:55	11:20	6:55	12:00
5	6:55	[illegible]	6:55	12:20	6:55	12:20
6	6:50	[illegible]	6:50	1:30	6:50	1:30
7	6:50	[illegible]	6:50	2:50	6:50	2:50
8	6:50	[illegible]	6:50	4:15	6:50	4:15
9	6:45	4:35	6:45	4:35	6:45	4:35
10	6:45	4:35	6:45	4:35	6:45	4:35
11	6:45	4:35	6:45	4:35	6:45	4:35
12	6:40	4:35	6:40	4:35	6:40	4:35
13	6:40	4:35	6:40	4:35	6:40	4:35
14	6:40	4:35	6:40	4:35	6:40	4:35
15	6:35	4:40	7:25	4:40	6:35	4:40
16	6:35	4:40	8:00	4:40	6:35	4:40
17	6:35	4:40	8:40	4:40	6:35	4:40

Night of	Light	Exting.	Light	Exting	Light	Exting.
1	6:50	4:45	No	light	6:50	12:00
2	6:55	4:40	6:55	8:35	6:55	12:00
3	6:55	4:40	6:55	9:45	6:55	12:00
4	6:55	4:40	6:55	10:55	6:55	12:00
5	6:55	4:35	6:55	12:05	6:55	12:05
6	6:55	4:35	6:55	1:10	6:55	1:10
7	7:00	4:35	7:00	2:05	7:00	2:05
8	7:00	4:30	7:00	2:55	7:00	2:55
9	7:00	4:30	7:00	3:35	7:00	3:35
10	7:00	4:30	7:00	4:05	7:00	4:05
11	7:00	4:25	7:00	4:25	7:00	4:25
12	7:05	4:25	7:05	4:25	7:05	4:25
13	7:05	4:25	7:05	4:25	7:05	4:25
14	7:05	4:20	7:05	4:20	7:05	4:20
15	7:05	4:20	7:05	4:20	7:05	4:20
16	7:05	4:20	7:05	4:20	7:05	4:20
17	7:10	4:15	7:10	4:15	7:10	4:15
18	7:10	4:15	7:30	4:15	7:10	4:15
19	7:10	4:15	8:50	4:15	7:10	4:15
20	7:10	4:10	10:05	4:10	7:10	4:10
21	7:10	4:10	11:10	4:10	7:10	4:10
22	7:15	4:10	12:10	4:10	7:15	4:10
23	7:15	4:05	12:55	4:05	7:15	4:05
24	7:15	4:05	1:30	4:05	7:15	12:00
24	...	...	...	....	1:30	4:05
25	7:15	4:05	2:00	4:05	7:15	12:00
25	...	...	....	...	2:00	4:05
26	7:20	4:05	2:25	4:05	7:20	12:00
26	...	...	..	....	2:45	4:05
27	7:20	4:00	2:45	4:00	7:20	12:00
27	...	...	....	....	2:45	4:00
28	7:20	4:00	3:00	4:00	7:20	12:00
29	7:20	4:00	No	light	7:20	12:00
30	7:20	4:00	No	light	7:20	12:00

Night of	Light	Exting.	Light	Exting.	Light	Exting
1	7:20	4:00	No	light	7:20	12:00
2	7:20	4:00	7:20	9:50	7:20	12:00
3	7:25	3:55	7:25	10:55	7:25	12:00
4	7:25	3:55	7:25	11:55	7:25	12:00
5	7:25	3:55	7:25	12:45	7:25	12:45
6	7:25	3:50	7:25	1:30	7:25	1:30
7	7:25	3:45	7:25	2:05	7:25	2:05
8	7:30	3:45	7:30	2:35	7:30	2:35
9	7:30	3:45	7:30	3:00	7:30	3:00
10	7:30	3:45	7:30	3:20	7:30	3:20
11	7:30	3:45	7:30	3:40	7:30	3:40
12	7:30	3:45	7:30	3:45	7:30	3:45
13	7:35	3:45	7:35	3:45	7:35	3:45
14	7:35	3:45	7:35	3:45	7:35	3:45
15	7:35	3:40	7:35	3:40	7:35	3:40
16	7:35	3:40	7:35	3:40	7:35	3:40
17	7:35	3:40	7:35	3:40	7:35	3:40
18	7:40	3:40	9:00	3:40	7:40	3:40
19	7:40	3:40	10:00	3:40	7:40	3:40
20	7:40	3:40	10:55	3:40	7:40	3:40
21	7:40	3:35	11:33	3:35	7:40	3:35
22	7:40	3:35	12:05	3:35	7:40	3:35
23	7:45	3:35	12:30	3:35	7:45	3:35
24	7:45	3:35	12:50	3:35	7:45	3:35
25	7:45	3:35	1:10	3:35	7:45	12:00
25	...	...	...	...	1:10	3:35
26	7:45	3:35	1:30	3:35	7:45	12:00
26					1:30	3:35
27	7:45	3:35	1:55	3:35	7:45	12:00
27	.	..	....	....	1:55	3:55
28	7:45	3:35	2:20	3:35	7:45	12:00
29	7:45	3:35	No	light	7:45	12:00
30	7:45	3:30	No	light	7:45	12:00
31	7:45	3:30	No	light	7:45	12:00

Night of	Light	Exting	Light	Exting	Light	Exting
1	7:50	3:35	7:50	10:40	7:50	12:00
2	7:50	3:35	7:50	11:25	7:50	12:00
3	7:50	3:35	7:50	12:05	7:50	12:05
4	7:50	3:35	7:50	12:35	7:50	12:35
5	7:50	3:35	7:50	1:00	7:50	1:00
6	7:55	3:35	7:55	1:25	7:55	1:25
7	7:55	3:35	7:55	1:45	7:55	1:45
8	7:55	3:35	7:55	2:00	7:55	2:00
9	7:55	3:35	7:55	2:20	7:55	2:20
10	7:55	3:35	7:55	2:40	7:55	2:40
11	7:55	3:35	7:55	3:05	7:55	3:05
12	7:55	3:30	7:55	3:30	7:55	3:30
13	7:55	3:30	7:55	3:30	7:55	3:30
14	7:55	3:30	7:55	3:30	7:55	3:30
15	7:55	3:30	7:55	3:30	7:55	3:30
16	7:55	3:30	7:55	3:30	7:55	3:30
17	8:00	3:30	9:30	3:30	8:00	3:30
18	8:00	3:30	10:05	3:30	8:00	3:30
19	8:00	3:30	10:30	3:30	8:00	3:30
20	8:00	3:30	10:55	3:30	8:00	3:30
21	8:00	3:30	11:05	3:30	8:00	3:30
22	8:00	3:30	11:40	3:30	8:00	3:30
23	8:00	3:30	12:00	3:30	8:00	3:30
24	8:00	3:30	12:25	3:30	8:00	3:30
25	8:00	3:30	12:50	3:30	8:00	3:30
26	8:00	3:30	1:25	3:30	8:00	12:00
26		...	....	..	1:25	3:30
27	8:00	3:30	No	light	8:00	12:00
28	8:00	3:30	No	light	8:00	12:00
29	8:00	3:30	No	light	8:00	12:00
30	8:00	3:30	8:00	10:05	8:00	12:00

July, 1912

Night of	Table No. 1 All-Night Lighting		Table No 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	8:00	3:30	8:00	10:35	8:00	12:00
2	8:00	3:30	8:00	11:05	8:00	12:00
3	8:00	3:30	8:00	11:25	8:00	12:00
4	8:00	3:30	8:00	11:45	8:00	12:00
5	8:00	3:30	8:00	12:05	8:00	12:05
6	8:00	3:30	8:00	12:25	8:00	12:25
7	8:00	3:30	8:00	12:45	8:00	12:45
8	8:00	3:30	8:00	1:05	8:00	1:05
9	8:00	3:35	8:00	1:30	8:00	1:30
10	8:00	3:35	8:00	2:05	8:00	2:05
11	7:55	3:35	7:55	2:55	7:55	2:55
12	7:55	3:35	7:55	3:35	7:55	3:35
13	7:55	3:35	7:55	3:35	7:55	3:35
14	7:55	3:40	7:55	3:40	7:55	3:40
15	7:55	3:40	7:55	3:40	7:55	3:40
16	7:55	3:40	8:30	3:40	7:55	3:40
17	7:55	3:45	9:00	3:45	7:55	3:45
18	7:55	3:45	9:20	3:45	7:55	3:45
19	7:55	3:45	9:40	3:45	7:55	3:45
20	7:50	3:45	10:00	3:45	7:50	3:45
21	7:50	3:45	10:25	3:45	7:50	3:45
22	7:50	3:45	10:55	3:45	7:50	3:45
23	7:50	3:50	11:25	3:50	7:50	3:50
24	7:50	3:50	12:05	3:50	7:50	3:50
25	7:50	3:50	12:50	3:50	7:50	3:50
26	7:50	3:50	1:45	3:50	7:50	12:00
26	...	...	....	..	1:45	3:50
27	7:45	3:50	No	light	7:45	12:00
28	7:45	3:55	No	light	7:45	12:00
29	7:45	3:55	No	light	7:45	12:00
30	7:45	3:55	7:45	9:30	7:45	12:00
31	7:40	3:55	7:40	9:50	7:40	12:00

August, 1912

Night of	Table No. 1 All-Night Lighting		Table No 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting	Light	Exting
1	7:40	3:55	7:40	10:10	7:40	12:00
2	7:40	3:55	7:40	10:30	7:40	12:00
3	7:40	4:00	7:40	10:45	7:40	12:00
4	7:40	4:00	7:40	11:10	7:40	12:00
5	7:35	4:00	7:35	11:30	7:35	12:00
6	7:35	4:00	7:35	12:00	7:35	12:00
7	7:35	4:00	7:35	12:40	7:35	12:40
8	7:35	4:00	7:35	1:35	7:35	1:35
9	7:30	4:05	7:30	2:40	7:30	2:40
10	7:30	4:05	7:30	4:00	7:30	4:00
11	7:30	4:05	7:30	4:05	7:30	4:05
12	7:30	4:05	7:30	4:05	7:30	4:05
13	7:25	4:05	7:25	4:05	7:25	4:05
14	7:25	4:10	7:25	4:10	7:25	4:10
15	7:25	4:10	7:25	4:10	7:25	4:10
16	7:25	4:10	8:05	4:10	7:25	4:10
17	7:20	4:10	8:30	4:10	7:20	4:10
18	7:20	4:10	8:55	4:10	7:20	4:10
19	7:20	4:15	9:25	4:15	7:20	4:15
20	7:15	4:15	10:05	4:15	7:15	4:15
21	7:15	4:15	10:50	4:15	7:15	4:15
22	7:15	4:15	11:40	4:15	7:15	4:15
23	7:15	4:15	12:40	4:15	7:15	4:15
24	7:10	4:20	1:40	4:20	7:10	12:00
24	.	..	....	....	1:40	4:20
25	7:10	4:20	2:45	4:20	7:10	12:00
25	...	..	....		2:45	4:20
26	7:10	4:20	No	light	7:10	12:00
27	7:05	4:20	No	light	7:05	12:00
28	7:05	4:20	No	light	7:05	12:00
29	7:05	4:25	7:05	8:35	7:05	12:00
30	7:05	4:25	7:05	8:55	7:05	12:00
31	7:00	4:25	7:00	9:15	7:00	12:00

September, 1912

Night of	Table No. 1 All-Night Lighting		Table No 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	7:00	4:25	7:00	9:35	7:00	12:00
2	7:00	4:25	7:00	10:05	7:00	12:00
3	6:55	4:30	6:55	10:35	6:55	12:00
4	6:55	4:30	6:55	11:20	6:55	12:00
5	6:55	4:30	6:55	12:20	6:55	12:20
6	6:50	4:30	6:50	1:30	6:50	1:30
7	6:50	4:30	6:50	2:50	6:50	2:50
8	6:50	4:30	6:50	4:15	6:50	4:15
9	6:45	4:35	6:45	4:35	6:45	4:35
10	6:45	4:35	6:45	4:35	6:45	4:35
11	6:45	4:35	6:45	4:35	6:45	4:35
12	6:40	4:35	6:40	4:35	6:40	4:35
13	6:40	4:35	6:40	4:35	6:40	4:35
14	6:40	4:35	6:40	4:35	6:40	4:35
15	6:35	4:40	7:25	4:40	6:35	4:40
16	6:35	4:40	8:00	4:40	6:35	4:40
17	6:35	4:40	8:40	4:40	6:35	4:40
18	6:30	4:40	9:30	4:40	6:30	4:40
19	6:30	4:45	10:30	4:45	6:30	4:45
20	6:30	4:45	11:30	4:45	6:30	4:45
21	6:25	4:45	12:35	4:45	6:25	4:45
22	6:25	4:45	1:40	4:45	6:25	12:00
22		.	.	.	1:40	4:45
23	6:25	4:45	2:45	4:45	6:25	12:00
23	.	....	..	.	2:45	4:45
24	6:20	4:50	No	light	6:20	12:00
25	6:20	4:50	No	light	6:20	12:00
26	6:20	4:50	No	ligh	6:20	12:00
27	6:15	4:50	No	light	6:15	12:00
28	6:15	4:55	6:15	7:40	6:15	12:00
29	6:15	4:55	6:15	8:05	6:15	12:00
30	6:15	4:55	6:15	8:40	6:15	12:00

October, 1912

Night of	Table No. 1 All Night Lighting		Table No 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting.
1	6:10	4:55	6:10	9:20	6:10	12:00
2	6:10	4:55	6:10	10:10	6:10	12:00
3	6:05	5:00	6:05	11:15	6:05	12:00
4	6:05	5:00	6:05	12:30	6:05	12:30
5	6:05	5:00	6:05	1:50	6:05	1:50
6	6:05	5:00	6:05	2:10	6:05	2:10
7	6:00	5:00	6:00	3:30	6:00	3:30
8	6:00	5:05	6:00	4:45	6:00	4:45
9	6:00	5:05	6:00	5:05	6:00	5:05
10	5:55	5:05	5:55	5:05	5:55	5:05
11	5:55	5:05	5:55	5:05	5:55	5:05
12	5:55	5:05	5:55	5:05	5:55	5:05
13	5:50	5:10	5:50	5:10	5:50	5:10
14	5:50	5:10	6:30	5:10	5:50	5:10
15	5:50	5:10	7:30	5:10	5:50	5:10
16	5:45	5:10	8:20	5:10	5:45	5:10
17	5:45	5:10	9:20	5:10	5:45	5:10
18	5:45	5:15	10:25	5:15	5:45	5:15
19	5:45	5:15	11:25	5:15	5:45	5:15
20	5:40	5:15	12:30	5:15	5:40	5:15
21	5:40	5:15	1:35	5:15	5:40	12:00
21					1:35	5:15
22	5:40	5:20	2:40	5:20	5:40	12:00
22		.	...		2:40	5:20
23	5:35	5:20	3:45	5:20	5:35	12:00
23				..	3:45	5:20
24	5:35	5:20	No	light	5:35	12:00
25	5:35	5:20	No	light	5:35	12:00
26	5:35	5:20	No	light	5:35	12:00
27	5:30	5:25	5:30	6:40	5:30	12:00
28	5:30	5:25	5:30	7:20	5:30	12:00
29	5:30	5:25	5:30	8:10	5:30	12:00
30	5:30	5:25	5:30	9:10	5:30	12:00
31	5:25	5:30	5:30	10:20	5:25	12:00

November, 1912

Night of	Table No. 1 All-Night Lighting		Table No 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting.	Light	Exting
1	5:25	5:30	5:25	11:40	5:25	12:00
2	5:25	5:30	5:25	1:00	5:25	1:00
3	5:20	5:30	5:20	2:15	5:20	2:15
4	5:20	5:30	5:20	3:30	5:20	3:30
5	5:20	5:35	5:20	4:45	5:20	4:45
6	5:20	5:35	5:20	5:35	5:20	5:35
7	5:20	5:35	5:20	5:35	5:20	5:35
8	5:20	5:35	5:20	5:35	5:20	5:35
9	5:15	5:40	5:15	5:40	5:15	5:40
10	5:15	5:40	5:15	5:40	5:15	5:40
11	5:15	5:40	5:15	5:40	5:15	5:40
12	5:15	5:40	5:15	5:40	5:15	5:40
13	5:15	5:40	7:05	5:40	5:15	5:40
14	5:10	5:45	8:10	5:45	5:10	5:45
15	5:10	5:45	9:15	5:45	5:10	5:45
16	5:10	5:45	10:15	5:45	5:10	5:45
17	5:10	5:50	11:20	5:50	5:10	5:50
18	5:10	5:50	12:25	5:50	5:10	5:50
19	5:10	5:50	1:25	5:50	5:10	12:00
19	..			..	1:25	5:50
20	5:10	5:50	2:35	5:50	5:10	12:00
20	.			....	2:35	5:50
21	5:05	5:55	3:40	5:55	5:05	12:00
21				....	3:40	5:55
22	5:05	5:55	No	light	5:05	12:00
23	5:05	5:55	No	light	5:05	12:00
24	5:05	5:55	No	light	5:05	12:00
25	5:05	6:00	5:05	6:00	5:05	12:00
26	5:05	6:00	5:05	7:00	5:05	12:00
27	5:05	6:00	5:05	8:10	5:05	12:00
28	5:05	6:00	5:05	9:30	5:05	12:00
29	5:05	6:00	5:05	10:45	5:05	12:00
30	5:05	6:00	5:05	12:05	5:05	12:05

December, 1912

Night of	Table No. 1 All Night Lighting		Table No 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting	Light	Exting	Light	Exting
1	5:05	6:00	5:05	1:20	5:05	1:20
2	5:05	6:05	5:05	2:35	5:05	2:35
3	5:05	6:05	5:05	3:45	5:05	3:45
4	5:05	6:05	5:05	4:55	5:05	4:55
5	5:05	6:05	5:05	6:05	5:05	6:05
6	5:05	6:05	5:05	6:05	5:05	6:05
7	5:05	6:10	5:05	6:10	5:05	6:10
8	5:05	6:10	5:05	6:10	5:05	6:10
9	5:05	6:10	5:05	6:10	5:05	6:10
10	5:05	6:10	5:05	6:10	5:05	6:10
11	5:05	6:10	5:05	6:10	5:05	6:10
12	5:05	6:15	7:00	6:15	5:05	6:15
13	5:05	6:15	8:05	6:15	5:05	6:15
14	5:05	6:15	9:10	6:15	5:05	6:15
15	5:05	6:15	10:10	6:15	5:05	6:15
16	5:05	6:15	11:10	6:15	5:05	6:15
17	5:05	6:15	12:15	6:15	5:05	6:15
18	5:05	6:15	1:20	6:15	5:05	12:00
18				...	1:20	6:15
19	5:05	6:15	2:30	6:15	5:05	12:00
19	.	.		....	2:30	6:15
20	5:05	6:15	3:45	6:15	5:05	12:00
20	.	.			3:45	6:15
21	5:05	6:15	No	light	5:05	12:00
22	5:05	6:15	No	light	5:05	12:00
23	5:05	6:20	No	light	5:05	12:00
24	5:05	6:20	No	light	5:05	12:00
25	5:10	6:20	5:10	7:10	5:10	12:00
26	5:10	6:20	5:10	8:30	5:10	12:00
27	5:10	6:20	5:10	9:50	5:10	12:00
28	5:10	6:20	5:10	11:10	5:10	12:00
29	5:10	6:20	5:10	12:25	5:10	12:25
30	5:10	6:20	5:10	1:35	5:10	1:35
31	5:10	6:20	5:10	2:45	5:10	2:45

REINFORCEMENT OF DIRECT CURRENT, THREE WIRE FEEDERS.

One of the perpetually recurring problems calling for the attention of central-station managers and engineers is what size of conductor to provide for the delivery of a given load or combination of loads. This problem reaches its most acute and aggressive stage at the installation of the conducting system, when the station is first set in operation; but it seldom fails to resurrect itself, like Banquo's ghost, at odd and inconvenient moments. The load on the system grows, and the feeders originally provided cease to be adequate. New mains and feeders must be bought and laid. How large are the new feeders to be? If the prospects are in favor of a continued increase in load, why not purchase and lay extra feeders, large enough to provide a margin for future growth? But how much margin should be provided, for margin means investing capital that for the moment is unproductive? If some benevolent intelligence in the alleged spirit world would accurately predict for us the increase of load that the new feeders would have to carry, month by month, into the future, so that the element of uncertainty could be eliminated from the problem, then the problem would become a question of pure engineering economics, which could be solved by arithmetic if the course of future prices in energy, copper and other essential commodities were also included in the benevolent spiritualistic forecast. In present practice, of course, the elements of uncertainty cannot be eliminated, and the problem includes both engineering economics and a commercial estimate based on experience. This means that the curves of loads and prices, as plotted against time, may not safely be extended by guesswork more than a certain number of months ahead, and the problem of engineering economics becomes restated within these limitations.

The article by Mr. A. W. Welch which we print this week discusses this question for the case of a low-tension, three-wire conducting system in a city. The main problem is how much capital will be invested idly, for the monent, in reinforcing a feeder, and how long will the saving in power, through reduced I^2R loss, take to pay off the investment, assuming that the load never rises above what is in sight, say, twelve months ahead? The question is a many-sided one, involving Kelvin's economy law as one of its aspects, but also involving such matters as obtaining city permits to open street trenches, prospective changes in prices, voltage-regulation facility, etc. One very important detail to be settled before the question of economics can be decided is the unit cost of energy wasted in the feeder. The article offers the choice between 2 cents and 1 cent per kw-hour, favoring the former, and does so in the right direction, according to our view. The question here at issue is vital and yet is very differently answered among different central-station men. Some of the men will maintain that a kilowatt-hour is a unit of energy that has to be supplied at the switchboard, whether it is wasted just beyond the switchboard itself or a mile away. They contend that on a hydraulic system if a cubic foot of water at the delivery valve of the pump costs a certain fraction of a cent, then if leakage occurs in the distributing pipes the pumps have merely to furnish extra cubic feet in order to replace the loss, and that the unit cost of this should be the cost of a cubic foot at the pump. Others will maintain, however, that in the hydraulic analogy if the leakage is distributed over a wide area of pipes the unit cost of replacement is properly the cost of delivering a cubic foot of water at the mean distance of leakage, and that wasting a cubic foot at a mile from the pump costs the supply company more than wasting a cubic foot at the pump. A good debate on the above question should be interesting to attend. It seems to us, however, that there is force in the arguments in favor of reckoning the company's cost of replacement at the mean position where the waste occurs. If the company, instead of supplying energy to consumers, supplied it to itself without profit and at bare cost of production, the unit cost of energy wasted would be, not the unit cost at the switchboard, but the unit cost at the average delivery distance, thus including distributing-system costs.

RELATIVE EFFICIENCY OF VARIOUS EARTHS IN RADIOTELEGRAPHY.

The article by Prof Charles A. Culver, on page 1360, is a good illustration of the advantage that may be derived from making a series of simple systematic experiments and stating the results obtained without encumbrances of deduction or theory. In the case described an inclined sending antenna was used in conjunction with a vertical receiving air-wire, and also with a horizontal receiving air-wire. The inclination of the sending antenna in the direction of the receiving station introduces an element of complexity into an otherwise relatively simple system; nevertheless, the results obtained suggest some interesting explanations. It is well-established doctrine that the ground made in wireless telegraphy should be thoroughly good at both sending and receiving stations in order to realize the best results obtainable from a given power radiated. At the sending station the waves virtually start from a conducting base, which, if not physically provided at the surface of the ground, provides itself at a lower moist-earth level, at the sacrifice of the radiation energy that is thus entrained into the substance of the soil. Similarly, at the receiving station, if a good conducting base is not provided at the foot of the air-wire, the receiving antenna provides its own conducting base at permanent moisture level and uses the overlying stratum of soil as a leaky condenser up to the foot of the mast wire, with a corresponding sacrifice of energy in the receiver. The results reported in the article seem to be consistent with our existing theories of wave transmission and reception, imperfect as these admittedly are. It is interesting to note that a horizontal antenna, wheeled about in various directions close to the ground, should so easily give results comparable to those obtained with much greater effort on larger and less portable receiving mast wires. The plan is in conformity with that which has to be used within laboratories when investigating the behavior of radiating systems. Small model radiators and receivers are used in such a manner that a short wave-length is produced, and that the two stations, although physically close together, are electrically separated by a number of wave-lengths. Although the arithmetic of freely radiated waves is advancing, we shall have to depend for the present on an abundance of such experiments.

Street-Lighting Tables.

With the present issue there is given, in the form of a supplement, our annual street-lighting schedules prepared in conformity with a plan followed continuously since 1890, when the schedule devised by Mr. W. H. Frund was first published.

According to the table designated as No. 1 the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise. By such a plan the lamps are in service for about 3830 hours per year. An "all-night" lighting schedule giving a total of about 4000 hours could be obtained by lighting fifteen minutes earlier and extinguishing fifteen minutes later than shown.

Table No. 2 is the so-called "Philadelphia Moonlight Schedule." This schedule differs from that of Table 1 in that advantage is taken of moonlight, beginning with the fourth night after new moon. On moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset, with the exception of the night before, the night of and the night after full moon, when the lamps are not lighted. This schedule involves the use of the lamps for about 2000 hours per year.

Table No. 3 is calculated according to the compromise system of Mr. Frund, and ignores the moon until midnight throughout the year. After midnight the lighting hours are the same as in Table No. 1 except that the lamps are not used on the three nights before full moon. According to this schedule the lamps are used for about 3000 hours per year.

All of the tables are based on mean local time and may be considered correct within ten minutes for any place in New York, Connecticut, Pennsylvania, Rhode Island, New Jersey, Ohio, Indiana, Illinois, Iowa, Delaware, Maryland, Virginia, West Virginia, Kentucky, Missouri, Kansas, Nebraska, Utah, Colorado, Nevada and northern California. They are also correct within ten minutes for all places within the United States proper during the months of March, April, September and October. The maximum disagreements are reached in June, when the nights are shorter in the Northern than in the Southern States, and in December, when the reverse is the case. During these months the disagreement along the northern border of the United States and as far south as Charleston, Birmingham and Los Angeles will not exceed twenty minutes. A maximum disagreement of one-half hour may be assumed for Jacksonville, Fla., and Houston, Tex.

Recommendation of Award of Edison Medal to George Westinghouse.

A meeting of the Edison medal committee of the American Institute of Electrical Engineers was held in New York on Nov. 24 to make a recommendation for the award of the Edison medal in 1912. In opening the proceedings Prof. Elihu Thomson, chairman of the committee, explained that the meeting was called in accordance with the by-laws to discuss the names that had previously been suggested by ballot of the committee as meriting an award of the medal, and to select one name to be submitted formally to the members of the committee for selection or rejection in December.

A general discussion, lasting for three-quarters of an hour, followed the raising of the question as to the nature of the "achievement" contemplated in the by-laws. There seemed to be some difference of opinion of the scope to be allowed in interpreting the word, especially as to whether it should include achievement of an administrative character in connection with the electrical industries on the one hand, or on the other hand should be confined to achievements relating to the electrical science and arts. After considerable discussion it seemed to be the consensus of opinion that administrative achievement came within the scope intended if it involved engineering foresight or judgment of possibilities, and more especially if it took the form of conceiving a possible combination of a number of scientific elements which together might constitute creation of a new industry. It seemed to be also the consensus of opinion that administrative achievement confined to business methods and ordinary promotion from small to large magnitude was not contemplated.

After complete discussion, in which practically all members took part, Mr. George Westinghouse was nominated by Mr. Frank J. Sprague as candidate for the Edison medal "for meritorious achievement in connection with the development of the alternating-current system for light and power," and upon vote the motion was carried. The name of Mr. Westinghouse will be submitted to the members of the committee for mail voting by secret ballot, in accordance with the by-laws, the result of which will be announced in December.

A. I. E. E. Meeting and Smoker.

Following the business portion of a meeting on Dec. 8 of the American Institute of Electrical Engineers, at which a paper on "Methods of Varying the Speeds of Alternating-Current Motors" will be read by Mr. Gus A. Maier, an informal reunion and smoker will be held in the Engineering Societies Building, New York. The reading of the paper will be started promptly at 8:15 p. m. At 10 o'clock the tenth floor will be thrown open and the members will go from the auditorium to meet each other in the Institute rooms. Should any prefer to continue the discussion in the auditorium it will be arranged that they may do so. Light refreshments will be served.

The American Institute of Electrical Engineers and Water-Power Development.

The difficult and unsatisfactory situation existing at present in regard to the development of water-powers of the United States some time ago led the United States National Waterways Commission to provide for a public hearing for the discussion of water-power questions in Washington on Nov. 21. The American Institute of Electrical Engineers was invited to attend and to contribute to this discussion, as were also a number of other societies and certain individuals prominent in the field of water-power development. The board of directors regarded the acceptance of this invitation as a duty to the membership of the Institute, in view of the provisions of the constitution and in view of the public nature of the question. On Nov. 10, on recommendation of the public policy committee, it passed a resolution authorizing the public policy committee to attend the hearing and to express its views on the development of water-powers, such views to be kept as far as possible within the limits of engineering questions and presented as a written brief, together with such discussion of this brief at Washington as may be necessary to make clear the views contained. It was further provided that the president be authorized to request the co-operation with the public policy committee of such members of the Institute as are experts on water-power development and who the committee feels would help its deliberations and its standing at the hearing at Washington.

The president appointed as the advisory members called for in the resolutions Messrs. Edward D. Adams, Philip P. Barton, Louis Bell, Dugald C. Jackson, William S. Lee, Lewis B. Stillwell and Percy H. Thomas.

The public policy committee appointed a sub-committee consisting of President Dunn and Mr. H. W. Buck to make a preliminary draft expressing its views, which draft was submitted to a full meeting of the public policy committee and the advisory members, and was modified to conform to and to represent their joint opinion. On Nov. 20 the president of the Institute, Mr. Stott, chairman of the public policy committee, and Messrs. Townley, Stillwell and Finney went to Washington to represent the Institute at the hearing which, on Nov. 21 and the morning of Nov. 22, was devoted by the commission to the presentation of the Institute's views and such discussion of them as was brought out by questions of the commissioners.

President Dunn defined the attitude of the American Institute of Electrical Engineers toward the issues by pointing out to the commission that the Institute was a scientific and professional body and not commercial, and that it refrained from making suggestions or expressing its views on the commercial, political, legal or other aspects of the water-power situation except as these were incidental to the questions of electrical engineering involved which it brought to the attention of the commission. He also discussed under cross-examination by the commission the factors determining the rates for water-power, the statistics on developed and undeveloped water-powers in the United States, and the engineering as distinguished from the commercial advantages of interconnection of contiguous hydroelectric systems.

Mr. L. B. Stillwell answered questions of the commission in regard to distances over which electric transmission was possible, the causes of interruptions to service in hydroelectric systems as compared to the same interruptions in steam-electric systems, and the difficulties in securing capital on account of the large investment required by hydroelectric systems. He also pointed out that the value of a stream as a source of power was usually much greater than its value as a waterway.

Mr. Calvert Townley presented to the commission views in regard to the difficulties under which hydroelectric systems labored in their early stages from failure of their expected market to develop, and answered many questions of the commission regarding the development of water-powers in New England and the bearing of steam auxiliaries upon the income of hydroelectric systems.

Mr. Stott on the second day of the hearing gave information on the rate at which the cost of coal had been rising in the last decade and the rate at which coal consumed per hp-hour in steam stations had been falling. He was questioned by the commission in regard to the control steam competition exercised over the rates of hydroelectric companies and on the first cost of steam-electric stations.

Mr. Finney described the interconnections of the plants of the Southern Power Company and the advantages, not only engineering but otherwise, that resulted therefrom, and gave important information to the commission upon the opportunities for the utilization of secondary power of hydroelectric systems for electrochemical purposes. Mr. Finney also answered many questions of the commission in regard to the general relations of the water-power companies of the South.

Mr. Edward D. Adams, as one of those specially invited by the commission, submitted views to the commission in writing upon the economic features of the question.

The Institute delegation left after the morning hearing on Nov. 22. The rest of the hearing was devoted to other societies and to members of the National Electric Light Association. An abstract of the brief required by the board of directors follows:

A. I. E. E. BRIEF.

In opening, the brief states that the function of the American Institute of Electrical Engineers is scientific and professional, and is not commercial; consequently, its committee refrains from expressing itself on the commercial, industrial, legal or political aspects of the water-power situation, except when these are incidental to the effect of that situation upon the practice of electrical engineering, which it is the society's object to promote. It is also appreciated that the commission is probably desirous not of the views of particular individuals, which might represent only individual opinions, but would be glad to have before it such opinions as are shared by a group of experts and may therefore be regarded as representative and out of the field of controversy.

Attention was called to the fact that prominent electrical engineers have for a number of years been contributing to the *Transactions* of the American Institute of Electrical Engineers papers bearing on all phases of the water-power question, and that the subject is one of vital interest to the American Institute of Electrical Engineers because the whole character of water-power development has been changed from that of a local enterprise to that of a great public-service utility by means which electrical engineers have provided, and the utility and development of water-power depends almost entirely upon the fact that it may be transformed into electric power.

RELATION OF WATER-POWER TO NAVIGATION.

That the utilization of rivers and smaller streams for navigation and for the development of power are naturally inter-related is obvious. As regards by far the greater part of undeveloped water-powers on the public domain, the ultimate value as sources of power of those streams is vastly greater than any possible value which could be realized by attempts to utilize them as channels for navigation, though in the case of many of our larger rivers the possibilities of development for purposes of navigation predominate as compared with power development. In all cases where practical possibilities of both navigation and power development exist the two objects in view are co-operative and not antagonistic—the construction of the dams and locks necessary to secure navigability affording a natural and generally effective means of developing the power of the streams.

WATER-POWER A PUBLIC UTILITY.

Modern water-power developments usually are not local private enterprises, as is generally supposed. The developments in recent years in the electrical transmission of power have made possible the distribution of electric power from a single water-power plant over territories embracing in some cases over 40,000 sq. miles in area, supplying electric power for diversified purposes to hundreds of thousands of people. Such distribution of water-power is an advantage to the consumers, and any policy tending to retard or handicap the development of water-powers is a disadvantage to the people in the surrounding territory and retards its industrial development.

The regulation of public utilities by public-service commissions has become practically an accepted principle in the United States, and there is no reason why safeguard from unfair charges for water-power should not be found by this means, especially where the wide area covered by electrical distribution makes the public nature of a water-power obvious.

DISTRIBUTION OF INVESTMENT IN HYDROELECTRIC SYSTEMS.

The investment of capital in hydroelectric systems is not confined to the dam and power house. In general, not over 50 per cent of the investment is represented in the generating plant, the balance representing the cost of the transmission lines radiating from the plant, the substations at the ends of the transmission lines for the conversion and distribution of the transmitted power, and the secondary distribution lines delivering power from the substations to the premises of the various consumers. The distribution system outside of the power plant, while not apparent to the casual observer of a power house and dam, represents

in many hydroelectric developments the greater part of the total investment.

COMPETITION BETWEEN WATER-POWER AND STEAM-POWER.

The belief among certain classes of the public that water-powers yield excessive or disproportionate profits springs primarily from two causes—the conception that the water itself is the power and the idea that the expenses of operation of a water-power are small while the company's income is large.

While, certainly, the power could not be devoloped without the water, the water on its part can deliver no power except by means of the dam, the power house and its appurtenances. It is difficult for the public to regard these once built as involving continuing expense, but they do. This expense is comparable in amount with the cost of coal in a steam station, and is the return due to the capital invested. It takes the form of interest, sinking-fund expenditures, depreciation and taxes. The invested capital in a water-power is much greater than the public realizes; with interest charges at not more than 5 or 6 per cent, in a majority of cases, from 70 to 80 per cent of a water-power-company's income is absorbed. This return to capital is not profit. Without the prospect of it capital cannot be secured.

Of a water-power once built and after its expected market has been developed the operating expenses, exclusive of the returns to capital, are seen by the public to be small, which they are, in a majority of cases absorbing only from 15 to 20 per cent of a company's income. The remainder, however, that is left for profit after capital and operating charges are paid is usually not large and certainly not excessive, especially when there is always risk of damage from floods, lightning, failure of expected market to develop, and such uncertainties of operation as the art of electrical engineering has not yet been able completely to remove. Practically all water-power development depends on the answer to the question "What is steam-power in the territory costing?" and the sources of water-power can be utilized only when they deliver energy at a substantially lower cost.

Besides the cost of power, the relative amount of investment is a determining factor. While at present a steam-electric plant can be built for $75 per horse-power, the cost of a hydroelectric plant is from two to four times that amount. Part of this difference is because the steam plant can be built near the center of its market, while the water-power is almost invariably at a distance.

With the capital required for a water-power so much greater, the tendency is to build a steam plant, even if the power it delivers is not as cheap as that of a water-power. If it can be shown that water-power can be delivered for, say, $25 per horse-power per year, but that steam-power can be produced for, say, $27, the water-power plant will not be built, but a steam-power installed. If, however, the water-power could be delivered for $24, the difference might turn the tide in favor of the hydroelectric investment.

It is because of the great effect of slight differences in the cost of water-power upon the determination of the question "Shall water-power or steam-power be developed in a given community?" that even light burdens in the form of taxation, charges for sinking fund to wipe out the investment at the end of a limited period or limitations as to tenure, even though not immediately onerous, loom so large in settling it.

Attention is often called to the increasing cost of coal, with an implication that the cost of steam-power will rise, permitting hydroelectric companies to raise their rates and exact undue profits. The implication is not correct. It is true that the cost of coal is rising, but it is also true that steam engines and boilers are constantly being improved in efficiency, and that the art of producing power from steam is progressing at a rate so much more rapid than that at which the price of coal is rising that the cost of steam-power is continually falling. Should a limit to this fall be reached, which is not yet in sight, gas and oil engines are making such constant reductions in the cost of power that there is no probability that water-powers will be free from the controlling competition of other kinds of prime movers. It is safe to say that extortionate rates in water-power would be highly improbable, even if the principle of rate regulation by commission were not applicable to hydroelectric companies.

CONSTRUCTION RISK IN HYDROELECTRIC DEVELOPMENT.

While hydroelectric engineering is tending toward more standard methods of construction, each individual development will present new problems in engineering, with the inevitable construction risk connected therewith. During construction the works are constantly subject to serious damage by abnormal floods, and unexpected difficulties and physical conditions may arise whereby the cost of construction may be very materially increased beyond original expectations. Furthermore, after the plant itself is satisfactorily completed, the success of the enterprise is commonly dependent upon the industrial development of a large territory surrounding the plant upon which it relies for its market for energy. Such industrial growth can be predicted only on general principles, and may be subject to unexpected retardation due to industrial depression or other unforeseen causes. Again, unexpected competition may develop from new and improved steam and other engines, all of which limit or defer the profits of the enterprise. On account of these engineering and operating risks and uncertainties capital which is invested in hydroelectric enterprises is entitled to reward commensurate with the risk.

REVOCABLE OR LIMITED-TERM PERMIT.

The revocable permit for the construction of a hydroelectric system does not attract capital because of the obvious uncertainties involved. In case of revocation, not only would the power plant and dam be forfeited, but all of the transmission lines, substations and distribution system dependent thereon for their operation would be jeopardized. Not only is it difficult to induce capital to invest in such a development based upon a revocable permit, but it is very difficult to close the long-term contracts with consumers which are necessary to make a hydroelectric system financially successful. Consumers are unwilling to make their future business requiring power dependent upon a permit which might cause at any time the complete disorganization of the system supplying it.

A limited-term franchise also involves financial and engineering difficulties which seriously impede the normal development of a progressive hydroelectric system. Such systems are laid out from their inception for ultimate growth, and in this respect are comparable to large railway systems. The transmission lines are constantly reaching out into new territory in order to meet new demand and with the development of the art it is necessary to make investments in extensions in order to maintain satisfactory service and to meet the demands of consumers.

With a limited definite term beyond which renewal of rights is uncertain, no company would be willing to continue indefinitely the extension and improvement of a system so necessary and desirable from the standpoint of public service. The necessity of writing off not only the original cost of the plant but the continual annual investment in additions thereto within the limited term of the permit requires an annual sinking fund that adds materially to the cost of the water-power. This is a hardship, not only upon the company, but upon the consumer.

Before the end of such limited-permit development of the system would cease, maintenance expenses would be cut to a minimum, and the plant would deteriorate to

point where the service to the public would become unsatisfactory.

INTERCONNECTION OF CONTIGUOUS HYDROELECTRIC SYSTEMS.

It has been suggested that with the growth in extent of large hydroelectric distributing systems ultimate interconnections and combinations between them might establish a monopoly and permit the raising of prices for energy. Such interconnection between contiguous hydroelectric systems offers decided and important engineering advantages. It improves the constancy of electrical pressure and enables the system to draw power from two or more independent power plants.

The rainfall occurring at different times on two or more separate watersheds is thus made to benefit all of the consumers on the combined systems. Such interconnection also permits reduction in operating expenses and assures better service by reducing to a minimum the probability of total interruptions at any time from line troubles or otherwise.

The investment and consequently the cost of energy can be reduced by combination, because less capacity in generating machinery to serve as spare plant for emergencies need be installed, and operating expenses can be reduced by rendering repairs easier, owing to greater facilities for shutting down for work or for inspection. Any tendency toward raising the price of energy as an accompaniment of such combination is restrained automatically by competition with steam-power, and can be regulated by government commission.

EXTENT OF WATER-POWER DEVELOPMENT.

The statistics of water-power collected under the direction of Congress several years ago and embodied in the report of the National Conservation Commission of 1909 show that there is at present developed in the United States about 5,000,000 hp of water-power.

The amount of power produced by steam from coal is difficult to estimate, but is considered to be about 27,000,000 hp, and is rapidly increasing, with attendant depletion of coal reserves. A large part of this it is not only possible but easy for water-power to replace if it were made freely available through development. Within range of development at a cost of investment that would make the cost of such power about equal to that of steam-power, there is still undeveloped in the streams of the United States about 35,000,000 hp.

Any action by Congress that would accelerate the release of this power would conserve enormous supplies of coal for such domestic and industrial purposes as only coal can supply.

CONCLUSION.

The brief repeats that it is beyond the province of the Institute to urge upon the commission specific measures or to discuss other than incidentally phases of the water-power question not involving electrical engineering. It has therefore offered what appear to that body to be engineering and economic facts on which the commission may rely.

Magnification of Electric Currents.

At a meeting of the National Academy of Sciences held in New York on Nov. 22 Prof. M. I. Pupin gave a preliminary account of a theoretical and experimental investigation of the problem of magnifying the feeble electric currents used in cable telegraphy and telephony. As a result of experimental work conducted during the past five years Professor Pupin has developed and built an induction-type generator by means of which feeble currents in a circuit can be magnified to any desired extent, the generator acting locally somewhat as an energy relay. The feeble current is passed through the primary circuit of the generator, the secondary of which consists of a small disk of copper driven by external power. On account of the self-excitation of the machine and the reaction between the primary and secondary currents, the current in the primary is enormously augmented. In the early experiments considerable difficulty was encountered by reason of an inherent tendency of the machine to become excited automatically to an excessive degree. In a machine recently completed these difficulties have been overcome, and the theory of its operation, which was worked out by Professor Pupin some years ago, has been thoroughly verified. Professor Pupin has announced his intention of describing both the theory and the machine in detail in a paper to be presented before the American Institute of Electrical Engineers.

On account of the many novel features of the work mentioned by Professor Pupin in his brief outline before the National Academy of Sciences, the New York daily papers contained numerous incorrect statements as to the significance of this work, in one case the claim being made that by the use of the Pupin invention street cars could be operated from telephone circuits.

Proposed Extension of Municipal Electric Pumping in Chicago.

In a communication dated Nov. 16, 1911, Mr. John Ericson, city engineer of Chicago, laid before Mr. L. E. McGann, the commissioner of public works, an elaborate report on the condition and needs of the water supply of the city. Mr. McGann transmitted the report to the City Council, which referred it to the committee on water department. Mr. Ericson's report contained some interesting references to the proposed electrical operation of waterworks pumping stations.

In the Lake View (North Side) pumping station it is recommended that two electric-motor-driven centrifugal pumps, each of about 25,000,000 gal. rating per twenty-four hours, be installed for temporary relief and ready for operation by June 1, 1912. The estimated cost, including piping, valves, switchboard and wiring, is $85,000.

At the Twenty-second Street (West Side) station it is planned to construct an entirely new pumping station. Such station, when complete, will then contain the two 25,000,000-gal. electric motor-driven centrifugal pumps which are now being completed in the present Twenty-second Street station. Two additional pumping units of similar size and type are to be ordered as soon as possible. The two pumping units of similar type recommended for temporary use at the Lake View station, as mentioned above, are also recommended to be placed in this station. This new station when completed will then be entirely modern and contain six 25,000,000-gal. electric-motor-driven centrifugal pumps, with a normal combined rating, against a head of 130 ft., of 120,000,000 gal., and a maximum rating against a slightly lower head of 150,000,000 gal. per twenty-four hours. It will be an entirely electrical station, thus avoiding all complications attendant on the use of both steam and electric drive. In case of temporary failure of the electric power, to be obtained from the Chicago Drainage Canal, the district normally served from this station can be supplied by reserve engines to be provided elsewhere. This new electrically operated station will require less ground area than the present one. The two new electric pumps for this station are estimated to cost $60,000.

For the present Rogers Park (North Side) pumping station it is advised that automatically controlled, electrically driven centrifugal pumps, receiving energy from the Sanitary District, be installed for connection with the sewer system in this district. These motors can be placed in small, well-protected masonry chambers so as to be prop-

[illegible] O[illegible] the c[illegible] pletion of such an installation, or an equivalent one, the Rogers Park pumping station can be entirely abandoned by the city as far as operating the plant is concerned.

It is recommended that a new booster pumping station be built in the neighborhood of Forty-eighth Avenue and Milwaukee Avenue (Northwest Side). The booster station, it is advised, should contain two 1,000,000-gal. motor-driven centrifugal pumps, complete with auxiliaries, appurtenances and accessories. The estimated cost of this booster station, including property, building and foundations, completely installed and ready for operation, is $9,000. The cost of transmission lines and connections to station is $3,000.

Plan for Electrification of All Boston Transportation Service.

The regular monthly meeting of the New England Section of the Electric Vehicle Association of America was held at the Lowell Building, Massachusetts Institute of Technology, Boston, on the evening of Nov. 23. Mr. E. S. Mansfield, president of the section, was in the chair, and the speaker was Mr. Henry C. Long, of Boston, author of the Boston harbor and dock improvement bill passed at the last legislative session. Mr. Long outlined, with the aid of eighty lantern slides, a plan for the abolition of all steam and horse traction within the Boston district and the substitution of electric power for handling every form of transportation of passengers, merchandise and freight.

The plan includes the construction of a 52-mile, four-track suburban belt railroad around the outer edge of the Boston metropolitan district from Lynn to Hull; the provision of electrified passenger and freight service on the belt line; electrification of all steam-railroad lines within the metropolitan area; construction of an electric freight elevated inter-warehouse and wharf railroad, and complete electrically operated shipping and receiving docks and wharves along the Boston waterfront, with provision for the handling of freight off the railroad tracks of the district by electrically driven tractors and storage-battery trucks. An important feature of the plan is the reservation of an industrial right-of-way for factory location along the belt line, with provision for electrical operation of all industrial plants thus situated.

Mr. Long stated that at the forthcoming session of the Legislature a bill will be introduced on behalf of the scheme, which is designed in many respects to make use of the best points of the systems now in service in Liverpool, Odessa, Melbourne, St. Louis and other cities. The speaker contended that the removal of horse traction from the streets would pay for the belt-line system, and argued that terminal costs at Boston could be greatly reduced by the adoption of electricity along the lines indicated.

Tubular Tungsten-Lamp Filament.

A patent issued on Nov. 14 to Dr. W. D. Coolidge, of Schenectady, N. Y., on an application filed Aug. 1, 1906, covers tubular filaments of incandescent lamps so arranged as to have a relatively large radiating surface per unit volume. The shape selected enables one to use less filament material when building a lamp of a certain candle-power for a definite voltage.

Incidentally the patent discloses a method of obtaining ductile tungsten wires. The material for the filament is obtained in the form of a fine powder by the reduction of tungsten trioxide with hydrogen or with finely divided carbon or graphite. The powder thus obtained is relatively non-coherent, and in general cannot be worked into lamp filaments without the application of some special treatment or process for shaping the refractory power into coherent wires. According to one process, the refictory tungsten powder is rubbed into a warm plastic am gam consisting of equal parts of cadmium and mercury, tl tungsten being added in the proportion of 40 per cent or iore by weight. The product thus obtained may be squirtedvarm through a die or may be otherwise manipulated. After obtaining ductile wires as above described, they ar rolled out into strips having a relatively large surface [illegible]. These flat strips are drawn through a steel, sapphir [illegible] diamond die of the proper size to curl them up into tu[illegible]. The edges of the strip may be overlapped to streng[illegible] the finished filament, or a gap or slit may be left betw[illegible] the opposing edges of the tube.

To remove the volatile components abo[illegible]entioned suitable lengths of the strip or tube are m[illegible]d in treating bulbs and there subjected in vacuo or an [illegible]rt atmosphere to the heating action of current passed t[illegible]hrough. The current distils or vaporizes the cadmiu[illegible] mercury of the binding material and consolidates a[illegible]ters together the particles of tungsten. The relativel[illegible]ge surface of the flattened wire or tube brings a large [illegible]portion of the filament within a very short distance of [illegible]r the front or back surface of the strip, so that when [illegible]strip is heated by current volatile material can pass ou[illegible]thout difficulty and without disturbing the arrangement [illegible] the refractory particles of the conductor. The finishe[illegible]ments may be straight or looped and are operative [illegible]igher voltages than could be used with the same mat[illegible] disposed in a cylindrical wire.

Milwaukee's Electrical In[illegible]try.

A preliminary statement of the ge[illegible] results of the thirteenth United States census relati[illegible] the manufacture of electrical machinery, apparatus [illegible] supplies in the city of Milwaukee, Wis., has been issu[illegible] the Bureau of the Census. The accompanying sum[illegible] comparing the figures for 1904 and 1909 shows percen[illegible]s of increase for all items except for capital invested a[illegible]or miscellaneous expenses, which exhibit decreases.

There was an increase of 50 per ce[illegible] in the number of establishments; 22 per cent in the va[illegible] of products; 52 per cent in the number of salaried e[illegible]oyees; 20 per cent in the salaries; 22 per cent in th average number of wage-earners employed during the y[illegible], and 22 per cent in the wage-earners' wages.

STATISTICS OF MILWAUKEE'S ELECT[illegible] INDUSTRIES.

	CEN[illegible]		Per Cent [illegible] 1904 to 1909.
	1[illegible]	[illegible]	
[illegible]	18	[illegible]	[illegible]
Capital	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$223	52
[illegible]	$372,000	[illegible]	20
Wage-earners (average number) ..	[illegible]	815	22
[illegible]	$598,000	[illegible]	22
[illegible]	$352,000	[illegible]	[illegible]
[illegible]	$928,000	[illegible]	[illegible]
[illegible]	$2,749,000	[illegible]57,000	22

There were eighteen establishme[illegible] in 1909, as compared with twelve in 1904, an incre[illegible]e of six. The value of products in 1909 was $2,749,0[illegible], as compared with $2,257,000 in 1904, an increase of $[illegible]2,000.

The value of products represents heir selling value or price at the plants as actually turn[illegible] out by the factories during the census year and does n[illegible] necessarily have any relation to the amount of sales for hat year. The values under this head also include the am[illegible]unt received for work done on materials furnished by oth[illegible]rs.

Meeting of the Empire State Gas & Electric Association.

A meeting of the Empire State Gas & Electric Association was held [illegible] at the Technology Club, Syracuse, N. Y. [illegible] was one of the series of gatherings which are now held by this association each year at different points in the State. The general subject under consideration was street lighting, and between fifty and sixty representatives of companies from different parts of the State were present.

Mr. H. W. Pe[illegible], of Rochester, chairman of the committee on arrangements for the meeting, presided. The subject under discussion was introduced by Mr. M. G. Kennedy, of Syracuse, who referred to the importance of the topic and said that lantern slides illustrating the lighting in Syracuse would be presented later. Mr. H. Thurston Owens, New York, exhibited slides showing lighting effects in foreign cities and explained methods in use. Others also exhibited lantern slides.

During the discussion the talk turned upon two or three special points to which much consideration was given. One was the question of the cost of furnishing service of this character. The elements entering into the question of cost were studied carefully, and an analysis was made to show the proportion of the total represented by each element of expenditure or charge that should be made against this service. Other subjects which were brought up and discussed at length were the use of tungsten lamps on magnetite arc circuits, the life of rectifier tubes, the advantages and disadvantages of tungsten lamps as compared with arc lamps and the relative advantage or disadvantage of ornamental lighting as compared with illumination.

Among the speakers were Messrs. A. D. Dudley, Syracuse; W. T. Dempsey, New York; John P. Radcliffe, Jr., Yonkers; J. O. Montignani, Rochester; L. C. Reynolds, Auburn; G. T. Macbeth, Mount Vernon; De A. Ryan, General Electric Company; Mr. [illegible]lace, Westinghouse Electric & Manufacturing Company; Norman Macbeth, Westinghouse Lamp Company, and G. S. Barrows, United Gas & Improvement Company.

The delegates had lunch at the Hotel Onondaga, Syracuse.

Railway Telegraph Superintendents at Chicago.

A two-day joint meeting of the Eastern and Western divisions of the Association of Railway Telegraph Superintendents was held in Chicago on Nov. 23 and 24. Mr. C. Selden, of the Baltimore & Ohio, Baltimore, chairman of the Eastern division, presided on the first day, and Mr. E. A. Chenery, of the Missouri Pacific, St. Louis, on the second. The first day's session was given over largely to traffic considerations and the filing of message forms. A recent ruling of the Interstate Commerce Commission has required the commercial telegraph companies to file message sheets and classify accounts in accordance with the commission's recommendations, and these orders, it was believed, might affect railroad telegraph business as well.

On Friday the subject of train dispatching by telephone versus telegraph came up for discussion. Mr. G. A. Cellar, of the Pennsylvania Lines West, who is also president of the telegraph superintendents' association, declared that where telephone dispatching has shown a saving in number of dispatchers and in operators' salaries such economy has been distinctly offset by the increased cost of operation and maintenance of the telephone lines. Mr. W. C. Walstrum, of the Norfolk & Western Railroad, reported the cost of operating his telephone system to be $1.01 per mile of road per year. Special maintainers and linemen are employed.

Mr. C. S. Rhoads, of the Big Four Railroad, Indianapolis, said his 1400 miles of telephone lines have been in service nearly three years, resulting in a substantial decrease in dispatchers, salaries and offices, compared with telegraph operation. Besides saving labor, he declared telephone operation to be much safer, since the sending operator is required to write down the orders as he transmits them, assuring a speed at which the receiving station can follow. In telegraph practice it had become customary to "send" much faster than the matter could be written down at the receiving end, the operator catching down only occasional words and depending on his memory to fill in the gaps later. This produced many errors in train numbers, meeting times, etc., declared Mr. Rhoads. The speaker also noted the possibility of simplexing telephone dispatching lines for through Morse operation, gaining a number of additional telegraph circuits. By inter-operation with friendly roads it is thus possible to establish circuits which may become useful in establishing communication around fallen line sections, accidents to poles, etc. Mr. Rhoads said his 1400 miles of lines are taken care of by three inspectors, who receive $65 a month, with unlimited expense accounts, and have the aid of twenty-one linemen. Twenty-one motor cars are in use by these men.

Mr. W. F. Williams, of the Seaboard Air Line, asserted that the saving effected by telephone operation cannot be expressed on a monetary basis. The figures for his own 1100 miles of lines, he said, show a gain of 11 per cent in train time, in spite of an increase of 14 per cent in track density. Mr. J. J. Ross, of the Michigan Central Railroad, declared that the presence of simplexing apparatus on his telephone circuits seemed to clear the lines by discharging static accumulations. Mr. F. H. Van Etten, of the Chicago, Terre Haute & Southern, also recounted his experience.

On Thusday the association was the guest of its associate members at luncheon, visiting the factory of the Kellogg Switchboard & Supply Company in the afternoon. On Friday afternoon a special car was provided to convey the members to the Hawthorne plant of the Western Electric Company, where a luncheon was served preceding an inspection of the works.

Co-operation Among Electrical Contractors.

At a joint meeting of the Chicago Electrical Contractors' Association and the Faraday Electrical Association (the latter an organization of the smaller electrical contractors in Chicago) held recently Mr. Frederic P. Vose, secretary and counsel of the Electric Credit Association, of Chicago, gave some good advice to the contractors in an address bearing the title "Need of Organization." He asked the question, "What's the matter with the contracting business, anyway?" He said that the greatest losses of the electrical manufacturers and jobbers occur in the extension of credit to electrical contractors. This would seem to indicate that a large number of these contractors have not yet learned to do business on business principles. This state of things proves the need of organization.

The manufacturers and jobbers are coming to regard it as better policy to push their sales to responsible contractors rather than to discourage them by furnishing their irresponsible competitors with the means with which to cut into the business. However, all commercial virtue is not monopolized by the big contractor. There is many a small contractor who possesses integrity, ability and energy and who should be encouraged. Mr. Vose said that there are three things to be observed by the small contractor: First, to sell product and service at a proper margin above cost; second, to adopt business methods that are really methodical; third, to practise and maintain honest principles, not only toward customers but also toward competitors.

In determining a proper margin of profit there must be taken into consideration operating expenses, current ex-

penses, selling expenses, rent, salaries, wages, superintendence, interest, insurance (fire, accident and industrial liability), light, heat, power, postage, stationery, taxes, telegraph and telephone, bad debts and allowances, freight, cartage, express, carfare, advertising, breakages, counterclaims, damage claims, loss of time through manifold causes, lean years due to business depression, and many other items. Furthermore, it is to be remembered that 50 per cent added to the cost is only 33⅓ per cent on the selling price. It is better to figure percentages of profit on the selling price rather than the cost price, because in the latter case business men are apt to become prodigal of expense.

Recounting the advantages of association, Mr. Vose mentioned the interesting fact that the business done annually by the members of the National Association of Electrical Contractors exceeds $32,000,000. It has been discovered that the expense of carrying on an electrical contracting business under favorable conditions will be not less than 17.5 per cent of the total business done and may run up to 28 per cent as the amount of business decreases. The practice of relying on "extras" for a profit was denounced strongly. Three "C's" are necessary in the triangle of business success. These are character, capacity and capital.

Proposed Order for Stenciling and Numbering of Poles in New York.

The tentative form of a proposed order requiring companies to stencil and number their poles and structures for carrying overhead wires has been prepared by the New York Public Service Commission, Second District. The order is to apply to all electrical, municipal, telephone, telegraph, railroad and street railway corporations.

A formal hearing upon the form of the order was held by the commission at Albany on Nov. 23. Objections to the order were made by representatives of steam and electric railways and telephone and telegraph companies. Mr. C. G. M. Thomas, Long Island City, vice-president of the Empire State Gas & Electric Association, presented on behalf of the association a suggestion for amendment of the form of the order.

As proposed tentatively by the commission, the order requires that each pole of the corporations of the classes named be stenciled with a number and the initials of the company. Certain details as to the height of the mark, etc., were included in the order. It was also provided that the poles should be numbered consecutively, beginning at the station. It was stated on behalf of the companies in the Empire State Association that it would not be practicable to number the poles consecutively from the station. In case two lines should extend from the station it would not be possible to mark them except in different ways. In the case of extensions of pole lines it might be desired to add lines branching from the main line, and in this case it would not be practicable to number the poles consecutively.

It was suggested, therefore, on behalf of the companies in the association, that the order omit all details as to size and height of lettering on poles, and that it specify merely that each pole be marked in some way that would indicate the ownership clearly. It was also suggested that the lettering be readable, under ordinary circumstances, at a distance of 6 ft.

Concerning the identification of poles, it was recommended that each company report by Feb. 1, 1912, the method of marking poles which is in use on its system at the present time. This information, when furnished to the commission, should show the manner both of marking poles and of numbering them for identification. If companies have no proper system, an appropriate time should be allowed for the preparation of such a system. It was suggested, furthermore, that when a system is prepared within the time suggested the details of the plan should be filed with the commission, and thereafter no change should be made, except on thirty days' notice.

Mr. Thomas, in presenting these suggestions, gave a list of companies represented at the meeting of the association at which the subject was discussed.

Underground Electrolysis in Chicago.

In a recent communication to the Chicago commissioner of public works, Mr. John Ericson, city engineer, includes a report by Mr. Ray Palmer, consulting engineer, on an investigation of damage to underground pipes and lead-sheathed cables caused by electrolysis from electric-railway return currents.

Extensive surveys were made in definite districts affected by surface and elevated railway return currents. The result of the survey showed that the electric-railway return conductors in the city are defective, or are insufficient at present to keep return current from damaging and destroying underground metallic pipes, etc. Both water-mains and gas-mains were found in cases to be much pitted. On one 36-in. water main the pits were ¼ in. or more deep. In one case it was found that 30 amp was flowing in a 24-in. water-main, and in another case 143 amp in a 36-in. water-main. It was found that the return conductors of the elevated railways do not have sufficient capacity at present to keep the electric current from straying, and it is recommended that large cables should be run from one end of the elevated structure to the other, tapping all track rails every 300 ft. The report states that while there is no practical way of determining how much water leakage is due to damage caused by electrolysis, yet there is probably a considerable loss from this cause. It is stated that the lead-sheathed cables of the city police and fire alarm system, telephone, lighting and power companies are being considerably damaged in different parts of the districts surveyed, and that the telephone and electric-light companies find it necessary to keep a force of men in the field working continuously in order to protect their underground investment from stray-current damage. The People's Gas Light & Coke Company has allowed return feeders to be attached to its mains, the feeders leading to the different railway-station busbars.

Stray currents were found to be carried by pipe in structural-steel buildings, and the report states that "if the defects in the surface, elevated and tunnel return circuits are properly repaired it will be an easy matter to protect the structural steel, pipe lines and other metallic work of buildings from stray currents by adding resistance in all pipe joints where they enter the building, shunting the building and connecting all entering pipe lines with insulated copper cables, and connecting the structural steel work to a low resistance to ground placed embedded in loose earth below the basement floor." For the protection of bridges it is recommended that "copper cables of equal carrying capacity to that of the return circuit at each end should be laid across the river at all bridges and tap the four rails at each end. Additional cables should be run from the rails on bridges to these main cables, so that the current released on the bridges will not stray or damage the structures."

In summing up, the report states that water-pipe mains have been seriously damaged in certain districts in Chicago, and that other sub-surface metallic structures, including cable sheaths, bridges and structural-steel buildings, are being damaged by electrolysis at the present time; that most of this damage is caused by the return circuits of the surface, elevated and tunnel companies, and that a great part of the damage is due to insufficient or defective return conductors.

It is recommended that the present ordinance limiting the difference of potential due to stray currents to 25 volts be changed so as to reduce this limit to 12 volts, and that the railroad companies be required to equip their return systems with insulated metallic-wire circuits and voltmeters, whereby at any time the difference of potential can be determined between the negative busbars in each station and the extreme limit of the return circuit in the corresponding feeding district. Also, that the companies be required to install a system equal to or better than a pipe and cable sheath drainage system, consisting of insulated copper wires, pipe straps, ammeters, etc., whereby the maximum amperes flowing in sub-surface pipes, etc., shall be limited to 10 per cent of the total output of the station. When the stray currents are reduced to an amount corresponding to 12 volts of maximum drop it is stated that pipes, lead sheath and other sub-surface metallic work can be protected by a properly installed pipe and cable sheath return "drainage" system.

It is recommended that the railway companies be required to make one or more of the following improvements, in order to conform to the limits of the above proposed ordinance: (a) Reconstruct all defective track work and install additional return feeders; (b) install a negative busbar system; (c) install a return current "drainage" system; (d) reduce the size of power plant in substation feeding districts; (e) insulate the railway return circuit. Should the railway companies decide to install "drainage" systems after reducing the return drop to 12 volts maximum, it is advisable that the gas, telephone, lighting and power companies work with the city to better their own electrolytic conditions at the same time.

Another recommendation is the installation of a number of large insulated cables between different points of pipe lines and the feeding station negative busbars in each district. All electric-railway river crossings and bridges should be so equipped with bonds, contacts and additional feeder cables, in order that no appreciable leakage shall result when cars are operated over the bridges or when the bridges are open. All special work, dead-end lines, steam-track crossings, surface and elevated line crossings, etc., should have jumper cables of equal conductivity to the rails. Additional return cables should be installed and tapped at regular intervals into the cross bonds and rails. The small amount of current which will stray into water-pipe lines after the improvements suggested are made can be diverted from the mains near the feeding station by means of cables connected to clamps on pipes. Pipe-line diverting cable should be lead-sheathed when laid in ducts and rubber-covered when insulated on poles.

Talk on Investments by Mr. Henry L. Doherty Before New York Electrical Society.

Mr. Henry L. Doherty gave a talk before the New York Electrical Society at the Engineering Societies Building on the evening of Nov. 16 in reference to the subject of investments. The talk was made as an informal presentation to the society of a plan which he has developed for the creation of a new spirit of thrift, particularly among workers in electrical properties. To show the effects of systematic investment for employees, and in that way for the country as a whole, Mr. Doherty gave illustrations of the earning power of money when the interest return is compounded.

In beginning his talk Mr. Doherty spoke briefly of the general business conditions in this country and of some of the forces which affect these conditions. His remedy for the condition of unequal distribution of wealth is to induce those who have not accumulated wealth to do something to better their position. The first question to be considered is whether it is possible for the majority of the people of this country to accumulate wealth, and to this question the speaker's answer was yes. The second question is whether it will be possible for people to accumulate wealth by making the necessary preliminary savings. Mr. Doherty believes that this is possible. Some of the largest fortunes have been accumulated after small beginnings; the turning point in the history of such fortunes has been when the money was a very small sum. The third question is how saving on the part of workers on small or moderate salaries is to be effected.

Mr. Doherty then proceeded to answer the last question. He referred first to the principles of political economy and to the growth of recognition of property rights. In the course of his argument he showed that everybody should have funds to rent as well as hands or brain with which to work. He said that there is no way of keeping the workingman employed except by the continuation of building operations. If employment of labor should be reduced to the point represented by the means of those who have funds to buy there would be no employment for many. Prosperity in the country depends on the ability to continue building for the future. There must be continued development and accumulation for the future. More and more there is production by property rather than labor. The telephone is substituted for the messenger, mechanical power and water-power for labor. The extent to which wealth has been accumulated in this country was then considered. The workers earn an average amount estimated at $22,000,000,000 annually, or $550 each. The accumulated wealth of the country is but $121,000,000,000, much of which is invested in securities of low-income value, such as government and municipal bonds, and, assuming a return of 6 per cent on this accumulated wealth, the annual income from the ownership of property is but about one-third of the earnings of labor. Mr. Doherty then showed the percentage of wages that would have to be saved and invested at various rates of interest to equal in forty years the wealth which has already been accumulated in the 300 years of the settlement of this country.

It was an argument in encouraging people to save to consider that all opportunities had not passed, and, in fact, that perhaps the greatest opportunities of all are just beginning to be apparent. In referring to the modern efficient tungsten lamp, the speaker said that this lamp gives one-half of 1 per cent of the efficiency of the coal in the mine from which the power is secured. Every change in life brings opportunities to men to get their share or more of wealth. Mr. Doherty wanted not only to make it advantageous for those now represented as capitalists to go ahead with development work, but to make it equally advantageous for those who are not now capitalists to become small investors. A great many people believe that they must have government or municipal bonds to secure safety in investment, but an interest return of only 2 or 4 per cent largely destroys the encouragement for saving. Business cannot exist and support the organizations required if only these small returns can be secured. Nothing is of more importance to the American people than to know how to invest money properly. The great mass of American people are not investors, because they do not, like the French people, know how to save. They are not savers because they would not know what to do with the money if they had it saved.

At present it is possible, Mr. Doherty said, to make safe, conservative investments on a 7½ per cent interest basis. To show the difference between the results of interest compounded at that rate and at lower rates, Mr. Doherty said that $1 invested for seventy years, with interest compounded quarterly at the rate of 2 per cent, would become at the end of the period $4.01; at 4 per cent the amount would become $16.26; at 7 per cent the amount would become $128.72, and at 7½ per cent the amount would become $181.52. It was then shown by Mr. Doherty that if a pur-

chaser of securities buys those paying the higher rates of interest, which necessarily involve more risk than the lower interest-bearing securities, he can still afford to lose a certain percentage of his original investment at the end of each year, and come out as well in the end as if he made the investment which promised only the smaller rate of return. Safety can be secured largely by diversity in the investments. If the great body of people in the country are to be induced to save and become investors the habit will have to be formed largely through employers of labor. Mr. Doherty believes that employees should own the securities of the companies for which they work, although some men do not want to take the responsibility of having their employees invest in securities of their own company. If the wage earner is to be made an investor and the principles of thrift are established, the results will be a great factor, if not the greatest factor, in solving the ills from which the country has been suffering.

Valuation of Public-Utility Properties.

An interesting joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers was held on Nov. 22 to discuss the timely and complicated subject of valuation of public-utility properties. The feature of the evening was a carefully thought-out paper by Mr. Frank F. Fowle, of Chicago, on "Going Value." Mr. J. G. Wray, chief engineer of the Chicago Telephone Company, presided as chairman of the Chicago Section of the Institute, and he introduced Mr. Ralph W. Pope, honorary secretary of the Institute, who happened to be in Chicago and who extended a few words of greeting to the assembled engineers.

Mr. Fowle's paper was a survey of the whole situation in relation to what has been called "going value," and space is available in the present summary for only a few of the principal points brought out in an able review. In the beginning the speaker said that there were many honest differences of opinion on the subject. Going value is as much property as though it had physical existence. There is, however, no universally accepted theory as to just what constitutes it.

First, the author considered briefly the economic aspect of the subject and gave definitions of economists to show what "value" is. He then sketched the theory of rate regulation and said that he should consider principally the theory that rates should be based on cost of service (the theory on which regulation is based) rather than on free commercial competition—the "value of service" theory. Tangible and intangible values were next considered and analyzed, and Mr. Fowle remarked that it is now well recognized that an established business costs more than the actual physical plant. What have been called "intangible values" consist of the valuations put on franchise, going value and good-will, and these values are difficult to separate. A franchise is now regarded as a contract rather than a valuable gift, and, as for "good-will," it is usually thought there is no value to be attached to it where the customer has no element of choice in seeking service in a particular field.

The nature of "going value" was next taken up, and the speaker said that it is generally taken to be that element of value created by an active going business in addition to the value of the physical plant. Several methods of determining this value have been proposed, and six of these were taken up in detail.

Capitalizing net earnings was spoken of as the first method. This method is the natural one to apply in a private business, but it is not usually considered equitable as applied to a public-service utility operating under a public franchise.

The "reproduction of net earnings" method was the second plan considered, and to this considerable attention was devoted. This plan is used in water-works valuation especially, but is of general application to all public utilities. With the aid of diagrams Mr. Fowle told how this method, which is an old and familiar one to appraisers of utility properties, is arrived at. If, for instance, it will take seven years for a new plant to reach the proportions and earning capacity of the old plant under valuation, then by a calculation of the net returns during these intervening seven years and by a summation of these returns the "going value" will be reached under this method. The period necessary for the new plant to overtake the old plant may vary from five to eleven years, and in general the longer this period the greater will be the going value. This method has never been sanctioned by the Wisconsin Railroad Commission, and Mr. Fowle confessed that he was yet to be convinced that it is the correct method. A going value under this theory might be figured out for an unprofitable business, and some other objections were enumerated. One of these is that this method measures no element of value that can be considered under the general cost-of-service theory of rate making.

Taking up the third method of arriving at going value, the speaker said that it has been called the "capitalized losses" method. This is the plan approved by the Wisconsin commission and one which Mr. Fowle appears to favor. Accurately, it should rather be called the capitalized value of deferred profits. This may be criticised as putting a premium on bad management, for it takes into account the losses of the earlier years in developing the business. However, the Wisconsin commission says that local circumstances in each case should receive consideration. The principle must be applied with great care to see that no injustice is done either way. The Beloit case, Mr. Hagenah's analysis in the Chicago gas and other cases were cited. This method, too, is open to objections. Its underlying motive is a desire to do justice to the pioneers in the industry, but engineers and appraisers should proceed with caution and use the method with good judgment and a due regard for equity.

As the fourth method, Mr. Fowle enumerated the "merged securities" plan. Here duplication of properties enters into the problem. This duplication is due to public authorization. Therefore, when a consolidated company comes under regulation the value of the unnecessary duplication of capital must be considered. If the public is responsible for this duplication it seems just to allow a going value to the extent of the duplication, but questions of equity and public policy are involved and it is to be remembered that duplication value is not really going value.

The "cost of development" method was taken up as the fifth plan. The cost of development is almost always present, and usually is most burdensome in the early years of the business. It is usually treated as a part of operating expense, and so may become an unfair burden on a company when, for the purpose of rate making, the history of the early years of that company is analyzed. Selling cost is a legitimate outlay which must be recognized. Perhaps it is not "going value" in the broad sense.

Several miscellaneous plans were grouped together under the sixth division of the subject. One of these is to take one-half of one year's gross receipts as the going value. Another is arbitrarily to assume one-third of the value of the physical property as the going value. A third places this figure at 27 per cent instead of one-third. Still another basis is a certain fixed sum per connected customer, and in one case this figure was assumed to be $30. A further proposal is to fix going value at an amount anywhere from one-half to the full sum of one year's gross receipts, according to circumstances. These methods, however, while of some interest, are not admissible under the general cost-of-service theory in rate making.

At the end of his paper Mr. Fowle drew the following conclusions:

(1) Under the cost-of-service theory we seem bound to recognize every element of actual cost for both tangible and intangible property which is legitimate, reasonable and necessary.

(2) Going value, under the cost-of-service theory, cannot be supported by capitalized net earnings in excess of a fair return on the cost value of the property.

(3) Rigid rules for measuring the legitimate going value, if any, under the cost-of-service theory cannot safely be laid down, because the local circumstances in each case are different, and each issue should be treated on its merits.

(4) The general test for value of any kind, under the cost-of-service theory, is always the cost, but this may be tempered by the great desirability of distributing justice and equity to both the public and the utility companies in equal measure.

Discussion.

After some introductory remarks by Mr. Wray, Mr. Benezette Williams, an engineer who has had wide experience in the appraisal of water-works and who is a past-president of the Western Society of Engineers, was called upon to open the discussion. Mr. Williams made an interesting speech. He said that the fundamentals of this problem must not be lost sight of. The capitalization of net earnings to determine going value has no standing in the courts or before public-service commissions and may be dismissed at once. In the cost method of determining the value of a public utility the value is arrived at by ascertaining the cost of construction and adding to it the cost of developing the business. That is all there is to it. Here, properly speaking, there is no such thing as going value at all. The confusion of terms is one great trouble encountered in this discussion. The "cost" method outlined by Mr. Williams has been presented to nearly all the courts of the land. The speaker recalled several water-works cases, particularly the Kansas City case of 1894. The city here, as all cities do, contended for the "junk theory" of appraisal. Justice Brewer decided that the "junk theory" was not admissible, neither was the reproduction-cost theory nor the capitalizing-of-earnings theory. The plant is worth more than the cost of reproduction because it has a business. This added value, said Mr. Williams, must necessarily have to do with the future. How is this future value to be measured and described? Obviously, it is the excess in revenue that an operating plant will produce over a corresponding new plant in the same field. In other words, the old plant produced a revenue from service that no other plant can give until after a considerable lapse of time. The total revenue during this lapse of time is the only thing that can be called "going value." Mr. Williams said in effect that the Wisconsin commission has wabbled on this question, its later decisions differing from the earlier ones. It is to be remembered that it makes a difference whether a plant started up under the old conditions or under the modern plan of regulation.

A public utility is never complete until the point of saturation is reached at a schedule of rates that will bring proper remuneration. Up to that time years with deficits are usually recorded. A public utility usually cannot be made to pay from the beginning unless the rates are prohibitive. More than half of the present-day trouble arises from the use of terms. Take "good-will," for instance; there is no such thing in relation to a public utility. Also consider "tangible" and "intangible" values. Property is tangible, but no value of any kind is tangible; it is constantly changing and cannot be tangible. The "going value"—the service the plant is rendering—is the most tangible element of all that enter into into a public utility. The term "going value" is unfortunate; it does not express the thought intended to be conveyed. Mr. Williams believes the true term should be "business value," or "revenue value," or "service value." Real going value is the total value of the plant as a going concern.

Mr. Wray asked if there were not, after all, such a thing as "good-will" in the survey of the public-utility situation. For instance, cannot a man exercise his good will in choosing whether he will ride to his destination on a surface line, an elevated railway or a steam railroad? Can he not select between gas, electricity or kerosene oil for lighting, or may he not send his message by telegraph, telephone or mail?

Mr. Williams explained that he referred to a utility in its own field, as, say, a telephone company, not as comparing a telephone company and a telegraph company.

Mr. J. W. Alvord, also a past-president of the Western Society of Engineers, pointed out that the cost of creating revenue, while a vital item, is not always taken into account in figuring cost. Mr. Alvord believes that the Wisconsin commission has put itself at variance with a long series of decisions in the courts in the method it has evolved in arriving at the value of public utilities. As an illustration, the speaker said that we may consider that there are several "yardsticks" available for measuring this value. These yardsticks have been enumerated by the courts and are mentioned in Mr. Fowle's paper. The Wisconsin commission and other public-service commissions have mixed up the yardsticks. Let us, said the speaker, be logical in using each of these available methods. Let us consider each logically to its end. When all the conclusions have been reached by using the various methods, let us compare the results and reason the matter out judicially and see which conclusion an intelligent, fair-minded man decides will come nearest the real value of the plant. Mr. Alvord's definition of going value is "the value of a created income."

Mr. W. J. Norton, of the Commonwealth Edison Company, Chicago, formerly of the Public Service Commission of New York, spoke briefly, citing particularly the Des Moines gas case.

Dr. M. G. Lloyd, of Chicago, referred to the confusion of terms. He thought that allowance for deferred profits should not be called going value.

Mr. J. R. Cravath, of Chicago, defended the Wisconsin commission. He said if that commission has varied from the decisions of the courts perhaps it is because it has looked at the situation from the viewpoint of the "square deal" to both the public and the investors rather than from the severely legal or technical point of view. He said that the Wisconsin commission is to be commended for this sensible attitude.

In the few minutes available at the closing Mr. Fowle said that he agreed with Mr. Williams that it would have been better if going value had been construed in the first instance as total value. There is some fallacy, the speaker contended, in the reproduction theory. An old plant may be more attractive as an investment, but not more valuable. Logic, he said, may be carried to an absurd extreme in determining plant valuation; for instance, in computing population the curve may be carried back to a time when there was no population, and so the severely academic method may be made ridiculous.

Electric-Service Rates and Municipal Ownership.

Mr. C. Nesbitt Duffy, comptroller of The Milwaukee Electric Railway & Light Company, spoke on the subject of "Some Features of Electric-Service Rates and of Municipal Ownership" before the Milwaukee company section of the National Electric Light Association Thursday evening, Nov. 23, his remarks being occasioned by a series of questions on public utilities recently put by a debating team at the University of Wisconsin. Mr. Duffy first discussed the elements which may affect the prices charged for

electric service, including kind of plant, distribution system, class of service, local costs, etc., and then described briefly the commercial methods of the Milwaukee company.

The most important special problem faced by an electric utility, said the speaker, is that of increasing its plant, generating capacity and distribution lines to keep step with the industrial, commercial, civic and social advancement of its community. A private company can solve this problem better than a municipality because it is not restricted in the administration of its business by the limitations of a city charter or other legislative enactments. Again, all of the knowledge, experience, ability and resourcefulness at the command of a private company can be specialized and concentrated on this problem from an engineering, executive and financial standpoint. The average municipality, on the other hand, has many other special problems, of equal or greater importance to the community. These demand immediate attention and the exercise of all of its legislative and administrative functions, as well as its financial resources.

The establishment of a municipal street-lighting plant in Milwaukee, for which bonds are now being issued, was actuated, said Mr. Duffy, by political, not economic, reasons. Unfortunately, he added, voters are not usually guided by reasons, but by political influences and prejudices, often founded on ignorance or misrepresentation of facts.

The principal weak point in any agitation for a municipal plant, he went on, is the erroneous idea that the city can do its public lighting at less cost than it can be done by a private company, when exactly the opposite is the case. Taking the estimates of the city's engineers in the Milwaukee case, the cost of lamp operation will be increased 31 per cent, or $40,000 a year, over the present contract with the private company, which was made six years ago and has been extended temporarily.

It is not generally known or understood what an important part "fixed charges" play in the cost of electric service, said the speaker. "Fixed charges" are approximately 60 per cent of the total cost of conducting the business. "Fixed expenses" (fixed operating expenses and fixed charges) are approximately 80 per cent of the total expenses, "variable expenses" being only 20 per cent. This explains why a municipal plant cannot do its public lighting as economically as a private plant, and also why it is necessary for a private company to make "minimum monthly charges," regardless of whether any electric energy is consumed or not. The necessity for this is apparent when it is known that approximately four-fifths of the total expense of conducting the business is "fixed" and has to be met by the municipal or private plant, regardless of what the consumption of electricity or the income derived therefrom may be. The practical advantages of private ownership over municipal ownership Mr. Duffy mentioned thus:

(1) Ability of the private company to command unlimited capital, if it is properly safeguarded and a reasonably adequate return thereon is assured, not only for the original installation of a plant and equipment of the best type and adequate capacity for the needs of the community, but also for all necessary additions and betterments thereto, as well as the extension of the service and the development of the business, unhampered by the limitation of city charters and other legislative restrictions.

(2) Economy and superiority of private service, due to the construction of the best plant at the lowest cost that money and skill can produce; the high standard of its maintenance; the economy and efficiency of its operation; the prompt, courteous and satisfactory treatment of consumers, and the efficiency and stability of its managers and employees, who, immune from political preferment or changes, are selected solely for their qualifications for the discharge of the duties and responsibilities of the positions to which they have been called.

(3) The development and extension of the business in keeping up with the reasonable needs of the community for enlarging its activities of every kind—to the end that the advantages of the service may be placed within the reach of the greatest number of people, since the greater the volume of the business the less the cost of the service will be to the users.

There are other disadvantages of municipal ownership, said Mr. Duffy, which are of more vital importance to the public and more far-reaching in their ill effects to the community than those already referred to. One of these is the danger of rates being made too low, owing to ignorance of the actual cost of furnishing the service or utter disregard of what the cost may be. The fixing of rates is thus sometimes treated not as an economic question but as a means to an end, that end being the gaining of popularity with the public for the purpose of the political advancement of the party in power. The fixing of rates for electric service by a municipality under these conditions may temporarily convert a community to utopianism or socialism, but there will be a rude awakening when the users of the service are compelled to pay higher rates and the taxpayers are forced to make good financial deficits resulting from an attempt to give something for less than it can be produced.

In addition to the practical disadvantages of municipal ownership briefly referred to, said Mr. Duffy in closing, many objections could be pointed out from an ethical standpoint to show its absurdity, its impracticability, as well as the injustice of the burdens it necessarily and eventually imposes upon a community without any compensating benefits.

Public Service Commission News.

NEW HAMPSHIRE COMMISSION.

In a signed statement outlining the work of the board since its establishment in June, 1911, Chairman Edward Niles, of the commission, points out that the amount of business already brought before the board shows clearly that there is a public demand in the State for its services. Among electrical and related matters which have been brought forward are the inadequacy of telephone service; poor quality and excessive price of gas; consolidation of telephone companies; capitalization of electric companies and location of lines; assessment of land damages caused by overhead circuits; street-railway fares and schedules and the extension of telephone and electric-lighting systems into additional municipalities. The statement indicates that not a single case where the price or quality of electric service has been questioned has been brought before the board, pointing to a state of unusual harmony between the central stations and their customers.

WISCONSIN COMMISSION.

In a decision in the matter of an action to restrain the Railroad Commission from enforcing the penalty provision for a non-compliance with the provisions of the public utilities law by the Cawker Building Company, of Milwaukee, the Supreme Court recently held that the respondent company was not a public utility, and consequently not subject to commission jurisdiction. The Cawker Building Company is the owner of the Cawker Building in the city of Milwaukee. When the building was erected a steam plant was installed to provide heat, lighting and motor service for the benefit of the tenants. It was subsequently found that to operate economically it was necessary to utilize the full capacity of the plant. To do this it was necessary to dispose of the surplus energy, which was done by contract with three adjoining manufacturing concerns. This energy was sold in competition with a public utility operating under commission regulation and under an indeterminate permit granted by the commission.

The commission took the ground that the Cawker Building Company was a public utility according to its interpretation of the statutes. In its decision the court held that the mere furnishing of energy by a private individual or corporation to a few neighbors in the vicinity did not make that concern a public utility either under the letter or under the spirit of the law. In the present case it was held that the furnishing of energy was incidental merely and limited to the concerns in question. The court did not attempt to define or to fix a standard as to what constituted a public utility under the law, but was of the opinion that each case must depend upon the circumstances involved. This decision is not entirely satisfactory to the commission, for the reason that it does not fix the status of the many similar concerns now doing business in competition with existing commission-controlled utilities. These smaller concerns are of every gradation in size, and apparently it will take a number of years for the commission to learn over which ones it has jurisdiction.

The commission has refused to change its previous order in the case of the city of Neenah versus the Wisconsin Traction, Light, Heat & Power Company, on a rehearing of the case applied for by the respondent on the ground that it had additional evidence concerning the plant valuation. In the testimony at the rehearing the company claimed that the valuation of $320,000, upon which the commission based its previous order of a 25 per cent rate reduction, is lower by more than $300,000 than the actual price paid for the original property and the subsequent additions. The company based its claim upon the fact that when the various properties now consolidated by the respondent were acquired the total amount paid, including subsequent improvements, was $663,570, or a value of $557,397, exclusive of improvements. The commission's valuation was based upon the value of the physical properties at the time of the consolidation, but the value upon which the former rate order was based was higher than the physical valuation.

According to the facts in the case, the approximate physical value of the entire property purchased with the $557,000 of securities would reach about $266,185, of which about $219,630 was assignable to the gas plant. The commission held that a price over $500,000, if such price was paid for the respondent's gas plant, did not represent a reasonably prudent investment upon all of which the respondent is now entitled to earn. The average investment in gas plants of similar size in the State per thousand cubic feet of gas sold is $5.11, with a maximum of $8.51. This figure, based upon the respondent's alleged valuation, would be $12.87. All facts in the case, including the earning value of the plant as based upon past operations, tend to the conclusion that the plant when purchased was worth far less than the amount now alleged to have been paid. The commission was inclined to the opinion that the securities paid over as a consideration for the property did not represent or even approach in value the amount shown by their faces. Whether the company is over-capitalized or whether the excess in price over a reasonable value was actually paid and represented an unfortunate investment was considered immaterial, and the commission was decidedly of the opinion that such over-capitalization or over-investment should not be saddled upon the respondent's consumers. The case was dismissed and the company ordered to put into immediate effect the rate schedule as contained in the commission's previous order.

OHIO COMMISSION.

The Ohio Public Service Commission has before it now the question of whether the small mutual telephone companies are entitled under the new law to interchange of business and physical connections with the regular companies. It seems that on the surface the law provides for this, but the independent companies of the State have joined hands and declare they will fight the matter through the Supreme Court rather than allow these small companies to force this point where the large companies do not desire it. On the other hand, it is charged that it has not been so long ago since the large companies were seeking this business with considerable anxiety. The Kilbourn Mutual Telephone Company has asked the commission to order the New Ashley Telephone Company, the Citizens' Telephone Company of Delaware and the Sunbury & Galena Telephone Company to permit interchange of service, and the hearings took place before the commission last week.

In regard to this matter H. P. Folsom, vice-president of the Citizens' Telephone Company, of Circleville, said that if it is decided that the mutual companies may force interchange of service the larger companies will be forced to maintain them as well as their own systems, as they are poorly equipped and are not kept in proper repair to take care of the service. If they are forced to pay a proper rate on interchange of service, he said, they could not exist. Mr. Folsom argued that it would be a very one-sided arrangement and that the independent companies will fight through the Supreme Court to annul the portions of the new law pertaining to the interchange of service if the commission decides that the mutual companies have the right to force this issue.

The Bucyrus Light & Power Company has filed a complaint with the commission asserting that the service rate fixed by the Council of Bucyrus is unfair. The ordinance fixing the rate was enacted some time before the public utilities law was passed, and the city contended in the hearing last week that the commission had no authority to interfere for this reason. It is possible that the case will be taken into the courts, no matter what the decision of the commission may be.

A petition is being signed at Hamilton asking the commission to take steps to compel the Cincinnati & Suburban Bell Telephone Company to permit subscribers of the Home Telephone Company of Hamilton to use its toll lines under the public utilities law. The petition has been signed by many prominent business men of the place.

The commission has issued authority to the Springfield & Washington Electric Railway Company to issue $200,000 stock at par and $300,000 of thirty-year bonds to be sold at not less than $85. This is perhaps the first instance in Ohio where this class of stock has been sold at par. It is said that this road will be extended from South Charleston to Washington Court House at once.

The commission has sent notices to 360 public-utility companies to file their tariff charges and service rates at once or expect punishment. These should have been filed by Oct. 1, but because of the newness of the law allowances have been made. If within a reasonable time this information has not been filed the names of the companies will be certified to the Attorney-General for action. The fine is $1,000, and each day of omission may be construed as a separate offense.

MASSACHUSETTS COMMISSION.

The Fitchburg Gas & Electric Light Company has applied to the Gas & Electric Light Commission for authority to increase its capital stock by an amount not exceeding $131,350, covering 2627 shares of the par value of $50 each, such new stock or the proceeds from its sale to be used in paying floating indebtedness already incurred for new construction, extensions and permanent improvements and in meeting the cost of additional plant and property required in the company's business. The directors have determined a price of $85 per share at which the new stock is to be offered to existing stockholders, subject to the board's review. The amount of money estimated as necessary for the purposes of the issue is about $223,295.

The Haverhill Electric Company has petitioned the board for the right to issue additional capital stock of the par

value of $111,700, covering 1117 shares at $100 each, the price fixed by the directors being $130 per share, the estimated amount required for purposes similar to the Fitchburg petition being $145,210.

The Malden Electric Company has petitioned the board for authority to issue 2070 additional shares of stock of the par value of $100 each, the money to be devoted to meeting the cost of extensions and improvements and liquidating floating indebtedness. The directors have fixed the price of the stock at $145 per share, about $300,150 being required by the company.

The Malden & Melrose Gas Light Company has petitioned the board for authority to issue additional stock of the par value of $40,000 and to consolidate with the People's Gas Light Company, of Stoneham.

The Springfield Gas Light Company has applied to the commission for the right to issue additional stock to the par value of $135,000, to meet the cost of extensions and improvements; for authority to issue new stock to the par value of $111,000, for consolidating with the Chicopee Gas Light Company, and for permission to consolidate the latter organization.

The Boston Transit Commission recently gave a hearing regarding the location and character of the westerly terminus of the new subway to be built through the Back Bay district of Boston in place of the so-called Riverbank subway. The new subway, which will run mainly under Boylston Street, will be built in the near future by the Boston Transit Commission, and will cut down the running time of electric cars from westerly suburbs of Boston in and out of the city proper about ten minutes.

Hearings have been continued during the past week before the Railroad Commission upon the detailed locations desired by the Boston & Eastern Electric Railroad Company, which has been authorized by the Legislature to build a high-speed line between Post Office Square, Boston, and the north shore district of Lynn and Salem. Interest has centered upon a route through the large manufacturing city of Lynn. The original plans of the company called for the building of a semi-subway for underground electric operation through West Lynn. At the latest hearing the company agreed to a route beneath Lynn Common or North Common Street, which will bring the benefits of the road nearer the business center of the city.

An important hearing was held by the Railroad Commission on Nov. 23, at which the Boston Elevated Railway Company appeared on behalf of the establishment of an electric express and freight service on its surface lines in Boston. Over 500 persons of high official and private position appeared in support of the project.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has received an application from the Lewiston & Lake Ontario Shore Power Company for permission to exercise franchises in the villages of Lewiston and Youngstown and the towns of Porter and Lewiston, and for permission to begin construction of its plant and system for transforming and distributing electricity for all purposes. The applicant company proposes to purchase electricity which is for sale throughout the towns of Lewiston, Porter and Wilson, Niagara County, from the Niagara, Lockport & Ontario Power Company, and asks the commission to authorize the sale of $25,000 of stock, the proceeds to be used to acquire the necessary real and personal property for right-of-way, distribution system, transformer stations and equipment. Substations will be located in Lewiston, Youngstown and Ransomville. A hearing on this matter has been appointed to be held at Buffalo on Dec. 1.

The commission has received a complaint from George Duchscherer, proprietor of the Hotel Touraine in Buffalo, alleging that the New York Telephone Company has refused to connect its trunk lines operated in connection with a switchboard of that company in one building of the hotel with the lines of the Federal Telephone & Telegraph Company at its switchboard in another building, in order to enable the hotel to give its patrons service over the lines of both companies from the single instrument in their rooms. The complaint has been served upon the company and an answer is required by the commission within twenty days.

CURRENT NEWS AND NOTES.

Baltimore A. I. E. E. Meeting.—The November meeting of the Baltimore Section of the American Institute of Electrical Engineers was held in the Physical Laboratory of Johns Hopkins University on Friday evening, Nov 24, at which a paper entitled "Photography with Invisible Rays" was presented by Prof. R. W. Wood, of the university. By invitation many members of the Engineers' Club of Baltimore were present.

* * *

Edison Would Refuse Nobel Prize.—At the annua meeting of the John Ericsson Memorial Society of Swedis Engineers Mr. Edward H. Johnson, the former busines associate of Mr. Thomas A. Edison, stated that the grea inventor would refuse the Nobel prize if offered to hin He added that Mr. Edison thoroughly appreciated th honor attached to the award of the prize, but believed tha it should be bestowed upon those who otherwise woul not have sufficient means to develop their work commer cially and make it profitable to the world.

* * *

N. E. L. A. Convention Arrangements.—During th National Electric Light Association convention to be hel in the state armory at Seattle June 9 to 15, 1912, an im pressive exhibit will be made of electrical apparatus, a has been done in former years. The floor area to b devoted to the exhibition will be about 8000 sq. ft. Th convention hall in which the meetings will be held wi have about 6000 sq. ft. of floor area in addition to a ga lery. Two other large rooms are available for the parall sessions which will be conducted according to the pla used so successfully in New York. Long before the co vention date the total membership will have passed th 10,000 mark, which it is now approaching steadily an rapidly.

* * *

Conference of Hodenpyl, Hardy & Company's Opera ing Officials.—Operating officials of the Union Railwa Gas & Electric Company and the Commonwealth Powe Railway & Light Company, which operate in Wiscons and Michigan respectively and are under the manageme of Hodenpyl, Hardy & Company, 7 Wall Street, New Yo City, met at the Hotel Sherman, Chicago, Nov. 13-16 i clusive, for conference on matters relating to operati of the various properties. About 100 were present, cluding the staffs of the New York and Detroit offic Papers were presented on operating and accounting su jects, and a very valuable address was made by Mr. C. Winslow, of the United States Forestry Commission, up the preservation of wood ties and poles. A dinner wa held on Wednesday evening, Nov. 15. The sessions we highly interesting and beneficial throughout, and it i planned to make the conference an annual affair. Amo those in attendance at the sessions were Messrs. Berna C. Cobb, president of the underlying companies; Willi H. Barthold, E. J. Bechtel and William M. Eaton, vi presidents; H. G. Kessler, general auditor, and S. E. W assistant secretary and assistant treasurer.

ADDITIONAL HIGH-PRESSURE FIRE PUMPS FOR NEW YORK CITY.—The city of New York is now installing an additional high-pressure motor-driven fire pump in each of its two pumping stations, making, when completed, six such pumps in each station. The buildings were originally laid out for eight pumps.

* * *

COMMONWEALTH EDISON SECTION, N. E. L. A.—Mr. H. M. Byllesby is scheduled to address the Commonwealth Edison Section of the National Electric Light Association in Chicago on Dec. 5. This will be the first of a series of meetings at which the members of the section will listen to addresses by prominent public-service executives, including Mr. Samuel Insull, Mr. B. E. Sunny and Mr. B. I. Budd.

* * *

MEETING OF THE SCRANTON COMPANY SECTION.—The regular monthly meeting of the Scranton Company Section of the N. E. L. A. was held in the Board of Trade Building, Scranton, Pa., on Nov. 23, the attendance being over 200. The speaker of the evening was Mr. T. C. Martin, who spoke of the work of the N. E. L. A. throughout the country. One of the features of the meeting was a demonstration of first-aid-to-the-injured work by representatives from the Brisbin colliery. Mr. H. L. Badger also addressed the gathering, taking as his topic "Results of Organization, Both Social and Technical, with the Bell Telephone Company." Entertainment and refreshments were provided at the close of the meeting.

* * *

LOS ANGELES A. I. E. E. SECTION.—The regular monthly meeting of the Los Angeles Section of the American Institute of Electrical Engineers was held Nov. 21, with an attendance of about seventy-five local members and visitors. Prof. Harris J. Ryan, Leland Stanford University, presented a paper entitled "Polarity in Polyphase Current Circuits," accompanied by many diagrams. Prof. R. W. Sorenson, of Throop Polytechnic Institute, Pasadena, discussed the paper and pointed out the practical use of the method in calculations in regular practice, relating particularly to compensators or auto-transformers. The next regular meeting of the local section will be held on Dec. 9, when the subject of "Public Service" will be discussed by Mr. T. B. Comstock, engineer of the Board of Public Utilities, Los Angeles, and by Mr. Paul Shoup, vice-president and general manager of the Pacific Electric Railway Company.

* * *

ELECTRICAL SHOW AT LOS ANGELES, CAL.—The Los Angeles Electrical Exposition opened in the Shrine Auditorium Nov. 25, with approximately eighty exhibitors. Among these are the United States government, which has four exhibits, including a most interesting collection of models from the Smithsonian Institution, and the Southern California Edison Company, which occupies a prominent booth in the building. The usual array of vacuum cleaners and other labor-saving and domestic appliances are on exhibition, as well as models of many of the best known electric carriages on the market. The electrical decorations are particularly effective and striking, more so than would have been possible had the original intention of holding the exposition in Fiesta Park been carried out. The attendance on the opening night was all that could be desired. The show will remain open till Dec. 9.

* * *

PATENT OFFICE DELAYS.—Hon. E. B. Moore, commissioner of patents, in his annual report just issued makes a strong appeal for the enactment of legislation requiring that an application for a patent shall be prosecuted within six months of any action of the Patent Office. A bill to this effect was introduced into Congress, but was strongly opposed by some patent attorneys. The present period within which the applicant is allowed to amend is one year, and under the existing practice there have been many instances of cases being amended just within the one-year limit in order to keep them alive, they thus serving as dragnets in many cases to catch inventions along similar lines which may be subsequently applied for, thereby involving inventors in expensive interference proceedings. The commissioner states that the office has been severely criticised recently, especially in the last year or two, for allowing applications, particularly those owned by corporations, to rest in the office for such long periods as really to have the effect of extending the patent period in case such applications are later passed to issue. Instructions, he says, have been repeatedly given to the examining corps to get rid as far as possible of all such cases as are delayed apparently by the applicant or his attorney, and had this bill passed it would have almost entirely overcome the criticism against the office.

* * *

PHILADELPHIA N. E. L. A. COMPANY SECTION.—On Nov. 2 the Comedy Company of the accounting department branch of the Philadelphia Electric Company N. E. L. A. Section cut loose from staid Quaker ways and the theories of higher accounting and presented the comedy farce "Her Gloves" to an appreciative audience of more than 500 persons. A dance followed and was a very enjoyable part of the evening's entertainment. At the November meeting of the commercial branch the subject "Salesmanship from an Insurance Man's Standpoint" was presented by Mr. Frederick C. Jones, of the Equitable Life Assurance Company. Mr. Jones called attention to many points of similarity in the work of the insurance man and the light and power salesman, indicating methods of approach and the necessity not only of studying the prospective customer from a business viewpoint but also of becoming thoroughly familiar with his individual habits as a means of securing that first attention which means so much in salesmanship. At a meeting of the meter department branch on Nov. 3 Mr. John V. Matthews presented a paper on "Three-Phase Systems and the Measurement of Power," in which economy of operation and theory of distribution were thoroughly covered. At the regular meeting of the accounting department branch Mr. Byron B. Smith presented a paper on "Accounting for Purchases," which laid stress on the importance of co-operation on the part of all who in any way become involved in the using of material, to the end that job and storehouse records may be accurately kept and that all may be traced through the accounting records. Mr. Smith convinced his hearers that departmental whims and "red tape" are not carried beyond the point of necessary information. The monthly general meeting of the section was held on Nov. 20, with Dr. C. P. Steinmetz as guest. Previous to the meeting Dr. Steinmetz was entertained at an informal dinner, about sixty members and guests attending. At the meeting the subject of "The Effect of Reactance on Alternating-Current Circuits and Apparatus" was treated by Dr. Steinmetz, the discussion being participated in by Mr. Snook, of the American Institute of Electrical Engineers, and Mr. A. R. Cheyney, of generating station "A." At the December meeting Mr. A. H. Armstrong will address the section on "The Coming of the Electric Locomotive." The death of Mr. Caryl D. Haskins has caused much sadness among his many friends in the Philadelphia Electric Company Section. He was an honorary member of the Metermen's Society, and that body has passed a resolution deploring his untimely death. Mr. Haskins was to have addressed the Philadelphia Electric Company Section at the February meeting next year.

GASOLINE STREET LIGHTING IN CHICAGO.—By an order of the City Council of Chicago, Mr. Carroll, city electrician, has been authorized to accept the bid of the American Development Company to supply gasoline street lighting for the year ending Aug. 31, 1912, at the rate of $26.64 per lamp per year.

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FEDERAL RELATION TO WATER POWER DEVELOPMENT.—Mr. Walter L. Fisher, Secretary of the Interior, is reported to have said, in addressing the National Waterways Commission in Washington, D. C., on Nov. 23, that the government should take no steps to prevent the development of water-powers by private corporations planning to utilize the energy by electricity. Rather, the Secretary is quoted as saying, federal regulation should be made strong enough to protect the public interest. Investors should be assured of a sufficient return to attract capital toward hydroelectric development.

* * *

ELECTRIC SERVICE ON THE CANAL ZONE.—As the Balboa power station of the Canal Zone on the Isthmus of Panama has been overloaded to the extent of about 20 per cent, the load from the villages of Corozal and Diablo has been transferred from that power house to the one at Miraflores. The Balboa plant, supplying all the electric light and power for Balboa, East Balboa and Ancon, is a temporary plant and will be dismantled, according to the present plan, within two years. The Miraflores plant, on the other hand, will be permanent. The Balboa plant supplies alternating current at 60 cycles, while the output of the Miraflores station is at 25 cycles.

* * *

PROPOSED CLEVELAND MUNICIPAL PLANT.—Mayor-elect Newton D. Baker of Cleveland, Ohio, has opposed immediate arrangements for the issue of $2,000,000 bonds for the erection of a new municipal lighting plant, as provided by vote at the recent election. Mr. Baker seems to have plans of his own in regard to this matter and has even refused the aid of the present city administration in getting information on what has been done by the two small plants already in operation. The trouble probably lies in the fact that he does not want the present City Council to take any action upon the matter. It is probable that negotiations will be resumed between the Cleveland Electric Illuminating Company and the Cleveland Railway Company whereby the additional power needed for the operation of the railway lines may be purchased from the former company's large new station. These negotiations were begun a year ago, but the illuminating company's figures were then considered too high. Vice-president Scovil stated a few days ago that the figures were not final and that the average price would depend upon the load-factor.

* * *

PROPOSED MUNICIPAL PLANT FOR TOLEDO, OHIO.—Councilman John B. Merrill, chairman of the street-railway committee of the City Council at Toledo, Ohio, has announced that as soon as the new councilmen take their seats he will introduce legislation providing for the establishment of a municipal lighting plant in that city. He has arrived at this decision, he says, because the Toledo Railways & Light Company is contesting the ordinance providing for a rate of 8 cents per kw-hour, with a discount of 1 cent. Mr. Merrill has stated that he believes the city can operate a plant that will furnish energy to the small consumer at 5 cents per kw-hour and to the manufacturer at 2 cents, and he cites the plants at Columbus, Ohio, and Pasadena, Cal., as examples of what can be done. Should this legislation be introduced it will probably have to be put to a referendum vote in the fall of 1912, in case such a vote is demanded. Mr. Merrill believes that a plant to cost half a million dollars will serve the purpose and that it can be operated in connection with the water-works system. City Solicitor Schreiber stated that a bond issue can be voted upon at a special election.

* * *

CATHODE-RAY TELEPHOTOGRAPH.—In his presidential address before the Röntgen Society Mr. A. A. Campbell Swinton described the operation of a proposed arrangement for transmitting pictures electrically. Both the transmitting and the receiving apparatus would consist of a cathode-ray tube, with arrangements for deflecting the ray through ten vibrations per second in a vertical direction and 1000 vibrations per second in a horizontal direction. In each case the ray plays over a screen divided into a large number of separate parts. At the transmitting station the ray would receive charges varying according to the luminosity of the parts of the screen over which it played, each part being active photo-electrically. The charges passing to the line wire affect the cathode ray at the receiving station and correspondingly vary the luminosity of the fluorescent screen, over which the ray plays completely ten times per second, in synchronism with the ray at the sending station.

* * *

PATENT OFFICE EXAMINERS.—The commissioner of patents, Hon. E. B. Moore, in his annual report just made public, pays a strong tribute to the present force of Patent Office examiners. The examining corps to-day is, he says, made up entirely of men who have been graduated from various technical colleges and schools, and they possess a very thorough foundation of knowledge when they enter the office through the competitive examinations. With but a few exceptions they all take courses at some of the law colleges of Washington which provide night sessions, with the result that in about four years of service they become graduates and are admitted as members of the bar, both in general and in patent law. The commissioner regrets, however, that, although the salaries have been materially increased in the past three years, he has been unable to hold as great a percentage of this specially trained class of men as is desirable to obtain the best possible aggregate efficiency. There is still a certain percentage that separates from the service after a comparatively short period —generally when they have become most valuable. This is on account of the low salaries as compared with the inducements offered by the large corporations and established law firms.

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THE CAPTAIN JOHN ERICSSON MEMORIAL SOCIETY OF SWEDISH ENGINEERS.—In 1907 a score of Swedish engineers founded a society called the Captain John Ericsson Memorial Society of Swedish Engineers. The object of the society as stated in its constitution is to honor the memory of John Ericsson, and to maintain and promote the good reputation of Swedish engineers. The society, which now has about 150 members, is actively engaged in collecting articles of all kinds which in any way relate to John Ericsson's work. Much interest in its work has been shown, and valuable assistance has been rendered by American engineers. Realizing the importance and the desirability of closer connections with the American engineers, the society at a recent meeting established a new class of members called associates who may be engineers of any nationality. At the same meeting it was decided that the society shall have a monthly dinner at which a lecture shall be delivered or other intellectual entertainment provided. The desire of the society is to stimulate interest in its work and bring together the Swedish and American engineers socially and professionally and to work with united forces not only to honor the memory of a great Swedish-American, but also to pave the road for the younger set of Swedish engineers coming to this country. Mr. C. G. de Laval, Harrison, N. J., is president and Mr. G. Tisell, 239 West Thirty-ninth Street, New York, is secretary of the society.

THE NEW YORK PUBLIC LIBRARY.

Its Electrical Equipment, System of Distribution, Means of Control and Method of Illumination.

A 250-Volt, Two-Wire, Direct-Current System Adopted Because of Large Motor Load and Great Length of Feeders—Lamp Circuits Equipped for Divided, Multiple and Remote Control—Extensive Low-Potential System.

BY EUGENE E. SMITH.

LOCATED at the Fifth Avenue end of Bryant Park, and extending from Fortieth to Forty-second Street, is the New York Public Library. The edifice, which was begun in 1897 and opened this year, is one of the finest in the world, and its architectural treatment within and without accords fully with the uses to which such a structure is put. Within its marble walls are housed the Astor, Lenox and Tilden Foundations, and room is provided for from 1,500,000 to 2,500,000 volumes. The main reading-room has seats for 768 readers, and in the entire building 1760 can be accommodated at one time. The stack-room has 334,000 running feet of shelving, while other special rooms provide 70,000 additional running feet of shelving. The building is lighted, heated and ventilated from a central generating plant located in the basement on the Fortieth Street side, and the features of this installation and also of the electrical equipment throughout the building are described in what follows.

GENERATING EQUIPMENT.

The installation comprises eight 217-hp Babcock & Wilcox boilers, two 200-kw, four-valve, non-condensing, single-cylinder, horizontal Fitchburg engines, and two 500-kw Fitchburg engines, each driving a two-wire, 250-volt, compound-wound Westinghouse generator. The sets are mounted on solid foundations of concrete set on a bed of sand, with a cushion of sand on all sides so as to prevent the vibration and noise under operation from traveling through the steel and masonry work of the building. The engines and generators are painted gray with a bluish stripe and varnished, and all other machinery has been finished to correspond. The conduits for the leads from the generators to the switchboard were installed in the engine and generator foundations, and terminate in an iron box at the generator end and at the switchboard end. The leads consist of stranded cable, extra flexible, and for the 500-kw generators each comprises four 700,000-circ. mil cables. Each lead from the 200-kw generators consists of two 00,000-circ. mil cables. These cables and the rheostat wires are rubber-insulated and lead-covered. For emergency and night loads a storage-battery plant has been installed, comprising 141 Electric Storage Battery Company's cells, thirty-four of which are end cells. All battery connections are made with lead-covered copper bars, which encircle the battery-rooms at a height of 7½ ft. above the floor. The bars are carried on porcelain insulators attached to iron hangers supported from channel irons. The hangers are suspended from the channel irons by bolts having insulating joints between the bolts and the hangers.

The switchboard is located in the center of the generator-room against the north wall. It contains the usual instruments, circuit-breakers, etc., in addition to watt-hour meters, graphic voltmeters and ammeters. The feeders are located on panels adjoining the generator section of the main switchboard. The switches are arranged according to size, the largest being at the bottom of the panels and the smallest at the top. The separate panel arrangement for lamp and motor circuits is due to the desire to meter the energy passing over each, and results in a simplified busbar arrangement on the rear of the board. The switches, which are set horizontally, are arranged so that the fuses are dead when the switch is open. At each switch is a name plate, and under each set of fuses on the face of the panel is a removable strip of marble, which can be taken out and cleaned should it be marred by the blowing of a fuse. The generator panels are 3 in. thick, while the other panels are 2 in. thick, and all are of white Italian marble. Above the switchboard, to a height of 4 ft., is a box inclosed on the front and sides with polished white marble for feeders. All connections on the rear of the switchboard running to switches are made with copper bars, and those running to instruments with asbestos-covered wire. The busbars are designed to carry 800 amp per square inch. In order to obviate the presence of cable behind the board copper rods have been installed from the lugs on the switches to the top of the board, where they are held in place by a perforated slate slab. The rods are covered with circular loom and have connectors fitted at the upper ends for the feeder cables. Inasmuch as the busbars and other connections necessitated these rods to be run at approximately 15 in. from the rear of the board, fiber braces are employed to hold them rigidly in place.

DISTRIBUTION SYSTEM.

Starting at the switchboard, an extensive conduit system runs through pull boxes to distribution boxes, to motors, outlets, etc. Black loricated conduit has been employed throughout the building except in the stack-rooms, where galvanized conduit is used. With the exception of the conduit in the stack-rooms, the conduit for lighting system in no place is smaller than ¾ in. The conduit work in the stack-rooms is exposed and is run through the angle-iron frames holding the stacks. A complete description of

[illegible] lighting of the stack rooms was published in the *Electrical World*, Oct. 17, 1908.

Pull boxes are installed in accessible places, so as to make the installation of feeders easy. A rack made up of porcelain rollers is installed in the box above the switchboard, and the feeder cables run on these rollers to a point over their respective lugs. From the box the feeder conduits run to a large pull box on the ceiling of the pump-room, whence the feeders are routed to the distribution boxes, etc. The conduits are installed so that all circuits are drawn in on the loop system. At each outlet for ceiling fixtures, wall fixtures, push switch, base receptacles and floor receptacles are special iron boxes, enameled both inside and outside. Ten riser points centrally located for the leads they feed are used, and the circuits are run up these riser shafts and connected to the lighting panels. From these panels sub-feeders are run to panels in rooms that require individual control of the lamps and motors.

The feeder system is divided into sections, so that the engineer can at certain times, day or night, know where lamps and motors are needed, and thus have control of the load. The main switchboard being located at the Fortieth Street side of the building and some of the riser shafts at the Forty-second Street side, with distribution panels on the top floors, the runs to the latter are exceptionally long. The circuits are designed so that the drop between the switchboard and any lamp or motor is not greater than 5 per cent, while the difference of potential between any two lamps is not more than 2 volts. The local switches used throughout the structure are of the Diamond H type, and double-pole, three-way and four-way switches, with lock and remote control, are used extensively. Bronze plates are fitted to all local switches. The base receptacles are also of the Diamond H type, with [illegible] face plates, and the floor outlets are of the Fountain waterproof type.

Fig. 1—Main Reading Room, New York Public Library.

The distribution boxes are of sheet steel, and each contains a switch panel and an interconnection panel, with gutter space on all sides for feeders and branch circuit wires. A panel of 1-in. marbleized slate is installed in each box, and on it are mounted the knife switches, automatic switches and busbars for lamp and motor circuits. The branch circuits are controlled by double-pole knife switches equipped with link fuses, and the remote-control switches throughout the installation are of the Pettingell-Andrews type. The busbars are arranged so that the feeders connect at one end and feed from the other end. The lamp circuits are controlled by knife switches located in the same position on all panels, and the switches are equipped with white handles, so that they can be readily distinguished from the other switches. Each panel is provided with a goose-neck and lamp-key socket.

The directories on each panel are made up in the form of a small plan of the section of the building in which the panel is located, and the outlets are marked and numbered to correspond to the number of the switch controlling them. The doors and trim of all the panels are made of cast bronze.

ILLUMINATION.

In the engine-room the lighting fixtures are arranged around the skylight in the ceiling and comprise clusters with white porcelain reflectors. Wall fixtures and base receptacles are also installed for working purposes, and on the top of each generator field frame is a 12-lamp standard with white porcelain reflectors. The latter fixtures are individually controlled from the generator section of the main switchboard by knife switches. The conduits carrying the wire to these fixtures are run on the inside of the

field frame. In the pump-room general illumination is provided by ceiling fixtures, and for working purposes base receptacles have been installed in the locations. Outlets in the boiler-room are placed so as to light the gages and

Fig. 2—Main Entrance Hall, New York Public Library.

ater columns, and wall receptacles are provided for work-ig purposes, with wall brackets and receptacles in the -les back of the boilers. In the ash pit, coal-rooms, feeder inway, locker and wash-rooms general illumination is cured from outlets controlled from distribution panels cated in the boiler-room and cker-room. Throughout the ib-basement drop lamps are rovided, and in rooms where achinery is located wall re-ptacles have been installed or working purposes. In iose portions of the basement hich are used for working irposes general illumination obtained from ceiling fix-res, controlled by push witches located at the en-ances to the respective ioms. In the printing and ookbinding departments, in ldition to the general illu-ination, drop lamps have en installed over the work-nches and machinery. The nels controlling lamp and otor circuits in these de-rtments are located so as to ve the workmen immediate ntrol of the circuits.

In rooms containing desks iced some distance from the ills provision is made for eding energy to the lamps rough extensions from terproof outlets in the floor, which connect to receptacles the back of the desks. For these receptacles extensions made with reinforced silk cord to portable lamps. In t room set aside as a lunch-room provision has been made for electric heating by the installation of receptacles for that purpose. In the lending and delivery-room illumination is obtained from ceiling outlets arranged in the ornaments of the ceiling around the skylight. These fixtures are so wired that the switches controlling the circuits are arranged in sections, each of which is connected to an automatic switch on the distribution panel. The automatic switches are controlled from a point in the main desk by means of push switches. The ceiling lamps are divided into two sections, and one section contains one-third and the other two-thirds of the lamps. In addition to this general illumination, provision has been made in the floor for extensions to desks for working lamps. The panels that control the latter are located in passages immediately below the room.

The corridors are illuminated by means of ceiling fixtures located at proper distance from each other and so arranged that there are no parts of the corridors not properly illuminated. The lamps in the corridors are controlled by knife switches. On the first floor are rooms used for special purposes, such as reading-rooms, stack-rooms and exhibition-rooms. The general illumination is provided from electroliers hanging from the ceiling, supplemented by desk lamps fed from floor outlets. In the special stack-rooms the lighting

Fig. 3—Circulation Room in Basement.

arrangements are similar to those in the large stack-rooms; that is, all the conduit and outlets are exposed on the bottom of the stack frame and in the aisles, and where there is no frame the conduit is held in place by stands fastened to the

tops of the stacks. The outlets in the stack aisles are controlled by automatic switches, operated from push switches set in the ends of the stacks.

The entrance hall on the Fifth Avenue side is lighted by standards of artistic design. The circuits are controlled by automatic switches operated by push switches located in

Fig. 4—Exhibition Room on Main Floor.

the base of the standards. Although the ceiling of the hall is on a level with the ceiling of the second floor, the illumination obtained from these standards is sufficient, the walls and ceiling being of white marble. From the foot of the stairs leading to the second floor are large fixtures of beautiful design, fed from automatically controlled circuits operated by push switches in the main hall. The exhibition-rooms are provided with ceiling fixtures, also supplied with energy through automatic switches, operated by push switches located at the entrances to the rooms. In some of the special reading-rooms on this floor stacks are arranged along the side walls and balconies over them, so that special provision had to be made for lighting the stacks.

The conduit is also exposed on the bottom of the framework of the balcony, and special outlet boxes equipped with reflector fixtures are inserted where necessary. Each fixture has two tubular lamps connected in series.

In the lecture-rooms the general illumination is obtained from ceiling fixtures. In addition, provision is made so that a reflector can be installed to illuminate a screen or chart at the lecturer's desk. A special flash-signal arrangement is provided from the desk to the location of the lantern operator. Arranged in the corridor overlooking the Fifth Avenue hall and located so as to give the best results are standards of pleasing design in addition to ceiling outlets. A number of special reading-rooms are provided for works in foreign and ancient languages, and in addition to the general illumination of these rooms standards are placed on the reading tables, fed from floor outlets through flexible conduit concealed in the furniture.

On the third floor are located the main reading-room, special reading and stack-rooms, catalog-room and art galleries. The main reading-room is located on the west side of the building. The fixtures for this room are suspended from the ceiling, and are of such size that a distribution panel has been placed in the attic space above the ceiling for each fixture. On these panels are mounted two automatic switches, so connected that one controls the section that feeds the upper lamps and the other controls the section feeding the lower lamps of the fixture. The control switches are arranged in a bank in the working space in the center of the reading-room. The fixtures are re-lamped by lowering them to the floor, and because of this the connections are made from the distribution panel to a gang of wall receptacles installed on the walkway immediately above each fixture. The connections from the fixture are made by inserting the plugs attached to the fixture wires into receptacles provided for this purpose. The wires from the fixture to the plugs are bunched and covered with a flexible tube.

Arranged around the entire reading-room are bookstacks illuminated by means of Frink stack reflectors fitted with tubular lamps. The circuits are controlled from the working section of the reading-room by means of push switches located in the bank of remote-control switches. The tables in the reading-room are provided with standards connected to waterproof floor outlets, and the lamps are controlled by knife switches on the distribution panels on the seventh stack floor below the main reading-room. The cables that feed the panels for the individual ceiling fixtures in the reading-room are controlled from the distribution panels on the seventh stack floor by means of large knife switches. The special reading and stack-rooms on this floor are equipped with lighting fixtures, for both reading and working purposes, of the same kind as those used in other rooms of the same character on other floors.

In the catalog-room, which is located in the center of the building, the lighting arrangement is almost the same as that used in the main reading-room. The art galleries

Fig. 5—Typical Distribution Panel.

are fitted up with ceiling fixtures for general illumination and about 1000 ft. of special cold-drawn bronze Frink reflector is used to light the pictures. Waterproof outlets have been provided in the floors of the art gallery, so that future arrangements may be taken care of. The attic space, in which are located the exhaust fans, ducts, tank

and distribution panels, is provided with an iron walkway, and to give proper illumination drop lamps are provided. Inasmuch as the space can be entered from two points, the lamps are arranged to be controlled from either entrance by three-way switches.

Throughout the building certain lamps on certain fix-

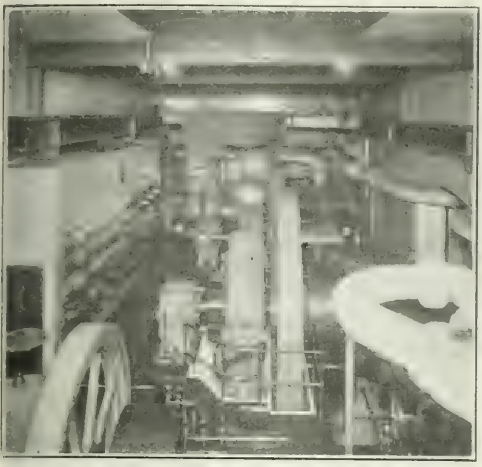


Fig. 6—Generating Plant, New York Public Library.

tures are independently wired and controlled and fed from special feeders. These lamps are for the use of the watchmen, and are so circuited that the engineer can pull all the switches on the main switchboard except the ones controlling these feeders. Many of the rooms of the building have more than one entrance, and the lamp circuits are therefore operated by three-way or four-way switches. The walkway surrounding the library and also the court are illuminated from lamp-posts of special design. Manholes are provided in the lawns, in each of which is a distribution panel controlling the lamps in the posts.

MOTOR EQUIPMENT

There is a completely equipped machine shop, fitted with electrically driven tools, in addition to a print shop and bindery. The printing shop and bindery are capable of doing the printing and other work necessary for the different departments of the library. The printing of the catalog alone will keep the machinery working for a number of years before it is finally completed. The presses and other apparatus are all electrically operated. The motor installation aggregates about 500 hp. Because of this load, and also because of the long run of some of the feeders, a 250-volt system was chosen.

BOOK CONVEYORS.

In addition to an extensive motor-driven ventilating system, there is a motor-driven elevator system, comprising two passenger elevators, a freight elevator, a sidewalk lift, an ash and coal conveyor, eleven automatic book lifts and two book conveyors. The book lifts are located in different departments of the library, and some are capable of being called and of being sent to any landing, and others are capable of being called and sent to only one point. There are six lifts in the main reading-room and main stack floors, one at each end and four in the center, and these are connected so that the cars can be called from the main reading-room and sent to any stack floor, but the attendant on any of the stack floors can only call the cars and send them to the main reading-room. In connection with this system there is a buzzer arrangement, which operates momentarily when the cars leave the floor and constantly until the door is opened at the floor to which the car is sent. At the four-car installation in the center of the main reading-room and stack floors there is at the main reading-room level an operator's station, so arranged that the operator can assume control of all four cars. By thus centralizing control unnecessary trips are prevented. At the operator's desk there is a set of lamp indicators, showing the location of each of the four cars. Lamp indicators are also located over the door of each shaft at the main reading-room level. There is also at the operator's station a lamp indicator to show when a car is wanted at any of the stack floors. All of the lifts are capable of carrying 250 lb. at a speed of 150 ft. a minute.

The electrically operated book conveyors are located on the second floor. One is arranged to carry books and baskets in a horizontal position from rooms in the northeast corner of the building to the northwest corner of the building, and the other is arranged to run from a room in the northwest corner of the building to the center of the stack-room on the sixth stack-floor level. In addition, there is a pneumatic tube system, with stations in rooms in different parts of the building, for conveying written requests, receipts for books, etc.

LOW POTENTIAL CIRCUITS.

Eight separate intercommunicating telephone systems are installed in connection with the power-plant department, the lift equipment and between departments. In addition, there are a number of bell and annunciator systems. A closing-down system is installed, arranged to be operated from the working desk in the main reading-room, various gongs being sounded throughout the building. The main reading-room also possesses an indicator system with annunciator drops, one annunciator facing north and the other passing south. The annunciators are made up of a box containing small lamps, with a numbered glass in front of each lamp.

The wires used for these various low-potential circuits, as well as for the time service and watchmen's supervisory system, are installed in a separate conduit system. Interconnection boxes are located in distribution panels above the lighting panels at central points of the low-potential systems. The energy for the low-potential system is obtained from batteries and motor-generators. A separate low-potential switchboard is provided in the engine-room.

The building and grounds were designed and the con-

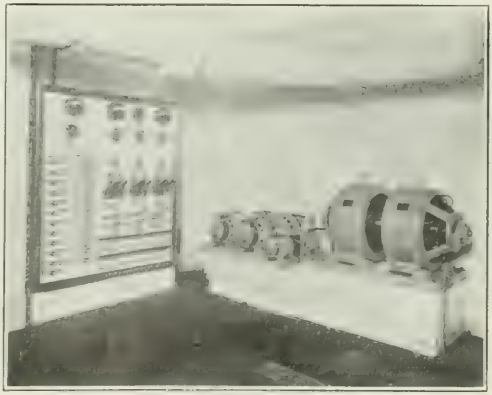


Fig. 7—Low-Potential Generators and Control Board.

struction supervised by Carrère & Hastings; Pattison Brothers were the consulting engineers; the Lord Electric Company was the contractor for the electrical installation, and the Tucker Electric Construction Company was the contractor for the electrical equipment installed in the furniture.

AN OIL-ENGINE CENTRAL STATION.

Details of Unit Costs, Repairs, Etc., of 755-hp Plant in Operation Six Years—A Small-Town System with a 41 per Cent Daily Load Factor, Operating Local Industries and City Water Pumping —750 Customers Among 5500 Population.

LEBANON, Ind., has one of the few central stations in the Middle Western States equipped with self-igniting oil engines of the Diesel type. These units have been in service more than six years, affording an excellent opportunity for examining their performance with respect to sustained fuel efficiency, as well as the items of their repair and maintenance over such a term of years. The local central-station situation is also of interest on account of the successful work that has been done in acquiring a motor load, most of the local industries and the city water-works pumping station being operated from the lines of the Diesel-engine plant, resulting in the excellent load-curve shown herewith.

The principal equipment of the Lebanon station comprises two 225-hp, 164-r.p.m., three-cylinder American Diesel engines, direct-connected to 160-kva, 2300-volt, 60-cycle, three-phase alternators, and a 125-hp, 83-kva, 225-r.p.m. unit of similar type. The last of the larger units was installed in 1907, the other two engines having been in service since 1905. Each set is arranged with its own belt-driven exciter, and one engine can also be belted to an air compressor in the main engine-room; but the compressed air for the plant is principally supplied by two motor-driven compressors in an adjoining room. At the rear of the plant building is the cooling tower for reducing the temperature of the engine-jacket water.

The fuel used in the engines is a partly refined heavy oil, testing 30 deg. Baumé and containing about 19,000 lb. Fahr. heat units per pound. From it the sulphur and other objectionable materials have been removed. This oil costs 2.75 cents per gallon delivered in tank cars to the 11,000-gal. underground storage container, 30 ft. south of the plant. The engines derive their immediate fuel supply from two 30-gal. steel tanks within the station, into which the oil is pumped by hand from the underground reservoir once every hour. Each time the levels in the tanks are thus

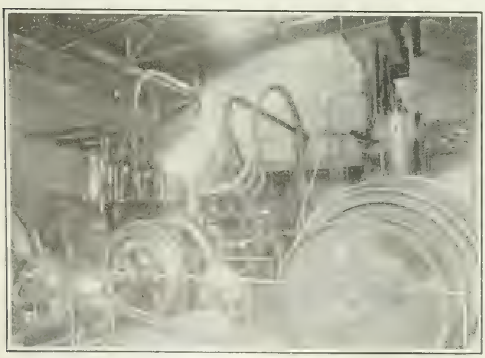


Fig. 1—Interior of Lebanon Plant Showing 225-hp and 125-hp Diesel Oil Engine.

restored to their normal heights record is made, on a blank form kept for the purpose, of the quantity pumped in, so that the figures thus obtained represent the hourly fuel-oil consumption of the engines. To one unaccustomed to the remarkable efficiencies of Diesel-engine operation the small size of the fuel-oil tanks and pipes in the station will occasion some surprise. The quantities of oil fed to the engines are, however, exceedingly small, averaging less than half a thimbleful per cylinder per stroke in the case of the 225-hp units. Under ordinary conditions the engines consume from 10 gal. to 20 gal. of oil per hour and produce 10 kw-hours per gallon of oil.

Fig. 2—Motor-Driven Air Compressor Delivering Air at a Pressure of 65 Atmospheres.

Compressed air for the fuel jets, at a density of about 65 atmospheres or nearly 1000 lb. per square inch, is supplied by two three-stage water-cooled compressors, one of the horizontal-tandem Ingersoll-Rand type and the other a vertical machine built by the American Diesel Engine Company, each compressor being separately belt-driven by a 30-hp, three-phase Westinghouse induction motor. A similar vertical compressor is arranged to be belt-driven directly from the shaft of one of the large engines. Connected to the high-pressure air line are a number of steel "bottles," or high-pressure containers, in which compressed air is held over for starting up the engines.

The free air for the engines is taken in through large pipes opening into the outside atmosphere in the case of the two earlier units, while the latest engine receives its air directly from the engine-room through the boxlike arrangement shown at the right of Fig. 1. As is well known, the Diesel engine operates on the four-cycle principle, every second revolution being a power stroke. On the compression stroke free air is taken into the cylinder and compressed ahead of the piston to a pressure of more than 500 lb. per square inch, raising it virtually to a red heat by the end of the stroke. At this instant the fuel oil is sprayed into the highly heated and compressed cylinder contents by the higher air pressure from the compressor lines. As the fuel spray enters the cylinder it is ignited by the high temperature met with and burns in a steady, not explosive, flame during the fraction of a second that admission lasts. The fuel supply is cut off after about one-tenth of the expansion stroke has been traversed, and from this point expansion proceeds adiabatically.

The cylinder jackets and valves are prevented from overheating by circulating through them water that has been cooled by trickling over the cooling tower just behind the station. This tower, as shown in Fig. 3, is 10 ft. by 5 ft. in plan and 10 ft. high, containing nine trays made up of wooden slats over which the water drips from the rows of perforated pipes overhead. Owing to the very high thermal efficiency of the Diesel engines and consequent small waste of sensible heat the quantity of water circulated is very much less than for an equivalent rating of gas engines. The water leaving the jackets is usually at a temperature of from 110 to 120 deg. Fahr., and during its passage through the overhead tank and cooling tower is lowered to about 80 deg. As a result of the low humidity which exists during part of the summer in this section of Indiana the

water coming from the tower is often reduced several degrees below the temperature of the atmosphere itself. From the cooling tower the water is caught in the concrete basin at its base, shown in Fig. 3, and thence is circulated directly through the engine jackets to the overhead tank, where it also undergoes a few degrees of cooling before passing to

Fig. 3—Cooling Tower for Diesel Engine Jacket Water.

the spray. A 2-hp motor-driven centrifugal pump performs the work of circulating this jacket water, while another motor-driven well pump keeps the level in the storage tank constant. Part of the jacket water coming from over the exhaust chamber is collected and filtered in the station and is then pumped to a nearby railroad watering tank for use in locomotives. The income derived from this source thus helps to reduce the operating cost of the station, and the waste heat in the water aids in keeping the tank from freezing.

All three of the engine-driven alternators are operated in parallel on a common 2300-volt bus, from which the various services are in turn taken off. Under the former plan of running the station the engines were run as separate systems, but by a change of wiring it has been possible to synchronize all apparatus without difficulty, securing the advantage of division of load between the various units. A resulting peculiar feature of the Lebanon plant is the exchange of relatively large cross-currents between the several alternators, these exchange currents often representing a value of as high as 25 per cent of the main current at the time of full load. The ammeters indicate that this pulsation occurs with a frequency of from 15 to 30 times per minute, but through the excellent field regulation imposed by a Tirrill regulator this variation is barely capable of being noticed on the bus beyond the separate machine leads.

The cost of producing a kilowatt-hour in the Lebanon plant has averaged 2.8 mills for fuel oil alone and 1.9 mills for labor. Three men are employed about the station, but one of them gives only half of his time to the operation of the plant, having also charge of making arc-lamp renewals, overhead repairs, etc. Lubricating oil and waste have averaged 0.2 mill per kilowatt-hour. The item of repairs on this plant has been rather heavy, although difficult to ascertain with accuracy. During four years prior to the time the present management took charge the renewal parts included fifteen cylinder heads, one crankshaft and two cylinders. This high fatality among the cylinder heads was afterward traced to the lack of adequate cooling by the circulating water. Thermometers have now been placed on all outlets, and these readings are carefully noted at frequent intervals, so that the temperature of no outlet water at any time rises beyond 120 deg. Fahr. Such a minor injury as a cracked cylinder does not necessarily impair the operation of an engine. One of the Diesel units at Lebanon has been running with a very small crack in the cylinder for several months, with no other evidence of its deficiency than a slight noise and a cloud of steam in the exhaust at each discharge from this cylinder. At all other times the exhaust gases are quite invisible, except when starting on very rich charges. During the year that the plant has been in the hands of its present management the repair items have been slight, as the result of the careful attention given the discharge water, although the cylinder just mentioned cracked without apparent cause and has not as yet been replaced.

The Lebanon plant enjoys an excellent load factor, its total output averaging about 41 per cent of the twenty-four-hour equivalent of its maximum demand. During the eight hours of the working day its load due to motors averages 78 per cent of its evening peak. Among the profitable motor services supplied by this station are the city water-works pumping plant, whose 60-hp load occurs eighteen hours daily during off-peak periods; a 25-hp planing mill, a 50-hp flour mill and 60 hp in motors in a cream separator factory. There is a total of 518 hp connected in three-phase motors. The rate for this motor service varies from 5 cents to 2½ cents per kw-hour, according to the quantity that the consumer may use.

Altogether the Citizens' Electric Light & Power Company, of Lebanon, has 750 customers, which in its little city of 5500 inhabitants gives one consumer to every seven people. The rates charged for lighting service are 10 cents per kw-hour to residences and 8 cents per kw-hour to stores and other commercial establishments. These rates are net, and in case of unpaid bills are subject to 10 per cent increase after the tenth of the month. The central-station

CENTRAL-STATION CUSTOMERS FOR MONTH OF SEPTEMBER.

Year	Metered	Flat-Rate	Total
1910	476	159	[illegible]
1911	[illegible]	[illegible]	[illegible]

income per inhabitant at Lebanon is $6.20. The accompanying table shows the number of flat-rate and metered customers receiving service from the company as of date Oct. 1, 1910 and 1911.

The gross receipts for the same period of September, 1910, were $2,534.53, and for September, 1911, $2,786.98. These returns indicate that during this year about forty of the most determined flat-rate customers were converted to service on a meter basis.

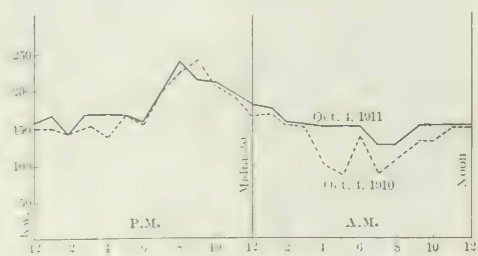


Fig. 4—Daily Load Curve of Diesel Engine Station, Lebanon, Ind.

Mr. C. E. Layton is secretary, treasurer and manager of the Citizens' Electric Light & Power Company, which operates the Diesel plant at Lebanon. Mr. T. C. McReynolds, of Kokomo, Ind., is president, and Mr. T. A. Scott is vice-president. The superintendent and chief engineer of the station is Mr. B. F. Jones.

MINIATURE HYDROELECTRIC PLANT AT SPRINGFIELD, VT.

Description of Reinforced-Concrete Dam, Power House with Impulse Wheel Operating Under 80-Ft. Head, and Circuit Arrangements for a Private Mountain Camp.

By M. A. Hicks.

FEW private fish and game preserves combine so much of the wildness and seclusion of a mountain glen with all the comforts and conveniences of modern life as does that known as "Muckross," owned by Mr. W. D. Woolson, of Springfield, Vt.

This preserve covers an area of 600 acres of mountainous land bordering Black River on the north and is well stocked with game native to the region. The approach over a steel suspension bridge at a height of about 25 ft. above the river and through a rustic anteroom, the door of which is guarded by an electric lock controlled from the distant bungalow, reminds one of some ancient castle with its moat and drawbridge and serves the purpose of keeping out undesired visitors.

This bridge with its anteroom located close beside the track of the Springfield Electric Railroad, and also the winding path beyond which leads to the bungalow in the glen, are all brilliantly lighted at night by incandescent electric lamps. All lamps exposed to the weather are mounted in special weatherproof fixtures designed for the purpose by Mr. J. Gardner Menut, the electrical contractor who installed them. These fixtures consist of 6-in. clear glass globes open at the bottom and mounted over 25-watt tungsten lamps. Porcelain weatherproof sockets are used and the fixture is mounted at the top of ¾-in. "galvaduct" piping, no ornamental posts being employed.

The service wires feeding these lamps are carried in ¾-in. "galvaduct" underground conduit, to which the vertical pipes are connected through 4-in. marine-type junction boxes having four outlets. The boxes are placed edgewise with one outlet for the lamp pipe at the top and the bottom one, having a 2-ft. length of pipe, closed at the lower end and driven below the bottom of the trench to act as a support to brace the pipe and fixture. The ¾-in. conduit carries four wires, two feeder and two switch wires, by which three-way switches at both the bungalow and anteroom control the lamps.

A telephone outside the anteroom enables visitors to announce their presence, and if welcome the door is opened for them by the same mysterious agency that conveyed news of their arrival. As they step inside a signal bell announces the fact to their distant host at the bungalow, where all kinds of electrical service, including lighting, heating, cooking, sweeping, ventilating, etc., are employed.

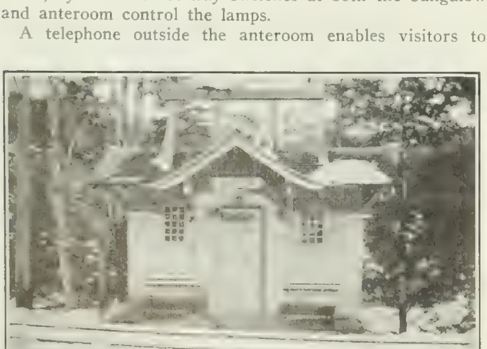


Fig. 1—Exterior View of Miniature Plant.

Excepting for the telephone and signaling service, which requires ordinary dry-cell batteries, the source of electric energy is a small spring-fed trout brook having an estimated average flow of 16 cu. ft. per minute, though sometimes dry in parts of its course and subject to floods of from fifty to sixty times the average flow. This little

Fig. 2—View of New Reservoir.

stream passes in a narrow, deep valley in a north to south direction through the preserve, and 500 ft. from its entrance into Black River falls over a nearly vertical ledge a distance of about 60 ft. Back of the falls there are rapids and a small gorge in the bedrock which formerly drained a long narrow and swampy meadow that extended nearly half a mile upstream.

By means of a reinforced-concrete dam this meadow has been converted into a sixteen-acre reservoir with a depth of 12 ft. at the dam, of which 6 ft. may be drawn for power purposes at a small hydroelectric plant located in the glen near the foot of the falls. The dam is the third one built in an attempt to impound the water of the stream at this point. Owing to the treacherous nature of the abutting hillside, which rises about 100 ft. above the dam and is composed of a sticky, clay-like soil or silt, without grit and which when saturated with water forms a treacherous quicksand, previous dams have failed.

At the eastern end the dam abuts against bedrock and rests upon it to a point about 40 ft. westerly from the spillway.

Messrs. Crosby & Parker, of Brattleboro, Vt., the contractors who built the dam, gave guarantees that it would remain watertight and safely hold for five years, and as the method of overcoming the difficulties met with may be of interest to others it is here given in some detail.

The main dam of reinforced concrete is 8 ft. wide at the base, rises 12 ft. to the spillway, which is 70 ft. long and has an ogee form on the downstream side and a slope or batter of 1 ft. in 10 ft. from the base to the top on the upstream side. It is reinforced with 1-in. twisted steel rods extending lengthwise in a vertical plane, with 1-ft. spacing. Heavy steel dowel pins extend down into bedrock for anchorage.

At the west end of the spillway and rising 3 ft. above it is the forebay, which is, in internal dimensions, 3 ft. wide, 6 ft. long and 9 ft. deep, the floor being raised 6 ft. above the bottom of the reservoir that the trout may always have sufficient water for their needs. A sluice pipe through the base of the dam provides means for draining and cleaning the reservoir if desired.

The top of the opening from the reservoir into the fore-

bay is some 3 ft. below the level of the spillway to the dam and thus prevents floating rubbish from entering, and also providing, when the plank covering is over it, a frost-proof place for the headgate to the penstock and the air pipe with it.

There are three sets of grooves in the sides of the forebay, each 2 in. wide and 1 in. deep, for wooden frame screens with heavy ¼-in. mesh galvanized wire netting. Any one may be removed for cleaning, leaving two in place, or if desired planks may be placed in one set of grooves to shut out the water from the forebay.

Extending from this forebay to the power house there is a 6-in. spiral riveted steel penstock with flanged sections bolted together. It is 380 ft. in length. Beyond the forebay the dam is reduced in thickness at the base to 2½ ft., with an even slope from bottom to top on each side of 1 ft. in 10 ft. and having the same reinforcement of steel rods as the main dam. For a distance of 40 ft. from the spillway this wall rests upon a bed of shale which has an almost vertical dip and a strike of about 42 deg. east of north. This floor of rock has a gradually descending slope for the distance named and then abruptly disappears in a slight overhang from the vertical and ends in a formation of clay and quicksand of unknown depth. An excavation was made beyond bedrock in this formation 10 ft. long, 8 ft. wide and to a depth of 4 ft. below the lip of the bedrock, when the inrush of very cold water and the dangerous nature of the material compelled a stop. A sounding rod 15 ft. long was sunk below this excavation without finding bottom.

To prevent caving of the sides and to confine the quicksand a border of sheet piling of matched spruce was driven around the edges of the pit to a depth of 12 ft.; then the bottom of the area inclosed was studded with piling well driven to place and concrete poured into the mould thus made and allowed to set to form a heavy slab for a foundation. Upon this was erected the extreme western end of the front flank wall of the dam, which is now, one year later, entirely buried by the caving and flowing of the clay-like soil over it from the hillside.

Extending from the northwest corner of the forebay at an angle of 45 deg. to the main dam is a wall of concrete 40 ft. long, 15 ft. high and 2 ft. thick. This wall rests upon bed-

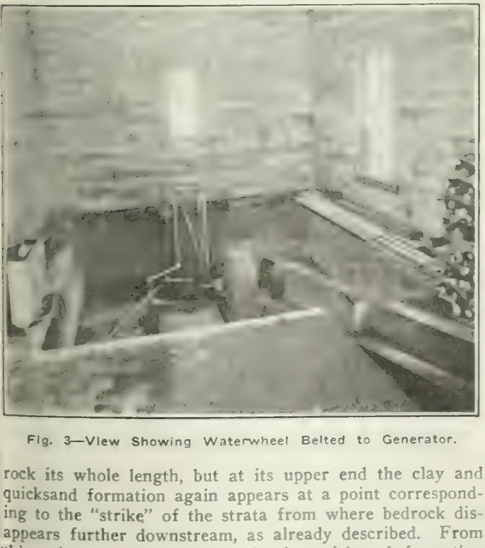


Fig. 3—View Showing Waterwheel Belted to Generator.

rock its whole length, but at its upper end the clay and quicksand formation again appears at a point corresponding to the "strike" of the strata from where bedrock disappears further downstream, as already described. From this point a trench was dug in the quicksand formation parallel to the front flank wall of dam, sheet piling driven as previously described, a concrete foundation made and a wall 35 ft. long, 15 ft. high and 2 ft. thick of concrete was erected. Between these flank or wing walls the space was filled with earth well settled into place, making a water-tight barrier against the lake above.

In clearing the bedrock preparatory to building the dam

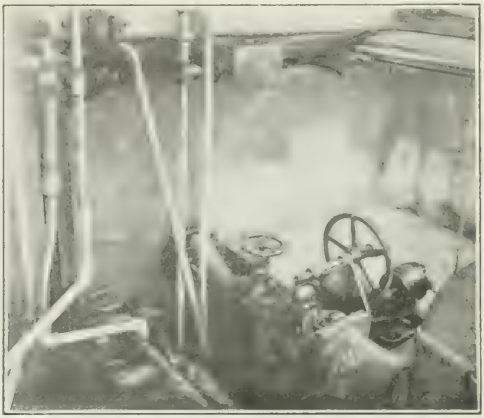


Fig. 4—Motor-Operated Needle Valve.

a small deposit of blue clay was met with. This was carefully saved and found useful when the reservoir first filled, as near the east end of the main dam where the shale rock has been weathered by frost a leak appeared, the water coming up out of the bedrock below the dam like a spring. But the clay tamped into place on the bottom of the reservoir just above that end of the dam entirely stopped it.

The power plant consists of a special 18-in. Pelton wheel using a 1⅛-in. nozzle under a working head of about 80 ft. when the reservoir is full, the static head being about 85½ ft. under same conditions. This wheel has a needle valve for controlling the admission of water to the buckets, and this valve is operated by a reversible electric motor back-geared to a worm and gear through the medium of a friction clutch, the worm gear acting upon a screw having four threads to the inch.

The electric motor takes energy from a storage battery at the bungalow about 200 ft. distant, where a double-throw switch and a small single-pole circuit-breaker control and protect it. The ⅛-hp motor runs at 3400 r.p.m. and it requires two minutes to open or close the waterwheel valve, thus obviating danger from water hammer.

The waterwheel is belted to a 3½-kw, 125-volt, 1300-r.p.m. compound-wound, Western Electric generator, which, however, is used at 112 volts, except when charging the 54-cell "Exide" storage battery. At maximum load there is delivered at the switchboard over a line calculated for 5 per cent loss a current of 25 amp at 112 volts. The normal charging rate of the battery is 3 amp and the regulation as yet is entirely by hand.

The storage battery is designed for emergency lighting and to help out the generator on peak loads. No "reverse-current" or "no-voltage" circuit breaker is used in the charging circuit to battery, dependence being placed upon 4-amp fuses for protection.

A switchboard in the form of a cabinet is located in a bedroom of the bungalow and has ammeters of the Weston type both for reading current of battery on charge and discharge and also generator output. There is also a voltmeter with switches to enable the potential of either the generator or battery as a whole to be ascertained, but there are no means for testing individual cells, that being done in the battery room in the basement.

The number of lamps at first installed for use at the bungalow, garage, stable and power house at the dam was forty-four; six lamps were connected for outdoor use on the suspension bridge and along the paths to the glen; in the anteroom and for a signal beside the railroad at the bridge there were three more. Of these there were forty 25-watt, six 40-watt and four 100-watt tungsten lamps, while two 60-watt carbon lamps were connected on extension cords for garage and battery room use.

Recently a new automobile shelter has been erected across the railway track and highway from the entrance to the suspension bridge, and this is connected to the same lighting circuit through an underground conduit.

All telephone and signaling circuits are carried in an underground lead-covered cable having fourteen wires. These include the local telephone and door lock circuits, public telephone and two buzzer circuits, one to give notice when the anteroom door at the bridge opens and one giving notice of the approach of an electric car when the latter is still a mile distant and two circuits in reserve for emergency use.

In closing it may be said that the region of the Connecticut Valley north from Bellows Falls is very interesting to students of surface geology, and that the location of the little hydroelectric plant above described is found within the terrace formation which extends up-stream from Bellows Falls a long way, marking in the main valley, as well as in valleys of tributary streams, the lines of an ancient glacial lake that became silted up, leaving potholes on Mount Kilburn, opposite Bellows Falls, 800 ft. above the present level of the river, filling ancient river and brook channels, and in many cases causing new channels to be cut through ridges of rock, thus making numerous gorges such as Cavendish Gorge, Queechee Gulf, Devil's Gulch and others, of which the one noted in this article is a sample in miniature. Soundings show that the deep chasm in bedrock now filled with the clay and quicksand formation at Muckross extends past the falls in the stream down to the river and probably under its bed, following the strike of the uptilted strata as if it were a "fault," or softer part, deeply eroded before the coming of the glacial lake. These gorges mark the sites of the best water-powers of the region to-day, but in all cases where a stream has cut itself a gorge the ancient channel, buried under great masses of drift, must be reckoned with in case a reservoir be established back of the rocky hill or ridge.

EFFICIENCY OF "EARTHS" IN RADIOTELEGRAPHY.

Experimental Investigation of the Variation in Efficiency with Size and Position of Earth Wire.

By Charles A. Culver.

The results of certain preliminary experiments extending over several years led the writer to the conclusion that the disposition of the earth connection in arranging a system for radiating or intercepting electromagnetic waves is of prime importance. These preliminary tests were carried out across both land and water. While the results were not wholly concordant, yet the data appeared to warrant a thorough and systematic investigation of the relative efficiency of various earth connections. It is also hoped that such a study may throw some light on the more or less obscure question of the function of the earth in the propagation of electric waves.

The present investigation has to do with conditions at a radiotelegraph receiving station. A similar study is being made with respect to a transmitting station. The tests were made at the distance of ¾ mile from the 1-kw station at Beloit College, Beloit, Wis. The receiving set was erected in Keep Athletic Field, just out of the city, and consist of a single vertical wire 50 ft. in length connected to regular loosely coupled oscillation transformer and perik detector. The shunted telephone method was used to co pare the intercepted energy. This method, though r extremely accurate, was adopted because of its convenien in practical field work. Dependence was placed on t possibility of being able to repeat any given set of resu rather than upon highly accurate measurements. T reader who has attempted to make quantitative measur ments under practical working conditions will readily a preciate the difficulties encountered and can judge the r sults accordingly.

The transmitting station is of the ordinary spark ty with a wave length of 650 m. The aerial approximates t L type, consisting of two horiozntal wires 275 ft. long su ported at a height of 75 ft. at one end and 35 ft. at t other. From the lower end two leads pass to the close coupled transformer of the transmitting set. This aer points in the general direction of the receiving station. T transformer is grounded to the city water system.

The soil between the two stations is, for the greater pa of the distance, composed of coarse sand. Immediate surrounding the receiving station, which for brevity w be designated as R, the soil consisted of about 2 ft. black loam covered with grass. Coarse glacial drift unde lies the loam. As a standard for comparison an "eart was established by burying (3 ft. deep) a piece of tin pla having an area of 400 sq. in. The first test consisted comparing with the above standard "earth" the effect an "earth" consisting of a piece of tin plate of the sar size but laid upon the grass. The receiving system w carefully adjusted to resonance and a series of alterna readings of the intercepted energy was made. The pla laid upon the grass was found to have the same efficien as the standard "earth."

A piece of galvanized wire netting of ½-in. mesh, havi the same area as the standard, was also laid upon the gra and proved to have an efficiency equal to that of t standard.

The sheet of metal and the netting were each in tu insulated from the earth at a height of 7 in. Under the conditions they both showed the same efficiency as t standard "earth."

Following the above comparisons tests were made of t relative efficiency of several forms of "earths" consisti of various lengths of No. 16 copper wire laid loosely up the grass. The following table embodies a part of t results obtained, S representing the transmitting station:

Direction of Earth Wire with Respect to S	Length of Earth-Wire, Feet	Ratio of Efficienc of "Earth" Testec to Standard.
Toward	50	1.5
Away from	50	1.1
Toward	100	2.2
Away from	100	0.9
Toward	180	3.0
Away from	180	0.7
At 90 degrees	50	1.0
At 90 degrees	100	1.1
At 90 degrees	180	1.5

In addition to the tests recorded in the above table 100 of earth wire was so disposed that 50 ft. pointed away fro S and 50 ft. toward S. The ratio of the efficiency of th arangement to that of the standard was 1.7. The syste just referred to was then arranged so that 50 ft. point toward S and 50 ft. at 90 deg. to S. The ratio of efficien in this case was unity.

A wire 25 ft. in length was buried 2 in. deep in mo earth and pointing toward S. This was compared with wire of equal length and direction, but laid loosely on th grass. The ratio of efficiency proved to be unity, thou

on a subsequent date the buried wire showed a somewhat higher efficiency than the one laid upon the grass.

A number of earth wires, each 25 ft. in length, were arranged radially upon the grass and pointing in the general direction of S, being roughly 30 deg. apart. The wire pointing directly toward S was connected and the energy noted. An adjacent wire was added to the arrangement and the energy again read. While it was found difficult to duplicate a given set of readings, the data clearly indicated that additional wires, after the first two or three, added little if any to the efficiency of the system. Following is a typical set of readings:

Type of "Earth."	Shunt Resistance to Produce Silence in Telephones.
Standard	70
1 Wire	70
2 Wires	55
3 Wires	45
4 Wires	45
5 Wires	45
6 Wires	45

The general effect of an earth connection when employing a horizontal aerial was also investigated. A section of wire 50 ft. in length was supported on insulators at a height of 2 ft. from the ground. The system was in line with S. Owing to the fact that it was necessary to move the instruments from place to place, only qualitative observations were made. The detecting instruments were first connected to the end nearest S, a wire stuck into the ground serving as an earth connection. A test was made to determine whether grounding the opposite or free end would affect the efficiency of the system. With the opposite end free the signals were clear and readable. Grounding the free end produced no apparent change in the strength of these signals. The instruments were then moved to the end farthest away from S. With the opposite end free very faint signals resulted, as was to be expected from Marconi's law of horizontal aerials. However, on grounding the free end the strength of the signals decidedly increased in intensity, being of the same order of magnitude as those heard when the instruments were connected to the other end of the aerial.

The above horizontal aerial was cut in the middle and the detecting apparatus inserted so that 25 ft. of wire pointed either way in line with station S. With the free ends unearthed no signals could be heard, but on grounding the end farthest away from S faint signals could be detected. On grounding the end nearest S and having the other end free stronger signals resulted. On grounding both free ends the signals were materially stronger.

The above aerial system was changed to a position at right angles to a line joining the two stations. With the detector in the middle of the system no signals could be heard. When both free ends were earthed very faint signals could be detected. With the above two 25-ft. lengths joined and the detector connected to one end of the resulting 50 ft. of wire faint signals were heard. On grounding the free end no signals could be detected. It will be noted that this is opposite in effect to the case when the aerial was in line with station S.

Owing to the fact that this investigation is not completed it is not the author's purpose at this time to enter into a general discussion of the significance of the above results. In passing, however, attention should be directed to the marked differences in the effect of the length and relative position of the various earth wires as indicated in the first table above. The effects produced by earthing the free end of a horizontal aerial are also of interest.

In closing it may be said that during the period covered by this investigation the earth's surface was more or less moist. Each system was carefully brought into resonance before making readings.

REINFORCEMENT OF DIRECT-CURRENT THREE-WIRE FEEDERS.

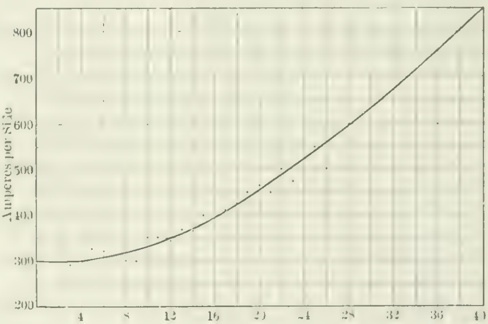
Economies and Practical Considerations Governing the Choice of Cables Larger than Necessary for Present Loads.

By A. W. Welch.

In selecting an economical cable system many points must be considered, some of which are discussed below. The cables must be designed for the lowest first cost of line and of central-station equipment commensurate with minimum cost of operation and maintenance, or to attain maximum income. But a primal consideration is that the customer shall receive normal voltage, as the income depends upon his satisfaction.

The present method of selecting a cable for use as a low-tension direct-current feeder is to estimate the load and then install a cable of sufficient size to carry it safely. When an existing three-wire feeder, of, say, 500,000 circ. mils cross-section per conductor, attains a peak load of 650 amp, it is time to consider its reinforcement. In low-tension three-wire distribution it is customary to use the approximate rule: Size of cable in circ. mils = carrying capacity in amp × 1000. Therefore, the feeder would be working for a period under an overload of 150 amp.

The distribution department of a company should always keep a record of the maximum loads per month occurring on each feeder. By plotting a curve as indicated and ex-



Load-Increase Curve of a 500,000-Circ. Mil, Three-Wire Feeder.

tending it an idea may be obtained as to the future load it will be called upon to carry. Consideration of this curve shows that the load has been steadily increasing for the past twenty-one months, so that it is reasonable to suppose that it will continue to increase to a certain extent, the limit depending upon the character of the neighborhood. For instance, a built-up residential district will have a definite load limit due to the fact that there are a given number of houses. As all the customers in such a district are using electrical energy for the same purposes and all future customers will want electricity for like purposes, it would be simple to estimate closely what the ultimate load will be. But in a section where large stores and office buildings are beginning to take the place of old-fashioned establishments it is difficult to forecast the load several years hence.

The illustration shows the load increase curve of a 500,000-circ. mil three-wire feeder situated in a section made up of residences and small shops. It shows that the load has been steadily increasing in almost a straight line for the past eighteen months, and during that period the monthly maximum has risen from 350 amp a side to 600. The feeder has been overloaded at least once a month for the past six months, and at the last point reached an overload of 20 per cent. Now, with the present practice fore-

sight would scarcely reach beyond a year, and by extending the curve for twelve months it is found that the maximum load to be expected at that time will be about 850 amp. Therefore, as the load should be balanced, two 350,000-circ. mil cables in multiple with the negative and positive legs of the existing feeder would take care of this increase.

With the present practice, either a 350,000-circ. mil auxiliary feeder or a smaller one would be installed, and the problem is, What would be the situation resulting from the installation of an auxiliary feeder of larger dimensions than would be necessary to handle the increasing load? Suppose a 500,000-circ. mil cable were used for reinforcing the original 500,000-circ. mil feeder previously considered. If this were done, a 1,000,000-circ. mil feeder would result instead of one of 850,000 circ. mils. The advantages of the larger feeder over the smaller are that enough copper is always present for increased loading, and it will not be necessary to have to reinforce the feeder for a longer period if the load should increase beyond the one-year estimate. The greater size will make burnouts less likely. Another point of some importance is that the line loss will be less. This will mean less demand upon the high-tension feeders and through them upon the generating station. The greatest saving in line loss will occur during the peak load and will, therefore, exert its greatest influence.

The approximate saving in money due to the reduction of the line loss on this feeder may be estimated as follows: The constants of the feeder are its length, which it will be assumed is 2000 ft.; its size, which will first be considered as 850,000 cir. mils and then as 1,000,000 circ. mils, and its specific resistance of 10.8 ohms per mil ft. The load conditions must now be determined by an estimate based upon present loads as tabulated hourly, or half-hourly on the station log sheets.

The following is the estimate of present load conditions on this feeder:

Average daily maximum load	= 600 amp for	2 hours
50 per cent average daily maximum load	= 300 amp for	2 hours
25 per cent average daily maximum load	= 150 amp for	8 hours
10 per cent average daily maximum load	= 60 amp for	12 hours

From this it is simple to determine the amp-hours for each load period, which are 1200 amp-hours during the two-hour peak, 600 for two hours, 1200 for eight hours, and 720 for twelve hours.

The next calculation will be for the purpose of determining the difference in voltage drop at peak load between the above two sizes. The drop in the case of the smaller cable is $10.8 \times 200 \times 600 \div 850{,}000 = 15.25$ volts, and the drop in the case of the larger cable is $10.8 \times 2000 \times 600 \div 1{,}000{,}000 = 12.96$ volts. The difference is therefore 2.29 volts.

The above table shows the saving in kw-hours due to the installation of the larger feeder. The total saving will be the sum of the four, or 4.3 kw-hours a day per side of the three-wire feeder, or 8.6 kw-hours for the total feeder, which at 2 cents per kw-hour amounts to 17.2 cents per day, or $62.78 a year.

This is, of course, a rather free method of arriving at the result, but is considered to be approximately correct, and an approximation is all that can be expected in an estimate.

The other advantages accruing from the installation of the larger feeder, such as the added safety and the fact that it will not require reinforcement so soon, should be worth at least as much again as the line loss saving; but the problem may be considered from the standpoint of line loss saving alone. The difference in cost between the 500,000-circ. mil and the 350,000-circ. mil reinforcements will be about $460. Therefore it may be readily determined by disregarding interest conditions that the saving of $62.78 a year will pay for the increased cable in less than seven and one-half years.

TABLE I.—SAVING DUE TO LARGER CABLES.

Sizes of Feeder, Circ. Mils.	Difference in IR Drop at Full Load of Smaller Feeder.	Kw-hour Saving due to Increased Copper.		Saving in Dollars per Year at 2 Cents per Kw-hour.	Cost of Additional Copper.	Years Required for Saving to Pay for Additional Expenditure	
		Per Day.	Per Year.			At 2 Cents per Kw-hour.	At 1 Cent per Kw-hour.
1,000,000...... 750,000......	[illegible]	25.28	9,227	184.54	576.00	3.12	6.24
750,000...... 500,000......	7.2	22.46	8,198	163.96	530.00	3.23	6.46
[illegible]	6.5	14.15	5,165	103.30	464.00	4.48	8.96
[illegible]	[illegible]	11.60	4,2[illegible]4	84.68	364.00	4.28	8.56

TABLE II.—CONDITION AT DIFFERENT PERCENTAGE OF PEAK LOAD.

	Two Hours, 100 per Cent.	Two Hours, 50 per Cent.	Eight Hours 25 per Cent.	Twelve Hours, 10 per Cent.
Load in amperes....	600.00	300.00	150.00	60.00
Amp-hours.........	1,200.00	600.00	1,200.00	720.00
Drop..............	2.29	1.15	0.57	0.23
Kw-hour loss.......	2.75	0.69	0.69	0.17

It is difficult to give any reasonable estimate of cable life without reference to conditions of installation. Under average conditions, however, an underground cable, if not disturbed and if properly protected from electroysis, should last at least twenty years. The most serious influences which operate to shorten the life of a feeder are lessened by increasing its cross-section, the load remaining constant. Assuming a cable life of twenty years, in the case of the problem just considered one may calculate that as the increased cost of reinforcement was paid for in seven and one-half years, there should be twelve and one-half years of life ahead for the feeder. At a saving of $62.78 a year at the end of the twelve and one-half years this will amount to $985; but as the load should have increased somewhat during this lapse the actual saving would be considerably greater. If interest on this income were taken into account the amount would be still further increased.

Table I shows the estimated conditions attending the selection of a cable of greater cross-section than is absolutely necessary for the conveyance of the current. The figures in the first column give the two sizes which are to be compared. For instance, what will be the saving accruing from the installation of a 750,000-circ. mil cable in place of a 500,000-circ. mil cable for the conveyance of 500 amp? Reading to the right along the line which contains

these sizes, one finds that the saving will be 22.46 kw-hours a day, 8198 kw-hours a year, which at 2 cents per kw-hour will produce an annual income of $163.96. As the additional expenditure for the copper amounts to $530, it will take a little over three years for this expense to be made up. The method used in calculating the kw-hour saving for each of the tabulated cases is based on full cable load for two hours, 50 per cent load for two hours, 25 per cent load for eight hours and 10 per cent load for the remaining twelve hours. For some locations these percentages will be high and for others low, but on the whole it seems to the writer to be a fair distribution of load. The actual price of energy per kw-hour will depend upon the company. Many will perhaps take exception to the 2-cent estimate and claim that it is too high. The last column of Table I gives the number of years required to pay for the increased copper by crediting the line loss saving at the rate of 1 cent per kw-hour.

The calculations are for reinforcement cables, and the additional copper will in each case consist of two legs of 2000 ft. each, because the load should be balanced on a three-wire feeder, making the reinforcement of the neutral unnecessary. Of course, in laying out a new feeder the difference in cost of three legs of each size must be considered. All engineers will agree that the larger feeder is more satisfactory from nearly every standpoint except that of first cost.

SOME NOTES ON EUROPEAN THREE-PHASE GAS-ENGINE PLANTS.

Gas-Engine-Driven Central Stations of from 2,000 kw to Over 40,000 kw in Germany Serving Mines, Rolling Mills, etc.

By WARREN H. MILLER.

THE Rhenish-Westphalian coal seams, which extend to the east from the Rhine as far as Unna and Karmen, are about 32 miles long and 9 to 14 miles wide. They are among the most productive in the world, surpassing those of England and surpassed only by those of Pennsylvania, and yield 80,000 tons of coal annually.

These enormous deposits have formed the basis for a corresponding development in the production of iron and steel. The Rhenish-Westphalian coal district now produces annually over 5,000,000 tons of pig-iron, forming about 40 per cent of the total output of Germany and nearly 10 per cent of that of the world. Most of the ore

Fig. 1—Generating Room of the Consolidation Mines at Schalke.

used in this district must be imported from Sweden, as the iron deposits in Germany itself are very poor; in fact, the iron problem lies at the root of affairs in Morocco, where the Germans are at present operating rich mines and insist on being allowed to do so without interference from France.

The reception of the ore requires a navigable river and great harbor facilities, and hence Durisburg, at the confluence of the Rhine and the Ruhr, with its immense artificial basins, has become one of the greatest iron-making centers of Germany. The Ruhr is an insignificant stream, not over 75 feet wide, but every foot of its stone-lined bank is a docking place for canalboats loaded with ore,

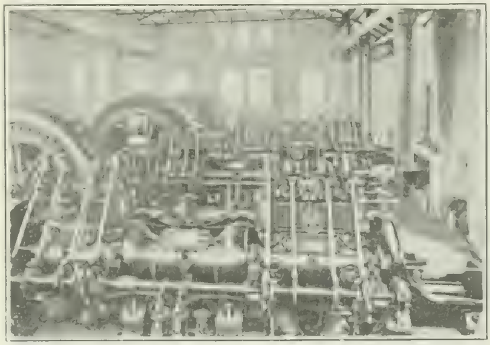


Fig. 2—Generating Room of the Phoenix Hütten, Ruhrort, Germany.

or pine timbers, or else pig-iron on its way outbound through Germany's network of waterways.

All through this district induction motors are used extensively for mine service, rolling mills, conveyors and isolated service of all kinds. Use is made of three-phase current, mostly of 50 cycles, running motors of 2000 volts for the mill rolls and 220-volt or 440-volt motors of 500 hp and less for other services. The fuel used is blast-furnace gas, though there have been a number of successful installations of coke-oven gas-driven central electric stations. The principal objection to coke-oven gas is the presence of sulphur, hard to eradicate, and a solution often resorted to is to burn the coke-oven gas under boilers and add a turbine-driven equipment, running in parallel with the gas-engine power houses.

The rapid development of this industry in Westphalia is one of the wonders of modern engineering. Instead of a few three-phase 60-cycle and 25-cycle plants scattered about the country as in America, there are in Westphalia around Durisburg and between it and Brussels alone some fourteen large electric central stations for three-phase drive, none of them less than 2000 kva in rating and aggregating 40,000 kva. With the exception of the Donnersmarkehütte in Zabrze, where there are two 800-kva, 1050-volt units, all of the engines are of the four-stroke cycle, though two-stroke cycle is receiving considerable development for direct current. The tandem two-cylinder arrangement appears to be the favorite, the electric constructive conditions being so much better than with twin engines. The universal frequency is 50 cycles, or, what amounts to the same thing, 47 and 48. The voltage ranges from 5600, as at the Rombacher Huttenwerke in Lorraine, or 5500, as at the Gewerkschaft Deutscher Kaiser in Bruchhausen (41,900 kva, 94 r.p.m., three-phase machines), to 2100-volt and 500-volt plants, 5500 being the favorite voltage. There are a few large plants, as at the 2100-hp plant of the Gutehoffungshütte at Oberhausen, with eight gas engines in parallel for three-phase electric drive. The universal system is with rotating field, the poles being mounted on the rim of a heavy flywheel with a simple copper damper on the pole pieces, consisting of seven or eight ⅝-in. round copper rods passing through holes drilled in the poles and riveted over short-circuiting bars at the ends. The speeds most used are 150, 125, 107, 100 and 94 r.p.m., the last two being the favorites for all sizes much larger than 70 kva.

The German angular speed requirements for parallel op-

eration are the same as the American, namely, 1/250 maximum permissible variation in angular rotation of the flywheel. The regulation is accomplished almost invariably by the inertia governor, and in the plants visited by the writer it was prompt, positive and efficient in the case of such disturbances as back-fires. The prime requisite is

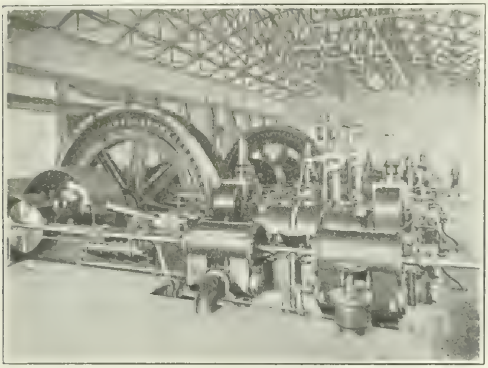


Fig. 3—Generating Room of the Donnersmarkehütte at Zabrze.

that the governor shall act sufficiently in advance of the change of speed in the entire engine to alter the driving power admitted in order to suit the new load. In this way is avoided the distressing hunting so frequently started by a back-fire in plants where the governor is too slow to alter the driving power.

Having heard so much of the smooth and quiet running of the large German central electric stations in blast-furnace works, and knowing something of American performances, the writer was very anxious to visit the Westphalia ore-smelting district and see them so as to judge for himself. Through the kindness of the Allgemeine Electricitäts Gesellschaft of Berlin, he was given entrée to some of the big "hütten," as the blast-furnace works are called, near Durisburg, particularly the three immense stations of the Phoenix Hütten, Ruhrort.

The latter works cover several square miles, the blast furnaces and rolling mills being built over their own mines. All of the rolls are electric-driven with 2000-volt, 2000-hp and 1200-hp non-reversing motors. Use is also made of 220-volt motors, mostly 500 hp, for running mine ventilator fans, conveyors, shipping machinery and blast-furnace apparatus. All of the small motors appeared to be of the variable-speed type. All of the electric lighting was done by direct current. Herr Oelrichs, the electrical engineer of the plant, spoke of running all his lamps next year on the three phases of his motor circuits, as is often done in America. As many new benches of coke ovens are now being built, he stated that next year it is proposed to put in a coke-gas-driven electric central station. The energy at present is generated in three central stations, the oldest containing three 930-kva, three-phase alternators with overhung field cores (the poles being attached to the inside rim of the flywheel), 100 r.p.m., 2100-volt, 47-cycle, driven by tandem two-cylinder four-stroke cycle gas engines operating on blast-furnace gas. There are also two 750-kva, three-phase alternators, 2100 volts at 140 r.p.m. with stator placed outside of the rotor, the field poles being mounted on the flywheel, according to the common construction. One other machine in this station was a 690-kva, 2100-volt generator driven at 94 r.p.m. by a tandem two-stroke-cycle gas engine. All of these were running in parallel peaceably enough, and also in parallel with units in the two other power houses. The 1200-hp motors at the rolls were constantly being placed in and taken out of service, and the load was fluctuating on all wattmeters from 100 to 200 kw every few seconds; however, the periodic swing due to interchange and play of the alternators on the varying load was not over 25 kw on each side of the normal position of the wattmeter needle. Each engine throughout the plant, in both No. 1 and 2 gas central station and in the turbine central station, is provided with a tachometer on a fixed standard. This arrangement seemed particularly praiseworthy, as these instruments not only indicated to the engine attendants at a glance the average speed of the engine but showed how it was behaving throughout each portion of each revolution—a most important thing to know instantly and accurately with gas engines in parallel. The 930-kva engine units, with overhung field poles, showed a very peculiar speed variation between 102 and 108 r.p.m., occurring periodically about every two revolutions, as if either the governor overtraveled slightly or the load was a little too great for steady angular flywheel speed. As the normal speed of these engines is 100 r.p.m., it is probable that they were underloaded and being held down with some difficulty by the governor. Their wattmeters showed only 700 kw. The 750-kva machines operated very steadily at from 138 r.p.m. to 139 r.p.m. Their wattmeters indicated from 500 kw to 600 kw. This equipment was installed in 1903, the engines having been built by Haniel & Leug, of Dusseldorf, licensees in Westphalia for the manufacture of the well-known Augsburg Nürnburg gas engines. The alternators and switchboard were built by the Allgemeine Company, of Berlin. The switchboard was of the usual high-tension, oil-switch, distance-control type.

In power house No. 2 are four 1680-kva, three-phase, 47-cycle, 2100-volt alternators driven at 94 r.p.m. by tandem two-cylinder four-stroke-cycle Augsburg engines, built by Haniel & Leug. The instruments showed loads fluctuating between 200 and 300 kw every few seconds. One engine was carrying from 900 kw to 1100 kw, the other two from 700 kw to 900 kw each, and one was not in operation The variations were not over 30 kw on each side of norma position of the wattmeter needle for the time being, a very good performance even for blast-furnace gas. The switchboard of this plant was of the most modern construction with each panel capable of being rolled out onto an iron wagon built for that purpose and repaired in the electrician's workshop, far from any current-carrying wires All of the main panels were interchangeable and all possessed spring-lock lugs which hooked them into the main busbar leads when the panel was pushed home into its place. A safety lock made it impossible to disconnect the panel or put it onto the bars without the main oil-switch circuit-breaker being first shut off. Of course such a system as this is possible only with electrically operated oil switches, as the panel carries only the instruments, the instrument transformers and the electrical oil-switch operating device with its transformers. This board also possesses a double set of busbars, both being in a cella under the board with double-throw switch for each pane The emergency busbar is like the ones in American plants being used for testing engines or division of the load between two distinct circuits. Use is made of a whistle system by which the board attendant would give one, two o three whistles, according to the number of the engine, immediately after a back-fire. The men on the floor coul then go at once to the engine needing attention. In th same power house with these were two 4000-hp twin tandem two-cylinder gas engines built by Thyssen & Company, of Mulheim, which ran the blower pumps.

In power house No. 3 were two Allgemeine turbine set one of 1500 kva and one of 2500 kva, and one cros compound ventil-geared reciprocating engine built in Duseldorf. All of these were driven by steam at 11 atmospheres pressure with superheated steam raised under boilers with the spare coke-oven gas. The wattmeters indicated 2300 kw and 1100 kw respectively, showing th

both turbines were fully loaded. The fluctuation in both changed by from 200 kw to 300 kw every few seconds. The tachometers showed a speed variation of not over 20 r.p.m. around a normal value of 2900 r.p.m., which seemed a pretty good performance for the turbine governor under such load fluctuations. The coke-oven gas is burned under boilers and then the steam is used in turbines. There was no other use that could be made of the superfluous coke gas, but next year, after the new coke benches have been completed, the Phoenix company expects to install coke gas engines. This arrangement will represent no particular innovation in Westphalia, as witness the seven Augsburg-Nürnberg machines, aggregating 7500 hp, of the Eschweiten Bergswerk Verein in Eschweileraue, and two 620-kva Nürnburg three-phase, 3150-volt machines at Bochrun. The power-factor of the entire Phoenix works, all three power houses being in parallel, was 0.73, which is excellent for such a peculiar drive as a large blast furnace, rolling mill and coal-mine industry.

The Phoenix plant is fairly typical of what is being done with three-phase electric drive, not only in Westphalia but all over Belgium, France, Spain and other parts of Europe where coal and iron conditions invite large blast-furnace installations. For this service the three-phase plants outnumber the direct-current plants two to one.

POINTS OF INTEREST IN LAYOUT OF A NEW TURBINE STATION FOR LEXINGTON, KY.

The Lexington (Ky.) Utilities Company is erecting a modern new turbine station near the site of its old plant to furnish central-station service for Lexington and to operate the local and interurban railway lines of the allied Lexington & Interurban Railways Company. As initially completed the new station will contain two 2500-kw horizontal Curtis General Electric turbo-generators, developing 4000-volt, 60-cycle, three-phase energy, but it is capable of extension later. Following the tendency of recent engineering design away from 25-cycle railway generation where interoperation with a lighting plant is desirable, all railway energy will be converted to 550-volt direct current by motor-generator sets. Two 750-kw sets will be installed in the plant and others will be operated in substations along the 33,000-volt transmission line extending to Versailles and Frankfort, 28 miles distant.

The new plant, for which excavating is already completed, will be of concrete, brick and steel, measuring 141 ft. by 144 ft. in plan, and will be surmounted by a 12-ft. concrete stack 200 ft. high. The boiler-room is to be equipped with two new Edgemoor and two Babcock & Wilcox 5000-sq. ft. units, the latter to be removed from the present plant.

As is typical of small-plant design, the coal-handling apparatus will all be contained in the boiler-room, but the arrangement at Lexington is rather novel. The coal-car spur is to be extended into the station at a level about 6 ft. above the boiler-room floor and directly over the coal-storage pit, which will be 65 ft. long, 24 ft. wide and 20 ft. deep. From drop-bottom cars crushed coal can thus be discharged directly into the pit, while lump coal, with the aid of a three-ton traveling crane and grab bucket, may be lifted from the car and conveyed to the crusher hopper alongside the track. This crusher in turn empties into the pit beneath. The latter is of concrete with a waterproof surfacing, and provision will be made for turning water on to the coal to gain the advantages of submerged storage if this becomes desirable. From the coal-storage pit the crane bucket is again used to fill the small bunkers directly over the boilers. The latter units will be equipped with Foster superheaters to improve the quality of steam admitted to the turbines.

The provision of an extra smaller circulating pump indicates the effort to improve the efficiency of the large turbine units at partial loads. The two main motor-driven circulating pumps are 16 in. in diameter, delivering 7000 gal. per minute at 25 lb. pressure. The auxiliary 10-in. pump will deliver about one-third this quantity of water at the same pressure. This extra head on the circulating system is required in connection with the cooling-pond arrangement which is imposed by the local conditions surrounding the plant.

Lexington and its vicinity are without water-bearing strata, and surface water has to be relied on. Sufficient pondage for a year's supply is held in the city reservoir, 2 miles distant and a number of feet lower than the city. Owing to this absence of wells or streams all water for the plant must be purchased from the city at a cost of about 6 cents per 1000 gal. In the present plant, which contains both reciprocating and engine units, a cooling pond has been resorted to, as shown in the accompanying illustration. This pond measures roughly 230 ft. by 120 ft., and is sprayed by fifty nozzles mounted on 15-in. pipes. Ten to 12 lb. pressure per square inch is required at the nozzles. The present pond is capable only of about 800 kw cooling duty and normally has to be sprayed at full capacity twenty-four hours a day, including the light-load period, in order to cool it down for the heavier loads which have to be taken care of later.

The peculiar stratum formation underlying the city, alternate layers of rock and clay, permits such rapid seepage that an attempt to prepare a new cooling pond would probably be in vain. Accordingly the old pond, which is 700 ft. distant from the new station, will be enlarged to carry the additional load. When first dug it is said that this pond absorbed all the water that could be pumped into it for many days. The surrounding strata are now thoroughly saturated, however, and the make-up water required is practically limited to the loss by evaporation. The old pond will be cleaned and extended by several hundred feet and will be connected with the new plant, 700 ft. distant, by 30-in. discharge and intake lines.

An interesting load on the 33,000-volt line operated from this station will probably be the motor-power requirements of one of the largest and finest country estates in America. These combined farm and summer-home grounds, which cover 8000 acres of choice blue-grass pasturage, are already completely electrically equipped and served by an isolated

Oil Cooling Pond to Be Extended for New Station.

plant and several gas engines. These it is proposed to turn to central-station drive, and when this has been finished to the taste of the multi-millionaire owner it promises to be the show farm installation of the country.

Mr. W. F. Bacon, vice-president of the Lexington Utilities Company, has recently removed his office to Lexington and is in general charge of the rehabilitation of the company's plant and lines. Mr. J. P. Pope is general superintendent of the lighting department. Sargent & Lundy, Chicago, are the engineers for the new plant.

HANDLING LUMBER BY ELECTRICITY.

Electric Motors Employed for Every Operation in Lumber Yard.

By E. L. Barnett.

AT the Pacific Coast meeting of the American Institute of Electrical Engineers a paper was read by Mr. Edward J. Barry giving a description of the application of electricity to the lumber industry at the sawmills and yards of the Potlatch Lumber Company, at Potlatch and Elk River, Idaho. Among other things, Mr. Barry described the application of electric storage-battery locomotives in transferring lumber from the sawmills to the dry-kiln and from the dry-kiln to the planing mill. During the discussion Mr. Ralph Bennett mentioned the fact that several monorail systems were in successful operation in the State of California and in the Southern States. It might also be mentioned that a number of electric traveling cranes, of both the runway and gantry types, are used for this service on the Pacific Coast.

It is the opinion of the writer that none of these methods should be employed as a complete system. Each has its own particular place, and the ideal system, especially where applied to existing yards, would be a combination of two or more of these particular methods of handling lumber.

The electric traveling crane, runway type, can cover a large area, and hence is applicable to removing lumber from the sorting table to the yard and in loading cars for shipment, the runways being so placed that the crane can cover a large area. However, this type is not adapted to moving loads over long hauls, the movement of the bridge being too slow, and a combination system should be adopted.

The runway type has a great advantage in loading and unloading, since the load can be moved in either direction at right angles and hence can be readily placed in any position. The first cost of a crane of this type with runways is high, although the maintenance should not be excessive if it is properly installed.

While the first cost of the gantry type will be greater than that of the runway type, it requires no expensive runways but only a simple track not much more expensive than the ordinary logging railroads, and the tracks can be so laid that the crane can be readily transferred from one section of the yard to another.

The monorail system is restricted to a narrow area almost directly under the monorail, and hence is applicable to the loading of cars on tracks parallel to each other and at right angles to the monorail. Since it is obvious that the monorail should be located with respect to a continuous supply, one logical location seems to be at the sorting table to remove piles of lumber to the cars for transfer. As this type requires only the trolley with trolley and hoist motors and electrical equipment for the same, and the monorail erected should cost less than the runways for the runway type, it is evident that this system should cost less than the latter for a given length of runway. Again, while the monorail erected will cost more than the track for the gantry type, the trolley with hoist and electrical equipment should cost much less than the gantry type of crane. However, to cover any considerable area will require an expensive installation of monorails.

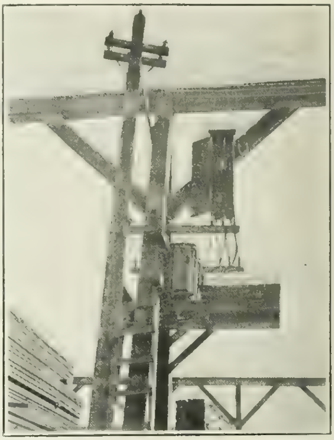


Fig. 2—Bank of Transformers for Crane Shown in Fig. 3.

The electric storage locomotive is especially adapted to moving large quantities of lumber over long or short hauls and hence may be used in moving lumber about the yards and from the yards to the shipping points. The storage-battery type of locomotive is desirable through avoiding complicated systems of wiring that would interfere with the capacity of the storage yards, and in handling lumber in the yards.

The following is a brief description of the method used by the Union Lumber Company, of Fort Bragg, Cal., for handling lumber by electric power. All the lumber from this mill passes along a slowly moving sorting table, where it is first graded and then removed, by hand labor, to the piling forms. These piles are then removed by the electric traveling crane shown in Fig. 1, by means of a special sling which will carry any amount up to 3000 ft., the load varying in weight from a few hundred pounds to approximately 6.5 tons. It may be interesting to note that this is redwo

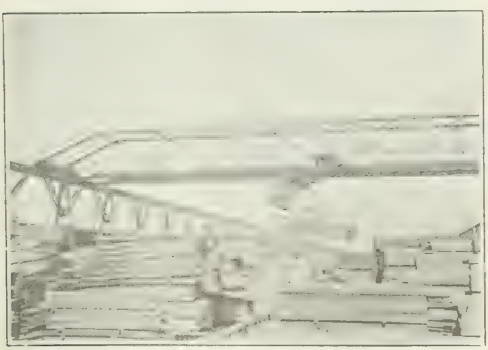


Fig. 1—Electric Crane Used by the Union Lumber Company.

Fig. 3—Crane at the Yards of Irvine Muir Lumber Company.

and fir lumber; the former varies greatly in weight and ranges as high as 5 lb. to the board foot.

The bridge of the crane is of 120 ft. span, and was designed for a load of 10 tons, 5 tons on each side. The bridge is driven by a 22-hp motor, the hoist by a 10-hp motor and the trolley by one of 5 hp. All are 220-volt,

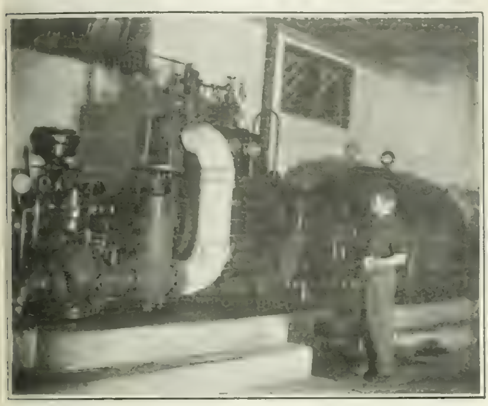


Fig. 4—940-kva Turbo-Generator at the Plant of Union Lumber Company.

60-cycle, three-phase induction motors. The trolley or carriage is of the monorail type. It was the intention to have one on each side of the bridge, but it has been found advisable to place an I-beam at the middle of the bridge and use but one trolley. It has been the purpose to use this crane in connection with a monorail system for handling the heavy timbers, and also for handling all kinds of lumber for distribution in the yard and for loading cars for shipment. At the present time all lumber is shipped by boats, being loaded on the cars by the crane and then run by gravity to the shipping wharf. In the future storage-battery locomotives may be used for transferring about the yards, in handling empty cars and for the necessary switching, horses being used for this purpose at the present time. This

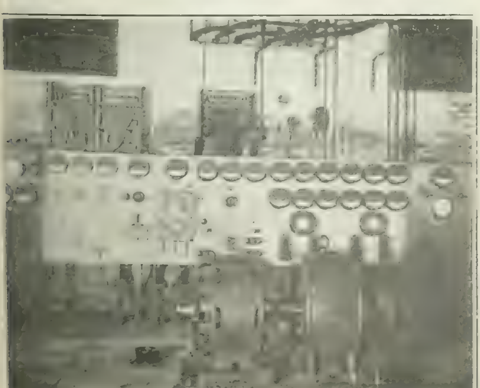


Fig. 5—Switchboard and Motor-Driven Exciter at the Plant of Union Lumber Company.

ane handles on the average approximately 120,000 ft. of mber per day of ten hours over a haul of from 20 ft. to 0 ft. Over short hauls in loading cars for shipment the ane has handled as much as 40,000 ft. in one hour.

Fig. 3 shows the crane of the Irvine Muir Lumber Company. This company purchases power of the Union Lumber Company, and the crane and yards are located about 1 mile from the generating plant, current being supplied over a three-phase line at 2200 volts. Fig. 2 shows the bank of transformers for transforming to 220 volts. The secondary switch with meter is also plainly shown in a weatherproof box. In Fig. 4 is shown the 940-kva unit at the generating plant, and Fig. 5 shows the switchboard and motor-driven exciter. The generating plant also contains a 300-kva, 2200-volt generator, direct-connected to a four-valve engine.

WATER-SUPPLY SITUATION OF LOUISVILLE CENTRAL STATION.

TECHNICAL visitors to Louisville Ky., familiar with steam-plant operation in other riverside cities often remark with surprise the situation of the Louisville Light Company's 14,000-kw turbine condensing generating station, located almost a mile distant from the bank of the Ohio River, which might be expected to furnish the best source of condensing water. On account, however, of the wide variation in level of this stream, which undergoes changes of nearly 50 ft. from flood to low water, the designers of the station early abandoned this source and have had recourse to a remarkable water-bearing basin located 50 ft. below the surface of a large part of the city and seemingly quite independent of the river water.

The present site of Louisville is over the sand and gravel-filled ancient channel of the pre-glacial Ohio River, through the center of which the latter-day stream of the same name is again cutting its way. The water-bearing sands and gravels above referred to lie at a depth of from 35 to 50 ft. below the present street surface and provide an almost inexhaustible supply of water at a uniform temperature of 55 deg. Fahr., winter and summer. These sand and gravel strata are nearly 65 ft. in thickness and are underlaid by the bed rock. Twenty-five years' experience with pumping from this underground basin has shown that it is much more dependable than the varying stages of the nearby river and is well-nigh inexhaustible unless pumped from a restricted area.

The first source of subterranean supply for the Louisville

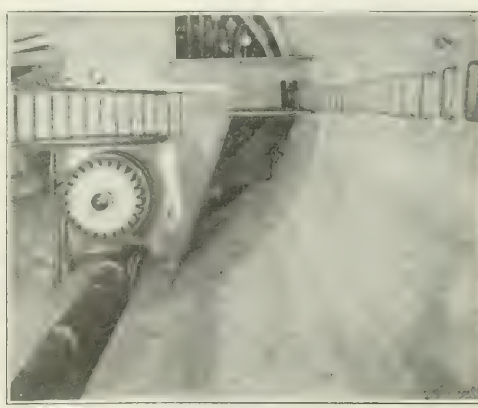


Fig. 1—Looking Downward into Pump Well of Louisville Lighting Company.

station was an open shaft, lowered below the hydrostatic water level. From this well a pump located in an adjoining shaft delivered its supply to the surface. After other experiments an elliptical brick wall, 56 ft. deep and with axes of 34 ft. and 48 ft. respectively, was put down, from the bottom of which thirty 8-in. tubes each 25 ft. in length were

driven, the last 10 ft. being made up of No. 12 strainers. At the depth at which these strainers are placed they are brought opposite the bedded gravels of the water strata, which thus act as an admirable filter provided by nature for the purpose. All of the thirty well tubes are connected through valves to a common manifold header, from which a

Fig. 2—Two 3000-kw Turbo-Alternator Units in Fourteenth Street Plant, Louisville, Ky.

Gordon compound duplex pump and a Worthington vertical duplex pump deliver 4600 gal. per minute to the condensing-water supply.

Later a concrete well, 60 ft. deep and 25 ft. in diameter, was put down, its bottom reaching 11 ft. below the static water level. From its base twenty-four 8-in. tubes are driven through the sand and gravel, these tubes being alternately 15 and 25 ft. in length and ending in 10-ft. strainers. All of the tubes are connected to a 20-in. header, from which a 16-in. Worthington centrifugal pump, driven by a vertical-shaft, 200-hp Westinghouse alternating-current motor, delivers 5000 gal. per minute against a 90-ft. head. A view looking down into this concrete well from the surface is shown in Fig. 1.

With the increasing requirements of water for the turbine condensing operation of the station, motor-driven impeller pumps have been added, avoiding the necessity of sinking the large and expensive concrete or brick wells. The first of these deep-well pumps installed was in a 10-in. steel tube driven from the surface to bed rock at a depth of 110 ft., and ending in a 35-ft. length of No. 12 strainer. The impeller of this Columbus pump is in eight 10-ft. sections, each carrying three double-bladed impellers. The pump is operated by a vertical 50-hp motor and delivers 1000 gal. per minute. Two other generally similar pumps later installed are provided with No. 40 strainer and are driven by 100-hp motors. They deliver respectively 1350 gal. and 1450 gal. per minute.

With these pumps a total supply of more than 13,000 gal. per minute is thus made available. With the cooling pond and various cisterns now used as a system of reservoirs, a total storage capacity of 500,000 gal. is afforded at the plant.

The turbine equipment of the section comprises two 3000-kw horizontal Westinghouse-Parsons turbo-generator sets, exhausting into Leblanc jet-type condensers, and the latest unit, a 7500-kw Curtis-General Electric turbo-alternator (the largest horizontal unit of this type yet built), exhausting into a Wheeler rain-type jet condenser, similarly the largest of its kind. This condenser is equipped with two tail pumps, one of which can be operated separately on partial loads. Condensing water for these units is cooled during periods of heavy load by spraying through the fifty-six 3-in. Koerting nozzles over the cooling pond, the nozzle pressure being produced by two 100-hp motor-driven centrifugal pumps, each capable of delivering 4500 gal. per minute. Under conditions of partial load the nozzle sprays are not operated, the circulation within the cooling pond itself providing ample cooling, while during the lightest loads of the day it is even found more economical to pump from the wells and waste the water required for cooling purposes rather than to attempt to re-cool it.

While the water obtained from the underground source is excellent for condensing purposes, continuing at a uniform temperature of 55 deg. Fahr. throughout the year, it is found rather hard for boiler-feed use and must be treated before being introduced into the boilers. A mixture of lime and soda is added to the water in four 40,000-gal. tanks each of which completes the precipitation process in four to six hours and is drawn from in succession. The treated boiler-feed water is then passed through a Cochrane heater having its temperature raised to 210 deg. Fahr. by the exhaust collected from the various pumps and auxiliaries about the station, and is finally introduced into the boilers by a Terry turbine-driven centrifugal boiler-feed pump, running at 1650 r.p.m. and delivering 500 gal. per minute.

Mr. G. Wilbur Hubley is chief engineer and general superintendent of the Louisville Lighting Company.

CONVEYOR SYSTEMS FOR HANDLING COAL.

Simple Equipments for Unloading Cars Applicable to Small Stations.

By Henry J. Edsall.

A MECHANICAL coal and ash-handling equipment is nearly always included in large modern boiler-rooms and such equipments have been installed in most of the larger boiler-rooms that were built before conveyors were developed to the point where they were considered part of the regular equipment.

The majority of the small boiler-rooms, however, have been left to struggle along with only the human machine with his shovel and wheelbarrow, to handle the coal. This is, as a rule, because the owner of the boiler-room does not consider it possible to install a coal conveyor without incurring so much expense that the saving to be obtained would not pay a good return on the investment. In many cases this is a mistake, and an equipment can be found

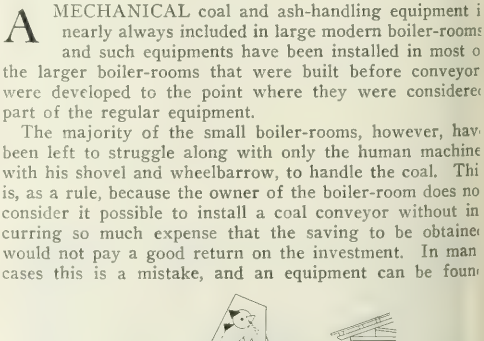


Fig. 1—Coal Elevator for Run-of-Mine Soft Coal.

which will meet his requirements and still be so simple and inexpensive that it will be a good paying investment for him and save him a great deal of trouble and annoyance.

Modern coal cars are nearly all bottom-dumping, and while they are easy to unload in the way that their designer meant them to be unloaded—that is, through the doors

the bottom—they are troublesome and expensive to unload by shoveling the coal over the side, especially in the large steel cars, or "battleships," as they are frequently termed locally.

Shoveling coal over the side usually means an expense of from 8 cents to 10 cents a ton, and if the coal is distributed along the side of the track it occupies considerable

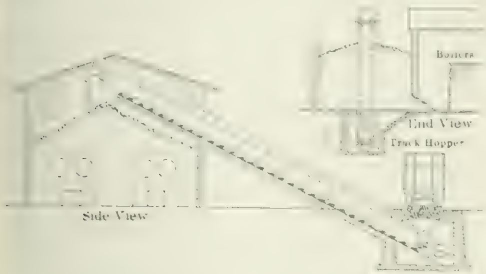


Fig. 2—Coal Conveyor for Boiler-Room Storage.

space, and this, as a rule, means that it has to be rehandled and wheeled into the boiler-room. Where more storage is desired than can be obtained by filling up the space close to the track the coal has to be trimmed back by shoveling or wheeling, or both, and this means more expense. Besides this the demurrage charges for holding the railroad cars longer than a certain time have to be considered, and these charges sometimes add up to a very appreciable sum during a year.

One way to facilitate the unloading of cars is to build a trestle or elevated siding, so that the coal can be dropped on the ground under the trestle. In order to obtain much storage in this way, however, it is necessary to build the trestle fairly high or long, or there will still be trimming required. Also, with a trestle more or less of the coal usually has to be wheeled to the boiler-room, and the farther it is distributed along a trestle the farther it has to be wheeled. If a trestle is built of wood it deteriorates when exposed to the weather, so that at least part of the timbers have to be replaced in eight or ten years, and lumber is becoming more expensive as time goes on. If the trestle is built of more permanent materials it becomes more expensive, and a mechanical equipment will ordinarily be found to be less expensive and more satisfactory.

The illustrations herewith show three simple and comparatively inexpensive mechanical equipments which will handle coal cheaply and satisfactorily. Fig. 1 shows an inclined chain and bucket elevator with two strands of chain and buckets spaced at regular intervals between the chains.

The coal is dropped from the cars into a concrete track hopper underneath the track and fed by means of a regu-

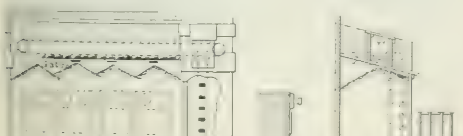


Fig. 3—Coal-Handling Equipment for Run-of-Mine Soft Coal.

lating gate to the foot of the elevator. At the head of the elevator the coal drops into a two-way chute, which distributes it in a bin close against the boiler-room wall. Openings in the lower part of the boiler-room wall allow the coal to go through, so that unless the supply becomes low there is always a pile on the boiler-room floor, within easy reach of the fireman. This equipment is installed in a Pennsylvania electric-light station supplying a community having about 3000 inhabitants.

In this way the coal supply is placed just where it is wanted, and no rehandling is necessary except when the supply becomes low. By making the pile fairly deep considerable storage can be obtained in a compact rectangular bin, and the cost for labor and energy for unloading will probably amount to not over 2 cents a ton. The buckets can be made large enough to handle run-of-mine soft coal, or, if it seems advisable, they can be made smaller and a grating placed over the track hopper, on which the large lumps would be broken by the attendant. This means a cheaper cost of installation but a somewhat higher labor cost in unloading. Where anthracite coal is handled the buckets can be made quite small and a single-chain elevator used.

Fig. 2 shows an inclined flight conveyor handling coal from a track at some distance to a bin close to the boiler-room wall. The coal is fed to the conveyor in the same manner as before, but in this case the buckets are replaced by flights of pushers attached to a single or double strand of chain, and these flights push the coal along in a steel trough and deliver it over the end into the bin. This makes quite an inexpensive type of conveyor, but it is not good practice to run them at an incline greater than about 30 deg. with the horizontal.

Fig. 3 shows a combination of an elevator and a horizontal flight conveyor, which distributes the coal in a somewhat longer bin along the boiler-room wall. The elevator in this case is of the gravity discharge type, with V-shaped buckets at intervals between two strands of chain. The buckets elevate the coal, and then as they turn and travel a short distance horizontally the coal falls out into the flight conveyor running at right angles. The flight conveyor discharges the coal into the bin through doors spaced at intervals in the bottom of the trough. In this case there is also a reciprocating feeder to feed the coal automatically to the foot of the elevator. This feeder consists of a plate which forms a bottom for the track hopper and to which a reciprocating motion is given by means of a crank and connecting rod. The coal moves forward with the plate and subsequently falls over the end when the plate moves back.

An equipment similar to one of those illustrated, or some modification of one of them, can usually be designed to suit almost any small boiler-room, and such equipments are likely to prove a money-making investment and a great convenience.

IMPROVING FIRE-ROOM EFFICIENCIES.

Details of Boiler-Room Equipment at Rockford, Ill., for Economical Generation of Steam.

PROBABLY no plant of its size in the country is as completely equipped for the analysis and record of fire-room operation as the newly reconstructed steam station of the Rockford (Ill.) Electric Company. Draft, feed-water input, proportion of CO_2 and flue temperatures are all matters of continuous record in this plant, and each adjustment by the firemen with changes of load is made with careful regard to stack pressure, CO_2 and feed-water as shown by the indicating devices in the fire-room. Mr. F. H. Golding, manager of the Rockford company, realizes, like many other progressive operators, that the greatest opportunity for improved plant economy exists in the fire-room and has set about to discover and put an end to the many insidious wastes which in the end react upon the coal pile.

The Rockford plant contains 10,000 kw total rating in three horizontal Curtis steam turbines and 1500 kw in

reciprocating engine-driven machines, besides 1500 kw in waterwheels.

Each of the five 500-hp Stirling and six 500-hp Heine boilers is equipped with both a draft gage and a feed-water valve indicator mounted on its front, as shown in Fig. 1. The draft gages, which are of the Westover float type, indicate to hundredths of an inch the complete circular arc representing about 0.65 in. of water column. The feed-water gages comprise simply pointers connected through gear trains to rack segments on the boiler-feed valve extensions. These are set at zero when the valves are closed, and their indications when open are to an arbitrary scale proportioned to the rate of feed-water input. After a little experience these arbitrary settings become significant to the firemen, showing them just how much water is entering each boiler.

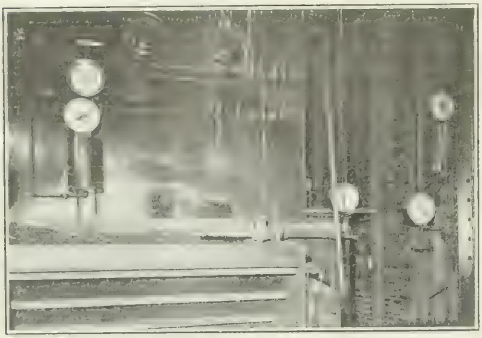


Fig. 1—Boilers Equipped with Draft Gages, Feed-Water Indicators and Steam Gages.

Behind one pair of the Heine boilers a Sarco continuous carbon-dioxide analyzer has been installed, although this set can be transferred to any other pair of units desired. This Sarco apparatus draws a continuous curve of the CO_2 ratio present in the flue gases, and by inspecting the curve sheet from time to time the firemen set their draft dampers as shown by the gages to obtain complete combustion without admitting surplus air. Definite relations have been determined between boiler load, thickness of fire and stack draft, and conditions of best combustion are thus reproducible at any time. To improve further the operation of the furnaces, care has been taken to close up all air leaks into the settings, and the fire doors are opened only the minimum amount necessary for inspection.

To show the fire-room employees the load on the turbine and engine units, a face-plate arm is moved over a row of contacts on the switchboard gallery, lighting lamps behind corresponding transparent numbers in the boiler-room and thus indicating the load in steps of 500 kw each. When an additional unit is to be started up the switchboard operator lights a red lamp on the boiler-room signal panel, giving the firemen a few minutes' warning and often enabling them to carry the extra load by readjusting the boilers already in service.

In the office of the chief engineer of the plant, located in the engine-room building and nearly 150 ft. distant, are installed an Orsat CO_2 sampler for testing the gas from each furnace, a flue-temperature thermometer which can be connected to any flue, a recording Venturi water meter, a steam-pressure gage, etc. These devices are shown in Fig. 2.

Sampling tubes from each boiler lead to the Orsat apparatus, and through these tubes, to insure fresh samples, gas is continually being withdrawn from the flues. The samples of gas to be tested are collected in liquid-immersed metal tanks, which are thus filled at a uniform rate during eight hours by a small motor which lowers the liquid in its counterweighted reservoir. This motor, which runs a 1700 r.p.m., has its speed reduced through a ratio of 1 t 720,000 by worm gears. As the contents of each tank ar analyzed in turn, an average eight-hour record is obtaine of the CO_2 present in the gas from the correspondin boiler. Compressed air is available for cleaning the sam pling device and has been found of much service for keep ing the pipes clear and in condition.

Each flue is also equipped with a thermoelectric coupl whose emf is arranged to actuate a millivoltmeter, cali brated as a thermometer to read from 75 deg. to 1000 deg Fahr. By means of fourteen switches this Wilson-Maele pyrometer can thus be made to indicate the flue tempera tures of any of the boilers in the adjoining building. Th flue temperatures are ordinarily run at 500 deg. Fahr., an if there is a marked departure from this value, the caus of the trouble, such as baffles down, etc., is at once in vestigated. With the aid of the pyrometer a close chec can thus be kept at all times on the operation of the fur naces and boilers.

The 5-in. Venturi water meter has a capacity of 230,00 lb. per hour, and is equipped with indicating, recording an curve-drawing attachments.

A feature of the operation of the Rockford plant is th daily record curve sheet in the engineer's office, on whic are entered in the form of curves the load factor of boile units, load factor of engine units, pounds water per poun coal, pounds coal per kw-hour, per cent CO_2, flue tempera ture, average; vacuum carried, back-pressure, and fee water temperature.

The curve chart has space for the entire month, and a the quantities are so plotted that an improvement in opera tion in any particular is indicated by a rising slope of th corresponding line, so that the trend of the plant perforn ance is apparent at a glance. A clerk prepares this recor and relieves his chief of all detail in this connection. daily record of the CO_2 ratio is also posted in the fir room to stimulate the employees there.

As the result of the care taken in firing, the CO_2 conte has been raised from 4 per cent and 6 per cent to a su tained average of 10 per cent, representing a saving several hundred dollars per month. The Rockford stea plant is now producing a kw-hour on from 3.2 lb. to 3.6 l of coal, the steam turbines being operated for the maj part of the output. Reclaimed coal, dropped from t grates, is used for banking the boilers, effecting consid able saving in fuel. But the local company is not willing to rest in the contemplation that all possible h been accomplished and expects that further experience w its complete indicating and recording equipment, now stalled only a few months, will result in drawing attent to other possible savings in the operation of the boil room equipment.

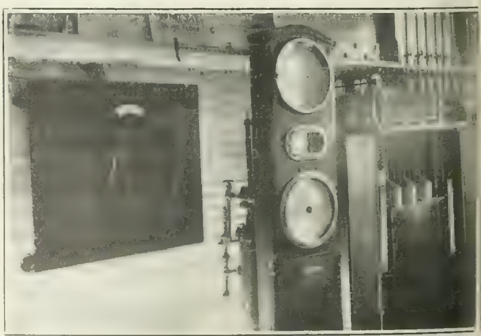


Fig. 2—Flue Pyrometer, Venturi Meter and Orsat Flue-Gas Sampling Machine.

LETTERS ON PRACTICAL SUBJECTS

OPERATING HIGH-EFFICIENCY UNITS ON REDUCED VOLTAGES AT LOW ENERGY COSTS.

Recently the writer was charged with the purchase of the lamps for an installation where the electrical energy was furnished free of charge under the terms of the rental contract, so that the cost of energy consumed by the lamps was negligible. The first conclusion reached was very naturally to make a selection of carbon-filament lamps, since these 16-cp units cost only 16 cents apiece, while even a graphitized-filament lamp would cost 21 cents and the other higher efficiency lamps seemed out of the question.

I determined to look further, however, at the relative lives of the different kinds of lamps in terms of their first cost, as the thought occurred to me that perhaps a saving could be effected by buying the more expensive lamps if these could be operated to give a correspondingly longer life. The 16-cp carbon lamps would have a life of only 700 hours, but the 60-cent 25-watt tungstens were rated at 1700 hours at their lowest labeled voltage. Operating these latter lamps at 4 volts below the minimum rating, however, would insure a life of 2300 hours, making the tungstens renewal cost practically the same as that for the carbon lamps. A point to be watched and taken into account, of course, is the reduced candle-power of the high-efficiency units when burning below voltage, and such units should be chosen sufficiently large to give ample light when run at the lower voltage. Such a tungsten installation, however, still has the advantage of being very much more efficient than the old carbon lamps, and the true conservationist will enjoy the satisfaction of knowing that he is not wasting energy, but putting his free electricity to the best use. Of course, the expensive high-efficiency incandescent lamps should not be used where there is danger of breakage or other damage other than natural "burning out" with long life. The same principle of using the higher-efficiency longer-hour lamps at lower voltage may also be applied to equivalent graphitized-filament and tantalum lamps, as well as to the tungsten.

Perhaps the most significant interest of such an installation operating on free electricity is the light thus thrown on the economy of high-efficiency units in all cases where the energy cost is low. Many will be surprised to learn that even with free energy the more costly high-efficiency units are in the end cheapest when operated as I have outlined.

Milwaukee, Wis. MALCOLM L. JONES.

UNIQUE REPAIRS TO A BOILER CHIMNEY.

Electric service for the citizens of Blue Island, Ill., a suburb of Chicago, as well as the water pumping for the town, is supplied by the Sanitary District of Chicago, which has installed one of its substations in the Blue Island municipal plant. The original equipment of boilers and engines is still maintained, however, to serve as an auxiliary in case of interruption to the hydroelectric energy transmitted 30 miles from the Lockport power plant on the Drainage Canal.

The steel smokestack of the Blue Island plant is 100 ft. high and 6 ft. in diameter and was installed twelve years ago. About two years ago the five top sections of the stack began to show evidences of deterioration and were replaced with new sections. During the summer of 1911, however, seven sections lower down on the original stack similarly began to give signs of weakening, and it was determined to replace these.

The five good sections at the top of the stack weighed more than 800 lb. each, and to have torn down the entire structure in order to replace the intermediate sections would have required handling these good sections twice. Accordingly the contractors, the Chicago Bridge & Iron Works, adopted the plan of erecting a scaffolding, as shown in the picture, to hold the good sections in place while the damaged parts were being renewed. The scaffolding consisted of four 6-in. by 6-in. uprights, braced with 1-in. by 6-in.

Repairs to a 100-ft. Stack at Blue Island, Ill.

crossbars, and the total weight which it supported exceeded 2 tons, held at a height of 100 ft. in the air. About fourteen days were required to complete the exchange of sections, and the plan adopted proved an entire success.

La Grange, Ill. M. C. HOLMES.

PARALLELING TRANSFORMER BANKS ON STAR-DELTA SYSTEMS.

An interesting condition arises when it is necessary to connect in parallel two transformer banks operating on a star-delta system. Assume a case where there is a star-

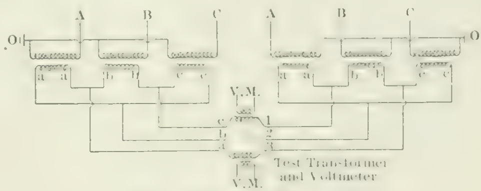


Fig. 1—Transformer Connections.

connected transmission system and it is required to install a bank of three transformers to feed into a delta distributing system. Fig. 1 shows the various connections which may be made, while Fig. 2 shows diagrammatically

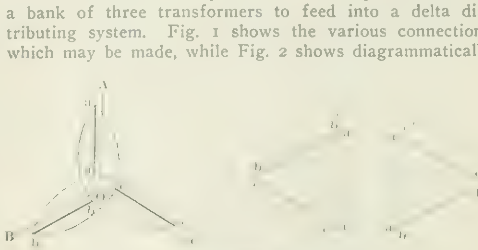


Fig. 2—Voltage Relations.

the two different phase relations produced by these connections.

It will be noted from Fig. 2 that the two different deltas produced will not parallel, regardless of what combination of leads is made. These two deltas are produced by either

a "right-hand" or a "left-hand" connection of the primary coils, or by the two possible connections of the secondaries.

Where the transformer banks to be paralleled are of the same type, and it is possible to trace out the connections of both the primaries and the secondaries and make exactly duplicate arrangement of connections, there will be no danger from throwing the two banks together without making preliminary tests. But if it is impossible to trace out the connections, on account of the leads being brought out underground, or if it is required to connect in parallel with transformers in a distant substation, a "phasing-out" test must be made. For this test two shunt instrument transformers, of the same voltage as the secondaries of the main transformers, and two voltmeters should be used. For convenience in making this test the three leads of the two lines to be paralleled should be tagged *a, b, c* and 1, 2, 3 respectively. By testing out the various combinations of leads as shown in the accompanying table, it can be quickly determined whether proper connections have been made for paralleling.

TRANSFORMATION COMBINATIONS.

1 2 [illegible]	1 2 [illegible]	1 2 3
[illegible] *b* [illegible]	[illegible]	*c a b*
[illegible] 2 3	1 2 3	1 2 3
[illegible] *b* [illegible]	[illegible] [illegible] *b*	*b a c*

This table shows the six possible combinations, the tests being made by connecting one testing transformer from 1 to *a*, the other from 2 to *b*, or 3 to *c*, etc.

If all of the above combinations are tested out without finding one which gives "no voltage" between the respective leads, it is obvious that the two transformer banks will not parallel, and the connection on one of the banks will have to be reversed according to Fig. 1.

The new connections having been made the series of tests, as shown in the table, should again be made and one of the combinations will be found which will give "no voltage" across the three respective leads.

Two testing transformers are necessary, as there are certain of the combinations of leads which will give double line voltage, which will cause both voltmeters to show full voltage.

Los Angeles, Cal. R. E. Cunningham.

TRANSFORMER CONNECTIONS.

In the first issue of October, 1911, a letter appears, "A Transformer Misconnection," from Mr. R. J. Jenkins,

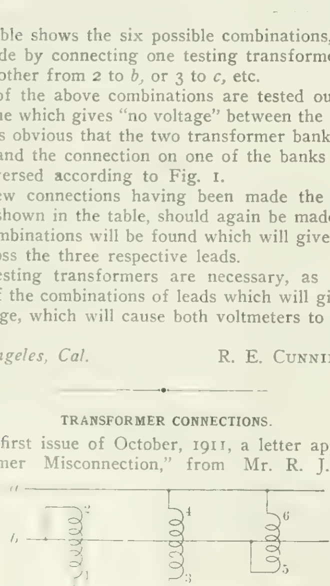


Fig. 1—Delta Connection.

which appears to call for comment for the benefit of those whose experience in transformer connections is limited.

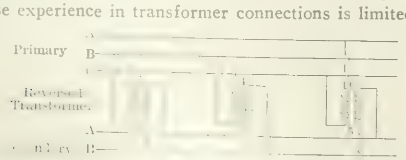


Fig. 2—Straight Delta Connection.

The diagram in his article (here reproduced as Fig. 1) is given to illustrate the misconnection, and is followed by the statement that the connection was made because it happened to be the shortest distance between transformer terminals and the busbars. But this arrangement of transformer is advantageous in constructive work and is used in many installations.

In contradistinction to Mr. Jenkins' reasoning he would

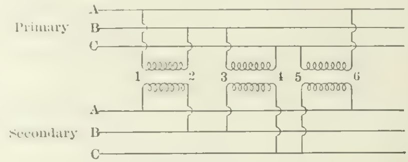


Fig. 3—Modified Connection.

have experienced no circuit-breaker trouble had he simply reversed the secondary of the transformer whose primary had been reversed by the short connection.

The diagrams of Figs. 2 and 3 are given to show there is no difference between using a straight delta connection and reversing one transformer, provided the secondary is correspondingly reversed.

Denver, Col. Vernon R. Marshall.

PRACTICAL METHOD FOR TESTING SOILS FOR FOUNDATIONS.

Probably there is no incident which so utterly disgusts the engineer of a central generating station as the settling of a foundation. A crack developing across one corner of the front of the building is bad enough, but the cracking of a generator foundation or the slow settlement of one side or corner is probably the most exasperating problem with which the engineer is called upon to contend.

It is very easy to test the soil upon which it is proposed to place a foundation. The entire operation is very simple and, as shown by Fig. 1, is easily applied without the use of special apparatus. It will be assumed that the trench has already been dug to the depth of the proposed foundation, as shown by Fig. 1. Drive two or more stakes at least 3 ft. long in the corners of the trench at least 3 ft. from the spot where the test is to be made. The stakes should be driven nearly level with the bottom of the trench and the tops accurately leveled.

Next a timber 12 in. square is placed on end and a mark made at the bottom of the timber level with the tops of the stakes, as shown at *c*. The upper end of the timber is fitted with a platform, built to touch against the guide timbers in the sides of the trench, or the timber may be supported in a vertical position by means of several light guy cables.

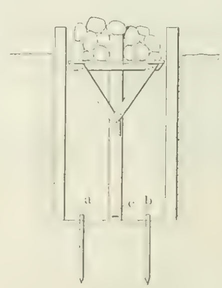


Fig. 1—Testing Soil.

The platform is then loaded with stone, sacks of dirt or any other heavy material available. The material is weighed as it is added to the platform.

Load is added to the platform until the timber begins to sink into the ground. Its sinking is shown by the line *c*, Fig. 2, dropping below the level of the stakes. When this

happens it is obvious that the load-carrying capacity of that particular soil has been exceeded. Should there be a load of 4 tons on the timber it is obvious that the actual load placed upon the foundation should never equal 4 tons to the square foot. But it has been found that a timber 1 ft. square will settle under a load which will not affect a

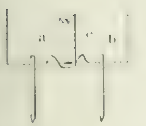


Fig. 2—Effect of Overload.

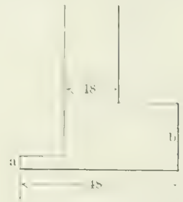


Fig. 3—Depth of Footing Required.

similar load per square foot under a large foundation. That is, the large foundation will safely carry more per square foot than will be sustained by a single square foot of the same soil. Therefore any load per square foot which will not settle a 12-in. by 12-in. timber endwise into the soil may be safely placed upon the footing of a wall. This means that if the test timber will carry 2 tons the footing may also be loaded to 2 tons per square foot and the margin of safety will be sufficient.

Next borings should be made in the bottom of the trench to determine if the soil is of the same character immediately below the bottom of the trench. Ordinarily, borings from 4 ft. to 6 ft. will be ample, but for very heavy work much deeper borings may be necessary. It will usually be found that clean sand and gravel are good for 3000 lb. to 8000 lb. for the former and 6000 lb. to 8000 lb. for the latter. This means from 1½ tons to 4 tons to the square foot, according to the nature of the sand and gravel in question.

Soft clay may be depended upon to support a load of 2000 lb. to 4000 lb.; medium hard clay from 4000 lb. to 8000 lb., and hard, dry clay from 8000 lb. to 10,000 lb. to the square foot. Soft, semi-liquid soils are very hard to estimate. They will sustain loads varying from 500 lb. to 1500 lb. per square foot, and for heavier loads they should be removed entirely or filled with stone, wood piling or sand piles until the test proves that the bearing capacity has been increased to a satisfactory figure.

The next step toward securing a foundation which will not settle is to calculate with exactness the load to be supported by the wall, including, of course, its own weight. Assume, for example, that a certain 18-in. wall must carry a load of 16 tons per linear foot in a soil which tests show to be able to support 2 tons to the square foot. How wide must the footing be made that no settling shall ever occur? A load of 16 tons to the square foot in a soil capable of carrying 2 tons will obviously require a footing 4 ft. wide. The wall is 18 in. wide, leaving 30 in. projection of the footing, or 15 in. on either side of the wall.

Next the thickness of the footing must be determined. As shown by Fig. 3, if the footing be made very thin, as shown at *a*, it will break at the point where it joins the body of the wall. If, on the other hand, the footing be made very thick, as at *b*, a waste of material is the result without the footing being made any better thereby. It has been found that the greater the load per square foot the thicker the footing must be, or, if it be a stepped footing, the steps must be made narrower as the weight per foot increases.

The following table is in use by competent authorities for ascertaining the width of offsets under the loads commonly used, that is, from 0.5 ton to 3.5 tons per square foot:

Applying this table to the problem, it is found that with a load of 2 tons to the square foot the offset, if made of 1:6 concrete, must not be more than 0.95 of its own thickness. Therefore, to project the footing 15 in. its thickness must be 15 ÷ 0.95 = 15.78 in., a little more than 15¾ in. The 1:9 concrete requires a deeper footing on account of 1:9 concrete possessing less strength than the 1:6; therefore

RATIO OF OFFSET TO THICKNESS OF CONCRETE FOOTINGS.

Kind of Concrete.	Pressure on Bottom of Footing, Tons per Square Foot						
	0.5	1.0	1.5	2.0	2.5	3.0	3.5
1:6	1.9	1.35	1.10	0.95	0.85	0.75	0.70
1:9	1.4	1.00	0.80	0.70	0.16	0.55	0.50

the 1:9 concrete footing should project only 0.7 its depth. Hence the necessary thickness is 15 ÷ 0.7 = 21.28 in. By following this rule with plain concrete footings one may be sure of making the footings of sufficient strength and without waste of material.

The above rule is so simple that it may easily be followed by any man who knows enough to use concrete, and its use will give results much more desirable than the hit-and-miss method of guessing at the width and depth of footing offsets. For reinforced-concrete footings, of course, an entirely different set of calculations is necessary. It is evident that a much thinner offset may be used, thereby resulting in a great saving of concrete, but at the expense of an outlay for metal and for labor of fabricating and placing it. The rules for calculating the size and strength of concrete reinforcing are so complicated that it is not possible to give them here.

Willoughby, Ohio. JAMES F. HOBART.

SUPPORTING MOTORS ON CONCRETE BUILDING CEILINGS.

Reinforced-concrete industrial buildings are now so common that the progressive contractor should be familiar with the best methods of installing motors in them. It is conceded that the best location for a motor of a capacity of less than, say, 50 hp is on the ceiling. There it is out of the way and does not occupy floor space. Modern induction motors require so little care, if they are intelligently selected, that they can readily be given such attention as they require even if they are mounted overhead. A good induction motor does not require much more consideration than a shafting hanger. It is the purpose of the writer, then, to describe some methods of mounting motors on ceilings of concrete buildings.

As a rule motors inverted at ceilings are held from stringers of some sort. Either timbers (Fig. 1) or structural steel sections (Fig. 2) can be used for stringers. Wood is cheaper, but introduces combustible material in what might otherwise be a fireproof installation. Wood also shrinks and swells. This results in loose bolts, vibra-

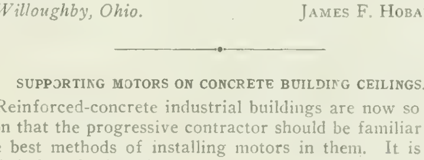


Fig. 1—Wooden Stringers Supported from Spool Casting.

tion and noise. However, wood is largely used because it can always be readily obtained and can be erected by any carpenter. Although somewhat more expensive than wood, structural steel members constitute ideal stringers. When firmly bolted into place they stay there. If an in-

stallation is properly laid out it is not necessary to drill the channels or other sections forming stringers. They can be clamped into place, as suggested in Fig. 2, without drilling. A discussion of methods of mounting motors is really one of supporting stringers, as after stringers of any reasonable design are in place the motor bed-plate can be bolted to them. Either steel or wooden stringers can be supported by the devices described herein.

In the usual concrete building the ceiling is divided into bays by beams that extend down from its surface. Stringers are most often supported from the beams, as suggested in the illustrations, but are sometimes clamped to the floor slabs between beams. The initial step, then, in erecting a stringer is to arrange some method of attaching to the beams the bolts that are to support it. If foresight has been exercised, provision for supporting bolts will have been made during the erection of the building. Otherwise the installer must drill holes in the concrete to accommodate the bolts.

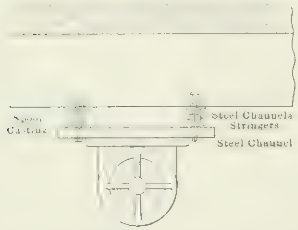


Fig. 2—Structural-Steel Stringers Supported from Steel Casting.

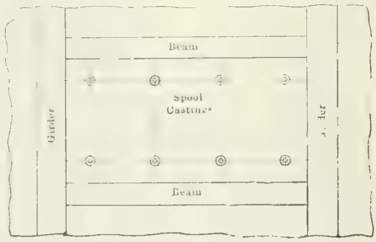


Fig. 5—Spool Castings in Ceiling.

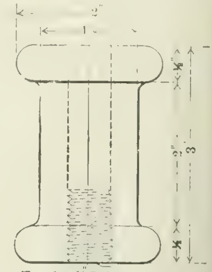


Fig. 6—Details of Spool Casting.

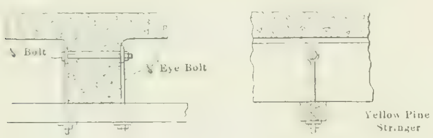


Fig. 3—Eye-Bolts Supporting Stringers.

Figs. 3 and 4 show methods of attaching bolts to beams of concrete buildings wherein no provision for bolts was made at the time the building was erected. It should be noted that in both of these examples ¾-in. round stock is used for the holes. Bolts of smaller diameter are not trustworthy for supporting the loads ordinarily encountered in practice. Also there is a possibility of a bolt smaller than ¾ in. diameter being twisted asunder when a nut is tightened with a wrench in the hands of an able-bodied wireman. In Fig. 3 a horizontal hole is drilled through the beam and through it is passed an ordinary bolt which supports an eyebolt on either side of the beam. The eye-bolts support the stringers. Where one bolt will safely sustain the load an L-bolt, similar to that shown in Fig. 7, can be used instead of the through bolt and the two eye-bolts. In Fig. 4 slanting holes are drilled in the beam side, in which hook-bolts engage. The hook-bolts are merely pieces of round stock threaded on one end and provided with a nut and bent to an angle of about 60 deg. to form a hook at the other.

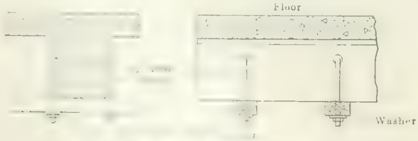


Fig. 4—Hook-Bolts Supporting Stringers.

In drilling holes in concrete an air drill or an electric drill will be found profitable if there is much drilling to be done. If such an investment is not justified, the ordinary rock drill (Fig. 8), which resembles a cold chisel except that it is longer and has a greater angle between faces at its cutting edge, is the best tool to use. Such a drill can be readily forged from tool-steel stock by a blacksmith and so tempered as to maintain its cutting edge for a maximum period. Note (Fig. 8) that the cutting edge of the drill is forged slightly wider than the stem to provide clearance. In using the drill its head is pounded with a hammer and the drill is turned a portion of a revolution between each blow to make the hole cylindrical and to prevent the drill from wedging in it.

In modern concrete industrial buildings, as above suggested, some provision is usually made during construction

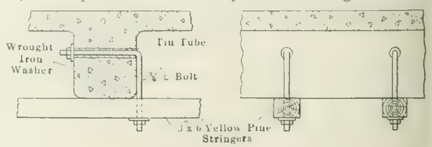


Fig. 7—L-Bolt in Tin Tube Hole.

so that pipes for heating and sprinkler systems, shafting, stringers and electrical conduits can be supported without its being necessary to drill the concrete after the building is completed. One method of making such provision is to cast in the concrete ceilings, as shown in Fig. 5, cast-iron spools such as that detailed in Fig. 6. Where these spools are inserted stringers can be bolted to them, as shown in Figs. 1 and 2. These illustrations show the spools set in beams instead of in floor slabs. For stringers the beam location is preferable because with it an unbroken line of stringers can be erected the entire length of a building. Cutting of the stringers into lengths to fit the spaces between beams is avoided.

Fig. 7 illustrates another method of preparing concrete

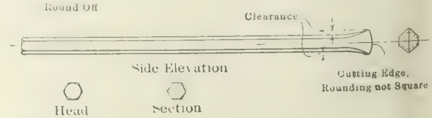


Fig. 8—Drill for Concrete.

beams for the reception of bolts. A sheet-iron tube is cast in the concrete at each location where a support point is desired; then the stringers to support a motor can be held by either an L-bolt (Fig. 7) or a through bolt and two eye-bolts, as in Fig. 3.

Nashville, Tenn. C. G. JASPE

QUESTIONS AND ANSWERS

We operate [illegible] [illegible] black sediment, requiring the oil to be changed quite frequently. After the oil has been filtered, is it suitable for use again in the tanks of the [illegible] render it unfit for further use? C. E. S.

Oil for circuit-breakers can be used over again many times provided it is first well filtered. Care should also be taken to remove the moisture in the oil, this being fully as injurious as the carbonized particles. Oil in switches should be inspected frequently, as the apparatus is liable to be damaged in case several severe short-circuits occur in quick succession when, as a consequence, the sediment has not had time to settle. It requires several hours for carbonized particles to settle to the bottom of the switch tank, and during this time the effective insulating qualities of the oil are impaired.

Kindly inform me what electrical apparatus is rated in kilowatts and what in kilovolt-amperes, and why. C. H. T.

The ratio between the kilowatt rating and the kilovolt-ampere rating of electrical apparatus is the power-factor. In apparatus having a power-factor which is nearly unity the difference between the kilovolt-ampere and kilowatt rating is usually ignored, and the apparatus is rated in kilowatts. In direct-current apparatus the power-factor is always 100 per cent, so that direct-current apparatus is uniformly rated in kilowatts rather than in kilovolt-amperes. In view of the fact that in alternating-current apparatus the power-factor is practically never 100 per cent, it would seem proper always to rate alternating-current apparatus in kilovolt-amperes rather than in kilowatts. The practice of thus rating such apparatus is by no means universal, some of the manufacturers preferring to rate their apparatus in kilowatts and others in kilovolt-amperes. So far as we are aware, the distinction between the two methods of rating depends more largely upon individuals than upon types of apparatus.

It is desired to construct a transmission [illegible] following conditions, and information on the best method would be welcome. There will be about 60 kw on the line for three hours, 25 kw for nine hours and 5 kw for the rest of the day. The electricity is for lighting a town of 800 inhabitants with no motor load. The potential at the power house is 2400 volts and at the end of the line 2080 volts. [illegible] has been [illegible] from a [illegible] over 2 per cent regulation drop. I believe step-up transformers would result in better regulation, but would it be enough to compensate for the expense of the transformers? F. F. B.

We assume that the transmission line mentioned is to be a single-phase circuit. Independent of whether it is single-phase or three-phase, it would be undesirable to use a wire smaller than No. 6 B. & S. gage. This wire has a resistance of, roughly, 2 ohms per mile, so that 5 miles of single-phase transmission circuit would have a total resistance of approximately 20 ohms. With a load of 60 kva and an emf of 2400 volts, the current would be 25 amp. At 25 amp and 20 ohms the resistance emf would be 500 volts, or, roughly, 20 per cent of 2400 volts. This value is somewhat larger than that ordinarily used, but would probably be permissible in the case, provided the voltage at the generator end can be adjusted so as to maintain proper voltage at the distributing end. Probably it would prove advantageous to operate the system initially at approximately 2400 volts, without step-up or step-down transformers, but to insulate the line for 10,000 volts, with the object in view of installing both step-up and step-down transformers, without changing the transmission wires, at a later date when the load increases to a value to justify or demand such a change.

[illegible] circuit from 3300 volts to 80 volts for a rotary converter. The direct current output of the latter is 125 volts, 240 amp. If one transformer is cut out, what voltage and amperage would be received from the direct-[illegible] [illegible]

The current which a rotary converter will supply to its load will depend solely upon the relation between the voltage at the commutator and the resistance of the load circuit. So long as the converter mentioned maintains its normal emf of 125 volts, the current which it will supply will depend solely upon the resistance of the load devices. However, if the load resistance is adjusted so as to require the normal commutator current of a certain value and the three delta-connected transformers are fully loaded under these conditions, then when one of the transformers is removed the only change that takes place is that the two remaining transformers are considerably overloaded. Each one will be required to carry 173 per cent of its rated load. In order for the two transformers not to be overloaded, it will be necessary to reduce the load on the converter to 57.7 per cent of its normal full-load value.

A motor-generator exciter set consisting of a direct-current motor rated at 500 volts, 1200 r.p.m., 15 hp, direct-connected to a compound-wound generator rated at 120 volts, 11 hp, 850 r.p.m., has given trouble. The generator voltage builds up and remains steady for a short time, but suddenly dies away. This has happened both on very light load and at full load. The field connections have been checked to determine if the shunt and series fields were bucking. When the voltage fails the action is the same as though both generator fields had been opened. Is the trouble caused by running the generator above rated speed? T. O. K.

The trouble with the generator mentioned is, as you surmise, the excessive speed at which it is operated. When a 120-volt generator designed for 850 r.p.m. is excited to give 120 volts at 1200 r.p.m. the magnetization of the field core is very much below the saturation, and hence if the machine is self-excited it will be unstable. In your case either one of two methods can be employed to obtain stability. Either the driving motor can be over-excited in order to decrease its speed appreciably or the generator can be separately excited from the system from which the motor receives its current. Either of these methods will give satisfactory results. However, over-exciting the motor may cause its field coils to become too warm, while exciting the 120-volt machine from the 500-volt circuit will involve a certain extra amount of loss in the additional rheostat in the field circuit.

An electric fan motor is wound for 52 volts, 133 cycles. It has eight poles, each split and possessing a starting coil. There are fifty-two turns per pole in the running field coil, which is composed of No. 17 single cotton-covered wire. The starting coil has forty-six turns per pole. The rotor has forty-three inductors. How may this motor be converted so as to operate on 110 volts, 60 cycles? W. S. B.

If without changing the winding on the machine it is operated at the lower frequency, with the original value of emf, the magnetic density will be 2.2 times the former value and the iron loss will be about 3.5 times as large per cycle. However, the frequency is less, and the final iron loss is only 1.6 times the initial value. By reducing the emf to about 40 volts the loss will be approximately the same as formerly, but the speed will be less than one-half of its former value. In order to double the speed it is necessary to halve the number of poles. The mechanical arrangement of the magnetic path is not such as to permit this change to be made properly, but fair results may be obtained by connecting the pole windings for four effective rather than eight poles. The windings should be connected in pairs for this purpose. Unless the number of turns is increased, the operating emf will be 40 volts. If the machine is to be operated at 110 volts, it will be necessary to use nearly three times as many turns as at present, with approximately one-third the size of wire now used. In any event, the motor will be incapable of carrying as large a load as formerly.

Central Station
Management, Policies and Commercial Methods

HELPING TO RENT WIRED HOUSES.

The Marion (Ind.) Light & Heating Company offers owners its assistance in finding tenants for electrically wired houses temporarily vacant. The company has erected an electrically lighted bulletin board at the side of its office on one of the prominent streets of Marion, where announcements of wired houses are posted at the request of the owners. The following is copied from the sign-board:

"MARION LIGHT AND HEATING COMPANY'S RENTAL BULLETINS.

"The following houses for rent are wired for electric conveniences:

ROOMS.	LOCATION.	RENT.	AGENT.

The only drawback to the usefulness of the plan to prospective tenants in search of quarters is the fact that no electrically equipped house remains posted long on the bulletin board before it is snapped up.

CENTRAL-STATION FOLDERS FOR NEW ORLEANS STREET-CAR PATRONS.

From boxes in its street cars the New Orleans Railway & Light Company is distributing each week about 15,000 folders advertising its electrical service. The little sheets are about half the size of a page of the *Electrical World*, with an equivalent amount of reading matter, and are folded three times to vest-pocket dimensions. Besides notes on electric heating and cooking devices, electric lighting, motor applications, etc., a number of bits of humor and epigrams and a list of current theatrical amusements are introduced to brighten up the text. Mr. W. E. Clement, contracting agent for the company, believes that this method of advertising central-station service will prove of much benefit, since the average street-car patron has nothing else to distract his attention and welcomes the bit of reading matter to beguile his journey. No name has yet been given the little sheet, but a prize of a complete combination home electric outfit, including percolator, toaster, disk stove and iron, is offered to the person suggesting the most appropriate title.

THE FARMER AS A CENTRAL-STATION CUSTOMER.

A word of caution to operators of transmission lines who have applications for service from farmers was offered by Mr. H. W. Bullock, of Eureka, Ill., in a discussion of farm service before the Illinois State Electrical Association Oct. 26. While the farmer wants lamps in every conceivable place where they may be needed, as well as motors for every possible use, he is, as a rule, very economical in the consumption of energy. Many of the farm customers near Eureka have large tungsten lamps on poles in dooryards, barnyards and feedyards, and motors are used for pumping water, grinding feed, sawing wood, elevating grain into cribs and running cream separators, churns, washing machines, sewing machines, fans, etc. A number of customers use electric irons. The Eureka company requires the farmer to bear the expense of secondary-line construction from the transformer to his own house service, the transformers being placed at convenient distribution centers for three or more customers. Nearly all the farms within a mile of the transmission line are now equipped electrically, and Mr. Bullock declares that this business is reasonably profitable where the customers are not too remote from the line.

A GREAT CENTRAL-STATION BUSINESS.

According to the *Electric City Magazine,* which is issued by the Commonwealth Edison Company of Chicago, that company "sells annually one-third more electricity to one-third more consumers for about one-third less dollars per annum than any other central-station concern in the world." The total connected load Sept. 30, 1911, was as follows:

	Kilowatts.	Equivalent in Lamps of 16 cp.
Light	194,149	3,882,984
Motors	149,837	2,996,732
Railway	125,500	2,510,000
Total	469,486	9,389,716

The company operates three principal generating stations and has three reserve generating stations. It has fifty-three substations, sixteen of which contain storage batteries. It has about 148,000 individual customers, the wholesale consumers being principally elevated and surface railway companies. The company employs about 3500 persons and $65,000,000 of capital, represented by stocks and bonds. Five per cent is paid on bonds and 7 per cent on stock, both selling at a premium, the former at about 103 and the latter at about 135. About a million tons of coal is burned annually. In taxes, franchise remuneration, etc., the company pays into the public treasury about $1,000,000 a year

LAMP RENEWAL ECONOMY WITH TUNGSTEN LAMPS.

The discussion at the recent convention of Railway Electrical Engineers in Chicago on the report of the committee on illumination served to bring out a fact not generally recognized as yet, namely, that the tungsten lamp as at present manufactured is probably a cheaper lamp to use from the standpoint of lamp renewals alone than is the carbon lamp. In other words, leaving out of account the cost of electrical energy, if a consumer wishes simply to use the lamp which will give him the least cost of lamp renewal per 1000 lumen hours, he has only to operate the tungsten lamp at a low enough efficiency to prolong its life to a point where lamp renewals will be less than with carbon lamps of the same candle-power. This does not, however take into account the possibility of the operation of the carbon lamp at considerably below ordinary efficiency, thus indefinitely prolonging its life. The point is nevertheless interesting as reminding users that tungsten lamps need not necessarily be operated at the high efficiencies ordinarily prevailing at present, and that if lamp renewal cost is to be brought down it can easily be done by operating these lamps at lower efficiencies, thus prolonging their life. Summed up briefly, the present lamp situation is such that all users who have any regard for saving in electrical energy are adopting

tungsten lamps for locations where the lamps are used enough to make worth while the extra investment in lamps and the added danger of lamp breakage by other than electrical causes. The wise user will not put tungsten lamps in sockets which are rarely used where there is danger of breakage, because a few broken lamps will wipe out any other saving.

PAVING BY ELECTRICITY.

About two months ago the city of Leavenworth, Kan., decided to repave a prominent business street, and let a contract for that purpose to a paving firm, which commenced work with a steam engine to run the paving machinery. Complaints from tenants on the street soon followed on account of the smoke, dirt and noise from the engine, and the Leavenworth Light, Heat & Power Company finally induced the contractor to rent a motor for the power service. A 15-hp motor was mounted on a wagon running the paving machine, which moves three times a week; and as the company's lines are on the street where the paving is being done, connection is easily changed to the service wires, the meter and starting box being carried on the wagon with the motor. As the use of the steam engine had delayed the work, working nights was suggested to the contractor, and now twelve 100-watt tungsten lamps on portable poles furnish light for the night work. The contractors are much gratified with the change to electricity and are getting excellent results.

The Leavenworth company has also carried through a plan to make a "white way" of the principal business street of the city. Through Mr. W. C. Duncan, the commercial manager of the company, the merchants were enlisted in the cause, and five-light tungsten poles are now being installed.

MOTOR APPLICATIONS FOR BRICK PLANT.

The Fallston Fire Clay Company, of Bradey's Run, Fallston, Pa., has recently equipped its brick plant with motor drive throughout. The installation when complete will have a total of approximately 325 hp of two-phase, 60-cycle, 220-volt alternating-current motors, which are belted direct to the various machines. The energy is purchased from the Beaver County Light Company, New Brighton, Pa., and is transmitted a distance of about two miles from the main power house in Fallston.

The application of the motors to the various machines is as follows: One mammoth Ohio brick machine, having a driven pulley 7 ft. in diameter by 19-in. face, and one 12-ft. pug mill, having a 4-ft. diameter pulley, 17-in. face, are both operated by one 75-hp, 600-r.p.m. two-bearing motor, with double extended shaft having a 13-in. diameter by 17-in. face pulley for brick machine and 11-in. diameter by 16-in. face pulley for pug mill. This outfit will be duplicated in the complete installation.

There are three 9-ft. Stephenson dry pans having 4-ft diameter by 17-in. face pulley, operated at 125 r.p.m., driven by one 35-hp, 600-r.p.m. two-bearing motor, pulley 10 in. in diameter by 16-in. face. The elevators are equipped with individual two-bearing motors rated at 7 hp, 800 r.p.m. One 5-hp motor running at 1800 r.p.m. is belted to a direct-current generator, which furnishes energy for mining machines. One 3-hp motor is geared direct to a triplex pump, which is used to pump water necessary in the brick plant. Later there will be a 25-hp crusher installed near the mine. When the plant is working up to capacity it is expected to turn out 60,000 bricks per day of ten hours.

This installation is considered rather interesting from the fact that in this application the extreme width of pulley and belt on two-bearing Crocker-Wheeler motors is used. If the installation operates successfully it will mean a new limit to pulley and belt width on two-bearing motors. All systems of drive were considered for the installation, including chain, gear and friction, but the belt drive was selected because it was considered the most practical for an installation of this kind.

ELECTRICITY FOR FARMERS NEAR PETERSBURG, ILL.

When it became known that the Petersburg Electric Light Company planned to build a 16,500-volt transmission line to Greenview and Mason City a number of prominent farmers along the way served notice on the company that if they could have the privilege of taking service at the town rates the right-of-way for the proposed line would be furnished free of cost. Thus practically forced into the supply of electricity to neighboring farms, according to Mr. R. H. Abbott, president of the company, arrangements were made to install several step-down transformer substations along the line, reducing to 2400 volts for distribution to the farms. These single-phase, high-tension transformers are mounted in small houses built on 25-ft. poles and are protected only by fuses. Thus far only two such substations have been erected, one feeding a 2-mile, 2300-volt line supplying four farmers, and one a 2-mile line with two farmers. The 2300-volt lines are of No. 6 hard-drawn copper wire carried on 6600-volt porcelain insulators on 25-ft. poles set forty to the mile, and the regular distributing transformers are equipped with both lightning arresters and 2300-volt fuses. All of the transformers, poles, lines, arresters, etc., are owned by the customers, so that the company is without investment on their account. A minimum bill of $2 per month is charged each customer, the regular Petersburg schedule applying for the energy consumed. The farmers seem to appreciate the service and several have gone to some expense to fit up their places with electrical equipment, installing pump motors, fans, irons, bathroom heaters and other appliances.

NOVEL ELECTRICALLY DRIVEN ASH AND DUMP CARTS FOR BOSTON.

The Quincy Market Cold Storage & Warehouse Company, of Boston, Mass., has recently placed in service an electrically driven coal and ash cart which represents probably the first application of its kind in the electric-vehicle field, and a duplicate equipment has been purchased by the Edison Electric Illuminating Company of Boston for ash service. The machine consists of a Philadelphia type of coal or ash wagon of 5 tons capacity, with a front frame carried upon a pair of standard couple-gear wheels with inclosed motors, and a rear or tipping section mounted upon a pair of 60-in. steel-tired wheels without springs. The wheelbase is about 8 ft. 6 in. The front wheels are 38 in. in diameter and are equipped with 5-in. Kelly block-rubber tires, the chauffeur's seat being located somewhat forward of the axle, with steering wheel and controlling apparatus at the front of the platform, permitting the front wheels to be turned 45 deg. The outfit is driven from a battery of forty-eight "National" thin-plate cells having high-bridged jars and bolted frames, the battery being located in a box above the front wheels. The body is tipped by a "Diamond" hand-operated hoist at the front of the wagon. The length of the machine over all is 14 ft., which is the maximum permitted for city coal carts operated in the business center of Boston, on account of the limitations of

space in backing against the curb between the sidewalk and the car track in narrow streets. The cart makes a speed of 5 miles per hour loaded and 7 miles per hour empty. In a haul of a quarter of a mile the machine is already showing substantial economies over horse traction, all charges being considered. The Quincy Market company operates the largest cold-storage system in the world, and it selected the electric coal car only after the most rigid investigation of its capabilities. It is stated that no other existing design of electric or gasoline truck could meet the space limitations imposed by the company.

GETTING AFTER THE IMPROPER METER SETTINGS.

The meter superintendent who halts awhile to make a general survey of the present condition of the meters that have been installed on his system several years is likely to find a surprise waiting for him in the number of settings that were either improperly made in the first place or have become bad examples through neglect or change of conditions in the customer's premises. Meters are located in damp closets and cellars, sometimes even in places where drippings from overhead drains fall upon their cases. In other instances both meters and wiring are in danger of mechanical injury, or the meters are installed in places where vibration causes them to creep. Many meters are located in such inaccessible places that much time is lost by the readers, while it is practically impossible for the meter tester to reach them to make a test on the installation.

A large Western central-station company is now making a detailed house-to-house inspection of its meters that have been installed from time to time during several years, and, needless to add, has uncovered numerous terrible examples of all the things that correct meter settings should not be. Most of these were installed under fairly correct conditions at the beginning, but the customer has allowed that part of his premises where the meter is located to run down or become cluttered up with junk and rubbish, so that an installation test on the meter under the conditions of dirt and moisture prevailing would be out of the question, even if the meter could be reached conveniently. In many such instances the wiring to the meters is also in sad need of repair or may never have been installed with any other idea than that it should be temporary to hold the customer's service for a few days. This fact is usually promptly forgotten and the "temporary" wiring continues in service month after month and sometimes is never changed until the time of some sweeping inspection like that now under way.

A clause in the company's contract requires that the customer shall provide a suitable place and connections for the meter, for which he is responsible. With this as a basis the company has attempted to require customers to have their wiring and meter setting repaired at their own expense. Many properly submit to this requirement, but where the consumer refuses to bear the expense the company puts the installation in repair itself, regarding the cost of doing this as a good investment for the saving of its meter repairs and the time of its readers and testers.

PORTABLE PUMP FOR FREEING MANHOLES OF WATER.

The Omaha Light & Power Company makes use of the portable motor-driven manhole pump shown in the accompanying illustration, energy for which is obtained from the nearest trolley wire. The outfit consists of a 10-hp motor arranged to drive, through a flexible coupling, a small centrifugal pump capable of delivering 100 gal. of water a minute against a suction lift of 15 ft. when operated at 450 r.p.m. The flexible suction pipe-line used for reaching into the manhole is carried in two sections on the brackets shown at the side of the cart. For priming the centrifugal pump at the start the small belt-driven vacuum pump seen

Portable Manhole Pump.

just below the flexible coupling is used. The motor is arranged with a bank of resistors for speed control, enabling adjustments to be made corresponding to the suction lift from which water is to be pumped. Mounted on the rear of the cart is a reel of two-conductor cable which can be run out to connect to the nearest trolley wire and ground-rail return, from which energy is obtained for operating the outfit. The cart with its pumping equipment was built for the Omaha company by Yeomans Brothers, Chicago.

CENTRAL-STATION DRIVE OF ILLINOIS COAL MINES.

Central-station service to coal mines certainly represents the isolated plant tracked and felled in its last lair. The electric companies in the coal fields of central Illinois continue to take on these mine loads, whose off-peak demand makes them desirable load-factor business. The Peoria Gas & Electric Company has recently equipped several coal mines electrically in its vicinity, one of which is unique in employing three-phase locomotives. Unfortunately, however, the State law of Illinois limits the electrical pressure which may be taken into mines at 275 volts, and special transformers were required to give the limiting voltage under this restriction. The mine extends 4000 ft from the entry, and as each locomotive used is equipped with two 37-hp motors the conductor-drop loss has been considerable.

At the Illinois electrical convention held at Rockford Oct. 26 Mr. J. J. Frey, of Hillsboro, Ill., told of several coal mines operated by his company within a radius of 12 miles of his station. One of these mines had been considered exhausted by the ordinary method of mining, but the electrical operation will extend its life many years. A coal washer driven by 300 hp in motors constitutes another good load for the Hillsboro system. Mr. E. H. Negley, of Canton, Ill., stated that the energy consumption per ton of coal mined he found to average 0.5 kw-hour for hauling only, of the coal out of the mine by electric locomotive In a paper read by Mr. W. A. Thomas, of Pittsburgh, Pa.

on the same subject of motor drive in mines the consumption per ton of coal in a mine completely equipped electrically was stated to be from 0.5 kw-hour to 3.5 kw-hours, averaging 1 kw-hour to 2 kw-hours. In the case of a certain large coal mine cited by the author about one-half of the possible output of 40,000 tons per month was being actually mined. A total of 1450 hp in motors is connected, but the maximum demand of the load reaches only 800 hp. Practically all operations are performed with motors, the pumping of water from the lower levels, however, constituting a large part of load. The coal is loosened by eight 25-hp coal-cutting machines and hauled out by thirteen 15-ton locomotives. A total of 300 hp is installed in pumps. The energy consumption at this mine has averaged from 2.1 kw-hours to 4 kw-hours per ton of coal mined, the high average of 3 kw-hours per ton being due to the large pumping requirements of the mine.

THE "ACTIVE-ROOM" RATE IN ST. LOUIS.

To correct some erroneous impressions in relation to its new "active-room" residence rate (*Electrical World*, Oct. 28, 1911, page 1068) the Union Electric Light & Power Company, of St. Louis, has issued some supplementary explanations which will be of interest to buyers and sellers of electricity. What follows is given substantially in the language of the company:

"First—It is not necessary to have four active rooms, and thereby require that at least 16 kw-hours be consumed per month at the 11-cent rate before the benefit of the low rate of 6 cents is secured. For example, consider a five-room flat, consisting of a living-room, a dining-room, a kitchen, two bedrooms and a bathroom. Three of these rooms, living-room, dining-room and kitchen, are regarded as active, and the first 4 kw-hours for each of these three rooms will be billed at the 11-cent rate, and the excess at 6 cents. The same flat, if the living-room referred to were converted into a bedroom, would have but two active rooms, a dining-room and a kitchen. In this case the first 8 kw-hours would be billed at the 11-cent rate and the excess at 6 cents.

"In the case of a four-room flat, consisting of two bedrooms, kitchen, dining-room and bath, there would be but two active rooms, the kitchen and dining-room. Therefore 8 kw-hours would be charged at the 11-cent rate and the excess at the 6-cent rate.

"Second—We find that some of our patrons have the impression that all electricity consumed in the active rooms is billed at the 11-cent rate, which, of course, is an error. The fact is that the first 4 kw-hours for each of the four or less active rooms, regardless of what part of the house the electricity is actually consumed in, is charged at the 11-cent rate, and all the excess electricity used on the premises, regardless of where it is used, is charged for at the 6-cent rate. The reason for charging for the first 4 kw-hours for each of the first four active rooms is that the lamps in these rooms are more apt to be used simultaneously, and therefore more nearly represent the maximum amount of energy that the customer draws from the company's service at one time and for which the company must make adequate provision. The lamps in the bedrooms, bathroom, basement, attic, etc., are used at odd times, and therefore are not regarded as increasing the demand.

"Third—In the system of rates previously employed the rate was based upon the number and size of lamps installed. Under the new rate the cost of the service is not affected by the number of lamps installed, and it is, therefore, permissible to equip the house with many convenience lamps, such as lamps in closets, additional portables, or decorative lighting, without increasing the charge.

"Under the new rate electric household appliances can be used at practically half the cost compared with the old rate, inasmuch as the energy consumed for lighting will invariably put the consumer on the 6-cent rate. Therefore any additional consumption through the use of electrical appliances will be charged at the low rate of 6 cents.

In a nutshell, the conditions are as follows: The minimum monthly charge is $1, regardless of the number of lamps or heating appliances in your residence. If you have two active rooms, 8 kw-hours (2×4) are billed at the 11-cent rate and the excess at 6 cents. Assuming a consumption of 15 kw-hours, your average net rate would be 8.2 cents per kw-hour, the saving on 15 kw-hours over the old rate being 47 cents.

"For three active rooms 12 kw-hours (3×4) are billed at the 11-cent rate and the excess at 6 cents. Assuming a consumption of 20 kw-hours, your average net rate would be 8½ cents per kw-hour. Here the saving on 20 kw-hours over the old rate would be 57 cents.

"If you have four active rooms 16 kw-hours (4×4) are billed at the 11-cent rate and the excess at 6 cents. Assuming a consumption of 25 kw-hours, your average net rate would be 8.7 cents per kw-hour. The saving on 25 kw-hours over the old rate would be 66 cents.

"In the foregoing the rates 11 cents and 6 cents, wherever referred to, are, of course, subject to a discount of 5 per cent for prompt payment."

CINCINNATI'S SOLUTION OF THE AUXILIARY-SERVICE NUISANCE.

The usual isolated-plant owner who approaches the central-station manager for standby or auxiliary throw-over service to his plant becomes not only surprised but aroused when he finds that for such readiness-to-serve provision it is proposed to charge at least for the investment in machinery and equipment necessarily reserved for the service. He has probably formed the idea that it is a simple matter for the central station to extend its helping hand to the throw-over clips on his main switch, when needed, and that out of its ample storehouse of energy the big station can furnish almost any amount, more or less, without noticing the difference.

Such a plant owner, according to Mr. J. D. Lyon, commercial manager of the Cincinnati central-station company, is comparable to the man who would object to paying annual insurance premiums until the year his house burned down.

The diversity factor of such throw-over services, Mr. Lyon also points out, is not nearly so high as has been supposed, but is, indeed, very low when the matter of isolated-plant interruptions from general causes is considered . For example, a break in a pipe line may put every gas engine in town out of operation, while a strike of teamsters might have a similar effect on steam stations using coal as fuel. Any such incident would at once throw the entire amount of this class of auxiliary service onto the central station's lines and the company would find that the high diversity factor it assumed had been reduced simply to the diversity factor between the services of the isolated plants themselves.

Accordingly, in the new rate schedule recently put into effect in Cincinnati the plant owner is required to guarantee $36 yearly, or $3 monthly, for each kilowatt of his desired connected demand. Such service is furnished through automatic overload circuit-breakers (furnished at the customer's expense) and set to open at demands exceeding that contracted for. In addition the company inserts in the line its own fuses of a carrying capacity slightly above the setting of the circuit-breaker and for replacing these fuses when blown as the result of an excessive overload makes a charge of $1 to the customer.

Where the isolated-plant owner is willing to accept off-peak restrictions on his throw-over service, agreeing to use no energy between 4 p. m. and 6 p. m., November to February, inclusive, he is permitted to use central-station energy up to an amount equivalent to his guarantee payment without additional cost. Beyond this charge is made at the usual schedule.

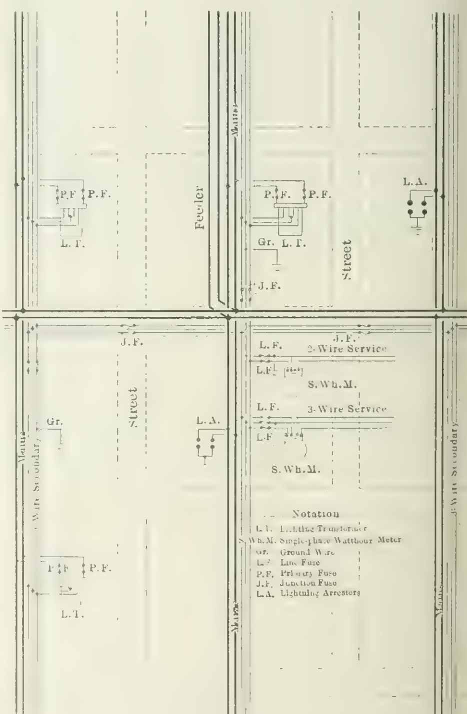
In cases where no off-peak limitations are agreed to by the customer for making his emergency demands the same monthly charge of $3 per kilowatt is made, but in return for this only the use of 30 kw-hours of central-station service for each kilowatt of contracted demand is permitted, all additional consumption being charged for at the regular rates in addition to the service charge.

GROUNDING SECONDARIES AT DENVER.

Among the larger central-station systems which have lately adopted the grounding of secondary lighting networks as a standard feature of distribution practice, that of the Denver Gas & Electric Light Company deserves mention on account of the rapidity and completeness with which the work has been accomplished. The importance of safeguarding the public and its consumers from accidental contact with circuits of dangerous potential has long been appreciated by the management, and in co-operation with the insurance interests and municipal authorities the company has done much in the past few years both to improve the quality of distribution service in older installations and to cast the weight of its influence on the side of better wiring in later applications of electricity to domestic and mercantile lighting. In common with many other central-station organizations, however, the company maintained a passive attitude in regard to the grounding of secondaries until about two years ago, when it was decided to investigate the problem with a view toward adopting the grounding practice. A broad consideration of the subject led the company to begin grounding its three-wire secondary network in the spring of 1910, and by the fall of that year the entire system of distribution secondary circuits was grounded according to a standard plan illustrated in the accompanying diagram.

The Denver Gas & Electric Light Company supplies electricity for lighting and power applications to all the territory within the city limits and to the local companies, manufacturing plants and amusement parks in the suburban districts surrounding the city. Energy is supplied to the distributing system from a main steam plant on the west side of the city, from an auxiliary station known locally as the Lacombe plant and from the transmission system of the Central Colorado Power Company, through a substation receiving energy from the two hydroelectric plants of the latter organization at Shoshone and Boulder. The operating center of the Denver system is at the West Side Station, which is connected with the auxiliary equipment of the company located elsewhere, so that the load may be distributed according to the conditions of service. The lighting service, which is of interest in connection with the grounding practice, is handled by multiple, single-phase, 2200-volt primary feeders and mains, supplying energy to secondary networks throughout the urban district through step-down transformers located at important centers of distribution and feeding individual consumers at 110 volts and 220 volts, according to the local load requirements.

The single-phase alternating-current system is made up of twenty-six two-wire, 2200-volt feeders extending from the station busbars to the electrical center of a definite section of the city which is electrically independent of any other section or feeder. The primary mains extend from the center of distribution in each section in the form of laterals or branches supplying energy to the most remote transformers of the district with the usual inclusion of intermediate transformers bunched, so far as practicable, to secure economy of operation and reasonable first cost. Any feeder may be fed from a special auxiliary bus in the station in case repairs, adjustments or inspection are necessary in connection with the switches and regulators in routine service. Within a given section the secondaries of all transformers are connected by three-wire tie lines forming low-tension busbars from which the leads to the various consumers are tapped. The transformers used on the lighting system vary in size from ½ kw to 50 kw, and all above 1-kw rating are connected for 2200 volts on the primary, each of the two secondary coils being brought out of the case and connected so as to give 110 volts between the middle or neutral line and either of the outside lines and 220 volts between outers. The company has found that with the load well balanced considerable saving



Method of Grounding Secondary Network.

in secondary copper results from this method of operation, as would obviously be anticipated.

Each transformer is connected to the primary main through outside-type primary fuses of double the transformer rating in amperes. The secondary network is sectionalized between each pair of transformers by a set of fuses or junction cut-outs, these being placed approximately at the point of zero current between the adjacent transformers on each secondary interfused section. The object of this fusing of secondary sections is to prevent the transformers on either side of a defective unit or secondary service from assuming heavy overloads. As soon as any abnormal conditions arise the junction fuses on either side of a defective section blow, as well as the primary fuses on the transformers, and the section is automatically cleared from the system. The junction fuses are of copper wire, being about 50 per cent larger than the rating of the smaller of the two transformers between

which they are in each instance placed, and varying from about 60 amp between 5-kw transformers to 400 amp between 50-kw units. No fuses are installed in the neutral lines of the secondary networks, although fuses are placed in all leads running from any wire of the secondary service to consumers' premises.

The company began grounding in the residential district by connecting the neutral of the secondary mains to the nearest water hydrant at intervals of about two blocks. All services enter buildings in Denver from alleys at the rear, through which the primary and secondary mains are carried. The neutral-main ground connection is made by a No. 4 B. & S. copper wire stapled to the pole and covered with weatherproof insulation, the ground wire being run down the pole and to the hydrant at the bottom of a trench 18 in. deep. The alleys are 16 ft. wide and the neutrals are usually carried on 35-ft. poles about 20 ft. above the ground. Approximately 60 ft. of No. 4 wire is usually required for the ground connection in residence districts, the maximum length being 125 ft. The neutral ground wire is attached to the hydrant by the simple process of winding it beneath the footing bolt and making tight with a wrench. In the down-town section the usual length of ground wire required from the secondary network is from 10 ft. to 50 ft. The company has given up the use of the inclosed fuse in its secondary mains on account of the cheapness of open fuses. The total number of grounds made on hydrants by the fall of 1910 was about 150, the work being done with the consent of the Denver Union Water Company, which supplies water for domestic and commercial service within the city. From four to six hydrant grounds can be installed per day by a force of two men. In the residential district the average cost of making a ground was about $4.50, the cost of material coming to $2.50, with labor $2. In carrying out the work of grounding it was found necessary to put the current coils of all meters in the outer leads of the incoming service, in order to protect the company against loss of revenue from accidental grounds in the consumer's house-wiring. No evidence has been found of the disintegration of the hydrant grounds and no perceptible expense of maintenance has been found to exist in connection with the grounding system.

By regulation of the municipal authorities early in 1911 all new electric-lighting installations are required to ground their neutral wires, the owner and wiring contractor being responsible for this work. All wiring in new buildings is required to be in iron-armored conduit, and where possible concealed wiring in old buildings is required to be installed in this manner. The use of inflexible metal conduit is permitted in connection with switch loops and wall outlets, while open wiring is allowed in approved metal molding. Drip loops are provided in conduit where it enters the building. The main switch and cut-out or fuse are required to be installed in a rear room or hallway, where the exit door is located, and all wires in the building are disconnected by this, a plan which obviously is of much value to firemen. The fuses are placed ahead of the main switch in order to protect the latter from short-circuits. The meter loop is taken from below the switch, so that both switch and cut-out protect the meter. The cut-out cabinet or center of distribution is required to be placed on a side wall not over 7 ft. above the floor and away from any grounded portion of the building, such as a sink, radiator or stove. These cabinets are not allowed in clothes closets or bathrooms.

Under the present conduit system the cut-outs are installed in an iron cabinet, the metal of which is 1/16 in. thick, with tight-fitting door. Inclosed fuses are also required. The different circuits branch out from the cut-out cabinet and are connected and held in place by lock nuts on either side of the sheet metal of the cabinet, with an insulating bushing at the end of the pipes to protect the wire covering. The city requires conduit to be permanently and effectively grounded in such a manner that in case either wire comes in contact with the conduit and a ground exists on the opposite polarity it will be able to operate the heaviest fuse before burning off the ground. This ground is usually made by bonding the conduit to the water pipe. Grounding to steam or gas pipes is not allowed. An insulating joint and canopy ring are required to insulate the fixture proper from the conduit. When fixtures or sockets are installed over cement or grounded floors, or in places where they can be reached from grounded parts of bathrooms, stoves, ranges, etc., porcelain sockets are required to insure safety while turning on the lights. The ground wire connecting the conduit with the water pipe cannot be smaller in circular mils than one-half the main feed wire. A special clamp is provided for grounding the neutral wire to the cabinet box and conduit system in the box, just inside the building in each case. The company's experience indicates that, both from the standpoints of fire hazard and safeguarding individuals, the grounding of lighting secondaries up to a point where the maximum potential between any lead and ground does not exceed 150 volts is an excellent precautionary measure.

Wiring and Illumination

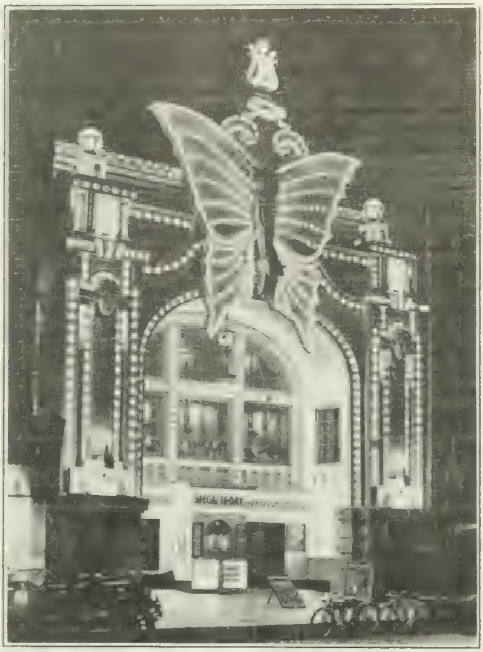
UNUSUAL LIGHTING FEATURES OF A SMALL MILWAUKEE SHOW HOUSE.

The accompanying illustration shows the striking effect obtained at the Butterfly Theater, Milwaukee, when the front is studded with 1800 5-watt, 12-volt tungsten lamps, wired in series multiple. In addition to these standard-base lamps there are 500 others of the candelabra type, used to outline the program cards at the entrance. The effect of these 2300 lamps is brilliant indeed, and rarely fails to arrest the attention of the passerby along Grand Avenue.

Only direct-current central-station service is available in the downtown section of Milwaukee, so that it became necessary to adopt the series-parallel scheme in arranging the small tungsten lamps. The principal objection to this arrangement is, of course, the unbalancing and over-voltage imposed on the rest of the lamps of a group when one of its number burns out. This has been guarded against in the Butterfly installation by extending the wires of each group down to pairs of receptacles in a cabinet on the theater balcony. The lamps on the front are watched closely, and if one is seen to be out another is immediately inserted in one of the two receptacles attached to that circuit, restoring the current per lamp to its normal value. Next day, with a ladder, the burned-out lamp can be renewed, with any others that have been broken. This enables all renewals to be made simultaneously and saves the improper burning of lamps during the time that must elapse before means of renewing the burned-out units are at hand.

The interior of the Butterfly Theater is of unusual size for a moving-picture house and is lighted entirely by the indirect system. The floor measures 120 ft. by 40 ft. and is illuminated by twenty ceiling reflector bowls, each containing seven 60-watt tungsten lamps. Below the balcony are fifteen smaller indirect units, containing four 40-watt lamps each. A Milwaukee city ordinance requires at least "twilight" illumination of the auditorium during moving-picture performances. The indirect units are accordingly arranged on two circuits, one, made up of a single lamp in

[illegible] during the progress of the pictures. Since the intensity of the illuminated wall surfaces is not high compared with exposed units, the presence of this light does not detract from the pictures. The balcony lamps impose a relatively higher intensity at the rear, tapering toward the front of the house, a distribution which also prevents glare effects in the eyes of the audience.



Exterior Illumination of Show-House.

The lighting was laid out by the illuminating engineering department of The Milwaukee Railway & Light Company, which offers its services free of charge to any architect or owner of a building served by its lines. One of the suggestions of the engineering department was the indirect illumination of the present studded theater front, bathing the whole in distributed light of high intensity, set off by the central butterfly figure in silhouette. This would have made possible the use of standard-voltage multiple lamps and would present so unusual an appearance that it is hoped to carry out the scheme in some future installation.

BOTTLE ELECTRIC TOWER.

Following are details of construction and operation of the remarkable "Bromo-Seltzer" electric tower in Baltimore, a short account of which recently appeared in these columns:

The Bromo-Seltzer Tower building is the highest structure in Baltimore. The tower itself to the top of the roof just under the revolving bottle is 289 ft. 3½ in. high. The bottle and cork is 51 ft. 2½ in. high. The crown is 15 ft. 8 in. high to the top of the cross, with a clearance space of 13 in. between the cork and the crown, making a total height of 357 ft. 3 in.

A central core 13 ft. 2 in. in diameter and 53 ft. high, built in eight sections, and forming part of the steel construction of the whole tower, extends up above the roof of the tower. This core is shown on the accompanying structural drawing and extends up to the base of the crown to take the plates which are part of the crown. The exact dimensions of the bottle are 51 ft. 2½ in. high to the top of the cork and 20 ft. 7 in. diameter. The cylindrical portion of the bottle is 33 ft. high, and this portion revolves. The shoulder and neck of the bottle is stationary.

The revolving part is made in nine panels, in order to carry the letters properly on the outside. The panels are supported by nine bridge trusses each 30 ft. 10 in. long with 7 in. overhang at the top and 19 in. at the bottom and 2 ft. 9 in. deep. Each of these trusses rests against two rollers, one at each end. Two circular tracks are placed around the central core at the ends of the bridge trusses. The nine trusses are connected by cross and angle frames at the inside and outside verticals, making a stiff annular structure with nine sides and nine rollers at the top and nine at the bottom.

The top of the building is in the form of an octagon with eight radial I-beams extending out to the inclined roof. On each of these beams are eight heavy rollers carried in Hyatt roller bearings. A 70-lb. rail bent to a perfect circle rests on these rollers and carries the total weight of the revolving structure. Just inside of the rail is a circular rack made in nine sections, each section having thirty-four teeth, or a total of 306 teeth of 7-in. face and 2-in. circular pitch.

The floor plan shows the driving mechanism, which includes a back-geared, 10-hp, 125-volt direct-current motor. The motor runs at 825 r.p.m., the back gear reducing 6 to 1. The back-gear shaft carries a bevel pinion 5 in. in diameter and 5-in. face meshing into two bevel gears with sixty-nine teeth each. These drive the two shafts in opposite directions. Each shaft has on it a pinion 10 3/16 in. diameter, sixteen teeth, 7-in. face, meshing into the rack on opposite sides, which drive the revolving portion of the bottle around at

Fig. 1—Bromo-Seltzer Tower Building.

1½ r.p.m. While a 10-hp motor is employed, it is found that it takes scarcely 3 hp to operate easily.

The whole bottle is covered with No. 16 galvanized Toncan metal, except the sheets carrying letters, these latter being No. 13 plates. There are twelve letters on the bottle making the words "Bromo-Seltzer." Each of these letters is 10 ft. high and 5 ft. wide. The width of th

lines of the letters, which are made in trough form, is 15 in. The sides of the trough are 4 in. high, being made of the same metal.

A row of 8-cp to 12-cp lamps is placed in the center line of the troughs, making a total of 315 lamps in the letters. The letters are painted white inside; the body of

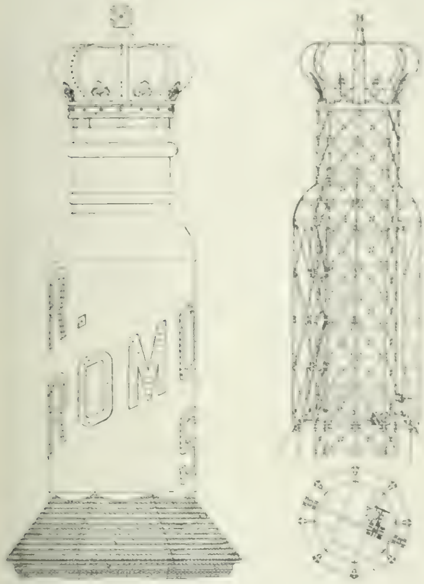


Fig. 2—Elevation and Section of Bottle Sign.

ie bottle is painted blue, the same color as bromo-seltzer bottles. For the illumination of the moving structure the main wires are carried up to a switch inside the core. From there the wires lead to two short trolleys secured to one of the vertical columns of the core. Two circular racks are fastened on the inside of the revolving structure on insulated supports. The trolleys run in contact with he tracks.

Ten cutout boxes are placed so as to serve the letters in each panel, and these are connected to the circular tracks. Leads are run from these cutout boxes to the back of each of the letters and up along the line of the lights. A series of holes is cut through the outside casing sufficiently large o allow the lamps to pass through. The lamp sockets are et in plates secured to the shell of the structure by three crews and thumb nuts. An old lamp can be taken out and new one inserted in a couple of minutes. The sockets are onnected to the lighting wires by flexible cords so that ach lamp can be drawn into the inside of the bottle and enewed when worn, thus avoiding the necessity of the orkman going on the outside of the structure.

The total weight of the revolving structure is about 15 ons, and when running the movement is so smooth and ree that there is no vibration felt on the floors below. The rown is 20 ft. in diameter, 10 ft. 2 in. to top of arches and ft. 6 in. to top of maltese cross. The maltese cross is ft. high and 3 ft. wide. The lower band of the crown is 5 ft. in diameter and 2 ft. 4 in. deep. There are sixteen usters of five 8-cp lamps in the center of this band, each uster of a color to represent a jewel, such as a ruby, nerald, etc. Rising from this band there are eight imerial arches 25 in. wide at the base, narrowing to 17½ in. the top. These arches are made in a rounded trough ape and each contains eighteen 8-cp lamps.

Between the eight arches there are eight fleurs-de-lis, 3 ft. across and 3 ft. high, each leaf being 14 in. wide. In the center there is a cluster of three lights. The maltese cross has twelve 8-cp lamps on each side, with one central cluster of five lights. Various colored lamps are used to get the effect of the various jewels.

The crown is built of copper on a structural iron framework and the whole is covered with goldleaf. The total number of lamps in the crown is 282.

This bottle and crown with its method of illumination were designed by Mr. Samuel T. Williams, of Williams & Shock, Baltimore. The structural ironwork was erected by the Lauer & Harper Company, the sheet-metal work by Vaile & Young and the electric lighting by the Kingsbury-Samuel Electric Company.

THE LIGHTING OF RAILROAD STATIONS.

The present practice in the illumination of railroad stations, approaches, offices, dining-rooms, etc., was discussed in a report of the committee on illumination presented before the Association of Railway Electrical Engineers at the Hotel La Salle, Chicago, Nov. 9. Mr. C. R. Gilman, chief electrician of the Chicago, Milwaukee & St. Paul Railroad, headed the committee, the other members of which were Messrs J. R. Cravath, W. D'A. Ryan, S. W. Everett, C. W. Bender, Richard Hamilton, T. R. Wentworth and B. F. Fisher.

The lighting of station properties, it was pointed out, must be planned with a view to the maximum efficiency consistent with minimum cost of installation and maintenance. In cases, however, it is wise to make a sacrifice in efficiency to provide a system of lighting that will conform to the general architecture of the room. Waiting-rooms and dining-rooms are examples where the esthetic considerations should be given weight in the design.

The spacing and height should be chosen with a view to providing a uniform illumination over the useful working plane and should avoid the placing of units of high intrinsic brilliancy in the direct line of vision, resulting in a disagreeable glare. Local lighting should be provided for by low-candle-power lamps properly equipped with a suitable reflector to screen the light from the observer's eyes and direct it in the most useful direction.

Station Approaches.—A low general illumination is required along the approach to a station to facilitate the ready access and exit from the station by pedestrians and vehicles. A low-candle-power unit inclosed in a diffusing sphere is preferable for this class of lighting, rather than a high-candle-power unit, with its tendency to dazzle the approaching patrons. Ornamental iron or concrete standards will add to the attractiveness of the system in most installations.

Waiting-Room.—A general illumination of sufficient intensity to permit of convenience in reading is required in the waiting-room. The choice of sizes and type of unit will, of course, depend on the interior construction and size of the room, large units being favorable for high intensities, high ceilings and large rooms, and small units favoring the reverse conditions. The incandescent lamp is most generally used because it lends itself well to artistic layouts. The question of chandeliers versus individual units must be solved by compromising between light distribution and architectural appearance.

In general it may be said that the fewer the number of light centers the more pleasing the artistic effect. On the other hand, as pointed out above, too few light centers may produce objectionable lack of uniformity as well as appreciable shadows. The properly designed installation will strike a balance between these considerations.

The larger the number of smaller units, the report continued, the nearer we approach to uniform illumination and absence of shadows, but as we go to the smaller units the

maintenance cost increases, so we must further compromise between uniformity of illumination and cost of maintenance.

Baggage-Room.—A medium general illumination, augmented by local lighting over the attendant's desk and receiving window, will generally suffice for this class of lighting. High-efficiency incandescent lamps equipped with suitable reflectors suspended close to the ceiling are well adapted for the general lighting, while low-candle-power carbon lamps and opaque reflectors will provide the required local lighting. Where storage bins, used for checking parcels, are required to be lighted a low-candle-power carbon lamp, equipped with a reflector to concentrate the rays on the bins and suspended on a drop cord, will in most cases meet the requirements.

Offices.—Because of the exacting nature of office work, a strong general illumination with as large units as is consistent with good distribution is productive of good results. The lamps should be suspended near the ceiling and provided with reflectors to avoid glare and secure even distribution of light. This system of providing a good general illumination makes the lighting independent of furniture arrangement and discourages the use of the local light with its unsightly appearance, glare and cost of maintenance. Local lighting is also to be discouraged because it invites rearrangement, such as changes in mounting, height and type of reflector or lamp, by the desk users, who are rarely qualified to make such rearrangement. A slightly lower intensity will suffice in a private office where little clerical work is done.

General indirect lighting is also finding favor for office illumination, its strong point being absence of glare and annoying shadows.

Yards.—It is needless to emphasize the necessity of providing a good reliable system of illumination in the classification yards. Here cost of installation and maintenance should be subordinate to reliability of service and proper intensity and distribution. The character of the work requires that the space between the cars, tracks and switches be properly lighted regardless of how dark the night or bad the weather. Safety to workmen and the economical handling of the cars are essential to keep in mind.

The properties of a lamp chosen for this class of work should be good distribution, reliable action and a color of light suitable for penetrating smoke, fog, etc. The flame lamp, with its penetrating yellow flame and high efficiency, lends itself admirably to this class of work. The development of the long-life electrodes has added an impetus to the adoption of this type of lamp. Large-type tungsten-filament lamps are now developed that, used under suitable reflectors, are also useful for this class of work. The unit should be suspended high in order to avoid decreasing the ability of the eye to see and to eliminate shadows between cars. Units should be spaced to provide an even illumination of sufficient intensity to make the lettering on the car legible at the required distance. The lighting requirements in the terminal yard are possibly slightly less severe, but can be handled in about the same manner.

Shops.—The lighting of shops is a very broad question, involving as it does many classes of work and types of buildings. Each shop is a problem in itself which can be successfully solved only by a study of local conditions and requirements which determine the type of lamp, its height and equipment. The usual practice is to provide a good general illumination and augment this with local lighting at the tool when necessary.

An essential feature of a well-lighted shop, when only general lighting is employed, is uniformity of intensity, a low but sufficiently uniform intensity being preferable to a high intensity characterized by brightly lighted spots which make the less brightly lighted spots appear dark by contrast. Uniformity is favored by a large number of small units, while low maintenance, low initial cost of lamps, wiring, etc., are obtained by a fewer number of larger units. The type of unit, then, and its spacing must be chosen after due consideration of the conditions, preference being given to as large a unit as possible consistent with a reasonably even distribution of light.

Care should be exercised in the placing of the lighting to avoid excessive glare. This is effected in the choice of unit, type of reflector and height of suspension. Obviously the best solution is to use low-candle-power lamps for bays with low ceilings and *vice versa.* Local lighting at machine tools is best obtained by a low-candle-power lamp equipped with a metallic reflector to concentrate the light on the work and to shade the eyes of the workman from the bare filament. This reflector should be mounted in such a way that the light rays do not strike the workman's eyes.

Dining-Room.—Here the artistic considerations predominate, efficiency being a secondary consideration. A good general illumination of a pleasing color should be provided, floor outlets being installed to afford ready connections for candelabra and other table decorative schemes.

Lunch-Rooms, Counters, Etc.—A less artistic scheme of lighting answers in lunch-rooms. Good general illumination, favoring the counters slightly, will in most cases meet the requirements.

The following tables give some idea of the present-day practice in illumination intensities recommended for the various departments of a railroad station:

APPROXIMATE EFFICIENCY FACTORS WITH NEW LAMPS AND CLEAN GLASSWARE.

Equipment	Color of Walls.	Color of Ceiling.	Dimensions (ft.)	Ceiling Height (ft.)	Per Cent Efficiency.
Prismatic or opal reflectors at ceiling	Light	Light	40x40 or more	10 to 16	55 to 65
Prismatic or opal reflectors at ceiling	Dark	Light	40x40 or more	10 to 16	50 to 60
Prismatic or opal reflectors at ceiling center	Light	Light	15x15	8.5 to 10	50 to 60
Prismatic or opal reflectors at ceiling center	Dark	Light	15x15	8.5 to 10	45 to 55
Prismatic or opal reflectors at ceiling center	Dark	Dark	15x15	8.5 to 10	30 to 40
Bare lamps at ceiling center	Dark	Light	15x15	8.5 to 10	30 to 40
Bare lamps at ceiling center	Light	Light	15x15	8.5 to 10	40 to 50
Bare lamps at ceiling center	Dark	Dark	15x15	8.5 to 10	20 to 30
Indirect cove	Light	Light	30x50	15 to 18	15 to 25
Indirect efficient conical reflectors on central fixtures	Light	Light	40x40 or more	10 to 15	34 to 44
Indirect efficient conical reflectors on central fixtures	Light	Light	15x15	8.5 to 10	32 to 42
Indirect efficient conical reflectors on central fixtures	Dark	Light	15x15	8.5 to 10	22 to 32

AVERAGE INTENSITIES OF ILLUMINATION—RAILROAD STATION LIGHTING.

	Ft. Candles
Station approach	0.25 to 1.0
Waiting-room	2.00 to 3.0
[illegible]	0.50 to 1.5
Offices (general)	3.00 to 5.0
Offices (private)	1.00 to 3.0
Dining-rooms	2.00 to 3.0
Lunch-rooms and counters	1.00 to 3.0

Train Sheds and Platforms.—A general illumination is required of sufficient intensity to afford convenience t

passengers in passing to and from the trains and to enable conductors and trainmen to inspect the tickets, and also to facilitate the handling of baggage.

Because of the prevailing high ceilings of train sheds, the lighting has been confined principally to the larger units such as arc lamps. However, since the development of the high-efficiency incandescent lamp in large sizes we may expect a goodly share of this class of lighting to go to the incandescent lamps. In low-ceiling sheds relatively small units located between tracks give better results from the standpoint of light distribution and consequent avoidance of shadows.

Freight House and Platform.—The requirement for this class of lighting is low general illumination, sufficient to discharge or load and sort the various classes of freight. This may be accomplished best by incandescent lamps, the type of lamp being governed by the height of roof truss. In most cases the high-efficiency incandescent tungsten-filament lamp will be found best adapted, and this should be equipped with suitable reflectors and suspended close to the ceiling. For buildings with high ceilings where the lamps may be hung at a height sufficient to eliminate objectionable glare and also secure proper distribution the flame or luminous-arc lamp may be used to good advantage. Where there are receiving and shipping desks or tables these can be lighted by means of drop lights, consisting of small-candle-power lamps equipped with metal reflectors. These reflectors should be of such shape as to screen the lamp filament from the clerk's eyes.

The lighting of platforms is accomplished to best advantage by means of small-candle-power incandescent lamps. These units should be equipped with metal reflectors and suspended either from wall bracket arms on the side of the shed or else from the roof where the platforms are covered by projecting eaves. The intensity of illumination required for this class of work is about the same as that necessary for the interior lighting of freight houses.

Letters to the Editor.

Soldered Wire Connections.

To the Editor of Electrical World:

Sir:—Your first issue of November contains an article on page 1144 entitled "Method of Soldering Wires in Terminal Lugs," to certain portions of which the writer wishes to take exception. While the method described may prove satisfactory in appearance to all and in stability to some, there will yet remain a few who will agree that in few cases will the method described produce a first-class job.

To secure proper adhesion between wire, solder and lug the temperature of all three must be above the melting point of solder at the instant of contact. If this condition does not exist nothing more than a good friction fit of all three parts will be secured; and if any doubt as to the truth of this exists in the mind of the reader let him apply a steady torsional strain to the wire or lug so secured.

While the use of a soldering pot as described is desirable, unless a method of heating both lug and wire be employed in conjunction, stability is sacrificed to speed and appearance. This is particularly true when the wire to which the terminal is to be soldered happens to be a "stranded conductor," wherein, to secure maximum mechanical strength and electrical conductivity, it is absolutely essential that the solder be maintained at the melting point until it has thoroughly permeated the interstices of the conductor.

It might be suggested that were the wire terminal and lug to be held in the molten solder until they had acquired a temperature equal to that of the solder, the method described would be ideal. To prevent adhesion of solder to the outside of the lug it should first be dipped in a light oil of high flash point, being careful to see that no oil is permitted to reach the inside of the lug. It will be found advisable when holding the bared ends of heavy conductors in the solder pot to wrap the insulation well with a rag previously wrung out in cold water to prevent as far as possible the melting of the insulating compound and the consequent smearing of the terminal. However, any such drip will not impair the joint if properly made, though it will detract from the appearance of the finished job.

Pawtucket, R. I. Frederick P. Kenny.

Registering Maximum Demand.

To the Editor of Electrical World:

Sir:—The editorial in your issue of Nov. 4 entitled "Maximum Demand and Size of Residences" has undoubtedly been widely read with much interest. The oftener the question of maximum demand is discussed, the more surprising it is that no better means has been found for determining this important factor. It is true that floor area gives an approximate measure for the demand, on the same principle that a man's chest measure gives some indication of the size of his collar or shoe, but it can scarcely be said to be customary to order these articles of wearing apparel in this manner.

If such a method is to meet with general acceptance by central stations, it is only reasonable to suppose that the public will have little faith in measuring instruments used by them. No eulogy on the watt-hour meter is necessary. It is a beautiful piece of mechanism, but to yoke it with a floor-area maximum-demand indicator seriously affects, if not entirely destroys, its accuracy, since both factors, maximum demand and consumption, are necessary to obtain a net result. Just what constitutes an "active room" is likely to become as much of a riddle as "What is whiskey?"

If the maximum demand is desirable in order to know the equipment necessary to serve a customer, why should heating appliances be exempt? Certainly all kilowatts of demand look alike so far as investment is concerned; and to adopt such a system as noted in the editorial only makes an arbitrary rate more arbitrary. In some companies a flatiron represents peak load and theoretically should be penalized instead of being favored.

Incidentally, in passing, I would take issue with the statement, "It is interesting to note the progress of a residence rate which a few years ago was comparatively little known, but through its merits secured the indorsement of the National Electric Light Association rate committee above referred to." On page 31 of the committee's paper there is this statement in italics: "The committee is by no means unanimous as to whether a differential for residential business is desirable." Furthermore, there is a grave doubt as to whether "progress" is correctly used as above quoted. If such a maximum demand "meter" as floor area represents progress, then we should retrogress and adopt a meter which really measures and for which eveyone including the general public can have respect.

There is a system for determining maximum demand for power installations, the details of which are mentioned in the National Electric Light Association *Bulletin* for July, paragraphs 22-54, which is almost as logical as the residential system referred to, namely, to take a percentage of the connected load, apparently without respect to the nature of the load. One of the strongest points in favor of electric service is that it is popular in spite of the charging methods in use.

The writer some months ago devised a maximum-demand indicator to place on any watt-hour meter, direct or alternating current, single-phase or polyphase, but when a

search was made of the Washington records Patent No. 722,030 was disclosed, which was granted March 3, 1903, on an application filed by C. H. Merz, of Westminster, England, Sept. 25, 1902.

In the writer's design, which conflicts with the above, it was intended that the device be mounted complete on the registering mechanism. The clock runs for only ten or twenty minutes and hence need not be an elaborate affair. It is rewound by a line-actuated solenoid. This indicator was the result of appreciating thoroughly the necessity for a maximum-demand meter for small installations the price of which would not be prohibitive. This indicator could be manufactured and attached to any meter-dial train at a cost not exceeding $3. I am not seeking litigation and have dropped the matter so far as a patent is concerned, but do not intend abandoning the subject until someone explains why it is that a patent can be issued in this country and smothered for eight years, while during this time central stations either pay a sum running into three figures for kilowatt maximum-demand meters or else adopt methods for measuring energy which no reputable concern should countenance for a moment and which every customer should rightly condemn. It is farcical in the extreme to see instruments of precision relegated to the background or else coupled with an arbitrary standard (!) due to our archaic patent laws, business regulations or what not.

The American owner of Patent No. 722,030 states that these maximum-demand attachments can be expected to be on the market in the next few months, but where have they been for the past eight years?

Pawtucket, R. I. CECIL W. BROWN.

[The patent describes a watt-hour meter attachment actuated or controlled by a clock mechanism, by means of which at definite intervals of time a disk frictionally driven by the meter is brought back to an initial position. A pin on this disk acts on an indicating arm, initially moving the arm through an angular distance proportional to the energy passing through the meter in a fixed period of time; the arm then remains in this position until when the consumption through the meter is greater during the fixed period of time, when it is advanced further by an amount corresponding to the difference. Thus the position at any time of the arm indicates the maximum demand which up to that time has occured, not momentarily, but in a significant period of time.—ED.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Direct-Current Turbo-Generators.—R. J. ROBERTS.—An illustrated paper read before the Manchester Section of the (British) Institution of Electrical Engineers. The author discusses some of the mechanical difficulties experienced with direct-current turbo-generators and suggests methods for removing them. He considers that the mediocre performance of these machines in the past has been due to inadequate comprehension of the mechanical problems. After a brief discussion of the construction of the stator the author deals with methods of ventilation. The quantity of air generally used for cooling purposes is from 80 cu. ft. to 100 cu. ft. per minute per kilowatt loss, and where the commutator is separately cooled the commutator losses are excluded. The power required for fans and air friction is generally a large proportion of the total loss. The power required by the fan varies from 4 kw to 18 kw as the total output increases from 100 kw to 750 kw. An improvement in fan loss might possibly be secured by doing away with radial ventilating ducts in the rotor and merely using axial ducts, as shown in Fig. 1. The adoption of this or a similar scheme would mean a reduction in fan loss of from 1 to 1½ per cent. Further, a still greater reduction might be obtained by discarding inefficient fans on the rotor and using a more efficient separately driven fan. The author then discusses the construction of the shaft, the rotor, the banding or end-turn sheaths, the commutator and the brush gearing. As to probable improvements of construction he thinks that one of the ultimate aims is the decrease in span between bearings. This may lead to reversion to the Eickemeyer or butterfly winding for armature, with the equalizers possibly combined in the end connections. The radial type of commutator is possibly the ultimate general design, but it will be some years before this type is generally adopted, and in the meantime great improvements may be effected by the use of higher brush pressures and higher current densities and peripheral speeds. A suggestion for the mounting of the commutator is shown in Fig. 2. The brush holders are yet very far from perfect, and possibly the present almost universal box-type holder will disappear for some form of the old lever-type holder.—Lond. *Electrician*, Nov. 10.

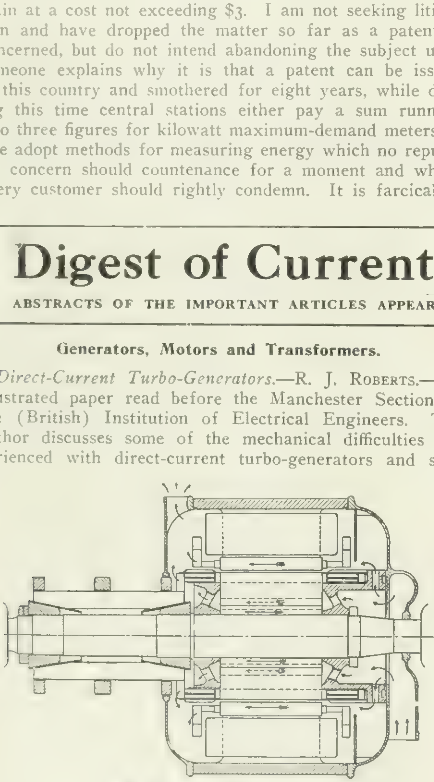


Fig. 1—Direct Turbo-Generator.

Synchronous Machines for Voltage or Current Regulation.—R. MOSER.—The author proposes to discuss the use of synchronous machines for producing a constant voltage or for producing a constant current or for compensating the voltage drop in long lines. The author first takes up the separately excited machine and follows this by a discussion of the synchronous commutator machine and of the constant-voltage machine. The article is to be continued. A complete abstract will be given when the article is finished.—*Elek. Zeit.*, Nov. 9.

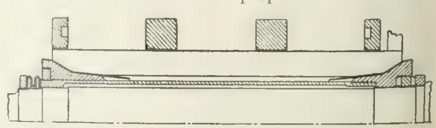


Fig. 2—Mounting of Commutator.

Carbon Brush Connections.—A note on a recent British patent (No. 76, Nov. 2, 1911) of the British Thomson Houston Company (General Electric Company of this country). In a method of connecting flexible conductor to brushes, a hole is drilled in the brush, into which a loop of the conductor is placed and secured by a cement, which in hardening expands and makes good contact with the brush. Any cement which expands on hardening can b

used. A cement known as "smoothon" and consisting of 70 per cent of cast-iron fillings, 25 per cent of plaster of paris and 5 per cent of free carbon gives good results.—Lond. *Elec. Eng'ing*, Nov. 9.

Lamps and Lighting.

Neon Tube.—G. CLAUDE.—The author has shown that the absorption of the luminescent gas which occurs in neon tubes is due to the volatilization or disintegration of the electrodes, and that by reducing the volatilization by using electrodes of very large surface the absorption may be rendered negligible and tubes of long life may be obtained. Further, the gases obtained by treating the particles of volatilized metal with nitric acid contain besides neon quite a proportion of helium. According to the investigations of Ramsay and the author, this curious phenomenon must be due to a selective action of the volatilizing metal on the helium which is contained in the neon, but in too small a quantity to be detected by the spectroscope. It seems an established fact that the transfer of the electric charges in the tube is brought about by the intermediary of the helium which is present.—*Comptes Rendus*, Oct. 16; *Lumiere Elec.*, Nov. 11.

Metallic-Filament Lamps.—R. A. HOUSTOUN.—A continuation of his long serial on studies in light production. The present instalment deals with metallic-filament lamps and gives data on the temperature and radiant efficiency. Mention is made of an investigation by G. Leimbach, from which the following table is taken. The first column gives the name of the lamp, the second its watts per hefner candle, the third the ratio of total energy radiated to total energy supplied in per cent, the fourth the "radiant efficiency," and the fifth the "luminous efficiency."

	Watts per Candle	Percentage Radiated.	Percentage Radiant Efficiency.	Percentage Luminous Efficiency.
[illegible] lamp	3.8	[illegible]	2.85	[illegible]
[illegible]	2.0	[illegible]	4.43	[illegible]
[illegible]	2.0	[illegible]	4.26	[illegible]
[illegible]	[illegible]	[illegible]	4.63	[illegible]
[illegible] metal filament	[illegible]	80.5	4.41	[illegible]
[illegible]	[illegible]	68.5	5.03	[illegible]
[illegible]	[illegible]	72.2	4.44	[illegible]
[illegible]nus colloid lamp....	[illegible]	[illegible]	5.42	[illegible]

The total energy radiated was ascertained by taking readings with a bolometer in different directions. The light was separated from the dark heat by means of a ferrous ammonium sulphate filter. The third column is especially valuable. It constitutes the only reliable data available on the convection and conduction loss of incandescent lamps.—Lond. *Electrician*, Nov. 10.

Theater Lighting.—An illustrated description of the electric equipment of the new London opera house of Oscar Hammerstein. The supply of energy is obtained from two companies both on the direct-current system, the pressure being 200 volts for motor service and 100 for lighting. Twelve circuits control the stage arc lamps, thirty-two the stage lighting through dimmers, twenty the auditorium through dimmers, and fourteen the stage generally. The stage is lighted from above by means of eight battens each containing 200 lamps, while at the stage border are another 250 lamps. There are seventy-five lamps at each side of the proscenium opening, and there are also twelve hanging lengths of twenty-four lamps at the sides of the stage. Metallic-filament lamps have been used throughout and are in four different colors. In addition to this there are eight large projector lanterns to give several effects, such as sunrise, sunset, rainbow, storm, waterfall, etc. There are six bunch lamps, each containing twenty-four lamps and thirteen stage plugs. The candle-power of the metallic-filament lamps varies from 16 cp to 25 cp, 32 cp being the most general size. The stage lighting requires about 2300 lamps and the house 3000. This represents a load of about 200 kw, exclusive of the arc lamps and stage gear.—Lond. *Electrician*, Nov. 10.

Generation, Transmission and Distribution.

Induction Motors for Driving Winding Engines.—H. J. S. HEATHER.—An article illustrated by diagrams in which the author discusses the safety of induction motors for driving winding engines, and shows that the automatic cutting off of the supply can rarely do any good and may do considerable harm. The author thinks that on induction motors for winding engines no-voltage releases, if used at all, should be set very low; that overload releases, if used, should be regarded only as a means of preventing further damage to a broken-down machine, and should therefore be set at a current higher than any that the motor can possibly take under any conditions of speed and rotor resistance so long as the insulation holds; and that a runaway governor, if used, should apply only the mechanical brakes and should certainly not cut off the electrical supply.—Lond. *Electrician*, Nov. 10.

Generation, Transmission and Distribution.

Electricity in Mining.—An illustrated article describing the electrical equipment of the Rhymney Valley collieries of the Powell Duffryn Steam Coal Company, which include generating plant driven by coke-oven gas and exhaust steam, as well as two of the largest electric winding plants in the world at a colliery which is entirely without boilers. From an electrical viewpoint the Britannia colliery is the most interesting of this group. For winding the Ilgner system is employed. The flywheel is attached to a motor-generator consisting of an induction motor of the slip-ring type driving a pair of continuous-current generators, which supply current to the two large slow-speed motors directly coupled to the winding drum. The speed and direction of motion by the winding motors is controlled, as in the Ward Leonard system, entirely by varying the field magnetism of the generators, the armature circuits never being broken. Each winding drum is coupled to two motors, one at each end, and each is rated at a maximum of 2160 hp and a normal output of 1300 hp. They run at a maximum speed of 62.8 r.p.m., and the emf at the armature terminals varies from 0 volt to 600 volts. They are separately excited from a 200-volt circuit receiving energy from separate motor-generators. They are sixteen-pole machines with interpoles as well as distributed compensatory windings to perfect the commutation. The two flywheel sets, one for each winding plant, consist each of an induction motor, two direct-current generators and a 33-ton solid-steel flywheel running at a maximum speed of 500 r.p.m. and capable of storing 30,000 ft.-tons. The two sets are placed in line and can be coupled together, so that when the two plants are winding coal each will assist in dealing with the peaks of the other. Further couplings are provided between each motor-generator and its flywheel, so that the set can be run in any one of the following ways: Either motor-generator alone with one or both flywheels or without a flywheel, both motor-generators entirely without flywheels, or the whole coupled up together.—Lond. *Elec. Eng'ing*, Nov. 2.

British Energy Supply Statistics.—Statistical tables giving information on 119 British energy supply stations in fifteen different columns, concerning equipment, rates and uses of energy.—Supplement to Lond. *Electrician*, Nov. 3.

Chicago Generating Plant.—An illustrated description of the new generating station of the Commonwealth Edison Company in Chicago.—Lond. *Elec. Review*, Nov. 10.

Installations, Systems and Appliances.

Time-Limit Cut-Out.—D. H. OGLEY.—The author has made experiments with a cut-out fitted with a time-limit device in which a small piston, attached to the plunger of the cut-out, moves in a cylinder containing about 1/8 in. of pure glycerine. The plunger is prevented from rising immediately the current reaches the value indicated on the particular setting, by reason of the viscosity of the glyce-

rine. The time taken to release the piston, therefore, depends upon the thickness of the glycerine and hence upon the temperature. The author tested the device at different temperatures and his results are given in several diagrams. The chief conclusion which may be drawn from them is that it is useless to attempt to calibrate a cut-out fitted with such a time-limit device, except at the temperaure at which it will have to operate.—Lond. *Elec. Review*, Nov. 10.

Charging for Electrical Energy.—GLÄSSNER.—Several fair rates have recently been proposed, but their introduction would involve considerable expense for such stations as use now a straight meter rate with simple meters. The author proposes a rate in which the same meters are to be used as heretofore but in connection with limiting devices which limit the load. This can be done without great expense and may offer some advantages.—*Elek. Zeit.*, Nov. 9.

Electric Heating.—An illustrated description of various arangements in which 16-cp or 32-cp carbon lamps are used for heating and cooking purposes.—*Elek. Zeit.*, Nov. 9.

Electrophysics and Magnetism.

Afterglow of Electric Discharge.—R. J. STRUTT.—A paper read before the (British) Physical Society on further observations on the afterglow of the electric discharge and kindred phenomena. It is shown that ozone prepared by means of the Siemens ozone tube used at atmospheric pressure is able, when mixed with nitric oxide, to give the greenish-yellow afterglow flame. This result is attained only when the ozone has been concentrated by fractional distillation. A blue glow is obtained under the same conditions with sulphuretted hydrogen and ozone. The effect of sulphur compounds in improving the air glow noticed by the older experimenters is shown to be due not to any direct intervention of these bodies in the reaction, but to their power of destroying organic matter prejudicial to ozone. When once this is got rid of the sulphur compounds are of no further advantage. It is found that pure oxygen does not give an afterglow. The afterglow seen in electrodeless bulbs containing oxygen is due to some interaction with water vapor. The luminosity given out when ordinary spring water is shaken with ozone is shown to be due to oxidation of peaty matter contained in it. Brown peat water gives greatly enhanced luminosity—Lond. *Electrician*, Nov. 10.

Homogeneous Fluorescent Röntgen Radiation.—C. G. BARKLA AND NICOL.—An abstract of a paper read before the (British) Physical Society. It was formerly shown by one of the authors that the fluorescent Röntgen radiations emitted by elements exposed to primary Röntgen radiation can be arranged in series, one radiation in a particular series being emitted by each element and the radiation belonging to that series becoming more penetrating with an increase in the atomic weight of the radiating element. The homogeneity of radiations of only one series (the K series) was shown by Barkla and Sadler. The present paper describes experiments showing the homogeneity of fluorescent Röntgen radiation in the second series (the L series) and exhibiting the homogeneity of radiations of the two series from a number of elements. Details are given of the observations on the radiations from barium. Similar results are recorded in the case of the radiations from iodine, antimony and silver. The homogeneous fluorescent radiations of different series are emitted simultaneously by an element exposed to Röntgen radiation of a more penetrating type than either.—Lond. *Electrician*, Nov. 10.

Electrochemistry and Batteries.

Energy Consumption in Electric Steel-Refining Furnaces.—CARL HERING.—In electric steel-refining furnaces the metal is to be kept at a constant temperature during the process of refining. On the basis of certain assumptions which are given in detail the author calculates what would be the maximum economy of energy which could be obtained in such a furnace. A furnace of hemispherical shape is assumed to get as small a surface as possible. The basis of the calculation is a figure for the constant loss per square foot of metal surface taken from tests of the Hiorth induction furnace, namely, 1.2 kw per square foot. This figure also agrees well with results obtained with another

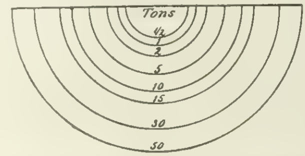


Fig. 3—Increase of Size of Furnace with Increase of Capacity.

furnace. On this basis the author calculates the following table. It gives the kilowatts which will be required on the above basis to keep steel at the refining temperature, the bottom of the hearth being hemispherical and the metal just filling the hemispherical part. Hence it gives the least number of kilowatts, or kilowatts per ton, of charge re-

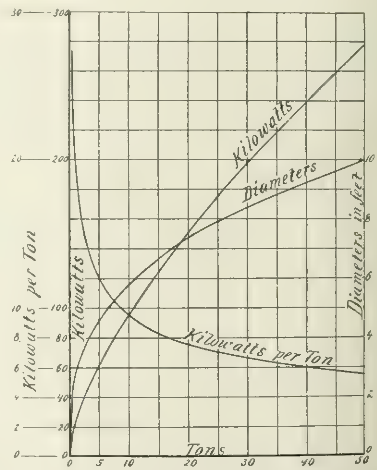


Fig. 4—Minimum Kilowatts per Ton as Function of Size of Furnace (Condition at Least Loss).

quired under the best practical conditions for obtaining the least loss. Fig. 3 shows the increase of size of furnace with increase of charge rating, and Fig. 4 the minimum kilowatts per ton as a function of size of furnace (condition of least loss).

CAPACITY.				
Gross Tons per Charge.	Cubic Feet.	Diameter in Feet.	Kilowatts.	Kilowatts per Ton.
½	2.57	2.14	13	26.0
1	5.13	2.70	20	20.0
2	10.3	3.40	32	16.0
[illegible]	25.7	4.61	60	12.0
10	51.3	5.80	95	9.5
[illegible]	77.0	6.65	124	8.0
[illegible]	154	8.38	200	6.6
[illegible]	257	9.93	278	5.5

The author believes that even these low figures can be improved upon.—*Met. and Chem. Eng'ing*, November.

Electrometallurgy.—A note on three electric-furnace papers recently presented before the Faraday Society. Harden described the Paragon combined arc and resistanc

furnace. D. F. Campbell discussed progress in the electro-metallurgy of iron and steel. E. K. Scott described the Hering pinch-effect furnace.—Lond. *Elec. Eng'ing*, Nov. 9.

Units, Measurements and Instruments.

Systems of Units.—K. Schreber.—The author first formulates sharply the definitions of weight, force, mass and material and emphasizes that weight is a special form of force and that mass and material are two very different conceptions. He discusses the question whether the unit of mass or the weight of force should be used, besides the units of space and time, as the foundation of a rational system of units. As to suitability and ease of use either would be good enough, but since the mass appears only in a part of the mechanics, while the force is used not only in the whole of mechanics, but in almost all other fields of physics and engineering, he concludes that the only justified system of units should be based on the unit of force.—*Elek. Zeit.*, Nov. 9.

Emf of Weston Cell.—P. Janet, F. Laporte and R. Jouaust.—As the result of various corrections the value of the emf at 20 deg. C. of the standard Weston cell, on the basis of the definitions of the true ampere and the international ohm, is 1.01836 volts, instead of 1.01869 volts, which was the former value.—*Comptes Rendus*, Oct. 16; *La Lumière Elec.*, Nov. 11.

Testing Iron Sheets.—Van Lonkhuyzen.—The author modifies a measuring method of Maxwell in such a way that it may be used for the commercial testing of sheet iron according to the standardization rules of the German Association of Electrical Engineers. It is a ballistic differential method, which when compared with other ballistic methods has several advantages because the ballistic galvanometer is replaced by a needle galvanometer (used as zero instrument) and because the accuracy of the method is high on account of the compensation of the sources of error and the method is very convenient to execute. Two sets of apparatus for using the method are described.—*Elek. Zeit.*, Nov. 9.

Hot-Wire Ammeter.—R. Hartmann-Kempf.—An illustrated description of a hot-wire ammeter without shunt for wireless telegraphy.—*Elek. Zeit.*, Nov. 9.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—The first part of a detailed and profusely illustrated description of the singing quenched-spark system of the Telefunken company. When two oscillating circuits are coupled together the energy sways backward and forward from one to the other, and each circuit emits waves of two frequencies, and this leads to serious inefficiency in practice with the usual spark, because only one of the two frequencies can be utilized. M. Wien has shown that if the oscillations in the primary circuit are stopped as soon as the secondary circuit is oscillating the latter will continue to oscillate at its natural period, and will therefore emit waves of only one frequency. A much higher efficiency is, therefore, to be expected with the "quenched spark" than with the ordinary spark. What takes place is shown graphically in Fig. 5. It will be seen that the spark is quenched as soon as the energy in the primary circuit is a minimum and that in the secondary a maximum. Thus, after quenching, the primary no longer oscillates, and the secondary oscillates with its natural period; so that, under suitable conditions, a feebly damped train is obtained, as indicated. The conditions for quenching are easily obtained. With ordinary circular electrodes placed close together, or even with quite thin plates placed edge to edge so as to form a small gap, quenched sparks are obtained and will continue so long as the heat is conveyed away rapidly enough. As soon, however, as the electrodes become hot the spark becomes an arc and quenching no longer occurs. Also, a single wave is not obtained unless the spark gap is quite small. A section of the spark discharger as now used by the Telefunken Company is shown in Fig. 6. It consists of circular plates of copper, each faced with a plate of silver, which is ground true except that it is slightly recessed at the center. There is a groove some distance from the center and the metal plates are separated by mica rings to a distance of

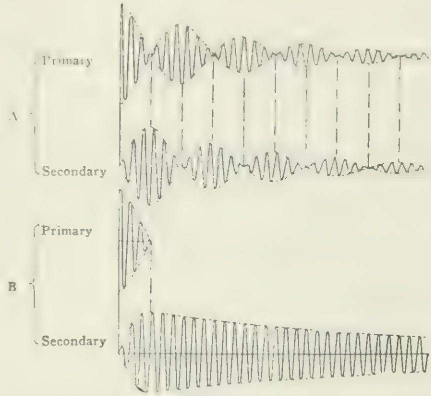
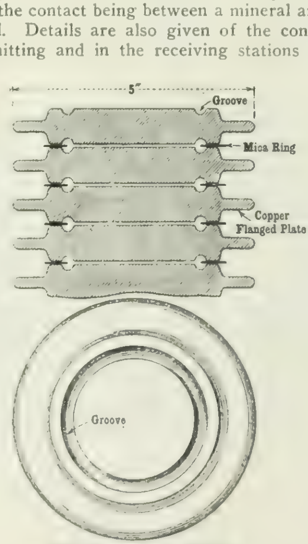


Fig. 5—Diagram of Oscillations in Coupled Circuits. A—Ordinary Spark. B—Quenched Spark.

0.2 mm. The spark forms at any point of the flat surface; it is then forced toward the periphery in a radial direction by the electromagnetic field, and is eventually extinguished on its path. A number of these spark-gaps are held in series. The pressure per gap is 1200 volts. Since the waves to be received are intermittent but rapid, so-called integrating or contact detectors are chiefly employed for receiving, the contact being between a mineral and graphite or a metal. Details are also given of the connections in the transmitting and in the receiving stations and of the



Plan of Copper Flanged Plate

Fig. 6—Section and Plan of Spark Discharger.

arrangement of the detector and of the receiving set. The article is to be continued.—Lond. *Electrician*, Nov. 10.

Wheatstone-Bridge Connection in Telephony.—L. Sabatier.—The author has formerly discussed the connection of the microphone in shunt with the source of current instead of in series with the line and has pointed out its

[illegible] He now discusses in some detail the arrangement due to Belin in which the Wheatstone bridge connections are employed. He discusses the effect of this arrangement on the efficiency of the transmission and determines the best values of the resistances of the different branches of the bridge. The results of his analysis are given in the [illegible] diagrams.—*La Lumière Élec.*, Nov. 11.

Miscellaneous.

French Association for the Advancement of Science.—A report of the proceedings of the Dijon Congress of the French Association for the Advancement of Science. Turpain presented papers on a recording microammeter and on a thunderstorm recorder. Dauvé discussed the possibility of using the capillary electrometer in chemical analysis. Jégou dealt with several problems of wireless telegraphy, especially the prevention of interference. Blondel discussed two new methods based essentially on the use of the oscillograph for the study of acoustic phenomena. In another paper Blondel discussed the determination of the direction from which a wireless message is received by means of two receiving antennas. Broca discussed a method of measuring electrolytic resistances. Matignon dealt with recent progress in the aluminum industry. Razous discussed means for preventing the spontaneous combustion of stored coal.—*La Revue Elec.*, Oct. 27.

Mascart.—The Mascart monument at the Laboratoire central et l'École supérieure d'Électricité was recently dedicated in the presence of members of the Mascart family and representatives of the French government. The International Society of Electricians in Paris was represented by Lippmann, and the committee of subscribers by General Sebert, who made the dedication speech. This speech is given in full.—*La Revue Elec.*, Oct. 27.

Pratt Institute.—L. FABRE.—An illustrated article on the electrical engineering course in the Pratt Institute in Brooklyn.— *La Lumière Elec.*, Oct. 28.

British Institution of Electrical Engineers.—A summary of the new proposed constitution of the British Institution of Electrical Engineers and an account of the discussion of it at a recent meeting. The proposed changes, which have met with some opposition, are also the subject of a long editorial.—Lond. *Electrician*, Nov. 10.

BOOK REVIEWS.

ADDRESSES TO ENGINEERING STUDENTS. Edited by Waddell & Harrington, consulting engineers. Kansas City, Mo.: Waddell & Harrington. 493 pages. Price, 75 cents.

The book entitled "Addresses to Engineering Students" is of octavo size, with neat dark-green cloth binding, containing 493 pages. The aim of the editors has been to place before students in engineering colleges in particular a treatment of questions of vital importance to the engineering profession. The work is the compilation of the papers and addresses of many of the most prominent engineers and educators in the country, and the reader, therefore, is treated to a condensed consensus of opinion on these matters which would be very difficult for him to secure in any other way.

The preface shows that the book is intended both for a reference book and a text for colleges of engineering, and the papers are so arranged for the latter use as to attract the interest of freshmen and sophomores and to supply them with food for thought and reflection as they become better educated and more mature. The table of contents gives the titles and authors of forty-four papers, including thirty-two different engineers and educators.

The first seven papers deal with subjects concerning the young engineer especially, as follows: "The Profession of Engineer;" "Advice to Freshmen;" "Two Kinds of Education for Engineers;" "The Durable Satisfactions of Life;" "Engineering Education;" "The Value of English to the Technical Man;" "The Necessity for Individual Engineering Libraries and for Continuing Study After Graduation."

The paper entitled "The Educational Value of the Technical Press, with Special Reference to Engineering News," points out facts about the technical press which students ought to know. They usually have but little time in college to read the technical journals, and advice as to how and what to read is profitable to them. "The Twentieth-Century Engineer" is a paper of historical interest, and also outlines the place and importance of engineering to-day. "Business Training for the Engineer" is a subject of vital importance to the practising engineer, and greater emphasis even than the author places upon the teaching of English the law of contract and the business side of engineering would have enhanced the value of the paper. "Some Relations of the Engineer to Society," "Engineering and Life," "The Present Status of the Engineering Profession and How It May Be Improved," "The Engineer's Duty as a Citizen," "The Next Step," "The Engineer as a Professional Man" and "Success" are papers whose value can scarcely be overestimated in considering and emphasizing the ethics of the engineering profession.

"Study Men" is a paper which gives advice "the soundest of the sound," as stated in the editors' prefatory note concerning it, and while it is an address to engineering students, older practitioners can well afford, to their profit to heed what is said. Papers dealing with graduate study and higher education for engineers, and the final paper in the book, giving an outline of "The Human Side of the Engineering Profession," furnish much of interest and value to the mature engineer.

The value to the engineer of the use of good English is made prominent throughout the book, not only by emphatic statements in various paragraphs concerning it, but by the general character of the book itself. The prefatory notes by the editors are valuable in giving the reader a brief outline of the work and position of the author of the paper immediately following.

Though one might hope to find within the pages a paper by some municipal engineer on a subject dealing with engineering and political science, little can be said in adverse criticism of the book as a whole as one quite fulfilling the intention of the editors. The index to the book covers twelve pages and is unusually complete, with 2085 references. The book is clearly and accurately printed on substantial paper; it is strongly bound, and the title is prominent on the back in gold letters on the dark-green covering.

WALKER'S LOOSE-LEAF POCKETBOOK FOR ENGINEERS. By Norman R. Corke. London: John Walker & Company, Brooklyn, N. Y.: The Cooke & Cobb Company.

This engineer's pocketbook, made up on the loose-leaf principle, is stated to be the outcome of experiments with various forms of loose-leaf and other notebooks which have been put to the test of actual use for a period extending over several years. A style of book was adopted having advantages as to mechanical construction, size and adaptability, and in order to enhance the value of the pocketbook it was decided to include a certain number of printed pages containing tables, formulas, etc. The tables in the book are those most generally useful to engineers and they have been compressed into the smallest possible space. To add to the convenience of the book a section consisting of special paper is included. This paper is divided into centimeter, half centimeter and millimeter squares, distinguished from one another by a suitable variation in the thickness of the lines, and is printed with orange-tinted ink on one side only of a special thin paper, so that curves etc., drawn on it with India ink may be reproduced by blueprinting in the usual manner. There are also plain blank pages which may be used for making blueprint copies of any diagrams or matter of which more than one cop

may be desired. These pages of section, blank and ruled paper are provided with metallic eyelets, so that they can be readily removed from the book at any time and placed in a permanent holder. The great advantage of the loose-leaf system is that it is only necessary for the user to carry about such pages as he actually requires for the time being, the other pages being filed away in special filing cases provided by the publishers, so that they may be referred to at any time or again used in the pocketbook. The book has been prepared in five editions, English, American, Canadian, French and German. Refills of the printed matter, the specially ruled or blank pages are supplied on application of those wishing them by the English or American publishers.

New Apparatus and Appliances

ELECTRIC PROJECTOR APPARATUS FOR LANTERN SLIDES AND NON-TRANSPARENCIES.

For exhibiting before small audiences projections of post-cards, photographs and other pictures on opaque materials, a type of reflector apparatus has become quite popular in which the picture is itself highly illuminated and has its reflected image thrown enlarged on a white screen. Heretofore the results obtained with such devices have been disappointing, however, on account of the dimness or low intensity obtainable at the image making the picture indistinct. This drawback has been corrected in an improved arc-lamp projector brought out by the Victor Animatograph Company, of Davenport, Ia., in which the superior brilliancy of a small electric arc is substituted for the usual incandescent unit. A small hand-fed arc is used, the slender carbon pencils being adjusted from the front of the lantern. The pictures shown may range from 2½ ft. in height at a distance of 5 ft. from the lantern to 15 ft. high at 30 ft. distance. The arc is arranged for operation with both direct and alternating current, and the rheostat connected in series with the device prevents short-circuiting when the carbons are pressed together to pick up the arc. Photographs, post-cards, newspaper clippings, etc., can be projected with this apparatus.

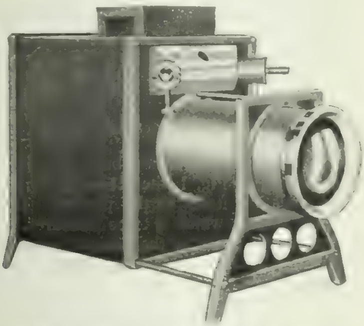


Fig. 1—Electric-Arc Post-Card Projector.

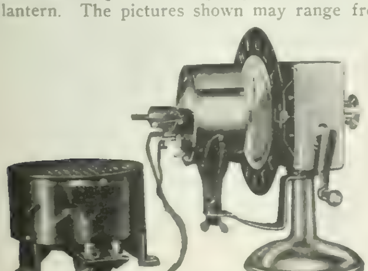
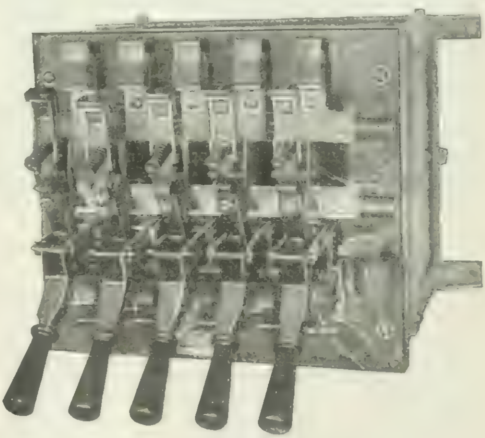


Fig. 2—Electric-Arc Stereopticon.

The same manufacturer has also developed an improved form of electric-arc stereopticon, illustrated herewith, in which the successive transparent slides, themselves measuring 21-32 in. by ¾ in., are brought opposite the projecting lens by rotating the disk shown. The separate pictures are thus bound together in groups of fifteen, and such a record can be changed in two seconds. The complete equipment is much smaller and lighter than the ordinary stereopticon, weighing complete with 210 slides only 12½ lb.

MULTIPLE-SWITCH STARTING RHEOSTATS.

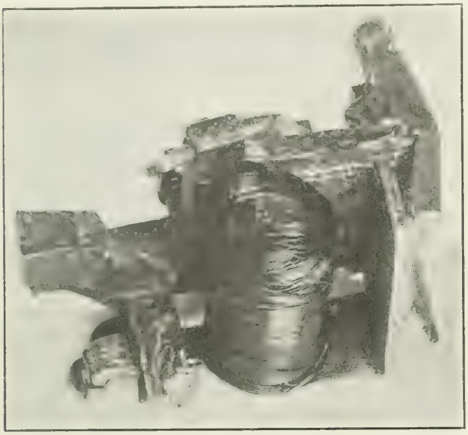
The accompanying illustration shows a new multiple-switch starter of which a line is being placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee, for use in cutting out the individual steps of resistance in accelerating large motors. The new switches used on these starters differ from former types in that a toggle-joint operation permits of closing by pushing the handle downward instead of up. The contact made is quick and absolute. In starting, the left-hand switch is closed first, then the second, third, etc., allowing a second or two between. Each switch, by means of metal stops near the handles, holds in place the switch before it. When the last switch is closed the no-voltage release magnet holds them all in contact and the entire resistance is short-circuited. The switches cannot be closed out of order, and two or three switches, for instance, cannot be closed and the others left open. Releasing the hand from any handle except the last causes all switches to open. The motor cannot run with resistance in the circuit, and the resistance is, therefore, also protected from overheating. Overload release is included in the various types made.



Multiple-Switch Motor Starter.

BEHAVIOR OF ENAMELED WIRE UNDER SEVERE FIRE TEST.

The accompanying illustration shows a relay coil of black enameled wire which successfully withstood a fire hot enough to melt its brass frame. While the outer covering of the coil and its fiber heads were completely destroyed



Enameled Wire Coil After Fire.

and the insulating paper between the wire and core was carbonized, a test of the coil's resistance showed this to be exactly the same, 46 ohms, after as before the fire. The insulation resistance of the coil measured to its core (the separating paper being wholly carbonized) measured 10,000 megohms. The breakdown voltage of the outer layer of wire, which came directly into contact with the flames, proved to be 170 volts, an average of 94 volts per 0.0001 in. of enamel thickness, and thus exceeding the original specification of 75 volts per 0.0001 in. While the outer two layers lost somewhat in adherence and elasticity, their insulation resistance remains unchanged, and the effect of the fire is not detectable on the inner layers.

The coil shown was used in a piece of automatic telephone apparatus which was subjected to a bad fire. The manufacturer, the Automatic Electric Company, Chicago, has been a large user of this improved enameled wire in its own business for more than five years, and through its supply sales department now offers this wire under the name of "Raven enameled wire" on the open market.

BRISTOL'S FRICTIONLESS INK-TYPE RECORDING INSTRUMENT.

To meet the demand for a frictionless ink-type recording instrument to parallel the Bristol smoked-chart recorder as nearly as possible in fundamental simplicity, and to record accurately fractions of millivolts and be adapted for use as a recording electric pyrometer, the instrument illustrated herewith has been developed and placed upon the market by the Bristol Company, of Waterbury, Conn. These instruments have been tested out in practical service for two years past, and are the result of several years of study and experience with a design of a frictionless ink recorder patented in 1909, which uses a hinged electrical movement carrying a retaining receptacle for marking fluid extending over the path of the recording tip and provided with means for periodically making contact with the source of marking fluid and the chart.

Fig. 1 is an interior view, showing the galvanometer movement case hinged to the back of the instrument and carrying the inking pad in front of the recording arm. Fig. 2 shows the sensitive electrical movement swung to one side for convenience in removing the record and inserting a fresh chart. A capillary gold tube open at both ends is carried at the end of the recording arm at right angles to the surface of the chart. The inking pad is suspended from the case of the electrical movement and is curved to correspond with the arc covered by the motion of the end of the recording arm.

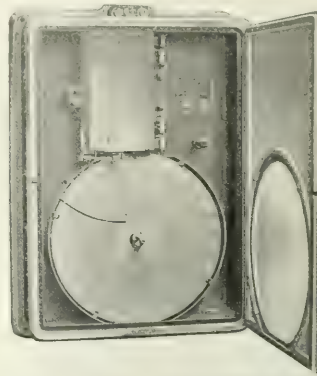


Fig. 1—Interior View of Galvanometer.

When the movement is swung back into its operatin position, as shown in Fig. 1, the recording arm can swin free, accommodating itself to the position correspondin to the delicate current which is to be measured. The cloc which revolves the chart at the desired speed also auto matically presses the inking pad toward the chart every te seconds, bringing one end of the capillary tube into cor tact with the chart and the other end simultaneously int contact with the inking pad. A fine dot of ink is left on th chart and the capillary tube is replenished with ink fro the pad. The recording arm thus carries a constant suppl

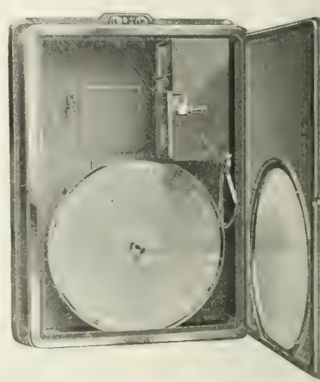


Fig. 2—Electrical Movement Swung to One Side Before Removi the Recorder.

of ink, and its perfect balance, which is very important, always maintained. The electrical movements used in th recorders are made especially for the purpose by the West Electrical Instrument Company.

Although the most important applications of these reco ing instruments have been for pyrometers, they have a been used for electrolytic research, recording voltmet and recording shunt ammeters.

AUTOMATIC CONTROLLERS FOR MOTOR-DRIVEN MACHINERY.

The Electric Controller & Manufacturing Company, of Cleveland, Ohio, has recently placed on the market a line of automatic controllers designed for the specific purpose of giving the utmost convenience in the control of motor-driven machinery. It has been estimated that the output of many machines can be increased 20 per cent by the central grouping and convenient arrangement of all the operating levers. "Headlines of control" is recognized as being very important in securing the utmost production from a machine, and the automatic controllers described were designed to provide this class of control for starting, stopping or reversing the motor and machine.

The controller consists of a small operator's switch and an accelerating unit. The controllers are built in three types to secure: (1) Non-reversing and dynamic braking; (2) reversing without dynamic braking; (3) reversing and dynamic braking. For each type there are four different forms of accelerating units which vary in design from a simple train of accelerating switches up to a unit having a fused service switch, a train of accelerating switches and complete circuit-breaker features, as shown in Fig. 2.

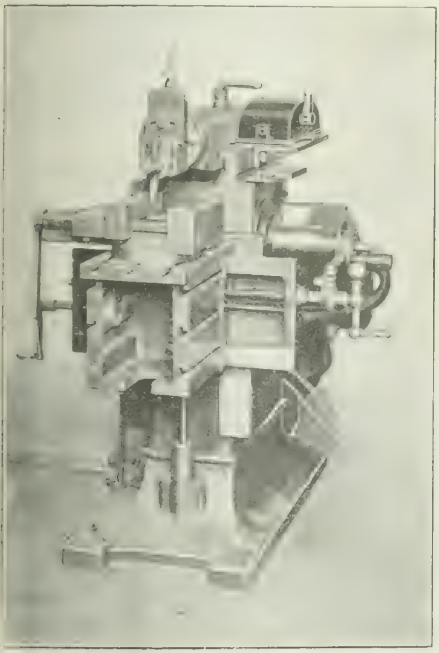


Fig. 1—Motor-Driven Shaper Equipped with an Automatic Controller.

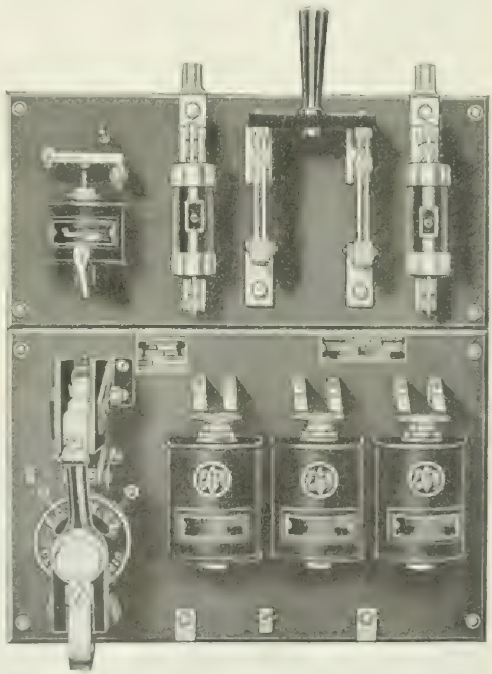


Fig. 2—Accelerating Unit Consisting of a Fused Service Switch, Accelerating Switches and Circuit-Breaker.

The accelerating unit automatically accelerates or retards the motor through the action of series-wound accelerating switches which possess the remarkable characteristic of acting not only as switches but as current-limit relays as well. When the current in the winding of one of these switches exceeds a predetermined value the switch locks open and cannot close until the current is reduced to the proper value.

When the operator's switch is thrown to the running position current flows through the motor, all of the starting resistance and the coil of the first accelerating switch. As the motor accelerates the current drops, and when it reaches the correct value the first accelerating switch closes, cutting out a portion of the starting resistance. The succeeding accelerating switches operate similarly, ultimately cutting out all of the starting resistance and putting the motor across the line. By throwing the operator's switch to its original position the motor is disconnected from the line and consequently stops. Different positions of the handle of the different types of operator's switch provide for drifting, reversing or rapid stopping by dynamic braking.

Dynamic braking is secured by a change of connections, accomplished by the operator's switch, which first inserts all the starting resistance in series with the armature. The motor is then quickly and evenly brought to rest by automatic dynamic braking, the accelerating switches in this case acting as retarding switches by cutting out step by step the resistance as the current generated by the motor decreases owing to the slowing down of the motor.

The manufacturers claim the following important advantages for this automatic controller: (1) It limits the acceleration and retardation current at all times to a safe value. (2) It accelerates and retards the motor in the minimum safe amount of time and automatically varies the time of acceleration and retardation, depending upon the load which the motor has to start and stop. (3) It provides the best conditions for good commutation. (4) By limiting the current, both in starting and stopping, it limits all mechanical strains on the motor and driven machinery. (5) It obviates the necessity of mechanical clutches on many motor-driven machine tools. (6) It adds very materially to the safety of an installation, since in case of accident the motor may be quickly stopped. (7) It inherently provides no-voltage protection, for if the voltage fails the switches drop open, and upon the return of voltage they automatically close in their regular method and sequence, again accelerating the motor to full speed.

METHODS OF CONNECTING WIRES TO TERMINAL LUGS.

By H. B. Logan

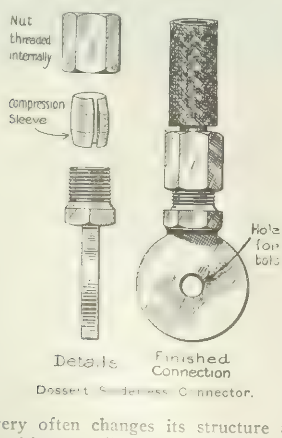
An analysis of the article by Mr. H. D. George in the issue of Nov. 4 seems to leave much to be desired in the essentials of convenience and time-saving. The article in question is in the section devoted to "Wiring and Illumination" and is entitled "Methods of Soldering Wires in Terminal Lugs." The first method described requires the following separate and distinct operations: (1) To have or procure a plumber's furnace; (2) to get it ready for use; (3) to melt a pot of solder; (4) to cut insulation from end of conductor and brighten end by scraping or sandpapering; (5) to smear the bared end of conductor with soldering flux; (6) to tin it by plunging it into solder pot; (7) to knock off surplus solder; (8) to push conductor into hole in lug; (9) to souse lug with wet waste to cool it; (10) to scrape or file off shreds and globules of solder; (11) to brighten surfaces of lug with fine sandpaper.

Contrasted with the foregoing, another method of connecting wires to terminal lugs is to use the Dossert solderless connectors, which eliminate entirely the use of solder and require only the following operations: (1) Cut insulation from end of conductor and brighten end by scraping or filing; (2) push conductor into hole in lug; (3) tighten up nut with wrench.

A comparison shows that the soldering method requires the following adjuncts: Plumber's furnace and means for heating same, solder, soldering flux, wet waste and sandpaper, whereas to connect up the Dossert lug requires nothing but a jackknife, a file and a wrench. The saving in time, labor, materials and cost is increased by the fact that soldering operations usually require a man and a helper, while a Dossert joint can be made by one man, no matter how large the cable.

As shown in Fig. 1, the shank of the Dossert lug is threaded externally while the hole is tapered. The compression sleeve is tapered at both ends and slotted longitudinally. The nut is threaded internally and is tapered at the outer end. When the conductor is thrust into the lug and the nut is tightened up the action of the tapers and slotted sleeve exerts a pressure on the cable or conductor of several thousand pounds to the square inch, according to size, thereby making good electrical contact.

At best a soldered joint is unreliable. Tin, for reasons



Dossert Solderless Connector.

unknown, very often changes its structure and becomes crystalline, and in turn affects all other metals that it comes in contact with in a similar manner. This may be the reason why cables often drop out of lugs into which they have been soldered. A Dossert lug will not heat as much as the cable which it connects when the cable is heavily overloaded.

Mr. George in his article describes another method of soldering wires in lugs, which is to heat the lug with a blow torch and when sufficiently hot feed wire solder into the hole. The solder melts and the bared conductor end is thrust into the hole, as previously described. He adds: "However, the use of a blow torch in this way should be avoided if possible, as it blackens the exposed surfaces of the lug. A thorough cleaning with fine sandpaper is then necessary and that requires considerably more time than is justifiable." This method seems to be sufficiently condemned by the statement that it should be avoided if possible, but it is also open to objections as to multiplicity of materials, operations and cost, together with the use of the dangerous blow torch with its menace as a fire hazard when brought into buildings. The high temperature to which a splice has to be heated in order to solder it injures and lessens the life of the insulation, especially if it be rubber. This bad feature is, of course, eliminated by the use of solderless connectors.

A HP-HOUR ON 21.8 LB. OF STEAM WITH HALF-LOADED NON-CONDENSING LENTZ ENGINE.

The Natrona County Electric Company, doing the electric-service business of Casper, Wyo., has had a 250-hp Lentz poppet-valve engine in service during the last eigh

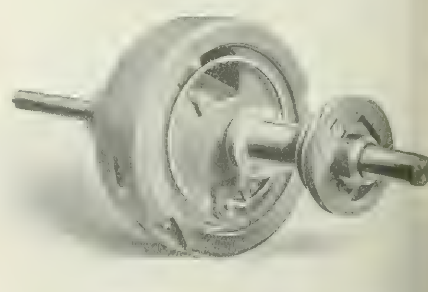


Fig. 1—Combined Inertia and Centrifugal Governor.

months, and Mr. J. A. Ward, superintendent of the company, reports some gratifying results of operation an tests of this unit. The unique features of the Lentz type c engine were described in an article on the installation Galesburg, Ill., appearing in the *Electrical World* of Ma

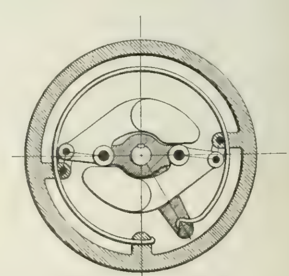


Fig. 2—Section of Combined Inertia and Centrifugal Governo

4, 1911. Briefly summarizing these points of difference, t engine at Casper, as shown in the accompanying illust tion, is of the tandem horizontal type, having its popp type valves operated from a full-speed lay-shaft paralleli the piston travel. The use of elastic packing is entir

voided in these engines, the valve-stems being ground to 0.001-in. fit and the piston stuffing-boxes being formed by a series of accurately ground fixed and floating rings. The governor, which is of the combined inertia-centrifugal type, is shown inclosed in the globular housing opposite the high-pressure cylinder in the illustration. Its inertia

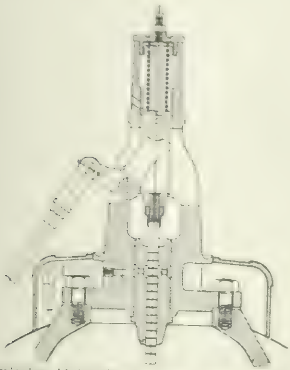


Fig. 3—Admission Valve Mechanism, Showing Roller Contact, Valve Stem, Etc.

and flyballs operate sliding wedges which control the ... of the eccentrics, the construction also making valve adjustments possible with the engine in motion. The lay shaft is driven by bevel friction wheels, arranged with ...w teeth projecting along one side, in order to prevent ...

Other features of the Lentz engine are its relatively high speed, light weight, etc. The engine is a European invention, the American units described being built in this country under license, by the Erie City Iron Works, of Erie, Pa.

The engine at Casper is of the 250-hp type, with cylinders ...in. and 27 in. by 23 in., taking saturated steam at about ... lb. pressure per square inch and exhausting into the atmosphere against 1½-lb. back-pressure. It drives, at ... r.p.m., a 200-kva, 2300-volt, 60-cycle, three-phase Fort Wayne alternator. The engine was erected under local supervision, all adjustments being made as far as possible by rule. Steam was then turned on and the unit operated for six hours, after which it was shut down for only a few minutes for the purpose of making some final adjustments.

Two five-hour efficiency tests have been run on the Casper engine by Mr. Ward, showing a steam consumption of 21.8 lb. of dry, saturated steam per indicated horsepower-hour, under conditions of 115 lb. steam pressure, 1½-lb. back-pressure on atmospheric exhaust, 164 r.p.m. and 103 kw average load. These results, according to Mr. Ward, exceeded the builders' half-load guarantees by 1.3 lb., and practically equaled the full-load efficiencies promised, in spite of the fact that the half-loaded engine was operating against the back pressure, for which no allowance had been made.

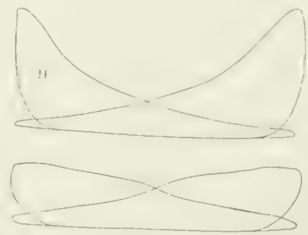


Fig. 5—Indicator Card from the Galesburg (Ill.) Engine.

In operation the packingless steam valves have been found perfectly steam-tight, and according to the plant engineer have shown themselves capable of close setting to give very perfect cards. The superintendent also calls attention to the convenience of the hand-speed adjustments, which is found especially handy when paralling alternators, as the Lentz engine is operated in connection with an Atlas belted engine.

All of the bearings that are used on the Lentz engine are oiled by gravity, while force-feed cylinder oil pumps feed oil directly to the bottom sides of the cylinders, obviating piston wear.

Reproduced herewith in this connection are indicator cards taken from the Galesburg (Ill.) engine already referred to. This engine was operating condensing at the time the test was made by Mr. C. T. E. Johnson, local superintendent of water-works.

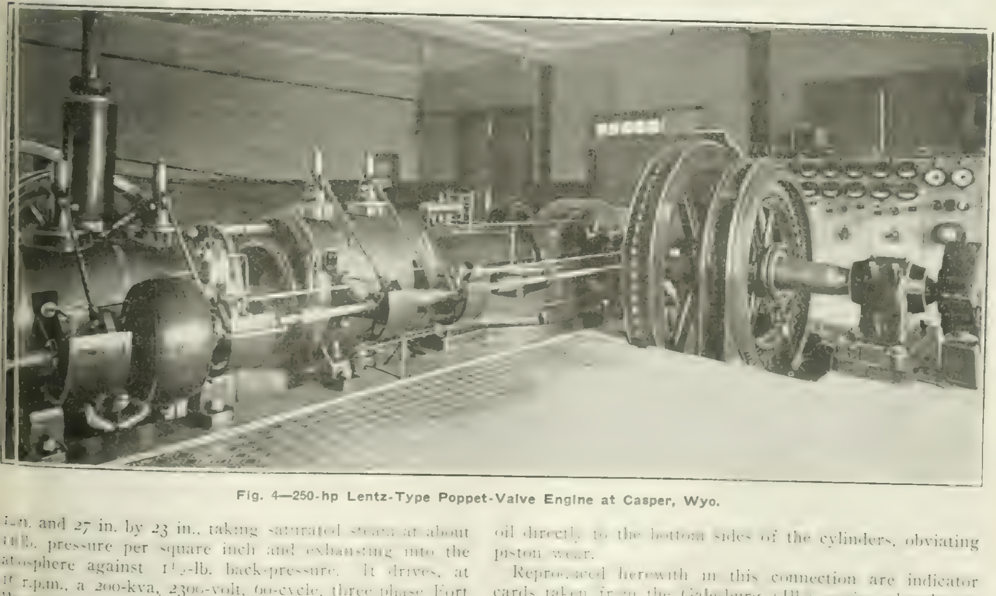


Fig. 4—250-hp Lentz-Type Poppet-Valve Engine at Casper, Wyo.

Industrial and Commercial News

The Week in Trade.

RESULTS of its annual canvass of manufacturers, financiers, railroad officials and other representative business men with regard to their views upon trade conditions, their causes and remedies, were made public this week by the National Association of Manufacturers, and a summary of the 10,000 answers received to the 20,000 inquiries sent out shows that business interests in the various sections of the country are united in the belief that political agitation is largely responsible for the unsatisfactory conditions that exist in general trade at the present time. The various remedies for relieving these conditions, classified in the order of their importance as shown by the canvass, were: Cessation of political agitation, cessation of tariff legislation, amendment or improvement to the Sherman Act, federal incorporation and regulation of trusts, more national and individual confidence, an improved system of banking and currency, governmental prosecution of the labor trust with all other illegal combinations in restraint of trade, and, finally, increased export trade and rehabilitation of the American merchant marine. Without doubt many of the so-called causes or restraining influences are largely exaggerated, both in their actual and their immediate influence upon the business situation. In any event, the tendency apparent this week in industrial circles to set aside excuses, give less attention to imaginary conditions and advance business in spite of the restraining influences which have always existed in more or less prominent form, is a step in the right direction. Mild improvement has been made in a number of lines during the week. The majority of steel mills are in active operation, and the volume of business is increasing, though profits are curtailed by low prices. Large contracts for pig-iron are pending, and the principal orders at present are coming from pipe manufacturers. Inquiries and orders for cotton goods are also expanding. Business failures for the week ended Nov. 23, as reported by *Bradstreet's*, were 293, as compared with 238 for last week, 212 for the corresponding week in 1910, 217 in 1909, 193 in 1908, and 258 in 1907.

The Copper Market.

THERE is a rather general belief at this writing that advance in copper prices has reached its limit for the present. The upward movement has been weakened by decrease of speculative interest in standard copper, and second hands are offering electrolytic freely, at concessions from the prices asked by the leading agencies. Consumers, therefore, are satisfied that there is no necessity for alarm

Standard Copper.	Bid.	Asked.	Settling Price.
[illegible]	12.80	13.10	....
[illegible]	12.80	13.10	12.95
[illegible]	[illegible]	13.17½	13.02
[illegible]	12.90	13.30	13.10
[illegible]	[illegible]	13.10	13.00
[illegible]	[illegible]	13.10	13.00

	£ s d	£ s d
[illegible]	[illegible]	[illegible]
[illegible]	59 18 9	60 0 0

	Highest.	Lowest.
Standard	12.95c	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Best selected.	[illegible]	[illegible]

over the present trend of the market, and are buying only for immediate requirements. While the producing element, with a view to influencing sales, presents the argument that stocks of copper are decreasing and that the supply is getting low, consumers still hold to their belief that there is plenty of copper to supply normal demand, and that slight price changes are unimportant since substantial increase will keep them out of the market more than ever. This attitude on the part of consumers is strengthened by a feeling that the recent advance has been too rapid to be permanent. Buying of copper abroad, while not especially active, is on an encouraging scale, and exports for the month, including Nov. 27, aggregate 24.[illegible] tons. With a good export showing, prospects of a fair de[illegible] livery to domestic interests, and the fact that November is a short month, there is a strong probability that the next rep[illegible] of the Copper Producers' Association will show a decrease in surplus stocks. Standard copper in New York on Mon[illegible] was irregular, and the tone was weak. Activity in Lon[illegible] was not very pronounced, but the market was strong, wi[illegible] an upward trend. With indications at present pointing [illegible] early improvement in general trade, the outlook for the c[illegible] per industry is far brighter than it has been for some mo[illegible] past. The daily call on the Metal Exchange Nov. 27 quo[illegible] copper as per the accompanying table.

Industrial and Commercial Notes.

New York Edison Increasing Its Power Load.—Am[illegible] private plants in New York City recently supplanted by [illegible] tral-station service was that in the Liberty Tower, one of [illegible] newer skyscrapers, opened for occupancy about a year [illegible] The contract which the owners have entered into with [illegible] New York Edison Company calls for an installation of [illegible] incandescent lamps and 210 hp in motors for operating [illegible] elevators, three pumps and one sidewalk lift. The plant w[illegible] formerly supplied the building was installed in a sub-basem[illegible] cut in the solid rock when the building was erected, and [illegible] resented an investment of about $40,000. It was estim[illegible] when the private plant was installed that its yearly ou[illegible] would be some 625,000 kw-hours, but actual consumption, [illegible] said, has been 250,000 kw-hours per year. The showroom[illegible] the New York Edison Company have been reporting a [illegible] satisfactory increase in orders for heating appliances s[illegible] cold weather has become pronounced. Fifteen radiators [illegible] disposed of within the past two weeks, these being about 2 [illegible] to 3 kw in capacity. One of the devices having a ready [illegible] is the electric bar heater for mixing hot drinks. The he[illegible] comes in two sizes, three and five quarts respectively, [illegible] consumes about 990 watts.

Navy Contracts Awarded to Diehl Manufacturing C[illegible] pany.—The electrical turret-operating equipment for [illegible] new battleships *New York* and *Texas*, now building at [illegible] New York Navy Yard and the Newport News Shipbuil[illegible] & Dry Dock Company, respectively, will be furnished by [illegible] Diehl Manufacturing Company, of Elizabethport, N. J. [illegible] equipment for each ship consists of ten upper-hoist t[illegible] equipments at $14,935; ten lower-hoist motors and brake[illegible] $7,482; ten rammer equipments at $9,293, and ten elev[illegible] equipments at $9,040, making, a total of $81,500. The I[illegible] company will furnish this apparatus for $77,500. The Ge[illegible] Electric Company, which furnished similar equipment for [illegible] battleships *Florida* and *Utah*, was the only other bidder, [illegible] its price was $82,524.

One Thousand-Volt Direct-Current Railway for Mexic[illegible]—The Mexican office of Siemens-Schuckertwerke has clos[illegible] contract for the construction of a railway for the cit[illegible] Pachuca, in the State of Hidalgo, Mexico. The first inst[illegible] tion will comprise four 34-ton electric locomotives, two [illegible] stations and overhead equipment. The line will be 17.4 [illegible] long and be operated at 500 and 1000 volts, direct current [illegible] equipment admitting of operation on either tension. The n[illegible] sary energy will be transmitted by the Mexican Light & P[illegible] Company at 6000 volts, 50 cycles, three phase. The road [illegible] be used for city and suburban passenger traffic, and for ha[illegible] ore from silver mines.

Supreme Court Upholds Muskegon's Right to Issue B[illegible] for Municipal Plant.—The State Supreme Court has [illegible] [illegible] a decision affirming that of the Circuit Court, which [illegible] that all of the proceedings for the issuance of $75,000 b[illegible] by the city for the construction of a municipal lighting [illegible] were valid. The action was brought by the Muskegon Tra[illegible] & Lighting Company, which obtained a temporary injun[illegible] that was subsequently set aside by the Circuit Court.

Status of the Mechanics' Lien Law in Illinois.—Electrical supply dealers and contractors who do business in the State of Illinois will do well to take into account the rights of sub-contractors under the Illinois mechanics' lien law, following the refusal of the Supreme Court of that State on October 11 last to grant a re-hearing in the case of Kelly versus Johnson. Frederic P. Vose, of Chicago, who is an attorney-at-law and secretary of the Electrical Credit Association of that city, has prepared the following statement of the law as it is now deemed to be: "The Illinois Supreme Court has already held that the right to lien to which a sub-contractor for work, labor or material is entitled is derived from the contract between the original contractor and the owner, and that if such a contract provides there shall be no lien on the improved property for material and labor furnished by the original contractor, such contract is binding upon a sub-contractor, and a sub-contractor, where a lien has been waived in the original contract, has no lien for material or labor. The court now goes further and holds, in the Kelly versus Johnson case, that the right to a lien under the original contract may be waived by the original contractor after the execution of such contract and that all sub-contractors under such original contract furnishing labor or material under contracts dated after a waiver of lien has been made will have no right to lien. It is also held that any law passed by the Legislature attempting to deprive the owner or general contractor of the right to make contracts waiving the power to a lien would be unconstitutional. The point to be borne in mind seems to be that sub-contractors, in the ordinary course of business, may be presumed to have no right to place a mechanics' lien on a building for electrical or other construction work.

Colorado Municipality Cannot Enter a Partnership.—Judge Gamble, of the District Court of Boulder, Col., on Nov. 9 issued an order restraining the city of Longmont from building or becoming in any way interested in the construction, ownership or operation of an electric-light plant, as provided for in an ordinance adopted by the City Council last year. The city on Aug. 22 sold $46,000 of 5 per cent electric-light bonds. It appears that the appropriation for the construction of the municipal lighting and power plant was found insufficient, and a contract was entered into between the city and the [illegible]nt Service Company, whereby the money was to be [illegible]r erecting a substation and distributing lines, while the [illegible] company was to pay for laying water mains and all [illegible] necessary work outside the city limits. The Service [illegible] was to be reimbursed and to receive 10 per cent in[illegible] until the indebtedness was wiped out. The order was [illegible]d upon the application of the Northern Colorado Power [illegible]ny, which alleged that the contract was illegal and void [illegible] ground that a municipality cannot enter a partnership. [illegible] restraining order will stop all work for the present. The [illegible] company's contract to light the city of Longmont ex[illegible] Dec. 1, and the company has applied for a renewal of the [illegible]t on a more attractive basis.

[illegible]eign Trade Opportunities.—A recent consular report, [illegible]ng South African notes, states that the Johannesburg [illegible]ality will place orders during the current year for a [illegible]w turbo-alternator with steam piping at an estimated [illegible]f $75,000 and a 2000-kw converter to cost about [illegible] A boiler with economizer, superheater and draft ap[illegible], costing $35,000, has just been contracted for with [illegible]k & Wilcox, Ltd. The plan adopted by the Pretoria [illegible]ality for extension of the tramway system at a cost [illegible],000 will, it is stated, involve the placing of car orders [illegible]ting about $20,000. The Pretoria municipality is also [illegible] enlarge its generating equipment by the addition of a [illegible]w turbo-generator and two boilers with accessories. [illegible]ethlehem municipality (Orange Free State Province) [illegible]ortly place contracts for an 80-kw generator, two motor-[illegible] boosters, a 260-cell storage battery, traveling cranes and [illegible]oards.

Cities Service Company Buys Brush Electric Light & Power Company, of Galveston, Tex.—The Brush Electric [illegible] & Power Company, which operates in Galveston, Tex., [illegible]n purchased by the Cities Service Company, the oper[illegible] company for a number of the public utilities controlled [illegible] L. Doherty & Company. The Galveston property was [illegible]lled by the Galveston Gas Company, which was organ[illegible] Texas in Aug., 1856, to manufacture gas and electricity. [illegible] capital stock of the Brush company is $125,000. Its direct-current equipment totals 400 kw, and its alternating equipment about 5000 kva. The company recently obtained a new fifty-year franchise which is free from objectionable restrictions. The property is in good physical condition and a large part of it is new. The purchase price was about $150,000, and it is said that the Cities Service Company will pay for it with the proceeds of a sale of its preferred stock to a London banking house.

Pittsburgh, Shawmut & Northern Railroad Adopts Telephone Dispatching.—The Pittsburgh, Shawmut & Northern Railroad Company has placed an order with the Western Electric Company for equipment to be used in connection with the introduction of train dispatching by telephone on a part of its system. A switchboard is also to be furnished, thus giving the railroad its own telephone system. There will be six selector stations on the dispatching circuit, which is to be approximately 50 miles in length and will extend from St. Mary's, Pa., to Brookville, Pa. It is intended to have the train dispatcher located at St. Mary's. The telephone stations will for the present be ten in number. The selective and telephone apparatus will be of the most modern type and of Western Electric Company manufacture throughout.

Independent Telephone Interests in Northern Illinois.—It is reported that the interests in control of the Chicago Subway Company, which is closely affiliated with the Illinois Tunnel Company, the receivers of which operate the competing automatic telephone service in Chicago, are planning to purchase a controlling interest in the Interstate Independent Telephone & Telegraph Company, of Aurora, Ill., which is an independent company giving telephone service in a number of cities and towns in northern Illinois. The Interstate company, which is in the hands of receivers, gives long-distance connections to the Chicago competing company, and it is now proposed, apparently, that the two properties pass under the same ownership.

Increase in Hudson & Manhattan Railroad Fares.—On the plea that the company has not earned interest on its bonds, taxes and other fixed charges on the business thus far developed with a uniform 5-cent fare, the Hudson & Manhattan Railroad Company, which operates the subways between New York and New Jersey, has announced that, beginning Dec. 24, the rate between Jersey City and Hoboken and Sixth Avenue, New York, will be increased to 7 cents. This is 1 cent less than the existing rate by ferry and trolley between the water-front in New Jersey and uptown New York. The present rate of 5 cents between local stations in New Jersey and between local stations in New York will be maintained.

Southern Sierras Power Company.—The Southern Sierras Power Company has been organized with a capital of $5,000,000, and an authorized bond issue of $5,000,000, as a subsidiary of the Nevada-California Power Company. The company will erect a power plant at San Bernardino to operate in conjunction with present Bishop Creek plant of the Nevada-California company, supplying farming districts in southern California. D. A. Chappell, of Denver, is president, and T. S. Hayden, president of the Denver Union Water Company, is vice-president. The offices are in the Symes Building, Denver.

Detroit United Railways Reaches Agreement with City.—The Detroit United Railways has agreed to forfeit $5,000 per day, secured by a $1,000,000 bond, for each day that possession of the traction lines is withheld from the city after the latter has obtained legislative authority to operate them and has given a six months' notice of intent to purchase. A franchise covering this agreement has been prepared for submission to the Common Council of the city. This franchise, with all present rights of the company, would expire in 1924.

American "Z" Tungsten Lamps.—The American "Z" Electric Lamp Company, of New York, announces that it has issued a license to Kilburn, Brown & Company, of London, under which that firm is allowed the exclusive selling and manufacturing rights of "Z" tungsten lamps in the United States, and that the business will be conducted after Dec. 1 at its new offices and warehouse at 29 Lafayette Street under the style "American 'Z' Electric Lamp Company, Kilburn, Brown & Company, sole licensees."

Cheyenne Electric Railway Sold.—Eastern capitalists have, it is reported, purchased the Cheyenne (Wyo.) Electric Railway, which will be operated in conjunction with the Northern Colorado Power Company. W. J. Barker, now president of the latter company, will head the new company, which has applied for a new franchise.

Financial.

The Week in Wall Street.

Prices in the New York market have been very irregular this week, and the volume of trading has been exceedingly light. The opening on Monday was strong, and some advances were made in the early trading, but reaction took place in the early part of the day, resulting in net declines for many of the active stocks. The general trend of business throughout the day was clearly of professional character. While the statement to Parliament of Sir Edward Grey, British Secretary for Foreign Affairs, on Anglo-German matters had no immediate influence on the market, since the importance of the Moroccan incident as a market factor disappeared some months ago, considerable interest was taken in financial quarters in the manner in which the delicate situation would be relieved. Further weakness developed in the market on Tuesday, and the nature of the day's proceedings was similar to that of Monday. The opening was slightly higher than on Monday, followed by a sharp decline, while in the last few minutes of trading general recovery took place, and the losses of the earlier part of the day were made up. A rise in call money rates on Monday to 3½ per cent was followed on Tuesday by an advance to 3¾, the highest figure thus far in the year. Rates in the local market on Nov. 28 were: Call, 3@3¾ per cent; ninety days, 3½@3¾ per cent. Foreign exchange experienced a sharp decline. Following Sir Edward Grey's speech, prices rose in the Berlin stock market, indicating that the statement had been favorably received. Interest is marked in the reorganization plan of the Metropolitan Street Railway, and Interborough-Metropolitan shares were strong in Tuesday's market. Transfer of gold to San Francisco and Canada in large quantities was made on Tuesday, and further shipments are expected before long. The quotations in the tables are those at the close Nov. 28.

NEW YORK.

	Nov. 21.	Nov. 28.	Shares Sold.		Nov. 21.	Nov. 28.	Shares Sold
[illegible]	[illegible]	[illegible]	1,[illegible]	Int. Met., pf.	47[illegible]	47	15,060
[illegible]	[illegible]	[illegible]	[illegible]	Mackay, Cos.	85½*	83	200
[illegible]	63	[illegible]	128,[illegible]	Mackay, C. pf.	73	72[illegible]	210
Am. [illegible]	[illegible]*	[illegible]*	——	Man. Elev.	136*	134	[illegible]
Am. [illegible]	36	[illegible]	2,700	Met. St. Ry.	15*	15*	—
Am. [illegible]	[illegible]	[illegible]	[illegible]	N. Y. & N. J. Tel.	13[illegible]*	13[illegible]*	—
[illegible]	[illegible]	[illegible]	[illegible]	Steel, com.	63[illegible]	64[illegible]	[illegible]
Am. T. & T.	140	1[illegible]	36,720	Steel, pfd.	109⅛	109[illegible]	5,[illegible]
B. R. T.	[illegible]	77[illegible]	7,550	W. U. T.	78½*	77[illegible]	1,8[illegible]
Gen. Elec.	1[illegible]	15[illegible]	[illegible]	West'h, com.	[illegible]	[illegible]	1,70[illegible]
Int. Met.	[illegible]	15	14,400	West'h, pfd.	115*	113	—

PHILADELPHIA.

	Nov. 21.	Nov. 28.		Nov. 21.	Nov. 28.
Am. R[illegible]	[illegible]	[illegible]	Phila. R. T.	23[illegible]	23[illegible]
[illegible]	1[illegible]	1[illegible]	Phila. Elec.	16	16
Elec. St. Bt'y.	[illegible]*	[illegible]	Phila. Trac.	84[illegible]	84
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	51[illegible]	5[illegible]

CHICAGO.

	Nov. 21.	Nov. 28.		Nov. 21.	Nov. 28.
Chi. City Ry.	186*	186*	Com. Edison	133[illegible]	134[illegible]
Chi. Elev. Rys.	30*	30*	Chi. Subway	[illegible]	[illegible]
Chi. Elev. Rys., pf.	94*	94*	Chi. Telephone	13[illegible]	139[illegible]
Chi. Rs., Ser. 1	95*	95*	Nat'l Car	105*	105*
Chi. Rs., Ser. 2	33*	33½	Nat'l Car, pfd.	118*	118*

BOSTON.

	Nov. 21.	Nov. 28.		Nov. 21.	Nov. 28.
Am. T. & T.	140	140[illegible]	Mex. Tel.	3*	3*
Cum. Tel.	155	156[illegible]	Mex. Tel., pf.	6[illegible]*	6[illegible]*
Edison	[illegible]	287	N. E. Tel.	150	150
Gen. Elec.	155½	15[illegible]	W. T. & T.	27[illegible]*	27[illegible]*
Mass. E. Ry.	21[illegible]	21	W. T. & T., pf.	107¼*	104¼*
Mass. E. Ry., pf.	95½	94			

*Last price quoted.
Shares sold for the week, Nov. 20 to Nov. 25.

Financial Notes.

Annual Report of Allgemeine Elektricitäts-Gesellschaft.—The annual report of the Allgemeine Elektricitäts-Gesellschaft of Berlin for the fiscal year 1910-11 shows that, after deduction of general expenses, taxes, interest on bonds and amounts written off, there remained a balance of approximately $5,550,000 available for dividends, as compared with $4,700,000 in the year preceding. After distribution of dividends, and in consequence of the large capital to be used for extensions of the factories, the liquid means of the company, some 45,000,000 marks (about $11,250,000), will undergo a reduction, in view of which it is intended to issue new debentures to the value of 30,000,000 marks at a suitable time. The company owns property covering 270 acres, and owing to large incr[illegible] in orders, both in hand and in prospect, it is now ma[illegible] plans for substantial extension of the Berlin factories, mac[illegible] shops and small motor factories. There are 60,818 emplo[illegible], of whom 5,454 are engaged at the factories in Vienna, [illegible] and Milan. During the year the company supplied tu[illegible] generators and transformers numbering 92,470, with an o[illegible] of 2,827,336 hp, which compares with 72,460 machines [illegible] 1,476,623 hp output in the preceding year. All of the pro[illegible] of the company have been in very good demand during [illegible] year. Orders for high-speed generators from 8000 hp to 1[illegible] hp for coupling to water turbines, three-phase motors [illegible] economic regulation for driving rolling mills and contin[illegible] current motors for submarine boats were very numerous [illegible] ing the year. The new locomotive motors, particularly [illegible] single-phase type, have given excellent results. The [illegible] tension factory produced apparatus and transformers for [illegible] sures up to 110,000 volts and for outputs exceeding 20,00[illegible] Large numbers of turbo-generators and turbo-driven auxi[illegible] machines were ordered for use on German and other fo[illegible] battleships. Among the largest turbo-units delivered wer[illegible] following: To the Rheinisch-Westfälisches Elektric[illegible] Werke, Essen, one 21,500-kva unit; two 16,000-kva units t[illegible] Oberschlesische and the Berliner Elektricitäts-Werke; [illegible] 12,000-kva units for Buenos Ayres, and one 9400-kva uni[illegible] the Königliche Bergwerksdirektion, Saarbrücken. Sales o[illegible] lamps, which have lost some of their popularity abroad [illegible] to success of the large metallic-filament lamps, were on [illegible] the same value as in the year before. Orders for meter[illegible] installation material were received in such large volume [illegible] they necessitated immediate enlargement of the works [illegible] and some of the departments of the company had to be t[illegible] ferred to rented premises. The meter sales during the [illegible] will more than double those in the year preceding. Sal[illegible] electric heating and cooking apparatus were also more [illegible] double those of the preceding year. The department for [illegible] tric clocks has brought out new apparatus for wireless [illegible] graph and for controlling purposes, also tachometers of [illegible] description. The marine department has designed new [illegible] telegraph apparatus, distance speed indicators and s[illegible] switches for use on board ships. Inclosed installation ma[illegible] for rough industrial and agricultural work has also bee[illegible] veloped during the year, and unprotected porcelain ma[illegible] has been designed to meet present-day requirements. C[illegible] for high-tension cable have shown an increase. The man[illegible] ture of enameled wire has also expanded and the manufa[illegible] of insulating material capable of withstanding heat has [illegible] gressed satisfactorily. All metal-working departments o[illegible] company have had larger outputs during the year. The [illegible] of metallic-filament lamps increased 60 per cent. The r[illegible] states that the useful life and strength of the lamps [illegible] nothing further to be desired. The capacity of the ele[illegible] works erected during the year by the company aggr[illegible] 263,500 hp, as compared with 226,600 hp in the previous [illegible] New plants and extensions are being constructed with a[illegible] gregate capacity of 492,000 hp. The most noteworthy f[illegible] of the year in the electric-railway branch of the com[illegible] business was the opening of the electric trial service o[illegible] Dessau-Bitterfeld line, with alternating-current equi[illegible] The results of the trial were so satisfactory that the Pr[illegible] State Railway authorities at once decided to equip two [illegible] main-line tracks completely for electric traction. The co[illegible] is paying considerable attention to welfare work among i[illegible] ployees.

To Issue More Capital Stock.—The Fitchburg [illegible] Electric Light Company, of Fitchburg, Mass., has filed a [illegible] tion with the Gas & Electric Light Commissioner requestin[illegible] mission to issue 2,627 additional shares of capital stock [illegible] par value of $50. The proceeds are to be used for pay[illegible] floating indebtedness caused by cost of extensions to the [illegible] pany's plant. The financial statement of the company o[illegible] 30, 1911, as filed with the Secretary of the Commonw[illegible] shows as follows:—Assets: Machinery, $883,353; lan[illegible] buildings, $173,793; merchandise, material and stocks in [illegible] ess, etc., $95,967; cash and debts receivable, $69,993; [illegible] received on collateral, $3,271; unfinished construction [illegible] 026; miscellaneous equipment, $20,612; total, $1,295,015. Liabilities: Capital stock, $566,150; debts, $337,269; capital [illegible] premium, $217,805; profit and loss, $170,520; guaranty [illegible] [illegible]; total, $1,295,015.

Federal Light & Traction Company Notes.—Marked improvement continues to be shown in the earnings of the Federal Light & Traction Company, 60 Broadway, New York, which operates public utilities in New Mexico, Washington, Wyoming, Colorado, Arizona, Oklahoma, and Missouri, as described in these columns [illegible] statement of earnings of the subsidiary companies for the month of October showed gross returns of $138,308, as compared with $127,343 in October, 1910, a gain of 8.6 per cent. Operating expenses for the month were $80,355, as compared with $72,457, an increase of 10.9 per cent, and net earnings [illegible] for the previous October, an increase of 5.6 per cent. In the ten months ended Oct. 31, 1911, gross earnings were $1,074,557, as compared with $986,214, a gain of 8.9 per cent. Operating expenses were $642,841, as compared with $576,817, an increase of 11.4 per cent, and net earnings for the period were $431,715, as compared with $409,398, an increase of 5.4 per cent. The earnings of the Trinidad Electric Transmission, Railway & Gas Company, which began operations Sept. 1, 1911, are included in the statement for the month of October but not in the statement covering the ten months. As a matter of fact, October earnings are not properly comparable with previous statements owing to changes in accounting methods, an entirely new system of accounting having been instituted in July, but the steady growth of both gross and net revenue is apparent. The company has secured a new twenty-year franchise at Rawlins, Wyo., carrying with it a contract for city lighting, upon very favorable terms. Day service has been established, and a campaign for motor [illegible]d is in progress. A fifty-year franchise has been secured [illegible] Sheridan, Wyo., and a contract for sewerage pumping has been closed with the city of Albuquerque, N. M., running to maturity of the franchise. The company's new-business campaign for alternating-current lights and sign lighting alone is [illegible] a new revenue of from $7,000 to $10,000 per annum. Gross earnings in the year ended Oct. 31, 1911, were $1,540,249, as compared with $727,927 in the year ended June 1, 1910. Operating expenses in these respective periods were $918,766 and $463,331, and net earnings were $621,482, as compared with $264,596.

Reorganization of New York Traction Companies.—Following the decision of the Court of Appeals that the Third Avenue Railroad Company can carry out the bondholders' plan of reorganization without the consent of the Public Service Commission, a meeting was held by the bondholders' committee to discuss the manner in which the reorganization will be effected. The old property of the Third Avenue Railroad Company will be immediately transferred to the new Third Avenue Railroad Company, and as soon as this transfer is made the issuance of new securities will follow. There are numerous minor modifications to be made, as the interest allowances, etc., have been accruing for the past eighteen months and these will have to be disposed of. The company will apply to the Public Service Commission for a formal order of approval, in accordance with the court's decree. The old securities of the railroad company consist of $16,000,000 of stock and $54,028,000 of bonds, or $70,028,000 in all. In the reorganization plan it is proposed to issue $16,590,000 of capital stock, $15,790,000 of 4 per cent refunding bonds and $22,536,000 of 5 per cent adjustment bonds, which, with the $5,000,000 of old first-mortgage bonds outstanding, would make $59,916,000 capitalization, or over $10,000,000 less than that of the old company. In view of this fact, it will be incumbent upon the Public Service Commission to grant the application of the company. The Metropolitan Street Railway Company made the first move to take advantage of the decision of the court in the Third Avenue reorganization case, and applied on Nov. 22 to the United States Circuit Court for a postponement of the sale of the property of the Metropolitan Street Railway, which was set for Nov. 23. The court granted a postponement of the sale of the property to Dec. 29. The Metropolitan bondholders will, it is believed, follow the example of the Third Avenue company and incorporate a new company to take over the property of the old concern after it has been bought in under foreclosure by the bondholders, who will be in a position to buy the property at the December date.

Consolidated Gas, Electric Light & Power Company's Income Increases.—The earnings of the Consolidated Gas, Electric Light & Power Company, of Baltimore, for the four months of the new fiscal year, beginning July 1, showed a material increase over those for the corresponding period of the previous year. This gain in income, it is explained, is due to the new business which the company has obtained during the first four months of the new year. The report issued a few weeks ago, covering the fiscal year ended June 30, 1911, showed that 5472 new customers had been secured during the twelve months, or an increase of 5.7 per cent over the gain in the previous year. It is stated that the increase in the four months of the new fiscal year of 1912 has been in proportion to the gain reported for the previous year. In this connection it is pointed out that the new business which has been obtained by the company has not been provided by newcomers to Baltimore, but is the result of the efficient campaign for additional customers which the company's solicitors have carried on throughout the city. This gain in new customers, it is said, has been in both the gas and electric lighting departments. The company proposes to maintain the activity for new business during the remaining months of the year, and the officials say that if they can extend their service in the months to come in as satisfactory a manner as they have been able to do in the four months of the new fiscal year, a most favorable record will have been established for 1912. The financial district is speculating as to what the directors of the company will do regarding the common-stock dividend, which is now on a 5 per cent basis. It was thought that the dividend would be increased to 6 per cent in September, but the directors failed to take the action predicted. There is a rather general opinion to the effect that the board will probably put the stock on a 6 per cent basis this month. During the past few weeks there has been considerable buying of the 4½ per cent bonds of the Consolidated Gas, Electric Light & Power Company. It is claimed that the demand for these bonds is due to the improved condition of the company's earning account.

Detroit Edison's New Stock Issue.—Following its decision to increase its capital stock from $9,000,000 to $15,000,000, as previously reported in these columns, the Detroit Edison Company is now offering to stockholders of record on December 9 the right to subscribe to $1,500,000 new stock at par to an amount of 25 per cent of their holdings. Payment may be made in full on Jan. 3, 1912, entitling the subscriber to immediate delivery of the stock paid for, or payments may be made in instalments, as follows: On Jan. 3, 1912, 50 per cent; on April 1, 1912, 25 per cent, and on July 1, 1912, 25 per cent. All payments must be made at the office of the company in New York.

Northern Ohio Traction Company Increases Dividend.—An extra dividend of one-quarter of 1 per cent on the common stock, payable Dec. 15 to holders of record Nov. 30, has been declared by the Northern Ohio Traction & Light Company. The regular quarterly dividend of three-quarters of 1 per cent, also payable Dec. 15, was recently declared. It is stated that the company will place the stock on a regular 4 per cent basis, beginning next year.

DIVIDENDS

Brooklyn Rapid Transit Company, quarterly, 1¼ per cent, payable Jan. 2.

General Electric Company, quarterly, 2 per cent, payable Jan. 2.

Indianapolis Street Railway Company, semi-annual, 3 per cent, payable Jan. 2.

Northern Ohio Traction & Light Company, extra dividend, one-quarter of 1 per cent, payable Dec. 15.

REPORT OF EARNINGS.

Period.		[illegible]	[illegible]	[illegible]	[illegible]	Net Surplus.
[illegible] COMPANY						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible] COMPANY						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October,	1910......	77,993	*42,746	35,247	18,545	[illegible]
MONTREAL STREET RAILWAY COMPANY.						
October,	1911......	$442,393	$232,202	$210,191	$35,697	[illegible]
October,	1910......	386,688	205,750	180,938	31,998	[illegible]
PHILADELPHIA COMPANY.						
October,	1911......	$1,645,808	$1,071,633	$775,891	$627,733	[illegible]
October,	1910......	1,649,891	988,597	846,277	605,694	[illegible]
SOUTHERN CALIFORNIA EDISON COMPANY.						
Yr., Sept.,	'11......	$3,621,394	$1,769,453	$1,851,941	$1,333,464	[illegible]
Yr., Sept.,	'10......	3,302,210	1,622,498	1,679,712	1,202,180	[illegible]

General News

Construction News.

... an electric-light plant in Bay Minette is under consideration. Hampton D. Ewing, president of the Bay Minette Land Company, is interested in the project.

SHADES MOUNTAIN, ALA.—The Shades Cliff Land Company, which is planning to develop 600 acres on Shades Mountain, is reported to be contemplating an electric railway extension, costing about $50,000, and taking over a 4-mile line already built. G. T. Brazleton, 2014 First Avenue, Birmingham, Ala., is president of the company; Robert L. Totten, of Birmingham, Ala., is engineer in charge.

MURFREESBORO, ARK.—E. L. Timmons, of Shawnee, Okla., it is reported, is contemplating building an electric-light plant in Murfreesboro.

CHICO, CAL.—The Chico Business Men's Association is considering the installation of a new street-lighting system in the business section of the city. It is proposed to erect electroliers, each carrying five lamps, to cost approximately $45 each.

COALINGA, CAL.—The Coalinga Water & Electric Company is extending its system to include the East Side field from the Good Luck property, where the line leaves the main power line. The transmission line will run through the Pleasant Valley Farming Company's property, thence through the property of the Coalinga Brick & Tile Company, and from there into Coalinga, making two separate lines into the city.

FRESNO, CAL.—The Fresno & Eastern Railroad Company, recently incorporated with a capital stock of $1,500,000, contemplates the construction of an electric railway, 75 miles in length, extending from Fresno to different points in this territory. Fayette M. Meiggs, of Oakland, Cal.; Albert B. Dodd, of San Francisco, Cal., and George J. Aldrich, of Audubon, N. J., are among the incorporators.

REDDING, CAL.—The Northern California Power Company has purchased all the land it needs for its proposed power plant on the Big Bend of Pit River from the Central Pacific Railway Company for $4,250. The deed also gives the power company a right-of-way through the railroad company's lands for its ditches, tunnels and pole lines in connection with its power development project. The Northern California Power Company has commenced work on power plant, which will involve an expenditure of about $4,000,000.

SAN DIEGO, CAL.—The Board of Supervisors has awarded the San Diego Consolidated Gas & Electric Company contracts to erect an electric-lighting system and supply electricity for street lamps in the City Heights and Normal Heights districts for a period of five years. Under the terms of the contract the company agrees to supply sixty-three 6.6 amp alternating-current arc lamps at the rate of $5 each per month in City Heights and seventeen lamps in Normal Heights at the same rate. Work will begin on the installation of the system at once.

MANITOU, COL.—Preliminary arrangements have been completed and work will begin at once on the construction of an aerial passenger railway from Manitou to the summit of Pike's Peak. E. A. Norton, of Manitou; F. R. Coffman and H. A. Lindsey are interested.

CLINTON, CONN.—Plans are being made by the Pond's Extract Company for the installation of an electric-light plant at its works. The new boiler house is nearly completed, a new smokestack is being placed, and estimates are being received for the equipment of an electric-light plant with sufficient output to light the entire laboratory.

TAKOMA PARK, D. C.—The Town Council, it is reported, has decided to install an electric light and power plant in Takoma Park. E. E. Blodgett is chairman of the committee to take charge of the matter.

DE LAND, FLA.—The City Council has entered into a contract with the De Land Electric Light, Power & Ice Company for lighting the streets of the city for a period of five years. The new contract provides for twenty-six new lamps.

FORT PIERCE, FLA.—The proposition to issue $15,000 in bonds for the construction of an electric light plant, it is reported, will be submitted to a vote of the people on Dec. 12. R. Whyte is Mayor.

OCALA, FLA.—The Florida Power Company has withdrawn its offer to supply electrical energy to the city of Ocala at the rate of 3 cents per kw-hour. The proposition was submitted to the town seven months ago and it has not yet received an answer. W. N. Camp is president of the company.

ORLANDO, FLA.—The Gulf Coast Fruit Association, which has a farm of eighty acres near Orlando, is reported to have awarded contracts for extensive improvements and extensions to its property to L. C. Lowe, of Huntington, W. Va., architect, and J. H. Braden, contractor, of Fullerton, Ky. The proposed work will include the erection of factories, construction of 100-mile canal, an electric railway 100 miles long, two power houses, two substations, ice and packing plants, twenty-six dwelling houses and several commission houses, the latter to be built in various cities. The company proposes to enlarge its farm to 4000 acres, to be drained by proposed canal.

CUTHBERT, GA.—The bonds recently issued by the city of Cuthbert for improvements to the municipal electric-light plant and water-works system have been sold, and steps will be taken to begin work at once on improvements to the plants.

JACKSON, GA.—The $12,000 bond issue recently voted by the city for improvements to the municipal plant has been sold. The proceeds will be used for the purpose of changing the equipment of the steam plant to utilize energy transmitted from the plant of the Central Georgia Power Company on the Ocmulgee River, near Jackson. Work will soon begin on the construction of the substation. It is expected to have the plant completed by Jan. 1, 1912.

JESUP, GA.—Bonds recently voted for the installation of the water-works system have been sold, and as soon as the location of the power house is definitely decided upon work will begin on construction of the system. Arthur Pew, of Atlanta, Ga., is engineer in charge.

JONESBORO, GA.—The City Council has decided to call an election to submit the proposition to issue bonds to provide funds to enlarge the municipal electric-light plant, water-works and sewer systems.

HAILEY, IDAHO.—The Kirkpatrick Brothers are considering plans, it is reported, for the installation of an electric-power plant on Silver Creek to supply electricity for lamps and motors in Picabe.

WALLACE, IDAHO.—Plans are being considered for the installation of an electric-power plant at the Iron Mountain mine, near Wallace, at a cost of about $100,000.

WENDELL, IDAHO.—Preparations are being made to erect a power plant at Thousands Springs. The interests in control of the National Copper Bank, of Salt Lake City, Utah, are said to be concerned in the project. The proposed plant will cost approximately $500,000 and will develop about 5000 hp. Lafayette Hanchett, of Salt Lake City, is one of the promoters.

CHICAGO, ILL.—The contract for furnishing and erecting operating machinery for lock gates of the canal lock adjacent to the power house near Lockport, Ill., has been awarded to the Klemp Simpson Company, of Chicago, Ill., for $4,140.

GALENA, ILL.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 4 for conduit and wiring system, gas-piping system and interior lighting fixtures at the United States post office and custom house at Galena, Ill., in accordance with drawings and specifications, copies of which may be obtained at the above office or of the custodian at Galena, Ill. James Knox Taylor is supervising architect.

PEKIN, ILL.—Plans are being prepared by the Pekin City Railway Company to extend its system in Pekin and for the construction of an extension to Tremont, Delavan, Hopedale, Boynton and Hittle.

AUBURN, IND.—The County Commissioners have engaged Mahurin & Mahurins, of Fort Wayne, Ind., architects, to prepare plans and specifications for a power plant.

KENDALLVILLE, IND.—The City Council has made arrangements with the Toledo & Chicago Interurban Railroad Company to furnish electricity to carry the peak load. The company agrees to furnish the service at 2¼ cents per kw-hour, and also offers to supply energy to operate the entire system at 1.80 cents per kw-hour with a sliding schedule down to 1 cent per kw-hour. The municipal plant is unable to meet the demands made upon it and is in need of extensive repairs.

LOGANSPORT, IND.—The Board of Public Works has awarded the contract for furnishing the new arc lamps to the General Electric Company, of Schenectady, N. Y., at $1,510.

OTTERBEIN, IND.—The Otterbein Light & Power Company, recently incorporated with a capital stock of $10,000, it is said, contemplates the construction of an electric-power plant to supply electricity for lamps, heat and motors. R. H. Holt, Lewis Leaming and R. W. Pearce are interested.

ALLISON, IA.—An election will be held Dec. 11 to submit to a vote the proposition to grant an electric-light franchise to Claud Mackey.

BOUTON, IA.—The Jones Electric Company, of Perry, Ia., is reported to have secured a contract to construct an electric-light and power plant in Bouton.

CORYDON, IA.—We are advised that the Town Council of Corydon, Ia., has called off the bids advertised for Dec. 5 for the reconstruction of the municipal electric-light plant, owing to a contemplated change in the plans. It is probable that bids will be called later on for small generators, driven by oil engines. The Iowa Engineering Company, Clinton, Ia., has charge of the engineering work.

GALVA, IA.—Bids will be received by I. E. Baumgardner, town clerk, until Dec. 15 for the erection of building and installing equipment ... electric-light system in Galva. The Electric Engineering Company, of Sioux City, Ia., has charge of the engineering work.

[illegible] electric-light plant in Glidden, for which bonds to the amount of $10,000 were recently voted. O. B. Moorhouse is city clerk.

[illegible] n line from the power plant at the Keokuk dam to St. Louis. The [illegible]sed line will be 167 miles long and will cost about $2,000,000. Work [illegible]

[illegible]

[illegible] has been sold to the Western Utilities Company. The company will be reorganized and bonds to the amount of $750,000 issued for extensions [illegible] improvements to the plant.

[illegible] plant in the basement of the city hall and has authorized bids [illegible] advertised for an electric generator and engine for the same, to [illegible] approximately $3,000. The present plant supplies electricity for [illegible] will also light the new Carnegie library. The old boilers in the present engine-room will be removed and the room enlarged.

[illegible] on of sixty five electroliers, to be erected on Broad Street.

DEARING, KAN.—The Union Traction Company, it is reported, will submit a proposition to the Dearing Council for lighting the streets [illegible]

LEAVENWORTH, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 22 for installation of conduit and wiring system, lighting fixtures, etc., in the United States post office and custom house in Leavenworth, Kan., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian, Leavenworth, [illegible]

McLOUTH, KAN.—An electric-lighting system is being installed in McLouth by Moxley & Company, which has been granted a twenty-year franchise. The company also has a contract to light the streets of the city for a period of five years.

PARSONS, KAN.—Application has been made to the Board of City Commissioners by Frank Workman for an electric-light franchise in [illegible]

[illegible]MON, KAN.—At an election held recently the proposition to [illegible] $30,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant and water-works system, was defeated.

BARBOURVILLE, KY.—The Bon Jellico Coal Company, recently organized, has leased 1300 acres of rich coal lands in Whitley County [illegible] preparing to open mines on same. The company proposes to [illegible] a complete electrical equipment to operate the mines and all [illegible] Arthur Groves is president and E. B. Taylor, of Williams[illegible] manager.

[illegible]ENSBORO, KY.—Messrs. Russell & Brewster, of Chicago, Ill., [illegible] secured the controlling interest in the Rural Home Telephone Com[illegible] which operates in Daviess, McLean, Hancock and Ohio Counties. The following officers have been elected: Theodore Tyler, of Chicago, president: W. B. McIllvaine, of Chicago, Ill., vice-president, and L. N. [illegible]k, of Owensboro, Ky., secretary and treasurer.

RUSSELLVILLE, KY.—The City Council has rejected the proposition submitted by W. M. Case, of Clarksville, Tenn., to purchase the municipal electric-light plant for $25,000.

[illegible]INGTON, LA.—W. J. Tracy, of Cleveland, Ohio, has been [illegible] a franchise to construct an electric railway from Slidell to [illegible]ville, St. Tammany Parish. This line, it is said, is a link in a [illegible] railway between Slidell and Hammond, which will eventually [illegible]nded to Baton Rouge, La.

[illegible]USTA, MAINE.—The Cienfuegos, Palmira & Cruces Electric [illegible] & Power Company, a Maine corporation, has voted to increase [illegible]orized capital stock from $3,500,000 to $20,000,000.

[illegible]KLAND, MAINE.—The Rockland, South Thomaston & St. George [illegible]

[illegible]TON, MASS.—Orders have been placed by the Edison Electric [illegible]ting Company of Boston with the General Electric Company, of [illegible]tady, N. Y., for one 15,000-kw turbo-generator set, to cost about [illegible]0. This is the second turbo-generator with a rating of 15,000 kw ordered by the Edison company within the past fifteen months. [illegible]h will increase the turbine capacity of the company to 81,000 kw.

CHICOPEE, MASS.—The Board of Aldermen has voted to issue bonds to the amount of $96,000, the proceeds to be used for reconstruction of the municipal electric-light plant.

FITCHBURG, MASS.—The Fitchburg Gas & Electric Company has applied to the Massachusetts State Board of Gas and Electric Light Commissioners for permission to issue 2627 additional shares of stock, par [illegible] $50, the proceeds to be used [illegible] making extensions to its plant. The new stock is to be offered at $85.

GREENFIELD, MASS.—The Massachusetts Northern Railways Company has acquired control of the Connecticut Valley Street Railway Company, of Greenfield, Mass., Athol & Orange Street Railway Company, of Athol, Mass., and Gardner, Westminster & Fitchburg Street Railway Company, of Gardner, Mass., and the Templeton Street Railway Company, of Templeton, Mass. The new company contemplates the construction of railways connecting Miller's Falls and Orange and an extension to Winchendon, which will give a through line from Boston to Greenfield.

LEOMINSTER, MASS.—The special lighting committee is preparing plans for the installation of the new street-lighting system in Leominster. It is proposed to replace the 115 arc lamps now in use with about 575 tungsten lamps, most of them to be of 40 cp. The tungsten lamps will cost the town $15 each per year. The street-lighting service is furnished by the Leominster Electric Light & Power Company.

MALDEN, MASS.—The Malden Electric Light Company has submitted a proposition to the City Council offering to reduce the price of arc lamps from $100 to $86.56 each per year for all-night and every night service on a ten-year contract, instead of from $100 to $98 as stated in the issue of Oct. 28.

NORTH ADAMS, MASS.—Plans are being considered by the Merchants' Association for the installation of a new ornamental street-lighting system on Main Street. It is proposed to use ornamental lamp standards with tungsten lamp clusters.

SPRINGFIELD, MASS.—The City Council has appointed a committee to consider the question of municipal ownership of a lighting plant.

BATTLE CREEK, MICH.—The City Council has authorized the Mayor to appoint a committee to make investigations and secure data as to the cost of construction and maintenance of an electric plant to supply the city with electricity for lamps and motors. The committee will also select a site on which to erect such a plant.

CLARE, MICH.—The plant and holdings of the Milling Light & Power Company, of Clare, Mich., have been purchased by C. C. Field, of Detroit, Mich., a representative of the Consolidated Light & Power Company, which is building two dams on the Chippewa River and is planning to supply electricity to a number of small towns in this vicinity. J. L. Hudson, of Detroit, Mich., is president of the Consolidated company.

MUSKEGON, MICH.—The City Council has accepted the bid of the Grand Rapids-Muskegon Power Company to furnish the city with electricity for lighting the streets. Under the terms of the contract the company will furnish arc lamps at $57.50 each per year with all-night service and 60-cp incandescent lamps at $16 per year per lamp to burn all night. The city now pays $76 each for arc lamps and $12 each per year for 20-cp incandescent lamps. The city recently decided to build a municipal electric-light plant, for which bonds to the amount of $75,000 were voted. The installation of a municipal plant will be abandoned for the present.

EAGLE LAKE, MINN.—The Consumers' Power Company, it is reported, is considering the question of submitting a proposition to this village to supply electricity for lamps and motors. It is proposed to extend the transmission line from the company's plant at the Rapidan dam, near Mankato.

EVELETH, MINN.—The Council is reported to have adopted a resolution to call an election to submit the proposition for municipal ownership of a light, heat and power plant and water-works system to a vote.

MAYNARD, MINN.—At an election held recently the proposition to issue $5,000 in bonds, the proceeds to be used for the installation of an electric-light plant, is reported to have been carried.

MAZEPPA, MINN.—The City Council, it is stated, is considering the question of installing an auxiliary engine in the municipal electric-light plant. Either a steam or a gasoline engine will be installed.

MINNEAPOLIS, MINN.—The City Council is reported to have accepted the proposition offered by the Minneapolis General Electric Company to erect and maintain 137 ornamental lamps in the Bridge Square district.

MORTON, MINN.—The Wherland Electric Company, of Redwood Falls, which has been granted a franchise to supply electricity in Franklin, it is reported, contemplates extending its transmission lines to Morton in the spring.

PINE CITY, MINN.—The Eastern Minnesota Power Company, it is reported, is extending its transmission lines to Brahm, Grasston, Mora, North Branch, Harris, Princeton, Grandy and Isanti.

PLUMMER, MINN.—The Battery Company, of Milwaukee, Wis., is reported to have applied for a franchise to install an electric-light plant in Plummer. It is proposed to utilize the water-power of the Clearwater River to operate the plant.

SLEEPY EYE, MINN.—Bids will be received until Dec. 5 by H. C. Peterson, city recorder, for one 60-kw and one 75-kw, three-phase, 60-cycle, alternating-current generator with field rheostat and accessories.

WASECA, MINN.—The City Council has authorized the Water and Light Board to enter into a contract with the Consumers' Power Company, of Mankato, Mich., to supply electricity to operate the municipal electric system for a period of ten years at the rate of 4 cents per kw-hour; also to operate the water-works pump. Bonds have recently been issued to rebuild the distributing and lighting system. The Con-

[illegible]

[illegible] Dakota. The company is successor to the Bullock Public Service Company and will control the electric systems in the following towns: Beatrice, Blue Springs, Wymore, Norfolk and Blair in Nebraska; Magnolia, Logan and Missouri Valley in Iowa, and Fairfax, S. D. E. A. Bullock, of Norfolk, Neb., is president of the company and Clyde Bullock, of Norfolk, is secretary.

NORFOLK, NEB.—The proposition to issue bonds to the amount of $75,000, the proceeds to be used for the installation of an electric-light plant and water-works system, will be submitted to a vote at an election to be held Dec. 12.

VIRGINIA CITY, NEV.—The County Commissioners have granted the Truckee River General Electric Company a franchise to erect its high-tension transmission line across Storey County.

DOVER, N. H.—The City Council is considering the question of installing a new street-lighting system. It is proposed to replace the arc lamps now in use with tungsten lamps. The Twin State Gas & Electric Company, which furnishes the street-lighting service, has agreed to install tungsten lamps on several streets for demonstration purposes. W. G. Meloon is manager of the company.

ATLANTIC CITY, N. J.—Work has commenced on the installation of the new ornamental lighting system for the Boardwalk. Ornamental lamp standards will be erected, which will carry festoons of incandescent lamps. The city has appropriated $30,000 for improvements to the system.

ALBANY, N. Y.—The Capital City Construction Company, of Albany, N. Y., has secured the contract for electric wiring the state hall, at [illegible].

HUDSON, N. Y.—The Red Hook Light & Power Company has applied for a franchise to supply electricity in Hudson.

LEWISTON, N. Y.—The Lewiston & Lake Ontario Shore Power Company has applied to the Public Service Commission, Second District, for permission to exercise franchises in the villages of Lewiston and Youngstown and the towns of Lewiston and Porter, and also for authority to begin construction of its plant and distributing system to supply electricity for lamps, heat and motors. The company proposes to purchase electricity from the Niagara, Lockport & Ontario Power Company. Permission is also asked to sell $25,000 in capital stock, the proceeds to be used to purchase right-of-way, erection of distribution sys[illegible] Lewiston, [illegible] Ran[illegible]ville.

NEW YORK, N. Y.—The contract for installing a new engine and generator at the Manhattan Street Hospital, Ward's Island, N. Y., has been awarded to Frost & Sheldon, Albany, N. Y., for $6,285. Franklin B. Ware, of Albany, N. Y., is state architect.

NEW YORK, N. Y.—Bids will be received by Joseph Johnson, fire commissioner, until Dec. 5 for furnishing material and labor for the installation of a complete electric-lighting system in the quarters of engine company No. 33, located at 42 and 44 Great Jones Street, and in the quarters of engine company No. 33, located at 363 Broome Street, borough of Manhattan. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Fire Department, 157 and 159 East Sixty-seventh Street, Manhattan.

SENECA FALLS, N. Y.—Plans are being considered to organize a company under the name of the Seneca Falls Power Company for the purpose of consolidating the water-powers along the Seneca River in Seneca with the object of establishing a central power plant. The company will be composed of the fifteen power owners along the river in Seneca and includes all the large manufacturing establishments in the village. The only expense in developing the water-power will be the construction of one large power house in case one large lock is used, or two or three smaller stations if a larger number of locks are utilized. It is expected that the construction work will not exceed $100,000. Ernest G. Gould is interested in the company. M. J. Barnes, engineer, has been making investigations in connection with the project.

OXFORD, N. C.—The Board of Town Commissioners has granted the North State Hydro-Electric Company a franchise to supply electricity in Oxford. Under the terms of the franchise the company agrees to supply electricity for lighting the streets of the city for a period of twenty-three years and five months at the rate of $60 per arc lamp per year and incandescent lamps at $18 each per year. The city now pays $75 per lamp per year for arc lamps and $35 each per year for incandescent lamps. The company has purchased the plant and holdings of the Oxford Water & Electric Company. Charles E. Johnson, of Raleigh, N. C., is president of the company.

SELMA, N. C.—Arrangements are being made for the construction of a new electric-light plant and water-works system in Selma.

TRYON, N. C.—The Hoke-Hill Real Estate & Investment Company has purchased 300 acres of land and has an option on 5000 acres near Tryon. It is said that the company will develop the property for residential and agricultural purposes. The company, it is reported, proposes to construct a hydroelectric power plant to supply electricity for lamps and motors. Investigation of water-powers is being made by William Farr, of Asheville, N. C., and F. G. Rogers, of Greenville, S. C., engineers. D. M. Hoke, of Greenville, S. C., is president of the company.

MINOT, N. D.—The City Commissioners are reported to have entered into a contract with the Consumers' Power Company to supply electricity to light the city.

PORTAL, N. D.—It is reported that negotiations are under way between the officials of Bowbells and parties interested in the local electric-light system whereby electricity for operating the system in Portal will be furnished from the Bowbells plant.

CLEVELAND, OHIO.—The contract for the construction of the addition to the municipal electric-light plant has been awarded to D. W. McGrath for $5,294. H. S. Holton is director of public service.

CLEVELAND, OHIO.—A resolution has been introduced in the City Council recommending the installation of a municipal conduit system. It is proposed that the city build the system and rent space to all telephone, telegraph and electric lighting companies. Some time ago the Council passed ordinances requiring the companies to place all their wires underground, stipulating that a certain number of miles be put in conduits each year. It is said that the companies are not living up to the provisions of the ordinance.

CONVOY, OHIO.—At an election held Nov. 7 the proposition to construct an electric-light plant to be owned and operated by the municipality was carried. W. F. Henney is village clerk.

EAST YOUNGSTOWN, OHIO.—The Mahoning & Shenago Railway & Light Company has been granted a franchise by the Village Council to double-track its car line through East Youngstown to the village limits.

HOOD RIVER, ORE.—The City Council has granted the Hood River Railway & Power Company a ten-year contract for lighting the streets of the city. The Pacific Power & Light Company has the present contract. It is understood that new company has made a great reduction in the price for the service.

McMINNVILLE, ORE.—Bids will be received by the city of McMinnville until Dec. 3 for the sale of bonds to the amount of $30,000, the proceeds to be used for improvements to the water and light systems. A. C. Chandler is city recorder.

PORTLAND, ORE.—The City Council has granted the Portland Railway, Light & Power Company a franchise to extend its electric railway on Sandy Boulevard from East Seventy-second Street to the city limits.

PORTLAND, ORE.—The executive board has authorized the city auditor to advertise for bids for lighting the streets of the city, which are not now served by the lighting system of the Portland Railway, Light & Power Company. Under the contract which the company holds with the city it refuses to make extensions for lamps more than 1200 ft. beyond the present installations. It is said that the Mount Hood Railway & Power Company will submit proposals to light the districts not covered by the present contract.

WOODVILLE, ORE.—The Rogue River Electric Company, of Medford, Ore., is reported to have secured a contract to install an electric-light plant in Woodville.

ALLENTOWN, PA.—The City Council has granted the Lehigh Valley Transit Company a franchise to build an electric railway from Eighth Street and Hamilton Street across the Eighth Street Bridge to Ninth Street and thence to the city limits.

CHURCHVILLE, PA.—The citizens of Churchville and Richboro are negotiating with the Philadelphia Suburban Gas & Electric Company, of Wyncote, Pa., to extend its system to this section to supply electricity for lamps and motors to these towns. The plant of the company is located near the Jenkintown station.

GREENSBURG, PA.—Preparations are being made by the West Penn Electric Company to extend its transmission lines from Greensburg to Saltsburg and New Alexandria. The Saltsburg Electric Company and the New Alexandria Company, recently incorporated as subsidiary companies of the West Penn Electric Company, have been granted franchises by the boroughs of Saltsburg and New Alexandria to supply electricity for lamps and motors.

PITTSBURGH, PA.—An ordinance has been introduced to the City Council granting a francihse to the Keystone Light Company, which has applied for permission to extend its transmission lines from the North Side to the wards in the old city of Pittsburgh. The ordinance provides for a maximum charge of 4 cents per kw-hour for electricity and the payment of 2½ cents of its gross earnings to the city.

WILLIAMSPORT, PA.—The electric-lighting and steam-heating plant and laundry building at the Williamsport Hospital was destroyed by fire recently, causing a loss of about $30,000.

HONEA PATH, S. C.—The Board of Public Works is reported to have awarded the contract for the construction of the proposed electric-light plant and water-works system to Cothran & Cothran, of Greenwood, S. C., engineers, to cost approximately $50,000. John F. Monroe is chairman of board.

FREEMAN, S. D.—It is reported that it is proposed to organize a co-operative company for the purpose of installing an electric-light plant in Freeman.

WOONSOCKET, S. D.—The City Council has granted the Shuler Electric Company a franchise to construct and operate an electric-light

plant in Woonsocket. The street-lighting system will include about forty lamps. The company will establish a twenty-four-hour service and will supply electricity at the following rates: For the first 25 kw-hours, 18 cents per kw-hour; from 25 to 50 kw-hours, 17 cents; from 50 to 75 kw-hours, 16 cents, and above 75 kw-hours, 15 cents.

JELLICO, TENN.—Preparations are being made by the Jellico Electric Light, Heat & Power Company for extensive improvements and extensions to its plant, including the installation of a direct-connected unit of 300 hp, consisting of engine and generator. Contract has been awarded for the erection of smokestack 103 ft. high, 4 ft. 6 in. in diameter. A 200-hp boiler was recently installed in the plant.

TRENTON, TENN.—The contract for construction of a municipal electric-light plant and water-works system has been awarded to the Allen Engineering Company, of Memphis, Tenn., for $17,233. R. C. Houston, 1634 Exchange Building, Memphis, Tenn., is engineer.

DALLAS, TEX.—The capital stock of the Dallas Automatic Telephone Company has been increased from $500,000 to $700,000.

FORT WORTH, TEX.—The Forth Worth Southern Traction Company is planning to erect three new substations, to be equipped with rotary converters, alternating-current and direct-current, step-down transformers, switchboards, etc.

FORT WORTH, TEX.—The Northern Texas Electric Company is offering $3,500,000 in capital stock and $5,500,000 in bonds, the proceeds to be used for extensions and improvements to its system. The company is a holding company and owns the stock of the Northern Texas Traction Company, which operates street railways in Forth Worth, Tex., and also an interurban electric railway between this city and Dallas, a distance of 33 miles. The Northern Texas Electric Company also owns the Fort Worth Southern Traction Company, which is constructing an electric railway from Fort Worth to Cleburne, 30 miles distant.

GALVESTON, TEX.—The Cities Service Company has announced the purchase of the plant and holdings of the Brush Electric Light & Power Company, of Galveston, Tex., which was controlled by the Galveston Gas Company. It is understood that the price paid for the property was about $1,500,000. In the issue of Nov. 11 this plant was reported to have been sold to the Newman interests of New Orleans, La.

HAMLIN, TEX.—The Hamlin Electric Light & Power Company, recently incorporated, is reported to be planning to establish a plant in Hamlin, to cost approximately $10,000.

LAREDO, TEX.—The Laredo Electric Railway Company is contemplating the purchase of a gas engine direct-connected to a 400-kw, 2300-volt generator.

BURLINGTON, VT. — The Electric Light Commissioners have awarded the contract for the installation of a new 750-kw turbo-generator set and condenser in the municipal electric-light plant to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for $20,500. The city is to furnish the foundation and the intake water pipe from the lake. The cost of building the foundation and the intake pipe is estimated at about $3,000, making the total cost about $24,000.

CENTRALIA, WASH.—Machinery has been received for the new power plant of the Centralia Light & Traction Company. Arrangements have been made with the Eastern Railway & Lumber Company to supply steam to operate the new plant.

EPHRATA, WASH.—A company is being organized under the name of the Ephrata Electric Company for the purpose of building an electric plant to furnish electricity for lighting the city. Work will soon begin on construction of the proposed plant. The capital stock of the company is placed at $10,000.

SEATTLE, WASH.—The new power plant of the Pacific Coast Power Company at Derringer, on Lake Taps, near Auburn, was placed in service on Nov. 11. Electricity generated at the plant has been contracted for by the Seattle Electric Company, for distribution in Seattle, affording the company two hydroelectric generating plants, the other being located at Electron. The Seattle company has closed down its steam generating plant at Georgetown, as well as its steam plant on Post Street; the latter will be held for service in case of emergency. Through permission granted by the Public Service Commission of Washington the Seattle Electric Company has reduced the price for electricity for lamps in Seattle, to take effect immediately. Under the new schedule the rates are as follows: For the first 60 kw-hours, 7 cents per kw-hour and all consumed above that amount 4 cents per kw-hour, with a minimum charge of $1 per month. Under the old schedule the rates were 9½ cents per kw-hour for the first 20 kw-hours, 8½ cents for the second 20 kw-hours, 7½ cents for the third 20 kw-hours and 5 cents for all over 60 kw-hours, with a discount of 10 per cent for prompt payment. The new rates are the same as those charged by the municipal electric plant.

BRILLION, WIS.—The contract for the installation of an electric-light and power system in the plant of the Brillion Iron Works, in Brillion, has been awarded to the Acker Electrical Company, of Sheboygan, Wis. The equipment includes a generator and oil engine, one 20-hp motor and five 5-hp motors and switchboard. The plant will be equipped with tungsten lamps.

HATFIELD, WIS.—It is reported that the La Crosse Water Power Company, of La Crosse, Wis., has been granted permission by Judge Sanborn, at Madison, Wis., to repair the damaged portion of the dam at Hatfield. The cost of the work is estimated at $150,000.

MERRILL, WIS.—Plans are being considered by the Merrill Railway & Lighting Company for extending its railway system to Lake View. The company is considering the trackless trolley system.

MILWAUKEE, WIS.—The contract for a condenser for a garbage incinerator in the Third Ward has been awarded to the Westinghouse Machine Company, of Pittsburgh, Pa. The Allis-Chalmers Company, of Milwaukee, Wis., secured the contract for turbine and auxiliary apparatus. Total cost of contract awarded is $15,092.

NEENAH, WIS.—Preparations are being made by the Wisconsin Traction, Light, Heat & Power Company to supply electricity for lamps and motors in West Neenah.

SUPERIOR, WIS.—The contract for construction of the power station of the Great Northern Power Company in this city has been awarded to Emil Sedlachek, of Superior. The new station will be located at the corner of Logan Avenue and Twenty-eighth Street and will be 60 ft. x 40 ft. A new transmission line along the Wisconsin side of the St. Louis River from the hydraulic power plant at Thomson to Superior will also be erected. The new power station will supply power for both Superior and Duluth in case of accident to the line on the Duluth side of the river.

TWO RIVERS, WIS.—The City Council is contemplating increasing the output of the municipal electric-light plant and water-works system. The cost of the work is estimated at about $25,000.

WEST SALEM, WIS.—The village of West Salem has petitioned the Wisconsin Railroad Commission to issue a declaration of convenience and necessity which would give the right to another lighting company to operate in West Salem. The present plant is considered inadequate to supply the service required.

CHEYENNE, WYO.—The property of the Cheyenne Electric Railway Company, with a twenty-two-year franchise, has been purchased by an Eastern syndicate, headed by W. J. Barker, president of the Northern Colorado Power Company, of Denver, Col. The price paid for the system is understood to be about $115,000.

BASSANO, ALTA., CAN.—The Bassano Electric Power & Traction Company has awarded a contract to Gorman, Clancy & Grindley for the construction of power house and electric railway from Bassano to the large Canadian Pacific Railroad irrigation, 5 miles in length. Orders have been placed for material for the railway. S. E. Whiting, of Bassano, is interested in the traction company.

EDMONTON, ALTA., CAN.—Plans are being considered by the City Commissioners for extensions and improvements to the electric-lighting system.

INNISFAIL, ALTA., CAN.—The Council is reported to be contemplating the installation of an electric-light plant in Innisfail.

LETHBRIDGE, ALTA., CAN.—Bids are being asked by the City Commissioners for additional equipment for the power plant of the municipal tramway system in Lethbridge.

LETHRIDGE, ALTA., CAN.—By-laws appropriating $450,000 for the installation of a street-railway system in Lethbridge next year will be submitted to the ratepayers at an election to be held Dec. 11. Of the proceeds $300,000 will be used for the construction of the street railway and the remaining $150,000 will be utilized for extensions to the power plant. If the propositions are carried contracts for the work will be awarded early in the year.

KAMLOOPS, B. C., CAN.—In the report submitted by Dutcher & Maxwell to the City Council in regard to the proposed hydroelectric power plant on Barrier River, it is estimated that 2000 hp could be developed at a cost of $190,000.

VANCOUVER, B. C., CAN.—The contract for construction of a water-power plant on Punledge River, Vancouver Island, for the Canadian Collieries, of Dunsmuir has been awarded to Grant, Smith & Company, of Vancouver, at $500,000. The proposed plant will develop about 12,000 hp, which will be utilized for the company's railway and mines.

VIRDEN, MAN., CAN.—The Mayor and Town Council would like to receive propositions for the installation and maintenance of an electric light and power plant within the limits of the town. Further information may be obtained on application to J. F. C. Menlove, secretary and treasurer.

ST. JOHN, N. B., CAN.—It is understood that an agreement has been reached between the Council committee and the St. John Railway Company which provides for a substantial reduction in the rates for electrical service now charged by the company. Under the new schedule the rates for energy for motors are said to be as follows: For less than 5 hp, $65 per horse-power per year; from 25 to 30 hp, $50; from 30 to 100 hp, $42.50; 100 to 200 hp, $40; above 200 hp, $37.50. For electricity for lamps the rate is 13½ cents per kw-hour up to 1000 kw and 10 cents for all above that amount, with a discount of 25 per cent in both cases.

DARTMOUTH, N. S., CAN.—The property of the Dartmouth Gas, Electric Light, Heating & Power Company is reported to have been purchased by F. B. McCurdy & Company. It is expected that the property will be taken over by the Nova Scotia Power Company, whose plant will be located on the Mersey River, 80 miles from Halifax. The price paid for the plant is understood to be about $75,000.

HARRISTON, ONT., CAN.—Plans are being considered for the installation of an electric street-lighting system in Harriston. The proposition will probably be submitted to a vote of the ratepayers.

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for the city of Kingston will be submitted to the ratepayers at an election to be held in January.

LINDSAY, ONT., CAN.—Surveys are being made for an electric railway to connect Port Hope, Peterboro, Omemee, Lindsay and Orillia. [illegible] from Montreal to Toronto. Electricity for operating the proposed system may be obtained from Niagara Falls. The Canadian Northern Railway Company is reported to be interested in the project.

LONDON, ONT., CAN.—The farmers of London Township are contemplating securing electrical service from the Hydroelectric Power Commission. A petition has been presented to the commission to submit prices for the service.

LONDON, ONT., CAN.—The London & Lake Erie Railway Company has appointed a committee to confer with the Hydroelectric Power Commission to secure estimates of cost of energy from the transmission system of the commission to operate an electric railway between London and Port Stanley.

LONDON, ONT., CAN.—It is reported that preparations are being made for the construction of the radial railway between London and Sarnia. Plans, it is said, are being prepared for the construction of a large hydroelectric plant on the Aux Sables River at Rock Glen, in West Williams Township. It is proposed to build an 80-ft. dam which, it is understood, will be erected at a point where there is already a natural waterfall that has been utilized for water-power purposes to operate mills in the township.

SUDBURY, ONT., CAN.—The City Council has granted Louis La Forest a franchise to build an electric railway to Copper Cliff.

WELLAND, ONT., CAN.—The City Council is negotiating with the Welland Electrical Company with a view of purchasing the plant to be owned and operated by the municipality. If the system is taken over by the city, electricity for operating it will be secured from the Hydroelectric Commission transmission system.

MONTREAL, QUE., CAN.—The Montreal & Southern Counties Railway Company is building an extension from McGill Street, Montreal, to Richelieu, 14 miles from St. Lambert. The company is also making preparations for the construction of a railway from St. Lambert to [illegible]

New Industrial Companies.

THE BUFFALO MOTO VEHICLE SERVICE COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 by W. R. Huntley, J. H. Vail and C. R. Huntley, of Buffalo, N. Y. The company proposes to manufacture, repair and deal in motor vehicles.

THE COPEMAN ELECTRIC STOVE COMPANY OF MISSOURI, of St. Louis, Mo., has been incorporated with a capital stock of $30,000 by Allan Kannedy, C. A. Tiles and John F. Carr. The company proposes to buy and deal in patents, electrical devices, etc.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, Ill., has been incorporated by William Low, Thomas Stacey and William B. Walrath. The company is capitalized at $60,000 and proposes to manufacture and deal in electrical apparatus, appliances, etc.

THE GENERATING LIGHT & MOTOR COMPANY, of Camden, N. J., has filed articles of incorporation with a capital stock of $125,000 for the purpose of manufacturing machinery, motors, etc. The incorporators are: J. J. Brady, F. West, of Philadelphia, Pa., and G. D. Connelly, of Camden, N. J.

THE GREATER NEW YORK TRANSIT BUILDING COMPANY, of New York, N. Y., has been incorporated by C. T. Harvey, R. B. Holton, and R. S. Harvey, of New York, N. Y. The company is capitalized at $50,000 and proposes to construct electric railways, elevated railroads, etc.

GURLITT-BRAUN-DAVIS CORPORATION, of New York, N. Y., has filed articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing and dealing in motor vehicles, etc. The incorporators are: H. Gurlitt, D. S. Davis, Jr., and V. C. Bogardus, of New York, N. Y.

THE KOOTENAI POWER CONSTRUCTION COMPANY, of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $600,000. The incorporators are: W. J. Maloney and N. P. Coffin, of Wilmington, Del.

THE MARINE ELECTRIC COMPANY, of Louisville, Ky., has been incorporated by E. C. Thirwell, H. A. Tepel and C. G. Thirwell. The company is capitalized at $5,000 and purposes to operate a machine shop for electrical repairs.

THE ERNEST H. MEEKS ELECTRICAL COMPANY, of Norfolk, Va., has been incorporated with a capital stock of $30,000 for the purpose of doing a general electrical supply business. The officers are: Ernest H. Meeks, president; J. J. Collins, vice-president, and E. T. Meeks, secretary and treasurer.

THE METEOR AUTOMOBILE COMPANY, of Mount Vernon, N. Y., has been incorporated with a capital stock of $50,000 to manufacture motors, engines, motor vehicles, etc., by F. A. Kateley, A. F. Gescheidt and J. Emmeluth, of Mount Vernon, N. Y.

THE MORGAN STEEL JACKET REINFORCED BUILDING FOUNDATION COMPANY, of East Orange, N. J., has been incorporated by C. G. Geyer, F. E. Ruggles and L. Matthews, all of East Orange The company is capitalized at $125,000 and proposes to do a general mechanical and electrical engineering business.

THE MOTOR STARTING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: L. E. Wales, of Wilmington, Del.; L. E. Replogle and L. W. Cooper, of Indianapolis, Ind.

THE NATIONAL CONDUIT MACHINE COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $100,000 by H. R. Berry, J. C. Campbell and G. E. Weaver.

THE NEW ERA MANUFACTURIIG COMPANY, of Jersey City, N. J., has been incorporated by W. W. Bender, H. O. Coughlan, of New York, N. Y., and H. T. Lette, of New York, N. Y. The company is capitalized at $125,000 and proposes to manufacture electric stoves, sadirons, kitchen utensils, etc.

THE PARIS AUTO STARTER COMPANY, of Paris, Ill., has been incorporated by Frank C. Fishback, E. B. Brooks and Paul P. Shutt. The company is capitalized at $10,000 and proposes to manufacture electric starters, automobile devices, etc.

THE PERFECTION STORAGE BATTERY & LIGHTING COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $50,000 to deal in electric generators, automobile appliances, etc. The incorporators are: Carl E. Winters, George B. Lyons and John W. Hake.

THE SORENSEN SMOKE CONSUMER COMPANY, of Jersey City, N. J., has been incorporated by Charles E. Johnson, Olaf Anderson and Charles Orenson, all of 15 Exchange Place, of Jersey City, N. J. The company is capitalized at $50,000 and proposes to manufacture smoke consumers and fuel economizers.

THE STANDARD BOILER WATER PURIFIER COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000. The incorporators are: G. W. Weller, Jr., H. Knock and M. J. Dain, of Pittsburgh, Pa.

THE THERAPEUTIC LAMP COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing electric lamps, appliances, etc. The incorporators are: W. A. Soles, M. C. Worth and J. Becker, of New York, N. Y.

THE TUNGSTEN ELECTRIC SIGN & SCENE COMPANY, of Mansfield, Ohio, has been incorporated with a capital stock of $5,000 by George H. Lowrey and others.

TURK & BROWN, INC., of Rochester, N. Y., has been incorporated by S. H. Brown, Alfred H. Brown, both of 139 Park Avenue, Rochester, N. Y., and John F. Turk, 252 Main Street, Hornell, N. Y. The company is capitalized at $10,000 and proposes to manufacture motors, engines, machinery, vehicles, etc.

THE UNITED ELECTRIC SUPPLY COMPANY, of Marion, Ohio, has filed articles of incorporation with a capital stock of $10,000. The incorporators are A. J. Berry and others.

THE UNITED HYDRO-ELECTRIC POWER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of doing a general contracting business and electrical work of all kinds. The incorporators are: F. B. Schanne, F. M. Livingston, of New York, N. Y., and J. C. Williams, of Brooklyn, N. Y.

THE WISHART-DAYTON AUTO TRUCK COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture motor vehicles. The incorporators are: R. A. Inch, S. E. Wishart and J. B. Smith, of New York, N. Y.

New Incorporations.

LOS ANGELES, CAL.—The Appleton Land, Water & Power Company has been incorporated with a capital stock of $300,000 by E. N. Greenleaf, H. M. Brown, A. G. Stepper and others.

FLORENCE, COL.—Articles of incorporation have been filed for the Fremont & Interurban Railway Company with a capital stock of $125,000 by D. F. Foot, J. V. McCandless, H. A. Hicks, Charles Roach and W. K. Hurd. The company proposes to build interurban railways extending from Florence to Rockvale, Williamsburg, Coal Creek, Lincoln Park, Portland, Hardscrabble irrigation district and Concrete.

WILMINGTON, DEL.—The British-American Light, Heat & Power Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $6,000,000 and the incorporators are: N. P. Coffin, E. E. McWhinney and W. J. Maloney, of Wilmington, Del.

SALMON, IDAHO.—The Lemhi Power Company has filed articles of incorporation with a capital stock of $76,000. The company proposes to operate in Lemhi County. The officers are: C. L. MacKenzie, president; Edward Riggs, vice-president, and Ralph Irwin, secretary.

WALLACE, IDAHO.—The Long Valley Light & Power Company has been incorporated with a capital stock of $100,000 to build a hydro-

electric power plant on the North Fork of the Payette River, to develop about 4365 hp. The company proposes to supply electricity for lamps and motors in Rosebury, Crawford, Lardo and Thunder City. Walter C. Clark, of the Bunker Hill & Sullivan Mining Company, of Wardner, Idaho, is president of the company.

SHERIDAN, IND.—The Sheridan Water, Light & Heat Company has filed articles of incorporation with a capital stock of $100,000. The incorporators are: J. L. Vickery, Perley Weaver, J. A. Branson, J. G. Vetter and Fred Beauchamp.

CENTRAL CITY, IA.—The Wapsipinicon Power Company has been incorporated with a capital stock of $30,000 by Fred J. Cross, Andrew Kasper and Oscar R. Barber.

NEW ORLEANS, LA.—Articles of incorporation have been filed for the El Salto Power Company with a capital stock of $300,000 by Monte M. Lémann and David W. Pipes, Jr.

PORTLAND, MAINE.—The Western Washington Power Company has been incorporated with a capital stock of $25,000 to acquire water-powers and lands, etc., in the State of Washington and elsewhere. C. M. Drummond is president and W. B. Drummond treasurer, both of Portland, Maine.

PORTLAND, MAINE.—The Western Utilities Company has filed articles of incorporation with a capital stock of $500,000 to construct and operate a plant for the generation of gas and construct dams, etc., for the production of power of all kinds. C. E. Eaton is president and T. L. Croteau treasurer, both of Portland, Maine.

BUCKLEY, MICH.—Articles of incorporation have been filed for the Duck Lake Power Company by Harlin Brown, David E. Wynkoop and Ralph Wynkoop. The company is capitalized at $16,000 and proposes to supply electricity in the villages of Buckley, Sherman and Mesick, where franchises have been secured. The company owns 140 acres of land at the outlet of Duck Lake, where it has established a hydro-electric plant.

RENO, NEV.—Articles of incorporation have been filed for the Nevada Valley Power Company with a capital stock of $2,500,000. The company proposes to build a hydroelectric power plant on the Truckee River to develop about 4000 hp. The directors are: A. D. Ayers, H. B. Danforth, A. A. Smith, of Reno, Nev., and others.

JERSEY CITY, N. J.—The Panama Tramways Company has filed articles of incorporation with a capital stock of $750,000 to construct and operate tramways in the Republic of Panama. The incorporators are: L. H. Gunther, B. S. Mantz and J. R. Turner, all of Jersey City, N. J.

LAKEWOOD, N. Y.—The Western New York Electric Company has been granted a charter with a capital stock of $10,000. The company proposes to operate in the villages of Lakewood, Ashville, Panama, Celoron and Falconer and the towns of Busti, Harmony and Ellicott. The directors are: Albert S. Price, Frank W. Bullock, George L. Maltby, William H. Reynolds, Almet N. Broadhead, Sheldon B. Broadhead and William A. Broadhead, of Jamestown.

LEWISBURG, OHIO.—Articles of incorporation have been filed for the Lewisburg Lighting Company by D. L. Gaskill, A. C. Robeson, J. M. Bickel, W. T. Fitzgerald and Z. T. Dorman. The company is capitalized at $5,000.

WAGONER, OKLA.—Articles of incorporation have been filed for the Wagoner Electric & Gas Company with a capital stock of $1,500 by H. K. Herbst, W. H. Stueve and Emil T. Gunther.

EUGENE, ORE.—The Eugene Belt Line & Interurban Railway Company has been incorporated with a capital stock of $250,000 to build an electric railway to connect Eugene, Springfield, Coburg and Junction City. The incorporators are Lawrence Harmon and E. R. Ernsberger.

ALLENTOWN, PA.—The South Whitehall Electric Light & Power Company has been incorporated with a capital stock of $5,000. The incorporators are: Charles N. Wagner, of Allentown, Pa., treasurer; R. P. Stevens and Charles M. Walter, both of Allentown.

CURWENSVILLE, PA.—The Anderson Creek Electric Company has been granted a charter with a capital stock of $5,000. George L. Benner, of Curwensville, Pa., is treasurer.

HARRISBURG, PA.—Charters have been granted by the State Department to the Lehigh Valley Light & Power Company, the Hanover Light & Power Company, of Hanover, Pa., and the Salisbury Electric Light & Power Company, of Salisbury, Pa.

HARRISBURG, PA.—Charters have been granted by the State Department to the following companies: The Edison Electric Company, of Topton, Pa.; the Longswamp Township Electric, of Reading, Pa.; the Maiden Creek Township Electric Company, of Maiden Creek, Pa.; the Maxatawny Township Electric Company, of Maxatawny, Pa.; the Richmond Township Electric Company, of Richmond, Pa.; the Edison Electric Company, of Kutztown, Pa., and the Edison Electric Company, of Fleetwood, Pa. Each company is capitalized at $5,000, and the incorporators are: Walter A. Rigg, George L. Roller and Harry Reigel, of Reading, Pa.

WEST PITTSTON, PA.—The Garden City Electric Company has been granted a franchise with a capital stock of $5,000. The directors are: J. A. McMillan, 114 Exeter Street, West Pittston, Pa., treasurer; W. S. Tompkins and L[illegible] Jones, of West Pittston, Pa.

JOHNSTON, S. C.—The Electric Light, Ice & Fuel Company has been incorporated with a capital stock of $20,000 by F. M. Boyd and B. S. Boyd.

SPRINGFIELD, S. C.—The Springfield, Salley & Wagener Telephone Company has been incorporated by L. M. Mins and W. D. Black. The company is capitalized at $10,000.

KNOXVILLE, TENN.—The Knoxville Power & Light Company has been incorporated with a capital stock of $500,000 by Asbury Wright, R. M. Jones, E. G. Oates, Abraham Rosenthal and Walter McCoy. The company is a subsidiary of the Eastern Tennessee Power Company and will operate under a franchise recently granted by the municipality to the latter company. The Knoxville company will distribute electricity generated at the plant of the Eastern Tennessee company on the Ocoee River at Parkville. The transmission line is being constructed and will be ready for operation by Jan. 1, 1912. The company will also supply electricity in Chattanooga, Tenn.

DALLAS, TEX.—The Hancock Electric Company has been incorporated with a capital stock of $6,000 by W. L. Hancock, A. Hyman and J. B. Adoue, Jr.

DEL RIO, TEX.—The City Ice & Electric Company has been incorporated with a capital stock of $40,000 by C. G. Foulks, J. A. Raman and W. H. Wolff.

FORT WORTH, TEX.—The Fort Worth & Southwestern Railway Company has been chartered with a capital stock of $400,000 by W. D. Morton, L. A. Wright, J. P. Parr, of Glenrose, Tex.; D. C. Morris, of Walnut Springs; W. M. Shuler, of Waco, and others.

HAMLIN, TEX.—Articles of incorporation have been filed for the Hamlin Electric Light, Heat & Power Company with a capital stock of $10,000 by W. W. Johnson, W. S. Whaley and H. A. Knight.

JOURDANTOWN, TEX.—The Atascosa Ice, Water & Light Company has been incorporated with a capital stock of $15,000 by T. P. Zanderson, B. B. Daugherty, W. M. Avent and others.

McKINNEY, TEX.—Articles of incorporation have been filed for the Union Telephone Company with a capital stock of $75,000 by H. W. Head, C. A. Shock and C. B. Dorchester.

BRATTLEBORO, VT.—Articles of incorporation have been filed for the New Hampshire Power Company, under the laws of the State of Maine, with a capital stock of $15,000,000 for the purpose of development of extensive water-powers in central New Hampshire. The company is said to have secured options on property which will give it control of the flowage of the greater part of the Black Water, Sugar, Mascoma, Smith, Warner and Contoocook Rivers in Merrimack, Sullivan, Hillsborough and Grafton Counties. Numerous storage reservoirs, it is said, will be formed by the erection of dams at various points, which will be utiliz d to generate electricity to be supplied to manufacturing plants in New Hampshire and Massachusetts. It is estimated that about 100,000 hp can be developed. The officers are: Robert C. Bacon, of Brattleboro, Vt., president; Clarence E. Eaton, Portland, Maine, treasurer, and James E. Manter, of Portland, Maine, clerk.

PLEASANT RIDGE, VA.—The Back Bay Telephone Company has been granted a charter with a capital stock of $5,000. The officers of the company are: Charles T. Moore, of Pleasant Ridge, Va., president; T. F. Williams, of Princess Anne, Va., vice-president, and C. W. Dawley, of Pleasant Ridge, secretary.

SEATTLE, WASH.—The Sound Electric Company has been granted a charter with a capital stock of $10,000. The incorporators are: E. Ellsworth, H. Schacht and Edward Ellsworth.

SEATTLE, WASH.—Articles of incorporation have been filed for the Highland Park & Lake Burien Railway Company by W. H. Coughlin, 302 American Bank Building, Seattle, Wash.; William H. Murphy, James R. Stirrett and J. R. McLaughlin. The company proposes to build an electric railway from Seattle to Highland Park and Lake Burien, a distance of 8 miles.

MORGANTOWN, W. VA.—The Monongahela & Marion Railway Company has been granted a charter by the Secretary of State. The company is capitalized at $50,000 and proposes to build a street railway between Morgantown and Fairmont. The incorporators are: John Madigan, M. E. Fetty, Parker S. Johnson, Sanford Barrickman and John E. Price, all of Morgantown, W. Va.

Personal.

MR. ANSON M. HOLCOMB, formerly instructor at Cornell University, has been appointed assistant professor at the Case School of Applied Science.

PROF. W. S. FRANKLIN, of Lehigh University, will present a paper on Dec. 5 before the Schenectady A. I. E. E. Section entitled "Fundamentals of Electrostatics."

MR. S. M. BUSHNELL, of the Commonwealth Edison Company, Chicago, has been appointed chairman of the central-station heating committee of the commercial section of the National Electric Light Association.

MR. F. P. CUMMINGS, of the electrical department of the Denver Gas & Electric Light Company, has been made general superintendent of the Montgomery (Ala.) Light & Water Power Company, where his ability and enthusiasm assure him success.

MR. H. L. WALTHERS, formerly manager of the Yreka Railroad, is now manager of the Siskiyou Electric Power & Light Company,

[illegible] acquired from the Rogue River Electric Company, with headquarters at Medford, Ore.

MR. JOHN HAYS SMITH, formerly editor of *The Electrical Age*, and of the *Electric Club Journal*, and until recently associated with the Allegheny County Light Company, of Pittsburgh, Pa., has been appointed assistant commercial engineer for The Milwaukee Electric Railway and Light Company.

MR. A. H. FLEET, formerly expert electrical specialist for the Bureau of Construction and Repairs of the United States Navy, and more recently shop engineer of the Southern Railway, has joined the naval-apparatus staff of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

MR. W. F. RABER, manager for H. M. Byllesby & Company of the Pueblo (Col.) railway and lighting properties, has also been appointed manager of the plants of the Colorado Electric Light & Power Company at Canon City and at Skagway in the Cripple Creek district, recently acquired by the Chicago firm.

MR. LAWRENCE A. COLEMAN, assistant secretary of the United Electric Light & Power Company, New York City, was married Nov. 22 to Miss Florence E. Miller, of New York. After his return from a short honeymoon spent at Atlantic City, Mr. Coleman's many friends showered him with felicitations.

MR. A. F. TRAVER has been appointed superintendent of the Denver Gas & Electric Light Company, with supervision of the gas, steam-heating and electric departments filling the position made vacant by the resignation of Mr. Dostal. Mr. Traver's promotion is well merited and is viewed with favor by his associates.

DR. C. P. STEINMETZ delivered two lectures recently before the engineering students of the University of Illinois. The subjects were "Unexplored Fields in Engineering" and "The Nature of Electrical Energy." The audience at each lecture thronged the lecture-room of the Physics Building, in which the lectures were given.

MR. C. A. TUPPER will address the Milwaukee South Side Civic Association, Dec. 6, on the subject of harbor plans for Milwaukee. Mr. Tupper recently completed an extended investigation and trip among the principal harbors of Europe, and makes the interesting assertion that no city abroad which he visited can boast the superb natural water fronts of Milwaukee and Chicago.

MR. W. H. WISSING, formerly manager of the commercial department of the Union Electric Light & Power Company, of St. Louis, and more recently vice-president of the Central Station Development Company, Cleveland, has accepted the management of the new-business department of the Sierra & San Francisco Power Company, with offices in the Wells-Fargo Building, San Francisco.

MR. WALTER CLYDE JONES, a state senator from one of the Chicago districts, addressed the Electric Club of Chicago on Nov. 22 on "The Initiative and Referendum." Senator Jones, who is a member of the club and rather closely affiliated with electrical interests by reason of legal and business associations, is a candidate for the Republican nomination for Governor of Illinois. He pointed out, in earnest and vigorous fashion, the value of the initiative and referendum to all honest public-utility enterprises.

MR. P. B. SAWYER, general manager of the Des Moines Electric Company, of Des Moines, Ia., has been appointed manager of the Union Electric Company, of Dubuque, Ia., succeeding Mr. L. D. Mathes, who has resigned to become manager of electric-service and street-railway properties in Montgomery, Ala. Mr. Sawyer will take hold of the Dubuque property about the first of the year, and will have charge of both the central-station and the street-railway service of that city.

MR. C. N. DUFFY, comptroller of The Milwaukee Electric Railway & Light Company, delivered an address on the topic of "Civic Advertising" before the Advertisers' Club of Milwaukee on Wednesday evening, Nov. 22. Mr. Duffy's remarks were confined to the broader aspects of his subject. He contented himself with arousing the enthusiasm of his audience, to whose professional abilities he left the working out of details of a campaign to further the interests of the Wisconsin city. His remarks received hearty applause from the large number of interested persons present.

MR. EDWARD H. JOHNSON was a speaker at the fifth annual dinner of the Capt. John Ericsson Memorial Society of Swedish Engineers given at the Engineers' Club on Nov. 25 In introducing him Mr. Robert Lundell referred to Mr. Johnson as a pioneer in the electrical field who had been instrumental in bringing the electrical industry to its present state, and recalled his connection with Edison, Bergmann, Sprague and others. Mr. Johnson had much of interest to tell his audience in regard to the early days of electrical engineering. He referred at length to Mr. Thomas A. Edison, of whom he has been an intimate friend for forty-one years and with whom he was associated in business for many years. Mr. Johnson was the first president of the Edison Electric Light Company, which was founded on Oct. 16, 1878, and at that time had offices at 65 Fifth Avenue, New York City.

MR. DAY BAKER, New England manager of the General Vehicle Company, Boston, Mass., is the proud recipient of a near-diploma from Thomas A. Edison, in the shape of a photograph of the king of inventors bearing the following handwritten inscription: "I want to commend the conscientious, intelligent efforts you are making, which are materially assisting in bringing about the day in which the electric vehicle in our cities will become more common than the horse." Mr. Baker was recently elected permanent chairman of the Boston Electric Vehicle Club, and is giving a great deal of time during the winter to lectures upon electric-vehicle transportation. Recent invitations have been accepted to address gatherings at the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers, at Brown University, Providence, R. I., Tufts College, Boston, and at the conventions of the National Foundrymen's and Metal Workers' associations. Much good is being accomplished in arousing popular interest in electric automobile commercial and pleasure vehicle equipment and service, and all makes of machines are treated impartially in the larger interests of the industry's growth. Many Boston church and society gatherings are displaying an interest in the campaign against the horse and gasoline car.

Trade Publications.

SIGN FLASHERS.—The Reynolds Electric Flasher Manufacturing Company, 617 West Jackson Boulevard, Chicago, has just issued Bulletin No. 17, describing thermotype flashers, and Bulletin No. 16, describing transformers. The thermotype flasher is used extensively in window signs or for small signs of every description, where one, two or three lamps are used. The transformers described are for use with the tungsten lamp.

CUTLER-HAMMER PUBLICATIONS.—The Cutler-Hammer Manufacturing Company, of Milwaukee, has just published a number of new bulletins. No. 10½ describes new multiple-switch starting rheostats made in standard sizes from 10 hp to 150 hp for 110-volt, 220-volt and 500 volt direct-current service. New types of switches are used on these starters. No. 18 describes squirrel-cage primary-resistance motor starters, made in capacities from 5 hp to 30 hp for 110-volt, 220-volt and 440 500-volt circuits. Bulletin 2145 describes a new multiple-switch starter which, in addition to no-voltage release, is equipped with two new-type single-pole overload circuit-breakers. A compound multiple-switch starter and speed regulator is described in Bulletin 2260. This is made in capacities from 10 hp to 200 hp and combines in one panel starting and regulating rheostats. The apparatus described in Bulletin 2270 is like that of Bulletin 2260, except that the main-line knife switch and fuses are mounted on the panel so as to facilitate installation. This is called a compound universal motor starter and speed regulator.

BUSINESS NOTES.

THE MUTUAL ELECTRIC & MACHINE COMPANY, Wheeling, W. Va., has just completed additions to its plant which will practically double its facilities. The office has been moved into the new building, and the address is now 59-16 Eighteenth Street.

PASS & SEYMOUR, Solvay, N. Y., have secured the services of Mr. C. C. Heeb, formerly Syracuse manager for the H. C. Roberts Electric Supply Company. Mr. Heeb will travel from the New York office, and will spend most of his time among his old friends in Pennsylvania.

PASS & SEYMOUR, SOLVAY, N. Y., will move their Chicago branch from its present quarters to 700 West Jackson Boulevard on December 1. This move is made necessary to obtain additional space to take care of increasing Western business. The new quarters will have some three times the space of the former location.

ENGINEERING BOOKS.—The book department of the Engineering News Publishing Company has been purchased by the McGraw-Hill Book Company, 239 West Thirty-ninth Street, New York. This adds to the list of the McGraw-Hill Book Company a number of important standard treatises, primarily in the field of civil engineering. The transfer of this business was made on Nov. 6.

HOSKINS MANUFACTURING COMPANY.—The Hoskins Manufacturing Company, of Detroit, manufacturer of electric furnaces, pyrometers and heating appliances, has opened an Eastern office at 30 Church Street (Room 1036, Hudson Terminal Building), New York City. Mr. E. L. Smalley, formerly factory superintendent for the Hoskins company, is in charge of the new office, with the title of Eastern representative.

ICE-MAKING PLANTS FOR CENTRAL STATIONS.—Among recent sales of ice-making plants to central stations by the York Manufacturing Company, York, Pa., are the following: 60-ton plant to Ware County Light & Power Company, Waycross, Ga.; 120-ton plant to Consolidated Ice & Power Company, Valdosta, Ga.; 40-ton high-pressure side and 15-ton freezing and distilling system to Point Pleasant Water & Light Company, Point Pleasant, W. Va.,; 40-ton plant to Colon Electric, Ice & Supply Company, Colon, Canal Zone.

KERR STEAM TURBINES.—The Kerr Turbine Company, Wellsville, N. Y., has in active service over 700 of its machines, aggregating more than 50,000 hp, and more unfilled orders are now booked than at any previous time in the history of the company. Although its plant has been materially enlarged, a night shift has been necessary for the past two and a half years. Among most recent orders for electrical service are two 75-kw and one 35-kw lighting set to the American Shipbuilding Company for the new steamer *City of Detroit*, and two 75-kw lighting sets for water-works service in the city of Chicago.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

American Institute of Electrical Engineers. Honorary secretary, Ralph W. Pope; acting secretary, F. L. Hutchinson. Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

American Electric Railway Accountants' Association. Secretary, H. [illegible] Weeks, Davenport, Ia.

American Electric Railway Engineering Association. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

American Electric Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

American Physical Society. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

Arkansas Association of Public Utility Operators. Secretary, W. J. Thorpe, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, James Farrington, Steubenville, Ohio.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 135 Adams St., Chicago.

Association of Railway Electrical Engineers. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Edison Illuminating Companies. Secretary, N. T. Wilcox, Lowell, Mass.

Colorado Electric Light, Power & Railway Association. Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Col.

Electric Club, Chicago. Secretary, N. E. Obright, 1500 American Trust Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electric Vehicle Association of America. Secretary, Harvey Robinson, 124 West 42d St., New York. Meetings, fourth Tuesday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

Indiana Electric Light Association. Secretary, J. V. Zartman, Indianapolis, Ind.

Internal Combustion Engine Association. Secretary, Chas, Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

Iowa Electrical Association. Secretary, A. W. Zahm, Mason City, Ia.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, [illegible], Ia.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan.

Louisiana Electrical Association. Secretary, W. H. Bower Spangenberg, 627 Poydras St., New Orleans, La. Meets third Monday of each month.

Maine Electrical Association. Secretary, Walter S. Hyman, Waterville, Maine.

Michigan Electrical Association. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electrical Association. Secretary, T. C. Gordon, Little Falls, Minn.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National District Heating Association. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual convention at Detroit, Mich., June 25-27, 1912.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

National Electric Light Association. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., June 9-15, 1912.

National Electric Light Association, Canadian Section. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

National Electric Light Association, Georgia Section. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

National Electric Light Association, Mississippi Section. Secretary, A. H. Jones, McComb City, Miss.

National Electric Light Association, Nebraska Section. Secretary-Treasurer, S. J. Bell, David City, Neb.

National Electric Light Association, New England Section. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

National Electric Light Association, Pennsylvania Section. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

National Electric Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago.

National Fire Protection Association. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

National Independent Telephone Association. Secretary, Joseph B. Ware, Grand Rapids, Mich.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New Orleans Electrical Contractors' Association. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

Order of Rejuvenated Sons of Jove. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill.

Pittsburgh Electric Booster Club. Recording Wattmeter, O. R. Bombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

Society for the Promotion of Engineering Education. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

Society of Wireless Telegraph Engineers. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

Southwestern Electrical & Gas Association. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

Street Railway Association of the State of New York. Secretary, C. G. Reel, Kingston, N. Y.

[illegible] den, Manchester, Vt.

[illegible] Secretary, W. S. Boyd, 135 Monroe St., Chicago, Ill. Next annual meeting Jan. 23-35, 1912.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago [illegible] Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 21, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,008,998. VAPOR ELECTRIC LAMP; P. H. Thomas, Montclair, N. J. App. filed Feb. 9, 1904. Mercury vaporization is retarded so as to prevent it from dominating a red-ray-producing gas.

1,009,025. CONTROLLING VAPOR ELECTRIC DEVICES; P. H. Thomas, Montclair, N. J. App. filed Feb. 9, 1904. A plurality of condensing chambers for the mercury for causing the circulation of a non condensable red-ray-producing gas.

1,009,035. INSULATING MATERIAL FOR EMBEDDING ELECTRICAL CONDUCTORS; L. E. Barringer, Schenectady, N. Y. App. filed Feb. 5, 1906. Composition of calcium hydrate, silica and asbestos, steam-hardened.

1,009,059. TROLLEY DEVICE; J. H. Finch, Jr., West Roxbury, Mass. App. filed Dec. 28, 1910. Cam-slotted support for the harp, to avoid "jumping."

1,009,061. APPARATUS FOR MERCURIAL DECOMPOSITION OF ALKALINE CHLORIDES; R. Frank, Grunewald, Germany. App. filed Jan. 30, 1911. Movable cathode type. Ribbed drums move the mercury over the bottom of the compartments.

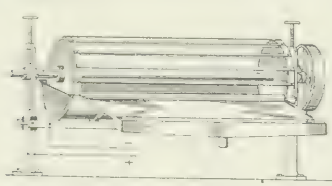
1,009,080. AUTOMATIC SWITCHING APPARATUS; F. B. McBerty, New Rochelle, N. Y. App. filed Sept. 11, 1908. Selector switch for automatic telephone exchange.

1,009,106. RECEIVING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Nov. 3, 1909. Selective and protective system for wireless telephony and telegraphy.

1,009,120. INCANDESCENT ELECTRIC-LAMP SOCKET; A. Weber, Schenectady, N. Y. App. filed Oct. 1, 1906. Two-part porcelain base and terminals for keyless sockets.

1,009,129. METALLIC-FILAMENT LAMP; O. Birnbaum, Vienna, Austria-Hungary. App. filed Nov. 8, 1910. The filaments are kinked and connected adjacent to the leading-in point to prevent overheating.

1,009,133. ELECTROLYTIC APPARATUS; H. Croston, New York, N. Y. App filed July 22, 1909. A scraper moves the mercury electrode; NaCl decomposition.



1,009,143.—Electrical Precipitator and Amalgamat[illegible]

1,009,143. ELECTRICAL PRECIPITATOR AND AMALGAMATOR; J. Frey, San Francisco, Cal. App. filed Nov. 18, 1910. A cylindrical cage anode is rotated in a trough [illegible] the mercury cathode [illegible]

1,009,162. SWITCH FOR SPARKING DEVICES; F. J. Marrington, Fort Dodge, Ia. App. filed March 6, 1909. For multiple-cylinder internal-combustion engines.

1,009,166. RAIL BOND; H. Milliken, New York, N. Y. App. filed Feb. 15, 1910. Vertically arranged looped strands of wire forming a thin, flat body.

1 [illegible] Petersen, Hartford, Conn. App. filed Feb. 1, 1911. Indicator, rotary wall type.

1,009,182. POLYSTATION LINE CIRCUIT; G. Ritter, Stuttgart, Germany. App. filed Feb. 12, 1910. Grounded two-wire circuit. Non-interfering party telephone or telegraph.

1,009,190. TELEPHONE TRUNKING SYSTEM; C. A. Simpson, Chicago, Ill. [illegible] Means for charging the storage battery of a private branch exchange over the two-wire trunk circuit.

1,009,229. MOTOR-STARTER SWITCH; W. S. Evans, Newark, N. J. App. filed Dec. 30, 1910. Automatic short-circuiting for three-phase induction motors.

[illegible] Philadelphia [illegible]

[illegible]

1,009,309. RAILWAY SIGNALING; L. F. Howard, Edgewood Park, Pa. App. filed Sept. 8, 1909. [illegible] of a polarized [illegible] is rotated by means controlled by the condition of a track section.

1,[illegible] matic regulation to [illegible] the lag in compensatory storage-battery systems of distribution.

1,009,311. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed [illegible] Regulation of alternating current systems having storage-battery compensatory influence.

1,009,317. DETECTOR FOR WIRELESS SIGNALING APPARATUS; M. B. Johnson, San Antonio, Tex. App. filed Oct. 6, 1910. Has a spring clip for holding a suitable mineral and an adjustable screw.

1,009,338. AUTOMATIC GAS-PRESSURE ALARM; E. R. Perkins, Cleveland, Ohio. App. filed Jan. 7, 1908. For gas furnaces.

1,009,345. ELECTROMAGNETIC SIGNALING INSTRUMENT; S. H. Sauvé, Denver, Col. App. filed June 18, 1910. A bell has a freely movable ball armature striker.

1,009,354. APPARATUS FOR HEATING WATER; A. Trepreau, Joinville-le-Pont, France. App. filed Feb. 18, 1911. A heating coil around a water coil in a casing.

1,009,357. COMBINED TROLLEY-POLE BASE AND CATCHER; H. E. Vail, Salt Lake City, Utah. App. filed Feb. 7, 1911. Has a lock to hold the pole in case of jumping.

1,009,370. AUTOMATIC ELECTRIC COUPLING MECHANISM; M. Wuerpel, St. Louis, Mo. App. filed April 17, 1907. For use with M. C. B. couplers or independently. (See Patent No. 827,988.)

1,009,386. EXPLOSION CIRCUIT-BREAKER; H. P. Davis and F. W. Harris, Wilkinsburg, Pa. App. filed Nov. 30, 1908. One terminal is a projectile adapted to be driven from a tubular terminal by explosion.

1,009,401. ELECTRICAL PULL SOCKET; E. H. Freeman, Trenton, N. J. App. filed June 2, 1911. Spring and block snap switch for incandescent lamps.

1,009,476. CIRCUIT CONTROLLER; J. P. Coleman and P. Utne, New York, N. Y. App. filed March 10, 1911. Automatically reversible motor drive, the controller drum being raised by two counterweights.

1,009,494. VAPOR RECTIFIER SYSTEM; S. Ferguson, Schenectady, N. Y. App. filed Sept. 25, 1905. Resistances and reactance connected in circuit to bridge the no-voltage interval.

1,009,518. MAGNET FRAME FOR MAGNETO-GENERATORS; G. Honold, Stuttgart, Germany. App. filed July 7, 1910. The pole pieces are held together by the frame without screws or pins.

1,009,549. ELECTRIC COOK STOVE; E. Moss, Kingsburg, Cal. App. filed Aug. 14, 1911. Separable heating and cooking chambers have vacuum walls.

1,009,559. FURNACE FOR TREATING SULPHIDES, PHOSPHIDES, ETC., IN ATMOSPHERES OF VARIOUS GASES; S. Peacock, Chicago, Ill. App. filed Sept. 19, 1910. Inclined rotary furnace body with a helical resistor.

1,009,565. INCANDESCENT-LAMP SOCKET; C. D. Platt, Bridgeport, Conn. App. filed Dec. 20, 1910. Pull switch with toothed contact carrier.

1,009,566. CHAIN GUIDE FOR PULL SOCKETS; C. D. Platt, Bridgeport, Conn. App. filed Dec. 23, 1910. One-piece sheet-metal guide and bracket.

1,009,608. ELECTRODE; E. Weintraub, Lynn, Mass. App. filed June 2, 1911. Flexible braided wire sheath filled with pieces of magnetite.

1,009,611. VALVE-OPERATED MECHANISM; G. J. Wittmann and P. E. King, Newburgh, N. Y. App. filed Sept. 27, 1909. An electric motor for opening and closing gate valves and limiting switches.

1,009,614. INCLOSED FUSE; G. Wright and F. H. Weston, Schenectady, N. Y. App. filed June 21, 1911. A tubular fusible member and connectors soldered at the ends.

1,009,625. ELECTRIC FURNACE; W. C. Arsem, Schenectady, N. Y. App. filed Aug. 18, 1909. A jacketed vacuum furnace with vaporizing and condensing chambers.

1,009,636. APPARATUS FOR USE IN THE DISTRIBUTION OF ELECTRIC CURRENTS; G. Berry, West Drayton, England. App. filed May 6, 1911. A main transformer and a spare transformer, with an auxiliary transformer connected in series with the latter, are connected in parallel across a system.

1,009,637. STREET-INDICATING DEVICE FOR TROLLEY SYSTEMS; W. C. Bisell. Wardner, Idaho. App. filed Feb. 19, 1910. Device on the wire to coact with the trolley pole to close a circuit.

1,009,643. SPARK-PLUG PROTECTOR; A. R. Bullock, Cleveland, Ohio. App. filed Feb. 29, 1908. A projecting skirt to keep out water.

1,009,648. ELECTRIC SWITCH; W. H. Chambers, Baltimore, Md. App. filed May 20, 1907. Pivoted blades with a reciprocating operating handle and toggle connections.

1,009,659. ELECTRICAL ATTACHMENT PLUG; W. C. Fellows, Philadelphia, Pa. App. filed Dec. 22, 1910. Two-part porcelain with split clamping bushing.

1,009,661. ALTERNATING-CURRENT MOTOR STARTER; W. H. Gaulke, Milwaukee, Wis. App. filed Oct. 19, 1910. Special form of holding lever [illegible] catch.

1,009,666. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Greenwich, Conn. App. filed Feb. 25, 1908. The booster field in a storage-battery compensating system is energized by alternating current.

1,009,689. TELEPHONE INSTALLATION; A. Pictet, Geneva, Switzerland. App. filed Sept. 9, 1911. An advertisement is automatically spoken over the line while the subscriber is waiting.

13,316. (Re-issue.) ELECTROLYTIC PROCESS OF PRODUCING COMPOUNDS; C. E. Acker, Ossining, N. Y. App. filed Sept. 14, 1911. Producing cyanides and cyanamides from NaCl, etc. Original [illegible]

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CONTENTS.

ELECTRICAL ENGINEERING STANDARDIZATION.

Our esteemed contemporary the London *Electrician,* in a recent editorial article on this subject, makes some interesting comments on the last edition of the A. I. E. E. standardization rules. Such comments have the particular value that pertains to long-distance perspective, since a colleague situated at a distance can often see either a situation or a discrepancy more clearly than one close at hand. It is earnestly to be hoped that, in all fundamental physical characteristics, the electrical engineering standardization rules of different countries may be brought into union by the work of the International Electrotechical Commission. It is manifestly incongruous and harmful to general engineering interests that the fundamental rules which specify the nature and behavior of electrical machinery should differ from country to country. On the other hand, there are certain conditions local to each country that are unfortunately not amenable to adjustment or alteration, such as standard frequencies of alternation. The standard frequencies in this country are 25 cycles and 60 cycles per second. It is regrettable that these are not in simple two-to-one relation, such as 25 and 50, or 30 and 60; but it would be apparently hopeless at the present time to change them, on account of the large amount of capital already invested in machinery and apparatus producing these frequencies. Even supposing, however, that this country is indefinitely committed to standard frequencies not in agreement with those of other lands, this consideration ought not to introduce any serious impediment to the development of uniform international standardization rules. One of the suggestions thrown out in the article referred to is in relation to photometric and electrical engineering notation. The three symbols *I*, *E* and *R* have, by a most fortunate series of events, been adopted internationally for Ohm's law by the action of the International Electrotechnical Commission. Unfortunately these three symbols are also recommended in the A. I. E. E. standardization rules for certain photometric quantities. The photometric notation is as yet in a very primitive stage, from the international point of view, and it is greatly to be desired that international action shall be taken with regard to it. We are happy to say that the Illuminating Engineering Society has recently taken measures with a view to an international conference at The Hague next year on the subject of standards, nomenclature and notation relating to photometry and illuminating engineering.

ELECTRICAL REDUCTION OF IRON.

In another column will be found an instructive report concerning a Swedish plant for the direct reduction of iron from its ores in the electrical furnace, which is strik-

[illegible] direct heating agent in large work. Electrical iron and steel making are by no means unfamiliar, but actual reports of tests, particularly in the direct reduction of iron ores, have been comparatively few. The plant here concerned at Trollhättan takes power from the Swedish government plant at 10,000 volts, three-phase, and employs in the furnace two-phase secondary currents derived from a pair of 1100-kva furnace transformers. Secondary voltages between 50 volts and 180 volts can be obtained and regulated during operation. The plant was established by the Swedish Association of Iron Masters and has been used in an experimental way on a considerable scale to find out the best working conditions, the stability of various electrodes and the general economic possibilities of the process. To this end electrodes of both German and Swedish makes were used, and twenty-nine different kinds of charge were run off, mostly from four varieties of ore. The general working of the apparatus appears to have been highly satisfactory, and the continuity of working has been very encouraging. In particular, the crucible in which the arcs are formed seems to have stood up to its work remarkably well. During nearly five months of continuous working only eighteen hours was taken out for crucible repairs. The electrodes, too, seem to have endured remarkably well. They are water-cooled as far as possible, and it is a fact worth noting that the heat lost in the cooling water amounted to nearly 7 per cent of the total load on the furnace, which would perhaps indicate that a careful balance should be struck between cost of electrode material and the power necessary to economize its use. The consumption of energy strikes one as considerable, amounting to nearly 2400 kw-hours per ton of iron reduced. At this rate approximately 3⅔ tons of iron would be produced per kw-year, which perhaps puts the matter in a more favorable light. Obviously, only very cheap power can profitably be utilized in the working of this interesting process, but given cheap power the possibility of producing a very high grade of iron by a direct electrical process with extremely small auxiliary fuel consumption is most important. It may be remarked that in Sweden and Norway twenty-four-hour electric power is sold as low as $5 per hp-year, and recently a figure as low as $3.50 has been reported.

A SEASONABLE REMINDER.

About this time, said the old almanacs, look out for snow. Similarly, this is the time of year when the underwriters and their electrical advisers issue a warning about the possible dangers from temporary electric wiring in window displays for the holiday season. These displays often include special electrical effects involving the use of both lamps and motors, together with Christmas trees and a liberal use of tinsel and cotton batting. Sometimes in the Christmas rush the special wiring is done hurriedly, and it is well to call attention to this possible danger now and to point out to all merchants and others in charge of Christmas displays that the special holiday wiring should be done by competent men. Sometimes the wires are carried over nails and there is some possibility that the insulation may be worn off, causing a spark, which, of course, the proximity of the highly inflammable material used in Christmas displays renders dangerous. Obviously, the use of electric lamps diminishes the fire hazard greatly, particularly in the case of Christmas trees, where miniature lamps are so often used in place of candles, with excellent results. Christmas trees lighted by candles, either in stores or in the home, are always dangerous, particularly after the trees get dried out in a warm room. But, even where electric lamps have replaced the dangerous candles, it is well to take all precautions. The holiday throngs in stores increase the danger of a possible panic from even a small fire, and it is to be remembered also that fire-insurance policies provide that if there is a material increase in the hazard, without permission, the insurance shall be void. Therefore, it is not amiss to utter a timely word of warning about possible dangers from careless wiring, or wiring done by incompetent persons, during the holiday rush.

SERIES INSTRUMENT TRANSFORMERS.

Although the fundamental equations for representing the performance of the several different types of stationary transformers are identical, yet certain factors that are relatively negligible in one type become of much importance in other types. Thus, in the shunt instrument transformer it is essential for the voltage ratio to remain closely constant, while the current ratio can be allowed to vary throughout a very wide range; in the series instrument transformer, on the other hand, the voltage ratio is of no immediate importance, but the current ratio must be maintained with the minimum of variation. For this reason the series and shunt instrument transformers differ radically in details of mechanical construction and are often treated as being essentially different in operating characteristics. Probably the most convenient method for representing the performance of either a shunt or a series instrument transformer is that involving the use of the equivalent one-to-one-ratio electric circuits for the actual primary and secondary electric circuits and the magnetic circuit of the apparatus. According to this plan, the primary circuit is connected directly in series with the secondary and load circuits, while in shunt with the latter two circuits is joined the magnetizing circuit, which is assumed to replace the magnetic circuit of the transformer. Obviously, to the extent that the magnetizing circuit current is negligible in comparison with the load current the ratio of primary to secondary currents will be equal to the inverse of the ratio of turns. To the extent that the primary and secondary circuits possess negligible impedance will the delivered emf bear to the impressed emf the direct ratio of turns. Operating requirements dictate small primary and secondary circuit impedances for shunt instrument transformers and large magnetizing circuit impedance for series instrument transformers.

To a predominating extent the characteristics of a series instrument transformer depend upon the magnetizing circuit. In view of the fact that the equivalent impedance of this circuit cannot be made infinite—that is, the admittance cannot be negligible—the transformer cannot possibly oper-

ate with a current ratio corresponding accurately to the inverse of the ratio of turns. However, the current ratio would remain constant under all operating conditions, even though the magnetizing circuit admittance were not negligible, if only this admittance remained constant. Constant magnetizing circuit admittance would mean constant permeability of the magnetic circuit and a core loss varying directly with the square of the magnetic density, neither of which conditions exists in nature. A complete analysis of the characteristics of a series transformer must therefore include a study of the variation in the permeability and core loss of the magnetic circuit throughout the operating range. Such a study is recorded in an article by Mr. Arthur P. Young which appears in this issue.

Of the uses to which a series instrument transformer is put the most usual is that of current transformer for ammeters. It is frequently used also to supply current to the series coils of a wattmeter or watt-hour meter. When used for this purpose the transformer must maintain not only a closely constant ratio of primary to secondary current, but the secondary current must be closely in time-phase opposition to the primary current. In determining the time-phase relations of the currents consideration must be given to the impedance of the secondary and load circuits, as well as to that of the magnetizing circuits. This fact is fully considered in the article by Mr. Young. Since it is physically impossible to construct a transformer with negligible magnetizing circuit admittance, and the secondary and load circuit impedance must have an appreciable value, it would seem that the series instrument transformer giving the most nearly perfect performance would be the one having an extremely high magnetizing circuit impedance of closely constant value and a secondary-load circuit impedance of low value, the reactive and resistance components of which bear to each other the exact ratio of the reactive and resistance components of the magnetizing circuit impedance. The time-phase displacement of the currents in such a transformer would always be zero, and the ratio of the current values would be constant, although not equal to the inverse ratio of turns—a defect of no importance whatsoever when the instruments are calibrated with the transformer with which they are to be used.

EXPERIMENTAL MEASUREMENTS OF STATIONARY ELECTRICAL WAVES ON PARALLEL WIRES.

It is well known that if we take a pair of parallel insulated overhead lines, such as might be used for a single-phase transmission circuit, and with their distant ends free we suddenly impress on the home ends any momentary electrical disturbance the disturbance transmits itself along the line at the speed of light. As soon as the disturbance, which might be a sudden charge, arrives at the distant free end of the line it is reflected back again toward the home end and continues to oscillate to and fro between the two ends of the line in much the same manner that a sudden mechanical disturbance communicated to one end of a long, horizontally stretched rope may be observed to run back and forth over the same. If the wires were devoid of resistance so that no energy was expended in heating them by the passage of current waves, such a system of electric oscillations might be expected to continue indefinitely. In any practical case, however, the electric oscillations so speedily subside that special means are required to reveal their existence. If the disturbance impressed on the home end of the line, instead of being a sudden electric shock, is a rapidly succeeding series of rhythmic, high-frequency impulses, then instead of a single wave of disturbance running to and fro over the line we obtain a train of waves so running. If the waves are still being shipped off at the home end when the head of the train returns from its first reflection at the far end, there will be a mingling or superposition of waves. In other words, the outgoing and returning waves will interfere. In general the interference will be irregular, so that the different sets of waves will cancel each other to a greater or less extent; but in the particular cases in which the returning waves happen to fall into step with the outgoing waves the blending leads to marked increase in the magnitude of the waves or there is a resonant building up of wave intensities. Moreover, the wave blending will be of such a nature that the resultant waves will not move. That is, the individual waves continue to run to and fro along the wires, but their mutual blendings in superposition result in stationary oscillations, which are, therefore, relatively easy to detect.

There are two ways in which such wave systems can be investigated experimentally. One is to employ actual transmission lines many miles in length, to impress moderate-frequency electric oscillations upon them at one end, and to measure with ammeters, voltmeters or oscillographs the resulting system of wave disturbance as the frequency is varied. This is essentially an engineering method. The second way is to employ in a laboratory a pair of thin parallel wires a few meters in length and to impress on one end of the line a very high-frequency disturbance in such a manner that with the aid of delicate galvanometers the resulting system of stationary waves can be measured as the length of line is varied. This is essentially a method of physical science. A research with the second method by Messrs. F. C. Blake and Charles Sheard has recently been published in the *Physical Review* under the title, "On the Free Vibrations of a Lecher System Using a Lecher Oscillator." The results show that if the ends of the line are open at the distant end stationary waves can be set up when the line length is one, two, three, four, five, etc., times the wave length of the impressed oscillation, corresponding to what may be considered by analogy to occur acoustically in an organ pipe with the distant end open. If, on the contrary, the distant ends of the wires are connected or their circuit closed, then stationary waves can be set up when the line length is one, three, five, seven, etc., times the wave length of the impressed oscillation, corresponding to the acoustic analogy of what occurs in an organ pipe with the distant end closed. There is thus a remarkable analogy between electric resonance over a pair of parallel wires and acoustic resonance in an organ pipe. Of course, the nature of the oscillation in the two cases is very different, the one being ethereal and electromagnetic, the other being gaseous and involving the motion of material particles.

Annual Meeting of A. S. M. E.

[illegible] of the [illegible] Society of Mechanical Engineers was held in the Engineering Societies Building, New York, Dec. 5 to 8 inclusive, the convention opening with a social session and reception Tuesday evening, when Dr. A. C. Humphreys was installed as president. His predecessor in office, Col. E. D. Meier, delivered his retiring address on "The Engineer in the Future," in which he declared engineering to be the profession of both the present and the time to come. The engineer, he added, is a devout believer in natural laws, needing no superior court to define them as "reasonable," for every infraction of such laws brings its punishment.

At the Wednesday afternoon session a report on "Tests of Large Boilers at the Detroit Edison Company," by Prof. D. S. Jacobus, was read by Mr. H. O. Pond, who was in immediate charge of the tests. These huge Stirling boilers, rated at 2365 hp on a basis of 10 sq. ft. of heating surface per hp, commonly supply steam outputs of 8000 kw, and have each furnished 11,000 kw for short periods. But even more notable than the great size of these double-fired units, which measure 26 ft. wide, 14 ft. deep and 29 ft. high, are the economies of performance which they show, having an over-all efficiency of 80 per cent at nominal rated loads, and decreasing to 76 per cent at 100 per cent overload. One of the boilers tested was equipped with Roney stokers, taking 1½ per cent of the steam generated for its jets and stoker engine. The Taylor underfeed stoker for the other boiler required about 3 per cent of the steam generated to drive the turbines of its draft blowers, returning its exhaust to the feed-water heaters. Professor Jacobus gave credit to Mr. Alex. Dow, general manager of the Detroit Edison Company, for the idea and installation of the huge boilers at Delray, the equipment being developed by the engineers of the Babcock & Wilcox Company and of Westinghouse, Church, Kerr & Company. In conclusion the writer remarked that he is engaged in developing a boiler to combine the performance of the Detroit units with those of the marine type, insuring sustained high efficiencies at outputs from 80 to 400 per cent of nominal rating.

In the discussion Mr. R. H. Rice pointed out the advantages of reduced labor cost, space and real estate with such large boilers, and the resulting improved simplicity of fire-room layout, although he added that the maintenance of brickwork remains a question. He also suggested arrangements for adding cold feed-water to shut off the steaming output of large units in emergencies. Mr. R. D. DeWolf presented a number of curves comparing superheater pressure drop, flue-gas temperatures, CO_2 content, etc., in the cases of the two different stokers tested. Mr. W. D. Ennis computed the economy of the Detroit units to be 1.9 lb. coal per kw-hour, tracing the high efficiency to reduced furnace radiation losses. Mr. B. C. Johnson said that these large boilers achieve 89 per cent of the theoretically possible 87 per cent thermal efficiency. Mr. H. H. Esselstyn, the consulting engineers' resident representative at the Detroit station, exhibited photographs and sketches of successful and abandoned furnace brickwork constructions. Prof. William Kent declared the present tests to show the highest efficiencies ever obtained with coal containing more than 25 per cent of volatile matter. Mr. R. G. Carpenter ascribed the high Detroit economies to close control of air supply, the excess oxygen being limited to the condition of maximum efficiency. Mr. E. D. Dreyfus compared gas-engine economies with the steam efficiencies of the Detroit units, obtaining about 23,000 heat units per kw-hour in each instance, although the turbine plant benefits from its greater reliability of operation. Mr. H. G. Stott warned against huge boilers as a panacea for boiler troubles. The large volatile content of the coal used, he said, specially suited the high combustion chambers of the Detroit boilers, but he asked why the tests were not carried beyond 214 per cent of normal rating, which is a very conservative loading in the light of present practice. Mr. Stott also pointed out that the fixed charges of investment are especially important at light loads, so that it may pay to lose efficiency at overloads if the fixed charges, which must be continuously carried, can thereby be reduced.

A paper on "Herringbone Gears" of the Wuest system was next presented by Mr. P. C. Day, Milwaukee, Wis., among the applications of such gears suggested being the turbine operation of low-speed, direct-current generators, marine propellers, steel-mill rolls, motor-operated pumps, etc., in addition to the use of magnifying ratios for driving electrical generators from low-speed waterwheels, etc.

Mr. James E. Howard next abstracted his paper on "Strain Measurements of Some Steam Boilers Under Hydrostatic Pressures."

A special parallel session was held Wednesday afternoon by members interested in cement-plant engineering. Mr. Frederick H. Lewis presented a paper on "Electrical Power in Cement Plants," in which he compared auxiliary and motor drive, concluding that the electric mill is advantageous in sizes above 2000 bbl.

Mr. J. D. Porter confirmed the advantages of electricity to cement manufacturers, enumerating arguments obtained from users of motor-driven plants, among which he mentioned economy, flexibility, fitness, accuracy of cost measurement, etc. With the exception of three, he said, the last twenty plants built have installed electric drive.

Letter Cablegrams.

To popularize transatlantic cable service for business and social messages the Western Union Telegraph Company makes the interesting announcement of the establishment of two new forms of cable service between the United States and England on Dec. 6. These two forms are known as cable letters and week-end letters. The former may be filed at any Western Union telegraph office to be forwarded to the cable offices at New York or Boston. Thence they will be cabled at the convenience of the company to reach London or Liverpool in time for delivery on the morning of the second day following receipt in New York or Boston. The tariff for cable letter is $1.50 for twenty words, with 30 cents for each additional five words.

Week-end letters may be filed up to midnight on Saturday for delivery in London or Liverpool on the following Tuesday morning. The rate is $1.50 for thirty words, with 25 cents for each additional five words. In each case these rates are for cable transmission only, although if desired messages will be mailed from cable offices to destination without extra cost. If telegraphed to or from cable offices, the regular land-service tolls will be added. Cable letters and week-end letters must be written in plain English words. In cable transmission address and signature words will be counted and charged for. Previous transatlantic cable rates have been 25 cents a word.

In addition a deferred-service cable rate of one-half existing full-price rates will be established on Jan. 1. These messages are liable to be deferred for a period not exceeding twenty-four hours.

Commencing on Dec. 15 deferred press dispatches in plain English for American papers will be accepted at the cable rate of 5 cents a word.

It is of interest to add that the first of the new cable letters was dispatched on Dec. 7 from the Postmaster-General of the United States to the Postmaster-General of Great Britain.

The Commercial Cable Company will meet the cut in rates in relation to deferred-service cablegrams and deferred press messages.

New York Jovian Luncheon Club.

New York City, although the most important electrical center of the country, has lagged behind other large cities in providing means for bringing electrical men together socially. This reproach has at last been removed, and last week the lead of Philadelphia, Chicago, Denver, Pittsburgh and other cities was followed in the establishment of a luncheon club in the metropolitan city by the Order of the Rejuvenated Sons of Jove. As is well known, this is a national organization of electrical men, which, though largely social, and at "rejuvenations" jovial, in character, has also a serious object, namely, to bring together electrical men for co-operation in advancing the commercial side of the electrical industry. The slogan of the organization is "All together, all the time, for everything electrical," and the vigorous work it is performing in binding together electrical men for co-operation in advancing the cause of electricity is admirable in every respect. The membership of the order now exceeds 5000, and there are branches in every section of the United States and Canada where there is any considerable electrical activity. Owing to the more serious purpose of the organization, all who are interested in advancing the electrical industry are eligible as members. The institution of luncheon clubs has been found to advance very highly the co-operative feature of the order, through bringing men together under favorable conditions for the exchange of information for their mutual benefit and for the advancement of electrical interests in general.

The movement toward the formation in New York City of a Jovian Luncheon Club was brought to a favorable conclusion under the leadership of Mr. G. E. Watts, statesman for New York, and Mr. George W. Elliott, statesman at large, with the assistance of Mr. J. B. Olsen, Mr. B. M. Downs and other local members of the order. At the first luncheon, held Nov. 29, there was a most gratifying attendance, the total being 104; and the interest and enthusiasm manifested on that occasion clearly indicated not only the need of such a social center as the club will afford, but the warm spirit with which it will be supported.

Mr. Watts presided, and at the close of the luncheon in well-chosen words informed those present of the plans that had been matured, and asked the hearty co-operation of all members of the order in making the semi-monthly meetings at luncheon a means for the reunion of all men in New York City and vicinity having the interest of the electrical industry at heart. He pointed out how the opportunity thus afforded would, aside from its social features, conduce to the advancement of the cause of electricity by promoting the spirit of co-operation which today is characteristic of all successful industrial advancement. He stated that at each luncheon a short talk would be given by a man of prominence in public life or in the national or local commercial or industrial field. As the luncheons will end promptly at 2 p. m. their attendance will not result in any material inconvenience to busy members.

Mr. Washington Devereux, statesman for Pennsylvania, was the guest of honor and gave an interesting talk on "Jovian Luncheon Clubs," during which he described the methods which had made the Philadelphia club the leading one of the order, and dwelt upon the great benefit it had conferred on the electrical fraternity of the Quaker City. Formerly there was very little acquaintance between electrical men of that city, and those engaged in the same line of work were inclined to take opposite sides of the street in order to avoid each other. That condition, Mr. Devereux said, had absolutely changed since the formation of the club. Meetings at luncheons established human relations which mitigated the effects of competition between those engaged in the same line of work and induced a hearty spirit of co-operation in the general advancement of the electrical trade. The address of Mr. Devereux was in true Jovian vein and was enthusiastically received.

Work of the Commercial Section of the N. E. L. A.

A permanent office for the Commercial Section of the National Electric Light Association has been opened in the Engineering Societies Building, New York City, by Mr. Philip S. Dodd, secretary of the section. The general offices of the association are also in this building. A meeting of the executive committee of the section will be held in the new office Dec. 9, and the tentative program of the year's work outlined at the previous meeting in Chicago will be discussed and details will be settled definitely.

The Commercial Section is doing a work of increasing practical importance. Its membership is well on to 1000. At the New York N. E. L. A. convention last June the reports of the various committees embraced a collection of valuable data. The two booklets of the section—one on "Data on Electric Signs," prepared by the sign committee, and the other on "The Electrical Equipment of the Home," prepared by the wiring committee—already have demonstrated usefulness by the fact that they have attained a combined circulation of over 65,000 copies.

Final committee appointments have been made. At least three of the committees will prepare publications, to be available to members for general distribution probably before the date of the coming Seattle convention. These reports are intended to demonstrate the possibilities of electric service and to stimulate interest in the varied uses of electrical energy. Definitely classified information will be given on such subjects as street lighting, industrial lighting, residence lighting and domestic heating and cooking appliances.

Perhaps the most vital feature of the work planned for the coming year will be the compilation of a "cumulative commercial index," in which it is hoped to give in a readily accessible form all classes of information useful to the commercial men of the electrical industry. This index will consist of a digest of commercial articles that have appeared in the technical press for a period of perhaps five years past. It will also include papers read before societies on subjects having a commercial bearing. Further, there will be chapters devoted to electrically operated devices, with descriptions of such devices, as well as price lists and other information of this character. Questions relating to public policy and the mutual relations of operating companies, contractors, jobbers and consumers will also form a feature of this work.

It is proposed to establish an advertising exchange for all members, which will concentrate in the central office in New York examples of all classes of advertising devoted to the sale of electricity and electrical devices. Other features of the work of the section are in prospect, and, taken in all its aspects, the comparatively new Commercial Section promises to become a vital factor in the commercial development of the electrical industry as a whole. Its work should have a direct bearing on the success of operating companies, manufacturers and jobbers.

Following is a list of the names of the chairmen and secretaries of the various section committees: Commercial development of the electrical industry, Mr. W. W. Freeman, Edison Electric Illuminating Company of Brooklyn, chairman; cost of commercial department work, Mr. E. L. Callahan, H. M. Byllesby & Company, Chicago, chairman, and Mr. J. G. Learned, Public Service Company of Northern Illinois, Chicago, secretary; competitive illuminants, Mr. F. H. Golding, Rockford Electric Company, Rockford, Ill., chairman, and Mr. Ward Harrison, Cleveland, secretary; steam heating, Mr. S. M. Bushnell, Illinois Maintenance Company, Chicago, Ill., chairman, and Mr. Thomas Donahue, Merchants' Electric Light Association, Lafayette, Ind., secretary; selling electricity to large power users, Mr. Joseph Lukes, Truckee River General Electric Company, Reno, Nev., chairman, and Mr. Stanley Walton, Pacific Gas & Electric Company, San Francisco, Cal., sec-

retary; residence business, Mr. J. F. Becker, United Electric Light & Power Company, New York City, chairman, and Mr. H. H. Boynton, Cleveland, secretary; industrial and commercial lighting, Mr. E. H. Beil, Youngstown Consolidated Gas & Electric Company, Youngstown, Ohio, chairman, and Mr. F. B. Rae, Jr., New York, secretary; commercial electric refrigeration and ventilation, Mr. J. W. Meyers, 1000 Chestnut Street, Philadelphia, chairman; electric advertising and decorative street lighting, Mr. W. H. Hodge, H. M. Byllesby & Company, Chicago, chairman, and Mr. Claude Bender, Cleveland, secretary; contract order routine, Mr. T. I. Jones, Edison Electric Illuminating Company of Brooklyn, chairman, and Mr. M. S. Seelman, Edison Electric Illuminating Company of Brooklyn, secretary; membership, Mr. George Williams, 60 Wall Street, New York City, chairman, and Mr. W. W. Dodd, Cleveland, secretary; electric vehicles, Mr. L. R. Wallis, 39 Royalston Street, Boston, chairman, and Mr. P. D. Wagoner, Long Island City, N. Y., secretary; commercial index, Mr. E. L. Callahan, H. M. Byllesby & Company, Chicago, chairman.

Electric Vehicle in Boston.

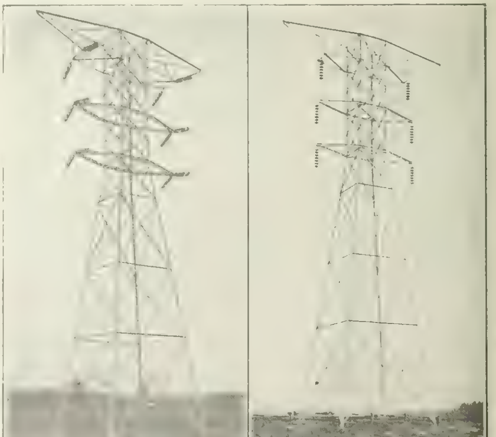
At a meeting of the Boston Electric Vehicle Club held on Dec. 6 the discussion was largely devoted to publicity methods, in view of the maturing of plans for newspaper campaigning in 1912. It was announced that about $3,600 had already been secured, on the desired basis of $100 per month per vehicle dealer represented at Boston, for pushing the advertising work of the coming year. The dealers are enthusiastic as to the results already attained and as to future possibilities. Besides its newspaper advertising, the club is working in various other ways to stimulate the trade and educate the public as to the vast strides of the industry in recent years. Its plans for a great display at the Boston 1912 Electric Show are arousing popular interest as never before. Special emphasis was laid upon the necessity of appropriations along the above lines to enable the seed sown to be harvested in the form of a great tide of popular interest and patronage in the coming months.

Mr. Frank J. Stone, Boston, suggested the operation of an educational lantern-slide exhibit in the streets with an electric vehicle as the stage, the use of telling headlight effects, and the installation of stencil projecting lamps on the vehicles which would throw the words "Electric Vehicle" upon the sidewalk whenever a truck or pleasure car approached the curb. In view of its trifling cost and effectiveness, the latter suggestion was received with much enthusiasm. A representative of the *Electrical World* called attention to the value of the automatic motor-driven stereopticon, as illustrated in the interurban station of the Pacific Electric Railway Company in Los Angeles, where the scenic attractions of the mountain and beach country reached by the lines are displayed consecutively for hours to persons in the waiting-room without any expense for attendance. Mr. C. F. Smith, of the Boston Edison company, mentioned the value of an electric emergency truck as a helper of teamsters on slippery pavements. Mr. E. S. Mansfield touched upon the great advertising value of such service. Mr. Tiffany, Boston, outlined the electric ambulance service now maintained by the Massachusetts Society for the Prevention of Cruelty to Animals. It was hinted that large applications of the electric vehicle in New England fire-department service are probable in the near future, members of the club who have seen the pioneer work at Springfield, Mass., speaking most enthusiastically of the results of operation in that city. Brief remarks were also made by Messrs. Thomas Glenn, La Rue Vredenburgh, C. R. Erkman and Welles E. Holmes.

It was announced in closing that at the meeting of the New England Section of the Electric Vehicle Association of America to be held at the Lynn works of the General Electric Company on Dec. 14 Mr. H. S. Baldwin, head of the department of small motor manufacturing, would read a paper contrasting vehicle motors of ten years ago with present products. The announcement was also made that Prof. Elihu Thomson would address the meeting on vehicle motive power, as originally planned. At the last meeting of the club it was voted that members would go from Boston to the meeting exclusively in electric machines.

New 100,000-Volt Line Placed in Operation Between Shawinigan Falls and Montreal.

The new line of the Shawinigan Water & Power Company between its new hydroelectric station at Shawinigan Falls and its new terminal station at Maisonneuve, on the outskirts of Montreal, has recently been placed in operation. The development has been carried on with remarkable dispatch under the supervision of the company's own staff, headed by Mr. Julian C. Smith, general superintendent and chief engineer. The head works for the new station were begun in May, 1910, and the power-house cofferdam in September of that year. The work was carried on incessantly and concrete was set with the thermometer registering 20 deg. below zero. The work on the transmission line began last May, and the line was operated at 50,000 volts in October. In November transmission at 100,000 volts began,



Strain Tower and Intermediate Tower on the Shawinigan Falls Line.

and on Nov. 14 one of the 12,500-kva, three-phase transformers in the terminal station was carrying full load.

The new power house at Shawinigan Falls is designed on the unit system, as is also the terminal station at Maisonneuve. The hydroelectric station will house three units, two of which are at present installed. The wheels, which were built by the I. P. Morris Company, Philadelphia, are of the twin spiral-case type, rated at 20,000 hp under a 145-ft. head. They operate at 225 r.p.m. and drive 14,000-kva, 6600-volt, three-phase, 60-cycle alternators built by the Canadian Westinghouse Company. The energy passes to a 14,000-kva, three-phase transformer built by the General Electric Company, which steps up the potential from 6600 volts to 100,000 volts.

The transmission line is about 85 miles, and for a distance

of about 60 miles parallels the tracks of the Canadian Pacific Railway on a 100-ft. private right-of-way. The line is approximately 10 miles distant from the company's other lines running to Montreal. The types of steel towers employed are shown in the accompanying engraving and were designed by the company's engineering staff. They are 70 ft. high and have a 20-ft. base. They carry six 250,000-circ. mil aluminum cables and two ⅜-in. steel cables as ground wires. The towers are spaced 520 ft. apart, and every eleventh tower is a strain tower. Strain towers are also provided at all angles. Electrolytic lightning arresters of the General Electric type are installed at both ends of the lines. At the Ottawa River there are two long spans of 1300 ft., with special towers on each bank.

The new substation at Maisonneuve is a short distance from the old terminal station in the same town. The dominating idea of the design has been to make each unit from the water to the terminal station at Montreal complete in itself. Thus there is a single wheel driving a single alternator connected to a single three-phase transformer feeding a single transmission line which supplies energy to a single step-down transformer at the other end. Provision is made for three units in the terminal station just as there will be three units in the generating station with a two-circuit transmission line. The terminal station can be extended if need be without disturbing the arrangement or interfering with operation by simply adding new sections to one end of the structure. The switching apparatus and control in the terminal station is of Canadian Westinghouse manufacture, and the transformers are of General Electric make. Since the station was placed in operation the company has been more than pleased with the results. The older transmission lines of the company operate at 50,000 volts.

Turin International Electrical Congress.

Electric Light, Heat and Traction.

In Section IV of the Turin International Electrical Congress papers on electric light and heat were presented, and in Section V papers on electric traction. Abstracts of these papers follow:

ELECTRIC HEATING.

Mr. C. A. Rossander presented a very comprehensive report on the present state of the art of electric heating and its future development. Beginning with a short résumé of the various methods of transforming electrical energy into heat, he promptly excludes those industrial operations where electric heating is used for producing very high temperatures and proceeds with a description of the various fundamental types of construction used in the manufacture of commercial heating apparatus where moderate temperatures and relatively small quantities of energy are dealt with.

Leaving the question of design, he treats of the applications of electric heat, commencing with electric cooking. Actual figures are given of the amount of energy in kilowatt-hours necessary to cook different kinds of food. The average figure for meat is given as 0.4 kw-hour or 0.5 kw-hour per kilogram.

Comparing an illuminating-gas stove with an electric stove on the basis of equal heating value, 1 kw-hour of electric energy is equivalent to 0.415 cu. m of gas. However, on account of the more perfect regulation possible with electricity, this figure was said to be somewhat low, and after giving similar figures from different sources the author concludes that 1 kw-hour of electric energy should be considered as equivalent to not less than 0.5 cu. m and not more than 1 cu. m of illuminating gas.

In discussing the inherently unfavorable characteristics of a cooking load and the methods of minimizing them so as to reduce the cost of energy supply for this purpose, mention is made of the long-hour heating apparatus used in Hartford, Conn., which was described in the *Electrical World*, Vol. 57, page 45.

Electricity offers many practical advantages over coal or wood in heating large ovens for baking on a commercial scale. Professor Eckstrom in Sweden has made experiments in this direction and has found that the best results are attained by heating the oven to a given temperature and then cutting off the current and letting the oven gradually cool off, the temperature being so chosen that the bread will just be done when the oven has cooled off. The heating of water does not offer a very attractive field from the economical point of view except where cheap energy is available.

In speaking of various other domestic uses of electric heat, the author mentions a laundry near Paris where the proprietor was willing to pay three times as much for electric heat as for coal heat.

Dr. Epström has made some interesting tests on electric house heating near Stockholm, where the average yearly temperature is + 6 deg. C. By using a thermostat for close control of the temperature to correspond with the momentary needs of the room it was found that in this particular case, with coke at $6.84 per ton and utilized in a hot-water-heating system, one could pay as high as 6.95 cents per kw-hour for electric energy.

In Sweden, where most electric energy is derived from water-power and sold at a price based on a fixed charge for a given demand and a very small consumption charge, there is a great field for heating during hours of light load, and to meet these conditions of operation various methods have been evolved for storing heat in masses of high heat capacity to be given off during the period of maximum load when the heating circuits are disconnected. Electric heat for holding boilers at boiling temperature is perfectly feasible in stations where a steam relay is operated in connection with a water-power.

Much has been done to perfect heating appliances and to devise ways and means of placing electric heating on an economical basis, but there is yet much to be done and the future for electric heating on a very large scale certainly looks bright.

The report was discussed by Messrs. Mengarini, Danioni and others.

INTERNATIONAL OUTLOOK IN SCIENTIFIC ILLUMINATION.

Mr. Leon Gaster presented a brief summary of a few of the most important problems in illuminating engineering which are now the subject of international discussion. He claimed that some generally accepted method should be adopted for comparing the color and daylight qualities of illuminants. It is also desirable that a definite and authoritative ruling be laid down regarding the amount of illumination demanded by different classes of work. It is desirable to adopt a truly international unit of candle-power, in order to avoid the confusion which exists at present by reason of the use of the hefner candle in addition to the so-called international candle. There should be international uniformity in methods of expressing and testing candle-power, in the measurement of illumination, in the units and nomenclature of illumination and in the designation of surface brightness and intrinsic brilliancy.

The author suggested that there should now be formed a truly international committee on which different systems of lighting should be adequately represented and in which representatives of bodies interested should also take part. This central committee might be aided in this work by sub-committees in various countries and would then be in a position to take up different points in an authoritative and permanent manner. The international photometric commission might well become the center of such a committee and

would co-operate with the Illuminating Engineering Society. It is desirable that the different commissions and bodies interested in illumination, which have heretofore worked on separate lines, should be brought into contact, with a view to concerted action. In this way uniformity in methods would be secured, and the results of researches in different countries would be rendered comparable with one another. The subject of illumination is assuming a prominent position in the field of industrial hygiene. Methods of lighting have a direct bearing not only on the eye, but also upon the general health, and the conditions of illumination have also an important bearing on the quality and output of work in factories. What is now needed is to determine the correct amount of illumination for various purposes, so that some tentative standard of good illumination may be arrived at and the study of illumination placed on a more scientific basis.

ELECTRIC PROPULSION OF SUBMARINES.

Present development in submarine navigation is due largely to the favorable characteristics of electric propulsion. Mr. Agostino Bezzi in a paper on the subject of electric propulsion briefly outlined some of the difficulties encountered, described ways and means that have been employed to overcome them and pointed out the most likely lines of improvement in the near future.

The battery question is of the greatest importance. This service requires batteries that take up the least space and possess the least weight per unit of energy that can be derived from them. Cost is a secondary consideration and energy efficiency is of little consequence.

A brief comparative study on various types of lead batteries and nickel-iron-alkaline batteries showed the latter to be far superior with regard to weight and volume per unit of energy and to be cheaper in first cost per unit of energy delivered during their useful life. In the application of batteries on submarines the matters of insulation and ventilation are of the greatest importance. It is desirable to use a high emf so as to reduce the size and weight of the electric equipment, but the atmospheric conditions are such as to make the insulation for voltages above 220 very difficult and for those above 440 quite impracticable. The ventilation requires the provision of a special plant for exhausting the gases, and this system still further complicates the problem of insulation due to condensation of sulphuric acid in the ventilation ducts and hoods. The alkaline battery offers much greater difficulties in this respect than does the lead battery. First of all, it requires more ventilation and, secondly, the ventilating system becomes entirely covered with a coating of carbonates, which are good conductors and thus render the insulation of the batteries extremely difficult. No satisfactory solution of this problem has yet been developed.

Naturally all motors are direct-current, and since the resistance of the propeller increases with the speed the shunt winding is always used and occasionally a compound winding is also used.

Rheostatic speed control is limited in range and inefficient, and regulation by varying the field strength, while good in efficiency, is too limited in its range of variation. The most successful methods of control employ two motors or a double-winding motor, the adjustment of speed being accomplished by a combination of field regulation and series-parallel control.

The efficiency of the motor equipment is of the greatest importance, since it has a direct bearing on the radius of operation of the submarine. It also is necessary to avoid excessive room temperatures due to heating of the motors. Artificial ventilation of the motors is very desirable, but exceedingly difficult of practical accomplishment. Air ventilation is too inefficient. The Siemens-Schuckert company has built a successful water-cooled motor.

The paper was dis[illegible]

HEAVY ELECTRIC TRACTION.

An analysis of single-phase and three-phase systems with a view to their application to heavy railroading was made by Mr. Giorgio Calzolari.

By way of introduction he summarized expert opinion on this subject by briefly reviewing the conclusions arrived at by the various commissions that have been appointed to investigate and study the subject. The preference of the various countries for one system or another as reflected in their present activities was then taken up and brief descriptions of electric-traction systems under construction in the various countries were given. This review seems to place Germany, Sweden and Austria on one side as favoring single-phase traction for general adoption in heavy railroad work, while Russia, France and Italy are opposed to standardization of any electric system at the present time and seem, if anything, to favor the three-phase system.

In studying the characteristics of the two systems the problem was divided into two parts, namely:

(1) The requirements of railway operation, viz.: (a) Sufficient starting and running torque; (b) ability to maintain schedule time; (c) multiple operation of motor cars or locomotives.

(2) Economy of operation in the following respects: (a) First cost of motive power plant; (b) simplicity and durability of the distribution system; (c) simplicity and durability of the electric equipment; (d) ratio of weight of motor equipment to torque and power; (e) energy consumption at locomotive and at power plant per ton-kilometer; (f) instantaneous power demands; (g) maintenance expense.

Both single-phase and three-phase motors are able to develop sufficient torque and power for heavy railroad work.

In regard to schedule speed the author looks upon the constant-speed characteristic of the three-phase motor as an advantage, and in comparing the induction motor equipped for either cascade or variable-pole operation with the single-phase commutator motor he is of the opinion that because of the variation of power-factor with speed the single-phase motor is more limited in its running speed than is the three-phase motor.

Multiple operation offers no difficulties with single-phase motors. It has been the general belief that because of their constant speed induction motors could not be operated in multiple on the same train without serious disturbances. However, actual experience has shown that no serious difficulty is experienced when two locomotives are attached to the same train even though one has new and the other old tires.

The question of first cost depends so extensively upon local conditions that it is difficult to show where either one of the systems has an advantage over the other in this respect.

The single-phase distribution system is clearly the simplest, and yet because of the extremely high tension on the working conductor the three-phase system with a much lower working emf has a greater factor of safety. As regards the motor equipment, the induction motor is simpler and more robust than the commutator motor, but both have a very short air-gap. Furthermore, the single-phase motor equipment weighs about 40 per cent more than a three-phase equipment for the same service, and because of this difference in weight the energy consumption per ton-kilometer is slightly in favor of the three-phase equipment, and if the three-phase system is operated with regenerative control the energy consumption at the power house is still further reduced. Regenerative control with single-phase motors is now being tried out on the Midi line in the French Pyrenees.

The three-phase system has an important advantage over the single-phase system in that it permits the running trains to feed energy back to a starting train, thus relieving the power house of excessive demands. The author estimates

that by suitable adjustment of the speed regulators the momentary demands on the power house of a three-phase system can be reduced by more than 30 per cent.

On the score of general maintenance the two systems are considered to be about equal. Summing up, the author thinks that the 10,000-volt, 15-cycle to 25-cycle, single-phase system is best adapted to long lines of moderate traffic and especially in cases where hydroelectric energy is developed exclusively for traction purposes, while the 3000-volt, 15-cycle, three-phase system is best adapted to lines carrying heavy traffic, and especially where there are heavy grades and long runs.

At the end of the paper the author gives a detailed description of the electrification of the Giovi lines with three-phase equipment.

The paper was discussed by Messrs. de Kando, Vallauri, Donati, Koronzai, Assadtchy, Mailloux, Eichel, Vicini, l'Hoest, Beckmann and Behn-Eschenburg.

SINGLE-PHASE TRACTION MOTORS.

A monograph on single-phase traction motors was presented by Dr. W. Kummer. Beginning with a statement that practically all electrical manufacturers who had earnestly studied the subject had adopted the single-phase system for heavy railroad work and that the motors now in use could be divided into three classes, namely: series, repulsion and repulsion with armature excitation, he then proceeded to give some of the mechanical characteristics of these motors.

Experience with steam traction has taught railroad engineers to require a driving motor that can develop a variety of torques at a given speed so as to be able to maintain the operating schedule; also one that can develop large torques at low speeds and two torques at high speeds so as to secure good economy of energy in starting and in operation over a road having grades.

These characteristics are fulfilled to a marked degree by all the single-phase motors, and in addition to this they may be arranged for regenerative control, an actual installation being under construction now in one of the lines of the Chemins de Fer du Midi, France. However, although regenerative control introduces certain complications in the equipment, it is quite feasible to utilize the motors for transforming the energy of retardation into electric energy which can be dissipated in a rheostat. This system is in use on the Valle-Maggia road. Following these general characteristics, the author took up in detail the relations between the motor torque and some of the principal dimensions. Using the following symbols, he gave formulas for the interrelations of the various quantities as represented by modern practice:

Normal motor torque in meter-kilograms	$= D$
Rotor diameter	$= D_a$
Gear ratio	$= U$
Drawbar pull per driving axle in kilograms	$= Z$
Diameter of the driving wheel	$= D_r$
Speed in kilometers per hour	$= V$

$D_a = 2.42 \times \sqrt{D}$, for gearless motors.

$D_a = 3.30 \times \sqrt{D}$, for geared motors.

Assuming one motor for each driving axle:

$$\left.\begin{aligned} Z &= 82.4 \frac{D_a}{D_r} \times \sqrt{D} \\ V &= 67.9 \frac{D_r}{D_a} \end{aligned}\right\} \text{ for gearless motors.}$$

$$\left.\begin{aligned} Z &= 30.3\, U \times \sqrt{D} \\ V &= 135.8 \frac{1}{U} \end{aligned}\right\} \text{ for geared motors.}$$

$\left.\frac{D_r}{D_a}\right\}$ being assumed as 0.5 for geared motors.

With reference to weights and torque, denoting:

Car weight in kilogram	$= G$
Car torque in motor-kilograms	$= D_t$
Adhesion weight in kilograms	$= G_a$
Adhesion coefficient	$= \mu$
Diameter of drives	$= D_r$

Thus

$$\frac{G}{D_t} > \frac{G}{G_a} \cdot \frac{1}{\mu} \cdot \frac{2}{D_r}$$

which for single-phase motors was about

$$\frac{G}{D_t} = 11 \text{ to } 13.$$

WORKING CONDUCTORS FOR ELECTRIC RAILROADS.

Mr. Gustave l'Hoest submitted a report on present methods of constructing working conductors for heavy electric traction, describing briefly the fundamental types of third-rail and the latest catenary constructions used on the high-tension single-phase and three-phase roads in Europe.

In conclusion he stated that the third-rail can be advantageously employed for direct-current traction where there are not too many switches and crossings. Its use is especially desirable in and around cities, where the unsightliness of the overhead construction is objectionable, and also on account of its non-interference with the clear view of signals.

On the other hand, high-tension systems are limited entirely to overhead distribution. With present-day methods no especial difficulty is encountered in handling emfs as high as can be utilized, and this with little or no fear of danger due to mechanical failure of any part of the line. However, the author notes a tendency on the part of some constructors to relax and take chances by employing a lower factor of safety.

HIGH-TENSION, DIRECT-CURRENT TRACTION.

In a paper entitled "Notes on High-Tension, Direct-Current Traction" Mr. Guglielmo Gyáros showed how, thanks to the commutating pole, the direct-current system has taken a new lease of life and will in all probability become the standard system for interurban and suburban lines.

The commutating pole has greatly increased the possibilities of commutation, and the high-tension motors equipped with these poles possess much better commutating qualities than do the ordinary low-tension motors. Experience has shown that high-tension motor brushes have an average life of between 200,000 and 1,500,000 motor-kilometers and that the motors will stand a momentary overload of 100 per cent without flashing over. The ordinary motor will flash over with an overload of 50 per cent.

As an example of the comparative cost of maintenance of single-phase and high-tension direct-current systems the author gave figures taken from the results obtained by the Washington, Baltimore & Annapolis Railway which were published in the *Electric Railway Journal*. It was the author's opinion that the single-phase system could compete with the high-tension direct-current system only when very high tensions were used on the working conductor. For example, he considered that on the basis of equal economy a 1000-volt direct-current system was equivalent to a 5000-volt or 3000-volt alternating-current system and that a 2500-volt or 3000-volt direct-current system was equivalent to a 15,000-volt alternating-current system.

There are now either in operation or under construction five important high-tension, direct-current lines in Hungary, and the author gave data regarding each one. These systems use the pantograph trolley with an aluminum contact bow. When used on catenary construction these bows have an average life of about 20,000 car-kilometers, but in ordinary trolley construction their life is much shorter.

Los Angeles Electrical Show.

The first electrical show to be held in Los Angeles, Cal., was opened on the evening of Nov. 25, and will be closed on Dec. 9, being open during that period, including Sundays, from 2 to 11 p.m. The show is in the Shrine Auditorium, which offers a floor space, including balcony, of close to 50,000 sq. ft. Both floors are completely taken up by the exhibitors, of which there are about fifty, representing all sections of the country. To interest the general public in the exposition, extensive advertising and display work was carried on for some weeks previous to the show in Central California, Nevada and Arizona, and special round-trip rates were offered by the railroads from these and other distant points. The Los Angeles Railway Company operates cars on a special schedule direct to the auditorium during the early portion of each evening. Considering that but five days was allowed the management and exhibitors to arrange the display before the opening night, owing to another attraction occupying the hall, much credit is due for the excellent showing made.

[illegible] DECORATION

The general design of decoration and lighting is pleasing and attractive, without any great spectacular effect. The arrangement is uniform with diversified features here and there among the different booths. The time of year being characterized by the Christmas spirit, the scheme of decoration anticipates to some extent the Yuletide period in the use of miniature Christmas trees, foliage and the like, all, of course, being in conformity with the lighting features.

The iron roof trusses are draped along the bottom chord with strings of evergreen. Along this trimming, at intervals of about 5 ft., 16-cp lamps of corresponding green color are hung. Inclusive of twenty-eight crystal chandeliers, each having ten lights, 2500 lamps, of the capacity noted, are installed. In addition the general lighting is augmented by seventy-two arc lamps.

The booths are arranged at all four sides of the hall, with a double line of booths through the central portion of the main floor. These latter are divided by a 12-ft. center aisle. The front framework of the booths is of arch construction, with columns at intervals of approximately 10 ft., surmounted with lamps inclosed in white frosted globes. The booth framing is in white, with the name of the respective exhibitor stamped on the arch in blue and gold. The lighting for this decoration aggregates 50 500-watt, 50 250-watt and 170 100-watt lamps. The accompanying photograph, taken at the opening of the show, gives an idea of the illuminating features and general arrangement.

Many of the exhibitors displayed individual electric name and specialty signs, and added to the decoration of their sections small incandescent lamps strung along the struts and braces between the columns.

SPECIAL FEATURES.

The companies represented offered varied features to interest the general public and the student in electrical work, as well as the user of electric motors, the central-station man and the electrical constructor. For the former the application of electric energy to various forms of household appliances for reducing labor to a minimum, such as washing machines, electric irons, cooking appurtenances and the like, was attractively shown and demonstrated. The part that electric energy takes in the manufacture of food products and wearing apparel was also exemplified.

General View of Los Angeles Electrical Show.

Among the individual exhibitors guessing contests were inaugurated, prizes of electric household utensils and similar specialties being offered to the successful contestants. The management offered cash prizes to the school children of Southern California for the best work executed and exhibited in plans and general drawings. Local orphan asylums were invited to send the children, gratis, and two special days were set apart to allow all school children, regardless of age, to visit the show at one-half the regular entrance fee. Dec. 1 was given over to the students of Throop Polytechnic Institute, Pasadena, and all the pupils of the Pasadena schools. Dec. 4 was devoted to the Merchants & Manufacturers' Association

of Los Angeles. During the hours of the show musical concerts are given by the Catalina Band, one of the best organizations of its kind in southern California.

The show is given upon a co-operative profit-sharing basis. The net proceeds, after all expenses are deducted, will be divided among the exhibitors in proportion to the respective exhibit space occupied. It is confidently expected that the returns will more than repay each company for the initial outlay for space, which, it is stated, is lower per square foot than has ever been the case for a similar show held in a large city.

The exhibition is given under the auspices of the Los Angeles Electrical Exposition, an association of the leading electrical interests of the city. The entire executive committee, excepting the manager, gave its services freely. The committee is composed of Messrs. H. B. Woodill, chairman; C. S. Walton, vice-chairman; C. G. Pyle, secretary and treasurer; D. M. Moses, general manager; J. E. MacDonald, T. E. Burger, L. O. Lieber and W. B. Palmer.

For the operation of the different displays it was necessary to have electric energy in greatly varied classes of service, ranging from 500 volts direct current to 15,000 volts alternating current. Both two-phase and three-phase currents, at commercial voltages, were employed for many purposes. The electrical energy throughout was generally furnished by the Southern California Edison Company, except the 15,000-volt current, which was supplied by the Los Angeles Gas & Electric Company.

PUBLIC SERVICE COMPANY EXHIBITS.

The Southern California Edison Company, which furnishes electricity to a large section of Los Angeles and vicinity, had in operation a motor-generator set, this being used for supplying the direct-current motors at the exhibit, and an accompanying operating panel, regularly equipped; a mercury arc rectifier for magnetic street arc work was also shown. The company displayed one of its standard meter-testing outfits and explained its principle of operation. In addition, for the instruction of consumers there was illustrated, by means of five large dial faces and hands, the method of reading meters, an attendant marking on a blackboard each respective reading in kilowatt-hours as the hands were shifted to various positions. The exhibit was in charge of Messrs. C. S. Walton, G. E. Simpson and E. R. Stauffacher, all connected with the company.

The Pacific Electric Railway Company's exhibit was particularly attractive in being a reproduction of one of the cars regularly employed on the route. To effect this, the front of a red car, including nickel guard bars over the entrance, was placed upon one of the elevated platforms forming part of the sides of the main floor of the auditorium. The latter, representing the body of the car, was suitably draped along the side with a black field, supplemented by orange and red trimmings, at the center of which the familiar Pacific Electric cylindrical seal of black, white and red was placed. The interior portion of the suggested car was given over to free moving pictures and stereopticon views, there being a seating capacity of about 100 persons. This illustrated feature was devoted to travelogue talks of scenes along the route, and an account of the growth of the system from 10¼ miles of railway in 1893 to 970 miles in operation in 1911. The company also exhibited the Hunt "automatic flagman," which it employs at crossings. This was in direct charge of the inventor, Mr. Hunt, who explained the operation by means of a minature Pacific Electric car, operating on a track about 3 ft. long. The overhead wires of the diminutive railway were electrically connected to operate the regular relay used for the signal, with four contact points for starting and stopping the operation. An automatic block signal was also shown. The display was arranged by Mr. Edward C. Thomas, advertising agent of the Pacific Electric Railway Company, who represented the company at the show with an efficient force of assistants.

The Western Union Telegraph Company exhibited a typewriter-telegraph system, taking messages from the visitors and transmitting on the machine in full view. The company also displays its regular duplex and quadruplex instruments and some of the new features introduced for the convenience of the public. Old-type instruments, formerly in service, are exhibited. Mr. F. A. Bennett, commercial agent, and Mr. G. E. Palmer, district equipment supervisor, represent the company.

The Home Telephone Company, whose system was in service at the show, installed a cabinet panel exchange board with single operator and a regular sound-proof telephone booth for the convenience of those attending.

EDUCATIONAL AND SPECTACULAR.

The United States government has furnished an interesting and instructive exhibit, gathered from the National Bureau of Standards, the Weather Bureau, the Smithsonian Institution and the navy.

The Bureau of Standards presents many items of electrical and mechanical interest, including a potentiometer for calibrating measuring instruments, many standard electrical measuring instruments, a polariscope, standards of weights and measurements, as well as various capacity standards. A large map is exhibited showing the various states of the Union which have passed weights and measures laws and those states in which such law is contemplated, as well as the cities that have been inspected. Mr. Frank A. Wolff, Jr., of the bureau, is in attendance.

The Weather Bureau, through the courtesy of Prof. Willis L. Moore, chief of the bureau, offers an exhibit which is distinctly educational to the general public, indicating the extent of the work executed. Meteorological instruments showing the distance and velocity of the wind, range of sunshine, rainfall, temperature and the part that electricity takes in obtaining this data are displayed and explained. The booth is attractively dressed with storm flags, marine meteorological charts and a large photographic display of atmospheric phenomena. Mr. A. B. Wollaber, head of the Los Angeles district, represents the bureau.

The Smithsonian Institution shows many interesting models of pioneer electrical apparatus, illustrating the remarkable growth of the electric industry. Among the models shown are Henry's electromagnetic signaling apparatus (1831); Henry's reciprocating electromagnetic apparatus (1831); Henry's "Yale" magnet (1831); Morse telegraph register (1837); Page electric motor (1850); Wallace electric-light dynamo (1873), and Wallace arc lamp (1877).

The Navy Department exhibits its standard wireless-telegraph system, complete with sending coil, helix and spark-gap and detector. Miniature battleships, gunboats, torpedo boats, etc., are shown. Pulleys and mechanical equipment used in the service are attractively displayed. The department is represented by Messrs. J. J. Dowd, E. A. Wintermute and J. A. Aulbach.

Instructive displays for the general public were shown by the Los Angeles Creamery Company, which demonstrated the Burrell-Lawrence-Kennedy Company electric cow-milking machine with the aid of four cows; by the Los Angeles Silk Company, which showed a silk-weaving machine, electrically operated; by the Shredded Wheat Company, with its well-known model of the electrically driven wheat-shredding machine, and by the Globe Mills of Los Angeles, showing the application of electric energy to flour-milling products. The Los Angeles Electric Vehicle Company exhibited the Edison storage battery as an isolated electric-lighting plant for residential use.

Spectacular exhibits were given by Mr. W. B. Palmer with a Tesla high-frequency outfit. The display includes the lighting of incandescent lamps held in the hand and

similar "stunts." A reproduction of an electric chair, with lifting crown and appurtenances, was shown, in which Mr. Palmer subjected himself to a so-called voltage of 400,000. While under this action many "freak" antics were executed.

Mr. E. J. Rose also demonstrated with a 44-inch Tesla high-frequency outfit and a 30-inch Oudin high-frequency apparatus and with various classes of Röntgen ray apparatus, including a coin-operated machine of this latter character. Mr. Rose explained the effect produced by electric energy in different degrees of vacuum by means of a vacuum pump and glass vacuum tubes. The display was particularly attractive and the apparatus well demonstrated.

A list of the commercial exhibits is given on another page.

Petition for Changes in Treatment of Depreciation in New York.

A petition for permission to make changes in the uniform system of accounts, relating principally to the treatment of depreciation, has been filed with the New York Public Service Commission, Second District. The various companies which have joined in the petition to the commission ask for a hearing on the matter.

The petition states that, as a result of the experience with the system since it was prescribed by the commission on Oct. 21, 1908, certain modifications should be made and certain provisions not now in force should be incorporated. It adds that the tentative classification of accounts for electrical and gas corporations was submitted to meetings of representatives of companies and was then modified without further hearing before official adoption. The application, therefore, has reference to matters regarding which no previous hearing has been held.

Suggested change No. 1 would require the elimination of Rule 21, entitled "Particulars Required to Be Shown in Entries." This rule requires that every charge to a capital account shall show whether the thing in respect of which the charge is made is original capital or an addition, betterment, renewal or replacement. Experience has shown that many capital expenditures partake of the nature of all three of the capital divisions as specified by the commission. As an illustration a hypothetical case is cited. Paragraph 21, the petition states, has added greatly to the amount of accounting work. About forty-five capital accounts are provided, and as the charges to each account may be an addition, betterment or replacement, it means that the company must keep 135 accounts, for it would be impossible in the annual report to distinguish capital expenditures by these subdivisions unless records were made as the charges were met. Paragraph 16 is entitled "First Entries Must Enable Identification." This provides that throughout all capital accounts the first entry in respect of any particular thing shall describe it particularly so as to enable its identification, and if the purpose of the commission in dividing capital expenditures into additions, betterments and replacements is to enable it to review the character of the additions during the year to capital account, it seems to the petitioners that this purpose is fully accomplished by Rule 16, and that the companies could be relieved of dividing their capital expenditures as provided, and yet no element of supervision would be lost.

Change No. 2 would require the elimination of Rule 22 entitled "Betterments Involving Partial Destruction of Things Bettered." This rule is devoted entirely to the subclassification of capital expenditures known as betterments. If the suggestions for the elimination of Rule 21 are decided in favor of the petitioners, Rule 22 would also be eliminated, but even otherwise the petition declares that the rule, judged by itself, should be eliminated.

Change No. 3, as requested, is the modification of the account "fixed capital, at Dec. 31, 1908." This rule as drawn provides that the fixed capital of a corporation at Dec. 31, 1908, shall be carried in one account, and that the reserves for depreciation at the same date shall be carried in a separate account from similar reserves accumulated subsequent to that date. The rule infers that when any fixed capital goes out of service it must be identified as being part of the capital on Dec. 31, 1908, or as installed since that date. Instances are frequent where the cost of a thing may be represented by expenditures for construction prior to that date and for additions or betterments subsequent to that date. Identification of fixed capital as belonging to either of the two periods may not appear to be so difficult when the requirement is recent, but ten or twenty years from now the difficulty will be a real, if not an insuperable, one. It is not unreasonable to assume that of the "fixed capital at Dec. 31, 1908," some part will be in service as late as 1930, and, if then retired, another generation will have to apportion the depreciation as applying to either side of the controlling date Dec. 31, 1908. That a rule has been adopted does not, it seems to the petitioners, justify the act of drawing an arbitrary line through the company's financial history, on either side of which different treatment should be accorded transactions which are alike in their nature. The proposed modified rule continues the account "fixed capital at Dec. 31, 1908," but provides one reserve to which all depreciation is to be charged. If the amount to the credit of the reserve is not sufficient, the deficiency must be adjusted by a charge to surplus.

Change No. 4 is a modification of the account "accrued amortization of capital" intended to make the rule conform to the proposed modified rule in relation to "fixed capital at Dec. 31, 1908." The modified rule provides that the reserve accumulated for amortization after Dec. 31, 1908, shall be added to the reserve existing on that date, and that a corporation's history and practice may be continuous in this respect.

Change No. 5 is a modification of the account entitled "general office supplies and expenditures." An allied suggestion, change No. 6, is for a special account under "general and miscellaneous expenses," to cover rents of property used in connection with the operations of the company. No provision is made in the classification of operating expenses for the rental of property used for any other purpose than offices. Such rentals must now be charged as a deduction from income.

Change No. 7 is the proposed modification of the account entitled "general amortization—electric." The rule as now drawn leaves to the corporation the determination of the amount to be charged to operating expenses for amortization, except that whatever amount may be selected must not include expenditures for repairs. This latter provision is in conflict with the first part of the rule, in that it qualifies the action of the corporation to some extent. The petition recognizes that there is no question to-day but that depreciation is a fact, and that it must be cared for, and that there is a further consensus of opinion that depreciation must be made good out of earnings and that replacement of depreciated property must not be represented by new capital, but the method of arriving at the amount of depreciation is unsettled. Uniformity of practice among all corporations in relation to the determination of the amount to be reserved can never be accomplished. If depreciation were the result of wear and tear only, the problem would be a simple one, but depreciation arising from obsolescence and inadequacy can be determined only with the lapse of time. Apparatus that would be obsolescent in one locality would meet all the modern requirements in another locality.

The rules are seemingly based on the assumption that questions of amortization provision in all their bearings are settled. Literature on the subject contradicts this assumption. For the present, at least, corporations should be per-

mitted to accumulate their own reserves according to the methods which best suit the local conditions, and they should be allowed to do this with just as few restrictions as possible. The modified rule and notes in relation thereto suggested by the petitioners establish these as the practice. The requirements of the commission that amortization charges shall be so adjusted as to provide by the time structures go out of service a reserve equal to the original money cost thereof, less salvage, are not modified by the proposed changes in the rule, nor are there modifications of the requirement that such reserve be accumulated through the medium of operating expenses and that retired fixed capital is not to be replaced by the issue of new capital. The modified rule seeks to accomplish freedom on the part of the corporation in complying with these requirements, and, furthermore, that the amount reserved and the methods followed in determination of the amount may be reported to the commission after action has been taken, instead of in advance thereof.

The petition has been signed by the Westchester Lighting Company, the Northern Westchester Lighting Company, the Peekskill Lighting & Railroad Company, the Yonkers Electric Light & Power Company, the Municipal Gas Light Company of Albany, the Poughkeepsie Light, Heat & Power Company and the Syracuse Lighting Company.

Public Service Commission News.

NEW JERSEY COMMISSION.

During this week a hearing will be given by the commission to the electric-railway, electric-light and power and gas companies of the State on the adoption of a general balance sheet and income accounts and classifications of construction and operating accounts, and the hearing will be continued on complaints of Gateley and Hurley and others and the Board of Chosen Freeholders of Camden County versus the Delaware & Atlantic Telegraph & Telephone Company relating to rates charged for service; also, there will be hearing on the adoption by telephone companies of a general balance sheet and income accounts and classifications of construction and operating accounts.

NEW YORK COMMISSION.

The Richfield Springs Utility Company has been authorized to purchase the existing plant and distributing system of the Richfield Springs Electric Light & Power Company and to increase its capital stock to $20,000. The company is also authorized to make a mortgage upon all its property and franchises to secure an authorized issue of $100,000 par value of 5 per cent first mortgage thirty-year gold bonds. The company is authorized to issue capital stock to the amount of $13,600 and bonds to the amount of $34,000, to be sold at not less than 85, for the purchase of the properties mentioned and for rehabilitation of the plant at Richfield Springs.

MARYLAND COMMISSION.

Chief Engineer Charles E. Phelps, of the Public Service Commission, announced recently his intention of beginning very shortly a series of tests with the telechronometer, an instrument which, it is claimed, will accurately measure telephone service. At the same time he will test another instrument, manufactured by the same company that makes the telechronometer, which registers telephone service in a different manner. According to Mr. Phelps, the telechronometer is entirely unlike any instrument that has so far been invented for the purpose of registering telephone calls, as it measures the time of each call, and its adoption would mean, Mr. Phelps says, the revolutionizing of the present system of charging for telephone service. The other instrument to be tested simply registers the number of calls used.

MASSACHUSETTS COMMISSION.

The Gas & Electric Light Commission recently gave a hearing upon the petition of the Worcester Suburban Electric Company for authority to issue additional capital stock to the amount of $125,000 par value. A feature of the hearing was the testimony of President Philip Cabot regarding improvements in the central station in the valley of the Blackstone River. In the past nine months about $130,000 has been expended by the company in additions to plant, including the enlargement of a generating station at Uxbridge by the addition of a 1250-kw Allis-Chalmers turbine unit, with boiler capacity sufficient to run it at a full overload capacity of 1500 kw; the installation of condensers, exciters, transformers and a new intake. New substations have been built at Rockdale and Millbury, the latter being designed to replace a former substation in Grafton whose location menaced the regularity of service on account of its connections with various consumers in relation to the line. A new No. 0 three-phase, 11,000-volt copper line has been built from the Wexbridge station to Millbury, largely on private right-of-way. Local distribution at Millbury will be handled at 4000 volts instead of 2300 volts, on account of the relatively large area of distribution involved. The estimated cost of steam-plant extension was $100,000. The company now has franchises to serve territory extending up the Blackstone Valley to the city limits of Worcester. Mr. Cabot said that the territory in which the company is operating is growing rapidly, and that only a temporary depression has been felt in the manufacturing field, the company's earnings not being seriously affected at any time.

CURRENT NEWS AND NOTES.

Line Material Destroyed by Atmospheric Fumes.—Special all-copper socket shells and line parts have been required in installing the new street-lighting system at Mineral Point, Wis., where the presence of a large zinc smelter produces fumes which rapidly destroy any brass part exposed to the weather. Twenty-five tungsten standard fixtures and 134 single lamps are now being placed for the public lighting, all-copper sockets being specified for all of this work. Porch lamps on houses are similarly affected by the zinc fumes, although the receptacles indoors appear to suffer less severely than those exposed to the outer air.

* * *

Electricity for Chicago's New Tuberculosis Sanitarium.—Electric service for the new Municipal Tuberculosis Sanitarium to be erected at Bryn Mawr and North Fortieth Avenues, Chicago, near the northwest boundary of the city, will be furnished from the 12,000-volt transmission line of the Sanitary District of Chicago, which parallels the North Shore Channel of the Chicago Drainage Canal to the Evanston pumping station. A central power plant will distribute this energy to the numerous buildings of the institution, which will be built on the group plan, the power-house building containing the steam-heating boilers, sterilizing laundry, pumps, garbage crematory, refrigerating plant, and a 65,000-gal. water-storage tank in its tower. Pierce, Richardson & Neiler are the consulting engineers for the electrical and mechanical features. A small substation building 50 ft. east of the power house will contain the step-down transformers for reducing the 12,000-volt transmitted pressure to 440 volts for distribution about the grounds. Refrigeration from a plant in the power house will be distributed to cooling boxes in the buildings. The buildings will also be equipped with motor-driven vacuum cleaners. It is estimated that the buildings, sewerage system, electric lighting, piping, conduits, etc., will cost about $820,000.

last, the Commonwealth Edison Company of Chicago gave [illegible] company for a year or more. About 2500 turkeys were required for this remembrance, which cost the company about [illegible]

* * *

Meeting of N. Y. E. S.—At a meeting of the New York Electrical Society to be held in the Engineering Societies Building on Dec. 12 Dr. Louis Livingston Seaman, major surgeon First U. S. V. Engineers, will deliver an illustrated lecture on "A Scientific Hunting Expedition in Central Africa."

* * *

Wireless in Alaska.—At present the United States Signal Corps has nine wireless stations in Alaska, and a 10-kw station is being constructed. Two of the stations are being increased in capacity by the installation of 10-kw sets. The navy also maintains four stations in Alaska and neighboring islands.

* * *

Big Cut in Winnipeg Lighting Rates.—A dispatch from Winnipeg, Man., states that the city has definitely fixed the price of light and power furnished by the municipal plant at 3 cents per kw-hour, and that the private company will meet this cut. This new rate represents a reduction of 60 per cent from the rate in force prior to operation of the municipal plant.

* * *

Electrification of New Zealand Railroads.—In reply to an inquiry on the subject made by a deputation, the Minister of Public Works of New Zealand recently stated that the government has under advisement the eventual electrification of the entire state railroad system. Authority for electrification of a short line will be asked at the present session of the parliament.

* * *

Field for Electric Trucks.—The registered number of commercial automobiles of all types in New York State is about 8000, of which at least 50 per cent are used in Greater New York. It is estimated that during the hot days of last July 1600 horses died as a result of the heat during two weeks. The extra expense caused by such loss in summer and the inability of horses to make headway through snow in winter are rapidly proving to merchants that the automobile is more economical than the horse-drawn vehicle.

* * *

Commercial Acyclic Generators Dismantled.—The two 500-kw vertical turbine-driven homopolar generators in the plant of the Murphy Power Company, Detroit (described in the *Electrical World*, Sept. 1, 1910), the only acyclic direct-current machines in commercial lighting service, are now being replaced by 750-kw alternators on the same Curtis turbine frames. These homopolar generators produced 50 volts per single turn between collector rings when driven at 2000 r.p.m., their twelve sets of rings being so connected as to give 250 volts for the Murphy company's three-wire system.

* * *

Chicago Electric Club Affairs.—At the "get-together" meeting of the Electric Club of Chicago on Nov. 29 President Niesz gave a talk on co-operation among members to assure the continued success of the club. Mr. Frederic P. Vose, former president, made a thoughtful and eloquent Thanksgiving Day address, meriting once more the distinction of being the club orator. In discussing club affairs he urged the members not to "talk shop" too much at the meetings, but rather to lay aside usual topics two hours a week and either discuss subjects of broad general interest or enjoy the pleasure of social commingling. Mr. Albert Schieble took issue with this view. The club, he said, is distinctively an electric club, and the speaker made a plea for the discussion of topics relating to the wide sweep embraced in the science and art of electricity. Many other organizations give opportunity to debate questions of economics and sociology, he said. Let the Electric Club continue to attach predominant importance to electrical development.

* * *

Users of Commercial Power Vehicles.—Data as to the various services in which commercial power vehicles are used were compiled last winter during the national automobile shows. Cards left by more than 1500 visitors to the commercial-vehicle section of the Madison Square Garden Show in New York and about 1800 visitors to the corresponding section of the Chicago Show, all of whom were users of commercial power vehicles, were tabulated according to lines of business. Each of fifty distinct lines of business was represented by cards left by more than ten visitors to the shows. The building and contracting business led by a large proportion, equal to 7.7 per cent of the whole attendance. Manufacturers of metal goods were represented by 6.1 per cent; lumbering companies and retail yards by 6 per cent; canners, manufacturers of food stuffs, wholesalers and retail grocers by 6 per cent; printers and publishers by 5.1 per cent; machinery makers by 4.6 per cent, and general merchandise or department stores by 3.5 per cent.

* * *

Human Electricity.—A professor of electrical engineering recently received the following communication: "A question involving electric energy came before us today and, not being familiar with electrical matters, we decided to refer the question to you for information. A man makes the statement that every person is possessed of either positive or negative electricity or both, and that the amount of either can, by some electrical appliance now in use, be determined. He asserts that the greatest number of people are possessed of positive electricity and that one having negative electricity is rarely found. He says to determine if one has negative electricity a simple home test can be made as follows: From a green tree cut a small limb shaped like an inverted V and hold the ends one in each hand with the point upward. If the person holding the limb has negative electricity the moisture in the wood will act as a conductor, and as the person passes over water like a river or an underground stream the limb he holds will be attracted downward. What we wish to know is whether his assertions are founded on fact. Do people possess either positive or negative electricity, and is there any scientific method of testing the kind or quantity?"

* * *

Seattle Municipal Plant.—Advance sheets of the report of the lighting department of the city of Seattle for the year 1911 show that the total cost of the municipal light and power plant to date is $3,388,803. The present capacity of the plant is 16,000 hp, and bonds for $1,400,000 have been authorized for constructing a new dam whereby the water-storage capacity will be so increased as to give a generating capacity of 60,000 hp. An auxiliary plant of 4000 hp is being constructed, located centrally in the city, which will be operated by the overflow from the high-service reservoirs of the water department, that department being paid for the water so used. This will bring the capacity of the plant to 20,000 hp. The estimated revenue for 1911 is $850,000; expenses, including interest, $350,000; depreciation charge, $250,000—leaving a surplus of $250,000. It is stated in the report that the average business rate charged by the municipal plant is 3 cents per kw-hour, the average power rate being 2 cents per kw-hour. The residence rate is 7 cents for the first 60 kw-hours per month and 4 cents for all over that amount. Payment is received for city lighting as if furnished by a private plant: the rate is $54 per year for a 6.6-amp arc and $13.80 per year for 40-cp incandescents. The number of private cus- [illegible] is 17,000.

ELECTRICALLY DRIVEN ICE-CREAM FACTORY.

Producer-Gas-Engine-Driven Plant of the J. M. Horton Ice Cream Company in New York City.

Direct-Current Commutating-Pole Motors Drive Ammonia Compressors, and Many Operations Hitherto Performed Manually Are Converted to Electric Drive—Up-Draft Suction Producers Burning Anthracite Coal Used.

THE J. M. Horton Ice Cream Company is reputed to be the largest manufacturer of ice cream in the country and maintains a number of factories in New York, Brooklyn and Jersey City. Its largest and most representative factory is located at 205 East Twenty-fourth Street, which is also the main office of the company. Here there has been installed a modern producer-gas outfit driving direct-connected generators the output of which is employed for lighting the building and for driving various machines used in the manufacture of ice cream and water ices.

Two up-draft suction producers with their scrubbers are located in a compartment on the floor above the engine-room. The producers, which were built by the Tait Producer Company, New York, are designed to burn anthracite coal and are rated at 350 hp. At present pea coal is burned on the grates. This is chuted from a bin on the third floor, where storage for about 175 tons is provided. The coal is brought to the plant in trucks and elevated to the third floor, while the ashes are removed from the producer-room in ash cans and carted away by the company's own wagons.

From the producers the gas is conveyed through dryers on the engine-room floor to the gas engines. A motor-driven blower is used in starting the producer, and duplicate piping is arranged so that the engines may operate with pressure gas or with suction gas. Pilot burners are provided in the producer-room to guide the attendants, and pilots are arranged on the engine-room floor for the benefit of the engineer. All valves in the producer-room are operated from the engine-room floor and are under the direct charge of the engineer, so that there can never be any question of mixed orders. At stated times during the day samples of the gas are taken from the producers in rubber bags and analyzed in an Orsat apparatus.

A certain percentage of the exhaust from the gas engines is returned to the ash pit of the producers, together with air sucked in the pipe on the way. The producers operate on the balanced-draft system, and pressure in the ash pit is used to balance that above the fuel bed. Although the producers are rated at 350 hp, they have been operated all summer under a 20 per cent overload.

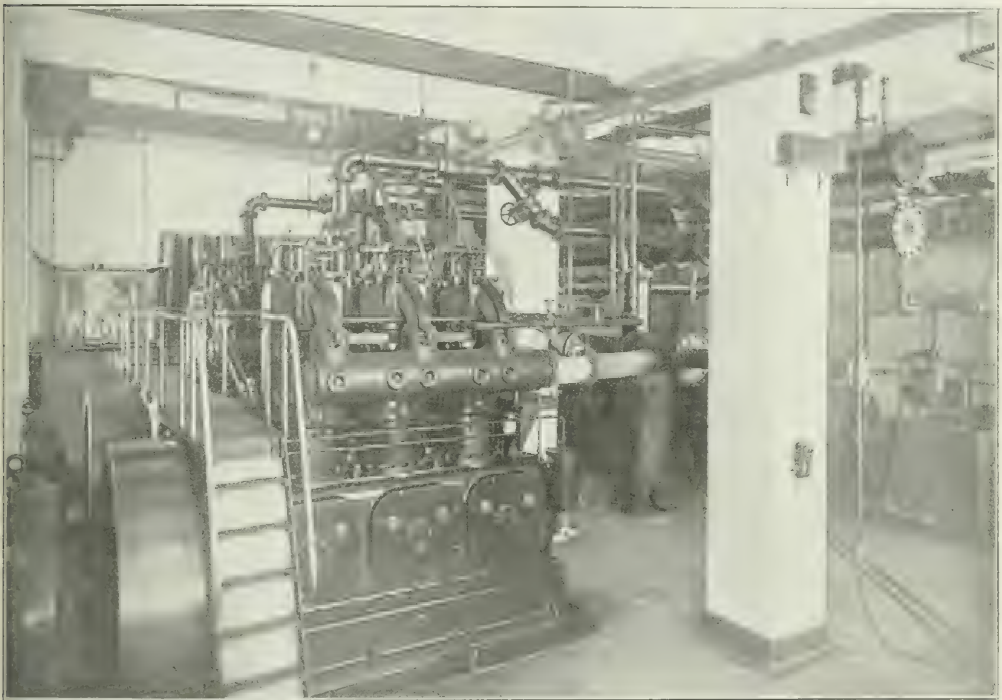


Fig. 1—Generating-Room; J. M. Horton Ice Cream Company.

The generating equipment installed in the engine-room comprises two 225-brake-hp Rathbun-Jones gas engines direct-connected to 150-kw General Electric generators wound for 250 volts. The engines are of the vertical three-cylinder type, and the ignition energy is obtained from a storage battery charged from a small motor-generator set. Each engine is equipped with a heavy flywheel, and the generators are fitted with slip-rings connected to auto-transformers used as balancers for a three-wire system. Energy at 125 volts is employed for lamp circuits and energy at 250 volts for all motor circuits.

For controlling the circuits a seven-panel switchboard is installed in the engine-room. The board is designed for the ultimate capacity of the plant, space being provided in the engine-room for an additional gas-engine set and also

for another refrigerating set. It is equipped with three generator panels, and the two panels on the extreme right carry the switches for the motor and lamp circuits. The circuits leading to the motors on the second and third floors of the factory have pilot lamps in them which are lighted while the motors are in operation. By this means the engineer knows just what motors are operating at any time. The wiring throughout the building is laid in conduit.

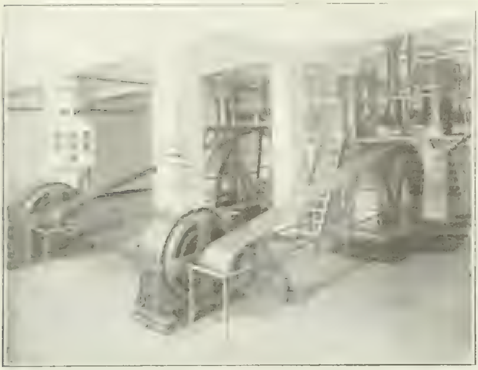


Fig. 2—Motor-Driven Refrigerating Machines.

The refrigerating equipment at present installed consists of two compressors built by the York Manufacturing Company, one of which is rated at 75 tons and is belted to a 125-hp motor, the other one being rated at 50 tons and driven by a 90-hp motor. The motors are of General Electric make and are fitted with commutating poles. They are designed for a speed variation ranging from 250 r.p.m. to 500 r.p.m., the compressors delivering full rated output at the latter speed. The water from the jackets of the refrigerating machines and from the gas engines is pumped by a 10-hp turbine pump to a tank on the third floor of the building. Duplicate pumps are provided on this floor, one consisting of a 20-hp General Electric unit and the other of a 22-hp Allis-Chalmers unit, which force the water from this tank to a cooling tower built on the roof of the building.

Ammonia vapor is compressed in the refrigerating machines to a pressure of approximately 150 lb. per square inch, and the liquid ammonia thus produced is permitted to "evaporate" under reduced pressure in coils of pipe placed in a tank containing brine for the circulating system. Motor-driven pumps are employed to circulate the cold brine. A turbine pump rated at 800 gal. is driven by a 35-hp adjustable-speed motor and supplies the brine for cooling one of the large chill-rooms on the second floor in which ice cream is set to harden after it leaves the freezers. In addition a 400-gal. pump driven by a 15-hp motor supplies brine to the ice-cream mixers, freezers and a small chill-room on the third floor. The freezers on the second floor are provided with clutches on the main shaft for individual control, the group being driven by a 20-hp motor. In addition there are a 10-hp motor driving the French freezers on the second floor, a 10-hp motor operating ice crushers and conveyors, a 7.5-hp motor connected to an ice hoist and two 7.5-hp motors connected to bunker-room fans in the cold-storage rooms.

On the third floor of the factory, in addition to the motors driving the pumps for elevating the jacket water to the cooling tower on the roof and the 15-hp motor driving the brine circulator, there is a 7.5-hp motor connected to ice-cream freezers and a 5-hp motor driving cream beaters, etc.

Aside from the more sanitary conditions brought about by motor-driven apparatus, experience is said to have demonstrated that ice cream of superior quality is obtained, this being due to uniformity of freezing.

In addition to supplying refrigeration to the ice-cream freezers and storage rooms on the upper floors, during periods of light load the compressors operate in connection with a tank ice plant in the basement off the engine-room, where 30 tons of ice can be made daily. The ice is pulled from the tanks by a Sprague hoist.

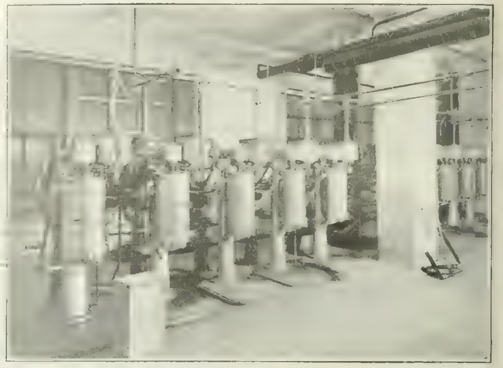


Fig. 3—Ice-Cream Freezers.

When the plant was erected a short time ago it was estimated that sufficient overload capacity had been provided to meet requirements for many years to come. However, as soon as it was completed it was found to be none too large for the growing business, and last summer it was operated on overload continuously. As indicative of the economy of the combined equipment it is stated that, when loaded, a kilowatt-hour was produced at the switchboard for the expenditure of 1.65 lb. of coal in the producer. A good average figure is stated to be 1¾ lb. of coal per kw-hour.

The building throughout is lighted by tungsten lamps fitted with prismatic glass reflectors, the lighting installation having been supervised by the National Electric Lamp Association's engineering department.

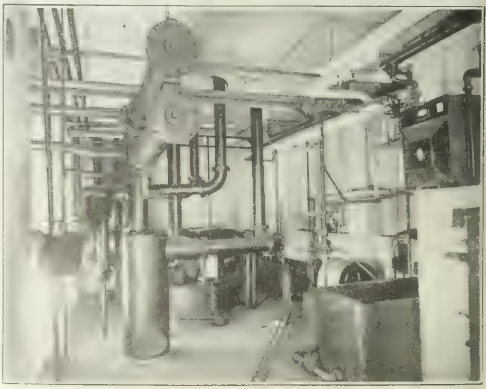


Fig. 4—Producer-Gas and Exhaust Piping in Engine-Room.

Messrs. Wallis & Goodwillie, of New York City, were the architects who designed the building and its equipment.

THE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY—III.

Logan, Jordan Narrows and Battle Creek Water-Power Stations of Utah System—Waterwheel Arrangement with Twin Runners Operating Under Different Heads.

In previous issues a complete description has been given of the Colorado system of the Telluride Power Company, a general outline of the Utah system and a description of the Grace plant of this system. Some other plants of the Utah system are described in the following article.

LOGAN STATION.

The Logan plant is located 56 miles south of Grace station and 72 miles north of Salt Lake City, on the Logan River, and about 3 miles from the city of Logan. A timber crib dam, 10 ft. high, 112 ft. long at the top and with a 72-ft. spillway, diverts water from the river about 2 miles above the plant into a tapering intake about 80 ft. long, with a connection at the end to a 5-ft. x 6-ft. wooden flume equipped with four screens and lift gates. The flow line extends for a distance of about 10,000 ft. to an enlarged section designed to hold sufficient water to make the handling of peak loads easier, a spillway having also been provided to dispose of the water accumulating at periods of light load.

The station is located on the bank of the river below the penstock intakes. There are two units in the installation, each being supplied with water from an independent penstock 44 in. in diameter and from 331 ft. to 358.5 ft. long. Two exciter penstocks are also provided, each being 10 in. in diameter and 345 ft. in length. The effective hydraulic head under which the turbines in the station operate is 208 ft.

EQUIPMENT.

The machinery is housed in a 40-ft. x 80-ft. brick building, with masonry foundations. The interior arrangement illustrates the straight-line design from waterwheels to outgoing leads, but in this plant the high-tension lines are paralleled upon a common busbar outfit receiving energy from either or both generators at will. The turbine equipment consists of two 1500-hp Leffel machines of the double-runner type, each being connected through flexible couplings to a 1000-kw, 1150-volt, three-phase, revolving-field General Electric generator operated at 400 r.p.m. Two Lombard "Type H" hydraulic governors are installed for speed regulation. Two 30-kw, 125-volt exciters are also provided, these being driven through flexible couplings by six 11-in. Leffel turbines mounted in two sets of three each and supplied with water through triple nozzles.

The switching equipment of this plant includes manually controlled oil switches of the automatic type in both the generator and the transformer circuits, open fuses being used on the outgoing lines to handle circuit openings in case of emergencies. Low-tension leads are carried under the floor from the generators to the oil switches, the busbars for the 1150-volt system being copper bars set in fiber insulators. The connections between the oil switches on the low-tension side of the station and the step-up transformer installation are placed in concrete trenches, coverings being provided on top of the latter to protect the wiring runs. A 17-ft. x 25-ft. brick substation is in service near the main plant in connection with the local electrical supply to the town, including street-railway, lighting and small-motor service. A seven-panel switchboard 17 ft. long is located in the center of the operating-room

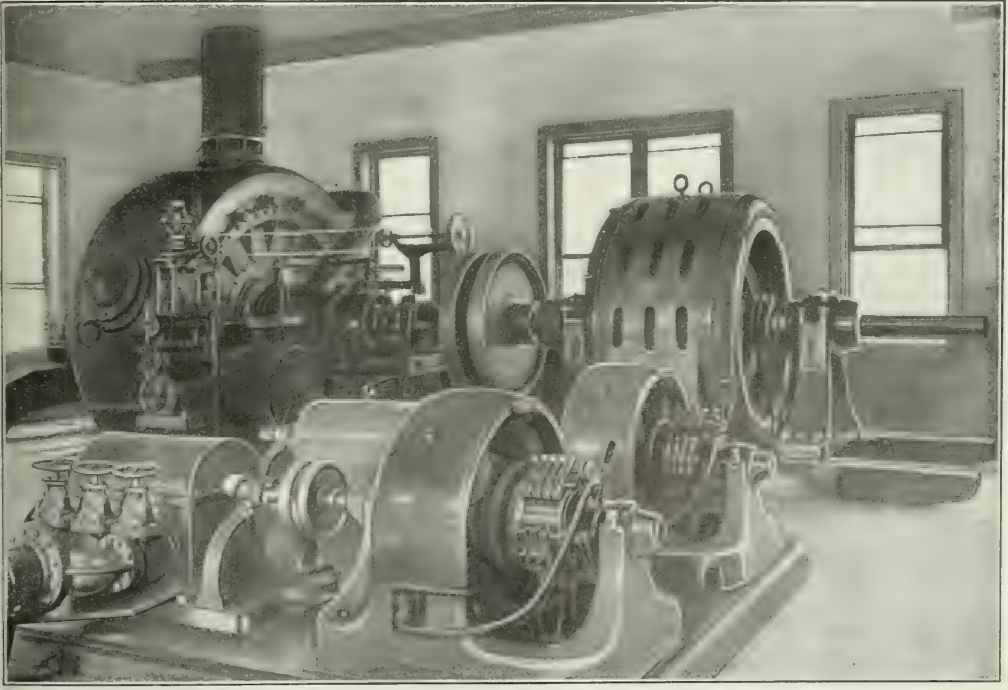


Fig. 21—Interior of Logan Station.

floor, the low-tension oil switches being mounted on the rear of the panels in an inclosed compartment

SWITCHING.

The switchboard layout comprises two generator panels, one exciter panel, one bus junction panel for multiple opera-

Fig. 22—Logan Station and Penstock.

tion, one transformer panel and two low-tension feeder panels. Beyond the low-tension oil-switch compartment on the floor of the operating room are installed a bank of six 333-kw water-cooled Converse transformers, a spare one also being available. The individual transformers have a voltage ratio of 635 to 23,132, but the company has connected them with the low-tension windings in parallel star with the neutral grounded and the high-tension windings in series delta, giving a ratio of 1100 volts to 46,000 volts for the set of six units. The outgoing leads from the transformers are connected to a set of three-phase busbars located about 16 ft. above the floor on a varnished wooden framework and glass insulators, paraffined wooden pins being employed at the supporting points. After passing through disconnecting switches and fuses the circuit is dropped to a 44,000-volt, three-phase oil switch mounted in a brick cell at the extreme end of the station, next the wall. There is one outgoing line with an oil switch and a disconnecting switch, and the mechanical handling of the switch is effected from a platform of varnished wood mounted on glass insulators, with stairways rising to a convenient height above the floor. The outgoing line is equipped with six spiral choke coils in series in each phase, and an installation of aluminum-cell lightning arresters provided with the usual disconnecting switches on the bus side. The station outlets are carried through open windows, a 5-ft. roof extension providing the necessary rain and snow protection. A 10-ton Whiting hand-operated crane serves the entire plant, and a small machine shop about 20 ft. x 13 ft. in dimensions occupies a bay near the transformer end of the station.

JORDAN NARROWS STATION.

The Jordan Narrows station is a plant purchased from other interests about five years ago, its erection dating back about twelve years. This installation has a rating of 1000 kw in two 500-kw units, and takes its water from the Jordan River at a diversion point about 2.5 miles above the station, which is located in a narrow gorge of the river about 20 miles south of Salt Lake City. The principal hydraulic features of the plant are a dam of timber-crib construction at the diversion point, the height being 7 ft., an intake and a canal 13,000 ft. long, terminating at a 45-ft. x 55-ft. x 12 ft. concrete forebay, from which two 6-ft. steel penstocks 260 ft. in length carry the water to the turbines. The canal has a cross-section of about 6 ft. x 10 ft., and at its head the usual screens and gates are installed. Tapering openings in the floor of the forebay discharge the water to the penstocks, each of which is provided with a 7-ft. cylindrical valve of the hand-operated type.

The station is a 27-ft. x 82-ft. brick structure of simple rectangular shape, the roof being of concrete, reinforced with steel I-beams. The plant is laid out to permit doubling its equipment without increasing the size of the building, the present equipment occupying one end of the operating room, with the exciter sets in the center. The electrical apparatus is installed on a switchboard opposite the exciters and in a 15-ft. x 30-ft. bay immediately behind the switchboard. The hydraulic installation at Jordan Narrows is peculiar in that one set of runners for each

Fig. 23.—Exterior View of Jordan Station.

turbine discharges through a draft tube about 28 ft. long into a tunnel outside the plant leading into the river below, while the other set discharges its water through a 9-ft. tube into an irrigation canal located on the further side of the station. In other words, each wheel consists of two different runners, one operating under a head of 55 ft.

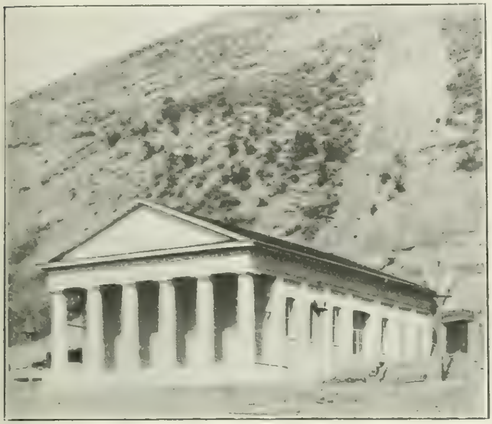


Fig. 24—Battle Creek Station.

and the other of 75 ft. Each runner develops 325 hp under its rated head, and the full load on the plant requires a water consumption of 256 cu. ft. per second. The wheels are located just outside the operating room, the generators being directly driven through shafting extending into the station from the wheel casings. Cylindrical sliding gates are installed at each wheel, the operation being either by hand or by two Replogle governors. The latter are ordinarily idle, as the speed variations are handled by the plants at Logan and Olmsted. The exciter turbines, rated at 40 hp each, are supplied with water by branch pipes leading from a 24-in. overhead main carried across the side of the operating room from the penstocks.

The generators at Jordan Narrows are 500-kw, 500-volt, three-phase Westinghouse alternators, with revolving armatures, each directly driven by an S. Morgan Smith wheel of the type mentioned above. The exciter wheels are also of the foregoing make, and the exciters are rated at 30 kw each. The main units operate at 300 r.p.m., and the exciter speed is 1050 r.p.m. From the generators the energy is led under the floor in fiber conduit to a five-panel switchboard, composed of two generator panels, one exciter panel, one transformer panel and a reserve panel. The operating transformer equipment consists of three 250-kw Converse water-cooled units located in the bay above referred to, the primaries being connected in delta and the secondaries in star. The plant contains no oil switches, the 44,000-volt circuit being broken only in emergencies by switches of the sliding air-break type. In ordinary operation the circuit is broken on the 500-volt side of the station. Fuses are installed in each of the outgoing conductors, the line passing directly from the station through outlet bushings of fiber insulating compound to an open-air switchrack connecting with the trunk and branch transmission-line system. Spiral choke coils and multigap lightning arresters are in service, these being mounted on a rack in the transformer bay near the outlet bushings.

BATTLE CREEK STATION.

Unlike most of the plants of the Utah department, this station is provided with storage facilities, which are capable of delivering 11,000 hp-hours on the peak of the load. The station is located at the bottom of Battle Creek Canyon, 2.5 miles from Pleasant Grove, and has a generating rating of 2400 kw in a single alternator driven by two waterwheels of the Pelton type, operating under a net head of 1630 ft. Two reservoirs are in service in connection with the plant, one having a capacity of 276,000 cu. ft. and being used for storage, and the other, an equalizing reservoir, having a capacity of 425,000 cu. ft. The water diversion is accomplished by a masonry dam 15 ft. high and 25 ft. long, situated about 3 miles above the station, there being a flume of 24-in. wooden-stave pipe between the dam and the storage reservoir, the length of the flume being 2 miles and the diameter inside 24 in. The flume is composed of fifteen parallel staves 1.5 in. thick, secured by iron bands spaced 18 in. apart, and bolted at each end to metal shoes fitting the circumference of the pipe.

EQUIPMENT.

From the storage reservoir the water is carried to the station by a steel penstock 4963 ft. in length, the diameter varying from 30 in. at the upper end to 20 in. at the lower. The upper third of the penstock is provided with riveted joints, the lower section being of lap-welded imported pipe The station building is a 32-ft. x 80-ft. brick structure, with pillared portico serving as a weather protection for the outgoing circuits, masonry foundations being used for the building and machinery. Concrete floors and interior portions render the plant fireproof. The plant contains a three-phase General Electric revolving-field alternator, directly driven at 300 r.p.m. by a pair of 10-ft. wheels of 2000-hp individual rating, the unit being mounted on a horizontal shaft and provided with two Pelton deflecting nozzles, operated hydraulically and with needle-valve hand control

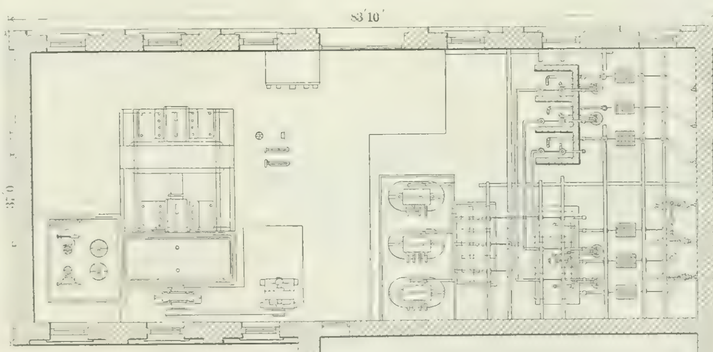


Fig. 25—Plan of Battle Creek Station.

at the nozzles themselves. A belt-driven exciter of 30-kw rating, wound for 125 volts and making 700 r.p.m., is installed near the generating unit. The plant illustrates again the straightforward design of the company's later stations, there being an installation of three 1000-kw, 2300-44,000- [illegible]

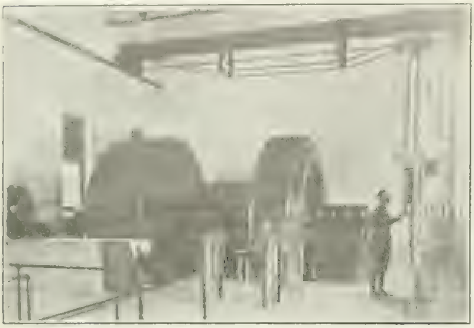


Fig. 26—Interior of Battle Creek Station.

type located beyond the main floor of the generator room and somewhat below it, with high-tension switches, wiring and lightning-arrester equipment at the end of the building most remote from the entering water supply.

WIRING.

The operating switchboard consists of a three-panel equipment mounted near the station wall on the generator side, this being equipped with one panel for generator service, one for the outgoing lines and one for instruments. The low-tension panel is provided with mechanical control through levers of the oil switch that is required in the generator circuit, remotely controlled apparatus operated by exciter current being installed in connection with the 44-000-volt line oil switches. The low-tension switch is located in the basement of the station, and the high-tension switches, of which three are in service, are located in the transformer bay at the end of the operating room. The connections provide for the operation of the transformers upon a single set of high-tension busbars through a solenoid-operated oil switch and disconnecting switches.

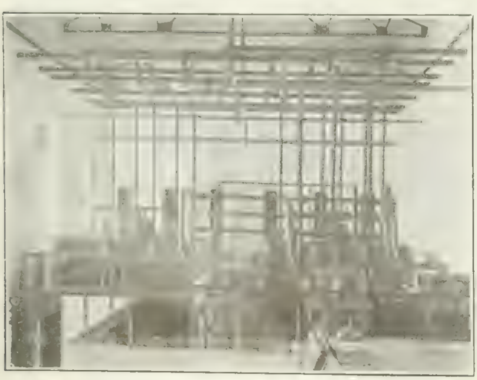


Fig. 27—High-Tension End of Battle Creek Station.

Two three-phase outgoing lines leave the station for Jordan Narrows and Olmsted respectively, and either line may be operated upon the bus if desired, or the line can be looped through on the bus in case the generating unit is shut down. The outgoing lines pass through a motor-operated oil switch in each case, disconnectors also being provided on each side of these. The transformers are connected in delta on both the primary and the secondary sides. The oil switches in the outgoing lines are provided with inverse time-limit relays.

The lightning protection includes six spiral choke coils per phase and a set of aluminum-cell arresters. Horn gaps are installed on the lines outside the building, with grounding device operated mechanically by hand from the station. Fiber conduit outlet bushings with insulated compound filling are used.

In following issues will be described other stations of the Utah System, future developments and system of transmission.

THE CHARACTERISTICS OF SERIES INSTRUMENT TRANSFORMERS.

Determination of the Effect of the Magnetic-Circuit Characteristics on the Current Ratio and Time-Phase Displacement.

By Arthur P. Young.

DURING the past few years series transformers have come into extensive use, more particularly in conjunction with certain types of alternate-current measuring instruments, such, for instance, as wattmeters, ammeters and power-factor indicators. As a consequence much has been written on this subject in recent times.

The subject is important because in all cases where measuring instruments operate in conjunction with series transformers the degree of accuracy obtainable with any given combination is not only dependent on the characteristics of the instrument itself, but, as will be shown below, to a very great extent on the characteristics of the series transformer or transformers with which the particular instrument is working.

While very rigid specifications, such as those compiled by the British Engineering Standards Committee, giving the permissible limits of error in single-phase integrating and indicating instruments, are enforced by supply-station and consulting engineers, thus insuring that a superlative standard as regards both accuracy and workmanship will always be maintained for this class of apparatus, no mention is made of series transformers in either of these specifications. This would seem to indicate that too little attention has been given to this particular point in the past, no doubt accounted for by the fact that the majority of supply engineers do not realize to just what extent the accuracy of their measuring instruments is dependent on the series transformers with which they are used, in cases where the latter are a necessary adjunct.

It would, therefore, seem that an article dealing with this particular aspect of the problem of series transformers would be of interest to supply-station engineers, and it is thought that it might not be unwelcome to all designers and manufacturers of these classes of apparatus.

There are two effects which should be considered, namely, the variation of the ratio of primary to secondary current with the load and the variation of the phase displacement between the primary and the secondary currents with the load.

The first of these will here be termed the "ratio characteristic" and the second the "phase-displacement characteristic." It is quite apparent that if one could build a perfect series transformer—that is, one in which, firstly, the ratio was constant for all loads, and, secondly, primary and secondary currents were always exactly opposite in phase to each other—the characteristic of any measuring instrument operated from it would not be affected in the slightest, no matter how the current or power-factor varied.

This, however, cannot be done, and as a result errors do

arise in actual practice, and if the "ratio" and "phase-displacement" characteristics of the series transformer corresponding to the actual working conditions are known, the extent of these errors can be accurately computed. The determination of these two characteristics can, of course, be done experimentally, and several methods[1] have been devised by means of which very accurate results can be obtained, provided a fully equipped laboratory is at the disposal of the experimenter, because all of these methods are suited only for the laboratory and could not be carried out in the commercial test-room. For this reason it is doubtful whether there are many manufacturers of series transformers who have made careful and accurate tests on their own productions with a view to determining their essential characteristics.

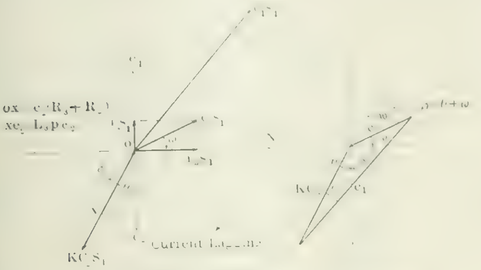


Fig. 1—Current Relations in Series Transformer.

There is, however, another method by means of which the same results can be achieved, and that is by calculation. The object of this paper is to give the results of the author's labors in this direction. He has constructed numbers of curves which can be applied to all types of series transformers in which the iron core is built up from "stalloy" punchings, the reason for choosing this particular brand of iron as a basis for the calculations being that it is used extensively in this class of apparatus. By the aid of these curves it is possible to plot the "ratio" and "phase-displacement" characteristics for given working conditions, provided the linear dimensions of, and the electrical data relating to, the series transformer are known.

A brief study of the method adopted in building these curves up from the permeability and core-loss curves for "stalloy" iron will make it quite clear that exactly the same procedure could be employed for any other brand of iron, and provided the permeability and core-loss curves are known a series of curves exactly similar to those given in this article could be easily made out.

ANALYSIS OF FUNDAMENTAL CHARACTERISTICS.

Assuming that

S_1 = primary turns.
C_1 = primary current.
S_2 = secondary turns.
C_2 = secondary current.
i_mS_1 = magnetizing ampere-turns.
i_cS_1 = core loss ampere-turns.
C_0S_1 = resultant of i_mS_1 and i_cS_1.
ω = phase displacement between C_0S_1 and i_mS_1.
e_1 = induced voltage in primary.
e_2 = induced voltage in secondary.
θ = phase displacement between C_2 and e_2.
ϕ = effective phase displacement between C_1 and C_2.

That is, with reference to the primary, the secondary current is equivalent to a current equal to C_2, and *leading* the primary current C_1 by a small angle ϕ.

K = theoretical ratio $= \frac{S_2}{S_1}$ $\qquad K_a$ = current ratio $= \frac{C_1}{C_2}$

The relationship between primary and secondary currents is shown vectorially in Fig. 1.

The author has shown elsewhere[2] that if there were no magnetic leakage between the two windings the current ratio would be given by the following expression:

$$K_a = \frac{C_1S_1}{C_1S_1 - C_0S_1 \sin\beta} . K \qquad (1)$$

where,

$$\beta = \theta + \omega.$$

Also, $\phi = \frac{C_0S_1}{C_1S_1} \cos\beta$, radians,

that is, $\phi = 57.4\frac{C_0S_1}{C_1S_1} \cos\beta$ degrees. (2)

Before one can calculate K_a or ϕ for any particular case it is apparent that he must know the values of three quantities, namely, C_1S_1, C_0S_1 and β. The first of these is simply the primary ampere-turns, and for a given primary current can be easily calculated. C_0S_1 and β, however, cannot be determined until one knows the magnetizing and core-loss ampere-turns corresponding to the particular value of the flux density at which the iron core is being operated. This computation would have to be made for different values of the primary current taken over the whole range before the current ratio and phase-displacement characteristics could be plotted, so that of necessity the process would be laborious.

However, the process can be simplified considerably if only 1 cm length of the iron core be considered, because both C_1S_1 and C_0S_1 will then express ampere-turns per centimeter length and C_0S_1 per centimeter length and β are dependent simply on the value of the flux density in the iron core. That is, in a number of series transformers having cores of different dimensions, provided the same iron is used throughout, and the flux density in each is the same, the values of C_0S_1 per centimeter length and β corresponding to this state of affairs will be identical in each. The result would not be altered if the primary and secondary turns on each transformer were different and they were operating on various frequencies and under different load conditions.

Magnetizing Ampere-Turns i_mS_1.

Assuming a sine wave for the distribution of current and denoting the root-mean-square ampere-turns per centimeter length of the magnetic circuit by a, there is obtained:

$$i_mS_1 \text{ per centimeter} = a = 0.563\,H \qquad (3)$$

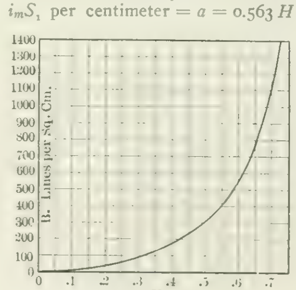


Fig. 2—Magnetization Curve of Core Material.

Fig. 2 shows the B-H curve for "stalloy" iron corresponding to a range of B from 0 to 1400 lines per square centimeter. In a well-designed transformer the range of

[1] See "Some Measurements on Phase Displacements in Resistances and Transformers," by C. V. Drysdale, D. Sc., Lond. *Electrician*, Nov. 23, 1906; "Determination of the Constants of Instrument Transformers," by P. G. Agnew and T. T. Fitch, *Electrical World*, Oct. 28, 1909; "Current Ratio and Phase-Angle Test of Series Transformers," by H. S. Baker. *Electrical World*, January 26, 1911

[2] See "The Theory and Design of Current Transformers," by Arthur P. Young. *Journal* of the British Institution of Electrical Engineers, Vol. 45, 1909, page 674.

induction in the core between no-load and full-load will lie within these limits. The curve is an actual test curve kindly sent to the writer by Messrs. Joseph Sankey & Sons, Ltd., Bilston, the suppliers of "stalloy" iron.

Investigation shows that an approximate law can be deduced for the curve, this being of the form $H = k \cdot B^n$.

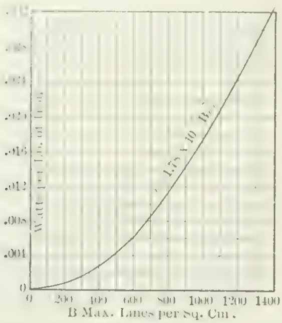


Fig. 3—Total Loss Curve for Core Material.

By assuming that the curve changes at a value of $B = 150$, the curve can be expressed by means of two equations, one covering a range of B from 0 to 150 and the other corresponding to higher values of B between 150 and 1400.

The expressions are as follows:

$$B\text{'s } 0\text{-}150 \ \ldots \ H = 0.0174\, B^{0.62} \qquad (4)$$

$$B\text{'s } 150\text{-}1400 \ \ldots \ H = 0.97\, B^{0.28} \qquad (5)$$

If plotted it will be found that the combined curves agree very closely with the actual test curve shown in Fig. 2.

Substituting in equation (3),

$$B\text{'s } 0\text{-}150 \ \ldots \ a = 9.8 \times 10^{-3} B_m^{0.62} \qquad (6)$$

$$B\text{'s } 150\text{-}1400 \ \ldots \ a = 5.46 \times 10^{-2} B_m^{0.28} \qquad (7)$$

B_m representing the maximum value of the flux density.

Core-Loss Ampere-Turns $i_c S_1$.

In general:

$$\text{Total core-loss in watts} = W = e_1 i_c,$$

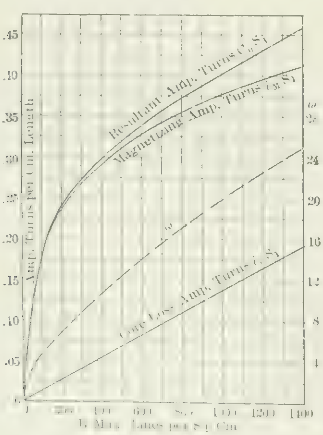


Fig. 4—Magnetomotive Forces Required for Excitation.

and,

$$e_1 = 4.44 \times 10^{-8} f B_m A,$$

where,

f = frequency.

A = cross-section of core in square centimeters.

Therefore,

$$W = 4.44 \times 10^{-8} f A B_m \times S i_c.$$

If 1 cm length of the core be considered, then $i_c S_1$ in the above equation will be the root-mean-square ampere-turns per centimeter, and denoting these by b there is obtained,

$$\text{Watts per pound} = w = \frac{W}{A\delta} = 4.44 \times 10^{-8} \frac{f B_m}{\delta} \times b$$

where,

δ = specific gravity of iron in pounds per cubic centimeter.

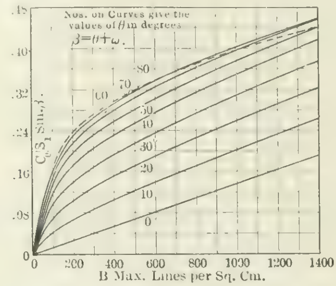


Fig. 5—Variation of Exciting Current with Magnetic Density.

Therefore,

$$b = \frac{w\delta}{4.44 \times 10^{-8} f B_m} \qquad (8)$$

This equation is quite general in its application.

Fig. 3 shows the core-loss curve for "stalloy" iron corresponding to the low values of B_m. This curve was obtained experimentally; it obeys a very definite law, being, in fact, a parabola. The equation is as follows:

$$w = 1.78 \times 10^{-8} B_m^2.$$

This equation is only true for fifty cycles, the core-loss test being carried out at this frequency. As, however, only a very small percentage of the total loss—probably not more than 5 per cent—is due to eddy currents, it can safely be assumed that the total loss is directly proportional to the frequency, so that, in general,

$$w = 3.56 \times 10^{-10} f B_m^2$$

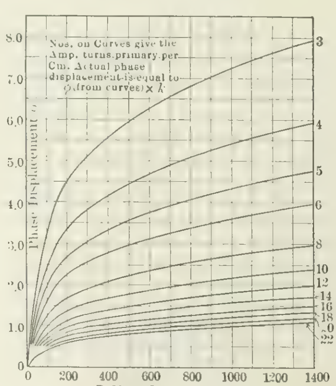


Fig. 6—Phase Displacements for Low-Current Values.

Also, for stalloy iron

$$\delta = 0.0173.$$

Substituting these values of w and δ in equation (8)

$$b = 1.385 \times 10^{-4} B_m \qquad (9)$$

This equation shows that the core-loss ampere-turns per centimeter length of magnetic circuit are directly proportional to B_m and independent of the frequency.

Resultant of Magnetizing and Core-Loss Ampere-Turns (C_oS_1).

In general:

$$C_oS_1 \text{ per centimeter} = \sqrt{a^2 + b^2} \tag{10}$$

(a) Values of B_m Between 0 and 150.

Between these limits of B_m, b is so small in comparison with a that it is near enough to assume that:

$$C_oS_1 \text{ per centimeter} = a,$$

the error so caused being not greater than 0.5 per cent.

(b) Values of B_m Between 150 and 1400.

Substituting the values of a and b as given in equations 7 and 9 respectively, in equation 10 there is obtained a general equation giving C_oS_1 per centimeter in terms of B_m, which is as follows:

$$C_oS_1 \text{ per centimeter} = a\sqrt{1 + (0.45 \times 10^{-6}) B_m^{1.44}} \tag{11}$$

Angle ω.

Fig. 1 shows clearly that in general:

$$\tan \omega = \frac{b}{a}$$

One can, therefore, deduce two equations as follows:

(a) Values of B_m Between 0 and 150.

$$\tan \omega = 0.0141\, B_m^{0.39} \tag{12}$$

(b) Values of B_m Between 150 and 1400.

$$\tan \omega = 0.00254\, B_m^{0.72} \tag{13}$$

The equations deduced above for the four quantities, namely, i_mS_1, i_cS_1, C_oS_1 per centimeter and angle ω, have been plotted in Fig. 4, from which the value of either of these quantities corresponding to a known value of B_m can be at once determined.

DETERMINATION OF CURRENT-RATIO K_a.

The fundamental equation given in equation (1) is:

$$K_a = \frac{C_1S_1K}{C_1S_1 - C_oS_1 \sin \beta} \quad \text{where } \beta = \theta + \omega$$

That is, as the secondary load becomes more inductive θ will, of course, increase in value, and, other things being the same, the above equation shows that the current ratio will also increase and differ more widely from the theoretical ratio of K. One would, therefore, expect that the ratio characteristic with a non-inductive secondary load is much better than that obtained with an inductive load, and this is actually found to be the case. From this standpoint it is advisable to make θ as small as possible, although, as will be shown later, this will make the phase-displacement characteristic much worse.

The function $C_oS_1 \sin \beta$ is plotted in Fig. 5 against B_m for different values of θ, so that by aid of these curves it is quite an easy matter to construct ratio curves corresponding to given load conditions, provided that the number of primary turns, secondary turns and mean length of magnetic circuit are known. Conversely, the curves can be used for designing purposes, and the primary ampere-turns at full load required to give a ratio error within certain limits at a specified load determined, if the resistance and inductance of the secondary load are known.

It is quite obvious that before the curves can be used to calculate the value of K_a for any particular load the values of B_m and θ corresponding must be known. This question will be dealt with later, and, to make the method of procedure quite clear, an example will be given showing the ratio characteristics of an actual transformer as determined by this method.

DETERMINATION OF PHASE DISPLACEMENT.

The phase displacement between the primary and secondary currents is of extreme importance in cases where either an indicating or recording wattmeter or watt-hour meter is operated from the secondary of a series transformer; in fact, in all cases where the instrument so operated has both series and shunt windings.

Referring to the fundamental equation (2), given above it is seen that:

$$\phi = 57.4 \frac{C_oS_1}{C_1S_1} \cos (\omega + \theta) \text{ deg.}$$

If it be assumed that θ = zero—that is, that the secondary load is perfectly non-inductive—then it is quite clear that ϕ is dependent only on C_oS_1 per centimeter and ω for a given value of the primary ampere-turns (C_1S_1) per centimeter. One is therefore able to plot a number of curves connecting ϕ and B_m, assuming a definite value for C_1S_1 per centimeter in each case.

This has been done and the curves shown in Figs. 6 and 7 cover a range of primary ampere-turns per centimeter from 3 to 100. In a well-designed transformer the values of C_1S_1 per centimeter for loads ranging between full load and one-tenth load will be within these limits, so the curves as plotted should meet the majority of cases likely to arise in practice in this respect.

An absolutely non-inductive secondary load is, of course, never obtained in actual practice, and an inspection of the fundamental equation previously referred to will make it clear that if any value of ϕ as obtained from the curves be multiplied by a constant

$$k = \frac{\cos (\omega + \theta)}{\cos \omega}$$

the result will be the correct value of ϕ corresponding to the particular value of θ used in this expression.

To facilitate matters a number of curves have been plotted giving the value of k in relation to B_m, for various values of θ ranging between zero and 90 deg. These are shown in Fig. 8, and it will be at once observed that as θ is increased the constant k, and therefore ϕ, decreases. It is also interesting to note that some of the curves cross the zero line, and for certain values of θ the constant k is negative. This means that in such cases ϕ will also be negative, the physical meaning being that the phase displacement between primary and secondary currents can be made greater than 180 deg. if θ be large enough, and the secondary current instead of relatively *leading* the primary current in phase will *lag* behind it. Corresponding to the value of k = zero, ϕ will be zero and the secondary current will be exactly opposite in phase to the primary current. This happens when $(\omega + \theta) = \beta = 90$ deg., and a reference to Fig. 1 will make this clear, because then KC_2S_1 will be in phase with C_oS_1, and C_1S_1, and the primary ampere-turns will be simply equal to the secondary ampere-turns $+ C_oS_1$.

By aid of the curves given in Figs. 6, 7 and 8 one can quite easily construct phase-displacement curves showing how ϕ varies with the load. As in the case of ratio curves, it must be assumed that the value of B_m is directly proportional to the primary current, and before referring to the fundamental curves the value of B_m at full load must be known. It is also necessary to know the value of θ. The method of calculating these two quantities will now be dealt with.

DETERMINATION OF B_m AND θ.

Taking a typical case, assume that the secondary load consists of an ammeter, wattmeter and trip coil connected in series. Suppose that resistance of ammeter $= r_1$; reactance of ammeter $= pl_1$; resistance of wattmeter $= r_2$; reactance of wattmeter $= pl_2$; resistance of trip coil $= r_3$; reactance of trip coil $= pl_3$, where $p = 2\pi f$, f being the frequency.

Fig. 9 gives a vectorial representation of the secondary load, from which it is clear that the induced secondary voltage e_2 is the resultant of three components, and

$$e_2 = C_2 \frac{(R_2 + R)}{\cos \theta} \tag{14}$$

where

R_2 = resistance of secondary

$R = r_1 + r_2 + r_3$

Calling

$L = l_1 + l_2 + l_3$

there is obtained

[illegible] (15)

[illegible] equations enable one to calculate θ and e_2 pro-

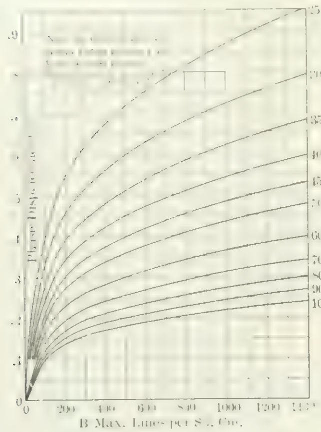


Fig. 7—Phase Displacement Between Primary and Secondary Currents for Large Current Values.

vided the resistance and self-induction of each component part of the secondary load are known.

Further,

$$e_2 = \frac{4.44}{10^8} S_2 A f B_m$$

where

$A =$ cross-section of core in square centimeters.

Therefore,

$$B_m = 2.25 \times 10^7 \frac{e_2}{S_2 A f} \qquad (16)$$

Substituting in this equation the value of e_2 as given in equation (14) there is obtained as a final result:

$$B_m = 2.25 \times 10^7 \frac{(R \quad R)}{S_2 A f \cos\theta} C_2 \qquad (17)$$

Equation (16) or (17) enables one to calculate B_m for given values of the secondary turns, cross-section of core and frequency. The first equation is used in cases where

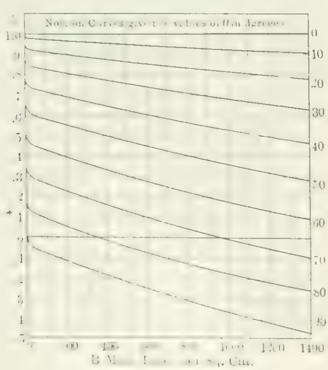


Fig. 8—Ratios of Cosines of Time-Phase Angles for Various Secondary-Phase Displacements.

the voltage drop in the secondary is known, and values for the second equation are taken directly from the total resistance and inductance of the secondary load. Taken in conjunction with equation (15), equations (16) and (17) show that the effect of increasing the secondary load resistance R_3 is to *increase* the value of B_m and *decrease* the value of θ for given conditions. On the other hand, increasing the secondary inductance L_3 will also cause an *increase* in the value of B_m, but at the same time an *increase* in the value of θ. The effect on the ratio and phase displacement characteristics of varying the secondary resistance and inductance can easily be determined by considering the curves given in Figs. 5, 6, 7 and 8.

As the values of B_m and θ for given load conditions are dependent on the frequency on which the transformer is operating, it is apparent that the characteristics of any

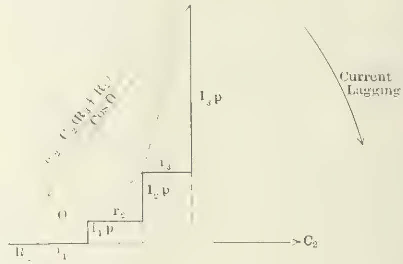


Fig. 9—Vector Representation of Secondary Load.

transformer will be affected by variations in the frequency. This particular point will be considered in a later issue.

THE ELECTRIC IRON-REDUCTION PLANT AT TROLLHÄTTAN, SWEDEN.

Experiments on a Large Scale for Determining the Commercial Possibility of Electric Iron Reduction.

At a recent meeting of the Swedish Association of Iron Masters (Järnkontoret) at Stockholm a report was submitted regarding the electric furnace of Trollhättan. As previously mentioned in the *Electrical World*, the association appropriated in October, 1909, a sum of $69,000 for the erection of a test furnace of the Grönwall, Lindblad and Stalhane type, which furnace should be of such dimensions that it could be worked as a commercial enterprise and its practicability as such be ascertained. The association received the co-operation of the government in the way of a free site on the government's grounds at Trollhättan and electrical energy at nominal cost from the government's power station. A 700-hp furnace of the same type has been in operation at Domnarfoet, Sweden, since the autumn of 1908, and in designing the new furnace the inventors could to a large extent profit from the experiences with the smaller furnace at Domnarfoet.

Besides the investigating of the larger furnace as a commercial possibility a number of points regarding the design and the behavior of the furnace were to be investigated, the most important of which were the following: The proper height of the furnace and other dimensions most suitable for different purposes and different charges; the most suitable design and way of building; consumption of electrodes and the shape and arrangement of electrodes; energy consumption per ton of iron of certain composition; coal consumption per ton of iron of certain composition; circulation of gas, its significance for the economy and means to accomplish circulation in case of choking charges; manufacturing of iron of different composition; conduct of various charges and concentrates and

the influence of same on the economy; value of escaping gases; efficiency of the furnace; maintenance cost at the furnace.

On Nov. 29, 1909, the work of excavating was commenced, and on Nov. 15, 1910, the furnace was started. Consignments of ore were sent from the different mines in

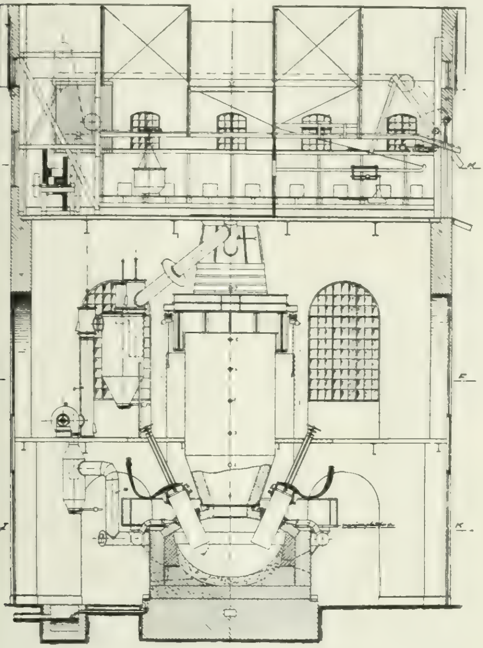


Fig. 1—Section of Furnace House.

Sweden to be smelted, and the pig-iron produced was sent to Swedish steel works to be made into steel, the quality of which was then tested.

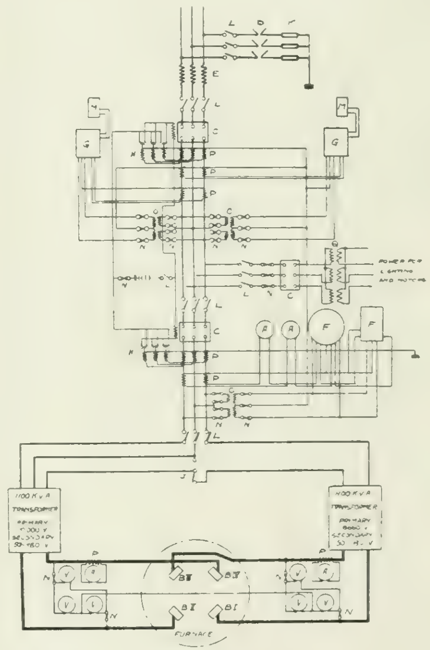
The plant comprises the following buildings: Coal storage, crusher building, furnace house and office building. The coal storage can hold a six months' supply of charcoal, or about 7000 cu. m. The coal is carried on band conveyors from the cars to the storage and from there by means of iron buckets running on a wire rope to the furnace top. The ore is taken from the heaps outside the crusher building by an elevator truck up to an incline, along which it slides into the crusher. The crushed material falls into a sheet-iron hopper, in which a sufficient quantity is collected to fill the truck to be elevated to the furnace top. The limestone, which is used as a flux, is crushed and transported in the same way.

The construction of the furnace is shown in Fig. 1. It is built in two separate parts, the shaft and the crucible or hearth. The shaft is a steel shell lined with firebrick. At the top it is riveted to an octagonal channel-iron ring, which rests on two beams supported by the walls of the building. At the top of the shaft is a Tholander charging bell operated by a 2½-hp reversible, three-phase motor. This bell is designed to deliver the ore round the sides and the charcoal at the center of the shaft. The hearth rests on a concrete foundation. The cover is made of 15-mm riveted steel plates, on the upper side strengthened by a 200-mm by 18-mm iron band. It is lined with firebrick with an inner lining of magnesite brick, the bowl-shaped bottom and the sides being rammed by a mixture of magnesite and tar. The electrodes are inserted through the roof at an angle 65 deg. to the horizontal. Each electrode consists of four square carbons having an area of 660 mm by 660 mm. At the opening in the roof each electrode is surrounded by a copper water-jacket, provided with an asbestos packing to prevent leakage of gas. The electrical contact pieces are wedged between the upper end of the electrodes and a holder of cast steel. This frame can be raised or lowered between two guides one on either side of the electrode.

The circulation of gas in this furnace is particularly important. The gas is drawn from the cool upper part of the shaft and blown into the crucible immediately under the hot roof. In this way it serves the double purpose of cooling the roof of the crucible and thus prolonging its life and on its way up through the shaft heating the charge and thus helping to a certain extent the reduction.

THE ELECTRICAL EQUIPMENT.

Three-phase alternating current is delivered at 25 cycles and 10,000 volts from the government power station. The feeders are provided with single-horn lightning arresters with series-coupled oil resistances and with inductance coils. The main switch has automatic circuit-breakers. The relays of Siemens type are adjustable for time as well as for overload and are actuated by means of dry batteries. After passing various series instrument transformers and



A—Ammeters.
B—Electrodes.
C—Automatic Oil Switches.
D—Lightning Arrester.
E—Induction Coil.
F—Wattmeters.
G—Kilowatt-hour Meters.
H—Maximum Relays.
I—Switch.
K—Oil Resistance.
L—Main Switches.
M—Clock Control.
N—Fuses.
O—Transformers.
P—Transformers.
Q—Transformers.
V—Voltmeters.

Fig. 2—Diagram of Connections.

another oil switch the mains enter the furnace transformers.

The two furnace transformers are each of 1100 kva, with a guaranteed overload capacity of up to 1375 kva under one hour. They are T-coupled, giving secondary two-phase currents. Regulation is possible between 50 volts and 90 volts in eight stages and by different connections of

the secondary coils also from 100 volts to 180 volts. The voltage can be regulated during operation.

The transformers, which are oil-insulated and water-cooled, are installed each in a separate chamber in the furnace-room. To make operation possible with only one transformer the high-tension side has been provided with a switch by means of which any one of the transformers can be coupled to the mains.

The low-tension conductors from the transformers are taken through the wall into the furnace-room. These conductors consist of six copper bars, 8 mm by 200 mm, for each electrode. These bars are supported on insulated clamps of brass. The energy is conducted to the four electrodes through 192 flexible cables (forty-eight per electrode). Each cable has an area of 185 sq. mm.

The instruments required for observing and regulating the working of the furnace and the electrodes are placed on an instrument board on the working floor. In the so-called furnace office on the floor above are placed the wattmeters showing the power consumption for the furnace and two kw-hour meters. In the same room are placed two galvanometers for the eight thermoelectric pyrometers, which measure the temperature in the furnace.

In electric pyrometers platinum-platinum-rhodium elements and silver-constant elements are used, the former in the lower and the latter in the upper part of the furnace. They are arranged to record the temperature every ten minutes.

ELECTRODES AND ELECTRODE CONSUMPTION.

Part of the electrodes used at the works were supplied by the Planiawerke, Ratibor, Silesia, and part by the Höganäs-Billesholm Company, Sweden. The purpose in using both was to obtain a comparison between the well-known Planiawerke electrodes and electrodes of Swedish manufacture. Results of the analyses of the electrodes are shown in Table I.

TABLE I.—ANALYSIS OF ELECTRODES.

	ELECTRODES FROM Plania.	Höganas.
	Per Cent	Per Cent
[illegible]	0.79	3.96
[illegible]	2.80	1.06
P	0.27	0.16
[illegible]		
SO_3	0.44	0.97
[illegible]	0.627	0.37
[illegible]	37.80	42.00
K_2O+Na_2O	1.21	0.45
[illegible]	6.08	10.20
[illegible]	2.62	2.16
[illegible]	28.04	21.70
[illegible]	0.52	0.38
[illegible]	21.22	19.80
Total	98.557	98.03

The rather large difference in the ash analyses is probably due to the difficulty in consuming the last traces of carbon by ignition.

From the above will be seen that the Höganäs electrodes contain a somewhat high percentage of ash and sulphur. In producing iron of high quality it is, of course, necessary that especially the percentage of sulphur should be kept as low as possible. With the electrode consumption found in actual operation and assuming that all of the sulphur combines with the iron, 1 per cent sulphur in the electrodes corresponds to 0.005 per cent to 0.006 per cent sulphur in the iron.

The electrodes in the furnace are four in number. Each electrode is built up of four carbons, 2 m long and 330 x 330 mm in cross-section arranged to form an electrode of 660 x 660 mm cross-section. Before being bound together the sides forming the joints are planed to a flat surface and the joint is made with a thick paste of molasses and graphite, so that the closest joint possible is formed. The upper part of the elec[illegible] paper and thin sheet iron, and the top surface is covered with a thick layer of ground asbestos and silicate of potash.

The sides of the electrodes are carefully planed smooth at the upper part for a distance of about 250 mm in order to make a good contact surface for the electric contacts. Between these and the electrode is also placed a fine-mesh copper wire cloth.

In order to observe the quality of the different makes, electrodes were built up of carbons from the two factories and each kind was used under similar conditions. No difference in durability could be discovered.

Table II gives the complete record for two electrodes (called No. 1 and No. 2), also the average for ten electrodes.

TABLE II.—RECORDS FOR ELECTRODES.

Electrode	Working Time. Hours.	Min.	Weight in Kg Before.	After.	Consumption of Electrode. Total Kg.	Per Cent.	Consumption per Ton of Iron. Gross.	Net
No. 1	1041	37	1321	557.5	763.5	57.79	2.09	1.21
No. 2	1115	31	1325	743	582	43.92	1.85	0.81
Average of 10	906	6	1313.3	635.8	677.5	51.61	2.28	1.16

An average of 110 liters per minute of cooling water was used for cooling the electrodes with a loss of an average of 97.8 kw, which is nearly 7 per cent of the total load on the furnace.

THE CHARGES.

During the time which this report concerns twenty-nine different qualities of charge were used, which, however, may be regarded as four main groups, viz., unroasted Tuollavaara, roasted Tuollavaara, Borgvik and Uddeholm ores.

The table forms a summary report of the energy and electrodes used for respective charges and also the amounts of pig iron and slag produced from four groups of charges.

Analyses of the iron were made from each tapping and analyses of the slag and the gas at frequent intervals. The tables are of great interest as showing the continuous and regular working of the furnace, but are too extensive to publish in these columns.

WORKING RESULTS.

While it may not be advisable to draw final conclusions on the basis of the results obtained, it is nevertheless of interest to examine these results with a view to find indications for the continued development and improvement of the process.

As a definite and highly satisfactory experience it should be noted that the need of repairs to the crucible has been very slight. During a period of nearly five months of continuous working only about eighteen hours have been required for repairs, which must be regarded as an eminently satisfactory result.

It is also satisfactory to note that the height and other dimensions of the shaft have in the main proved correct for normal conditions for fuel and ore.

If, however, earthy ore or concentrates or too fine fuel be used, or if the charge contains too much moisture, the working is injuriously affected, as would equally be the case with an ordinary blast furnace, and the design of the shaft does not appear to be well suited for such conditions. This is because it is then especially important to maintain a strong circulation of gas.

If this cannot be done the moisture is not evaporated, but gradually penetrates further down in the shaft, causing a lowering of the temperature. The reducing power of the CO is then decreased and the percentage of CO_2 in the resulting gas decreases. But this percentage of CO_2 is the indicator of the degree of utilization of the fuel used and must, therefore, under all circumstances be maintained as [illegible] possible.

For the conditions mentioned a shaft with a wider neck would be more suitable, as it leaves a larger space for the gas to pass up and a reduction of the temperature would be counteracted. Possibly it would also be an advantage to make the shaft wider and lower.

In order to produce an effective and uniform circulation of the gas it is in the first place necessary to purify it by washing, so that the frequent interruptions for cleaning may be avoided. Further, the gas pipes must be quite tight so that the gas drawn by the fan is really blown into the crucible, which must also be made as tight as possible. Alterations in these respects have recently been made.

The circulation of gas, which is so useful and necessary for the purpose indicated above, and which, moreover, is a protection for the roof, has, however, the disadvantage that the electrodes are attacked by the carbonic acid in the gas. Nevertheless, the electrode consumption has been low. The average for the entire time per ton of iron has been 10.28 kg gross and 5.27 kg net. Electrodes with screw joints are now being adapted for the furnace and the gross consumption may then be reduced—under most favorable circumstances to equal the net consumption.

The experience with this furnace appears to indicate that with this size four electrodes is a minimum number. It would probably be better to use six electrodes with three-phase currents. This would distribute the heat more uniformly and the risk of disturbances of the work on account of defects in the transformers would be reduced. Losses through cooling water would in this case probably be increased, but this would undoubtedly be more than counterbalanced by the advantages gained.

During the time to which the report refers only unburnt limestone has been used. In view of future comparisons with ordinary blast-furnace results it was desired to maintain the conditions very similar to those under which the same ores are usually treated. It is, however, evident that by the use of burnt lime the economy of the process will be improved and this improvement would increase in proportion as the quantity of lime required is increased. Whether unburnt or burnt limestone is used the percentage of CO_2 in the gas remains the same. This proves that the CO_2 derived from the limestone may be replaced by CO_2 formed by the reduction of the ore by CO. The energy required for burning the limestone is, therefore, saved and the same quantity of fuel reduces more ore.

At the end of the test period in the early part of June the furnace was shut down for the purpose of making the alterations mentioned above. It was again started during the first week of September and has since been in uninterrupted work.

Comparing the figures in Table IV with the earlier results it will be seen that a great improvement has been obtained over the first six months' working result.

TABLE III.—SUMMARY REPORT OF TESTS.

Per Cent Iron in Ore	Per Cent Iron in Charge.	Slag per Ton Iron	Material Charged per 100 Liter Charcoal	Electric Power: Time Used, For Working		For Interruptions.		Total		Average Load	Kw-hours Used, Total	Kw-hours Used, Per Ton Iron.	Iron Produced per Kw-year	Consumption of Electrodes: Gross	Net.	Per Ton Iron, Gross.	Per Ton Iron, Net.
		Kg.		Hours.	Min.	Hours.	Min.	Hours.	Min.	Kw			Ton.	Kg			
Group I Total 65.57	62.10	205	66.49	2,009	56	105	39	2,115	35	1,319	2,651,029	2,296	3.82	13,012	6,743	11.24	5.83
Group II Total 66.06	62.56	224	71.13	184	32	4	58	189	30	1,694	312,601	2,149	4.08	1,578	763	10.84	5.24
Group III Total 49.50	42.42	780	90.31	639	18	20	57	660	15	1,017	650,480	2,623	3.34	2,281	1,121	9.19	4.52
Group IV Total 57.92	53.06	458	69.88	506	34	22	11	528	45	1,733	877,706	2,643	3.31	2,474	1,285	7.45	3.87
Grand Total 61.54	57.00	327	70.77	3,348	10	153	45	3,501	55	1,344	4,500,596	2,391	3.66	19,345	9,912	10.28	*5.27

*Net—51.24% of gross.

Per ton of iron there were then used from 2150 to 3800 kw-hours, and for the entire time an average of 2391 kw-hours. The ores then used varied somewhat in quality, but it will be seen that a reduction of 20 to 25 per cent has been effected in the energy consumption. Correspondingly, the output of pig-iron per kw-year has been raised from an average of 3.66 tons to over 5 tons. The charcoal consumption has been reduced from 418 kg to from 340 kg to 345 kg per ton of iron, and the electrode consumption has also been reduced. The electrodes now used are supplied by the Planiawerke, and are provided with screw joints so that there are no waste stumps.

The practical importance of the process is best proved by the fact that there are now built or building furnaces for an aggregate of 27,000 hp, while, in addition, furnaces for about 36,000 hp are projected.

TABLE IV.—WORKING RESULTS FOR THE PERIOD SEPT. 3 TO SEPT. 30.

Pig-iron produced, tons	537.9
Quantity of slag, tons	88.9
Iron in the ore, per cent	67.65
Iron in the ore and lime, per cent	65.02
Quantity of slag per ton of iron, kg	165
Charcoal used per ton of iron, kg	339.9
Average load, kilowatts	1,407
Average power, horse-power	1,913.5
*Energy used per ton of iron, kw-hours	1,749
†Iron produced per kw-year, tons	5.01
Iron produced per hp-year, tons	3.68
Average CO_2 contents in gas, per cent	29.27
Average analysis of iron:	
C, per cent	3.64
Si, per cent	0.36
Mn, per cent	0.40
S, per cent	0.009
P, per cent	0.018

*According to instruments at the furnace.
†Estimated on the basis of 8,760 kw-hours per kw-year.

MANAGEMENT OF THE WORKS.

The management of the plant is in the hands of a committee appointed by the association and consists of Major-

General G. Geijer, Mr. Aug. Herlenius, chamberlain to the King, and Messrs. J. A. Brinell, chief engineer of "Järnkontoret," Axel Wahlberg and E. Odelberg, the last named acting as managing director for the committee.

At the works the management has been in the hands of Messrs. J. A. Leffler and E. Nyström, both engineers on the staff of "Järnkontoret," the former acting as general manager and the [illegible] superintendent.

The employees at the furnace consist of three men for charging, two for bringing up charcoal, four for crushing and bringing up ore, five furnacemen, three men for fitting electrodes, two for weighing iron and slag, one blacksmith, one blacksmith's helper, one electrician, five men for loading and unloading, one carpenter and one watchman and messenger, making a total of only twenty-nine workmen employed in the various operations.

Central Station
Management, Policies and Commercial Methods

GUESSING CONTESTS IN CHICAGO.

This year the employees of the Commonwealth Edison Company of Chicago have established two guessing contests, one based on the maximum load of 1911 before Dec. 22, in kilowatts, and the other on the largest day's kilowatt-hour output. The pools are kept separate, and each is to be divided 60 per cent to the one guessing nearest the correct figure and 40 per cent to the one guessing next nearest. The fee is 25 cents for each guess, and not more than five guesses are permitted in each pool from one person. Both pools will be divided on Saturday morning, Dec. 23. No guesses were received after Nov. 29. The highest total maximum output of the company to date occurred on Nov. 1, 1911, and was 190,160 kw. The largest kilowatt-hour output in one day up to the present time occurred on Nov. 2, 1911, and was 2,392,200 kw-hours.

FOLLOWING DOWN THE COMPLAINTS.

Most central stations are "up against" the difficulty that their customers' complaints receive only a perfunctory examination and reply, without having the trouble traced all the way back to its cause to guard against repetition of the objection. After an experience with dividing the responsibility for complaints among the various members of its office staff, one large central-station company is now arranging to put all complaints in the hands of one man, who has instructions to investigate each case to the very bottom. He will, of course, have the assistance of department heads in furthering his inquiries, but is expected to see each case through to the end. As the complaints are disposed of all the data connected with each case will be filed under a separate classification, and if repeated complaints are then received from the same customer, his status either as a chronic "kicker" or the subject of real and uncorrected injustice can be readily ascertained.

KEEPING THE ISOLATED PLANT OUT OF BROOKLYN.

The Edison Electric Illuminating Company of Brooklyn has ever been mindful of the great advantage to be derived from a good motor load, and in its strenuous endeavors for a brighter Brooklyn has managed to carry on some excellent work among manufacturers and contractors, thereby improving the load-factor of its system and adding to its revenues, a not altogether unwelcome combination. During the sixty days ended Nov. 1 the sales department has closed contracts for more business than was ever written in a similar period in the history of the company. The energy consumption will aggregate over 10,000,000 kw-hours per annum on these contracts alone, and it is of interest to note that the business was snatched from the isolated-plant field.

Five of the contracts are of more than passing interest and size, and the sales department of the Brooklyn company takes commendable pride in transmitting the details. The Tidewater Paper Mills, a new concern which will manufacture paper from pulp brought from Canada, will operate entirely by electricity. The connected load is 1000 hp and the load-factor over 60 per cent. The estimated revenue from this contract will exceed $50,000 per annum.

A contract with the Bush Terminal Company has been closed for a long term of years covering the supply of electricity for existing loft buildings and three in course of erection. The connected load approximates 4000 hp and the estimated annual income $100,000. Another terminal company supplied with energy is the New York Dock Company, whose two private plants were shut down and replaced by Edison service a short time ago. This company has now contracted for a further supply for two additional loft buildings which will pull about 1500 hp from the Edison company's system. The annual revenue received from the dock company is estimated at $25,000.

The Sternau Company, manufacturer of the famous Sternau ware, has signed a contract covering the complete needs of its new building on John Street. The company has at present in its old building an isolated plant which will be dispensed with. The annual revenue which this contract will add to the receipts of the company is estimated at $10,000. Still another isolated plant will give place to central-station service. The works of the Thomas Gill Soap Company, which were formerly operated by steam-driven apparatus, will hereafter take energy from the mains of the Brooklyn Edison company. The total business secured during the month of October exceeded that of the same period a year ago by 40 per cent.

APPLICATION OF ELECTRIC HEATING TO CELLULOID INDUSTRY.

In the manufacture of small articles of celluloid electric heating finds an application where practically no other heat source offers competition. Celluloid, as is generally known, is made from guncotton, camphor, etc., subjected to hydraulic pressure, and shares the highly inflammable nature of its principal constituent. For this reason it is important that flame of any kind be kept out of celluloid factories and workrooms, so that high-pressure steam has usually been used for heating the material during forming. Celluloid softens at about 250 deg. Fahr., but ignites at about 280 deg., so that the closest temperature control is required in handling it.

Use is being made of electric heating in Chicago in the establishment of a number of such small celluloid article factories in loft and factory buildings and other places formerly impossible for this purpose on account of absence of high-pressure steam. One operator of a small celluloid-comb factory in Chicago recently moved to a new location where steam was not available, and found that the owners

of the building would not permit the installation of a gas-heated high-pressure boiler. Finally he applied to the Commonwealth Edison Company, whose lines reached his new factory, and was shown how he might use an electric hot-plate element, which has since been in service with much satisfaction.

Since then one of the large manufacturers has developed a special celluloid heating element measuring 18 in. by 30 in. The running consumption is 225 watt-hours per hour, while for quick starting 450-watt and 900-watt connections are provided which quickly bring the surface of the plate up to the proper temperature. The heat is so adjusted that the celluloid blanks for combs or other articles can be laid on the plate in succession, the first one being properly softened by the time the last has been laid down. In this way the operator works continuously without loss of time. The new application of electric heat to the manufacture of celluloid articles is expected to make possible the establishment and operation of many such small factories in districts and cities where the requirements of special steam heat formerly made this impossible.

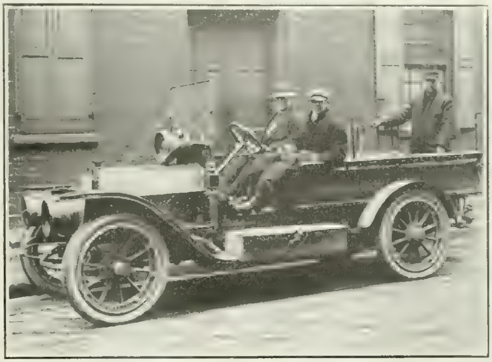
N. E. L. A. COMPANY SUGGESTION AND QUESTION BOXES.

Throughout the offices and departments of The Milwaukee Electric Railway & Light Company the local N. E. L. A. section has installed panels carrying letter boxes and racks of printed forms and envelopes for suggestions and questions pertaining to central-station matters. The question blank used, printed on white paper, has space for the query on one side and the answer on the reverse. The suggestion forms are printed on colored paper, one side bearing the conditions of the suggestion-box contest, which includes the award of $15, $10 and $5 in cash prizes for the best offerings during the year. All questions and suggestions are to be inclosed in the envelopes provided and dropped into the letter boxes. Mr. C. M. Wheelock is chairman of the question-box committee, and Mr. C. N. Duffy is chairman of the suggestion-box committee. Mr. O. M. Rau is president of the local section, Mr. A. H. Sikes vice-president, Mr. G. G. Post secretary, and Mr. F. J. Boehm treasurer.

CINCINNATI'S 60-HP EMERGENCY LINE AUTOMOBILE

Mr. F. R. Healey, superintendent of distribution for the Union Gas & Electric Company of Cincinnati, has just placed in service a completely equipped new emergency automobile which is used for making hurried runs in cases of overhead or underground trouble. The new wagon was especially designed and built to meet the needs of the line department and makes use of the chassis of a 60-hp Stearns touring car. Fully loaded with crew and a transformer or two, it is capable of running up any of the severely steep grades among the hills of Cincinnati at a speed of 30 miles an hour, or faster if desired on the level stretches. For illuminating the tops of poles or lines where repair men are doing emergency work after dark the car is equipped with powerful acetylene search-lanterns. The regular sidelamps are supplied from a storage battery carried on the machine, and are inclosed in red glass like the local fire-department wagons, demanding right-of-way over all other traffic. In boxes at the sides of the body is carried a full equipment of tools for doing overhead and underground work.

The truck is kept at the company headquarters on Plum Street, where a driver is always available. When a hurry call is received the wagon is immediately dispatched to the nearest place where the regular line crews are working and enough men are picked up to handle the emergency job, to which the car is next hurried. If it develops that a transformer or some other piece of equipment is required to complete the emergency repair the car can be sent to the storeroom for it without loss of time, returning while the repair gang is making ready. Using the wagon as a tractor, such a transformer can be hoisted to the pole-top



60-hp Emergency Line Automobile.

quickly and with little manual effort. In the case of emergency calls after night the car is first sent out to rouse such men as cannot be reached by telephone and then makes a second round picking up its crew from their respective homes. The Cincinnati company formerly had in service a lighter automobile which was used for a similar purpose, and this machine proved so valuable that the present powerful car was purchased and equipped.

ELECTRIC FANS FOR SCHOOLHOUSES.

Dr. W. A. Evans, formerly commissioner of health for the city of Chicago, now conducts a valuable department in the Chicago *Daily Tribune* under the heading "How to Keep Well." In a recent issue he discussed the subject of school ventilation, and among the recommendations he made was one of particular interest to those engaged in the selling of electric fans and of electricity to operate them. Dr. Evans' suggestions apply to schools in towns and cities in the United States located north of the latitude of Memphis, Tenn., and east of the longitude of, say, Phœnix, Ariz.

The Chicago Ventilation Commission has indorsed the following propositions: (1) In a mixture of air containing carbolic acid this gas does not settle out and rest near the floor. (2) The dilution method of ventilation is ineffective and uneconomical. (3) The putting of a given volume of air into a room does not necessarily constitute ventilation. (4) Ventilation is done better by air currents than by dilution. In practice, however, these principles are not observed, and the former health commissioner points out that almost invariably the air in schoolrooms is too still.

Authorities on the subject seem to have proved that air cannot be regarded as healthful unless it is moving with a considerable degree of velocity. As it strikes the body it must have force enough to blow away the foul air, and it must clean the breathing zone, which is the air around the head. Furthermore, it must clean the air around the body and under the clothing, which is referred to as Sedgwick's "aerial envelope." Therefore, still air may be regarded as deadly. Present methods too often result in giv-

ing the air in schoolrooms a morgue-like stillness. The hot air, frequently of a temperature about 130 deg. Fahr., is introduced about 8 ft. above the floor. Theoretically this air blows across the room against the ceiling, diffuses through the air, and leaves gently by an exit near the floor line. The object is to do away with air currents.

In practice this system of indirect ventilation does not give satisfactory results, and it is particularly to be deplored in schoolhouses, where the health of young children may be affected. The suggestion which is made by Dr. Evans is that schoolrooms be equipped with electric fans to be operated during the winter when the windows are closed or nearly closed. The author observes that fans are a means of comfort during the summer, but they are to be regarded as a source of health during the winter. This suggestion is an important one and, coming from a man who made an excellent record as commissioner of health in one of our largest cities, is one to which managers of electric-service companies should pay careful attention.

If every schoolhouse were equipped with electric fans for both summer and winter operation, a practical result would be a greatly extended use of this class of apparatus and of the energy necessary to operate it. The demand for electricity to operate these fans would seldom come on the peak, even during the shortest winter days. The question has, however, a broader and more important aspect than the mere advantage to electric-service companies, although this need not be overlooked, and managers of electrical utilities may well make some study of the possibilities of electric ventilation in schoolhouses, taking up the subject with the various school boards as opportunity arises. In particular it would seem as though all new schoolhouses in cities should be wired throughout for electric service, so that the advantages of direct electric ventilation in every room may be obtained thereafter at comparatively small cost.

REPLACING ISOLATED PLANTS WITH CENTRAL-STATION SERVICE IN ST. LOUIS.

Owing to the presence of cheap coal, at $1.40 per ton f.o.b. St. Louis, from the nearby Illinois bituminous fields, St. Louis has had perhaps more than its share of isolated lighting, power and heating plants. Good headway in the conversion of these installations to central-station service is now being made, however, as the result of the intelligent and effective campaign which has been waged for several years by the Union Electric Light & Power Company, which is rapidly acquiring former isolated plants as its customers and preventing new plants from being installed.

In the *Electrical World* of July 29, page 276, a note reported the conversion of two of the largest of such plants in the city to Union Electric service: the 850-kw Grand Leader department-store plant and the 500-kw Cupples Station plant, having three direct-connected engine units and two steam turbines. The sixty-nine hydraulic elevators at the Cupples plant are to be operated the year round by centrifugal motor-driven pumps. The Cupples plant furnishes service under a city franchise to offices, warehouses, etc., throughout a terminal railroad district covering fourteen city blocks. In these cases central-station lighting service is supplied during the summer, while the isolated plant returns to operation during the peak-load periods and to the extent of exhaust-steam heating requirements from October to April, the former station being under the Union Electric Company's control.

This summer lighting service to buildings supplied from private combination heating and lighting plants during the winter has proved one of the opening wedges in finally ousting the isolated equipment. The owners of the plants are usually glad to shut down during the warm months, when steam heating is not required, thus excluding excessive heat, smoke and dirt, and since this additional load comes during the summer period and off-peak winter hours when the central station's demand is light the arrangement is equally satisfactory to the electric-light company. In some cases such an arrangement is continued each year, isolated plants returning to operation during the steam-heating season, generally under the control of the Union Electric Company, thus relieving the owner of the property from the burden and care of operating a plant. The Union company impresses on the owner that the time which he, personally, puts in on the plant could be better and more profitably applied to the business he understands. In many cases the isolated-plant operator thus has demonstrated to him the convenience and economies of central-station service and a good customer for the year round is secured. After the company has operated a plant as above for several years and the equipment becomes gradually worn out, replacements or extensive repairs being necessary, the owner of the machinery usually finds he is able

WHO Purchases the supplies for your power plant—the fuel, boiler compound, packing, belt dressing, oil, waste, gauge glasses, oil cans, belt lacing and the many other odds and ends— **YOU?**

WHO Receives the salesmen and listens to their voluminous arguments— **YOU?**

WHO Listens to the complaints about this oil and that boiler compound— **YOU?**

WHO Listens to the excuses for lack of power and SHUT-DOWNS— **YOU?**

What's your time worth? Add that to all your power plant bills and contrast the total with the cost of our central station power—power that requires none of your time—that comes to you ready to use —that is ALWAYS READY—always sufficient.

Houston Lighting and Power Co. 1905
Phone Preston 71 917 Capitol Ave. Houston, Texas

An Open Letter to Plant Owners at Houston, Tex.

to make a more profitable arrangement with the company for outside service the year round, operating his own boilers at low pressure for atmospheric heating service.

As is characteristic of such installations in many other cities, office buildings, hotels and department stores are among the hardest classes of business to obtain. After solicitation of from one to five years, however, even these plants can usually be "shown" and become converted at once, or by degrees, to central-station service as outlined above.

With the permission of the owners experienced engineers are sent into the plants, the quantity of coal burned is measured, the engines are indicated and tests of various steam and power losses are made, evidence being acquired in this way of sources of expense which could be avoided with electric drive and district or isolated heating service furnished by the central-station company or the user, as may prove to be the less expensive method.

Where the consumer can really show that he is operating

his station at lower cost than he could purchase electric service and furnish his own low-pressure heating, and this the company's engineers find to be true, the Union Electric Company then makes the proposition of offering to operate the isolated plant either under its existing condition, with summer service and off-peak winter service from the company's lines, or as a low-pressure heating system; in the latter case using only the plant boilers and supplying electric-lighting service from its own lines the year round. With the electric company's expert staff of engineers and large facilities for buying fuel and supplies it is evident that the plant can be operated in this way more cheaply than as an isolated station under private direction, and the point of this argument, with others, usually appeals to the owner.

In several instances in St. Louis the Union Electric company has taken over isolated plants, operating these as auxiliary generating stations during the peak and at other times only to give sufficient exhaust steam for heating purposes during the steam-heating season. Under such conditions the local generators are connected with its own Edison distributing network, so that any energy generated on account of steam heating in excess of the demand in the building is delivered to the outside lines. When no heating is required these plants are shut down and electric service is supplied from the Ashley Street central station.

In other cases, as above noted, the company either converts the existing steam boilers into low-pressure units or installs its own steam-heating equipment, which is operated during the heating season. These decentralized heating plants also sometimes form the nuclei of localized steam-heating systems, the company often being able to go next door or within the same or adjoining blocks and replace other isolated electric plants, supplying winter steam from the boilers of the central isolated plant, while furnishing electrical energy from its main system.

An enumeration of a number of the large service installations of the Union Electric company was given in the *Electrical World* of May 19, 1910. As several additional large installations have been taken over since that time we give the following as examples of the class of business being handled:

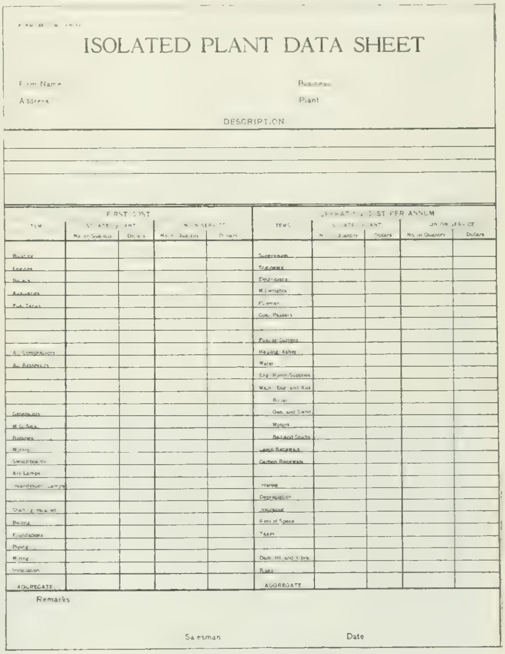
	Cubical Contents.	Kw-Hours per Year from Central Station.	Kw-Hours Generated.	Connected Load Kilowatts.
Office Buildings:				
(1)	1,538,107	91,100	0	150
(2)	1,402,600	196,311	0	187.5
(3)	431,160	74,106	0	150
(4)	1,533,096	285,450	0	270
(5)	1,879,000	427,601	0	394.4
Department Stores:				
(1)	9,048,878	2,214,350	0	1556.8
(2)	7,800,000	1,150,000	850,000	850
Hotels:				
(1)	1,600,000	385,472	0	222.2
(2)	1,027,014	90,000	60,000	75
(3)	902,328	100,000	71,420	150
(4)	2,000,000	646,100	0	407.3
(5)	1,000,000	341,276	0	203.5

During the year 1910 isolated-plant business amounting to 2406 kw was connected and 2,417,261 kw-hours were consumed by this 1910 business during the same year. The kw-hours generated in isolated plants during this period was 463,300 and revenue for energy delivered from the company's lines to these isolated plants during the period mentioned was $76,900.91. The revenue for steam heat and generation during the same period was $22,590.38 and the total revenue from plants taken over in 1910 was $99,491.29, the average price for energy from the company's lines being 3.24 cents per kw-hour.

From Jan. 1 to Sept. 1, 1911, there has been connected to the company's lines isolated-plant business equivalent to 1912 kw in ten buildings. In one of these plants the capacity is 500 kw.

The Union Electric company is now figuring on installing a substation for a large building, contemplating the operation of the latter plant during the central-station peak-load period and to the extent of the heating requirements. This building will have approximately 12,000-kw generating capacity and a cubical capacity of 12,000,000 cu. ft.

It is not the Union Electric company's policy to make random statements regarding the cost of central-station service as compared to isolated-plant service, and it is the company's rule not to assert that central-station service would be cheaper when the company's representative knows in his own mind that the consumer could generate energy at a less cost than it could be obtained from the company's mains. The company goes on the theory that there are some installations which the central station cannot expect to get, provided the consumer is in a position properly to operate an isolated plant. The company claims that in some plants steam is used and required in great volume



Isolated-Plant Data Sheet.

for cooking and manufacturing purposes when the electric requirements are less than the steam, or when the electric requirements are sufficient to give the required exhaust steam for atmospheric heating purposes seven or eight months in the year without the use of live steam.

For securing the power business of large industrial establishments the company has on its staff a number of experienced motor-application engineer salesmen. A record is kept of all of the isolated-plant installations in St. Louis and calls are made on the owners of these stations to acquaint them with the advantages and economies of central-station service. In the course of these visits permission is requested for one of the company's engineers to go through the plant and study the cost of power production and distribution, with an idea of determining whether a saving would be made were such service furnished by the electric company. From the plant fireman and engineer information as to the expenditures for coal, oil and supplies is secured and estimates are made of the overhead costs, including interest and depreciation on the investment.

Indicator cards are taken from the plant engines and the sources of various losses in shafting, belting and other transmissions are located and investigated.

As a bit of salesmanship psychology it is interesting to note that after the test has been made on the plant the solicitor usually makes several calls on the owner, ostensibly with the idea of asking for additional information, but at each visit lets drop some hint of a source of loss that has been discovered in the plant's operation. One or two of these suggestions usually make the owner keenly interested in the proposal which the central-station company has yet to offer and the intelligent discussion which the company's representative is able to make with him on the peculiar subjects and phases of his own business begets further confidence in the mind of the owner. The company has in its employ men who are familiar with the power needs of a great many and widely diversified manufacturing processes and where the solicitor's own knowledge is limited he has recourse to the application data of the large manufacturers and other central stations. Discussion with the owner soon reveals the fact that the solicitor is perhaps better informed on methods of power application for his particular business than even the owner himself and the company's complete report, which is submitted later, is usually awaited with great interest.

These reports, which are now being prepared in a standard style, open with a description of the present equipment and an account of the tests made by the company's engineers on the prospective customer's plant, including an estimate of the present cost of operation. After this there follows in great detail a description of the proposed installation of motors, the arrangement of drives and machines being carefully shown. In thus preparing for electric drive, in addition to the well-known advantages of better light, less power, etc., a point is made of the logical arrangement of the processes of manufacture possible, requiring less handling of the product. Estimates of the size of motors, hours' use and operating costs with electric drive are then appended, a statement being made of the first cost of the new equipment, on which interest and depreciation are charged. The total operating cost under these conditions is then compared with the operating cost of the isolated plant. Sometimes it is even found possible to omit charging depreciation and interest on the steam plant, although including these on the motor drive, and still reveal a striking contrast between the two installations. Herewith is reproduced a copy of an isolated-plant data sheet which accompanies the report submitted to the owner, this sheet giving in compact form a summary of the costs that are explained at greater length in the report. As shown at the left the items of first cost are compared for isolated-plant and uniform service, and at the right the operating costs per annum for both services, all classified under a great number of headings.

The solicitation of isolated-plant business in St. Louis has been under the direction of Mr. Frank D. Beardslee, commercial engineer for the Union Electric Light & Power Company, and the industrial power business under the direction of Mr. L. F. Philo, sales manager. Mr. Herman Spoehrer, secretary, has general supervision over the commercial departments of the company.

POPULARIZING THE ELECTRIC LIGHT IN GERMANY.

As recently noticed in the *Digest*, the central station in Strassburg, Germany, has paid much attention to extending its business to small residences, and has met with much success.

Any number of lamps up to four per customer are installed at the expense of the electric-light company under the following conditions: The first lamp is installed entirely free of charge if four customers in the same building apply for service. In Strassburg, it should be added, there are comparatively few single-family houses. For the second, third and fourth lamp 6 cents is charged per month per lamp during six years. This corresponds at 4 per cent interest to $3.84 per lamp, which sum may be paid at the time of the installation. The cost of installing more than four lamps is paid by the consumer. The charges for service are 9.5 cents per kw-hour and 6 cents meter rent per month. The customer must contract to pay a minimum of $4.30 per year during the six years, or for one year at least in case he moves. Fixtures are to be paid for by the customer except one simple fixture in the kitchen. The above conditions correspond to an average discount of 10 per cent on the customer's bill.

The central station pays the following lump sum to local electrical contractors for these installations: 9 cents per foot of riser; $3.60 for the first lamp, $3.10 for the second lamp, $2.90 for the third lamp and $2.40 for the fourth lamp. If the costs should be higher in special cases the contractor makes an agreement directly with the customer about payment of the excess sum.

Electric light has become very popular as a consequence of this plan, and applications are made from many laborers' quarters. In one and one-half years 6200 installations have been made under this system, with an average of three lamps per installation and an average yearly income of $8.30. The central station sees to it that in each installation there is at least one 50-cp lamp. Only 7.4 per cent of the consumers fell short of the minimum bill of $4.30 per year. The rest, 92.6 per cent, pay considerably more than this minimum, but the amounts vary widely. Loss to the central station from unpaid bills is very small.

The president of the Strassburg company advocates a system of charging under which the customer would pay a certain fixed sum according to the number of rooms inhabited, which entitles him to use a certain number of watts at any time as long as he pleases. He would not be restricted, however, to that maximum demand, the energy consumed beyond to be measured by a watt-hour meter.

Wiring and Illumination

CONTRACTORS' EDUCATIONAL CAMPAIGN IN CHICAGO.

An interesting series of joint meetings of the electrical contractors of Cook County, comprising the members of the Chicago Electrical Contractors' Association and the Faraday Electrical Association, is in progress in Chicago. The first-named association embraces the principal "downtown" electrical contractors, while the Faraday association includes the smaller electrical contractors doing business outside of the "Loop" district in Chicago or in the suburban area within Cook County. The meetings are held monthly and have for their purpose the raising of the standard of electrical construction work in Cook County and also teaching the smaller contractors how to do business and how to keep their records to show whether the business is really profitable or the reverse. Many of the small electrical contractors are rather inexperienced in business matters, and the electrical jobbers have been known to say that the small electrical contractor constitutes the greatest credit hazard in the business. It is one of the purposes of the meetings in Chicago to raise the standard of the business generally, and to co-operate with central-station men, underwriters, dealers in electrical supplies and lighting fixtures and others to that end. The value of these joint meetings has been recognized by the Department of

Electricity of the city of Chicago, which has arranged a conference with the two societies of contractors to discuss the rules and regulations for the installation of electrical apparatus in Chicago. These rules call for a high character of construction work and are well enforced.

Mr. C. R. Kreider is president of the Chicago Electrical Contractors' Association, and Mr. R. C. Bierdemann is president of the Faraday Electrical Association. These gentlemen presided alternately at the joint monthly meetings. At these meetings a speaker is provided who gives a talk on some practical phase of the electrical contractor's business, from either the technical or the business point of view. Among these speakers have been Mr. Victor H. Tousley, chief electrical inspector of the city of Chicago; Mr. F. H. Getchell, electrical engineer for Holabird & Roche, architects, and Mr. H. B. Crouse, of Syracuse, N. Y., of the Crouse-Hinds Company. Such a meeting was held at a Wabash Avenue restaurant on Nov. 22, and there were about seventy-five men present. The speaker of the evening was Mr. Frederic P. Vose, secretary of the Electrical Credit Association of Chicago, who gave an excellent talk on "Organization." The meetings have a serious and worthy purpose, but entertainment features are also provided, and the gatherings are found to be very enjoyable. The next joint meeting of the contractors will be held in the middle of December.

RECENT STREET-LIGHTING DEVELOPMENTS IN PUEBLA, MEXICO, AND VICINITY.

By Roscoe Scott.

The purpose of this article, which is supplementary to that entitled "Street Lighting in Puebla, Mexico" (see *Electrical World*, June 1, 1911, page 1454), is to report the satisfaction felt by the people of Mexico's third city as regards their pioneer system of ornamental incandescent street lighting, and furthermore to note the interest it has aroused in other Mexican municipalities.

At the outset this opportunity may be taken to modify a statement made in the former description to the effect that "when the entire city has been lighted in this way, as is the present intention, there will be approximately 1000 lamps in service." The fact of the matter is that there are at present about 1000 lamps installed, and that whenever the system shall have been extended to cover the entire city there will be approximately 5000 lamps in service.

Despite the fact that the ornamental street lighting is costing slightly more than the open-arc system it replaced, the general consensus of opinion among the citizens is that the beauty and effectiveness of the installation more than compensate for the additional expense. Already a movement is on foot to extend the lighting. It is stated by the central-station officials as quite likely that within a short period the present equipment may be increased by from 50 to 100 per cent, and moreover that since the lights were first turned on not a single adverse comment on either the appearance or the illumination has to their knowledge been expressed. Fourteen city blocks are now ornamented by the five-light posts with the quaint brackets of griffin design, twenty-nine five-light posts are distributed throughout the Zocalo, or city park, and in addition the Portales surrounding the Zocalo are illuminated by 100-watt lamps. The present installation was completely finished by June 1 and has been in service every night since that date.

The accompanying photographs show three new views of Puebla streets after dark, or, more correctly speaking, after sunset. It will be noticed, in the background of Fig. 2 and in the foreground of Fig. 3, that the streets are festooned with high arches of incandescent lamps. These were installed in August, 1910, and were lighted every night of the following month in honor of the Sixteenth of September, which last year marked the centenary of Mexico's independence. Intended originally for temporary use only, the arches were left in place by order of the City Council, and have been illuminated on all succeeding national holidays and other special occasions.

Just after the nominal cessation of hostilities in the recent Mexican revolution Puebla was the seat of much rioting and turbulence, to such an extent indeed that railroad communication with the city was for a time practically suspended. Throughout this period of violence, however, the street lamps and globes appear to have been exempted from all vandalism. The unabated interest in street-lighting improvements—not only in Puebla but in other Mexican cities, as will be noted below—incidentally speaks forcibly for the ability of the country to recuperate after a strife which so heavily drained its resources.

Figs. 1, 2 and 3—Ornamental Street Lighting in Puebla, Mexico.

Careful records of the performance of the 100-watt,

4-amp series lamps are being kept by Mr. J. C. Riach, general manager of the Puebla Tramway, Light & Power Company, but it is not thought that average figures of sufficient value to warrant their publication will be available before June 1, 1912.

As a result of this first installation of metal-filament series lamps on poles in Mexico, many electrical companies in that republic have interested themselves in the possibility of accomplishing similar results in their own territory. Among the places where special activity has been manifested may be mentioned Vera Cruz and Mexico City. The following statements are quoted verbatim from the *Mexican Herald,* an English daily printed at the capital, for Oct. 16, 1911, and refer to an installation of high-efficiency incandescent street lighting recently made by the Mexican Light & Power Company on one of the prominent streets. The latter are at present lighted for the most part by open carbon arcs of German manufacture:

"The demonstration of effective street lighting made by the Mexican Light & Power Company in this city last night was a complete success. This demonstration was made in the two blocks extending along Avenida San Francisco from San Juan de Letran to Bolivar Street. Twenty-two lamp-posts, each equipped with a cluster of five lamps, were erected along the two blocks, and last night for the first time the light was turned on. The effect was magnificent. It is safe to say that never before in the history of Mexico City has there been such a brilliant and perfect illumination as was seen last night. The Sunday evening promenaders seemed immensely to enjoy the experience of thoroughly lighted streets, and the occupants of the long lines of carriages appeared as distinctly as in broad daylight. The idea of this effective street-lighting system has been taken from Puebla. If the government of the Federal District decides permanently to adopt the new system, the city of Mexico will very soon become the best lighted city in the republic."

RECENT TELEPHONE PATENTS.

MOUTHPIECE.

Where it is desired to make a transmitter mouthpiece of transparent material such as glass, or of some white impervious material such as glazed porcelain, some special holder arrangement is necessary to secure the mouthpiece to the transmitter. Numerous metallic holders have been suggested, but one about as simple as any is that described in a patent granted to Mr. F. O. Beuermann, of New York City. He molds his mouthpiece with an annular groove in the wall at the small end, where the wall thickens. This groove is of uniform depth save at one joint where a projection is left. A short tubular metal nipple threaded throughout its outer surface is coated with cement and pushed down into the groove with a nick in its edge spanning the tooth left in the groove. The projecting end of the nipple fits the transmitter case.

FIRE ALARM AND TELEPHONE SYSTEM.

Where a fire alarm is superimposed upon a telephone system and a code or number wheel is used, it is of material advantage for the operator to recognize signals definitely and immediately. Mr. W. L. Denio has therefore arranged a transmitter in the fire-alarm circuit so that the operator will receive a peculiar tone coincident with the code and thus immediately recognize the character of the signal and will plug it through to the fire department without delay.

RINGING APPARATUS.

Mr. H. N. Faris has obtained a further patent upon his ringing apparatus. This is of the pole-changer variety with a transformer the primary circuit of which is open save when there is a demand for ringing current. This demand is evidenced by the operation of the ringing key. The vibrator operates continuously, but a saving of current from the ringing battery is effected because of the open primary circuit.

REPEATER

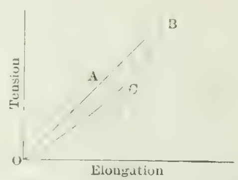
Some time ago we noted a patent for a repeater wherein the repeating direction of the apparatus was determined by the direction from which the exciting telephone current was received. The three patents recently issued to Mr. Charles Adams-Randall, of New York City, relate to a repeater and system of the same general type. One or more relays control the directional relation of the repeater or repeaters and this relay or these relays are in turn controlled by a push switch at the talking stations. Thus, if the button at one station be pushed, the transmitter of that station will have a relation to the repeater so that its currents will be sent to the distant end after being reinforced. If the button be not pressed then the station will be in receiving relation to the repeater. These patents are assigned to the Randall Telephone Manufacturing Company.

LETTER TO THE EDITOR.

Sags and Tension of Overhead Conductors.

To the Editor of Electrical World:

SIR:—The article in your issue of Nov. 11 by Mr. Alfred Still entitled "Sags and Tensions of Overhead Conductors" gives some very interesting and convenient methods for determining the mechanical constants of transmission lines. It occurs to me, however, in connection with the formulas which are developed in this and other articles recently appearing on the same subject that there is one factor not mentioned which should be taken into account in refined calculations. I refer to the failure of Hooke's law to apply to contraction as well as to elongation. That is, according



Relation Between Tension and Elongation.

to Hooke's law when a wire is subjected to tension the resulting elongation, if not carried beyond the yield point, will be very closely proportional to the force applied. However, if this tension is now gradually relieved, the decrease in elongation will not be proportional to the decrease in tension. As shown graphically in the accompanying illustration, the relation between tension and elongation will, as the tension is gradually increased, be given by the straight line $O A B$, but upon decreasing the tension the relation will be given by the curve $B C O$.

Owing to this property, when a span of wire which has been erected with a given sag and tension at a given temperature has been stretched from, say, a sleet load or a change in temperature, it will not return again to its original position when the conditions as to temperature and load return to what they were originally. That is, the wire will have a greater sag than that given by the formula. This is, of course, on the assumption that the elastic limit has not been reached.

To what degree this will increase the sag beyond the calculated value can best be determined by experiment.

Chicago. B. SMITH.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Insulation Tests of Electrical Machinery.—A. P. M. Flemming and R. Johnson.—The authors first point out the influence of temperature and moisture on insulation tests. In Fig. 1 a comparison of curves *A* and *B* shows the increase in insulation resistance resulting from the drying

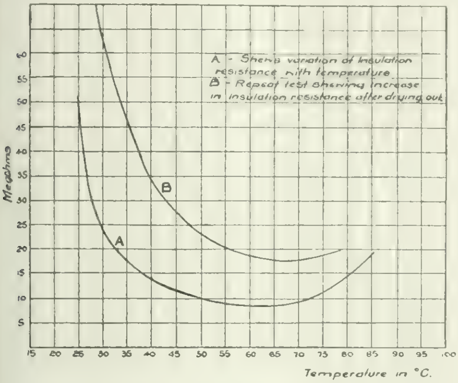


Fig. 1—Variation of Resistance with Temperature.

out of the windings of a 2000-volt induction motor where the insulation consisted of paper, mica and tape. The curves also show the effect of temperature on the insulation resistance and are typical of machines irrespective of the kind of insulation used, although as a general rule the decrease in insulation resistance as the temperature is raised is greater where organic materials, such as varnished papers and fabrics, are used than where those of a partly inorganic nature, such as micanite, are employed. The effect which moisture in the air has on the insulation resistance, however, should not be overrated, since in a moist atmosphere long before the slot insulation has absorbed sufficient moisture to affect appreciably the insulation resistance the exposed surfaces of the ends of the windings outside the slot portions will have become slightly conducting, due to deposits of moisture. The resistance will then be found to be greatly reduced solely through leakage over the surfaces from lightly insulated portions of the winding, or from bare copper, as in the case of direct-current machines. Particularly machines installed in chemical works have developed excessive leakage over the end of the windings due to the formation of conducting deposits. As regards pressure tests, these in general are only necessary during the time the machine is in the manufacturer's hands, that is, prior to putting it into service. The principal function of a pressure test is to determine whether there is any mechanical damage to the insulation between windings and ground. The test at the same time affords some indication as to the sufficiency of the thickness and quality of the insulating materials used. The principal risk likely to occur is that of the charring of the insulation due to internal heating, caused by the dielectric loss which is set up in insulation when it is subjected to alternating electrostatic stresses, this heating being more or less proportional to the square of the voltage. American and German practice of standardizing a test duration of one minute is recommended as reasonable. A danger not often recognized in applying pressure tests between windings of machines and ground lies in the possibility of causing short-circuits between adjacent turns of the coils. This is likely to occur if the test produces a breakdown to ground at a point in the winding or if a flashover occurs from the end of the winding to ground. In Fig. 2 the entire winding of the stator is represented diagrammatically by *A B*, and connection from the testing transformer to winding and ground is shown made at the two points *C* and *D*. If now failure occurs to earth at the point *E*, either through the breakdown of the insulating materials surrounding the coils or by a flashover from the windings across the air-gap to the armature iron, the potential at the point *E* is suddenly reduced to zero, and the full testing voltage is thrown across the portions of the winding *A E* and *B E*, the slope of potential being greatest across those turns nearest the point *E*. The momentary voltage across these turns may easily be sufficient to puncture the insulation between them. The risk may be minimized by connecting the testing lines to as many points as possible on the winding, as indicated by the dotted lines. This also affords similar protection against the effect of surges liable to be set up if the testing voltage is suddenly switched on or off.—Lond. *Elec. Review*, Nov. 17.

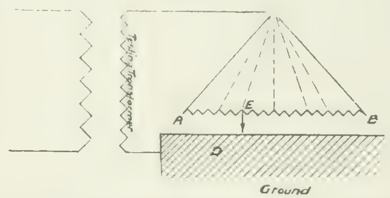


Fig. 2—Test Arrangement Shown Diagrammatically.

Parallel Operation of Compound-Wound Generators.—C. I. Young.—An article illustrated by numerous diagrams in which the author points out that it is a good plan to obtain a regulation curve on a generator after it has been connected to the prime mover with which it is to operate. The regulation curve furnished with a machine, though a correct record of test, may not give the operating characteristics in service, for the reason that the shape of this curve will depend to some extent on the speed regulation of the prime mover. After determining the regulation curve the next point is the consideration of the shunt resistance for the series field coils and the resistance to be connected between the series field coils and the busbar. In the majority of cases this is all that will be required. However, if after these adjustments the machines still fail to divide the load in proportion to their output ratings, it is in order to investigate the shapes of their regulation curve and see if some slight adjustment in the speed of either of the two prime movers, or perhaps both of them, cannot be made, such as will bring their curves more nearly in line. This can readily be done with belt-driven machines or with machines connected to direct-current motors, reciprocating steam engines or steam turbines in any but exceptional cases. With waterwheels or gas engines adjustment is not so easy. With induction motors the proposition is difficult. It is possible to secure slightly lower speeds by slotting the secondary end rings to increase their resistance, but higher speeds are practically impossible. If the adjustment of the shunt on the series field coils and the series resistance between the series field coils and the busbar is well made for each machine, and the regulation curves are lined up closely, the equalizer will have comparatively small corrective current

to carry. In many cases the generators are driven by prime movers with which speed adjustment is difficult or impossible. In such cases it may be necessary to put in an equalizer of larger size than the positive and negative cables between the machines. If the machines still refuse to divide the load properly, it is possible to help matters by inserting additional resistances in the series field circuits of both machines (the ratio of resistance of these two circuits being maintained), which will have the effect of making the ratio of equalizer resistance to the field circuit resistance lower and improving the operation, but at the expense of economy.—*Elec. Journal*, November.

Changing of Induction Motor from Two-Phase to Three- [illegible] ing ordinary two-phase induction motors to three-phase is that the required three-phase voltage is usually out of range of those found in common practice. Thus, in investigating the matter of changing a certain 50-hp induction motor from 220 volts, two-phase, to 440 volts, three-phase, the voltages suitable for delta or star connection of the primary were found to be 320 and 550 respectively, while the only available supply was 440 volts. The motor was of a somewhat obsolete type, with revolving primary and stationary wave-wound secondary. It was started by closing the line switch and, after attaining full speed, short-circuiting the stator, as shown in Fig. 3*a*. The original winding

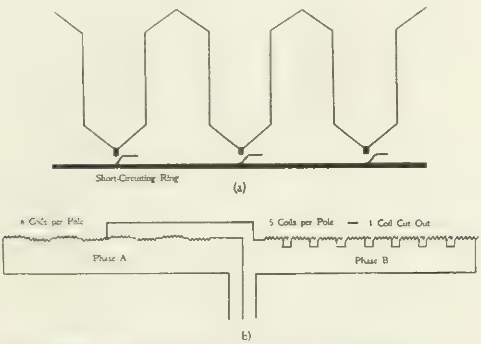


Fig 3—Method of Changing Motor from Two-Phase to Three-Phase.

consisted of six coils per group, each phase winding being connected in two parallel circuits of four groups in series, that is, ninety-six coils in all. To adapt this motor for operation on the three-phase, 440-volt circuit available without altering its operating speed, the following changes were made: In the primary-phase winding *A* (Fig. 3*b*) the two groups (forty-eight coils) were connected in series, the ends being connected to the line. In phase winding *B* the groups were connected in series, but one coil of each pole was omitted from circuit. These idle coils were left in the slots, however, in order to maintain mechanical balance of the rotor. One end of this phase winding was connected to the line and the other end to the middle point of phase winding *A*. The method involves no new idea, as it is simply an application of the familiar three-phase to two-phase transformation scheme to an induction motor. It is applicable in cases where the two-phase motor is liberally rated, as the starting torque and maximum torque will be reduced considerably and the temperature rise at full load when operating as a three-phase motor will be about 35 per cent greater than as a two-phase machine.—*Elec. Journal*, November.

Transformers.—W. T. TAYLOR.—A paper presented before the (British) Institution of Electrical Engineers on modern high-voltage transformers in practice, with special reference to a three-unit T-system. The author discusses those questions which particularly interest the operating engineer, such as the operation of transformers in practice, their construction, losses, cost, comparative advantages, etc. The methods of connecting transformers are considered in detail.—Lond. *Electrician*, December.

Induction Regulator.—E. E. LEHR.—An article illustrated by diagrams giving details of polyphase induction regulator windings and describing a systematic method of determining whether the windings of a regulator which has been completed are correctly placed and connected.—*Elec. Journal*, November.

Lamps and Lighting.

Metallic-Filament Lamps.—A note on progress made in metallic-filament lamp manufacture. The increase of lamps made by the Allgemeine Elektricitäts Gesellschaft during the last year has been 60 per cent. On the other hand, the manufacture of carbon lamps by the same company has decreased by 10 per cent, while the manufacture of miniature carbon lamps has increased by 500,000 lamps. The chief progress in metallic-filament manufacture has been the reduction of cost and increase of strength of the filament, but there has been progress also in the reduction of specific power consumption, especially with high-candle-power lamps. The invention of ductile tungsten by the engineers of the General Electric Company of this country is also utilized by the engineers of the German Welsbach Company and the Allgemeine Elektricitäts Gesellschaft. On the other hand, Siemens & Halske own the patents for mounting wire-drawn filaments which they had taken out in connection with the tantalum lamp. For this reason the former three companies and the latter company have now pooled their patents so that they all can make ductile tungsten lamps according to the methods of the General Electric Company and can use the method of mounting the filament of Siemens & Halske.—*Jour. f. Gasbeleuchtung*, Nov. 18.

Switching On and Off of Metallic-Filament Lamps.—E. W. MARCHANT AND W. PARRY.—An account of experiments on the effect of frequent switching on and off of metallic-filament lamps on their efficiency and life. It appears that with a lamp having a life of 1500 hours this would be reduced to 1000 hours, that is by 33 per cent, by 72,000 switchings. From this it is estimated that a lamp normally operating 1000 hours if switched off once an hour—that is, 1000 times—would show a reduction of life of less than one-half of 1 per cent. In other words, in practice the effect of switching is negligible.—Lon. *Illumin. Eng.*, October.

Perception of Lights of Short Duration at Their Range Limit.—A. BLONDEL AND J. REY.—As to the perception of lights of short duration, Bloch originally contended that the excitation necessary to produce an appreciable sensation was practically constant and proportional to the product of the illumination and the time. Charpentier, who verified this law between certain limits, likewise suggested that the retinal impression e produced by an illumination E of short duration t is fixed according to a linear law $e = E\,t$. But it has later been suggested that this law must be replaced by one in which the period of perception of a light just capable of producing the threshold of sensation should be infinite and the equation should be of the form $(E - E_0)\,t = C$, when C is a constant quantity. The present authors have made a great many measurements with a large number of observers and have found that when uniform lights are used the law is $(E - E_0)\,t = a\,E_0$, when E_0 is the minimum perceptible illumination and a a constant of time of about 0.21 second. An application is made to the technics of flashlight.—Lond. *Illumin. Eng.*, October, November.

Generation, Transmission and Distribution.

Group and Individual Drive.—H. E. POPCKE.—An article in which the author compares group and individual drive in machine shops and gives comparative figures of cost of installations and cost of the energy for friction loss. He

thinks that if the proper motor is used for individual drive the difference between the cost of individual and group drive is not large, if a new shop installation is considered, and will be paid for in two years' average. Instead of investing money in shafting and belting, it can be more economically invested in the purchase of electric motors for individual drive. The higher the cost of energy the greater is the advantage.—*Elec. Journal,* November.

Electric Power.—V. L. BOARD.—An article illustrated by diagrams on motor drive for biscuit factories.—*Elec. Journal,* November.

Traction.

Traction Power Plant in Hamburg.—W. WECHMANN.—The first part of an illustrated description of recent enlargements of the power plant and transmission line of the suburban single-phase traction line from Blankenese to Ohlsdorf. Two new turbo-generators, each of 1250 kw, have been installed with accessories.—*Elek. Zeit.,* Nov. 16.

Wheel-Base to Radius of Minimum Curve.—An article giving a diagram which permits one to determine quickly the minimum curve that a locomotive or car with a certain rigid wheel-base can negotiate, or the maximum wheel-base that can negotiate a given curve.—*Elec. Journal.* November.

Electrophysics and Magnetism.

Emission of Electrons by Metals Under the Influence of Alpha Rays.—H. A. BUMSTEAD.—An account of an experimental investigation which shows that the emission of electrons by aluminum and gold foils under the influence of alpha rays (secondary delta rays) varies with the speed of the alpha rays in a manner entirely analogous to the variation in the gaseous ionization produced by alpha rays. The emission at first increases and then rapidly decreases as the alpha rays near the end of their range, and the curves obtained show all the characteristics of the ionization curves in gases first obtained by Bragg. The curves lie within (to the left of) the corresponding curves for gases and have a less conspicuous "knee." So far they are in agreement with the known results on the retardation of alpha rays by metals, and with the hypothesis that the loss of energy by the alpha particles is due to an ionization of the metallic molecules. But the close similarity in the behavior of gold and aluminum is not in accordance with this view. In view of the dissimilarity in the ionization curves of different gases, the agreement in the curves obtained for aluminum and gold is unexpected, and leads to the suspicion that the observed effects may not be due to the metals themselves, but perhaps to a layer of absorbed gas in both cases.—*Amer. Journal of Science,* December.

Induction Coil.—E. T. JONES AND D. E. ROBERTS.—An account of experiments in which the authors investigate the elements (periods, amplitudes, damping factors and phases) of the two electrical oscillations which are set up in the secondary of an induction coil when the primary current is interrupted, and of calculating hence the maximum value of the secondary potential and the potential at any time during the oscillations.—*Phil. Mag..* November.

Electrochemistry and Batteries.

Electric Reduction of Iron Ores.—O. FRICK.—A very extended and detailed analysis of the results obtained in the experiments made on a large scale at Trollhättan, Sweden, and in the Noble furnace at Heroult, Cal., together with a discussion of the improvements which may be made. The results of the analysis are given in various tables of figures. —*Met. and Chem. Eng'ing,* December.

Italy.—R. CATANI.—A paper reviewing the application of the electric furnace in the metallurgical industries of Italy with special reference to the production of steel and pig-iron in the electric furnace and the manufacture of ferro-alloys.—*Met. and Chem. Eng'ing,* December.

Aluminum.—G. FLUSIN.—After a historical sketch of the aluminum industry the author gives an outline of the present electrolytic process and then deals at some length with the preparation of the starting materials bauxite, alumina, cryolite, fluxes and electrodes.—*La Houille Blanche,* October.

Electroanalysis.—C. A. PETERS.—An investigation of the electrolysis of sodium chloride with a silver anode to hold the chlorine and a mercury cathode to absorb the sodium. —*American Journal of Science,* November.

Units, Measurements and Instruments.

Standardization Rules.—A long editorial discussion of the recent changes made in the standardization rules of the American Institute of Electrical Engineers. As to voltages it is pointed out that the rules now recommend the adoption on low-tension, continuous-current circuits of the following pressures: 115, 230 and 550 volts, as against 110 and 220 volts in the previous edition of the rules, issued in 1907. These last-mentioned voltages, however, have been retained for alternating-current circuits, being also supplemented by pressures of 440 and 550 volts. "We do not know what consideration influenced the committee in making the change in the case of continuous-current circuits from 220 to 230 volts, but it is to be regretted that the same pressure could not have been retained as standard for both continuous and alternating-current circuits." No change is made in the frequencies recommended, namely, 25 and 60 cycles. "The fact that the larger is not, even approximately, a multiple of the smaller is unfortunate. In this connection the 25 and 50 cycles favored in this country (England) are an improvement." As to notation it is thought that the use of three separate fonts to denote magnetic flux, magnetic density and magnetic force is "certainly not advisable; while as I, E and R are now to be internationally adopted for electrical quantities, we hope that their use also for photometric units, as suggested in the American rules, will be reconsidered before their employment for this purpose has become at all general."—Lond. *Electrician,* Nov. 17.

Series Transformer.—P. G. AGNEW.—A long account of a study of the series transformer with particular reference to iron loss. While the ratio of transformation of series transformers usually decreases with increasing current, it may increase in individual cases, or even pass through a maximum. The ratio and the phase-angle performance may be accurately computed from the magnetic data of the core. In general, the slope of the ratio curve may be qualitatively predicted from the value of the Steinmetz exponent if the latter be assumed to be constant. But the iron losses, particularly at the low flux densities used, depart too widely from such a simple law for accurate work. The slope of the ratio curve may be accurately computed from the slope of the curve obtained by plotting the core loss against the flux on logarithmic co-ordinate paper. It is proposed that this logarithmic slope or logarithmic derivative shall be called the ratio of variation. It is much more useful than the actual exponent. The methods now in use for determining the "exponent" fail to give a true exponent that will satisfy the equation $W = KB^z$, unless z is a constant. The quantity actually determined by these methods is the ratio of variation. The wave-form of the secondary of a series transformer may be considered to be the same as that of the primary current for even the most precise measurements, as the distortion within the transformer is entirely negligible. While the effect of variations in wave-form on ratio and phase angle may be detected by accurate measurements, it is too small to be of practical importance, being of the same order of magnitude as the effect of small changes in frequency. The null methods used for accurate determinations of ratio and phase angle all give the theoretically correct results, well within the experimental error, so that the accuracy attainable is decidedly greater than is required in practice.—*Bull. Bureau of Standards,* Vol. VII, No. 3.

[illegible] AND C. J. HUBER.—An account of a comparative test of switchboard voltmeters and ammeters of American make at the Bureau of Standards. The first tests related to the performance of the instruments. The errors of calibration were found to be small in all the voltmeters, but much greater (and in some cases excessive) in the ammeters. The power loss in direct-current voltmeters is so small as to be unimportant. Further tests were made as to change in indications due to standing under load (zero shift, etc.), effect of stray field, damping, mechanical balance of moving system, insulation resistance, temperature coefficient and ruggedness of moving system. The second comparative tests related to details of construction, especially of the moving systems (torque, weight, number of turns, ratio of torque to weight) and the magnets (dimensions, air-gap, etc.).—*Bull. Bureau of Standards*, Vol. VII, No. 3.

Grouping of Series Transformers.—An article illustrated by diagrams discussing five usual methods of grouping series transformers with special reference to the methods of reversed V-connections and Y-connections.—*Elec. Journal*, November.

Telegraphy, Telephony and Signals.

Copenhagen.—F. JOHANNSEN.—An article giving statistical data on the telephone system of Copenhagen, which is one of the most extensively developed systems of Europe. It has about as many connections as Hamburg, with twice the number of inhabitants, or Vienna, with four times the number of inhabitants. Paris, with 2,500,000 inhabitants, has 45,000 connections; Copenhagen, with 500,000 inhabitants, had 31,000 connections at the end of 1909. The increase has been made chiefly during the last six years, as the number of the connections in Copenhagen increased from 19,000 in 1905 to 31,000 in 1909. At the same time the number of telephone conversations per day and per subscriber has decreased from 9.1 in 1905 to 8.2 in 1909. Since 1908 four-party lines have been added, and the 1600 subscribers on these lines carry on an average of a little less than one conversation a day. The accompanying figures give an analysis of the different classes of subscribers and their number of conversations:

Number of Conversations per Year	Percentage of Subscribers	Percentage of Conversations
Below 1000	[illegible]	10
1000 to 2000	[illegible]	20
[illegible]	18	20
Above 4000	1[illegible]	[illegible]

"Small" subscribers get a low rate, and the technical equipment of their lines is made as cheap as possible. On the other hand, for the "large" subscribers with a great many conversations during the day it is more economical to install an expensive equipment in order to reduce as much as possible the cost of operation. The equipment of the lines for the different classes of subscribers, as well as the charges and methods of operation, are described in some detail. In summing up the results it is concluded that the purely automatic system would not be successful if a great many small consumers had to be taken care of. But it is thought that the semi-automatic system, as used by the Bell company in this country and also by the Independents, may prove the solution for the future.—*Elek. Zeit.*, Nov. 16.

Long-Distance Wireless Telegraphy.—L. W. AUSTIN.—An illustrated account of quantitative measurements carried out with long-distance wireless telegraphy up to 1000 miles for the purpose of determining the law of the variation of strength of signal with distance. Over salt water the electrical waves decrease in intensity in proportion to the distance as found by Duddell and Taylor. In addition they are subject to an absorption which varies with the wave-length. This is true in general for day transmission. The absorption at night is entirely irregular, varying from zero to the day value, but is on an average much less during the winter than in summer. Variations also appear to occur during the daytime, but these are probably in general small. The received antenna currents between two stations with salt water between are proportional to the product of the heights of the sending and receiving antennas and inversely proportional to the wave-length, provided the antenna resistances remain constant. The experiments recorded were carried on with flat-top antenna heights of from 30 ft. to 80 ft. and wave-lengths of from approximately 1500 m to 4000 m.—*Bull. Bureau of Standards*, Vol. VII, No. 3.

Wireless Telegraphy.—A. BLONDEL.—A mathematical paper illustrated by diagrams on the use of two antennas for determining the direction in which a wireless message is received. Two different methods of orientation are discussed and the results of analysis are given in diagrams.—*La Lumière Elec.*, Nov. 4.

Wireless Telegraphy.—A continuation of the detailed and profusely illustrated description of the Telefunken system of wireless telegraphy. In the present instalment the equipment of various stations on board ship and portable military stations is described.—Lond. *Electrician*, Nov. 17.

Miscellaneous.

Reinforced Concrete.—P. LECLER.—A paper, illustrated by numerous diagrams, on the applications of reinforced concrete in electrical engineering, especially for switchboard partitions, conduit construction and the reinforcement of wooden poles without interruption of service.—*La Revue Elec.*, Nov. 10.

Insulating Material.—A note on a recent British patent (No. 5165, Nov. 9, 1911) of the British Thomson-Houston Company (General Electric Company of this country). This comprises a sheet of fibrous material, which is impregnated with a composition containing a phenolic aldehyde condensation product, and a stearine pitch. These are dissolved in a common solvent, such as amylacetate, the solvent being allowed to evaporate after impregnation. This gives a flexible material, which maintains its resistivity.—Lond. *Elec. Eng'ing*, Nov. 16.

Oxy-Acetylene Welding.—A paper by F. Carnevali giving hints as to the precautions to be taken in welding of medium and high-carbon steel as well as of cast iron by the oxy-acetylene flame. A separate article by Aug. S. Neumark discusses the production of oxygen in the workshop from alkali-chlorates.—*Met. and Chem. Eng'ing*, December.

BOOK REVIEWS.

THE COPPER HANDBOOK. A Manual of the Copper Industry of the World. Vol. X. By Horace J. Stevens. Houghton, Mich.: Horace J. Stevens. 1902 pages. Price, $5.

The tenth annual edition of the "Copper Handbook" contains 1902 octavo pages, and in addition to the miscellaneous chapters lists and describes 8130 copper mines and copper-mining companies in all parts of the world. The descriptions range from two or three lines, in the case of dead companies, wherein reference is made to detailed descriptions in past volumes at the period of their activity, up to twenty-one pages in the case of the Anaconda mine, which yields one-eighth of all the copper made in the world.

The miscellaneous chapters of the book, twenty-four in number, treat the subject of copper from all possible viewpoints, there being chapters on the history, chemistry, mineralogy, metallurgy, brands and grades, alloys and substitutes for copper, with a copious glossary. A chapter of statistics ending the book contains about forty tables, thorough-

ly covering copper production, consumption, movements, prices, dividends, etc. The "Copper Handbook" is sold on a plan adopted nine years ago, the compiler sending the book by mail, prepaid, to any address ordered, without advance payment of any sort and subject to return after a week's inspection.

The Theory of Electromagnetism. By G. T. Walker, M.A., Sc.D., F.R.S. London: Cambridge University Press. 52 pages, Price, 3s.

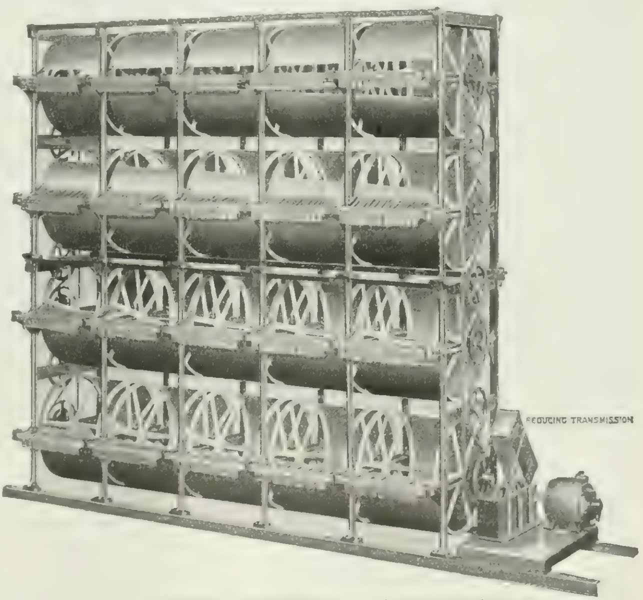
A short but advanced mathematical textbook on the vectorial theory of electromagnetism. There are seven chapters, which deal respectively with the following topics: Vector analysis; applications of vectorial methods to magnetostatics; the theory of Maxwell as expressed by Hertz; Hertz's equations for moving media; some effects due to the motion of charged particles through a stationary ether; the electron theory of Lorenz applied to stationary media, and the electron theory of Lorenz applied to moving media. The conclusion reached in the book is that Maxwell's equations as developed by Hertz are not in conformity with the experimental facts of optics in certain particulars, whereas the theory of Lorenz is in conformity with those facts. The conditions of relativity, or at least some of them, are deduced from the Lorenz theory in the manner originally demonstrated by Lorenz.

In these days, when the doctrine of relativity tends to become a cult and almost a religion, it is comforting to see it treated as a corollary to certain mathematical equations based on the behavior of moving electrons.

New Apparatus and Appliances

LAMP-FLASHING EQUIPMENT FOR ST. LOUIS HIPPODROME.

Talbot's Hippodrome is a large and handsome new theater in St. Louis. It is located at Sixth and Locust Streets, and is made conspicuous at night by a scheme of façade lighting of which the effect is similar to that which would be produced by an artist who made an outline sketch of the principal architectural features of the front of the building. This flashing of the spectacular outline lighting on the building front is accomplished by means of a lamp flasher of unusual interest, which is illustrated herewith. This mechanism, which is 6 ft. high and 8 ft. long, is one of the largest in service at the present time and has 232 switches of various carrying capacities, operated on 18-in. drums. The arrangement is for 191 changes, and the total number of lamps controlled by this machine is about 8000. The lighting load controlled is about 4000 amp at 10 volts, low-voltage tungsten lamps being used. A ⅙-hp, 110-volt direct-current motor drives the switching mechanism through a set of reducing gears which reduce the speed of the armature shaft in the ratio of 2500 to 1. The Reynolds Electric Flasher Manufacturing Company, of Chicago and New York, was the maker of this interesting combination.



Lamp-Flashing Equipment for St. Louis Hippodrome.

Fifty seconds is consumed in the operation of flashing the lamps on the entire theater front. The flashing begins by first throwing into circuit the semicircular cornice over the middle portion of the façade. The lamps come on one at a time in a manner similar to that observed in the script-writing effects often seen in electric signs. Other rows of lamps come in in the same manner, and light up in regular order various designs of the architectural ornamentation. The cornices and outlines on each side of the central portion next come into view, then the intervening sections and finally the window outlines, one at a time, until all the principal features of the front of the building stand out in lines of light. As stated before, the effect is as though an artist had sketched in the principal outlines of the façade, and the appearance is novel and striking. When the entire building front is outlined the lamps burn for seventy seconds and then are extinguished in the order in which they were lighted.

Electrical energy at 110 volts, direct current, is obtained from the Union Electric Light & Power Company. By the use of a rotary converter, alternating current at 110 volts is obtained, and this is reduced to 10 volts through two large transformers. Tungsten lamps operated at this voltage are used for the spectacular lighting. The sockets were made by the Federal Electric Company and are set in copper troughs.

The lamps are placed very close to one another, and when all the architectural features of the front of the building are outlined in light the effect is very brilliant. The flashing scheme was worked out by Mr. Bert Volker, electrician for Talbot's Hippodrome and the chief engineer for the Reynolds Electric Flasher Manufacturing Company. Including the flasher, rotary converter, transformers, wiring, cut-out blocks and lamps, complete, it represents an outlay of about $15,000.

INDUCTION MOTOR WITH AUTOMATIC STARTER.

In the accompanying illustration is shown an induction motor designed for providing a high starting torque with low starting current and yet to operate at high efficiency with low slip. The machine's centrifugal short-circuiting device closes automatically at a predetermined speed and thereby converts the secondary from a high-resistance to a low-resistance circuit. When a wider range of torque and current variation is desired use is made of the "star-delta" scheme of change in interconnection of the three primary-phase windings of a three-phase machine. By making this latter change at a sufficiently high speed the current is kept within reasonable limits. This motor has been developed for the market by Bruce, Peebles & Company, Ltd., Edinburgh, Scotland.

Induction Motor with Automatic Starter.

EXHIBITS AT LOS ANGELES ELECTRIC SHOW.

Following is a list of the commercial exhibits at the Los Angeles Electric Show, which closes on Saturday, Dec. 9:

American Multigraph Sales Company, Cleveland, shows the Gammeter multigraph in operation. Cards and circulars are printed with information regarding the electrical show. Mr. O. C. Haney, branch sales manager, Los Angeles, represents the company.

Baker-Chase Electric Company, Los Angeles, exhibits a line of electrical fixtures for residential use and an attractive display of electric heating appliances. Mr. E. W. Chase is in charge.

Bell & Jamison, Los Angeles, representing the Electric Railway Improvement Company, Cleveland, show one of the company's bonding cars for electric-weld rail bonding. The car is placed upon rails and practically demonstrated. Messrs. Bell, Jamison and W. A. Bly are in attendance.

Columbus Electric Vehicle Company, Columbus, Ohio, displays an inviting line of electric vehicles. The company provides ample floor space upon a platform at the side of the hall, setting forth its display to excellent advantage. Mr. G. R. Beach is in charge.

Crocker-Wheeler Company, Ampere, N. J., shows an assortment of small motors. Mr. W. B. Palmer, of Los Angeles, is in charge.

Cutler-Hammer Manufacturing Company, Milwaukee, represented by Mr. W. B. Palmer, Los Angeles, exhibits a line of electric-heating appliances, electric irons and electric disk stoves. Many of the company's well-known controlling devices are also shown. Mr. Palmer is in attendance. Mr. Palmer has attractively arranged both of the above displays on either side of the auditorium stage, reserving the center for his spectacular effects, of which an account is given elsewhere in a general description of the show.

Detroit Electric Vehicle Company, Detroit, has an attractive automobile exhibit of both pleasure and commercial vehicles. Mr. I. H. Stratton represents the company.

Dictaphone Company (Columbia Phonograph Company), New York, represented by the Southwest Sales Company, Los Angeles, displays a complete line of its electrically operated dictaphones, practically demonstrated. Mr. Warden is in charge.

Duntley Manufacturing Company, Chicago, represented by F. G. Kingston & Company, Los Angeles, has a well-arranged booth displaying its vacuum cleaners and air purifiers. Mr. Kingston is in attendance.

Electrical World, New York, has an attractive corner booth, centrally located, displaying samples of the *Electrical World, Engineering Record, Electric Railway Journal,* and electrical books. Mr. C. A. Rowley is in attendance.

Empire Electric Company, Chicago and Los Angeles, has a large and attractive exhibit upon the balcony floor. The company's space is well arranged to display its portable and instantaneous X-ray equipment, high-frequency apparatus, mineral tubes and like specialties. The company's display represents local manufactured products. Mr. E. J. Rose, inventor for the company, is in charge.

J. C. Farrar & Company, Los Angeles, show a line of insulators of various types for high-tension work, interior power-station protective apparatus and similar equipment. The company represents the Ohio Brass Company and exhibits a handsome assortment of this company's specialties. Messrs. J. C. Farrar and W. M. Cook represent the company.

Gans Brothers, Los Angeles, electrical contractors and dealers, exhibit a complete line of electric appliances for household use, including washing and wringing machines, electric-heating apparatus and the like. The company has an attractive feature in a miniature machine shop, comprising lathe, drilling machine, shaper, etc., in full operation, by means of a small motor, shaft and pulleys. Messrs. Gans are in charge.

The General Electric Company has one of the largest exhibits of the show. One section is devoted to motors of all types, automatic starters, controllers, mercury-arc rectifiers and other similar equipment. Another section is devoted to smaller apparatus, such as meters, fans, sockets, lamps, etc., while a third section displays the company's line of electric household appliances, including chafing dishes and cooking devices. At the front portion of its exhibit an attraction is offered by the operation of a three-phase motor under water in a glass-inclosed case. The company also shows an automobile battery-charging rectifier. The entire local office of the company alternates in attendance, under the charge of Mr. J. O. Case.

Great Western Smelting & Refining Company, Los Angeles, shows an attractive line of metals, such as babbitt, bar lead, etc., in charge of Mr. L. Swarts.

Haskins Glass Company, Wheeling, W. Va., exhibits an attractive assortment of its popular shades and globes, including the Haskins-Lucida reflectors. The booth is arranged in fitting manner to set off the display fully. Mr. H. P. Wallace, manager, is in attendance.

Kellogg Switchboard & Supply Company, Chicago, shows a line of portable and wall telephone sets, displaying also the Delco ignition system. The company has an attractive booth in charge of Mr. C. F. Hartung.

Kelman Electric & Manufacturing Company, Los Angeles, shows a line of its well-known oil switches near the entrance to the exhibit. Mr. J. N. Kelman represents the company.

B. F. Kierulff, Jr., & Company, Los Angeles, manufacturers' agents, representing the Fort Wayne Electric Works, the Sprague Electric Company and the General Incandescent Lamp Company, display the leading products of these three companies, as well as smaller electrical apparatus. Fort Wayne transformers, Sprague motors and a lamp assortment of the General Incandescent Lamp Company are well exhibited. Mr. Kierulff is in charge.

Los Angeles Brass Company exhibits a handsome line of brass lighting fixtures and fixture parts, as well as a display of its brass spinning and casting work. The display is well set off by an attractive setting. Mr. L. Swarts represents the company.

Los Angeles Electric Vehicle Company shows an electric automobile exhibit consisting of Edison pleasure and commercial vehicles. The Edison storage battery is also displayed.

Luitwieler Pumping Engine Company, Rochester, N. Y., exhibits its deep-well pumping machinery in large and small units electrically operated. The display is well arranged near the entrance to the auditorium. The Los Angeles branch of the company is in charge.

National Electric Lamp Association, Cleveland (engineering department), offers one of the largest displays of the exhibit with liberal floor space. Among the features shown is the well-known bronze Holophane tree, comprising "Mazda" lamps in sizes from 25 watts to 500 watts, with Holophane reflectors; a small metal display case, glass-inclosed, exhibiting thirty types of "Mazda" miniature units; a larger case of regular and high-voltage "Mazda" lamps of sizes from 25 watts to 400 watts; a display board showing a complete set of automobile lamps; a miniature Christmas tree aflame with small decorative units, and a wood display rack showing "Mazda" lamps employed for residential use, with decorative reflectors, such as Luceo and Fostoria. Mr. F. J. Blaschke represents the company; Mr. Glenn C. Webster, manager of the engineering department, is also in attendance.

Ohio Electric Vehicle Company, Toledo, presents an attractive display of electric automobiles, particularly of the pleasure type.

John A. Roebling's Sons Company, Trenton, N. J., exhibits its well-known line of cables, wires and insulating specialties. The display is attractively arranged on the balcony floor and is in charge of Mr. L. W. Drake, of the Los Angeles branch of the company.

Exhibit of National Electric Lamp Association at Los Angeles Electrical Show.

Southern California Electric Company, Los Angeles, shows a complete assortment of electric cooking appliances, electric washing and wringing machines, electric toys and novelties. The company offers a coffee percolator to the person who guesses the number of currants in a large bunch which is strung about a wire. Mr. J. C. Rendler is in charge.

Standard Electric Time Company, Boston, has a handsome display of electric clocks, particularly featuring its program clock for school and similar use. An attractive assortment of electric time stamps is shown. J. J. Estabrook, Pacific Coast manager, San Francisco, represents the company.

Standard Underground Cable Company, Pittsburgh, exhibits a complete line of cables, wires, terminals, junction boxes and similar specialities. The display is tastefully arranged. Mr. C. G. Pyle, Pacific Coast department, represents the company.

TUTTLE-STEVENS MANUFACTURING COMPANY, Los Angeles, presents a handsome line of automatic insulated electric cooking cabinets. The cookers are well demonstrated and attract considerable attention. Messrs. Tuttle and Stevens represent the company.

U. S. ELECTRICAL MANUFACTURING COMPANY, Los Angeles, shows a complete line of direct-current and alternating-current motors of various sizes, a full assortment of the different parts, speed regulators, and similar apparatus. Mr. Carl Johnson is in charge.

WARNER INSTRUMENT COMPANY exhibits an attractive display of its electric measuring instruments. The booth is fittingly decorated to set off the exhibit.

WOODILL & HULSE ELECTRIC COMPANY, Los Angeles, has a large display suitably divided into sections. The exhibit includes a complete line of electric cooking apparatus, electric household appliances, electric washing machines and similar appliances. A full assortment of condulets, sockets, lamps, wire and similar small construction specialties is shown. An attractive feature is presented in the "dictograph," which when a receiver is placed to the ear renders to those attending the show selections from an opera played at a local theater. A telephone line was leased for this purpose, the apparatus having been installed by Mr. E. H. Abbott. The booth is handsomely decorated with 250 4-cp lamps on the overhead framework, these having white and red globes. Mr. H. B. Woodill represents the company, with a large and able force of attendants.

WURLITZER electric pianos and organs are well represented by a large display on the main floor. During the intermission of band concerts demonstrations are given on the various instruments, attracting considerable attention. Mr. William L. Glockler is in charge.

PERIODICALS.—In addition to the *Electrical World*, the *Journal of Electricity, Power and Gas* is an exhibitor.

COMBINATION STEAM TURBINE.

The result of balancing the advantages and disadvantages of impulse and reaction turbines has been the so-called "combination turbine" which was first successfully introduced in 1904 by Sulzer Brothers, Winterthur, Switzerland. In this system the high-pressure part of a reaction turbine is replaced by a single impulse wheel, in which the greater part of the drop of temperature is converted into kinetic energy, so that only slight drops and low temperatures fall to the share of the low-pressure stages. The intermediate diaphragms, with their packings, which are most troublesome in working, are dispensed with, the over-all length is rendered short, the weight is greatly reduced, the shaft is very rigid and the axial thrust is small. The design is intended to insure great economy of steam, absence of any risk in applying high degrees of superheating, little axial thrust and high efficiency. In brief, this turbine consists of an impulse turbine with partial admission as the high-pressure stage and a reaction turbine with full admission as the low-pressure stage. The following is a detailed description of the latest type of Sulzer turbine embodying these characteristics.

Fig. 1 shows a 10,000-hp turbo-generator, of which Fig. 2 is a longitudinal section. Fig. 3 shows the construction and the connection of the various regulating organs of the turbine, wherein the parts seen from the front of the turbine are cut in a vertical plane.

The shaft or rotor B (Fig. 2) consists of a hollow steel drum, machined inside and out, with solid, polished shaft-ends joined to the rotor by flanges.

The fastening of the blades is done without riveting or calking, and a ridge on the concave side of the drop-forged distance block corresponding to a notch in the back of the blade firmly secures the latter. The high-temperature blades are made of steel and the low-temperature blades of bronze.

The letters which appear in Fig. 2 and Fig. 3 represent the following parts:

A, Impulse wheel.
B_1, B_2 and B_3 Reaction drum
C, Thrust balancing disk.
D, Bearings.
E, Elastic coupling.
F, [illegible]
G, Main stop-valve
H_1, Main throttle valve with yoke and governing gear.
H_2 and H_3, Auxiliary valve with yoke.
I, Engineer's foot-plate with lever for drain-cock and change over valve, if any)
K, Nozzle chamber.
M, Steam exhaust branch.
N, Hydraulic governor.
O, Supporting feet.
P, Oil servo-motor for governor.
Q, Safety or emergency stop-valve.
R, Safety or emergency governor.
S, Oil pump for bearings.
T, Shaft packings.
U, Tachometer.
W, Speed-changing adjustment
Z, Oscillating device.

Seamless rolled shroud rings are shrunk on around the blades of the impulse wheel A, thus closing the steam passage on the circumference. Lubrication is effected by cooled oil circulated under pressure. The shaft packings are not affected by longitudinal displacement of the shaft and require neither lubrication nor readjustment. They consist of a large number of thin brass segments, ground to the diameter of the shaft and tightened up into firm packets with interposed segments of wider bore. A specially designed coupling E is employed to joint the shaft of the turbine to that of the generator. This coupling is arranged to compensate differences in the position of the two shafts. The slight axial thrust which arises from the low-pressure side is taken up in the smaller sizes by a simple collar thrust bearing and in the larger sizes by an oil-balancing disk C. The oil is delivered by a pump into the space between the thrust-balancing disk and the thrust block. Thence it escapes through the annular slot at the periphery of the disk, which is narrowed in proportion as the axial thrust increases, thus automatically regulating the oil pressure.

The most characteristic feature of the turbine is the oil-pressure system (Fig. 3). Oil is used not only for the lubrication of the bearings, but part of it serves to operate all the controlling and safety mechanism of the turbine, namely, governor N, servo-motor P, speed-changing device W, overload valves H_2, H_3, emergency governor R, thrust-balancing disk, emergency stop-valve Q and change-over valve to work "non-condensing." The oil pump S, worked by the worm-driven transversal shaft, keeps the pressure of the oil system constant at about 22 lb. per square inch. After circulation all oil is collected and conducted into coolers and filters upon which it is drawn up by the pump for use over and over again.

The governor N consists of a centrifugal pump impeller keyed on the same transversal shaft as the oil pump. The additional pressure generated by the impeller acts upon a spring-loaded piston valve and upon the servo-motor piston which controls the steam admission valve. Any change of oil pressure, that is, speed of the turbine, causes a displacement of the spring-loaded piston valve, thus admitting oil to the servo-motor or relieving the same. The difference of speed between full load and no load depends upon the law in accordance with which the force of the spring varies.

Rough regulation is effected by opening or closing whole groups of nozzles, but fine regulation is obtained by throttling. In order to increase the precision of the governing action by eliminating the friction of rest an oscillating device Z acts upon the oil system and keeps the whole column of oil, and all the parts connected therewith, in constant motion. The speed-changing device W can be worked by hand or from the switchboard while the turbine is running. It consists of a reduction valve, admitting oil to the upper face of the spring-loaded piston valve of the servo-motor, thus supplementing more or less the force of the spring.

By alteration of the passages of the speed-changing valve the turbine speed can easily be fixed within the necessary limits.

To prevent racing of the turbine there is provided an emergency governor *R* the centrifugal weight of which is arranged to form a slide-valve piston; as soon as the admissible speed of the turbine is exceeded by about 10 per cent, the governor releases the pressure of the oil-pressure system, whereby the main throttle valve *H* and a second "emergency" throttle valve *Q* inserted between the main stop valve *G* and the main throttle valve *H* are closed at once.

All these parts are arranged so as to open only when a full oil pressure exists, and it is impossible to start the turbine unless the oil system is under pressure. Hence before starting the turbine an auxiliary oil pump is employed to generate pressure in the oil system. This auxiliary pump is stopped as soon as the turbine is in normal action.

The Sulzer designs can be adapted for use as exhaust turbines, mixed-pressure turbines, tapped or bleeder turbines and back-pressure turbines. In the exhaust turbine the irregular supply of steam is equalized by heat accumulators between the reciprocating engine and the turbine. If the exhaust steam alone does not suffice, the mixed-pressure turbine is employed. This consists of two impulse wheels with a reaction drum behind them. Normally, only the second impulse wheel and the reaction drum are at work, but as soon as the exhaust steam falls short of a certain pressure live steam is automatically admitted to the first impulse wheel and expanded down to the pressure of the low-pressure steam and mixed in the second impulse wheel with the exhaust steam supplied from the reciprocating engine.

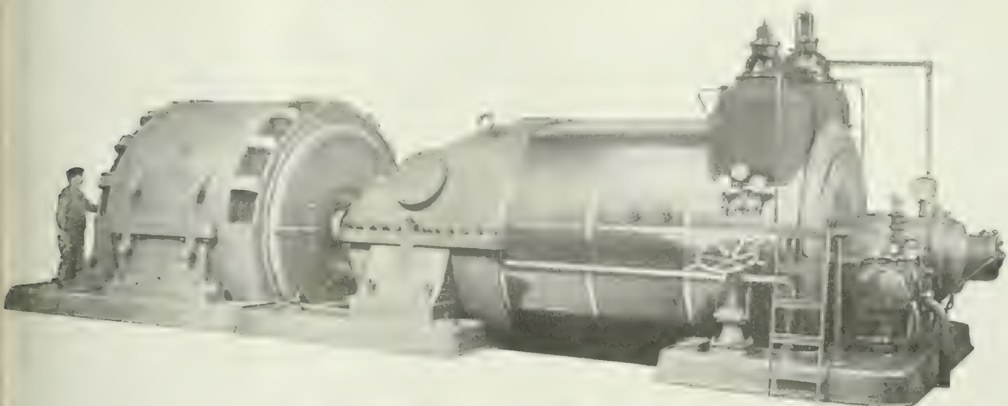


Fig. 1—10,000-hp Impulse-Reaction Turbo-Generator.

When some of the steam of the turbine at a stated pressure is required for other uses, say for boiling or heating, the turbine adapted is a tapped or "bleeder" turbine which is constructed like the mixed-pressure turbine. All of the steam is expanded in the first impulse wheel down to the pressure at which a supply of steam is to be tapped from the turbine and is then partly carried off by a supply pipe for other uses and partly passed on to the second impulse wheel, while the pressure at which the steam is tapped is maintained at a uniform level in case of varying loads by means of a mercurial governor. When all of the exhaust steam of the turbine is required for other purposes use is made of a back-pressure turbine, which resembles the ordinary steam turbine in construction except that it is of shorter over-all length. If the back pressure (or the pressure at which the steam is to be carried off) is sufficiently high, the reaction turbine portion may even be dispensed with entirely.

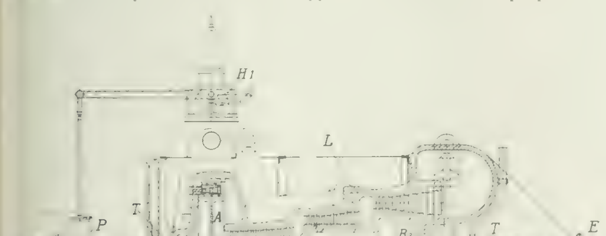


Fig. 2—Longitudinal Section of Turbo-Generator.

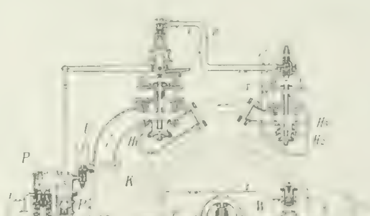


Fig. 3—Valve Gear.

Industrial and Commercial News

The Week in Trade.

Contrasting sharply with the conservative, day-to-day policy that has been followed for the greater part of the year, the growing tendency to place orders for the future is by far the most conspicuous development in the trade situation. Its appearance after several weeks of moderate optimism is most opportune, and though hesitancy and deliberation in commitments have by no means been dispensed with, the movement indicates that distinct progress has been made. Whether opening of Congress last Monday, with prospects of reviving excessive tariff legislation and further trust investigations, will offer a serious check to this advancement remains to be seen. At best, any further trade expansion will come slowly. A long session of Congress is expected, and most of the matters scheduled for consideration are closely related to industrial conditions. It is natural, therefore, to look for at least a temporary check. That confidence is well founded, however, is shown in the changes in the various industries of the country. Railroad earnings are becoming better, further decrease has taken place in the number of idle cars, and orders and inquiries for railroad equipment are increasing each week. A result of the latter has been an advance in the prices of steel bars by both the Steel Corporation and the independents. Jobbers and manufacturers are showing marked satisfaction over these signs of better prices in the steel trade, for while the volume of business has been increasing steadily, much of it has been written at rates too low for a good profit. Prices in the pig-iron market, on the other hand, have declined. Interest has been widely increased by these figures. Sales have been highly encouraging, and the immediate prospects for disposal of heavier tonnages are very good. Holiday trade has been good, and retail lines are reaping the benefit of cold weather. Mill operations in the Fall River district are enlarging, and improvement in the prices of cotton goods is reflected in the activity of trading in this field. Business failures for the week ended Nov. 30, as reported by *Bradstreet's*, were 216, as compared with 293 for the previous week, 217 for the corresponding week in 1910, 230 in 1909, 234 in 1908, and 272 in 1907.

The Copper Market.

While the smaller agencies have been offering electrolytic at prices considerably lower than the 13⅛ cents to 13¼ cents per lb. quoted by the larger interests, few orders of consequence have been placed this week by either domestic or foreign consumers. With absence of selling pressure and halt in advancement of prices, the buying movement has practically subsided, and the market has again assumed that

[illegible]	Bid.	Asked.	Settling Price.
[illegible]	12.60	12.85	
December	12.67½	12.80	12.75
[illegible]	12.70	12.85	12.77
February	12.70	12.90	12.80
March	12.70	12.95	12.82½

[illegible]

	Noon. £ s d	Closing. £ s d
Standard copper, spot	58 12 6	58 10 0
[illegible]	[illegible] 6 3	59 5 0

Extreme fluctuations for this year:

	Highest	Lowest
[illegible]	12.95c	11.57
[illegible]	[illegible] 5 0	£53 7 [illegible]
London, futures	60 0 0	54 0 0
[illegible]	[illegible] 16 0	57 [illegible]

degree of quietness which prevailed in recent weeks. Operators with high costs of production regard with extreme disfavor the prospects of a decline which will again bring prices under the 13-cent level, for this figure, it is claimed, means the difference between profit and loss for them. A net decrease of 1,704,640 lb. in the visible supply of standard copper in Great Britain and France during the second half of November was shown in the last fortnightly statistics, which reduced the visible supply in these countries to 131,821,760 lb. on Dec. 1, the lowest figure reported since May, 1909, when the visible supply was placed at 127,353,000 lb. Conditions at this time do not indicate that early improvement will be made in the industry, excepting a possible increase in foreign buying. Standard copper in New York has been rather dull and easier, while practically no changes of importance have taken place in London. The November report of the Copper Producers' Association, which will be published after this issue has gone to press, is expected to show a small decrease in the stocks carried by producers. Estimates place total deliveries at 125,000,000 lb., which, it is thought, will be about equal to production. Imports for November were comparatively light, and the exports for the month were 26,431 tons. The daily call on the Metal Exchange Dec. 6 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

To Stimulate British Electrical Export Trade.—There has recently been organized in London, under the name of Scholey & Company, Ltd., a new firm which will make a specialty of stimulating the export of British electrical manufacturers to the outlying foreign fields, thus resembling the Allied Machinery Company of America, recently organized to serve the interests of machine-tool makers. Mr. Scholey, the organizer of the firm, has had a long and successful career in the electrical business. For ten years he was assistant editor of *The Electrical Review,* of London, afterward gaining a few years' experience in electrical manufacturing and the selling of electrical goods in the employ of Mather & Platt, of Manchester. For the last ten years he has been intimately associated with the progressive firm of Dick, Kerr & Company, during which time he has made innumerable friends among the electrical men in Great Britain. For some years, however, Mr. Scholey has considered that sufficiently organized plans were not made for the disposition abroad of many British manufactures. Many millions of money are invested in Great Britain in the smaller companies manufacturing electrical goods. A large number of these companies have specialized in their manufactures and are thus in a position to make their own specialties much more cheaply and accurately than companies making a greater variety of materials. Such firms, however, are frequently so engrossed by their manufacturing that they have little time for the marketing of their goods outside their own local area and especially outside Great Britain. Mr. Scholey believes, therefore, that by creating a selling organization and by making special arrangements with a number of these specialists in electrical manufactures he will be able to supply the wants of foreign companies who may be desirous of getting the best British manufactured goods but who do not well know where or from whom to buy them. At the same time he will be benefiting these manufacturing companies by taking the expense and worry of selling off their shoulders. Scholey & Company have already entered into definite agreements with a number of firms manufacturing electrical specialties and in time they will add others to their list. Though the main feature of the business of Scholey & Company will be the developing of export trade, it is not intended to neglect the home markets, and as there is probably no one who knows personally a larger number of electrical men in Great Britain than Mr. Scholey this portion of the business will doubtless meet with immediate success. Mr. Scholey has taken into partnership with him C. W. Hill, who until within the last few weeks was the manager of the Bournemouth Tramways. Mr. Hill is well and favorably known to the electrical fraternity, and as Mr. Scholey and he have known each other for many years there is little doubt that their business associations will result successfully. The new company has taken commodious offices at 151 Queen Victoria Street, London, and has already done a considerable business. As quickly as opportunity occurs agencies will be opened up in this country and in the most prominent towns in the British colonies and South America.

Westinghouse, Church, Kerr & Company Contracts.—Westinghouse, Church, Kerr & Company are now engaged in [illegible] and construction of numerous additions to the

present boiler plant of the Canadian Westinghouse Company, Ltd., at Hamilton, Ontario, Canada. The original boiler plant consisted of a building designed to house four 200-hp Stirling boilers, of which two are now installed together with auxiliary apparatus. The new building is to use as much of the old structure as possible and when completed will provide for four 400-hp Stirling boilers, one of which is to be installed at the present time. The two 200-hp boilers installed in the old building will be left in position for the present. The stack is to be made large enough to take care of an additional 400 hp, making a total capacity of 2000 hp. The equipment to be installed consists of the boilers mentioned above, stokers under both old and new boilers, a new 2000-hp concrete stack, boiler-feed water heaters, pumping equipment, piping and overhead coal bunker, and coal and ash handling apparatus, with other auxiliary equipment. Space will be left for a future 750-kw turbine and a 500-cu. ft. air compressor. The old plant is operating without interruption during the progress of the work of improvement. In addition to the work which these engineers are doing at Champaign, Ill., for the Illinois Central Railroad, mentioned in these columns Nov. 25, they are also engaged with other work for the same railroad at Burnside, Ill. This work includes overhauling of the Burnside power plant to increase its general efficiency and to eliminate the present shortage of steam, construction of a concrete chimney for the entire requirements of the plant with reasonable provision for its future growth, and remodeling the boiler house to permit economical handling of coal and ashes. The coal-handling system consists of a balance skip hoist elevating coal from the track hopper, dumping it automatically into an overhead bin of approximately 150 tons capacity, whence it is discharged as desired into a 5-ton hopper which travels in front of the stoker hoppers and discharges into them as required. The ash-handling equipment is operated pneumatically. This work also includes overhauling the piping to give a modern loop system and permit installation of a new and sufficient feed-water heater and pumps, installation of two 600-kw exhaust steam turbines and generators for the generation of alternating current, the generators being excited by two 25-kw exciters, purchase and installation of the necessary alternating-current motors to change from the present steam drive to motor drive, installation of a cooling tower, complete electric feeder system for power and yard lighting including the overhauling of the present direct-current feeder system, and construction of an engine-room to house the turbines mentioned above. Orders have been placed for all equipment required for the foregoing changes.

Constantinople Telephone Company.—A company of this name has been organized to take over a concession for establishing a telephone system embracing the city of Constantinople, Turkey, and all of the suburban places on the European and Asiatic shores of the Bosphorus and the Sea of Marmora, comprising a population of 1,250,000. This will be the first general telephone system installed in Turkey. The capital is £300,000 in shares of £5 each, and the initial installation will be 10,000 stations. The concession was negotiated by Herbert Louis Webb, who is one of the directors of the company, other directors known in electrical circles in this country being F. R. Welles, vice-president of the French Western Electric Company, and Ernest Thurnauer, general manager of the French Thomson-Houston Company. The concession is an outcome of the progressive policy pursued by the modernized Turkish government, under which liberal institutions are being established and commercial development encouraged.

Electrical Lock-Gate Operation on Chicago Drainage Canal.—At a recent meeting of the Board of Trustees of the Sanitary District of Chicago bids were received for furnishing and erecting electrical operating machinery for gates on the navigation lock adjacent to the hydroelectric power house on the Chicago Drainage Canal near Lockport, Ill. The bids were submitted in two parts, one for the equipment of the main lower gate and the other for the equipment of the main upper gate. The lowest bidder for the two was the Klemp-Simpson Company, of Chicago, the amount being $4,140. Other bidders were George P. Nichols & Company, the National Contracting Company and the Strobel Steel Construction Company.

"Nela" Buildings of National Electric Lamp Association.—Ground has been broken for the new buildings composing the "Nela" group of the National Electric Lamp Association, 12 miles east of the city of Cleveland, overlooking Lake Erie. A commodious building will be erected to house the engineering laboratory, which will be removed from its present Hough Avenue location, while other special structures will be provided for the physical laboratory, lamp-development department, the general library, etc. In all a dozen buildings will be erected on the spacious campus, which commands a rare view of woodland ravine and lake. Nearly a million dollars is to be expended at Nela, it is said, and the first buildings will be ready for occupancy within a year.

November Incorporations.—Compilation by the *Journal of Commerce*, New York, shows that papers filed in the Eastern States during November for companies with an authorized capital of $1,000,000 or over, including increases in capital, represent a total of $150,593,400, an increase of $26,373,400 over October, and $31,570,400 as compared with November, 1910. Charters taken out by other companies with an individual capital of $100,000 or over, including states other than those in the East, increased the month's total to $362,158,400, which compares with $187,178,500 in October and $183,388,000 in November last year.

Westinghouse Company Enlarging East Pittsburgh Plant.—Two large additions are being made to the plant of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. One of these additions will be used for the manufacture of electrical equipment, and the other, a modern fireproof building, will be used for the manufacture of packing boxes.

Wants Bids on Generators and Oil Engines.—The Groton Light, Heat & Power Company, of Groton, S. D., is in the market for one or more 40-kw, 220-volt, direct-current generators and crude-oil engines to drive same. Correspondence may be addressed to H. A. Raitz, general manager.

Financial.

The Week in Wall Street.

Decided apathy prevailed upon the New York Stock Exchange during the first half of this week. Lack of stimulus or motive seemed to be the chief cause of this condition, although desire to wait upon the President's message was offered rather generally on Monday as an excuse for the inactivity of the day. Price changes on Monday were insignificant, and the volume of trading was very curtailed as compared with the daily average in recent weeks. The only items of general news in which the financial district displayed any interest were the opening of Congress and the filing of a petition by the independent tobacco companies seeking review by the Supreme Court of the plan for reorganiza-

NEW YORK.

	Nov. 28.	Dec. 6.	Shares Sold.		Nov. 28.	Dec. 6.	Shares Sold
All. Ch.	3½*	2[illegible]	300	Int. Met., pf.	47	46⅝	11,300
All. Ch., pf.	13[illegible]*	9	200	Mackay, Cos.	83	83*	——
Amal. Cop.	64	61⅛	60,150	Mackay C., pf.	72½	72[illegible]	53
Am. D. T.	33[illegible]*	33[illegible]	—	Man. Elev.	134	135*	100
Am. Loco.	36	35	1,000	Met. St. Ry.	15*	15*	— —
Am. Loco., pf.	102⅞	102[illegible]	250	N. Y. & N. J. Tel.	139½*	139½*	——
Am. Tel. & C.	78*	78*	—	Steel, com.	64⅞	62[illegible]	552,950
Am. T. & T.	139⅛	139	22,050	Steel, pfd.	109¼	109[illegible]	3,800
B. R. T.	77¾	77	6,[illegible]	W. U. T.	77½	78[illegible]	1,400
Gen. Elec.	154[illegible]	152¼	2,200	West'h, com.	65	65*	1,900
Int. Met.	15	14¾	12,272	West'h, pfd.	113	113*	——

PHILADELPHIA.

	Nov. 28.	Dec. 6.		Nov. 28.	Dec. 6.
Am. Rys.	46¼	46	Phila. R. T.	23¾	23¼*
El. Co. of A.	12	11⅞*	Phila. Elec.	16	16
Elec. St. Bt'y.	53[illegible]	54	Phila. Trac.	84[illegible]	84⅞
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	52[illegible]	52[illegible]

CHICAGO.

	Nov. 28.	Dec. 6.		Nov. 28.	Dec. 6.
Chi. City Ry.	186*	186*	Com. Edison	134½	133½
Chi. Elev. Rys.	30*	29*	Chi. Subway	½	⅜*
Chi. Elev. Rys., pf.	94*	94*	Chi. Telephone	139¼	138¾
Chi. Rs., Ser. 1	95*	95*	Nat'l Car	105*	104*
Chi. Rs., Ser. 2	33½	34[illegible]	Nat'l Car, pfd.	118*	118*

BOSTON.

	Nov. 28.	Dec. 6.		Nov. 28.	Dec 6.
Am. T. & T.	140[illegible]	139	Mex. Tel.	3*	3¼*
Cum. Tel.	156½	157	Mex. Tel., pf.	6½*	6½*
Edison	287	290	N. E. Tel.	150	154
Gen. Elec.	1[illegible]	153	W. T. & T.	27½*	27½*
Mass. E. Ry.	21½	22	W. T. & T., pf.	104¼*	104¼*
Mass. E. Ry., pf.	94	93			

*Last price quoted.
Shares sold for the week, Nov. 27 to Dec. 2.

bonds were more animated than those in stocks. No changes in the stagnation appeared in Tuesday's market as a result of publication of the President's message. The message did not contain any special additions to the President's previous remarks upon trust questions. That Presidential approval was given in the message to the decision of the Circuit Court upon the American Tobacco Company's reorganization plan was taken as an indication that reopening of the case upon independent petition is rather unlikely. Further weakness developed in the trading on Wednesday, and a downward tendency was in evidence throughout the day. Mild activity took place toward the close, and negligible declines were made. Allis-Chalmers issues declined slightly in the course of the day's transactions, strengthening the belief that reorganization of the company is imminent. Call money, after a rise to 6 per cent toward the close of last week, was quoted at about 5 per cent in the first three days of this week, but ease is predicted to occur within a short time. Rates Dec. 6 were: Call, 4½ @ 5 per cent; ninety days, 4 @ 4¼ per cent. The quotations in the table are those at the close, Dec. 6.

FINANCIAL NOTES.

Statement of the Washington, Baltimore & Annapolis Electric Railroad Company.—The Washington, Baltimore & Annapolis Electric Railroad Company has issued its report of earnings for the month of October and for seven months of the new fiscal year. The total gross operating revenue of the road for the month was $61,860.47, as compared with $64,802.71 in October last year, a decrease of $2,942.24. Operating expenses were $30,650.60, as against $31,330.52, a decrease of $679.92, and net operating revenue was $31,209.87, as compared with $33,472.19 for October, 1910, a decrease of $2,262.32. Deductions from income, including interest on bonds, taxes, etc., amounted to $22,083.81, as compared with $30,927.06, a decrease of $8,843.25, making the final net income $9,391.93, as against $3,230.88, a gain of $6,181.05 over this item in October, 1910. The falling off in business during October, it is pointed out, was due to the conflicting racing dates at Pimlico and Laurel, which affected the attendance at the local track. Last year 3729 passengers were carried by the company during the meet at Pimlico, the revenue from that traffic being $4,288.33. This year only 593 persons were carried during the races. This year the revenue amounted to $671.95, or a loss of $3,617. The gross operating revenue for the seven months ended October 31 totaled $438,988.98, as compared with $434,256.59 for the corresponding period last year, or an increase of $4,732.39. Operating expenses for the period were $205,361.44, as against $207,897.57 for 1910, or a decrease of $2,563.13. Net operating revenue for the seven months was $233,627.54, as contrasted with $226,359.02 for 1910, an increase of $7,268.52. Final net income, after deducting fixed charges, taxes, etc., amounted to $79,417.03, as against $10,974.26, a gain of $68,442.74. The percentage of operating expenses to gross operating revenue was 46.78 per cent, as against 47.87 per cent for the corresponding seven months of 1910.

Hall Signal Company Reorganization Plan.—The committee which, as previously mentioned in these columns, has been working for some time upon reorganization of the affairs of the Hall Signal Company, has formulated a plan for accomplishing its purpose, and it is expected that announcement of details will be made within a short time. The Hall Signal Company is a three-million-dollar corporation engaged in the manufacture and installation of automatic railway signals. Edward P. Goetz, secretary of the readjustment committee, says: "The sum of $100,000 has been raised with which to place the affairs of the company on a sound footing. Many overdue accounts were paid off with this money and funds were provided to purchase new supplies and materials. The company now has contracts and orders on hand aggregating $450,000, and its business prospects are very good." More orders are on hand at present than at any time since the summer of 1909. The plants of the company are operated on extra night shift three times per week.

Kansas City Railway & Light Statement.—The consolidated balance sheet of the Kansas City Railway & Light Company as of May 31, 1911, shows as follows:—Assets: Cost of properties, $51,055,530; special, $5,100; material and supplies, $338,060; miscellaneous investment, $75,190; accounts receivable, $264,489; accrued earnings, lighting companies, $54,084; bills receivable, $19,473; cash, $138,393; cash for coupons, $153,050; bonds expired, etc., $360,854; prepaid interest, etc., $32,510; total, $52,496,733. Liabilities: Preferred stock, $9,407,500; common stock, $9,543,080; stock of subsidiary companies, $72,350; bonded debt, $28,526,000; equipment notes, $120,000; bills payable, $984,382; maturing bonds, $5,100; miscellaneous accounts, $411,895; accrued taxes, $374,926; accrued interest, $217,898; coupons due, $153,050; depreciation and renewal reserve, $1,645,859; surplus, $1,034,693; total, $52,496,733.

La Crosse Water Power Company Reorganization.—C. C. Smith, receiver for the La Crosse Water Power Company, of La Crosse, Wis., has ordered the offices of the company closed and announcement has been made, it is said, that repairs at the dam cannot be completed until next spring. Efforts to cash receivership certificates to repair the damage are said to have failed and a 5 per cent assessment has been made against bondholders to raise the required money. The reorganization of the company that has been in progress for some months may be effected during the course of the winter.

Safety Car Heating & Lighting Company Increases Dividend.—An extra dividend of 1 per cent on the capital stock has been declared by the Safety Car Heating & Lighting Company, in addition to the regular quarterly dividend of 2 per cent. This raises the total dividend for the year to 9 per cent. An extra dividend of 3 per cent was paid at this time last year. The dividends are payable Dec. 22 to holders of record December 8.

Great Western Power May Merge with Pacific Gas & Electric.—Rumors of a mutualization plan to be effected between the Great Western Power Company and the Pacific Gas & Electric Company are rather general in financial circles, but interests in touch with these companies are not disposed to discuss the matter at present.

Ohio Company Will Issue $500,000 Stocks and Bonds.—The Springfield & Washington Electric Railway Company of Springfield, Ohio, has received permission from the Ohio Public Service Commission to issue $500,000 stocks and bonds. The company plans to issue $200,000 stock and $300,000 thirty-year bonds to be sold at not less than 85.

New Canadian Company Formed.—Advices from Toronto state that the Northern Ontario Light & Power Company, Ltd., has been formed to take over the properties of the Cobalt Power Company, Ltd., and those of the Cobalt Hydraulic Power Company, Ltd.

DIVIDENDS

Canadian General Electric Company, Ltd., quarterly, 1¾ per cent, payable Dec. 30.

Mackay Companies, quarterly, preferred, 1 per cent, common, 1¼ per cent., both payable Jan. 2.

Massachusetts Electric Companies, preferred, $2 per share, payable Jan. 2.

Sao Paulo Tramway, Light & Power Company, Ltd., quarterly, 2½ per cent, payable Jan. 2.

Standard Gas & Electric Company of Chicago, quarterly, preferred, 2 per cent, payable Dec. 15.

United Railways & Electric Company of Baltimore, semi-annual, preferred, 2 per cent, payable on demand.

West Pennsylvania Traction Company, quarterly, 1 per cent, payable Dec. 15.

REPORT OF EARNINGS.

BOSTON SUBURBAN ELECTRIC COMPANIES.

Period	Gross Earnings	Operating Expenses	Net Earnings	Fixed Charges.	Net Surplus
October, 1911	$71,381	$53,793	$17,588	$14,246	$3,342
October, 1910	[illegible]	49,392	21,429	14,147	7,282

FAIRMONT & CLARKSBURG TRACTION COMPANY.

October, 1911	[illegible]	$25,598	$42,371	.....	.....
October, 1910.......	58,504	19,386	39,118	......	......

MEXICAN LIGHT & POWER COMPANY, LTD.

October, 1911.......	$627,949	$135,247	$492,702	......	.....
October, 1910	[illegible]	147,757	451,415	.	...

MEXICO TRAMWAYS COMPANY.

October, 1911.......	$543,751	$266.326	$277,425	......	....
October, 1910.......	527,603	259.835	267,768	......	......

RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY, LTD.

October, 1911	$1,126,972	$526,358	$600,614	.....	......
October, 1910......	965,265	470,845	494,420	......	......

UNITED RAILWAYS COMPANY OF ST. LOUIS.

October, 1911......	$1,051,472	$663.540	$387,932	......	......
October, 1910	1,041,838	685,685	356,153	......	.....

General News

Construction News.

VALDEZ, ALASKA.—The Alaska Water, Light & Telephone Company is planning the erection of an electric power plant in the [illegible] Gulch district.

PHOENIX, ARIZ.—The Board of Supervisors has granted the Tracy Engineering Company a franchise to erect and maintain a transmission system from the Colorado River to Kingman and vicinity. The company is planning to build a large hydroelectric power plant on the Colorado River.

TUCSON, ARIZ.—Plans are being considered by the Powmott Development Company for the erection of a hydroelectric power plant, near Silverton. A transmission line will be erected from the plant to the company's mining properties, a distance of 15 miles.

PARAGOULD, ARK.—The Paragould Electric Light & Power Company, it is reported, is planning to make extensive additions to its plant, which will involve an expenditure of $15,000 and include the erection of an addition to its power house and the installation of a generator and a new engine.

ALLEGHENY, CAL.—Plans are being considered for the erection of a power plant at the Twenty-one Mine, operated by F. M. Phelps, in the near future.

BAKERSFIELD, CAL.—The Southern Sierra Power Company has filed notice of its intention of filing articles of incorporation in the State of California for the purpose of erecting power plants and transmission lines to supply electricity for lamps and motors in the southern San Joaquin Valley counties. The company is capitalized at $5,000,000, and is at present operating in Colorado and Wyoming. Delos A. Chappell, Lawrence C. Phipps, Jr., C. F. Potter, T. S. Hayden and G. Wood compose the directorate.

BAKERSFIELD, CAL.—The Board of Trustees has granted the San Joaquin Light & Power Company an electric railway franchise for a term of forty-nine years on North Chester Avenue, for a consideration of $250. Under the terms of the franchise the company is to pay the city 2 per cent of its gross earnings.

BERKELEY, CAL.—The Berkeley Electric Lighting Company, which is controlled by the Pacific Gas & Electric Corporation, has notified Mayor J. Stitt Wilson of a reduction in the price of electricity for lamps in Berkeley. A recent ordinance put the maximum rate of electricity at 8½ cents per kw-hour, which the company now voluntarily reduces to 7 cents per kw-hour.

BERKELEY, CAL.—The City Council has asked Mayor J. Stitt Wilson to secure data on and other information pertaining to the cost of the installation and maintenance of municipal lighting plants which are now in operation throughout the country. The Mayor recently recommended in a message that the city establish a municipal plant.

CONCORD, CAL.—The Mount Diablo Telephone Company, recently incorporated, is planning to erect a telephone line from Concord to Clayton and the Ignacio Valley, a distance of about 25 miles. H. C. Wetmore, of Concord, is president.

CRESCENT CITY, CAL.—Plans for the construction of a hydroelectric power plant on the Smith River, near Crescent City, it is reported, are being prepared by James H. Owen, with a transmission system throughout the surrounding territory. Sidney Sprout, of San Francisco, Cal., electrical engineer, is in charge of the work.

ELK GROVE, CAL.—The Pacific Gas & Electric Company, it is reported, contemplates the installation of a street-lighting system in Elk Grove. Incandescent circuits will be installed.

FRESNO, CAL.—The San Joaquin Light & Power Company is reported to have awarded the contract for the construction of its large power plant and dam, to be located at Big Creek, near Fresno, to the Stone & Webster Engineering Corporation, Boston, Mass.

GLENDALE, CAL.—Arrangements have been made whereby the system of the Glendale Light & Power Company in West Glendale will be taken over by the city, for a consideration of $55,000, and operated in connection with the municipal electric-lighting system. Bonds to this amount will be issued by the city. The system will be enlarged and improved, and new distributing lines erected. The amended plans for the ornamental street-lighting system to be erected on Fourth Street, from Everett Street to Central Avenue, on Brand Boulevard, from Third to Sixth Street, and on Glendale Avenue, from First to Sixth Street, call for 140 lamp standards, carrying five lamps each, to be placed 150 ft. apart.

LOS ANGELES, CAL.—Bids will be received by the finance committee of the City Council until Feb. 15 for the purchase of $3,500,000 power bonds and $3,000,000 harbor bonds. The bonds will be disposed of in one lot or delivered in several lots at different times, at the option of the purchaser.

LOS ANGELES, CAL.—The stockholders of the Pacific Electric Railway Company have voted a bond issue of $100,000,000 for the purpose of providing for the underlying bonds of the various subsidiary companies and for extensive additions to its system. Paul Shoup is vice-president and general manager.

LOS ANGELES, CAL.—The contract for the installation of ornamental electric fixtures and electrical work on the ornamental fence to be erected around the County Hospital grounds has been awarded to the Woodill-Hulse Electric Company, at $2,894.

MARTINEZ, CAL.—The Town Trustees have decided to install tungsten lamps for lighting the streets of the city, for which a contract has been awarded to the Pacific Gas & Electric Company. Work will begin at once on the installation of the new system.

NORTH SAN JUAN, CAL.—Plans are being considered by the Northern Water & Power Company for the construction of a large dam, capable of holding more than 500,000 inches of water. The dam will be located near North San Juan, on the Ray, Phelan and adjoining ranches.

OAKLAND, CAL.—The Oakland Gas, Light & Heat Company has announced reduction in the price of electricity for lamps to take effect from Dec. 1. Under the new schedule the maximum rate will be 7 cents per kw-hour with a sliding scale of 3 cents per kw-hour. The present rate is from 9 cents to 3½ cents per kw-hour. The company is controlled by the Pacific Gas & Electric Corporation. The reduction was voluntary on the part of the company.

PASADENA, CAL.—The City Council has authorized the municipal lighting commission to make improvements to the municipal electric-light system, including the building of conduits, line extensions and new equipment, involving an expenditure of $21,000.

PATTON, CAL.—Bids will be received at the office of the state engineer, Sacramento, Cal., until Dec. 16, for the construction of a power house to be erected on the grounds of the Southern California State Hospital in Patton.

PLACERVILLE, CAL.—Sealed proposals will be received by T. C. Atwood, county clerk, until Jan. 3, 1912, for the construction and installation of electric-lighting fixtures for all outlets in the court house in Placerville and outside standards at the entrance of same. Plans and specifications are on file at the office of Cuff & Diggs, architects, Sacramento, Cal., and at the office of the county clerk.

RIO VISTA, CAL.—The Pacific Gas & Electric Company is planning to replace the arc lamps now in use with tungsten lamps. It is proposed to install sixty tungsten lamps throughout the city. At present there are fourteen arc lamps and eight incandescent lamps.

SACRAMENTO, CAL.—Contracts have been awarded by the Pacific Gas & Electric Company for the erection of its new steam auxiliary power plant in Sacramento, as follows: To the Rickon-Ehrhart Engineering & Construction Company, of San Francisco, Cal., for structural steel work, at $48,500; Forderer Cornice Works, of San Francisco, Cal., $4,200, and the Ross Construction Company, of Sacramento, Cal., $4,417. The plant will have a generating capacity of 12,500 kw.

SAN FRANCISCO, CAL.—The Vermont Marble Company has petitioned the Board of State Harbor Commissioners to install a large electric crane, with capacity to handle large blocks of marble, on one of the local docks.

SAN JOSE, CAL.—Preparations are being made by the Sierra & San Francisco Power Company to supply electricity in San José. The company has two transmission lines running from its plant on the Tuolumne, one of which passes within 9 miles of this city. This county will be supplied from the substation near Alviso.

SANTA CLARA, CAL.—Plans are being considered by D. O. Druffield, of Santa Clara, for the erection of an electric power plant to supply electricity to operate the mills of the Pacific Manufacturing Company in Santa Clara.

STANFORD UNIVERSITY, CAL.—The Board of Trustees of the Leland Stanford, Junior, University has awarded the contract for the erection of a power plant on the college campus to Frank M. Gardiner & Company, of San Francisco, Cal.

STOCKTON, CAL.—The Sierra & San Francisco Company expects to have its system in operation in Stockton very soon. The company has its main line from the power plant within 4 miles of the city and the poles have reached the city limits.

TULARE, CAL.—The Tulare County Power Company has awarded the contract for the construction of a power house for its new auxiliary power plant to Oscar Parlier, for $10,000. The cost of the plant complete is estimated at $250,000.

VISALIA, CAL.—Plans are being considered for the installation of a new street-lighting system in Visalia. The Mount Whitney Power Company furnishes the street-lighting service in this city.

WATSONVILLE, CAL.—Specifications are being prepared for electroliers for Main Street for the Commercial League. As soon as plans are accepted bids will be asked for installation of same.

[illegible] H. S. Evans, of [illegible], and Fred [illegible], city engineer, for the construction of a municipal electric-light plant. The city now pays more than $9,000 per year for lighting the city.

DENVER, COL.—The Larimer Street Improvement Association is contemplating the installation of ornamental street lamps along several blocks in the business section of Larimer Street.

WILLIMANTIC, CONN.—The Board of Aldermen has adopted a resolution providing for a committee to enter into a three-year contract with the Willimantic Gas & Electric Light Company for lighting the city. The present contract expires in January, 1912. Under the present contract the city pays $92 each per year for arc lamps.

WASHINGTON, D. C.—Sealed proposals will be received by the Commissioner of Indian Affairs, at the Office of Indian Affairs, Department of the Interior, Washington, D. C., until Dec. 29, for construction of a brick dormitory and a central steam-heating and power plant for the Rapid City Indian School, South Dakota, in accordance with plans and specifications which may be examined at the above office, the offices of the supervisor of construction, Denver, Col.; the United States Indian Warehouses, Chicago, Ill., and Omaha, Neb.; the Builders and Traders' Exchange, St. Paul, Minn., and at the school. Further information may be obtained on application to the superintendent of the Rapid City Indian School, Rapid City, S. D. C. F. Hauke is acting commissioner.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 27 for furnishing and installing lighting fixtures in the United States buildings at Ames, Ia.; Barre, Vt.; Canandaigua, N. Y.; Carbondale, Pa.; Faribault, Minn.; Holdrege, Neb.; Hope, Ark.; Independence, Kan.; Ionia, Mich.; Lagrange, Ga.; Lewiston, Idaho; Lexington, Mo.; Malone, N. Y.; McKinney, Tex.; Missoula, Mont.; North Yakima, Wash.; Pontiac, Mich.; Stevens Point, Wis.; York, Pa.; Bowling Green, Ky.; North Platte, Neb.; Roswell, N. M.; San Juan, P. R.; Richmond, Va., and Bath, Maine, in accordance with plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

BROOKSVILLE, FLA.—The citizens have voted to grant a franchise to J. T. Fuller, of Umatilla, Fla., to construct and operate an electric-light plant in Brooksville.

AUGUSTA, GA.—Announcement has been made that J. G. White & Company, of New York, N. Y., and Redmond & Company, bankers, have secured the controlling interest in the Georgia-Carolina Power Company. It is stated that work will soon begin on the construction of a new power dam at Stevens Creek, which, it is estimated, will develop a minimum of 12,000 hp. The dam will be located at the mouth of the creek, about a mile above the city locks.

COMER, GA.—The City Council has granted the Comer Light & Power Company a franchise to construct and operate an electric-light plant in Comer Surveys have been made of the Comer mill property, and it is claimed that power can be developed to generate sufficient electricity to supply Comer and surrounding country.

DUBLIN, GA.—The Dublin Chamber of Commerce, it is reported, is considering taking up the matter of erecting a transmission line from the power plant of the Central Georgia Power Company, of Macon, Ga., which is located at Jackson, to this city, a distance of 60 miles. For several years the municipal electric plant has supplied electricity for nearly all the factories in the city.

TIFTON, GA.—Preparations are being made by the Tifton Ice & Power Company for enlarging its plant in this city, which will involve an expenditure of about $20,000. It is proposed to duplicate the machinery in the electric plant, and the ice plant will be enlarged to increase it to four times its present capacity.

WASHINGTON, GA.—Sealed proposals will be received until Dec. 20 by Boyce Ficklen, Jr., for construction of a new power plant, additions to the present water-works system and overhauling and extending the present electric-light and power transmission system in the city of Washington, in accordance with plans and specifications prepared by Westinghouse, Church, Kerr & Company, engineers. Copies of plans and specifications may be obtained from the city clerk upon deposit of $50, which will be refunded upon return of same. The specifications are divided into two parts, main and supplementary, and bids are desired as follows: (a) To furnish all material and do all construction by plans and specifications, this bid to be divided into two parts, one to cover the main specifications and the other the supplementary specifications; (b) this bid to cover construction of the building and foundations called for, but not to include the installation of machinery or construction of transmission lines; (c) this bid to cover the installation of all machinery and the construction of all transmission lines as called for in the plans and specifications, but not to include the construction of building and foundations for machinery, this bid to have separate bids called for under the main and supplementary part of the specifications.

NAMPA, IDAHO.—Preparations are being made by C. W. Van Kirk and J. J. Portner for the construction of an electric railway from Nampa to Caldwell, which will involve an expenditure of about $80,000.

ALTON, ILL.—The Board of Trade is considering the installation of an ornamental street-lighting system in the business district of the city.

ATHENS, ILL.—The City Council has awarded a contract to C. W. Carr, owner of the local electric-light plant, to light the streets of the city for a period of two years, at a cost of $1,728. An all-night servic will be furnished.

CABERY, ILL.—It is reported that a stock company, composed o local business men, has purchased the Cabery telephone system, owne by N. A. Watts.

CARLYLE, ILL.—The capital stock of the Citizens' Telephone & Telegraph Company of Clinton County has been increased from $15,000 t $35,000.

CLINTON, ILL.—The City Council has granted the People's Telephone Company, of Chillicothe, Ill., a franchise to construct and operate a telephone system in Clinton for a term of twenty-five years.

LA SALLE, ILL.—The City Council, it is said, has decided to advertise for bids on 122 arc lamps and two Rush generators of sufficient output to provide for seventy-five lamps each.

MINOOKA, ILL.—The installation of an electric street-lighting system in Minooka is reported to be under consideration. It is understood that an electric-light company will apply to the Village Board for a franchise to supply electricity for lighting the streets and residences in the village.

QUINCY, ILL.—The Quincy Merchants' Lighting Association has awarded a contract for the installation of sixteen ornamental lamp standards around Washington Park, to cost $1,600.

SPRINGFIELD, ILL.—The Park and Pleasure Driveway Board is reported to have decided to purchase the ornamental lighting system on Fourth Street Boulevard from the Springfield Light, Heat & Power Company, at a cost of $16,800. The question of replacing Welsbach lamps on South Grand Boulevard with tungsten cluster lamps, at a cost of approximately $7,773, is under consideration.

STEWARDSON, ILL.—The question of establishing an electric-light plant in Stewardson is reported to be under consideration by the Village Board.

ALEXANDRIA, IND.—The Central Indiana Lighting Company has applied to the Council for a fifty-year franchise in Alexandria. The company wishes to secure the franchise before closing a deal by which it will take over the property of the Alexandria Electric Light & Power Company. The new company proposes to abolish the flat-rate system and supply electricity at 10 cents per kw-hour with a reduction of 5 per cent for prompt payment. It also asks for the privilege of making a minimum charge of $1 per month. W. E. Hitchcock, of Muncie, Ind., is representative of the company.

ANDERSON, IND.—Bids will be received by the Board of Public Works until Jan. 2 for the installation of a new turbine engine at the municipal electric plant. The cost of the new machine is estimated at about $30,000.

HARTFORD CITY, IND.—The United Telephone Company is planning to make extensive improvements to its rural telephone service in Harrison and adjoining townships. New lines will be erected and a modern lock-out system established. The present party-line system will be abolished.

JASONVILLE, IND.—The directors of the New Home Telephone Company have decided to make improvements to its local system, involving an expenditure of about $5,000. All wires will be placed in cables, a new switchboard will be installed and new poles erected.

JENNINGS, IND.—A twenty-five-year franchise has been granted to C. Johnson to operate an electric plant in Jennings. A contract was also awarded to light the streets of the town. The plant also will supply electricity for motors.

NEW CASTLE, IND.—The Central Union Telephone Company has purchased the property and the franchises of the New Castle Independent Telephone Company for a consideration of $25,000. The Central Union Company has taken an option on a site on which it proposes to build a new exchange at a cost of about $150,000.

ONTARIO, IND.—Plans are being prepared by the Pigeon River Milling Company for the construction of a hydroelectric power plant to supply electricity for lamps and motors in Ontario, Lagrange and Rome. The work will include the construction of a power house and improvements to a 600-ft. concrete dam.

ALTOONA, IA.—At an election to be held Dec. 16 the proposition to grant a light franchise to G. T. Gibson, of Des Moines, Ia., will be submitted to a vote.

AMES, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., for installing lighting fixtures in the United States public building at Ames, Ia. James Knox Taylor is supervising architect.

BAYARD, IA.—The question of installing an electric-light plant in Bayard is reported to be under consideration.

BLANCHARD, IA.—A. L. Johnson, it is reported, is contemplating the installation of an ice plant in connection with an electric-light plant.

BRADDYVILLE, IA.—The installation of a new lighting plant in Braddyville is reported to be under consideration.

BRIGHTON, IA.—The contract for the construction of the power dam has been awarded to L. J. Highland.

DENVER, IA.—The proposition to grant an electric-light franchise in Denver will be submitted to a vote at an election to be held Dec. 11.

FORT DODGE, IA.—The Northern Iowa Power Company is planning

to construct a hydroelectric power plant north of this city. The company is capitalized at $500,000 and proposes to install a plant with an output of 2000 hp. The cost of the plant is estimated at $240,000.

GALVA, IA.—At an election held Nov. [illegible] the citizens voted to issue bonds to the amount of $8,500 for the installation of an electric-light plant in Galva.

GEORGE, IA.—The installation of an electric-light plant in George is reported to be under consideration.

GREENE, IA.—A petition is being circulated in Greene to grant Claud Mackey, of Waverly, Ia., a franchise to supply electricity to light the town.

HAMPTON, IA.—The Hampton Electric Light & Power Company has been awarded judgment for $8,000 damages against the Iowa Central Railroad Company for the loss caused when its plant was destroyed by fire last summer. It was charged that the fire was caused by a spark from a locomotive owned by the railroad company.

HOPKINTON, IA.—Investigations are being made with a view of building a dam on the Maquoketa River. If sufficient power can be developed a new electric-light plant may be installed.

KAMRAR, IA.—The local business men are considering the question of installing a street-lighting system in Kamrar.

KEOKUK, IA.—Work has been commenced on the survey for the proposed transmission line from Keokuk to Burlington by the Stone & Webster Engineering Corporation. The cost of the line is estimated at about $600,000.

MANCHESTER, IA.—The Manchester Light, Heat & Power Company is reported to have been awarded the contract for street lighting for a period of five years.

MOUNT PLEASANT, IA.—The City Council has authorized the city clerk to advertise for bids for the proposed alterations to the municipal electric-light and water plant.

PERRY, IA.—The proposition to grant a light franchise was defeated at a special election held recently.

PIERSON, IA.—A movement is reported to be on foot to install an electric-light plant in Pierson.

STEAMBOAT ROCK, IA.—At an election held recently the proposition to grant the Park Dam Company, of Eldora, Ia., a franchise to supply electricity for lamps in Steamboat Rock was carried.

HUTCHINSON, KAN.—It is reported that plans are under way for the formation of a corporation with a large capitalization for the purpose of supplying the entire Arkansas Valley with electricity for lamps and motors. The project also includes an electric interurban railway extending up the Arkansas Valley from Hutchinson to Garden City and also to supply electrical energy for pumping water from the underflow for irrigation purposes. It is said that men closely connected with large electrical manufacturing interests are interested in the project.

LAWRENCE, KAN.—The County Commissioners have rejected all bids submitted for furnishing machinery for the electric-lighting and water-pumping plant at the new county hospital, as all the bids were considered too high. The county clerk has been authorized to call for new bids.

MINNEAPOLIS, KAN.—The City Council is considering the question of purchasing the electric-light plant of the Jackman Roller Mills. The city last June voted to issue bonds for the installation of a municipal electric-light plant. Before purchasing the plant the proposition will have to be submitted to a vote of the people.

WICHITA, KAN.—The City Commissioners have decided to call a special election, to be held Dec. 12, to vote on the propositions for establishing municipal water-works, a municipal lighting system and other improvements.

CADIZ, KY.—Alexander Brothers are reported to have been granted an electric-light franchise in Cadiz.

CAMPBELLSVILLE, KY.—The Campbellsville-Taylor Company is reported to be contemplating the construction of an electric-light plant to replace the one recently destroyed by fire. The cost of the proposed plant is estimated at about $30,000.

NEW ORLEANS, LA.—The Louisiana Southern Railroad, which is now owned by the Yoakum interests, it is reported, will be equipped for electrical operation. Work on an entension of 20 miles to the railroad starting from Shell Beach is now in progress. The older portion of the road is being reconstructed and standardized. The road when completed will be about 75 miles long.

SHREVEPORT, LA.—The Shreveport Gas, Electric Light & Power Company has awarded the General Electric Company a contract to install a new street-lighting system in Shreveport, which will call for an expenditure of about $20,000. The contract calls for luminous magnetite arc lamps, of which about 285 will be installed.

WATERVILLE, MAINE.—The Waterville & Oakland Street Railway Company has filed amendments to its charter changing its name to the Waterville, Fairfield & Oakland Street Railway Company and increasing its capital stock from $100,000 to $500,000. The Central Maine Power Company recently acquired control of the Waterville & Oakland Street Railway and the Waterville & Fairfield Electric Railway. Harvey D. Eaton, of Waterville, is president, and Walter S. Wyman, of Augusta, is treasurer of the Central Maine Power Company.

MIDDLETOWN, MD.—The town of Middletown has entered into a contract with the Frederick City Gas & Electric Company for furnishing electricity for lighting the city. Work will begin at once on the construction of the system. The company has rebuilt its transmission line from Frederick to Braddock Heights and will erect a new line from the Heights to Middletown.

BOSTON, MASS.—Mayor Fitzgerald has directed Superintendent of Supplies Mullen to readvertise for bids for the contract to supply the city with lamps and equipment for the method of partial municipal lighting. The Mayor takes the ground that as the apparently lowest bid received on the first call includes an estimate of the duty to be paid upon the lamp, rather than an actual statement of the cost to the city upon delivery in Boston, it would not be proper to accept this bid. The contract calls for furnishing 11,000 lamps.

CHICOPEE, MASS.—The Board of Electric Light Commissioners has engaged Engineer Whiting to prepare plans for the proposed improvements to be made to the municipal electric-light plant, for which bonds to the amount of $96,000 were recently voted. The plant when completed will have an output of 1550 kw. The equipment will include two 500-kw generators, one 350-kw and one 200-kw machine.

FITCHBURG, MASS.—The county officials are contemplating the installation of an electric-lighting system in the Worcester north county court house at Fitchburg, Mass.

FITCHBURG, MASS.—The Fitchburg Gas & Electric Light Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue capital stock to the amount of $131,300.

HAVERHILL, MASS.—The Haverhill Electric Company has petitioned the Massachusetts State Board of Gas and Electric Light Commissioners for authority to issue 117 shares of additional capital stock, par value of $100, the proceeds to be used for payment of indebtedness incurrred in construction and improvements to its system.

HAVERHILL, MASS.—A movement has been inaugurated by the Haverhill Advertising Club for the installation of an ornamental street-lighting system in the business district. It is proposed to raise among the business men $12,600, the estimated cost to illuminate the retail business and manufacturing districts of the city for two years, after which it is proposed to turn the lamps over to the city. The plan is to utilize the present trolley poles, of which there are ninety in the district, each pole to be equipped with a bracket carrying four 60-watt tungsten lamps. The Haverhill Electric Company has offered to supply electricity to maintain the lamps at the rate of $70 per year for each pole.

MALDEN, MASS.—The Malden Electric Company has applied to the State Board of Gas and Electric Light Commissioners for authority to issue $207,000 in capital stock.

SUTTON, MASS.—The Worcester Suburban Electric Company is extending its commercial lighting and power circuits into the town of Sutton. The company will supply electricity to operate the municipal water-pumping station. The local telephone cables will be placed on the Worcester Company's poles, which will be 45 ft. in length.

TURNER'S FALLS, MASS.—A special town meeting has been called by the Selectmen of Gill to consider the question of lighting the streets of Riverside.

WEYMOUTH, MASS.—The stockholders of the Weymouth Light & Power Company have voted to appropriate $60,000 for extensions and improvements to its plant. The work will include the installation of a 1000-kw steam turbine with a Le Blanc condenser, a 400-hp boiler and a new chimney. Besides supplying electrical service in Weymouth the company furnishes energy to operate the municipal electric plant in Hingham and also electricity for lamps and motors in Hull.

STANDISH, MICH.—Negotiations have been closed whereby the local electric-light plant and water-works system have been purchased by C. F. Hall, proprietor of the City flouring and shingle mills. A new power house will be erected and the plant moved to the grist-mill property. Mr. Hall will apply to the City Council for a ten-year contract for lighting the city and for pumping water.

STANTON, MICH.—The Traverse City Iron Works have secured the contract for the construction of an electric-light plant and water-works system in Stanton.

COLERAINE, MINN.—Arrangements have been made by the Olive Iron Mining Company to light its plant in Coleraine by electricity. Cement will be supplied by the plant of the Western Mesaba Electric Company at Bovey, Minn.

JANESVILE, MINN.—The Village Council is reported to have granted the Consumers' Power Company a franchise to supply electricity for lamps in Janesville.

LAKE CRYSTAL, MINN.—The Consumers' Power Company has applied to the Council for a franchise in Lake Crystal. If granted, the company will extend its transmission line from the plant at the Rapidan dam, located near Mankato.

MADELIA, MINN.—The Consumers' Power Company of Mankato, Minn., is reported to have applied for an electric-light franchise in Madelia, Minn.

MINNEAPOLIS, MINN.—The Council water committee has instructed the city engineer to submit an estimate of the cost of installing an electric generating plant in the new filtration plant. Owing to the committee being unable to reach an agreement with the Minneapolis Gen-

... electricity to operate ... decided to make investigations as to the feasibility of installing a municipal plant to furnish the power. In case it is decided to build the plant, it is probable that all the machinery at the filtration plant, including the electrically driven centrifugal pumps, will be operated by power from the city plant. About 250 hp will be required to operate the machinery of the filtration plant.

TWO HARBORS, MINN.—Plans are being considered for installing a new electric unit in the municipal electric-light plant. Bids, it is said, will soon be asked on a 300-kw, 60-cycle, single-phase or two-phase generating unit. Bids will be considered for a direct-connected unit, also for belt, pulley drive, engine and generator, the engine to be a condensing engine without condenser.

VIRGINIA, MINN.—At a special election held Nov. 21 the citizens voted to instruct the city of Virginia to acquire by purchase or condemnation proceedings the water and light plant of the Virginia Electric & Water Company, to be owned and operated by the municipality. The City Council must secure a valuation of the property either by agreement under the terms of the franchise granted to the company or by applying to the district court for a board of appraisers to fix a fair valuation on the property.

WABASHA, MINN.—The Minnesota & Wisconsin Power Company is erecting a transmission line to Red Wing, and through Lake City to Wabasha. The company, it is said, expects to furnish electricity to the Wabasha "Big Joe" Roller Mill Company and other industries in this vicinity.

WADENA, MINN.—Plans for the installation of an ornamental lighting system from the Northern Pacific station to the court house are reported to be under consideration by the business men.

PRENTISS, MISS.—The local electric-light plant, owned by H. W. Hinton, has been purchased by W. C. Veach, foreman of the sawmill of the Taexler Lumber Company, of Prentiss. The machinery has been removed from the present power house to the Bozeman gin, where it has been installed.

JOPLIN, MO.—The city engineer, it is reported, has been instructed to prepare plans for the installation of an ornamental street-lighting system on Main Street from B Street to Twelfth Street and on Fourth Street from Kentucky Avenue to Jackson Avenue. Ornamental lamp standards will probably be used, each carrying a cluster of three lamps, with the exception of the corner standards, which will carry a cluster of five tungsten lamps. Arthur Cook is city engineer.

WINSTON, MONT.—Arrangements are being made by Henry M. Lancaster, of Spokane, Wash., owner of the East Pacific mine at Winston, to secure electricity from the transmission line of the Missouri River Power Company to light the mine and operate the machinery. It will be necessary to erect a transmission line 12 miles long to supply the service.

FAIRBURY, NEB.—The Council is reported to have rejected the turbo-generator set recently purchased for the municipal electric-light plant, considering it too small.

FALLON, NEB.—Plans and specifications have been approved by the City Council for the construction of a municipal electric-light system. The Council has authorized bonds to the amount of $15,000 to pay for same. Energy for operating the system will be secured from the government plant at Lahontan. The city will build the transmission line and distributing system.

KEARNEY, NEB.—The City Council has decided to submit to the voters the proposition to issue $40,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant in Kearney. The city is also considering the question of installing an ornamental street-lighting system. The cluster-lamp system is under consideration.

MARQUETTE, NEB.—The installation of a combined water and light plant in Marquette is reported to be under consideration.

WINSLOW, NEB.—An electric street-lighting system is being installed in Winslow. The power plant is to be located in the garage owned by William Brandert. The town officials have co-operated with Mr. Brandert to secure electricity to light the town. Tungsten lamps will be used for lighting the streets.

LAS VEGAS, NEV.—The Consolidated Power & Telephone Company is planning to increase the output of its plant, which supplies electrical service in this community. Orders have already been placed for a portion of the new machinery. Frank A. Clark is president of the company.

KEENE, N. H.—The Public Service Commission has authorized the Keene Gas & Electric Company to acquire $70,000 of the common stock and $70,000 of the preferred stock of the Ashuelot Gas & Electric Company, and has approved of the lease of the Ashuelot Gas & Electric Company to the Keene Gas & Electric Company. The Ashuelot Gas & Electric Company has been granted permission to supply electricity in the towns of Marlborough, Swansey and Winchester.

GARFIELD, N. J.—The Borough Council has abandoned the proposition to establish a municipal electric-light plant for the present. Reports submitted by engineers show that the cost of building a plant to meet the demands of the borough would be about $46,000. Several months ago bonds to the amount of $25,000 were voted to build a municipal plant.

NEWARK, N. J.—The contract for furnishing lighting fixtures for the Central High School has been awarded to R. C. Heather & Company, at $4,700, and that for supplying lighting fixtures for the Cleveland School to Jaehne & Company, for $1,880.

CUTTER, N. M.—The Vanadium Mines Company is reported to be considering plans for the installation of an electric power plant near Cutter. W. A. Bonitz, of Pittsburgh, Pa., is said to be interested in the project. The cost of the proposed plant is estimated at about $20,000.

DEMING, N. M.—The installation of a large hydroelectric power plant on the Gila River, 65 miles north of Deming, and the erection of electric transmission lines from the plant to Deming and through the Mimbres Valley to supply electricity for operating pumps, plants for irrigation purposes and other industries is being promoted by H. B. Johnson and R. H. Bouldare, of Silver City, N. M. The power site is located on the east fork of the Gila River. The first development will be a 15-ft. timber dam. The power diversion dam will be a 30-ft. dam where the flow of the river is 100 second-ft. without any storage. The cost of the entire project is estimated at $1,200,000, and it will require from two and one-half to three years to complete. The cost of the first development is estimated at from $300,000 to $350,000

BINGHAMTON, N. Y.—Mayor J. J. Irving has signed the ordinance authorizing the city clerk to communicate with the New York State Conservation Commission for the purpose of having a representative sent to Binghamton to ascertain the amount of water-power to be obtained from the Susquehanna and Chenango Rivers with the possibility of utilizing it for a municipal lighting plant, a sewage plant and other proposed public utilities.

LE ROY, N. Y.—The Town Board has granted the Le Roy Hydraulic Electric & Gas Company a franchise to erect and maintain transmission lines for the distribution of electricity for lamps, heat and motors in Le Roy. It is understood that the company also proposes to supply electrical service in the towns of Stafford and Bergen.

NEW YORK, N. Y.—Bids will be received by Arthur J. O'Keefe, commissioner of bridges, Department of Bridges, 13 to 21 Park Row, New York, N. Y., until Dec. 14, for furnishing and erecting one duplex, two-stage, motor-driven air compressor at the Williamsburg Bridge, in the borough of Brooklyn. Blank forms and specifications may be obtained at the office of the Department of Bridges.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 22 for wiring, etc., in the United States court house, New York, N. Y. James Knox Taylor is supervising architect.

ROCHESTER, N. Y.—The contract for rewiring the old building at the Rochester State Hospital has been awarded to the Rochester Electric Motor Company, of Rochester, at $6,350.

ASHEVILLE, N. C.—The Aluminum Company of America, of Pittsburgh, Pa., is reported to be interested in a water development on the Little Tennessee River Gap, west of Asheville, for which surveys are now being made.

ROCKINGHAM, N. C.—A deal has been closed whereby the Yadkin River Power Company has purchased the municipal electric-light plant in Rockingham for a consideration of $15,000. This secures for the company the Blewitt Falls plant, including water rights, dam, power house and transmission lines.

DAYTON, OHIO.—A company has been organized in Toledo for the purpose of harnessing the Big Miami River at Woodsdale, Ohio, between Hamilton and Middletown to develop power to operate a large electric plant. The company, which, it is said, includes Hamilton, Middleton and New York capitalists, contemplates the erection of a 28-ft. dam on the Miami River and a large electric generating plant, which will involve an expenditure of about $547,000. The Russell Company, of Dayton, Ohio, it is reported, will finance the project.

DELPHOS, OHIO.—The Delphos Home Telephone Company has increased its capital stock from $30,000 to $50,000.

GREENVILLE, OHIO.—The Greenville Electric Light & Power Company has been granted a franchise by the County Commissioners to erect and maintain electric transmission lines along certain roads in the country for a period of twenty-five years, with a view of supplying electricity in the villages of West Manchester and Lewisburg. The company has secured franchises to supply electrical service in these villages.

MARTIN'S FERRY, OHIO.—The Board of Control has awarded the contract for the new arc lamps for street lighting to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., at $1,325. The contract calls for a fifty-arc lamp system with the installation of twenty-five lamps. The new lamps will be erected in the central part of the city and the old lamps will be removed to new location in the outskirts.

SOUTH VIENNA, OHIO.—The Village Council has awarded contracts for machinery for the municipal electric-light plant as follows: To the Foos Gas Engine Company, of Springfield, Mass., for a 35-hp gas engine, oil to be used as fuel, and to the Western Electric Company for a 25-kw generator. The street-lighting system will consist of forty lamps. Charles C. Hubble, of the Hubble Engineering Company, of Columbus, Ohio, will have charge of construction of the plant.

TOLEDO, OHIO.—Mayor Whitlock and the executive heads of the city departments will consider plans for a high-pressure water-system pumping station, with a view of having it serve as a basic unit toward the establishment of a municipal electric-light and power plant to gen... ...city for commercial purposes. Superintendent Goodwillie

has been instructed to prepare full data as to the requisites of a high-pressure plant. The Toledo Railway & Light Company has submitted a proposition offering to supply electrical power to operate a high-pressure system at $12,000 per year service charge and 2 cents per kw-hour additional for energy actually used.

OKLAHOMA CITY, OKLA.—The city clerk has been instructed to advertise for bids for the installation of an electrolytic sewage-disposal plant at Packington.

WOODWARD, OKLA.—Judge Cotteral of the United States court has rendered a decision in the case of the Woodward Cotton Company against the city of Woodward, involving the issuance of electric-light bonds by the city, which sustains the city's right to issue the bonds and to build an electric-light plant. The Woodward Cotton Company has a contract for lighting the city and attempted to restrain the city from building the municipal plant.

CORVALLIS, ORE.—Plans are being considered by the Portland, Eugene & Eastern Railway Company for the construction of an electric railway from Monroe to Corvallis. L. Welch is general manager.

PORTLAND, ORE.—Plans are being considered by the Port of Portland Commission for the installation of an electric-lighting plant on the tugboat Wallula.

PRINEVILLE, ORE.—Plans are being considered by Louis Gerlinger, Jr., manager of the Salem, Falls City & Western Railway Company, it is reported, for the construction of an electric railway from Metolius to Prineville.

PANAMA.—The contract for complete hydraulic power equipment for the hydroelectric plant at Gatun in connection with the Panama Canal has been awarded to the Pelton Water Wheel Company, of San Francisco, Cal. The equipment will consist of three 3600-hp, vertical-shaft Pelton-Francis turbines, operating under 75-ft. head at 250 r.p.m. for driving General Electric steam-turbine-type generators; three pipe lines, each 10 ft. 6 in. in diameter by approximately 300 ft. long; Pelton oil-pressure waterwheel governors and headgates.

CHESTER, PA.—The City Council has awarded the contract for street-lighting to the Beacon Light Company for a period of five years. Under the terms of the franchise the company is to supply arc lamps at $75 each per year; 16-cp incandescent lamps at $10.50 per lamp per year; 50-watt tungsten lamps at $19 each per year; 60-watt tungsten lamps at $21 per lamp per year; 80-watt tungsten lamps at $25 each per year, and 100-watt tungsten lamps at $29 each per year. The price for arc lamps is $5 less than under the present contract. There are 313 lamps now in use.

PHILADELPHIA, PA.—Sealed bids will be received until Dec. 11 by Henry Clay, director of public safety, Room 215, City Hall, Philadelphia, Pa., for furnishing electric arc lamps for the year 1912. Proposal blanks and specifications and all information may be secured at Room 610, City Hall, Philadelphia, Pa.

PITTSTON, PA.—A new electric-light company, to be known as the Garden City Electric Company, has applied to the Town Council of West Pittston for a franchise to install and operate an electric-light system in West Pittston. The Crosstown Street Railway Company has also applied for a franchise to construct and operate an electric railway in West Pittston.

ROYERSFORD, PA.—At an election held recently the proposition to appropriate $30,000 for the installation of a municipal electric-light plant was carried.

SPRING CITY, PA.—The contract for erecting a power house and laundry for the State Institution for Feeble-Minded and Epileptics, in Spring City, has been awarded to John R. Wiggins Company, of Philadelphia, Pa.

STATE COLLEGE, PA.—The Board of Trustees of Pennsylvania State College has authorized two new buildings. This provides for a new unit to the engineering building, 50 ft. x 100 ft., which will house the cement-testing laboratories, the high-tension electrical apparatus and the stock-rooms for the engineering departments.

SUNBURY, PA.—Negotiations have been closed whereby the Northumberland County Gas & Electric Company will take over the plant and holdings of the Middle Creek Electric Company. The property includes the water-power plant, located 2 miles south of Selinsgrove; all land purchased for dam purposes, the mill and water-power plant at Kratzerville, and the large steam plants in Sunbury and Northumberland. The consideration is said to be $223,500. The Northumberland company now owns all the gas and electric plants in Sunbury, Selinsgrove, Northumberland and Milton. It also has a lease on the Lewisburg plant for a term of ninety-nine years, and an option on the property of the Middleburg Light, Heat & Power Company.

ABERDEEN, S. D.—Frank F. Fowle, of Chicago, Ill., electrical engineer, engaged by the City Commissioners to investigate the local electric-light and power plant, owned by the Aberdeen Light & Power Company, has submitted his report. In the report Mr. Fowle strongly advises against granting a franchise to a second company, if the present company manifest a disposition to "make good," on the ground that there is not sufficient patronage for two competing companies in a city the size of Aberdeen. He suggests many improvements to the plant in order to enable the company to give satisfactory service, and suggests that three months is sufficient time to make the necessary improvements.

MENNO, S. D.—The installation of an electric-light system in Menno is reported to be under consideration.

WAKONDA, S. D.—A company has been organized by local citizens under the name of the Wakonda Light, Power & Heating Company for the purpose of installing a plant in Wakonda.

COOKEVILLE, TENN.—The proposition to issue $30,000 in bonds for extensions and improvements to the electric-light plant and water-works system is reported to have been carried at an election held recently.

WAVERLY, TENN.—The city has decided to take over the local electric-light plant, owned by the Waverly Electric Light Company. It is proposed to replace the present arc-lamp street-lighting system with tungsten lamps. Bonds to the amount of $1,000 have been voted for improvements.

ABILENE, TEX.—The Abilene Independent Telephone & Telegraph Company is reported to be contemplating the erection of a new toll line to Northwest Texas. G. Klotz is general manager.

ARKANSAS PASS, TEX.—It is reported that bonds to the amount of $15,000 have been voted for the installation of an electric-light plant and water-works system.

CARLSBAD, TEX.—The contract for the installation of an electric-light plant, plumbing, heating and water-works at the tuberculosis colony at Carlsbad has been awarded to W. B. Kroeger, of San Antonio, Tex., for $14,650.

CLEBURNE, TEX.—Extensive improvements are contemplated by the Cleburne Telephone Company, which will involve an expenditure of about $50,000 and include the erection of 10 miles of cables throughout the city and new lines through the county and placing all wires underground in the city.

DALLAS, TEX.—Charles A. Mangold is promoting a project for the installation of an ornamental street-lighting system on Houston Street, from Commerce Street to Dall-Oak Cliff viaduct.

DALLAS, TEX.—John T. Witt has been granted a franchise to construct an interurban electric railway from the west bank of the Trinity River to a point in the county 10 miles west.

GRAPEVINE, TEX.—B. H. Yancy has purchased the property of the Grapevine Ice & Light Company. The new owner is making improvements to the plant and will install another generator and boiler.

THORNDALE, TEX.—The Thorndale Water Company has changed its name to the Thorndale Water & Light Company and increased its capital stock from $10,000 to $40,000. The company proposes to generate and sell electricity.

WICHITA FALLS, TEX.—The City Council has granted an extension to the contractors, Dobson & Gullahorn, until February, 1912, to complete the installation of new machinery in the local electric-light plant.

LEHI, UTAH.—The Utah Lake Irrigation Company is planning to install electric pumping machinery on its property near Saratoga Springs.

MURRAY, UTAH.—The City Council has decided to extend the street-lighting service into the southwestern part of the town. As soon as plans and specifications are completed fifty lamps will be erected. The Progress Company will supply electricity for maintaining the lamps at $1 each per month, making the total cost $600 per year.

FALLS CHURCH, VA.—The Town Council has passed an ordinance granting the Arlington Electric Company a franchise and has also voted to accept the proposal of the company to furnish electricity for street lighting. It is expected to have the system in operation by Jan. 1, 1912.

WINCHESTER, VA.—Arrangements are being made by the Winchester & Washington Railway Company for the installation of another large turbine in its plant; the present transformers are to be duplicated. The cost of the proposed improvements is estimated at about $1,000,000.

ASOTIN, WASH.—The Mount Vernon Telephone Company is planning to erect a telephone line to Asotin, Wash., and to the ranger headquarters near Dayton.

BELLINGHAM, WASH.—The City Council has instructed City Engineer Whitney to prepare plans and estimates for the installation of a municipal electric-light plant. The city engineer in a recent report to the Council stated that a plant of sufficient output to supply 125 arc lamps could be operated by power going to waste at the city pumping plant.

CASTLE ROCK, WASH.—Plans are being prepared by the Brown Company, Bailey Building, Seattle, Wash., for a light and power plant and the mechanical equipment for the Castle Rock Coal, Light & Power Company, to be located in Castle Rock. The cost of the work is estimated at $275,000.

CASTLE ROCK, WASH.—The Castle Rock Light & Power Company, recently incorporated, has taken over the property of the Huntington Coal Mining & Development Company and will make extensive improvements to the property. It is proposed to install an electric-power plant at once, to cost approximately $10,000. About $25,000 will be expended on the coal mine. The company is capitalized at $250,000, and the incorporators are: A. E. Braden, H. B. Davis, and I. W. Selden. The headquarters of the company will be located in Tacoma.

CLE ELUM, WASH.—The Kittitas Railway & Power Company has engaged the Brown Company, Bailey Building, Seattle, Wash., to make permanent surveys for the proposed new hydroelectric development and electric railway from this city into the Cle Elum flats, a distance of about 40 miles. The cost of the work is estimated at $1,500,000.

[illegible] ranch, located on Little Klickitat Creek, near Goldendale.

PASCO, WASH.—The City Council has awarded a contract to the Evans-Dickson Company, of Tacoma, Wash., for furnishing and installing eighty-four ornamental lamp standards, each carrying a three-lamp cluster, for $5,980.

SEATTLE, WASH.—The Board of Public Works has granted the Seattle, Renton & Southern Railway Company permission to construct an electric railway on Fifth Street, between Main and King Streets, and also for the construction of a double-track line near Kenyon Street. The company is also making improvements to its railway between Rainer Beach and Taylor's Mill.

SEDRO-WOOLLEY, WASH.—The State Board of Control has awarded the contracts for construction of the proposed power plant at the Northern Hospital for the Insane at Sedro-Woolley to the Eckhart Heating & Plumbing Company, at $34,920; the contract for electrical work was awarded to the Standard Engineering Company, of Seattle, Wash., for $2,650. Saunders & Lawton, of Seattle, Wash., are the architects.

SPOKANE, WASH.—Preparations are being made to install a compressor and mill at the Amazon-Manhattan mine in the Sunset district near Wallace as soon as the transmission line of the Washington Power Company, which is to extend up Nine Mile Creek, is completed.

TACOMA, WASH.—The Great Northern Railway Company is planning to build a large dam in the gorge of the Chelan River, which connects Lake Chela with the Columbia River, where it is estimated that 100,000 hp can be developed. The proposed dam will be 200 or 300 ft. high, depending on the site used.

WENATCHEE, WASH.—The City Council is reported to be considering the installation of a fire-alarm system.

SISTERSVILLE, W. VA.—The Sistersville Electric Light & Power Company has awarded the contract for the construction of the addition to its power plant in Sistersville to John J. Rae, of Clarington. The new building will be 45 ft. by 75 ft. The new equipment will include two new engines of the Westinghouse type with a rating of 1000 hp each and a new switchboard. The company is planning to supply electricity to operate the new electric railway now being constructed from Sistersville to Middlebourne.

HILLSBORO, WIS.—The installation of an electric-light system in Hillsboro is reported to be under consideration.

LA CROSSE, WIS.—It is said that damages to the plant of the La Crosse Water Company cannot be completed until next spring. It is understood that efforts to cash receivership certificates to repair the damage have failed and a 5 per cent assessment has been made against the boldholders to raise the required amount. The damage to the plant at Hatfield is estimated at about $200,000. The company, it is said, may be reorganized during the winter. C. C. Smith is receiver.

NEENAH, WIS.—The Railroad Rate Commission has issued an order requiring the Wisconsin Traction, Heat & Light Company, which furnishes the local service, to comply with its order of Aug. 4 reducing the rates on electricity for lamps and gas in the city of Neenah 25 per cent.

RAYVILLE, WIS.—The town officials have engaged W. H. Wright, civil engineer, to prepare plans and estimates for the installation of an electric-light plant, water-works and sewer systems in Rayville.

SHEBOYGAN, WIS.—The K. Schreier Brewing Company is reported to be considering the installation of additional electrical generating machinery, including a 450-hp generating unit, consisting of Corliss engine and generator to supply energy for motors and a 30-hp generator to furnish electricity for lamps.

UNION GROVE, WIS.—The installation of an electric-light plant in Union Grove is reported to be under consideration.

CALGARY, ALTA, CAN.—The cost for the proposed extensions to the municipal lighting system is estimated at about $175,000. Most of the work will be in Crescent Heights and North Hill.

VICTORIA, B. C., CAN.—An electric-lighting plant will be installed on the new river steamer to be constructed by the British Columbia Express Company. Plans are being prepared by Alexander Watson, shipbuilder.

VICTORIA, B. C., CAN.—The City Council is contemplating extending the cluster street-lighting system.

BRANTFORD, ONT., CAN.—Plans are being considered by Mayor Armstrong of Paris and Mayor Rastall of Brantford regarding the submission of by-laws for securing electrical service from the Hydroelectric Power Commission in both municipalities. The agreement of the city of Brantford with tne Cataract Power Company will expire within a year.

COBALT, ONT. [illegible] Light & Power Company, it is reported, has been organized to take over the properties of the Cobalt Power Company and its subsidiary companies and the Cobalt Hydraulic Power Company, Ltd. The companies furnish electricity for lamps, heat and motors in the towns of Cobalt, North Cobalt, Haileybury, Liskenard, Cochrane and Porcupine.

TORONTO, ONT., CAN.—The provincial government has granted the Ontario Hydroelectric Commission authority to lease Dams No. 4 and No. 8 on the Trent Canal. At Dam No. 4, which is on the Peterborough and Lakefield division, it is stated that about 3000 hp will be developed to supply electricity in Peterborough, Lakefield and immediate vicinity, while at Dam No. 8, which is on the Rice Lake branch, 5000 hp will be generated to supply electrical energy to the lower districts of eastern Ontario.

MONTREAL, QUE., CAN.—The Canadian Light & Power Company has acquired the controlling interest of the Saraguay Light & Power Company, of Montreal. The Canadian company has also taken over the property of the Central Light, Heat & Power Company, which has a steam plant in the commercial district.

MONTREAL, QUE., CAN.—The Cedar Rapids Manufacturing & Power Company has applied for permission to increase its capital stock from $250,000 to $10,000,000. Plans are being prepared by the company for the construction of a hydroelectric power plant at Cedar Rapids, 28 miles from Montreal. The initial installation will provide for 25,000 hp. The company expects ultimately to develop 150,000 hp, which it proposes to dispose of in bulk to existing companies for distribution. D. Lorne McGibbon is president and Henry Redgate consulting engineer.

CULIACAN, SINALOA, MEX.—The Guadalupe de Los Reyes Mining Company is planning to install an electric-power plant at its mines near Culiacan. The equipment will consist of two gas-producer engines with a rating of 180 hp each, a reserve gas generator and two electric generators with a rating of 120 kw. Salvador Ugarte, of Mexico City, has the contract for installing the plant.

MONTEREY, NUEVO LEON, MEX.—The Mexican Midland Light & Power Company, Ltd., of Montreal, Can., recently chartered with a capital stock of $45,000,000, is reported to have acquired the concessions and other holdings of the Mexican Hydroelectric Company, which had its headquarters in Mexico City. The company, it is said, will carry out the plans of the Mexican Hydroelectric Company for the installation of hydroelectric plants on the Waranjo River, in the state of San Luis Potosi, and the Rio Blanco, in the states of Nuevo Leon and Tamaulipas. Besides the available water-power owned by the company its concession from the federal government calls for the construction of electric railway systems and the erection of several hundred miles of transmission lines.

PACHUCA, HIDALGO, MEX.—The Fuerza & Ferrocarriles Company of Pachuca has applied for concessions for the construction of three hydroelectric power plants on the Tula River. The company proposes to develop 7900 hp with transmission lines to Tula, Jasso, Actopan and other mining towns in that district. Theodore Branderburg is general manager of the company.

Personal.

MR. ROBERT LINDSAY, general manager of the Cleveland Electric Illuminating Company, of Cleveland, Ohio, sailed from New York Dec. 2 for a month's vacation in southern waters.

MR. J. H. SHOEMAKER, of Waterloo, Ia., has resigned as general manager of the Corn Belt Telephone Company in order to enter a new field of work not identified with the telephone.

MR. F. J. WHITE, of the Okonite Company, will give a lecture on Thursday, Dec. 14, before the Electrical Engineers Society of Columbia University on the subject of the insulation of electric conductors.

MR. H. W. SMITH, formerly of the Milwaukee office of the Westinghouse Electric & Manufacturing Company, has been appointed electrical engineer of the Cleveland Construction Company, with headquarters for the present at Michigan City, Ind.

MR. GEORGE C. THORNTON and *MR. RICHARD W. ALGER* have formed a partnership for the practice of electrical and mechanical engineering under the firm name of Thornton & Alger, with offices in Chattanooga, Tenn. Particular attention will be given to the lighting of modern buildings and consultations for electrical power plants.

MR. R. M. JENNINGS, local manager for the Oregon Power Company at Marshfield, Ore., has been made manager of this company's properties at Eugene and Springfield, Ore., to succeed Mr. M. D. Spencer, who has been placed in charge of the gas and electric plants of H. M. Byllesby & Company at Monroe, Wash.

MR. WILLIAM COALE, of the Sterling Electrical Manufacturing Company, and chairman of the N. E. L. A. committee on light, heat and ventilation, was a guest of honor at the first meeting of the season of the Sidney (Ohio) Manufacturers' Association, at which he delivered an address on the subject of lighting by metallic-filament lamps.

MR. S. G. VIGO, formerly connected with the contract department of the Commonwealth Edison Company of Chicago, has accepted the position of power engineer for the Consumers' Electric Light & Power Company, of New Orleans. Before his departure Mr. Vigo was entertained at a farewell luncheon at the Grand Pacific Hotel by some of his Chicago friends.

MR. C. K. G. BILLINGS has resigned as a director and chairman of the board of directors of the People's Gas, Light & Coke Company, of [illegible]. Mr. Anthony N. Brady, of New York, was chosen to

succeed Mr. Billings as chairman of the board, and Mr. James F. Meagher, of Chicago, was elected a director to fill the vacancy caused by Mr. Billings' resignation.

MR. W. F. RICHARDS, superintendent of lighting and power for the Toledo Railway & Light Company, has returned to the active direction of his department after an enforced vacation of several months necessitated by a general nervous breakdown early in the summer. Mr. Richards went at once to a resort in northern Canada, recuperating there sufficiently to return to Toledo in October, although not taking up active duties again until recently.

MR. FRANK R. COATES has been elected president of the Toledo Railways & Light Company, Toledo, Ohio. Mr. Coates, who is a graduate of Lehigh University, has been connected with many of the great railroads of the country since his graduation in 1890. From 1900 to 1904 he was chief engineer of the Chicago Great Western Railway, since which time he has been associated with the firm of Thomas Phee & Company, contractors, of Chicago.

MR. HERBERT LAWS WEBB has been made a director of the Constantinople Telephone Company, which takes over a concession negotiated by Mr. Webb for the establishment of a general telephone system—the first in Turkey—embracing Constantinople and adjacent territory. Among the other directors of the company are: Mr. F. R. Welles, vice-president of the French Weston Electric Company, and Mr. Ernest Thurnauer, general manager of the French Thomson-Houston Company.

MR. H. W. FULLER, who for a number of years was general manager of the Washington Railway & Electric Company, Washington, D. C., has severed his connection with that company, and, following the lead of his superior, General Harries, has associated himself with the Byllesby organization. Mr. Fuller has been appointed vice-president and general manager of the Appalachian Power Company, with headquarters at Bluefield, W. Va. This company, which is controlled by H. M. Byllesby & Company, is engaged in developing a number of water-power sites on the New River.

MR. SAMUEL G. McMEEN, of McMeen & Miller, electrical engineers, Chicago, has been elected president of the Mount Hood Railway & Power Company, of Portland, Oregon. This company has a hydroelectric development at Bull Run, with steam auxiliary station in Portland. It will distribute electrical energy in Portland and near-by territory. Mr. McMeen has spent some years on the Pacific Coast in connection with public utility enterprises which retained the services of his firm, and in particular was for some time vice-president in charge of the Bay Cities Home Telephone Company, of San Francisco. His work in Portland will not make it necessary for him to sever his connection with the firm of McMeen & Miller.

MR. ATLEE H. TRACY has joined the Columbus (Ohio) staff of E. W. Clark & Company, bankers, of Philadelphia, and is engaged in commercial engineering work on hydroelectric and railway properties under Mr. M. S. Hopkins, consulting manager and engineer. Mr. Tracy spent five years in London and Manchester with the British Westinghouse company during the electrification of the London Underground Railways, and was in the office of Mr. George Gibbs, chief engineer of electric traction, Pennsylvania Railroad, for the six years covering the design and installation of the West Jersey and Seashore Railroad and the Long Island and New York terminal electrification. He resigned last spring to accept, temporarily, an appointment as secretary to the department of Water Supply and Electricity, New York City, under Commissioner Thompson.

Obituary.

MR. GEORGE B. MOFFATT, a director of the Electric Bond & Share Company, New York, N. Y., and formerly president of the Oregon Electric Railway, which he was largely instrumental in organizing in 1906, died in Portland, Ore., on Dec. 4 at the age of fifty-seven years.

MR. JOHN F. McGLENSEY, illuminating engineer for the Union Electric Light & Power Company, of St. Louis, died on Nov. 11. Several years ago Mr. McGlensey was one of the estimating engineers in the contract department of the Commonwealth Edison Company of Chicago. He left that company to become manager for Henry Newgard & Company, electrical contractors in Chicago, and afterward joined forces with Kohler Brothers, of the same city. About a year ago he accepted the position in St. Louis which he held at the time of his death. Mr. McGlensey was a man of high character, and his death is greatly regretted by many friends.

PROF. ENGELBERT ARNOLD died from heart failure on Nov. 16 at Karlsruhe, Germany, after an illness of a week. Professor Arnold was born March 7, 1856, in Schlierbach, canton of Lucerne, Switzerland. He studied from 1874 to 1878 at the Institute of Technology at Zurich and then for several years was engaged in practical engineering work, one of his positions being with the Maschinenfabrik Heim at Offenbach. During the years 1880-1891 he was instructor at the Institute of Technology at Riga, Russia, and at the same time in charge of the engineering department of the Russian-Baltic Electrochemical Company. Later he was chief engineer of the Oerlikon Company in Switzerland. In 1894 he was called as professor to the Institute of Technology at Karlsruhe. This chair he occupied for almost two decades. In 1905 he was made a private counselor, and in 1906 received the honorary degree of doctor-engineer from the Institute of Technology of Hanover. During 1906-1907 he was rector of the Institute of Technology at Karlsruhe. Among his many contributions to technical literature are books on armature winding of direct-current machines (1890), working drawings of alternating-current dynamos (1899) and direct-current machines, besides five volumes on alternating-current engineering, all published in German.

MR. ALDEN M. YOUNG, well known in electric-lighting circles, died in New York on Dec. 3. He was born at Hadley, N. Y., Sept. 6, 1853, and after leaving school entered the telegraph business, filling positions successively at Saratoga, Albany, Syracuse, Buffalo and New York. In 1878 he organized the telephone exchange at Waterbury, Conn., and in 1890 he built Waterbury's first electric-light station. He then organized the Waterbury Traction Company and later merged it with the lighting company. About the same time he also founded the New England Engineering Company and contributed largely to the successful introduction of lighting and railway plants in several New England cities. His work as an organizer in Waterbury and in connection with the various other enterprises in which he was the guiding spirit attracted much attention both in financial and electrical circles. He later came to New York and helped to organize the Kings County Electric Light & Power Company, of Brooklyn. At the 1898 Chicago convention of the National Electric Light Association Mr. Young was elected president of that body, succeeding Mr. Samuel Insull. Early in life Mr. Young became associated with Mr. A. N. Brady and other financiers in many enterprises, and at the time of his death was associated with the following public-service corporations either as an executive officer or as a director: Albany & Hudson Railroad Company, American Gas & Electric Company, Connecticut Power Company, Connecticut Railway & Lighting Company, Corning Gas & Electric Company, Dayton Lighting Company, Edison Electric Illuminating Company of Brooklyn, Electric Bond & Share Company, Fairmont & Clarksburg Traction Company, Kings County Electric Light & Power Company, New London Gas & Electric Light Company, Northern Westchester Lighting Company, Norwich Gas & Electric Light Company, Rockville Gas & Electric Company and the Stamford Gas & Electric Company. He was also a director of the National Carbon Company and the Consolidated Engine Stop Company and president of the New England Engineering Company and other industrial enterprises. Mr. Young was in business with his son-in-law, Mr. M. J. Warner, under the firm name of Young & Warner, manufacturers of railroad supplies, at 30 Church Street, New York. The deceased is survived by a widow and four married daughters.

ALDEN M. YOUNG.

Trade Publications.

DIRECT-CURRENT MOTORS.—Bulletin No. 33 issued by the Peerless Electric Company, Warren, Ohio, describes in detail the features of design and construction as well as the adaptability of its direct-current motors for all classes and conditions of service. Bipolar types are built in sizes ranging from 1/30 hp to 1 hp, and multipolar types in ratings ranging from 1/4 hp to 35 hp.

ORNAMENTAL STREET LIGHTING.—The Sterling Electrical Manufacturing Company, Warren, Ohio, has issued an attractive treatise on tungsten street lighting, with construction and cost data, under the title "From Post-Hole to Lights On." The company manufactures only tungsten lamps, but for the convenience of the consumer has collected data pertaining to poles, ornamental metal standards, glassware, conduits, transformers, etc., which go to make up the complete equipment. The information is of immediate benefit to municipalities, business men's clubs, boards of trade and others contemplating the establishment of ornamental street-lighting systems.

BUSINESS NOTES.

HARVEY S. JONES, secretary of the Ornamental Lighting Pole Company, announces the removal of the company's New York office from 90 West Street to 17 Battery Place.

PEERLESS ALTERNATING-CURRENT MOTORS.—The Peerless Electric Company, Warren, Ohio, announces a 1912 line of small alternating-current motors ranging in rating from 1/12 hp to ¾ hp.

FRANK B. COOK, of Chicago, manufacturer of telephone accessories, is about to remove his factory from that city to Zion City, Ill., where it will occupy one of the buildings formerly used by the colony of John Alexander Dowie.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 28, 1911.

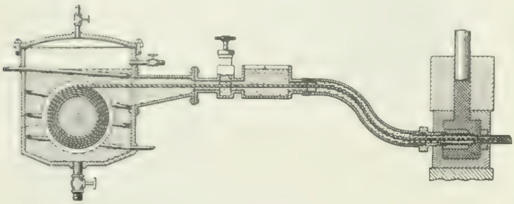
[illegible]

1,009,731. METHOD OF FORMING ELECTRIC CABLES AND APPARATUS THEREFOR; H. W. Fisher, Pittsburgh, Pa. App. filed Oct. 21, 1910. Applying the insulating compound.

1,009,732. MACHINE FOR COVERING ELECTRICAL CONDUCTORS; H. W. Fisher, Pittsburgh, Pa. App. filed March 20, 1911. Winding on the covering in the bath.

1,009,748. SWITCHING DEVICE FOR ELECTRICAL CIRCUITS; J. D. Hilliard and C. E. Parsons, Albany, N. Y. App. filed Aug. 22, 1906. Oil-break solenoid-operated switch.

1,009,762. TELEPHONE SYSTEM; R. H. Mason, Elyria, Ohio. App. filed May 29, 1907. "Measured service" system with meters controlled by the cord circuit.



1,009,731.—Method of Forming Electric Cables and Apparatus Therefor.

[illegible] SHOE FOR THIRD-RAIL ELECTRIC CARS; L. A. McCoubrie and C. F. Raydure, Philadelphia, Pa. App. filed April 24, [illegible]. Renewable contact piece. Improvement on Patent No. 985,430.

1,009,788. DYNAMO-ELECTRIC MACHINE; H. H. Ralston, Norwood, Ohio. App. filed Sept. 14, 1905. Slotted commutator section to receive the connectors.

1,009,798. PRODUCING MUSICAL TONES; M. L. Severy and G. B. Sinclair, Arlington Heights and Medford, Mass. App. filed Feb. 19, 1910. Electromagnetically operated strings.

1,009,810. INSULATOR; T. H. Watkins, Wakpala, S. D. App. filed June 21, 1911. A wire-holding plate is sprung in a socket.

1,009,813. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed March 7, 1907. Party-line, common-battery, lock-out type.

1,009,831. ELECTRIC DISTRIBUTION; J. J. Creveling, New York, N. Y. App. filed Feb. 2, 1909. Compensating generator and storage-battery lighting regulation.

1,009,834. ELECTROTHERMAL SWITCH; J. Erickson, Chicago, Ill. App. filed May 9, 1906. A stationary terminal and a movable fusible disk for providing new contact positions.

1,009,939. MANUFACTURE OF VAPOR ELECTRIC APPARATUS, P. H. Thomas, East Orange, N. J. App. filed May 25, 1904. Auxiliary mercury-sealed chamber for facilitating formation of the vacuum.

1,009,940. VIBRATOR BOX; H. C. Thomson, Boston, Mass. App. filed Jan. 27, 1910. For internal combustion motor-ignition work.

1,009,951. ELECTRIC DYNAMO AND MOTOR; E. J. Armstrong, Erie, Pa. App. filed Dec. 18, 1909. Air cooled with dust filter.

1,009,969. IGNITER FOR GAS LAMPS; F. W. Hill, Chatham, Pa. App. filed March 16, 1910. For acetylene lamps on automobiles.

1,010,001. ELECTRODE COVER FOR ELECTRIC FURNACES; J. L. K. Snyder, Cleveland, Ohio. App. filed Sept. 5, 1911. The cover forms an adjustable electrode.

1,010,011. SECTIONAL INSULATOR; A. O. Austin, Barberton, Ohio. App. filed Dec. 15, 1909. Flanged insulator units and tubular spacers for high-tension cables.

1,010,025. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed July 27, 1910. Generator-storage-battery lighting system with carbon resistors automatically governed.

1,010,058. ALARM DEVICE FOR LUBRICATORS; F. Lemann, Posen, Germany. App. filed Dec. 29, 1910. A float in the oil cup to move contacts.

1,010,069. KNIFE SWITCH; H. L. Peat, St. Louis, Mo. App. filed July 3, 1911. Fuse may be above or below the blade.

1,010,077. STRAIN INSULATOR; W. Schaake, Pittsburgh, Pa. App. filed Jan. 26, 1910. Wood-bar construction adjustable in length.

1,010,083. TRANSFORMER; H. C. Soule, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Circular coil-core type with adjustable means for securing the assembled windings to the core.

1,010,092. SMOOTHING IRON; T. G. Thomas, Houston, Tex. App. filed May 4, 1911. The body is of transparent glass with electric lamps inside.

1,010,096. OVERHEAD STRUCTURE FOR ELECTRIC RAILWAYS; T. Varney, Pittsburgh, Pa. App. filed Oct. 13, 1909. Auxiliary contact member for a gap in a trolley as on a drawbridge.

1,010,111. DRIVING MECHANISM; G. L. and F. E. Baker, Royal Oak, Mich. App. filed May 16, 1910. An electric motor mounted inside of a traction wheel.

1,010,118. COMMUTATOR BRUSH; J. L. Crouse, New York, N. Y. App. filed Feb. 6, 1906. The conductor plate has a resilient pin expanded into a hole in the carbon brush.

1,010,119. GAS-LIGHTING DEVICE; J. H. Crowner, Ottumwa, Ia. App. filed Dec. 8, 1910. Counterbalanced sparker.

1,010,125. CURRENT TAP; H. L. DeZeng, Philadelphia, Pa. App. filed May 24, 1910. A plug and two-part sleeve and lamp socket.

1,010,126. DYNAMO-ELECTRIC MACHINE; W. A. Dick, Pittsburgh, Pa. App. filed Dec. 31, 1908. Air-cooled field and coil construction.

1,010,134. COOLING DEVICE FOR ELECTRIC APPARATUS; C. Le G. Fortescue, Wilkinsburg, Pa. App. filed Nov. 6, 1908. Casing for transformer with means for circulating cooling fluid.

1,010,135. ALTERNATING-CURRENT MOTOR; V. A. Fynn, London, England. App. filed Feb. 24, 1910. Laminated rotor with squirrel-cage and commuted windings and a magnetic bridge.

1,010,165. INCANDESCENT LAMP; M. M. Merritt, Middleton, Mass. App. filed Feb. 24, 1906. Has an expansion member for fracturing the bulb when the lamp is "burned out," thus preventing renewal.

1,010,181. ELECTRIC-CABLE PROTECTOR; J. A. Sanford, Jr., East Liverpool, Ohio. App. filed July 7, 1911. A conducting shield on the head of an insulator to intercept a broken cross wire.

1,010,191. ELECTRIC HEATER; H. D. Shelton, Hughesville, Mo. App. filed Aug. 1, 1910. A disk-shaped heating unit to be mounted in a steam generator.

1,010,197. X-RAY TUBE AND VACUUM CONTROL THEREFOR; H. C. Snook and G. H. White, Philadelphia, Pa. App. filed April 7, 1911. Switching mechanism under control of the operator for varying the vacuum.

1,010,216. DYNAMO-ELECTRIC MACHINE; C. H. Bedell, Bayonne, N. J. App. filed Oct. 27, 1906. Sparkless commutator of multipolar machines.

1,010,251. AUTOMATIC FIRE ALARM; G. E. Glick, Carrington, N. D. App. filed July 8, 1909. Heat-expansible mercury container.

1,010,263. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; H. D. James, Pittsburgh, Pa. App. filed Feb. 3, 1910. Regulating switches with relay switches and interlocking switches.

1,010,271. INDUCTION METER; R. C. Lanphier, Springfield, Ill. App. filed Nov. 9, 1910. Split-phase type; arrangement of the series and shunt field relative to the rotatable disk.

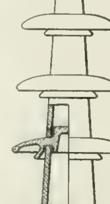
1,010,272. INDUCTION METER; R. C. Lanphier, Springfield, Ill. App. filed March 30, 1911. Removable shunt and series coils of split-phase, rotating-field type.

1,010,278. UNDERGROUND ELECTRICAL JUNCTION BOX; S. J. Lisberger and C. J. Wilson, San Francisco, Cal. App. filed Feb. 23, 1911. Three-phase, low-voltage, six-way junction box.

1,010,295. INCANDESCENT LAMP; M. M. Merritt, Middletown, Mass. App. filed Feb. 24, 1906. The bulb has a weakened area so that it will break in case an attempt is made to "renew" it.

1,010,371. ELECTRIC TRAIN-CONTROLLING DEVICE FOR RAILWAYS; R. T. and F. T. Jones, Baltimore, Md. App. filed Aug. 16, 1909. Block system using a ramp rail and air-brake operators.

1,010,372. TRAIN-CONTROLLING MECHANISM; R. T. and F. T. Jones, Baltimore, Md. App. filed May 23, 1910. Block system with cab signal and air brake.



1,010,011—Sectional Insulator.

1,010,377. STORAGE BATTERY; H. H. Kempf, New York, N. Y. App. filed May 13, 1910. Key-controlled meter attachment.

1,010,402. ELECTRODE FOR ARC LAMPS; J. J. H. Dempster, Schenectady, N. Y. App. filed Dec. 10, 1903. Purified natural titaniferous magnetite.

1,010,404. APPARATUS FOR PRODUCING NITROGEN COMPOUNDS FROM CARBIDES; A. R. Frank, Spandau, Germany. App. filed June 8, 1910. The carbide and the nitrogen are heated by an electric resistor.

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CONTENTS.

GAINS IN EXPORT TRADE.

For both September and October the figures on export trade are distinctly encouraging, and the gross totals for the elapsed portion of the year are equally good. It appears that in September the exports of electrical machinery were $658,831, as compared with $578,246 a year ago, and that the exports of electrical instruments and supplies were $841,769, as compared with $762,152. The same trend is seen in the data for October just to hand. The exports of electrical machinery were $583,000, as compared with $514,184, and of instruments and apparatus were $851,650, as compared with $780,233. It will be noted that there are fluctuations, but that the goods of smaller bulk continue, as for a long time past, to exceed in value the heavier dynamos, motors, etc. The reason for this is not quite clear, and as far as we are aware the subject has never been investigated as a broad proposition by those most deeply interested—the manufacturers. If there were a greater subdivision of the returns it might be helpful; but when, out of the total of $851,650 for instruments in October, we are told that $58,763 was for telephones and $6,169 for telegraphs, we are certainly left in rather blind conjecture as to what the other nine-tenths—$786,718—consisted of, and might vainly do a lot of fancy guessing on the subject. Moreover, it would be interesting to know if the foreign business is widely distributed throughout the industry or is confined in large part to a relatively few companies having also European works.

All told, the figures for the ten months this year are indicative of a distinct revival in trade, of which, indeed, there are now clearer proofs than were obtainable during the spring and summer. The total exports of electrical instruments for the ten months of this year are $8,883,694, a gain of more than $3,000,000 over the corresponding period of 1909 and $750,000 better than that of 1910. In like manner exports of electrical machinery were $6,713,063, a gain of $1,700,000 over the period in 1909 and nearly $1,000,000 over 1910. There can hardly be any doubt or question as to the hopeful meaning of such statistics.

THE 11,000-KW BOILERS OF THE DETROIT EDISON COMPANY.

Ever since the early days of the Detroit Delray station, when the manufacture of salt was planned there as a by-product of electrical generation, this unusual plant has presented many interesting departures in design and operation. But most recent and remarkable of these, as described on following pages, is the pioneer use at Delray of huge water-tube boilers, any one of which is capable of supplying for short periods steam turbine loads up to 11,000 kw. Each of these great steaming units is rated at 2365

boiler hp. on the absurd and outgrown basis of 10 sq. ft. of heating surface per hp. or 30 lb. of steam per hp-hour. Such a definition remains, of course, only as a memento of the days of the inefficient non-condensing engines and is practically meaningless in discussing the steam consumption of modern large turbines of the type at Delray, which deliver a kilowatt-hour on 15 lb. of steam. Boiler practice, too, has advanced until the operation of boilers at several hundred per cent of their normal full load on the old basis of 10 sq. ft. per hp is now regarded as entirely conservative and tending toward the highest efficiency. The Delray boilers have been tested up to 214 per cent of full load, which is equivalent to generating steam at about 7 lb. per hour per square foot—not an excessive evaporation for boilers in modern practice. Ordinarily the Delray units, of which there are five erected and five more to be installed, carry 6000 kw to 7000 kw each. This load increases to 8000 kw per boiler during the peak periods, and for short durations has reached 11,000 kw without any appearance of distress. The confusion in boiler ratings which makes possible such a paradoxical statement as the foregoing, that these 2365-hp boilers can furnish 11,000 kw at 100 per cent overload, points to the need for a new measure of boiler capacity.

But, rated at 2365 hp or 11,000 kw, the Delray boilers are really prodigious units, as a glance at their dimensions will show. Each boiler is 36 ft. high, 30 ft. wide and 28 ft. deep, being fired from both ends. The three huge steam drums are connected with the two mud drums by no less than 1564 3¼-in. tubes. Each boiler has four water-columns and an even dozen safety valves designed to relieve pressure rises above the normal steam condition of 205 lb. pressure and 150 deg. superheat. But more significant than the mere size of these great boilers is the economy of performance which they have revealed, reaching efficiencies probably higher than those yet reported on any other units using coal containing a high percentage of volatile matter. At normal rating these big units showed a combined thermal efficiency of 80 per cent (about 89 per cent being the maximum possible value), and this observed efficiency decreased only to 76 per cent at 100 per cent overload. The remarkable economies obtained can hardly be traced to exceptional flue temperatures or any other furnace conditions differing materially from ordinary experience. But the big units decrease the usual proportion of radiation losses, and with their single huge fires enable the closest attention to be given to but the one bed which is the equivalent of a whole roomful in an ordinary plant. Labor costs are thus reduced correspondingly, and the boiler-room layout is simplified and cheapened. The boilers themselves cost less per unit of rating than similar small units. Difficulties with furnace brickwork in the big boilers have apparently been solved as rapidly as they presented themselves. And, in answer to the question which is most likely to rise in the mind of the practical operator, one may retort by asking whether boiler units embodying 11,000 kw of steaming capacity are to arouse any serious fears of "too much concentration of power" in these days of 20,000-kw turbines and generators.

There are other things at Delray to interest the mechanical man besides the big boilers. Differing from earlier experience elsewhere, here 14,000-kw turbo-generators are ventilated with superior success directly from the engine-room, their discharge ducts leading outside the building. Several new 9000-kw turbines have their auxiliaries motor-driven, steam being bled from an intermediate turbine stage to heat the feed water. Closed heaters are used in this connection, combined four-stage centrifugal pumps delivering from the hot-wells clear through the heaters and economizers, and into the boilers "at one fell swoop." The pressure systems of both the oil and water step bearings are operated with a single accumulator, the two systems being connected by proportional pistons which adjust all variation. The high-pressure steam fittings are of an English gate type, little known in this country, in which the steam passage at the closure is constricted to one-half the diameter and consequently one-fourth the area of the corresponding pipe. The valve gate is thus traversed at high velocity, the steam regaining its pressure head on expanding into the following cone chamber. Such valves, it is declared, are light, cheap in spite of tariff duty and easily operated by one man.

DISTRIBUTION OF POWER IN LONG-DISTANCE TELEPHONE CIRCUITS.

The amount of power which is developed in a long-distance telephone circuit is so small that it is commonly ignored. Nevertheless, it exists, and upon its magnitude and distribution depends the practical success of a telephone circuit. The telephone excitation current and power come from the storage battery in the telephone central station, but the power of telephonic speech has to be developed in the transmitter by the action of the human voice. Up to the present time no means has been brought into service for enhancing the power generated in the microphone so as to extend in this manner the range of telephony. By loading a telephone circuit its range can be increased two-fold or threefold. If this is not enough, more copper must be used; but if the microphone could supply the exciter circuit of a generator driven by power so as to deliver at the generator terminals a magnified replica in voltage of the speech currents through the transmitter the telephonic range could be increased a hundredfold or more.

As has been mentioned in the *Digest*, some interesting measurements are reported in the *Elektrotechnische Zeitschrift*, by Herr F. Breisig, on the voltage, current and power in a simple telephone circuit. In a particular case the power received was 50 microwatts, of which 9.2, or 18.4 per cent, was absorbed by the telephone. By far the greater part of the power absorbed by the telephone is converted as I^2R into heat in the winding, and only a small portion is available as mechanical power for exciting air vibrations in the cavity of the listener's ear. It is shown that a relatively large amount of power is lost in the carbon transmitter during the operation of listening and when the transmitter is out of service. In fact, nearly four times as much power was absorbed in the resistance of the transmitter as was absorbed in the receiver. Nevertheless, it is not worth while complicating the apparatus with auto-

matic or semi-automatic switches to introduce the transmitter only when talking. Finger-operated button switches used to be furnished at one time for this purpose in long-distance telephone sets, but they were found to be more trouble than they were worth. A difficulty mentioned in the paper with all such measurements is that the telephone transmitter microphone does not maintain at all times a constant resistance. Nevertheless, measurements of this kind supply very welcome information.

REGULATED AND PROTECTED MONOPOLY.

In his recent address before the N. E. L. A. section in Chicago Mr. H. M. Byllesby said in substance that public opinion in this country is rapidly crystallizing in the idea that a public utility should be a regulated and protected monopoly. This is no news to those who have been following the trend of public thought and legislation, but it expresses concisely a gratifying fact. While it is too much to expect that the regulation of public-utility companies in the future will be accomplished altogether without friction, or that the commissions charged with the responsibility of such regulation will always be ideal in their make-up, yet unquestionably there is now general recognition of the principle that competition in public utilities is not a suitable means for checking corporate abuses and is both damaging to the capitalist and a general nuisance to the public. While regulation of this kind has been properly provided for in only a few states, it is certain that legislation providing for public-utility commissions will be passed in a large number of the states during the next few years. Not only is the regulation idea to be applied to public utilities, but the growing sentiment regarding federal and corporation laws and the conduct of present industrial constructions under proper regulation is also becoming one of the live questions of the day.

THE ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTOR.

The reasons usually advanced for selecting the direct-current in preference to the alternating-current system under modern industrial conditions are based on the superior flexibility of the motor speed control of the former. Advocates of the latter contend that the constant-speed alternating-current motor is a much better machine than the constant-speed direct-current motor, and that since by far the larger number of machines in use are employed in constant-speed service it is apparent that the choice between the two systems is to be determined largely by the merits of the available types of variable-speed motors. It is also pointed out that the highly successful performance of the single-phase motor in railway service furnishes conclusive evidence that for any problem involving the use of motors possessing "series" characteristics alternating-current motors offer a solution quite as satisfactory as direct-current motors. Nevertheless, when comparing the two distinctive types of motors available for adjustable-speed service, it cannot be denied that the modern direct-current motor is greatly superior to the best alternating-current motor thus far developed. A point of much interest in this connection was brought forward in a paper presented by Mr. Gus A. Maier before the American Institute of Electrical Engineers on Dec. 8, namely, that an adjustable-speed alternating-current motor can be even inferior to the direct-current motor and yet effectively supplant the latter machine. This condition is attributable to the desirability of eliminating the economic necessity of employing direct-current motors throughout an industrial establishment because a few of the total number must be of the adjustable-speed type. The advantages attending the abolition of apparatus for transforming from alternating to direct current, and the use of a large number of induction motors rather than direct-current shunt motors for constant-speed service, would, in the opinion of the author, outweigh the relative disadvantages of the somewhat poorer adjustable-speed alternating-current motor substituted for the few adjustable-speed direct-current motors.

If one were permitted to ignore the requirements of commutation he could state with some confidence that the adjustable-speed alternating-current type of motor may be built and operated more satisfactorily than a motor of the direct-current type. This statement would be based on the fact that the stationary transformer affords a convenient and economical device for voltage variation which has no counterpart in direct-current equipment. The field-magnetism and armature-voltage variation methods of speed adjustment can be applied to alternating-current commutator motors with results which are identical with those obtained with direct-current motors. The correct time-phase relation between the armature current and the field magnetism can be absolutely insured by impressing across the field coils an emf 90 time-degrees displaced from the emf impressed across the armature; that is, by connecting the field coils across one phase, and the armature across another phase, of a two-phase system. Such a motor can be accelerated from rest with the maximum value of torque per armature ampere by the use of a non-inductive rheostat, such as is employed with direct-current motors, while speed adjustment can be obtained by varying the voltage across either the field coils or the armature. A disadvantage of this type of motor resides in the transformer emf produced in the coil short-circuited by the brush, which renders the commutation unsatisfactory in the simplest form of the motor. Commutation difficulties can be minimized by introducing a counteracting emf, or reducing the current produced in the short-circuited coil by internal or external resistance leads. Another method of minimizing the commutation troubles consists in introducing the electrical energy into the armature inductively rather than conductively by utilizing the so-called repulsion principle. In the simple form of the repulsion machine, with the energy brushes short-circuited, the commutation difficulties disappear at synchronous speed, and at all speeds they are less than in the above-mentioned adjustable-speed motor, even when the change in speed is produced by introducing an emf in the energy circuit. Commutation troubles have not yet been completely eliminated, but it is not too much to expect a rapid improvement along this line as experience is gained with motors now being developed and as inventors and investigators realize more and more the importance of producing an alternating-current motor suitable for competing favorably with the adjustable-speed direct-current machine.

American Institute of Electrical Engineers Affairs.

The following account of the business done at the December meeting of the board of directors of the American Institute of Electrical Engineers illustrates the wide range of activity of that organization and the large quantity of work of importance disposed of monthly at the meetings of its governing body and carried on by the various committees. The policy whereby the internal management of the Institute now receives full publicity enables the high value of that body to the electrical profession to be appreciated to an extent that was impossible in the past.

At the meeting sixty-eight associates were elected, 110 students enrolled, and six associates transferred to the grade of membership. The action at the November meeting providing an appropriation for defraying the expenses of the "smoker" following the regular New York City monthly session was reconsidered, owing to danger of establishing a precedent with respect to expenditures by local sections and branches; instead, a reception committee was provided for, which will receive voluntary contributions to meet the expenses of the monthly "smokers." The expense of the December "smoker," the first held, was provided for in this manner.

On recommendation of the historical museum committee, the Institute extended its thanks to Mrs. Sidney H. Short for a bronze bust of her late husband, in a resolution expressing in fitting terms appreciation of the gift, which was accepted "in grateful memory of the personal qualities and distinguished accomplishments of an early member of the Institute, who contributed to many electrical arts as an inventor and to the development of electrical engineering in the United States and Great Britain."

ANNUAL AND OTHER MEETINGS.

A resolution was adopted providing that the annual convention of the Institute shall be held in Boston during the latter part of June, 1912, the exact dates to be determined later. The electrochemical committee has arranged for an electrochemical session during the convention. Another resolution provides that the date of the April Institute meeting in New York be advanced one week, making the date April 5 instead of April 12; also that an industrial-power meeting be held in Pittsburgh on April 25-27, under the auspices of the Pittsburgh Section.

The railway committee is organizing a special electric railway meeting for April 5, which, on account of the length of the program, will probably require an afternoon in addition to an evening session.

METRIC SYSTEM; REVISION OF STANDARDIZATION RULES.

A resolution was passed reciting that the board of directors regards it as desirable that the international metric system of weights and measures be more generally used in engineering literature in this country and directing that in all papers, reports and publications of the Institute measures expressed otherwise than in the metric system shall be accompanied by metric equivalents in parentheses, and that all the Institute committees affected be directed to carry out this instruction.

Dr. C. P. Steinmetz and Mr. B. G. Lamme were appointed a separate committee to collect material looking to the next revision of the standardization rules.

PANAMA VISIT.

The Panama committee reported desirable arrangements for accommodation on two steamers to the Isthmus, one from New York on Jan. 17 and another from New Orleans on Jan. 20, adding that although reservations have been rapidly taken up a few are yet available. Owing to the impossibility of President Dunn accompanying the party, a resolution was adopted designating Manager S. D. Sprong as the official representative of the Institute in connection with the visit.

AMENDMENTS TO CONSTITUTION AND BY-LAWS.

The amendment to the constitution providing for the election of the secretary of the Institute by the board of directors, which failed last year because it received only 70 per cent of the vote cast, whereas 75 per cent was necessary for adoption, was again discussed. The board decided to resubmit this amendment to the membership because of the large majority in favor of it and because its failure to receive the necessary three-quarters majority last year was considered to have been due to some misunderstanding.

The president brought up again the modification in the method of making nominations which he had presented to the meeting of section officers at the Chicago convention, which modification had been formulated by Acting Secretary Hutchinson. He called attention to the desirability of adding to the present system of nominating officers the feature of advance nomination by petition, so that when the nominating forms go out on Feb. 1 the members will have some guide as to possible candidates, with the result of a concentration in what is at present the extremely large scattering vote. So large has been the scattering vote in connection with nominations for manager that last year it was distributed among 581 different candidates, and as a result of such scattering the manager heading the list received only 4.8 per cent of the vote of the membership. The addition to the present nominating system consists merely in publishing at the time the nominating ballots go out the names of all candidates in favor of whom a petition of fifty names, or the separate indorsement of fifty names, has been received at Institute headquarters prior to Jan. 25. This arrangement is covered by a by-law adopted to supersede Section 18 of the present by-laws, as follows:

"In addition to the names of the incumbents of office, the secretary shall publish on the 'form showing offices to be filled at the ensuing annual election in May,' provided for in Article VI, Section 30, of the constitution, the names, as candidates for nomination, of such members and associates of the Institute as have been proposed for nomination for a particular office by the petition or by the separate indorsement of not less than fifty members or associates, received by the secretary of the Institute in writing by Jan. 25 of each year.

"The names of such candidates for nomination shall be grouped alphabetically under the name of the office for which each is proposed, and this by-law shall be reprinted prominently in the January issue of each year's *Proceedings* and shall be reproduced on the form above referred to."

FRATERNAL RELATIONS WITH OTHER SOCIETIES.

In the last few years so many matters have come up of common interest to the four national engineering societies that lack of an effective co-operation between them has been felt. In order to secure this, and on the suggestion of Past-president Col. E. D. Meier, of the American Society of Mechanical Engineers, President Dunn recommended that the board of directors authorize a conference committee to deal with inter-society matters. The board therefore adopted a resolution authorizing the president to designate the chairman and one other member of the public policy committee as members on the part of the American Institute of Electrical Engineers of a joint conference committee of the national engineering societies. The duty of the members of the conference committee shall be to meet and confer with corresponding members from the other societies on the call of any one of them and to inform the board of directors of matters that are considered to be of interest to the group of national engineering societies as a whole, and to make such recommendations as the conferrees think advisable to guide specific action by the American Institute of Electrical Engineers.

President Dunn asked the board to authorize him to communicate with the leading foreign electrical engineering societies with reference to the mutual establishment of

visiting-member privileges, so that members of the American Institute of Electrical Engineers visiting foreign countries may, upon the presentation of proper credentials from the secretary, have the privilege of temporary membership in the society of the foreign country; in return, members of foreign electrical engineering societies visiting the United States to have the privileges of the facilities afforded by the American Institute of Electrical Engineers in New York and in other cities of the United States; these visiting-member privileges to be in the nature of guest privileges in a club. In addition to the personal convenience thus afforded to members of the electrical engineering profession all over the world, the relation would serve as a bond of friendship and inducement to more frequent intercourse among electrical engineers. The board authorized the president to learn the attitude in the matter of the foreign electrical engineering societies.

NEW GRADE OF MEMBERSHIP.

The chairman of the intermediate grade of membership committee presented amendments to the constitution providing for an additional grade of membership in the Institute. The features of the plan are: First, making three grades of membership where there are now two; second, arranging that the highest grade shall be slightly higher than the present grade of member, and that practically all the present members shall be automatically transferred thereto; third, arranging that the intermediate grade shall be somewhat lower than the present grade of member, and that such of the associates (who now number 90 per cent of the Institute membership) shall be automatically transferred thereto whose records on file justify such transfer, the expectation being that about half of the present associates will thereby become members; fourth, giving to the vote of such associates as shall be transferred and to the vote of such members as are in the highest grade an increased weight; fifth, that the status of those who remain associates shall be exactly as at present.

The names for the three grades have not been finally decided upon, but those suggested are, for the highest grade, "fellow," for the next grade "member," and for the third grade "associate." The Institute is the only large engineering society whose membership is limited to two grades, and the fact that only 10 per cent of the membership of the Institute is in its first grade, which is called that of "member," and which prevents the use of the name member by a very large proportion of the total membership of the Institute, is an anomaly. An additional grade of membership to meet the condition now under consideration by the Institute has been established in all the great engineering societies in response to the demand of their membership, and it is felt that the present amendments, if adopted, will add greatly to the Institute's solidarity. The board of directors provisionally adopted the amendments, and will consider them for final adoption at its next meeting, the committee in the meantime being authorized to make recommendations for modifications in detail.

REPORTS OF COMMITTEES.

The public policy committee reported that Chairman Stott, Messrs. Stillwell, Townley and Finney and President Dunn had presented to the National Waterways Commission at Washington, D. C., on Nov. 21 and 22, the brief on water-powers prepared by the committee; that the Institute representation had been most successful and had added to the Institute's standing and prestige; that the water-power report had been published in the electrical press, and that requests for additional copies were constantly coming, necessitating the printing of two new editions.

The committee on indexing the *Transactions* of the Institute reported the completion of synopses of five years' *Transactions*.

The code committee is at work on the question of grounding secondary circuits.

Three meetings of the code of ethics committee have been held. A rough draft of a new code has been completed and will come up for final discussion at the committee's next meeting, after which it will be sent out for the opinion and revision of the advisory members appointed by the president after the last meeting of the board.

Report of Railroad Securities Commission.

The report of the Railroad Securities Commission has been transmitted to Congress by President Taft. The President concurs in the recommendations made by the commission and urges that proper action be taken to carry them into effect. The commission is composed of Messrs. Arthur T. Hadley, chairman; Frederick N. Judson, Frederick Strauss, Walter L. Fisher, Balthasar H. Meyer and William E. S. Griswold, secretary.

The report of the commission is a brief discussion with conclusions on a number of points which are in controversy in the present railroad situation. The discussions and recommendations apply generally to all agencies of communication and transportation enumerated in the act to regulate commerce. Two of the principal points developed by the commission are the need of publicity respecting the affairs of the corporations and the necessity of an attitude on the part of public authorities that will attract the capital required for railroad development. The commission believes that, so far as the immediate action of Congress is concerned, stringent provisions regarding publicity of stock and bond issues, which will show how far the laws are obeyed and will enable the federal government to hold the railroad officials responsible for the consequence of not obeying them, will be more salutary and more effective than any new statutory demands. It is also believed, however, that the time is near when the difficulties of the present system of complex control by state and federal governments, and the conflict of state laws, will become so manifest that further legislation on the subject will be imperative.

The commission, in speaking of the tendency of the public to misunderstand the conditions of stock issues, states that this tendency has led lawmakers to lay too much stress on keeping down the nominal amount of stock and too little upon getting the actual amount of capital needed and having it properly used. It is believed by the commission that authorization of securities by a commission would tend to create the impression on the part of the investing public of a guaranty or official recognition of values, which no administrative authority can safely give. The absence of such recommendation by the commission is intended to make it clear that no such guaranty should be given.

There is an essential community of interest between the shipper and investor, and it is folly to attempt to protect the one by taking away the rewards of good management from the other. A reasonable rate of return is one which, under honest government and responsible management, will attract the amount of investors' money needed for the development of railroad facilities. The substitution of electricity for steam is but a type of the many changes which railroads may be compelled to make, any one of which might involve large additions to their cost without the assurance of corresponding additions to their return.

Hydroelectric Progress in Deerfield Valley, Mass.

The New England Power Company is now building four hydroelectric developments in the Deerfield River valley, in Massachusetts, which represent an ultimate investment of about $4,000,000 and the annual production of about

[illegible] kw hours of secondary energy. The work includes four generating plants in the Shelburne Falls-Greenfield district, with hydraulic works and a storage reservoir at Peck's Mill, Vt., which will have a capacity of 2,500,000,000 cu. ft. The system will be interconnected with that of the Connecticut River Transmission Company, and will supply power from the New York state line eastward to Marlborough, striking within 30 miles of the Boston district. It is expected that the electric train service of the Hoosac tunnel will be operated by Deerfield River power, the existing Zylonite steam plant of the Boston & Maine Railroad being held as a reserve.

It is expected that by Jan. 15 a 66,000-volt, three-phase steel-tower transmission line will be completed between the South Vernon (Vt.) plant of the Connecticut River company and the plant sites near Shelburne Falls. Power from the former source will be utilized in construction work, the present supply being derived from the Greenfield Electric Light & Power Company's system. The first plant to be completed is now under construction at Scott's Bridge. Water will be diverted from the river by a concrete dam and carried to the plant by a 1700-ft. concrete-lined tunnel discharging into a forebay from which three 10-ft. steel penstocks will connect with the waterwheels, about 8000 hp being available under 65-ft. head. A cofferdam has been built at the power-house site, and work is progressing on foundations. The station is to be completed by September, 1912, the work being handled by the Fraser-Brace Company, New York.

At Shelburne Falls, near the Gragg estate, a similar development is being built by Fred T. Ley, Inc., Springfield, Mass. About a mile below the existing plant of the Greenfield company at Gardner Falls the Fraser-Brace Company is building a third plant of about the capacity of the foregoing, under a 60-ft. head. Preliminary work only has been done as yet upon the fourth proposed plant, which will be located at Bardwell's Bridge, near Greenfield, and contracts have not yet been closed for this installation. The storage reservoir in Vermont will have an area of about 1800 acres, and will be provided with an earth dam 1 mile long, 100 ft. high and 500 ft. thick at the base. Actual construction will shortly be commenced. The general work of construction is being handled by the Power Construction Company, of Shelburne Falls, Mass. Associated with this organization as consulting engineers are Messrs. J. G. White & Company, New York; Charles T. Main, Boston, and F. P. Stearns, Boston. The water rights and franchises on the Deerfield River were acquired by Chace & Harriman, Inc., Boston, who have general supervision of the project. The securities are being underwritten by Baker, Ayling & Company, Chace & Harriman Inc., and Estabrook & Company, Boston, and W. R. Grace & Company and Henry Phipps, New York.

Discussion of Rubber Specifications.

Mr. E. B. Katte, chief engineer of electric traction of the New York Central Railroad, recently invited a number of prominent manufacturers, consumers and chemists to a conference at which the subject of rubber specifications was discussed with a view to action for securing uniformity in rubber analysis.

The chief consideration that led to the conference was the belief that the art of analyzing rubber compounds has not reached the state of perfection which the commercial importance of rubber products seems to warrant. Various chemists have developed methods of analysis possessing more or less merit, but at the present time these methods cannot be relied upon to give concordant results. Users of rubber-insulated wire are particularly interested in the analysis of rubber compounds owing to the recent practice of inserting chemical clauses into specifications. The manufacturers are equally interested because in the present state of the art they are likely to have insulation refused by their customers, not because it is defective, but because some unforeseen method of chemical analysis indicates that the specifications have not been complied with. Chemists are interested not only in the scientific aspects of the problem, but also in its commercial aspects, because the chemical specification for rubber, with all it implies in its relation to chemists, will drop out of use unless the chemists are able to stand back of it with an analysis that cannot be controverted.

The conference was held on Dec. 7 at 335 Madison Avenue, the attendance including representatives of the United States Army, the New York Central Railroad, the Pennsylvania Railroad, the General Electric Company, the Standard Underground Cable Company, the Simplex Electrical Company, the Hazard Manufacturing Company, the American Chemical Society, and several chemists who have made a specialty of rubber analysis. Major Samuel Reber, U. S. A., was elected chairman, and after a discussion of the various aspects of the problem the following committee was nominated to determine a standard procedure in the analysis of rubber compounds: Messrs. H. B. Rodman, chemist Pennsylvania Railroad, Altoona, Pa.; C. R. Boggs, chemist Simplex Electrical Company, Cambridge, Mass.; W. B. Gieser, chemist New York Central Railroad, Albany, N. Y.; P. Poetschke, chemist the Lederle laboratories, 39 West Thirty-eighth Street, New York; James P. Millwood, consulting chemist, 246 Willoughby Avenue, Brooklyn, N. Y.; Wallace Clark, in charge of the wire and cable department of the General Electric Company, Schenectady, N. Y., and W. A. Del Mar, assistant engineer New York Central Railroad, New York.

The work of the committee will be largely in the nature of laboratory tests and comparison of results by correspondence and periodic meetings. Suggestions and communications will be received by the secretary, Mr. W. A. Del Mar, 335 Madison Avenue, New York.

Employees' Pension System of Baltimore Central-Station Company.

The Consolidated Gas, Electric Light & Power Company, of Baltimore, adopted a plan for pensioning employees at a meeting of the board of directors held Dec. 6, 1911, the details of which are given below:

At a meeting of the board of directors held a few months ago, upon the suggestion of President J. E. Aldred, a committee of the board was appointed to inquire into and formulate a system of pensions for the purpose of making provision for the employees of the company, who, after long years of faithful service, had reached an age when they were unequal to the further performance of their duties. The plan which has just been adopted makes provision for the following employees:

(1) Any employee who attains the age of sixty-five years after fifteen years' continuous service.

(2) Any employee who after twenty years' continuous service is by reason of permanent physical or mental disability unable to follow his usual employment in the company's service.

(3) Any employee who after ten years' continuous service shall become incapable of continuing in service by reason of injuries received while at work in the employment of the company.

The detailed plan for the application of the pension principle to the classes above mentioned is such as to result in very liberal treatment of the company's employees. It is provided that the entire cost of the pension system

shall be borne by the company, the system calling for no contributions from the employees themselves.

Before adopting the plan outlined a comprehensive survey was made of pension plans of public-service companies in this country and Europe. Endeavor was made to provide a broad, liberal and equitable plan, one which gives substantial recognition to long and faithful service to the company and the public.

The company believes that its thus voluntarily establishing a system under which continued income will be assured to those who, after years of continuous service, are because of age or infirmity no longer fitted to perform their duties will be accepted as an expression of appreciation of faithful and efficient service in the past and as an incentive for renewed effort to make the services rendered the public still more efficient and valuable.

The system, the company hopes, will increase among its employees the feeling of permanency in their occupation and cause an enlarged interest in the welfare of the company and the community which it serves and a desire on the part of employees to devote their best efforts to further the services rendered the public.

In commenting on the action of the board of directors of the company, President Aldred stated that "the adoption of a pension plan is but another step in the distinct policy of the management of the Consolidated Gas, Electric Light & Power Company, of Baltimore, to recognize its duties not only to the shareholders of the company, but to its employees and the public." The pension plan goes into effect on Jan. 1, 1912, and affects all of the company's employees, numbering about 1600.

A. I. E. E. Smoker.

Nearly 400 electrical men were the guests of the American Institute of Electrical Engineers at a smoker held in its rooms on the tenth floor of the Engineering Societies Building, New York, Friday evening, Dec. 8. The smoker was set for 10 p. m., following the meeting of the Institute, at which Mr. G. A. Maier presented a paper on adjustable-speed motors. Cigars were passed around during the evening, and sandwiches and coffee were served. This informal function was planned as the first of a series of smokers to promote social intercourse and acquaintance among New York electrical men, as well as to stimulate interest in Institute affairs. The first meeting proved a great success, the attendance being nearly twice the number expected. Voluntary subscriptions were received from members living in New York to defray the expense of the smoker.

Chicago Meeting of American Physical Society.

The regular Thanksgiving meeting of the American Physical Society was held in the theater of the Kent Chemical Laboratory of the University of Chicago on Dec. 2. About sixty members were in attendance, and a program of twenty-six short papers was discussed. Prof. W. F. Magie, of Princeton University, the president of the society, occupied the chair, and Prof. G. W. Stewart, of the University of Iowa, acted as temporary secretary in the absence of Mr. Merritt.

Among the papers relating more particularly to the science of electricity were the following: "Rays of Positive Electricity from the Wehnelt Cathode," Mr. Charles T. Knipp, University of Illinois; "The Effect of Prolonged Illumination on the Photo-electric Discharge in a High Vacuum," Messrs. R. A. Millikan and J. R. Wright, University of Chicago; "An Absolute Determination of the Minimum Ionizing Energy of an Electron, and the Application of the Theory of Ionization by Collision to Mixtures of Gases," Mr. Edwin S. Bishop, University of Chicago; "Oscillatory Discharge of a Leyden Jar," Mr. R. R. Ramsey, Indiana University; "A Method of Measuring the Effective Capacity of High-Tension Cables," Messrs. G. W. Stewart and D. M. Terwilliger, University of Iowa; "Electrostatic Induction in Long Lines," Mr. Carl Kinsley, University of Chicago; "The Application of the Potentiometer Method to the Determination of the Curve of Decay of the Counter Electromotive Force of the Aluminum Rectifier," Mr. C. W. Green, Albion College; "Effect of Frequency on the Capacity of a Condenser with Kerosene for the Dielectric, and the Limits of the Wheatstone Bridge in Measuring Small Capacities," Mr. S. Herbert Anderson, University of Illinois; "The Number of Ions Produced by an Alpha Particle from Polonium," Mr. T. S. Taylor, University of Illinois.

N. E. L. A. Rate Research Committee.

At the meeting of the rate research committee of the National Electric Light Association held at association headquarters in New York on Dec. 8 there were present Mr. E. W. Lloyd (chairman), of Chicago; Messrs. R. S. Hale, of Boston; L. H. Conklin, of Scranton; S. E. Doane, of Cleveland; R. A. Philip, of Boston, and W. J. Norton (secretary), of Chicago. Mr. John F. Gilchrist, president of the N. E. L. A. and chairman of the rate research committee reporting at the last convention, was present also. The work of the committee is being developed in relation to the following subjects: History of rates; court decisions relative to electric-light rates; history of government regulation; definitions; rate preparation, and comparative rates. The study relates less to actual rates as expressed in dollars and cents than to the fundamental principles underlying rate-making—that is, the basis on which rates should be made. The committee has made a start on its work, and some recommendations will be put into definite shape for consideration at the next meeting. This meeting will last two days and will be held in the office of Mr. Doane, of the National Electric Lamp Association, in Cleveland, on Jan. 4 and 5. The address of the secretary of the committee, Mr. Norton, is 120 West Adams Street, Chicago. Central-station men making a study of the rate question will find the report of the last committee of value. This report is now available in the printed *Proceedings* of the 1911 convention of the N. E. L. A., Vol. I, page 290 and subsequent pages.

Alternating-Current Motor Patent Litigation.

The United States Court of Appeals, sitting at St. Louis, recently handed down an opinion in litigation involving three patents granted to Mr. Ludwig Gutmann on alternating-current motors. The defendant in the suit was the Century Electric Company, which in a lower court had been held to infringe the several patents. The decision on appeal reversed the lower court and ordered that the complainant's bill be dismissed. The patents in the suit were issued respectively Aug. 25, 1891 (No. 458,162), and Dec. 4, 1894 (Nos. 530,176 and 530,177).

The claim involved in the earlier patent was as follows: "In an alternating-current motor, field-magnet coils consisting of such a length of conductor as will produce a counter-pressure or counter electromotive force equal or nearly equal to the pressure in the main line, the brushes of the motor-armature being supposed to be removed."

The court held that this claim merely expresses what was before generally known and practised in the art. "It

and counter potential equal or nearly equal to each other by the method Gutmann pointed out. No particular length of conductor to produce the counter electromotive force was specified by him, and if it had been he could not have patented it because the principle was known and the precise length of coil essential varied with the circumstances, and for any particular machine had to be determined by experimentation. If there was not enough resistance for the voltage sent into the machine the machine would overheat and possibly burn out; if too much resistance, the current could not be forced through. This was primary information when Gutmann entered the field. More than this, Gutmann's device was anticipated in the patent to Stanley, No. 591,301, Oct. 5, 1897, which was applied for Oct. 23, 1888, before Gutmann made application."

After quoting the four claims involved in the second patent at issue, the court stated that these claims contemplate "the production of mechanical motion from electrical energy by a single-phase alternating current in the field magnet inducing polyphase currents in the armature, accomplished by close-circuiting the wound coils on the latter, and —by the fourth claim, but not by the first three—by having the closed windings interconnected, thus producing a continuously progressive shifting of the magnetism in the armature or a rotation of the magnetic poles. It is contended for the patent that Gutmann succeeded in transferring the polyphase or split-phase currents from the field magnet, as in the old motors, to the armature. But we find this same arrangement in the prior patent to Elihu Thomson, No. 407,844, July 30, 1889. This patent describes an alternating electric current motor having a single-phase current in the energizing field and a set of closed coils on an armature inductively related thereto. Thomson points out clearly the polar shifting or rotation and the reason for it, and also says 'the coils on the armature or the closed coils may either be closed singly or together in series or in other ways.' There is in this patent to Thomson everything that is claimed by Gutmann. It is true that the former does not say in so many words, as the fact was, that the currents in his armature were polyphase. Gutmann does, but if the winding of an armature in several closed circuits will produce currents of different phase when in inductive relation to a magnetic field energized by a single-phase alternating current, merely saying so is not new and patentable as against a prior structure similarly arranged."

Taking up the third Gutmann patent, in which only one claim was involved, the court said that, as explained by the drawings and the specifications, this claim relates to "a duplex motor, the rotatable element of which is brought to speed by a single-phase alternating current applied either to the field or armature or both, thereby producing currents of displaced phase which are in turn conducted to a second magnetic field—all for the purpose of providing a self-starting alternating-current motor. Defendant's motor is nothing like this; it is a single-phase alternating motor with one field and one armature. It is contended, however, that the claim is not confined to the precise arrangement set forth in the specifications, which show a second magnetic field. We think that in this particular the claim itself is in harmony with the specifications in that a second field is contemplated; but if this were not so, then in so far as the claim is broader it was anticipated in the prior art. If there are not two magnetic fields in the Gutmann method, as the patent indicates, but only one field twice referred to as performing functions, there is nothing new when compared with a number of prior patents. It will suffice to cite that to Stanley, No. 439,042, Oct. 21, 1890."

In conclusion, the court said that, while there were many claims of anticipation of the three Gutmann patents and quite a number of other defenses, those referred to are sufficient [illegible] brought before it.

Cost of Street Lighting with Milwaukee's Proposed Municipal Plant.

The Taxpayers' League of Milwaukee calls to the attention of local citizens the increased cost of the public lighting by the new plant which the municipality is arranging to build alongside its garbage-disposal station, compared with the outlay for this service under the present contract with The Milwaukee Electric Railway & Light Company.

The first cost of the proposed plant and equipment for 2000 lamps, the report points out, will be $823,492.73, according to an estimate by R. W. Hunt & Company, to which must be added at least $60,000 for land sites. A bond issue of $250,000 at 4½ per cent and 5 per cent mortgages up to $330,000 have been authorized already, and must be followed by another $330,000 issue of mortgage certificates, making the total interest charges $42,750 a year. Depreciation at 4½ per cent will amount to $36,900 a year. The city plant will pay no taxes, entailing a further loss of $13,200 to the city revenues. Allowing $8,800, or 1 per cent, for contingencies and $71,500 for operating expenses, the total annual cost of the municipal lighting will thus be $173,150, or $86.57 per lamp. This street lighting is now being done by the private company at its contract price of $65 per lamp per year, so that the installation of the new plant will entail an increased cost of $21.56 per lamp, or $43,140 a year.

Edison on the Sherman Anti-Trust Law and Industrial Regulation.

The New York *Evening Sun* of Dec. 12 contains a long interview with Mr. Thomas A. Edison on present and proposed laws relating to trusts and the present industrial situation, in the course of which he stated that he was now engaged on a scientific investigation of the country's industries, with a view to inventing a plan to supplant the Sherman anti-trust law in the regulation of business. He hopes to construct a generic plan or law so designed as to do harm to no enterprise, while benefiting both the business world and the public. The plan, which he says may not take up more than one sheet of 6-in. by 8½-in. notepaper, may then be whipped into shape by trained judicial minds. Asked to speak as to the specific nature of the plan on which he is concentrating his energies, Mr. Edison said:

"I am trying to 'invent' a plan which will be satisfactory to all the commercial bodies in this country—a plan of business that will be practical and work to the benefit of manufacturers and the public. Whether it is possible to invent such a plan I cannot say, because the industrial situation is so complicated. Industries of the United States are so intertwined in their relationships, having so many customs, so many methods of selling and manufacturing, getting their supplies from such a variety of sources, that it seems almost impossible to get a plan or law so broad, so generic, that it will accomplish the desired result. We best see the extent of business complications when we drastically change the tariff. Results are far-reaching and hurt industries which the change is meant to benefit, producing good and bad results in unexpected places."

Mr. Edison is of the opinion that it is utterly impossible for lawyers alone to cope with the present situation. In this connection he said: "A lawyer cannot draw a law covering the complicated conditions of modern industry. He hasn't had the requisite mental experience in the proper field. What is wanted is some person familiar with the selling and buying, the technical as well as the financial end of all industries, to devise some generic scheme that business can work on. It will then be necessary to have the law put into a legal form by the best judicial minds.

"Lawmakers should not have the methods of doing busi-

ness left to them. Such methods should be left to business men. Lawyers should put the methods into legal shape; for business, more and more, is getting into the hands of scientific men as its technical part becomes more interdependent and involved."

Mr. Edison in the interview frequently denounced the present methods of lawmaking. The men who made the present trust law, he said, "didn't know pig-iron from coffins, so far as the producing business is concerned. * * * They sit around a green baize table and frame up a law as a sort of experiment, and instead of conducting all the experiments beforehand they then try it on business while it is still an experiment. Naturally it doesn't work—couldn't work. When it doesn't work they amend it, and after a few years of amendments the thing gets so confused that the makers themselves can hardly in the tangle find the head and tail of the law.* * * They never can adjust the situation without cataclysm. They don't know and haven't the time to learn the technique of business. They have to grind out so much law as a matter of course. * * * Their tried-out law as an experiment does some injury. The flaws are seen but not comprehended. Amendments are made and more injury is done. It is utterly hopeless for them to make a law to control industry that will injure no one. It is a hopeless task for lawyers to try to make such a law unassisted by the industrial experts of the country. No amount of amending the Sherman law can make it right. In this country, with numerous legislatures and a Congress pouring laws out at regular intervals, what chance has business? * * * When two or three men attempt to frame a law or discuss a problem, in an attempt to decide upon executive policy in business or government, there is always considerable difficulty. When five men take up the task difficulties are materially increased. If fifty take up the task it is hopeless. A committee, generally speaking, composed of a large number of men, frames American industrial law. The result is, to say the least, an obscure phenomenon."

Mr. Edison added that he did not underestimate the task before him. He said the task was one of the greatest he had ever tackled—in fact, the problem of the incandescent lamp was nothing beside it.

Referring to the Sherman anti-trust law Mr. Edison said it failed "because it makes everyone in the United States pursuing business do just what he desires not to do. Every man does not want competition. This law compels him to have it."

The attempt, he said, to solve the trust problem by foisting cut-throat competition upon the public, thus leading to the destruction of the weaker, must be given up and some basis of co-operation devised which shall control the power of great corporations to carry out destructive policies, if they have the desire. Amendments to the Sherman law cannot make it practical, for the law is wrong in principle. In inventing a machine, if one has the right principle to start with, the work runs from the complex to the simple, whereas if one has the wrong principle it runs from complex to more complex. Applying this to the Sherman law, he said that no amendments can make it right. The great industrial development in Germany was referred to, and it was stated that, while we suffer from what is variously called depression, industrial unrest and stagnation, Germany marvelously prospers. The reason he ascribes to the fact that Germany has legislated for prosperity, while we, trusting to the inspiration of our legislators and lawyers on subjects with which they are very slightly acquainted, have brought depression upon ourselves.

The remedy, he said, is in a law which shall prevent destructive competition and give every man just as much as he wants and is entitled to in the way of co-operative association; a law which shall permit groups of industries to associate without injury to the public for the purpose of preventing destructive competition; a law which shall prevent the manipulation of prices by the efforts of men except as they can make legitimate use of the law of supply and demand; and he would make it against the law to combine to increase prices, the law to apply not to the corporation, but to the responsible officers of the corporation.

Mr. Edison believes that in the end it will be found essential to legislate to enforce co-operation as against competition. Compelling men to compete when they see that it is to their interest not to do so brings about cut-throat competition, which accomplishes the destruction of the weaker concern and gives the control of the nation's trade to the strong. The inevitable end of such a system would be the real, if not apparent, ownership of the country by a few individuals or giant concerns. A large concern under the leadership of a far-sighted agent of industry or finance can concentrate its attack in some section of the country and by cutting prices destroy its rivals, and, through such victories repeated, the entire trade of the country may be controlled. It is not of much account, he said, to say that some giant corporations are now managed by highly ethical men who would not stoop to a tyrannical use of their power; for if the power for evil remains in existence the corporations will eventually come into the hands of a different kind of men, whose disregard of the precedents set by their predecessors will be disastrous to the consumer.

Mr. Edison would develop co-operation by permitting an association to be formed whereby those included agree with each other, under penalties, not to sell articles below the cost of production, including in that cost depreciation on the plant and legal rate of interest on the investment; the members of the association being prevented from agreeing with each other to raise prices above what would correspond to supply and demand. In this manner the consumer would be protected. All the contracts of such associations should be filed in a bureau open to the public and to the officers of the government, and proper legal means should be given the public and those in the association to enforce through judicial channels of the government the agreements entered into.

European governments, he said, permit the formation of such associations and allow them to set prices if they are not unreasonable. Germany encourages their formation, in order that the producers may obtain fair prices for their goods and "dump" at low prices in all other countries. From Germany's experience, he said, we should learn to form associations whereby none would be compelled to sell below the cost of production. While such associations would protect the small as well as the large producers, it would also give the larger and more cheaply producing concerns a great chance to send goods out of the country for actual cost of production here. This would give more employment to American labor and build up a great foreign trade, while the cost of goods to the American public would be not more than the cost of production plus the legal profit were there no exports.

Closing Sessions of A. S. M. E. Annual Meeting.

The 1911 meeting of the American Society of Mechanical Engineers at New York was brought to a close Dec. 8, after a three days' session, the first meetings of which were reported in the *Electrical World* of last week. On Wednesday evening Dr. Robert S. Woodward, president of the Carnegie Institution of Washington, D. C., gave an address on the subject of "Geo-dynamics, or the Mechanics of the Formation of Worlds." The speaker sketched briefly many interesting figures on the magnitude of this planet, and closed with an account of the planetesimal theory, which is in part succeeding the older nebular hypothesis.

Among the papers read at the professional session of Thursday morning was one by Messrs. G. H. Barrus and C. M. Manly, on the subject of "Variable-Speed Power Transmission." The Manly drive was described, which consists of a pump and one or more fluid-pressure motors, speed control being effected by hydraulic connection between the pump and motors. Tests were carried out by using an electric motor as the driving source, and at speeds of from 105 to 350 r.p.m. the efficiency of transmission averaged 87.7 per cent.

At a parallel session held by the Gas-Power Section Thursday morning Prof. R. H. Fernald, of Cleveland, Ohio, retiring chairman, read an address on "Internal-Combustion Engines," in which he traced the development and described modern types of gas-power units. Mr. H. J. Freyn, of Milwaukee, was elected to succeed Professor Fernald as chairman of the section for the coming year. Messrs. I. E. Moulthrop, of Boston, and Max Rutter were added to the executive committee for five years and one year respectively.

Mr. H. R. Setz, of Warren, Pa., opened the regular program with his paper on "Oil Engines," describing the Diesel or constant-pressure engine and its modifications. Various processes of fuel injection were described, leading up to a description of an experimental engine developed by the author, based on observations of the shortcomings of existing engines. Mr. Setz predicted great commercial possibilities for reliable engines to burn efficiently the heavy oils. As supplementary to his paper he presented figures comparing the cost of gas-producer, natural-gas engine, low-pressure oil engine and Diesel engine plants.

An account of a test of a 85-hp De La Vergne oil engine, by Mr. Forrest M. Towl, was next read in abstract by the secretary. The engine commonly operated an oil pump and was later tested with a prony brake. The total mechanical efficiency was 92.1 per cent and the total station efficiency 25.52 per cent. Prof. W. D. Ennis followed with a mathematical paper on "Design Constants for Small Gasoline Engines."

The morning session was closed with a paper on "Tests, Construction and Working Costs of a 1000-kw Natural-Gas Engine," by Messrs. E. D. Dreyfus and V. J. Holquist. The paper pointed out the care found necessary to obtain dependable test results, the observational errors being minimized to the last degree. The unit tested was located in the Allegheny (Pa.) plant of the American Locomotive Company. Cost of producing energy with the equipment was determined, including all operating expenses and investment charges.

"The Development of the Textile Industries of the United States," a general statement of present conditions, by Mr. Frank W. Reynolds, opened the professional session of Friday morning. Half a million operatives and nearly one billion dollars capital are employed in the combined textile industries of the United States, revolution in the drive of which has recently been worked by the application of motors. Mr. Reynolds' paper referred chiefly to the mechanical and manufacturing problems of mill operation. With mechanical drive, said the author, 72 to 74 per cent of the indicated engine horse-power reaches the machine, with group motor drive 65 to 70 per cent reaches the machine, and with individual motor drive the efficiency is 70 to 75 per cent. The relative economies of motor drive and mechanical drive are still debated questions among mill engineers, although there is no doubt that under conditions such as that of a mill to be driven by water-power inconveniently located electric power cannot be disputed as the best means of drive. The discussion which followed turned on the comparison of isolated and central-station service for mill operation, and it was pointed out that, at all events, the power cost, averaging only 3 to 4 per cent of the total manufacturing cost, may offer slight differences which are insignificant in terms of the much more important considerations of simplicity, convenience, safety and economy of routing work.

Among the entertainment features of the Mechanical Engineers' meeting was a ball Thursday evening, Dec. 7, at the Hotel Astor, and during the days of the convention a number of excursions were made to points of interest about New York, including the Brooklyn Navy Yard, the United States battleship *Delaware,* the White Star liner *Olympic,* the world's largest ship; the J. M. Horton Ice Cream Company, the Hotel Astor power plant, etc.

Variable-Speed Alternating-Current Motors.

The different methods proposed and used for varying the speeds of alternating-current motors were outlined briefly in a paper read by Mr. Gus A. Maier at a meeting of the American Institute of Electrical Engineers held in New York on Dec. 8. In addition to the well-known schemes used with induction motors for varying-speed and adjustable-speed work, the author described numerous types of alternating-current commutator motors employed for this purpose.

Attention was called to the Hunt scheme for obtaining two or three set speeds in a single induction motor by means of internal concatenation. According to one specific arrangement of the Hunt motor, the stator core is provided with an eight-pole primary winding equipped with taps brought out in such places that the winding can act simultaneously as the short-circuited secondary to a four-pole field produced on the rotor secondary. The secondary winding is arranged so that it may be either directly short-circuited on itself or connected to produce the effect of a four-pole winding operating in an eight-pole field. The motor can operate either as an eight-pole squirrel-cage induction motor or in concatenation with a speed corresponding to twelve poles.

The author expressed the opinion that it appears possible to design a cheaper two-speed motor of the Hunt type than one of the ordinary collector-ring type with two primary and two secondary windings. A considerable demand exists at the present time for an adjustable-speed, alternating-current motor, even if it be a little inferior in characteristics to a direct-current motor, in order to overcome the necessity of installing direct-current apparatus rather than alternating-current apparatus merely because a few of the many motors must be of the adjustable-speed type. The author outlined the circuit connections and operating characteristics of the adjustable-speed, single-phase motor of the compensated-repulsion type. As reduced to the two-pole model this motor is provided with four brushes. Two of these brushes act as the transformer secondary to the stationary primary which receives all of the useful power of the machine; the other two brushes act as part of an exciting circuit. When both sets of brushes are short-circuited on themselves the motor operates at practically synchronous speed as though it were a squirrel-cage-type, single-phase induction motor. By introducing into the exciting circuit an emf in time-phase with the supply emf the wattless current in the primary circuit can be adjusted to any required value, either positive or negative, according to the relative polarity of the introduced emf. By introducing into the transformer secondary brush circuit an emf in time-phase with the supply emf the speed can be adjusted to any required value either above or below synchronism.

Following a brief mention of polyphase commutator machines, outlines were given of the Scherbius and the Kraemer systems for obtaining adjustment of speed by combining polyphase commutator and induction motors. The Scherbius system was described in an article by Mr. J. J. Elink Schuurman in our issue dated April 20, 1911. In

the Kraemer system the commutator machine is directly connected to the shaft of the main motor and the energy furnished through the slip-rings of the main motor of the induction type is returned as mechanical energy to the shaft instead of being absorbed in resistance. This system was also mentioned in the article just referred to.

Discussion.

Mr. Harold W. Buck stated that recent developments in arrangements for varying the speed of alternating-current motors, which have not yet become of general knowledge, afford means for applying alternating-current motors for industrial purposes which are almost as flexible as those afforded by the direct-current motors.

In reply to a question by Mr. W. N. Smith relative to the types of variable-speed motors that have been employed satisfactorily on a commercial scale, Mr. Maier stated that the only type used in this country is the multi-speed motor. In Europe the adjustable-speed single-phase and the polyphase commutator motors have been used to some extent.

Mr. Carl J. Fechheimer called attention to the speed-varying system of Heyland, which is somewhat comparable to the systems of Kraemer and Scherbius. A note on this system appeared on page 1201 of our issue dated Nov. 11, 1911.

Mr. B. G. Lamme said that the Kraemer and Scherbius systems, being forms of the so-called cascade system, involve considerable expense and are not satisfactory for wide ranges of speed. He showed that one can readily obtain adjustable-speed characteristics in an alternating-current commutator motor by connecting the armature across one phase and the field circuit across the other phase of a two-phase system.

Dr. C. P. Steinmetz gave an excellent summary of the different types of motors that have been developed for variable-speed work. He remarked that in most of the alternating-current motors the variable speed is obtained by using a commutator, the lack of which on the alternating-current motor has been the basis of its chief claim for superiority over the direct-current motor. An infinite variety of variable-speed motors with commutators have been proposed, but the field for development of a commutatorless, variable-speed, alternating-current motor is still open.

Mr. C. O. Mailloux claimed that the successful operation of single-phase commutator motors in railway service has caused many electrical engineers to revise their opinions of the disadvantages attending the use of commutators, especially in Europe, where most of the development in alternating-current commutator motors has taken place. He expressed the hope that commutation will be brought to as high a state of perfection in connection with alternating-current as with direct-current motors.

Accounts for Telephone Companies in New York.

A uniform system of accounts for telephone corporations has been prescribed by the New York Public Service Commission, Second District. It is to be effective Jan. 1, 1912.

The order of the commission states that during the year 1912 any corporation may, for purposes of comparison, keep on its books, in addition to the accounts prescribed, such portions of its present accounts as may be deemed desirable. For purposes of efficiency of administration and operation any corporation, unless otherwise ordered, may keep temporary or experimental accounts and accounts covering particular divisions of its operations, provided that such accounts shall not impair the integrity of the system prescribed.

It is also ordered that each company be required to keep its accounts and records so that, when requested by the commission, it can show for each exchange system and each toll system in the State the cost of the property devoted to the service of such system and the revenues and expenses of each system. The revenues of an exchange system shall include such proportion of any tolls exacted for the use of toll lines as may be properly credited to the system which originates the toll business. The revenues of a toll system shall include the amount of tolls, after deduction of such proportion as may be properly credited to an exchange system for originating business. The proportion of tolls which shall be credited to an exchange system shall be determined by agreement between the corporations, if the systems are owned separately; if they are owned by one corporation, by resolution of the board of directors, unless otherwise ordered by the commission. The expenses of an exchange system shall include such parts of the operating expenses of toll lines as are not separable from the exchange system, and the expenses of the toll system shall include all operating expenses which are separable from the expenses of exchange systems.

Corporations are divided into three classes: Those having average annual operating revenues exceeding $100,000; those having average annual operating revenues exceeding $25,000 and not more than $100,000, and those having average annual operating revenues of $25,000 or less. The determining amount shall be the average of the annual revenues for three years preceding the date of the order. The classification of operating expense accounts includes a discussion of maintenance expenses, and in this section definitions of ordinary repairs and extraordinary repairs are given and the treatment of depreciation and amortization is described at length.

Decapitalization of Public Utilities.

The City Club of Chicago on Dec. 9 listened to an address by Mr. Delos F. Wilcox, franchise expert of the Public Service Commission for New York City, who spoke on "Decapitalization of Public Utilities." He complimented Chicago on its traction franchises, which are a great advance over previous franchises, but said that even these franchises were open to criticism because they made no provision for paying off and retiring the bonds and other securities of the traction companies during the term of the franchise, so that the city would own the properties at the end of the franchise term and thus be in a position to control its streets. He laid it down as a fundamental principle that the public must have control of its streets and highways, and that ownership is the best control. Operation is another question.

He also criticised the New York Subway franchises as inadequately providing for the future, because they did not require a complete retirement of the indebtedness against the subway construction during the term of the franchise, so that not only would the subways themselves be paid for, but also the equipment. He also criticised them because they made no provision to enforce operation of the extensions and additions which might be built.

He recited two objections urged against the plan of paying for the cost of public utilities out of earnings during the franchise period. The first of these is that capital cannot be found for investment under such conditions. To this objection he took exception and entered a denial. The second objection is that it burdens the present generation for the benefit of the next, as the earnings from service must be made sufficient to retire the securities issued in payment for the construction. He asked, in reply to this objection, what would be thought of a municipality which issued bonds for the construction of pavements or other public improvements and made no provision for retiring these bonds.

Proposed Public-Utility Legislation in California.

A public-utilities bill drafted by a committee of the California Legislature has been presented to that body, which is now in session at Sacramento. At the last public hearing before the committee in San Francisco attorneys of the corporations raised the point that the recently adopted constitutional amendment was in violation of the federal constitution. It was contended that in giving the commission the power to regulate private corporations and not municipally owned utilities the amendment clashed with that section of the federal constitution which guarantees equal protection under the laws.

Sections of the bill were redrawn to meet some objections that had been made. The registration requirement as to stock and bond issues has been omitted from the bill, and a penalty section added, making it a felony, with fine up to $20,000 or imprisonment, for a corporation or any member of it to use money raised by stock or bond issues for any purposes other than those stipulated. The section which required the consent of the commission before any new public-utility enterprises could be launched was amended to exempt wharfingers, warehouse companies, steam and interurban railroad companies, pipe lines and telegraph companies.

A bill introduced in the Assembly provides for the creation of a state water commission to consist of five members, including the Governor, the State Engineer and three members to be named by the Governor for four years and to receive $25 a day for actual service. It is proposed to give the commission control over all waters belonging to the people. The fee for a power permit is fixed at $250, while the fee for other water rights is fixed at $50. After a permit has been granted it is provided that there can be only one investigation by the commission into the merits of the petition. Should any claimant have a grievance he will have the right of appeal to the Superior Court.

Violation of the provisions of the proposed act is made punishable with a fine of not more than $5,000 or imprisonment not exceeding one year, or both. The bill would appropriate $100,000 for the purpose of putting the provisions of the measure into operation.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, will give this week a further hearing upon the application of the Red Hook Light & Power Company, which seeks to exercise franchises granted by the city of Hudson and to enter the field for the furnishing of gas and electricity in that city.

The commission has received a petition for a proposed new electric railway company operating between the cities of Buffalo and Rochester. The proposition involves the consolidation of the Buffalo & Williamsville Electric Railway, the Buffalo & Depew Railway and the Buffalo, Genesee & Rochester Railway, under the name of the Buffalo, Batavia & Rochester Railway Company. The Buffalo & Depew Railway now runs from the city line of Buffalo to the village of Depew, and the Buffalo & Williamsville Railway extends from the city line of Buffalo to the easterly bounds of the village of Williamsville, Erie County. The Buffalo, Batavia & Rochester Electric Railway Company and the Buffalo, Genesee & Rochester Railway Company hold certificates of public convenience and necessity for the building of the railroads between Buffalo and Rochester. The Buffalo, Batavia & Rochester Electric Railway is the owner and possessor of franchises from all the towns and villages through which the proposed line of railway will pass with the exception of the towns of Pembrook and Churchville, which franchises have expired. The proposed route of the Buffalo, Batavia & Rochester Electric Railway will form an extension of the Buffalo & Williamsville Railway, and the proposed route of the Buffalo, Genesee & Rochester Railway will form a continuation of the Buffalo & Depew Railway. These proposed routes join near the village of Batavia and will form one continuous connected line of railway.

The commission is asked to allow the issue of first-mortgage bonds to the amount of $3,000,000, of $1,000,000 preferred stock and of $2,500,000 common stock. It is proposed to convert the stock of the present railway corporations into the stock of the proposed consolidated corporation upon the basis of one share of stock at the par value of $100 in exchange for each $100 of outstanding stock. The petitioners have entered into an agreement with the Batavia & Genesee Construction Company, which, it is stated, is ready to make a contract to build and equip the railway from Buffalo to Rochester, furnish the right-of-way, pay interest on the bonds for a period of two years, the expense of marketing bonds abroad and the engineering cost upon the basis of cost plus 10 per cent profit, and to receive in payment therefor $3,000,000 of bonds at 85 and $1,000,000 of preferred stock at par, the balance to be paid in cash or in the common stock of the railroad company at par.

The petition states that the construction company has already arranged to sell the bonds in London at 85, provided the issue can be made at once. The proposed line of railroad takes it from the connection through Richville, Batavia, Churchville and Gates to a connection with the Rochester Railway tracks in Rochester.

The commission has received an application from the Western Union Telegraph Company for a rehearing upon the order recently made by the commission directing that company to discontinue its practice of charging the Postal Telegraph-Cable Company for certain words inserted on telegrams received from the Postal for further transmission over the lines of the Western Union company. The Western Union company will ask for a modification of the order made so that it will be allowed to charge for the name of the place and the state where the message originated and the word "via," so that three words will be charged for instead of the number of words at present charged for, which is, according to circumstances, four or five. The company was to have been heard at Albany on Thursday, Dec. 14, as to whether or not a rehearing would be granted.

The Central New York Gas & Electric Company has been authorized to exercise rights and privileges under franchises granted by the village of Newark and the town of Manchester. The company is restricted to the exercise of the franchise in the easterly half of the town of Manchester, the remaining part of the town now being occupied by another company. The Central company has been directed to show cause why an order should not be entered requiring it to manufacture, sell and distribute coal gas in the villages of Palmyra, Lyons and Newark, in conformity with the prescribed standards of illuminating power and purity. The company is also required to show cause why it should not make such improvements to its plant and distributing system as will result in improving the conditions under which gas is manufactured and distributed in these villages with proper regard to the pressure at which gas is maintained.

The commission has closed upon its records the complaint of residents of the village of Wilson, Niagara County, against the Conant-Bryant Power Company. The complaint was to the effect that the company had a contract with the village for an all-night service, but that for the last few months the current has been turned off at 2 a. m. Upon the hearing the company agreed to maintain all-night service and the complaint is closed without the necessity of a formal order by the commission.

The Keeseville Electric Company has been authorized to execute a mortgage on its plant and property for $500,000. The company is also authorized to issue $70,000 in twenty-year 6 per cent first-mortgage bonds, $30,000 of which shall be used to take up existing bonds par for par, and $40,000 of which shall be used for the construction of a transmission line to Ausable Forks from Ausable Chasm and local lines at Ausable Forks, and for electric apparatus and improvements to the power house.

The commission has received a petition from the trustees of the village of Cayuga, Cayuga County, asking for a reduction in the price of gas furnished by the Empire Gas & Electric Company. The petition states that the residents of the village of Cayuga should not pay more for gas than the residents of Auburn, as is the case under the present schedule of rates, and asks the commission to fix the maximum price to be charged and also to inspect the meters now used by the gas company to ascertain their accuracy. The complaint has been served upon the company and an answer required within ten days.

The third hearing on the complaint filed by certain organizations of stationary engineers charging that discriminatory rates are given by the New York Edison Company to large customers took place on Monday, Dec. 11, before Commissioner Maltbie, of the commission for the First District. Henry H. Edgerton, of Brooklyn, leader of the complainants, stated that their counsel had been obliged to withdraw from the case owing to pressure of other business, and that he would represent the petitioners before the commission. He presented several computations derived from annual reports of the New York Edison Company to show existence of preferential rates, and these tabulations were attacked by counsel for the central-station company on the ground that the results were based upon assumptions and did not therefore represent actual conditions. The compilations were placed upon the record and the case was adjourned until Dec. 26 at 2:30 p. m.

MASSACHUSETTS COMMISSION.

The Gardner Gas, Fuel & Light Company has petitioned the Gas and Electric Light Commission for authority to issue 822 shares of additional capital stock of the par value of $100 each, and of the aggregate par value of $82,200, for the purpose of raising money to pay outstanding bonded indebtedness and obligations associated with extensions and improvements to the property. The present capitalization of the company is $26,200, par value.

Further action on the location of the proposed tunnel of the Boston & Eastern Electric Railroad under Boston Harbor has been deferred by the Railroad and Boston Transit Commissions, sitting jointly, until the location of the road in East Boston is determined. The company plans to build a double-track tunnel under the easterly side of the business center, providing a route for fast service between the waterfront and Post Office Square, delivering and receiving passengers in the heart of the city as contrasted with the somewhat removed locations of the present steam-railroad terminals. A large station with underground platforms and loop tracks for quick handling of traffic is contemplated for Post Office Square.

NEW JERSEY COMMISSION

During the current week hearings are scheduled by the Board of Public Utility Commissioners of New Jersey for the consideration of information to be submitted by the Public Service Gas Company, to be used in an investigation which the board is conducting into the reasonableness of the charges for service. A petition of the Interstate Telephone & Telegraph Company for approval of an issue of bonds is also to be considered.

The board has ordered street-railway companies to report accidents.

A petition has been filed with the board protesting against the approval of an ordinance passed July 26, 1911, by the township committee of Eatontown, granting a franchise to the New York Telephone Company. The opposition to the approval was withdrawn when the company agreed that, as a condition, it should be stated that nothing in the ordinance should delimit the power of the board to regulate and control overhead construction.

OHIO COMMISSION.

In the case of the Utica Oil & Mineral Company recently the Ohio Public Service Commission indicated that the letter of the new public utilities law will have to be followed in every detail. This company, it seems, had endeavored to secure the approval of a new schedule of tariffs without taking the regular process required by the law. There was no particular objection to the change, as it had been provided for by an ordinance of the village of Utica, but at the same time the commission ruled that strict adherence to the details of the act must be made.

The commission has dismissed the petition of the Kilbourne Mutual Telephone Company to require the Citizens' Telephone Company, the New Ashley Telephone Company and the Sunbury & Galena Telephone Company to make physical connections with it. The commission decided that the Kilbourne Mutual Telephone Company is not operated for profit, and is therefore not entitled to such connections. If these small companies desire the advantage of connection with the larger systems it will be necessary for them under this decision to reorganize under the laws providing for incorporations for profit.

Because the ordinance had been enacted some time before the utilities law had become effective, the petition of the Bucyrus Light & Power Company for relief from excessively low rates was dismissed. The commission in this case recognized the principle applying to retroactive laws.

MARYLAND COMMISSION.

The Maryland Public Service Commission will take up for action the complaint of the Mayor and City Council of Baltimore and of the Park Approach and other associations against the Consolidated Gas, Electric Light & Power Company concerning rates charged by that company for gas and electricity, as soon as it disposes of the telephone case on which it is now engaged. A number of conferences have been held between the engineer of the commission, Mr. Charles E. Phelps, and the officers and engineers of the Consolidated company. Mr. Phelps is now at work on the voluminous reports of the affairs of the company which were submitted some time ago. They are exceedingly complicated, and it will be several weeks before he will complete his analysis of them and submit his findings to the commission. In the meantime a supplemental report will be received from the company showing the company's estimate of the value of its "intangible assets." It did not have this report ready when it submitted its other reports, and, although not expressly called for by the commission, the company asked permission to submit it, which permission was granted. It is probable that before the hearings on the gas and electric question begin experts will be called in from other cities to assist the commission's engineer to check up the figures and to aid the commission in determining what would be a fair price for the company to charge for gas and electricity on the basis of the present investment and the value of its property.

Orders have been passed from time to time affecting the Easton Fuel & Light Company, but Mayor Higgins of Easton and several others have complained that the company has paid no attention to them. Albert C. Ritchie, assistant general counsel, notified the commission that the law provides for a fine of $1,000 for each distinct violation of the orders of the commission, and that this penalty may be enforced against the corporation itself or against such of its officers or employees as have knowingly failed or neglected to comply with the commission's orders. The

commission directed him at once to take such steps as he thought proper to see that the orders of the commission are complied with.

[illegible] controversy between the Paper Mills Company and the Consolidated company as to a flat rate for electricity. The Paper Mills Company asserts that the Consolidated guaranteed that its bills for electric power would not amount to more than $100 a month, and when they ran over the company refused to pay the excess over $100. The central-station company maintains that under the provisions of the law it cannot give a flat rate and that fixing a maximum charge of $100 a month would be giving such a rate.

The Southern Maryland Railroad, now extending from Brandywine, in Prince George's County, to Mechanicsville, in St. Mary's, some time ago projected an extension from a point near Washington to Point Lookout, with a terminal and pier at Esperanza, in St. Mary's County. Last June the company applied to the Public Service Commission for authority to issue $2,000,000 in bonds and $1,500,000 additional stock, bringing its stock issue up to $2,000,000. The bonds were to be issued at 80 and the stock at 33⅓, Mr. Frank B. Jones, of Philadelphia, having filed an affidavit with the commission asserting that the bonds and stock could be sold at the prices mentioned. A day was appointed for a hearing, but the promoters of the proposition did not appear before the commission and no action was taken. It is asserted that the company will now issue the $2,000,000 of bonds originally asked for but without issuing the additional $1,500,000 of stock, and it seems that under the law the Public Service Commission cannot prevent this. This raises an issue that may result in legislation at Annapolis next winter.

A complaint has been filed with the commission by a number of newspaper correspondents of Denton, who allege that they are unable to secure a service by which news matter may be rushed to the newspapers of Baltimore and Philadelphia. The several correspondents claim that the telegraph facilities are such that news matter must come to Baltimore by a roundabout route. To secure better service the correspondents claim that an additional wire should be strung by the telegraph company. The limited telegraphic facilities are said to exist in other towns along the Eastern Shore, where the telegraph offices close early and where railroad orders over the line often delay private messages which have been filed previously.

WISCONSIN COMMISSION.

The commission has authorized the Berlin Public Service Company to issue $70,000 par value of 5 per cent bonds, to be issued and exchanged on the basis of 85.4 per cent of par value for the plant, property and effects, both tangible and intangible, of the Berlin Gas Company. The mortgage deed is made out to the Fidelity Trust Company of Milwaukee as trustee. The value of the property, according to the commission's tentative valuation, is $60,000.

An order has recently been issued by the commission which, while affecting directly the Merrill Railway & Light Company, is to be enforced in all cases where electrolytic meters are in use. The order consists of a new set of instructions, rules and regulations concerning the manner in which electrolytic meters, especially of the Bastian type, are to be tested, inspected and calibrated in order that the present rules of the commission fixing the maximum variation in accuracy as 4 per cent may be rigorously applied to electrolytic meters. When the original rules for meter service were drafted the commission had in mind meters of the motor or induction type only, and consequently the present rules for service do not include electrolytic meters. The order was issued after a joint conference between the engineering staff of the commission and the manufacturers and central-station managers concerned.

The commission has rendered its decision in the case of the La Crosse Gas & Electric Company. The petition in the matter was filed with the commission Aug. 19, 1910, by the La Crosse Gas & Electric Company, and in it authority was requested to substitute for the rates now in effect for gas, electric and heating service other rates which were in certain respects increases over rates now existing. This application was made following a period of operation under a previous provisional order of the commission affecting the petitioner's rates then in force.

During the portion of this period prior to the company's receipt of an indeterminate permit the rates as authorized by the commission were so limited by a franchise agreement that the maximum rate which the petitioner received for electric service was 10 cents per kw-hour and $1 per 1000 cu. ft. for gas. The company contended that its earnings were not sufficient and based its claim upon a valuation which it held should be the basis upon which it should be allowed to earn interest. The company's book value of date June 30, 1909, was $1,290,530, which was increased to $1,827,000 during the period to June 30, 1910. The total reproductive value was estimated by the commission as $963,c86. The present value of the physical property, as determined by appraisal and subsequent adjustments made necessary by facts revealed in the testimony and by investigation, was $719,740, and the cost of reproduction $921,337. The original cost of the property and the cost of subsequent extensions could not be accurately determined, for the records bearing on these matters offered little explanation of the original transactions. The present organization of the company is one that secured, through purchase, properties that had already been in operation for a considerable time, and it had added to these properties not only extensions made by itself, but other constructions built by other concerns for competitive purposes.

The difference between the company's alleged valuation and the valuation as made by the commission is due to several causes. The petitioner included the total cost of equipment, a considerable portion of which was duplicated when the various properties were acquired and was deducted by the commission as property not used or useful. The commission limited the cost of pavement to the actual cost incurred in cutting through it, and refused to accept the petitioner's contention that the total cost of $82,000 should be included in determining the reproductive value. Believing the company to be evidently overcapitalized, the commission was not inclined to accept the face values of the various securities purported to have been given in exchange for the different properties as evidence of the actual value involved. Although the petitioner testified that it was entitled to a certain sum as "going value" in virtue of the commission's policy in such matters, no reliable value could be determined upon because of the meager information at hand.

It was the opinion of the commission, though, that the earnings had been high enough throughout a period of years, with the possible exception of the time when vigorous competition existed, to make up for the early losses incurred in building up the business. Concerning these losses and the trouble which the utility has had for some time with its patrons, the commission comments as follows: "What consideration should be given to losses that may be the result of competition occurring some years after the first construction is a matter that is not clear. One view that may be held is that during periods when no public regulation of utilities exists and there is little restriction as to the number of concerns that may enter the same field the risks of the business are greater and the utilities are therefore entitled to larger returns during the profitable years than would otherwise be the case. Investors, it may be held, knowing as they should that these conditions prevail, take upon themselves, when entering the field, the risks of the business as well as the profits. Another view may be advanced holding that since a municipality during former years could

choose between allowing one or more utilities of the same kind to supply the community, it took upon itself the responsibility of increased costs and losses due to competition when duplicate franchises were granted. It seems quite certain that municipalities are to some degree responsible for the increased cost of service and losses in conducting the business when they permit duplicate investment to serve an already adequately supplied public. Just how the public in such instances expects to profit permanently by such action is difficult to say. As a rule its action is believed to be due to a misapprehension as to the cost of service, the amount of profit utilities usually earn and the rights to which they are entitled. High rates, poor service or other local circumstances have sometimes formed the grounds upon which attack or retaliation has been made by the public by permitting competition to take place; to what extent it was justified therein, in the absence of other protective methods, depends largely upon the importance of these offenses and whether the utility was responsible for them." While not committing itself, the commission evidently did not consider the La Crosse Gas & Electric Company the greatest offender.

From an examination of the available facts, the annual operating revenues and expenses, additions to the property and their relation to the present cost of reproducing the physical property, the commission held that the amount upon which the company was entitled to earn interest was not far from the cost of reproduction. The rates for gas service and for heating service were not changed, although the commission recommended that the form of the schedules be altered to conform more nearly with the respective cost curves. The minimum bill for electric lighting was increased from 75 cents to $1.

The present rates for electric lighting consist of a service charge of $1.80 per year per 16-cp lamp or equivalent demand, with one-third the connected load considered active, and a meter rate of 7.5 cents per kw-hour for a monthly consumption equal to or less than sixty hours per month, with an excess rate of 6 cents. This schedule was not altered for residence lighting, but for business lighting the commission ordered the percentage of active connected load increased from 33 to 38. No change was made in the rates for electric power because none was applied for, but an analysis of revenues and expenses showed that the company's power business is far from remunerative. The present output charge is 2 cents per kw-hour, whereas the output cost, according to the commission, is 3 cents per kw-hour. The company's relatively large power business is due not so much to the need of electric power as to the inducements in the shape of attractive rates which were offered during the time when competition was keen.

CURRENT NEWS AND NOTES.

LABORATORY EXPERIMENTS FOR NEW YORK EDISON EMPLOYEES.—Nearly 200 employees of the New York Edison Company are availing themselves of the laboratory practice courses offered by the company. There are 126 taking the elementary course, thirty-six in the direct-current course, and thirty in the alternating-current course. Employees engaged on night work have the use of the laboratory each Tuesday afternoon from 1 to 4 o'clock.

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RESIDENCE-BUSINESS N. E. L. A. COMMITTEE.—A meeting of the residence-business committee of the Commercial Section, National Electric Light Association, was recently held at the office of the chairman to organize and discuss plans for the year's work. Those composing the committee are Messrs. J. F. Becker, New York City, chairman; N. H. Boynton, Cleveland, secretary; S. M. Kennedy, Los Angeles, Cal.; G. B. Griffin, East Pittsburgh, Pa.; F. H. Gale, Schenectady, N. Y.; E. A. Norman, New York City; G. C. Osborne, Harrison, N. J., and F. D. Pembleton, Jersey City, N. J.

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MUNICIPAL RESPONSIBILITY IN GRANTING COMPETITIVE FRANCHISES.—In a recent decision by the Wisconsin Public Service Commission on a petition for higher rates by the La Crosse Gas & Electric Company there is an interesting discussion by the commission of the principle of granting competitive franchises, which practice is, by implication, condemned. An abstract of the decision is given elsewhere under the head of "Public Service Commission News."

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NELA ENGINEERING SOCIETY.—An organization to be known as the Nela Engineering Society has recently been formed by the members of the engineering department of the National Electric Lamp Association, Cleveland. The society will be a forum for papers and discussions on subjects of general engineering interest presented by members of the society and by outside speakers. Twenty-five persons were present at the organization of the society, which will meet every Thursday evening. Mr. M. D. Cooper was elected president.

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PROPOSED KENTUCKY PUBLIC UTILITY COMMISSION.—A movement is under way to secure legislation in Kentucky for a commission of public utilities. It is said that the first definite action toward the institution of such a body will be taken in a strong recommendation along this line by Governor James B. McCreary in his first message to the State Legislature in January. The work of the State relative to the regulation and enfranchisement of public-utility corporations is at present performed by the auditor of public accounts, the state treasurer and the secretary of state acting as a special committee. It has become too onerous, however, and it is proposed to establish a special commission, modeled along the lines of the state railroad commission, to handle the questions which arise in the regulation, taxation and adjustment of difficulties with telephone companies, electric companies and other public-service bodies.

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BOSTON SUBWAY LEASES SIGNED.—Leases covering the use of all subways and tunnels for electric railway service now existing in Boston were signed on Dec. 7 by President William A. Bancroft, of the Boston Elevated Railway Company, and by members of the Boston Transit Commission for the city of Boston. The leases also covered the use of the proposed Dorchester tunnel, Boylston Street subway, East Boston tunnel extension and the Cambridge connecting tunnel, as well as the Tremont Street subway and the East Boston and Washington Street tunnels now in operation. By the terms of the instruments, which are seven in number and which cover sixty-nine pages of printed matter when bound in a single volume, all the foregoing subways and tunnels are leased until 1936. At that time the termination is conditioned upon a two years' notice by either party. The rental to be paid by the company in every case is 4½ per cent of the net cost of construction, payable quarterly. After June 10, 1922, the company will be discharged from the obligation of collecting tolls for the city in its use of the East Boston tunnel. The leases were signed as a result of the agreement of the parties following an act of the last Legislature. Unless a pending suit by minority interests of the West End Street Railway Company to determine the constitutionality of the act authorizing the consolidation of the West End and Boston Elevated companies results in a finding against the act, there is nothing further to prevent the construction of the new tunnels and subways above mentioned by the Boston Transit Commission.

City Electrician Free of Political Influence.—By a provision of the new charter of Pueblo, Col., applying to the commission form of government, the position of city electrician is made permanent, except for cause. This is the second city of the Rocky Mountain regions to take inspection work out of politics, and as both Colorado Springs and Pueblo have unusually efficient electricians the progress toward permanency and safety in all new construction is very rapid.

* * *

A Fireproof Coal Pile.—Two central-station men were discussing the fuel value, or rather the lack of it, in a certain coal which one had been trying under his boilers. "On the day of judgment," he finally remarked to the other in accents of conviction, "when the fire-bells begin to ring and the whole world lights up with red flames, according to prophecy, you can just watch me scramble up on to that pile of Rhode Island coal, for I know that will be the last thing on earth to burn!"

* * *

Missionary Work by Wireless Telegraphy.—In a recent address at Northampton, Mass., Dr. Wilfred T. Grenfell, the well-known Labrador medical missionary, emphasized the value of wireless telegraphy as a means of communicating instructions from the hospital boat to persons ill or suffering from accidents at sea who are beyond the reach of contact treatment. Dr. Grenfell intimated that by this method the sphere of usefulness of the Labrador Deep-Sea Mission has been greatly increased within the past few years.

* * *

Boston Electric Vehicle Club Banquet.—Invitations are being mailed for a banquet to be given by the Electric Vehicle Club of Boston at the Boston City Club on Dec. 19 at 6 p. m. The speaker of the evening will be Mr. Hayden Eames, of Cleveland, Ohio, his subject being "The Motor Vehicle for City and State." A representative attendance of prominent city and state officials is expected, and a special effort will be made to bring home in a new and striking manner the fitness of electric pleasure and commercial vehicles for service in large cities.

* * *

Wireless Regulation.—The case of the United States against the steamer *Templemore,* of the Johnson line, charged with the violation of the new federal wireless law, is now pending in the United States District Court of Baltimore. The *Templemore* took a large number of Republican politicians across to England and Ireland some months ago and was not provided with wireless apparatus. The law says that any steamer carrying more than fifty passengers and sailing more than 200 miles from the coast shall be provided with a wireless outfit. One of the points which the defense is expected to raise is that the politicians were not passengers at all, but were members of the crew, with special duties. One of them, for instance, was the official rocket-shooter. He fired one rocket during the trip, it is declared, this being off the Irish coast. United States District Attorney John Philip Hill, with one of his assistants, will conduct the case for the government. Special interest attaches to this trial, as it is the first prosecution under the new law.

* * *

Electrical League of Cleveland.—The Electrical League of Cleveland held its third annual meeting and smoker at the Moose Club Hall on Thursday evening, Dec. 7. The earlier part of the evening was devoted to the election of officers for the coming year, as follows: Mr. David Aitken, president; Mr. J. Robert Crouse, first vice-president; Mr. L. Greisser, second vice-president; Mr. N. C. Cotabish, third vice-president; Mr. Peter Yensen, fourth vice-president; Mr. T. P. Cagwin, secretary; Messrs. H. H. Cudmore, A. L. Oppenheimer, G. C. Webster and C. T. McKinstry, executive board. A large delegation from the Electrical Boosters' Club of Pittsburgh was cordially welcomed by the members of the Cleveland League. Among the speakers of the evening who made brief addresses were Mr. A. A. Gray, of Chicago; Mr. Harris and Mr. Harrison, of Pittsburgh, and Mr. J. Robert Crouse. The entertainment features consisted of orchestra, glee club and mandolin music, vaudeville productions, boxing exhibitions, plenty of good cigars and an ample Dutch lunch. The smoker was characterized by a feeling of good fellowship and informality on the part of all present.

* * *

Scholarships for Throop Polytechnic Institute.—A friend of Throop Polytechnic Institute, of Pasadena, Cal., has established two scholarship awards to be known as the senior and freshman scholarship prizes respectively. The former consists in ample provision for a trip to Europe, and will be awarded on each commencement day to that member of the graduating class who has the best record in scholarship for the junior and senior years, the faculty taking also into account in assigning the award considerations of deportment or good manners and ability for original work. This prize is $750 cash. The freshman scholarship prize consists in full provision for a journey through some of the principal cities of the Eastern United States over a route recommended by the faculty, and will be awarded on each commencement day to that member of the freshman class who has the best scholarship record for the year, good manners and the quality of initiative being also taken into account. This prize is $250 cash. The faculty may in some instances permit this prize to be used for other purposes than travel, but reserves the right to indicate the mode of its use in case of any such exception.

* * *

Snowstorms and the Commercial Motor Wagon.—What leading merchants think of mechanical transportation is revealed in large display announcements that have appeared recently in daily and Sunday newspapers. In New York, for example, following the snowstorm of Monday, Dec. 4, John Wanamaker ran a 324-line advertisement headed "The Delivery System That Stood the Test of the First Blizzard." In this announcement the store called attention to the fact that in the face of the storm all deliveries went out on schedule from its distributing stations to such remote points as Stamford, Conn.; Greenpoint, L. I.; Plainfield, Morristown and Englewood, N. J. This extraordinary feat was accomplished with a fleet of fifty-eight motor vehicles, including ten large trucks that carried the packages in bulk to the suburban stations, whence they were distributed. Gimbel Brothers used one-third of their advertising space in Thursday's papers to announce that, so far as they know, their New York store is the only big store in the world that delivers its goods exclusively by motor vehicles, and that "no blizzard can stop Santa Claus when he starts from Gimbel's." The announcement stated that the delivery equipment includes seventy-five electric wagons, thirty gasoline wagons and thirty gasoline and electric trucks. With the opening of its large new department store in New York, Kesner's announced in a large display "Our specialty is service," and made the promise that its up-to-date motor delivery service would take care of every order promptly even if the second day should prove bigger than the opening day. Regarding the reliability of the motor truck for delivery work, Stanley Field, of Marshall Field & Company, in Chicago, said recently: "All the year around, winter and summer, the truck bucks the road and carries our goods into far and out-of-the-way places. It would be impossible to ship to these places by horses. We used to try, but the labor was too wearing on the animals and there was a loss with each journey. So we gave it up and used the railroad until the motor truck came."

ELECTRIFICATION OF A LOUISIANA RAILROAD.—It is announced that the Louisiana Southern Railroad, which with an extension now under construction will be 75 miles long, will be electrically operated. The road extends from New Orleans and serves a populous district.

* * *

ELECTRIC HOLIDAY CELEBRATION IN MUNCIE, IND.—The business men of Muncie (Ind.) have contributed a substantial sum to be used for an "electric holiday celebration." Special decorative street lighting will be erected along twenty-two blocks of city streets, and other electrical attractions will add to the effectiveness of the display.

* * *

CENTRAL-STATION LUNCHEON TO EMPLOYEES.—A luncheon was given last week by the Consolidated Gas, Electric Light & Power Company, of Baltimore, to the employees of its electric division at 30 South Eutaw Street, one of the company's buildings. Upward of 600 men were present. The purpose of the meeting was to afford an opportunity for the employees of the company to become better acquainted. There were informal talks by Mr. Herbert A. Wagner, vice-president of the company; Mr. Douglass Burnett, commercial manager of the electric division, and Mr. R. H. Tillman, industrial power engineer. A buffet supper was served and an orchestra played.

* * *

TABLES OF SCIENTIFIC DATA.—The first volume of the "Annual Tables of Constants and Numerical Data: Chemical, Physical and Technological," compiled and published by an international commission appointed by the Seventh International Congress of Applied Chemistry, is now open to subscription. Subscription blanks, the terms of subscription and descriptive leaflets may be obtained from any one of the three American commissioners—Dr. G. N. Lewis, Massachusetts Institute of Technology, Boston, Mass.; Prof. G. F. Hull, Dartmouth College, Hanover, N. H., and Prof. J. Stieglitz, University of Chicago, Chicago, Ill. After Jan. 15, 1912, the price of the volume is likely to be increased.

* * *

CENTRAL-STATION MEN AS FIRE FIGHTERS.—A correspondent calls attention to the omission from the abstract in our issue of Nov. 4 of the report of the investigation of fire in the generating station of the St. Croix Power Company at Apple River Falls, Wis., of that part relating to the rôle played in saving the station by the superintendent and station employees of the St. Croix company. He adds that there is no record of a finer piece of work, considering the extinguishing agents available, performed even by men trained in the art of fighting fires. "Not one crew in a thousand would have successfully carried out, or even seriously attempted, the work of extinguishing a fire located out of reach and of the proportions the one in question had gained when discovered. The successful accomplishment of this huge task should be an encouragement to other station men when confronted by a similar problem. There are thousands of power houses as inadequately protected from fire dangers as the one at Apple River Falls, and power-house owners should appreciate the importance of selecting intelligent men as operatives and of bringing about suitable recognition of the services of these operatives when a duty has been faithfully and intelligently performed."

* * *

OVER 10,000 N. E. L. A. MEMBERS.—At the meeting of the executive committee of the National Electric Light Association on Dec. 7 it was announced that the membership had reached 10,000 and was, in fact, very nearly 10,150. The news was received with much pleasure by the officers as indicating how rapidly the body is moving forward in execution of its program for the complete organization of the industry. Up to July, 1909, the membership of the association was still below 3000, but the last two years have been periods of unprecedented expansion, and there are many indications that the end is by no means yet. In his presidential address this year Mr. Freeman estimated that a few years hence the association might well have a membership of 25,000, while Mr. Samuel Insull, with wonted boldness, ventured upon the prediction that in view of the tremendous strides the central-station industry was making, the membership should within a period of perhaps ten years attain a figure of not less than 40,000. The official headquarters in the Engineering Societies Building are undergoing corresponding expansion, four additional rooms having been taken within the past three months, so that the space occupied by the association is virtually as great as that occupied by any one of the three founder societies.

* * *

ELECTRIC LIGHT POLARITY.—In a broadsheet sent out by the "Cross Publishing House," Nuevitas, Cuba, as one of a series expounding "The Gospel That Blesses All the Families of the Earth," the writer employs an electrical analogy to support a conclusion that "In the autumn of 1912 shall begin to be visited the antitype of the slaying of the firstborn." The title of the tract is "Concerning the Laws That Govern All Things," and it opens with an account of the electrician turning on the current, and how the light "unostentatiously and noiselessly crept into the bulbs and chased away the darkness." But, it is added, if "you follow the wires down to the power house, and as the whir and grinding of the high-speeded machinery strike upon your ear you begin to think that, after all, it takes a great deal of noise and friction to produce the velvety-slippered light, the electrician will tell you that there are two poles to this subtle light-current, positive and negative. He will tell you that the first-mentioned pole is the superior, is energizing and sweet, and that the negative is secondary, enervating and acid. If you should ask him which pole goes to the upper carbon of the scintillating arc light, he would inform you that it must be the positive, and that the negative must go below." The writer then proceeds to discuss whether "knowledge, as in the case of the light, is also produced by a terrible grinding and friction, and has what correspond to the positive and negative poles of the electric current."

* * *

LARGE CENTRAL-STATION STORAGE-BATTERY PLANT.—The installation of a storage battery weighing more than 600 tons and said to be the largest in the world was completed last week at the McClellan Alley substation of the Consolidated Gas, Electric Light & Power Company of Baltimore. This battery plant will eliminate the inconvenience of shutdowns, such as followed an accident some time ago at the McCall's Ferry station, when the whole lighting and power service throughout the city of Baltimore was discontinued for about six minutes. At the formal opening of the plant a buffet luncheon was given by officials of the electric company to several hundred guests. The Consolidated Gas, Electric Light & Power Company has an ample power supply for years to come from the large generating stations at Westport and McCall's Ferry, either of which alone is now perfectly capable of handling the city's need and both of which are kept in operation day and night. The battery, while constantly connected with the lines of the company, will not come into play unless both of the generating stations are disabled at the same time, when it will automatically pick up the "load" and sustain it without interruption to the service. The battery cost over $400,000, including installation, and it took fifty-one freight cars to transport the parts from Philadelphia to Baltimore. There are 20,216 lead plates weighing 303 tons contained in tanks weighing 72 tons, while 138 tons of acid, 18 tons of glass plate, 6 tons of switches and 9 tons of porcelain insulators were used. Other equipment includes heavy switchboards, 14 tons of copper connections and the charging machinery.

Electric Vehicle Association of America.—At the meeting of the Electric Vehicle Association of America to be held in the Engineering Societies Building, New York, Dec. 19, Mr. S. G. Thompson, of the Public Service Electric Company, Newark, N. J., will present a paper entitled "Is Central-Station Activity Justified in the Electric-Vehicle Field?"

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[illegible] in Philadelphia.—The Philadelphia Section of the Sons of Jove gave a theater party on the evening of Dec. 8. About 700 Jovians, with their wives and sweethearts, attended the Chestnut Street Opera House to witness the performance of Miss Lula Glaser in her latest success, "Miss Dudelsack." Quite a number of the New York Jovians journeyed to Philadelphia on this occasion, and the theater was appropriately decorated. After the theater an adjournment was made to the Bingham House for supper, during which speeches, songs, etc., were in order. The success of the entire undertaking was mainly due to Mr. Washington Devereux, and is in line with several features that he has inaugurated in Philadelphia in order to create and maintain an interest in the Sons of Jove.

* * *

New York Companies' N. E. L. A. Section.—The New York Companies' Section of the National Electric Light Association will hold its tenth regular meeting on Monday evening, Dec. 18, in the Edison Auditorium, 44 West Twenty-seventh Street. At the meeting Mr. Frederick Kurz, of the New York Telephone Company, will deliver an illustrated lecture on "The Telephone Girl," and Mr. M. S. Seelman, Jr., advertising manager of the Edison Electric Illuminating Company of Brooklyn, will speak on the subject "How to Promote Company Sections." The paper presented by Mr. George A. Saunders, of the Westchester Lighting Company, at the last meeting of the section on the "Relation of the Employee to the Employer and to the Public" will be discussed. The usual entertainment and refreshments will be provided by the entertainment committee.

* * *

Cahill Electrical Music at a New York Banquet.—During a banquet given last week at the Hotel Astor by the "Athletics" baseball club to the Baseball Writers' Association of America the New York Cahill Telharmonic Company provided entertainment in the form of music produced on the improved telharmonium, now called the "electrophone." This instrument, which is located at 535 West Fifty-sixth Street, was operated by two musicians who were in constant telephonic communication with the musical director at the Hotel Astor, 2 miles distant, as measured over the electrophonic circuits. So intimate was the intercommunication that the electrophone was used to accompany a soloist at the banquet. The electrophonic entertainment, which was highly successful, represented the first public performance of the improved instrument, which was described in our issue dated April 28, 1910.

* * *

The Panama Trip of the Institute.—Mr. S. D. Sprong, chairman of the committee on the Panama trip of the American Institute of Electrical Engineers, announces that it has been decided definitely that the trip to the Isthmus of Panama shall be undertaken. The New York party will leave that city on Jan. 17, at noon, arriving at Colon on Jan. 25 and returning to New York on Feb. 8. The New Orleans party is scheduled to leave that city on Jan. 20, at 11 a. m., arriving at Colon on Jan. 25 and returning to New Orleans on Feb. 6. The rates for the New York trip range from $125 to $210.50 and for the New Orleans party from $95 to $142.50. This includes meals and berth on shipboard, but not accommodations at Panama. Remittances for accommodations should be made payable to Mr. F. L. Hutchinson, acting secretary of the Institute, 29 West Thirty-ninth Street, New York.

* * *

Western Association of Electrical Inspectors.—The seventh annual meeting of the Western Association of Electrical Inspectors will be held Jan. 23, 1912, at the Plankington House, Milwaukee, Wis. The meetings will include an experience session, and reports of committees will be presented on grounding secondaries, public safety, theater wiring, show-window and display wiring, and pole-line construction. Among the papers will be one by Mr. W. J. Canada on "Grounding of Conductors and Conduit"; one by Mr. W. G. Middleton on "Electrolysis," and one by Mr. H. B. Long on "Lightning Protection of Buildings." Meetings were formerly held in October, but are to be in January in future to avoid conflict with other conventions and meetings. A special car will run out of Chicago to Milwaukee on Jan. 22 at 6:30 p. m. on the Chicago, Milwaukee & St. Paul, to accommodate delegates. Mr. W. S. Boyd, 76 West Monroe Street, Chicago, is secretary.

* * *

Concrete Work on Keokuk Dam to Proceed Throughout Winter.—The work of placing concrete on the great water-power dam and generating plant in the Mississippi River at Keokuk, Ia., will go on uninterrupted during the winter months. Machinery has been housed, water pipes have been covered, and arrangements have been made for heating the sand and water used in the concrete mixture. The power house and locks on the Iowa side, as already explained, are being constructed behind the protection afforded by a cofferdam wall. In spite of the unusual flood height of the river this fall, no delay has been experienced from this cofferdam. Work on the dam proper, stretching out from the Illinois side, has, however, been temporarily interrupted by high water; but, as this construction will take less time to complete than that of the power house and locks, the final date of completion will not be affected. Up to Oct. 17, when water overflowed the Illinois cofferdam, 69 of the 119 arches had been completed, the glistening white line of the 36-ft. concrete arches now extending more than half-way across the bed of the river.

* * *

National District Heating Association.—As previously reported in these columns, the coming annual convention of the National District Heating Association will be held in Detroit, Mich., on June 25-27, 1912. The program for the convention will include papers on the following subjects: Depreciation in underground distribution systems; operation of turbines and reciprocating engines in connection with steam-heating work; combined steam-heating, ice-making and electric-power system; radiation tests; heat losses in steam distributing systems; a large hot-water-heating system; quality of steam supply as affected by superheating; decentralized heating plants; relative economies of the one-pipe and two-pipe heating systems; common sources of trouble in customers' installations; thermodynamic economy of combined power and heating systems; different systems of underground construction. The headquarters of the convention will be at the Cadillac Hotel. The accompanying manufacturers' exhibition will be in charge of the association. The membership of the association has increased from 32, two years ago, to 182, and an effort is being made to reach the 250 mark within the next six months. Mr. D. L. Gaskill, Greenville, Ohio, is secretary.

DELRAY STATION OF DETROIT EDISON COMPANY.

Plant Includes Largest Boilers Yet Made, Capable of Supplying Turbine Loads Up to 11,000 kw.

High Economies in Steam Generation—Combined Hot-Well and Boiler-Feed Pumps—Special Steam Valves—Ventilation of 14,000-kw Turbo-Generators from Engine-Room Combination of Oil and Water Step-Bearing Pressure Systems—Stations Designed for Continuous-Load and Peak-Load Operation.

FOUR miles southwest of the business center of Detroit, on the shore of the splendid river connecting Lakes St. Clair and Erie—a stream which, by the way, carries the largest tonnage of water-borne traffic in the world—are located the great Delray power houses of the Detroit Edison Company, now totaling 75,000 kw in maximum turbine rating. Besides the unusual, distant location of this plant as originally dictated by the expected sale of exhaust steam to salt mines near by, the Delray stations embody many interesting and novel departures from ordinary plant practice, the most remarkable of which is the pioneer use here of huge nominal-2365-hp boiler units, from which steam demands as high as 11,000 kw per boiler have been taken. The extraordinary efficiencies shown by these great boilers in performance and test make it probable that the way thus blazed by the Detroit company will be the future line of plant development elsewhere, bringing the belated progress of boiler sizes more nearly abreast with the steam units of to-day.

Fig. 1—Generating Station of Detroit Edison Company at Delray, Showing Coal-Storage Yards.

THE TWIN STATIONS AND THEIR OUTPUT.

The Delray plant at present comprises the No. 1 station, built in 1904 and now containing two 9000-kw and three 3000-kw turbo-generators, and the newer No. 2 station, completed in 1908 and designed for four 14,000-kw turbines, three of which are already in service. The boiler-room containing the huge 2365-hp boiler units forms part of the No. 2 plant.

The principal output of the Delray plant is served to the customers of the Edison Illuminating Company in Detroit, including a large connected industrial motor load. The station also supplies the suburban district of the Eastern Michigan Edison Company which centers about Detroit within a radius of 30 miles, with one 50-mile transmission to Memphis, Mich. About one-fifth of the total generated output of the Detroit central-station system is absorbed by the Detroit United Railways to operate their street cars in outlying districts of the city. The electrified Detroit River tunnel of the Michigan Central Railroad is also operated by central-station energy from the plant to be described.

Under the present conditions of operation the No. 1 station is essentially the continuous-load plant, showing a nearly flat economy curve over a wide range of loading. The boilers in this section are to this end equipped with economizers to further its high-efficiency performance under various loads. The No. 2 plant with its 14,000-kw turbines and large boilers is, on the other hand, the peak-load station and is operated at its maximum capacity only during the hours of heaviest demand. The 14,000-kw turbines show their highest efficiency in the region of 8000-kw load, decreasing slightly with accession of load up to their maximum rating. A similar economy relation is shown by the big boilers, as the accompanying efficiency curve (Fig. 8) illustrates. These huge boiler units have their highest efficiency at about their rated load on a basis of 10 sq. ft. per hp, falling off about 5 per cent in economy at 210 per cent load.

ERECTION OF FIRST PLANT, WITH 511-HP BOILERS.

The country about Delray and Detroit is underlaid by a thick stratum of salt. Steam is required for evaporating the brine as pumped up from these depths, and the original design of the first Delray station included a surplus of boiler capacity in order that the four 3000-kw Curtis turbine sets might operate non-condensing, disposing of the exhaust steam to the salt refiners. Twenty-four 511-hp Stirling water-tube boilers were therefore installed, set in four batteries of six each. Each boiler contains 308 3¼-in. tubes, giving 4834 sq. ft. of heating surface. The second bank of tubes forms the superheater, with an area of 1500 sq. ft. and superheating to 600 deg. Fahr., or 200 deg. above the normal temperature of the steam at 210 lb. per sq. in. These boilers are equipped with Roney stokers, 104 sq. ft. of grate surface to the unit.

The outside groups of six boilers are served by two 132-ft. steel stacks, 11 ft. in diameter, and the inside double row by a 16-ft. stack of the same height. Induced draft for each battery of boilers is furnished by a 15-ft. fan,

engine-driven, the flues being so cross-connected as to [illegible] shutting down of any [illegible] as required. A shaft rigging is now being arranged for simultaneously controlling the valves of all four fan engines from a single governor, which will act to improve the speed regulation considerably.

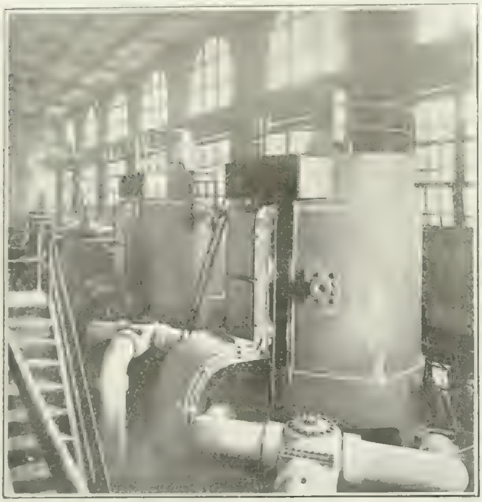


Fig. 2—[illegible]000-kw and 3000-kw Turbo-Generators in No. 1 Station.

As originally erected, the furnaces of these boilers in the No. 1 Delray station were each divided by a median wall 13½ in. in thickness, supporting the sprung masonry arches. These center walls have given some trouble, limiting the life of the ventilated arches to eighteen months or less. The experiment has accordingly been successfully tried of throwing together the stokers and two parts of the furnaces, replacing the two sprung arches by a single flat suspended arch, and so gaining all the advantages of a single large fire instead of two small ones. All of the boilers in this room will be similarly equipped with flat suspended arches, removing the center walls.

TURBINE EQUIPMENT IN NO. 1 STATION.

The first four turbo-alternators in the original Delray plant were 3000-kw, 4600-volt, 60-cycle, three-phase General Electric machines running condensing at 600 r.p.m. The plan for the evaporation of salt was never carried out, for the Edison company meanwhile found it convenient to meet its growing load by installing an additional 3000-kw turbine, without the necessity of adding any more boilers. The first four machines had a maximum rating of 4500 kw and the fifth exceeded this by 500 kw. Similarly the original four were equipped with water bearings using 1000 lb. per sq. in. pressure, and the fifth with oil step bearings at 800 lb. pressure. The installation of a separate accumulator when the new oil-bearing turbine was installed was avoided by arranging an 8-in. piston on the oil-pressure system, opposed by a 7-in. piston on the water system, so that the pressure adjustments of the water-borne accumulator are transmitted through to the oil bearing and are equally effective there.

The first four 3000-kw machines, installed in 1904, are now being replaced by 9000-kw alternators of similar type with a maximum rating of 11,000 kw each. Two of these larger units are now in place, as shown in Fig. 2. Each exhausts into a Worthington 16,000-sq. ft. surface condenser mounted as its base. The earlier 3000-kw units antedated the base type of construction, and therefore have their condensers installed in a condenser house adjoining the main turbine-room. The circulating pumps of the 9000-kw condensers are of the Worthington tri-rotor centrifugal type, having a capacity of 17,000 gal. per minute as driven at 720 r.p.m. by their 150-hp induction motors.

Circulating water for the condensing units in both plants is received through a screen house paralleling the main turbine-room. This screen house also contains the 75-hp, 18-in. centrifugal pumps for the 3000-kw units. The intake is through an entry canal extending out through the filled land in front of the power house and protected against floating ice at its outer end by a concrete sea-wall. Besides the outer fenders at this point for removing large debris, the water traverses sets of double screens in the screen house. These are so arranged that one can be hauled up by the screen-house motor crane and cleaned while the other remains in service. The screen house also contains the house service and fire pumps and an air compressor. A water-purification plant is later to be installed for the treatment of the boiler-feed water.

FEATURES OF NEW TURBINE AUXILIARY EQUIPMENT.

All of the auxiliaries of the new 9000-kw units are motor-driven, provision being made for bleeding steam from the second stage of the main turbine units for heating the feed water. Besides the compactness of such motor-operated auxiliaries, this arrangement, it is declared, results in a thermal efficiency at least equivalent to that with steam-driven auxiliaries, as in the case of the 14,000-kw units in Station No. 2.

Of special interest in connection with the new 9000-kw sets are the motor-driven, four-stage centrifugal pumps which combine the functions of both hot-well and boiler-feed pumps. At a single step these pumps thus take the condensate from the hot wells, send it through the closed

Fig. 3—Front of One of the 2365-hp Double-Fired Boilers.

feed-water heaters, and deliver it directly into the boilers through the economizers. While open-type feed-water heaters are used elsewhere in the plant, the closed heaters were rendered possible in the case of these combination pumps since the water handled, as condensed from the turbines, is pure and free from oil.

7,000 KW TO 11,000 KW FROM A SINGLE BOILER.

Principal interest in the Delray station surrounds, of course, the huge double-fired Stirling boilers, which have a rated capacity of 2365 hp on the basis of 10 sq. ft. of heating surface per hp. The normal output of each unit is, however, 7000 kw in regular service, and they have been drawn upon for 11,000 kw during short periods. Five of these huge boilers are now erected, the last two nearing

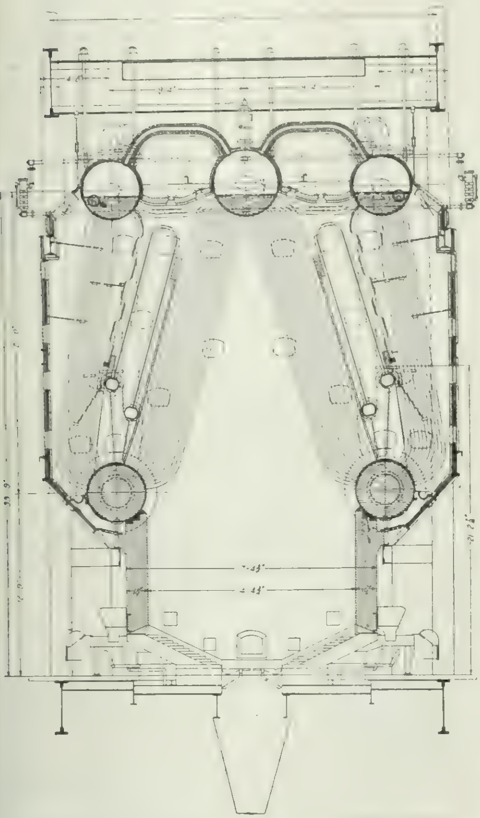


Fig. 4—Section of Boiler Fitted with Underfeed Stoker.

completion ready to operate, while the first three have been in service for periods ranging up to two years. The present boiler-room is now being duplicated on the west, where five 2365-hp units will be similarly installed in two rows, of three and an open pair respectively, giving a cross-aisle between the two rooms.

Following are the dimensions of these prodigious units: Width, 31 ft.; height, 36 ft.; depth, 28 ft.

Total surface, 23,654 sq. ft.

Fifteen hundred and sixty-four 3¼-in. hot-drawn seamless tubes.

One 54-in. steam drum; two 48-in. steam drums; two 48-in. mud drums.

The boilers are fired from both ends, three being equipped with Roney stokers and two with Taylor underfeed stokers. The Roney stokers have 453 sq. ft. of grate surface, giving a ratio of 52 to 1 in heating to grate surface. The Taylor stokers have a nominal area of 300 sq. ft. with a heating-grate ratio of 79 to 1. The boilers

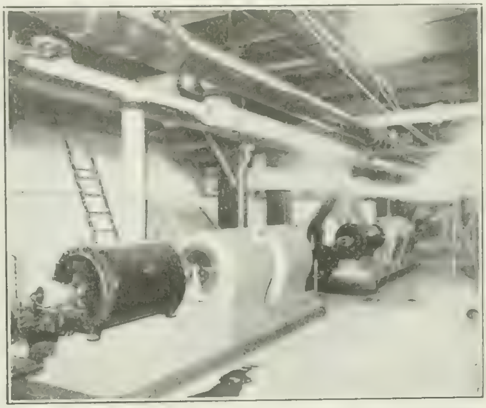


Fig. 5—Turbine-Driven Blowers in Basement for Underfeed-Stoked Boilers.

produce steam at 205 lb. pressure, superheated to 150 deg. Fahr. by traversing superheater coils mounted between the boiler tubes proper, as shown in Fig. 4. There are four water columns to each boiler, and each of the 54-in. steam drums is provided with eight 4½-in. safety valves, besides four 3-in. safety valves on the superheaters.

Forced draft is supplied to the two boilers equipped with the Taylor stokers by three double Sirocco blower sets exhausting into a common chamber. These blowers, which

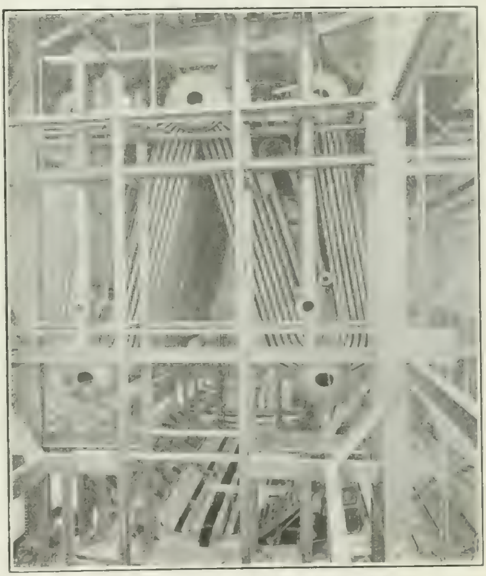


Fig. 6—2365-hp Boiler with Rocking-Grate Stokers, During Erection.

are mounted on the ash-basement level (Fig. 5), are driven in pairs by 175-hp Kerr steam turbines, running at 1710 r.p.m. and exhausting into the feed-water heaters.

The ashes from the boilers are discharged from hoppers

[illegible] track in the basement. A small storage-battery electric "goat," constructed with the same wheel-base as the cars so as to take the short-radius curves, pushes the loaded ash cars out of the building, where they are taken in tow by a large electric locomotive capable of handling a train load and drawn to the dumping ground.

ADVANTAGES AND RESULTS OF LARGE BOILERS.

The idea of boiler units for Delray far exceeding in size that of the standard ratings was first suggested by Mr. Alex. Dow, general manager of the Detroit Edison company. The construction of the huge boilers was undertaken by the Babcock & Wilcox Company, the adaptation of the mechanical stokers and furnace construction being in charge of Westinghouse, Church, Kerr & Company, engineers for the station.

One of the 2365-hp boilers is equivalent to a whole battery of the smaller units in the older room, so that the operation of the large boilers brings all this steaming capacity under the closest supervision of the fireman, who can thus devote all his attention to regulating the single large fire. In answer to whatever objections may be raised to carrying such a huge steaming capacity in a single unit, it is pointed out that turbine sizes have long far exceeded even this boiler rating. The cube-square law of radiation, which works against the ventilation of the larger sizes of turbines without forced draft, acts to improve the efficiency of large boilers, for while their capacity increases with their cubical contents the radiation losses vary only with the square of their linear dimensions. Besides the increased efficiency of such large boilers, their first cost per hp of rating is less, they occupy smaller area per unit of output, and greatly simplify the number of pieces and arrangement of apparatus required in the boiler-room.

The repairs and maintenance of the large units have not exceeded the usual cost per hp with smaller sizes. Tube trouble has been practically negligible, as was expected from the experience already obtained with the smaller units in the No. 1 plant. The brickwork troubles anticipated have now been almost wholly overcome. The wall under the mud drum of one of the Taylor-stoked boilers, now in use thirteen months, became deflected inward after about nine months' service, and required straightening, but this has now been anchored and should be good for an indefinite period of time.

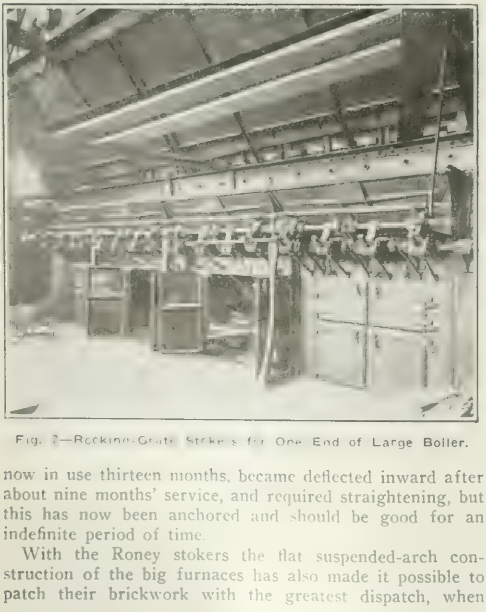


Fig. 7—Rocking-Grate Stokers for One End of Large Boiler.

With the Roney stokers the flat suspended-arch construction of the big furnaces has also made it possible to patch their brickwork with the greatest dispatch, when such repairs become necessary, at intervals of about three months. In fact, when required, a boiler in service on one peak load has been shut down, repaired, and put back in service for the peak of the following day.

ECONOMY TESTS OF DELRAY BOILERS.

Recently a series of tests on two of the 2365-hp Delray units was carried out under the direction of Dr. D. S. Jacobus, and this forms the subject of a paper presented by him Dec. 6 at the annual meeting of the American Society of Mechanical Engineers, reported in the *Electrical World* of last week. One boiler equipped with Roney stokers and one with Taylor stokers were studied, the test requiring the services of fifty men working in eight-hour shifts for six weeks. During this time 5000 tons of coal and 45,000 tons of water were measured.

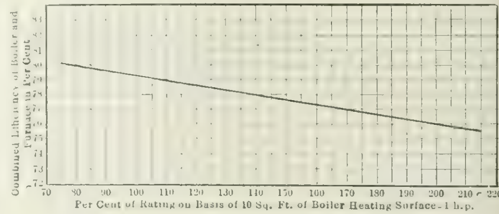


Fig. 8—Results of Tests of Large Boilers.

The results obtained from Dr. Jacobus' tests show that with both classes of stokers the combined efficiency of both boiler and furnace ranges from 80 per cent at slightly below nominal rating to about 76 per cent at double rating. His data and observations are given in full in the current *Journal* of the A. S. M. E.

As already noted, the turbines driving the blowers for the Taylor stokers exhaust back into the feed-water heaters, the steam used for this purpose (which is reclaimed) amounting to 2½ to 3 per cent. The Roney stokers require about 1½ per cent of the total steam generated by the boilers, and except for about one-fifth of 1 per cent, which is similarly reclaimable from the stoker engine, the remainder is used in the form of jets under the grates and is therefore lost in the chimney products.

Each row of two or three large boilers is provided with a steel stack, 18 ft. in diameter and 250 ft. above the grates, these stacks being lined with common brick backed by concrete.

As has been stated, the large Delray boilers normally carry loads of 6000 kw, increasing this to 8000 kw during the evening peaks, while for short periods 11,000 kw has been easily handled per unit. The steam demand on each boiler is indicated in the fire-room by a manometer U-tube, filled with mercury, the arms of which bridge the superheater coils. On account of their restricted area, these coils act as a Venturi tube in the steam line, the output of the boilers being thus indicated directly on the manometer scale.

NO. 2 STATION AND ELECTRICAL EQUIPMENT

In next week's issue of the *Electrical World* the description of the Delray station will be completed with an account of the new No. 2 engine-room containing three 14,000-kw steam turbines. These units are ventilated directly from the engine-room, reversing the usual practice of leading in outside air through ducts. The special English type of steam valves used at Delray will also be of interest to American plant engineers. In these valves, which are constricted in gate area to one-quarter the normal cross-section, steam velocities of 10 miles per second are reached. An illustrated account of the electrical switching equipment, bus arrangement and distributing system will also be appended.

THE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY—IV.

Nunn and Olmsted Water-Power Stations of the Utah System—Future Development Involving Fall of 1725 ft., Producing 75,000 hp.

IN previous articles have been described the Colorado system of the Telluride Power Company, the general outline of the Utah system and some of its generating plants in detail. In the following other stations of this system are described:

NUNN'S STATION.

Although not an active part of the present system, the so-called Nunn's station of the company, near Provo, deserves brief mention. This installation has the distinction of being the first plant to be constructed by the Utah Department, work having been begun upon it in 1897. The station is located in Provo Canyon, about half way between the present Olmsted plant and the headworks of the latter. The station building, a stone structure 48 ft. x 65 ft., with two 20-ft. x 20-ft. wings, contains two 1000-hp Leffel reaction turbines, each connected through a flexible coupling to a 750-kw, 800-volt General Electric three-phase generator. Two 25-kw exciters are also provided, one being belt-driven and the other turbine-operated. The plant is connected with the flume of the Olmsted station by two 48-in. penstocks, the static head on the installation being about 123 ft. On account of the superior development later made at Olmsted the Nunn's station is no longer used, but at any time when it is required it can be again placed in service, provided the flume in the upper portion of the Olmsted headworks is enlarged.

OLMSTED STATION.

This plant, located about 6 miles above Provo, and at the outlet of Provo Canyon, adjacent to the headquarters offices of the company, has a rating of 7200 kw and takes water from a diversion of the river about 4.5 miles above through a 6-ft. x 8-ft. wooden flume leading downward from an intake at a rock-filled, timber-crib dam, 16 ft. high, 125 ft. long and having a 77-ft. spillway. The intake is of timber, tapering from its head to its tail end, with a mean section of about 6 ft. x 10 ft. Two lift gates are provided to control the flow. The last 1015 ft. of the flow line consists of tunnel through the rocky side of the mountain, and at the point where the tunnel begins an overflow has been installed to handle excess water in the flume. The flume terminates above the plant in a pressure box approximately 15 ft. x 28 ft. x 36 ft. in dimensions, the box being housed in and equipped with screens and wire-operated gates, controlling the influx of water into the penstocks. The pressure box is about 320 ft. above the power house, and is connected with the latter by three 874-ft. riveted steel penstocks, tapering in diameter from 5 ft. at the top to 4 ft. at the bottom. At the lower end the penstocks turn slightly to the left and enter the station at the level of the operating-room floor. The plant is housed in a brick building of 62 ft. x 85 ft. inside dimensions, concrete foundations being used. Draft tubes and discharge tunnels are also of concrete.

Fig. 29—Interior of Nunn's Station.

Fig. 28—View of Olmsted.

GENERATING UNITS.

Three Allis-Chalmers turbines are installed, each being of the inward-flow reaction type, with spiral casing and single horizontal runners. Each is capable of delivering 3600 hp when operating at a speed of 300 r.p.m. under a head of 330 ft., with a discharge of 117 cu. ft. per second. Lombard governors, operated by oil pressure supplied by a motor-driven pump, control the flow of water to each turbine, the turbine gates being of the swivel type. With the exception of a thrust bearing, no separate support is provided for the turbine shaft, the turbine runner being carried on the end of the generator shaft. Directly connected to each turbine on a horizontal shaft is a 2400-kw, 2300-volt, three-phase, 60-cycle General Electric revolving-field alternator. There are two 75-kw exciters in the plant, operated in each case at 270 r.p.m. by directly connected Pelton waterwheels rated at 100 hp. For the exciter service a 12-in. separate steel penstock is installed between the pressure box and the station, two 8-in. pipes branching from this to the small turbines at the bottom of the line. Lombard governors are provided for the latter units.

Fig. 30—Generating Units at Olmsted Station.

An eight-panel switchboard is installed in the center of the operating room in front of the generating units. It contains three generator panels, three panels for transformer bank and outgoing-line control, two Tirrill regulator panels and one exciter panel. The generator leads

are run along the ceiling of the basement to hand-operated, non-automatic oil switches beneath the switchboard. The arrangement provides for connecting any generator to a bank of corresponding transformers or the multiple opera-

Fig. 31—Olmsted Dam.

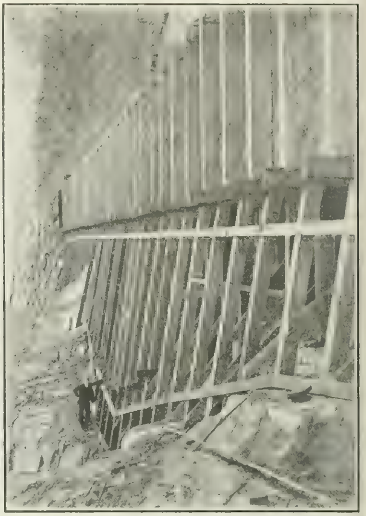


Fig. 33—Olmsted Flume.

tion of the generators upon a common bus. Energy for the city of Provo is taken from the 2300-volt bus and transmitted to the city over a 5000-volt line owned by the Provo

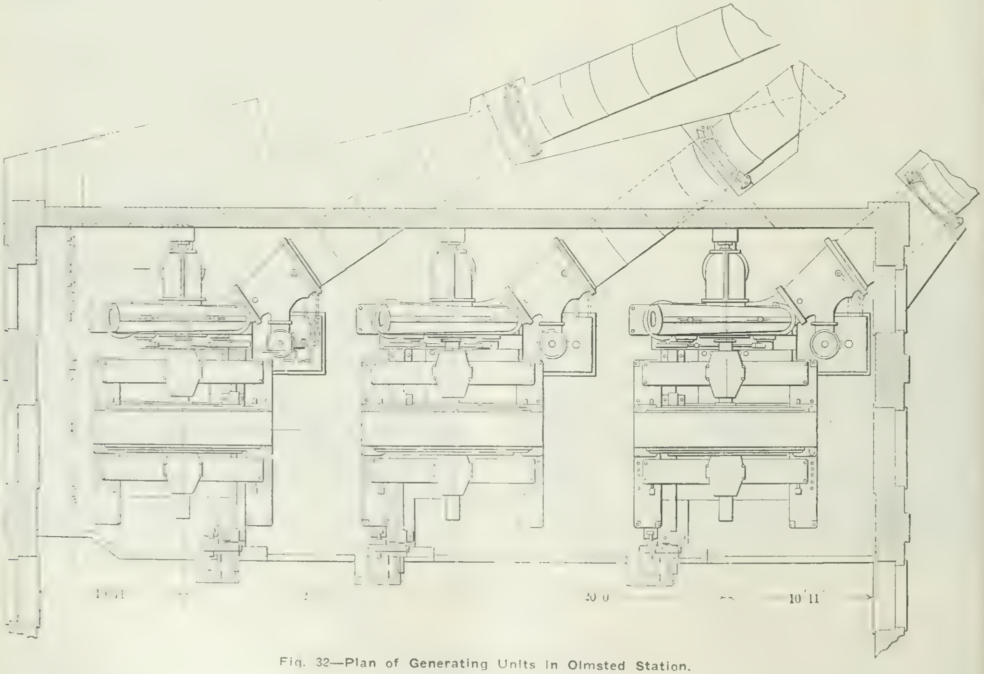


Fig. 32—Plan of Generating Units in Olmsted Station.

Electric Company, the potential being raised in a small corrugated-iron building containing three 100-kw transformers, located adjacent to the Olmsted station. Energy for local station service at Olmsted, including the lamp and small motors used on the headquarters premises, is supplied from three 75-kw transformers distributing at 115 volts and 230 volts.

HIGH-TENSION WIRING.

All high-tension switches in the plant are motor-operated, with remote control from the switchboard. The main transformer installation consists of ten 1000-kw water-cooled units, located in a depressed bay at the east end of the operating room, the space behind the transformers being

occupied by the high tension switches, which are mounted in brick cells. The transformers are connected with the outgoing lines and overhead 44,000-volt bus by cables protected in fiber conduit sleeves. The entire east end of the operating room is occupied by high-tension switches and an overhead framework of varnished wood carries

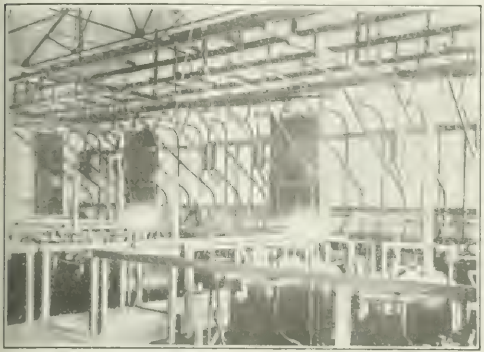


Fig. 34—High-Tension End of Olmsted Station.

the outgoing and transfer circuits on glass insulators mounted on treated locust pins. Disconnecting switches are installed on each side of the high-tension oil switches, and these are so arranged that the disconnectors from the transformer secondaries can also be connected directly to the line when desired, thereby maintaining continuous service in spite of the cutting off of a high-tension oil switch. The framing carrying the high-tension lines is mainly 4-in. x 6-in. timber, varnished. The outgoing lines are equipped with aluminum-cell and low-equivalent arresters, choke coils and outlet bushings of fiber conduit and insulating compound, run in sewer tile. The lines leaving the station are protected from the weather by a galvanized-iron hood and are equipped with a grounding mechanism actuated by levers in the operating room.

FUTURE POWER DEVELOPMENT.

The resources of the company provide for an extensive future development of hydroelectric power on the Utah system, with the possibility of smaller additions to the generating system in Colorado. An important enlargement of the facilities of the Utah system is now under way in the Bear Lake district. Bear Lake is a natural body of deep water about 140 sq. miles in area, lying in a mountainous basin surrounded on two sides by the Wasatch range and on the third by highlands. Its extension to the north, cut off from the main body by a sandbar, is alternately marsh and open water, the supply being from surface drainage and extensive springs from underground channels fed from the upper reaches of the Bear River. Bear River no longer flows through or into these lakes, but skirts them a few miles away and receives the natural outflow from the lakes. In 1907 Mr. L. L. Nunn secured all rights to this water under special governmental grant, and subsequently the development has been continuous. The lake is the second largest body of fresh water in the Great Basin.

BEAR LAKE IMPROVEMENTS.

The general plan of development is to equalize the flow of Bear River by drawing down the lakes during low-water season a possible 10 ft., by means of 16 miles of canal discharging into Bear River, and then refilling it during the flood season by means of another canal 4 miles long, from a point about 15 miles upstream. The final development will consist of a diverting dam and gateworks opening into the inlet canal, about 150 ft. wide x 12 ft. deep; about 6 miles of levees along the northern border and a large outlet gate works about 20 ft. high, leading to an outlet canal about 100 ft. wide by 6 ft. in working depth, the length being 16 miles. At present this development includes concrete gate works of about one-third capacity and a similarly reduced inlet canal, besides 2 miles of dike and about 4 miles of single-outlet canal, which is being pushed forward at the rate of about 1 mile per month. About 4500 sq. miles of drainage area are involved in the work of storage and flow equalization. A total of about 250,000 theoretical hp is estimated as available in the total fall of 1725 ft. between Bear and the Great Salt Lakes. This volume, utilized at the existing Grace development, is estimated as capable of producing 75,000 hp.

At Oneida Narrows, about 23 miles below Grace, the river passes through two narrow gorges associated with open valleys, which may be utilized as peak-load reservoirs. The flow at Oneida, estimated at 1600 cu. ft. per second, compared with a considerably smaller volume at Grace, is estimated as capable of developing 32,600 hp.

The conclusion of the series of articles on the generating and transmission system of the Telluride Power Company will follow in the next issue.

THE CHARACTERISTICS OF SERIES INSTRUMENT TRANSFORMERS—II.

Determination of the Effect of the Magnetic-Circuit Characteristics on the Current Ratio and Time-Phase Displacement.

By ARTHUR P. YOUNG.

IN the first instalment of this article, which appeared in the issue dated Dec. 9, the current ratio in series transformers was discussed at some length, and attention was drawn to the importance of the time-phase displacement between the primary and secondary currents.

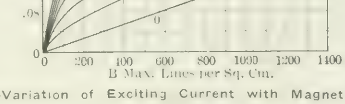


Fig. 5—Variation of Exciting Current with Magnetic Density.

The present instalment relates particularly to the phase-displacement features of the transformer.

EFFECT OF FREQUENCY VARIATION.

From equation (15)

$$\tan\theta = kf$$

where

$$k = \frac{2\pi L_3}{R_2 + R_3} = \frac{\tan\theta}{f} \qquad (18)$$

Also,

$$\cos^2\theta = \frac{1}{1 + \tan^2\theta}$$

therefore,

$$\cos\theta = \frac{1}{\sqrt{1 + k^2 f^2}}$$

Substituting this value of $\cos\theta$ in equation (14),

$$e_2 = C_2 \, (R_3 + R_2) \sqrt{1 + k^2 f^2} \qquad (19)$$

[illegible] and θ vary with the fre[illegible]quency. If the values of e_2 and [illegible] at any given frequency are known the values at any other frequency can readily be calculated by aid of these formulas. To enable this to be done rapidly a number of curves have been plotted showing how e_2 decreases with the frequency. These are shown in Fig. 10. It is assumed that the value of e_2 at 100 cycles is known and the percentage drop in e_2 is given for lower frequencies, the number on each curve being the value of θ at 100 cycles. Another set of curves shows how θ decreases with the frequency.

By aid of these curves one can quite easily determine the ratio and phase displacement characteristics of a transformer operated at different frequencies. For suppose that by means of equations (14) and (15) the value of e_2 and θ at 100 cycles corresponding to given load conditions has been calculated. Then by referring to the curves given in Fig. 10 the value corresponding to some lower frequency can at once be determined, and from the value of e_2 so deduced the corresponding value of B_m can be found by employing equation (16). The values of θ and B_m being known for the particular frequency, the ϕ and K_a curves can be plotted in the manner previously described by simply referring to the various curves shown in Figs. 5, 6, 7 and 8.

This question is of practical importance, and the above method affords a ready means of investigating the problem as to what extent the characteristics of a transformer are affected when it is used on different frequencies, other things being the same. There are two cases which have to be considered—the first, in which the secondary load is practically non-inductive, and the second, in which it is highly inductive. If any particular case be considered and curves plotted corresponding to, say, 25 cycles, 50 cycles and 100 cycles respectively, firstly, assuming θ = zero, which, of course, represents an absolutely non-inductive load, and, secondly, with θ = 60 deg., which corresponds to a highly inductive load, by aid of these curves one can deduce laws governing this effect which are quite general in their application. They can be enunciated as follows:

(1) Lag of Secondary Current Small.

(a) Decreasing the frequency gives a slightly worse ratio characteristic.

(b) Decreasing the frequency gives a much worse phase displacement characteristic.

(2) Lag of Secondary Current Large.

(a) Decreasing the frequency improves very slightly the ratio characteristic.

(b) Decreasing the frequency gives a much worse phase displacement characteristic, the magnitude of the errors so produced being practically the same as in the previous case.

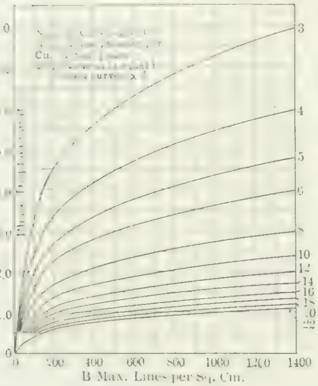


Fig. 6—Phase Displacements Between Primary and Secondary Currents for Low-Current Values.

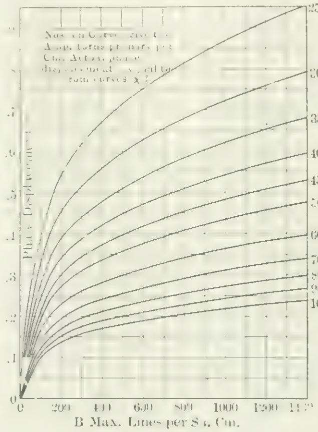


Fig. 7—Phase Displacements Between Primary and Secondary Currents for Large Current Values.

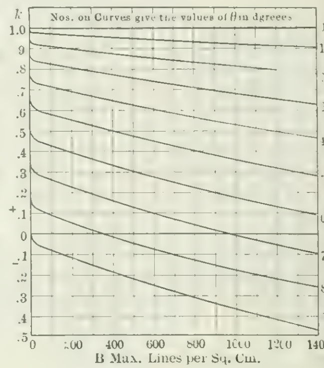


Fig. 8—Ratios of Cosines of Time-Phase Angles for Various Secondary-Phase Displacements.

Fig. 9—Vector Representation of Secondary Load.

PHASE DISPLACEMENT IN WATTMETERS AND WATT-HOUR METERS.

The phase displacement in wattmeters is of sufficient practical importance to warrant it being considered separately. The accuracy of a wattmeter or watt-hour meter is greatly dependent on the phase displacement ϕ of the series transformer with which it is operating, particularly

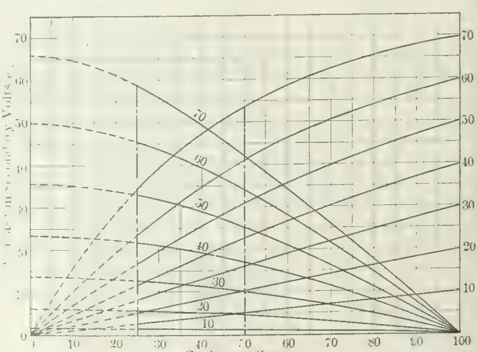


Fig. 10—Variation of Secondary Voltage with Frequency.

so when the power-factor of the circuit is low. This applies not only to wattmeters, but, in general, to all instruments having both current and potential windings, such, for instance, as a power-factor indicator. Considering the general case in which ϕ is positive, the effect is to make a wattmeter read high on inductive loads. This can be readily understood by referring to the vector diagram given

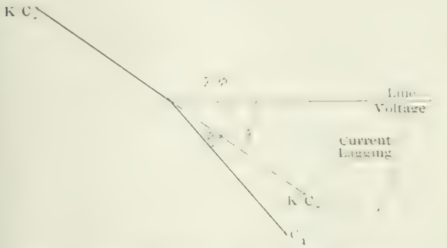


Fig. 11—Vector Diagram of Time-Phase Relations.

in Fig. 11. Suppose that the primary current C_1 lags behind the line voltage V by the angle λ, then

$$\text{true power} = W = C_1 V \cos \lambda$$

$$\text{power measured by wattmeter} = W_r = C_2 K V \cos (\lambda - \phi).$$

It can be assumed that the current ratio is equal to K as the error due to any discrepancy between K_a and K is independent of λ. This gives

$$W_r = C_1 V \cos (\lambda - \phi)$$

and

$$\text{per cent error in wattmeter reading} = \frac{(W_r - W)}{W} \times 100$$

per cent error in wattmeter =

$$\left\{ \frac{\cos (\lambda - \phi) - \cos \lambda}{\cos \lambda} \right\} \times 100 \qquad (20)$$

The errors corresponding to different values of λ for various values of ϕ ranging from 0.1 deg. to 3 deg. are shown by a series of curves given in Fig. 12. It is seen that with $\phi = 0.5$ deg. the error corresponding to $\lambda = 60$ deg.—that is, a power-factor = 0.5—is 1.5 per cent. It would appear from this that ϕ should be kept well within 0.5 deg. even down to very small loads in view of the fact that the specifications for watt-hour meters often allow an error of only 2 per cent in the meter reading due to a variation in power-factor from unity down to 0.5.

It should be pointed out, however, that in cases where watt-hour meters have to operate in conjunction with series transformers most manufacturers make a point of calibrating the meter with the transformer, connecting in series with it the actual or an equivalent secondary load, and do not guarantee their meters unless this has been done. If the meters are of the induction type, as is nearly always the case, the phase error due to the transformer is compensated for by means of the lagging adjustment provided on all meters of this type, so that it is made to read correctly on, say, a power-factor of 0.5 with full-load current passing through the series winding of the meter. By means of the low-load adjustment on the meter the variation of current ratio with load is also compensated for, but it is apparent that the meter will register correctly only when operating under exactly the same conditions as those under which it was originally calibrated. If it is desired to change the transformer or vary the load, the meter should be calibrated under the new conditions, and this is enforced by most manufacturers.

Due to the fact that the phase displacement ϕ increases as the load decreases it is obvious that the meter will not read correctly on low power-factors when the load is very small, even if it has been carefully calibrated in the manner previously described. An example illustrating this rather important effect will be given later.

ILLUSTRATION OF THE FOREGOING METHODS OF ANALYSIS.

At this point it seems well to summarize the methods of analysis described in detail above by applying them to an actual design. For this purpose there has been chosen a 2000-amp, 400-to-1 ratio series transformer of the "ring" pattern manufactured by one of the leading makers of this class of apparatus. The primary consists simply of a straight copper rod fixed axially with respect to a tubular iron core built up from ring punchings of "stalloy" iron. The secondary winding, which is designed to carry 5 amp at full load, is distributed uniformly around the iron core.

This particular form of design is extremely neat, and can be successfully employed for primary currents above 500 amp. It lends itself readily to the methods of determining the essential characteristics developed in this article, because in all such designs the magnetic leakage between primary and secondary must of necessity be nil, and therefore the assumption with which the present investigation was commenced is strictly correct.

The linear dimensions of the magnetic circuit of the particular series transformer taken as an example are clearly shown in Fig. 13. The essential information with regard to the transformer can be tabulated as follows:

Primary amperes at full load = C_1 = 2000.
Primary turns = S_1 = 1.
Secondary turns = S_2 = 396.
Theoretical ratio = $S_2 \div S_1 = K$ = 396.
Rated ratio = 400.
Primary ampere-turns at full load = 2000.
Mean length of magnetic circuit, centimeters = 32.4
$\therefore C_1 S_1$ per centimeter at full load = 61.8.
Cross-section of core, square centimeters = A = 7.8.
Resistance of secondary, ohms = R_2 = 0.45.

For the secondary load consider a very common case in which an ammeter, wattmeter and trip coil are connected in series across the secondary winding. The following information as regards resistance and reactance was obtained experimentally, using a 5-amp ammeter and watt-hour meter of well-known manufacture, and a trip coil wound also for 5 amp, so that the values given can be taken as representing average load conditions, particularly as the full-load secondary current of series transformers has been practically standardized at 5 amp.

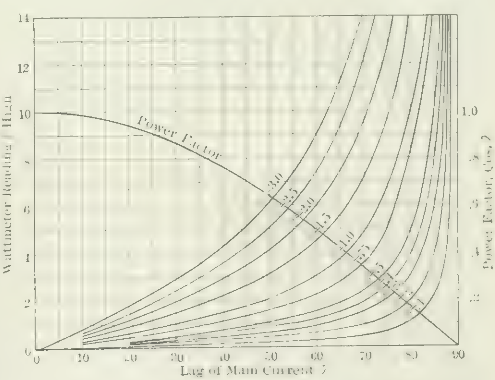


Fig. 12—Error of Wattmeter Reading at Different Lag Angles.

The values given for the reactances in the following table are for 100 cycles per second.

Resistance of ammeter, ohms = r_1 = 0.11
Reactance of ammeter, ohms = pl_1 = 0.3
Resistance of wattmeter, ohms = r_2 = 0.06
Reactance of wattmeter, ohms = pl_2 = 0.15
Resistance of trip coil, ohms = r_3 = 0.235
Reactance of trip coil, ohms = pl_3 = 1.19

First of all will be determined the characteristics at a frequency of 100 cycles per second.

[illegible]

$$R_s = r_1 + r_2 + r_3 = 0.405$$

[illegible]

Therefore $\quad \tan\theta = 1.92$ from equation (15)

hence $\quad \theta = 62.5$ deg.

and $\quad \cos\theta = 0.463$.

The value of B_m at full load will now be calculated by using equation (17) and assuming $C_2 = 5$. Thus:

B_m at full load = 672 lines per square centimeter.

Determination of Current Ratio K_a at 100 Cycles.

Knowing the value of B_m corresponding to full load one can readily calculate the corresponding value for any other load by assuming that B_m is simply proportional to the primary current—that is, to the value of C_1S_1 per centimeter. This, of course, is not strictly correct and would be true only if $C_1 \div C_2 = K_a$ was constant for all values of C_1. As, however, this ratio will not vary by more than 2 per cent over a very wide range of load, the errors introduced by assuming direct proportionality between B_m and C_1 are quite negligible.

Referring to the curves given in Fig. 5, the values of $C_0S_1 \sin\beta$ corresponding to different loads ranging between full load and 5 per cent of full load are determined and tabulated as follows:

Per Cent of Full Load.	Primary Current Amp.	C_1S_1 per Cm. x.	B_m	θ Deg.	$C_0S_1 \sin\beta$ from Curves $= y$.	$x-y$	$\frac{x}{x-y} = z$	$\frac{K_a}{KZ}$	Per Cent Error in Ratio, K_a
100	2,000	61.8	[illegible]	62.5	.343	61.457	1.0056	398.22	−0.45
[illegible]	1,600	[illegible]	[illegible]	62.5	.316	49.084	1.0063	398.50	−0.38
[illegible]	1,200	37.1	[illegible]	62.5	.286	36.814	1.0078	399.09	−0.23
[illegible]	[illegible]	24.7	[illegible]	62.5	.246	24.452	1.010	399.96	−0.01
[illegible]	400	12.4	134	62.5	.186	12.214	1.0152	402.02	+0.50
10	200	6.2	[illegible]	62.5	[illegible]	[illegible]	1.0204	[illegible]	+1.02
[illegible]	100	3.1	34	62.5	[illegible]	[illegible]	1.0265	406.5	+1.62

Determination of Phase Displacement ϕ at 100 Cycles.

By referring to the curves given in Figs. 6 and 7 one can readily determine the value of the phase displacement ϕ, assuming $\theta =$ zero for corresponding values of B_m and C_1S_1 per centimeter. Then from Fig. 8 are obtained the values of the constant k corresponding to the various values of B_m considered, assuming $\theta = 62.5$ deg. in each case. The tabulation is as follows:

Per Cent of Full Load.	Primary Current Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	ϕ_1 from Curves Deg.	k from Curves	Phase Displacement $\phi = k\phi_1$ Deg.
100	2,000	61.8	[illegible]	62.5	0.31	0.22	0.07
80	1,600	[illegible]	[illegible]	62.5	0.37	0.25	0.09
[illegible]	[illegible]	37.1	[illegible]	62.5	0.45	0.29	0.13
[illegible]	800	24.7	269	62.5	0.60	0.33	[illegible]
20	400	12.4	[illegible]	[illegible]	0.91	0.38	0.35
[illegible]	[illegible]	6.2	[illegible]	62.5	1.21	0.40	[illegible]
[illegible]	[illegible]	3.1	[illegible]	62.5	1.67	0.415	0.69

Determination of the Characteristics at 50 Cycles and 25 Cycles.

First must be determined the values of B_m at full load and θ for each periodicity. This can be done by aid of the curves given in Fig. 10, from which the values of θ corresponding to 50 cycles and 25 cycles respectively can be deduced at once, and the ratio between the voltage drop in the secondary (e_2) on either periodicity and that occurring on 100 cycles can also be determined. An examination of equation (16) will make it clear that if for any frequency f_1 the per cent drop in e_2 as found from the curves is n, then B_m at full load on frequency $f_1 = \frac{100 - n}{x} \times B_m$ at full load on 100 cycles.

For 50 cycles and 25 cycles the following results are obtained:

Cycles.	θ Deg. from Curves.	n	B_m
50	44.0	36	834
25	26.2	48	1,370

(a) Current Ratio (K_a) Characteristic on 50 Cycles and 25 Cycles.

Proceeding in exactly the same way as in determining the ratio characteristic on 100 cycles, using, of course, the values of θ and B_m, as given above for each periodicity, the following results are obtained:

CURRENT RATIO AT 50 CYCLES.

Per Cent of Full Load.	Primary Current $= C_1$ Amp.	C_1S_1 per Cm x	B_m	θ Deg.	$C_0S_1 \sin\beta$ from Curves $= y$.	$(x-y)$	$\frac{x}{x-y} = Z$	$\frac{K_a}{KZ}$	Per Cent Error in Ratio K_a
100	2,000	61.8	834	44	0.332	61.468	1.0054	398.14	−0.47
80	1,600	49.4	667	44	0.300	49.100	1.0061	398.42	−0.40
60	1,200	37.1	500	44	0.266	36.834	1.0072	398.85	−0.29
40	800	24.7	334	44	0.227	24.473	1.0093	399.68	−0.08
20	400	12.4	167	44	0.170	12.23	1.0139	401.51	+0.38
10	200	6.2	83	44	0.114	6.086	1.0187	403.41	+0.85
5	100	3.1	42	44	0.074	3.026	1.0245	405.7	+1.42

CURRENT RATIO AT 25 CYCLES.

Per Cent of Full Load.	Primary Current $= C_1$ Amp.	C_1S_1 per Cm x.	B_m	θ Deg.	$C_0S_1 \sin\beta$ from Curves $= y$.	$(x-y)$	$\frac{x}{x-y} = Z$	$\frac{Ka}{KZ}$	Per Cent Error in Ratio K_a.
100	2,000	61.8	1370	26.2	0.350	61.45	1.0057	398.26	−0.43
80	1,600	49.4	1096	26.2	0.304	49.096	1.0062	398.45	−0.39
60	1,200	37.1	822	26.2	0.258	36.842	1.0070	398.77	−0.31
40	800	24.7	548	26.2	0.206	24.494	1.0084	399.32	−0.17
20	400	12.4	274	26.2	0.156	12.244	1.0127	401.04	+0.26
10	200	6.2	137	26.2	0.104	6.096	1.0171	402.78	+0.69
5	100	3.1	69	26.2	0.065	3.035	1.0214	404.47	+1.12

(b) Phase Displacement (ϕ) Characteristics on 50 Cycles and 25 Cycles.

Using corresponding values of B_m and θ as previously determined for 50 cycles and 25 cycles respectively, there are obtained by aid of the curves given in Figs. 6, 7 and 8 the results here shown.

PHASE DISPLACEMENT AT 50 CYCLES.

Per Cent of Full Load.	Primary Current $= C_1$ Amp.	C_1S_1 per Cm x	B_m	θ Deg.	ϕ from Curves ϕ_1 Deg.	k from Curves.	Phase Displacement $\phi = k\phi_1$ Deg.
100	2,000	61.8	834	44	0.33	0.5	0.17
80	1,600	49.4	667	44	0.39	0.54	0.21
60	1,200	37.1	500	44	0.48	0.57	0.27
40	800	24.7	334	44	0.64	0.61	0.39
20	400	12.4	167	44	1.01	0.65	0.66
10	200	6.2	83	44	1.38	0.67	0.92
5	100	3.1	42	44	1.90	0.68	1.29

PHASE DISPLACEMENT AT 25 CYCLES.

Per Cent of Full Load.	Primary Current $= C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	ϕ from Curves $= \phi_1$ Deg.	k from Curves.	Phase Displacement $\phi = k\phi_1$ Deg.
100	2,000	61.8	1370	26.2	0.38	0.70	0.27
80	1,600	49.4	1096	26.2	0.45	0.73	0.33
60	1,200	37.1	822	26.2	0.56	0.77	0.43
40	800	24.7	548	26.2	0.74	0.80	0.59
20	400	12.4	274	26.2	1.20	0.84	1.01
10	200	6.2	137	26.2	1.85	0.86	1.59
5	100	3.1	69	26.2	2.5	0.87	2.17

CONCLUSION.

The ratio and phase-displacement values deduced above when plotted as curves, as in Fig. 14, show very clearly how the characteristics are affected by frequency changes. It will be noted that a change in frequency from 100 cycles to 25 cycles only slightly affects the ratio characteristics, the characteristic, however, being somewhat better on the lower frequency. On the other hand, the phase displacement characteristic is much worse on 25 cycles, ϕ being 0.69 deg. at 5 per cent of full load on 100 cycles as com-

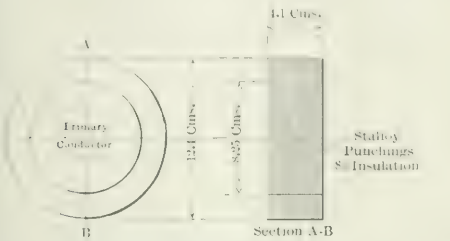


Fig. 13—Details of a Series Transformer Core: 2000 Amp to 5 Amp.

pared with 2.2 deg. at the same load on 25 cycles. A reference to the earlier part of this paper dealing with "Effect of Frequency Variation" will show that these results corroborate the general laws governing such variations there given for cases in which the lag of the secondary current is large.

All the formulas given in this article have been deduced on the supposition that there is no magnetic leakage between the primary and the secondary, and, therefore, the various curves plotted can be strictly employed only in cases where this fundamental assumption is true. In all cases where the transformer is of the "straight-through" type, such as taken in the example, the magnetic leakage is nil, and it is therefore reasonable to suppose that in cases where the methods of analysis described in this paper are applied the results obtained will be very reliable—probably more so than those obtained experimentally by carrying out lengthy tests employing necessarily delicate measuring apparatus. Even in cases where there is magnetic leakage, for instance, as when the primary and secondary coils are arranged side by side on one limb of a closed iron circuit, it will always be very slight, provided the design has been carefully carried out, and will probably

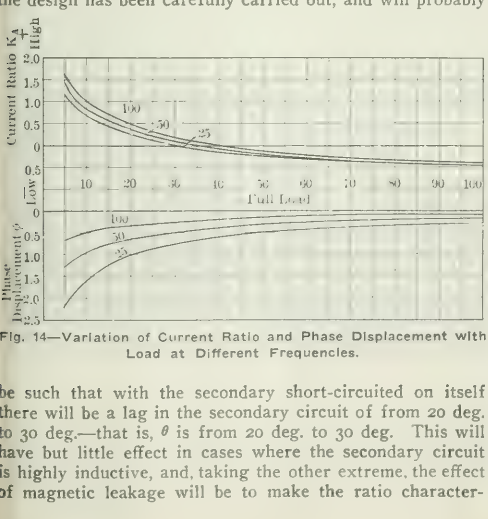


Fig. 14—Variation of Current Ratio and Phase Displacement with Load at Different Frequencies.

be such that with the secondary short-circuited on itself there will be a lag in the secondary circuit of from 20 deg. to 30 deg.—that is, θ is from 20 deg. to 30 deg. This will have but little effect in cases where the secondary circuit is highly inductive, and, taking the other extreme, the effect of magnetic leakage will be to make the ratio characteristic slightly worse and the phase displacement characteristic slightly better than the corresponding curves obtained by this method. It would, therefore, seem that for ordinary commercial purposes the results obtained by neglecting leakage will be sufficiently accurate.

In conclusion, there is one other point in connection with

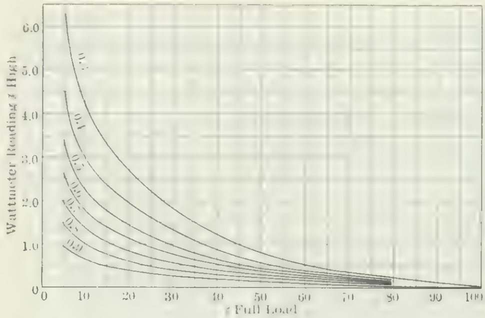


Fig. 15—Variation in Error in Wattmeter Readings with Load at Different Power Factors.

this subject which is worthy of note. It was pointed out earlier in the paper that in cases where a watt-hour meter has to operate in conjunction with a series transformer it is customary to calibrate the meter with the transformer, compensating for the phase error by adjustment on an inductive load having a power-factor of 0.5 with full-load current passing through the primary of the transformer. As ϕ increases with decrease of load it follows that after adjusting the meter in this way it will not read correctly on low power-factors if the load on the transformer is less than normal full load. A number of curves have been plotted in Fig. 15 for the particular transformer taken as an example, giving the errors arising in this way on inductive loads varying between full load and one-twentieth full load at 50 cycles for power-factors down to 0.3. These have been plotted from the phase-displacement curves given in Fig. 14 for 50 cycles by aid of the curves given in Fig. 12. It will be noticed that on low loads the errors are very considerable, on a power-factor of 0.5 at one-twentieth full load the error being as much as 3.4 per cent. It is, of course, impossible to compensate for these errors. These particular curves afford a very good illustration of the importance of reducing the phase errors to a minimum by careful attention to all points in the design which tend to produce this result.

ELECTRIC STREET-CLEANING APPARATUS.

A type of electric street-cleaning machine which has been introduced into a number of German cities, for instance, Berlin, Schöneberg, Charlottenburg, Hanover, Trier, Strassburg, Dresden and Hamburg, is shown in Fig. 1. These machines have been built for Herrn Baurat Szalla, Berlin, by Hentschel & Company, Berlin, and have given excellent service for the last few years.

After having made exhaustive experiments it was decided to use the electric system of propulsion for the following reasons: It is hygienically perfect, being absolutely odorless and almost noiseless; it is simpler to operate than the gas engine and gives less trouble and has fewer repairs. One of the most favorable characteristics of the electric power was the possibility of retaining the same type of cleaner as was developed for use with horses. This type takes up a minimum of room and can be turned around with the least disturbance of street traffic. The electric motor permits the highest attainments in this direction.

[illegible] hand wheel as a center within a space of about 20 ft. width, so that it can be turned around in the narrowest streets without the least trouble, while a benzine machine requires a street at least 40 ft. wide to permit its turning around.

The cleaning machine consists of cylindrical water tank

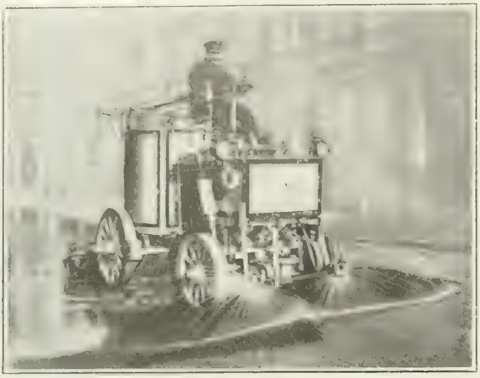


Fig. 1—Electric Street Cleaning Machine.

mounted on four wheels provided with ball bearings and steel tires. The tank holds 660 gal. and carries the driver's seat. Under the tank are located the shower pipes, which are arranged so that the flow of water can be controlled. In front of the front wheels there are two more shower pipes, which serve to loosen the dirt and are manipulated with foot levers. Behind the rear wheels the cleaning roll is situated. This roll is equipped with a spiral of soft rubber and is operated by the same lever that controls the rear shower pipe. The roll is driven by a gear connection to the rear wheels, which is thrown out when the roll is raised. The rear wheels are provided with brakes and a sander.

The battery is mounted in front of the driver and comprises forty cells of 200 amp-hour capacity at the five-hour rate. The charging current varies from 30 amp to 40 amp. To each forward axle there is connected a 4-hp series motor. The controller has five forward points, two braking points and three reverse points. Points 1 and 2 are for

Fig. 2—Electric Street Cleaners in Berlin.

starting, point 3 corresponds to a speed of about 4 miles per hour, point 4 corresponds to about 6 miles per hour and point 5 corresponds to from 8 miles to 10 miles per hour. To control the starting and the battery an ammeter and voltmeter with illuminated scales are provided. Two electric head lamps and a horn with a treadle bellows complete the equipment. The weight of the cleaner empty is about 4 tons.

One of these machines will cover 20 miles to 25 miles per day, which corresponds to approximately 500,000 sq. ft. of pavement for nine hours' working time. Although the speed of the electrically propelled cleaner is only 10 per cent greater than that of the horse-drawn cleaner, it is capable of doing much more useful work because of its ability to carry more water, its greater movability and flexibility of manipulation in heavy traffic, its quick turning and high speed when empty. On account of all these advantages the electric cleaner accomplishes more than 50 per cent more work than a similar horse-drawn cleaner.

Energy for charging costs from 3 cents to 4 cents per kw-hour, the charging being done in two stations owned by the city. A cleaner working on nine-hour schedule requires from 15 kw-hours to 20 kw-hours per day, at a cost of from 50 cents to 75 cents per day. The battery upkeep is fixed at a yearly expense of $150 paid to the makers, who make all repairs.

Assuming a day's work to cover 500,000 sq. ft. of pavement and 250 working days per year, the yearly operation and maintenance charges amount to about $800, against about $1,500 for a horse-drawn cleaner that will also cover the same area of pavement per day. This estimate does not include the wear and tear of the purely mechanical parts, such as the rubber brushes, which are the same for both kinds of machine. The saving incident to the substitution of electric motors for horses, assuming the useful work to be the same, is nearly $3 per day. This is more than enough to cover the extra capital charges and yet show a substantial saving. In Berlin, in addition to the ordinary street sprinklers, there are twenty-eight street-cleaning machines in operation, ten being horse-drawn and eighteen electrically driven. The horse-drawn machines will entirely disappear in the next few years and will be replaced by electric machines. Schöneberg, which is adjacent to Berlin, has twelve electric street cleaners. It is proposed in the near future to equip road scrapers for electric propulsion.

ELECTRIC VEHICLES FOR FIRE DEPARTMENT.

In the issue of this paper for July 22, 1911, page 202, an account was given of the pioneer work of the Springfield (Mass.) fire department in the application of electric vehicles to its service. At that time a combination wagon

Electric Ladder Truck.

and 85-ft. aerial extension ladder truck were in service, and the first two months' operation had resulted in a total cost of energy for charging the two machines of less than $11, the rate being 3 cents per kw-hour. It was apparent that even if the life of the batteries should be but a single year

there would still be a margin of nearly 100 per cent in favor of electricity as compared with the cost of service by horses. Two new units have just been added to the service, one being a combination wagon duplicating the earlier installation and the other an 85-ft. extension ladder truck which has been converted from horse to electric driving by the substitution of a couple-gear tractor truck equipped with four 3-hp motors in place of the forward pair of wheels originally used. The tractor has a wheelbase of 7 ft. 6 in., and the current is supplied to the motors from a battery of eighty cells of "National" seventeen-plate storage units hung in the tractor to provide additional adhesion. Solid-rubber tires are used on all wheels, and those on the tractor are double. Tests show that the truck can be turned around in a circle of smaller radius than its over-all length, as indicated in the accompanying photograph. The speed of the truck on a level street is 27 miles per hour maximum, and on a 10 per cent grade a speed of 12 miles per hour has been obtained.

The accompanying photograph was taken in front of the new Court Street headquarters building, in which all the apparatus is of the motor-vehicle type, there being no provision for horses in the establishment. It is probable that the converted ladder truck and the new combination wagon will be established in a new station of the all-electric type, which is planned for erection on the north side of the city in the Patten Street district.

ELECTRIC FIRE TRUCKS.

Within the last few years there have been conducted in Germany exhaustive experiments on electrically driven fire trucks, the results of which indicate that these are best adapted to service in large cities, while other methods of propulsion, or horses, are best for suburbs and small communities. The electric truck is superior with regard to the following points: Readiness for action; cost of operation and maintenance; simplicity of operation; cleanliness; absence of noise and odor. Electric fire trucks are used in Berlin, Charlottenburg, Schöneberg, Rixdorf, Bramschweig, Elberfeld, Duisburg, Hanover, Crefeld, Bremen, Cologne, Frankfort, Dortmund, Magdeburg, Mannheim, Düsseldorf, Schwerin, Wilhelmshaven, Munich, Hamburg and Münster, all in Germany. They are also used in Vienna, Basle, Amsterdam and London. Berlin leads with forty trucks and Vienna is next with twenty-eight trucks.

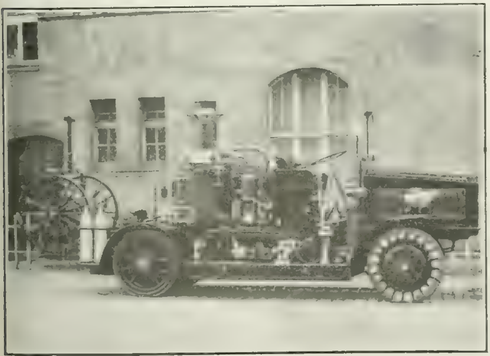


Fig. 1—Electric Fire Engine.

The above-mentioned experiments were carried out upon the truck described below. These tests were reported by Fire Chief Reichel.

The Berlin trucks (Fig. 1), which are built by the Daimler Motoren Gesellschaft, are equipped with motors built into the hubs of the front wheels (Sohner-Porsche or Mercedes-Electrique system). At present the Berlin Fire Department has six complete outfits, each made up of four trucks, and within the next year three more outfits will be added to these. Ultimately it is planned to have 145 auto trucks, 80 electrics, 21 steam and 44 benzine. Each fire outfit comprises one supply truck, one gas blower, one steam blower and one ladder truck, the whole being manned with twenty-four men.

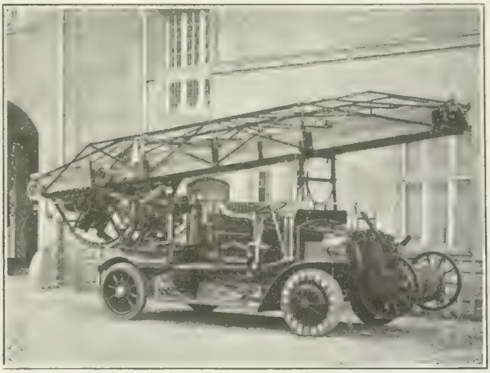


Fig. 2—Electric Hose Truck.

The motors are waterproof and dustproof and are rated at 15 hp, 225 r.p.m. and 160 volts. They are series motors arranged for series-parallel control, which gives five running speeds by dividing the battery. The working weight of the loaded truck is between 4.5 tons and 6.1 tons, and its speed on the level is respectively 25 miles and 22 miles per hour.

The battery consists of eighty-four Tudor cells and has a discharge capacity of from 117 amp-hours to 146 amp-hours and a charge emf of 220 volts. It is carried in four trays placed under a hood in front of the driver's seat and occupies a space 3.5 ft. by 5 ft. The weight is approximately 1800 lb. The working weight of the wagon varies from 5 tons to 6 tons.

The wheels of the truck are equipped with rubber tires 34 in. in diameter and 4.2 in. tread. The truck is provided with an electric and two mechanical brakes, which are independently operated by foot and hand levers and grip cast-steel rims in the hind wheels.

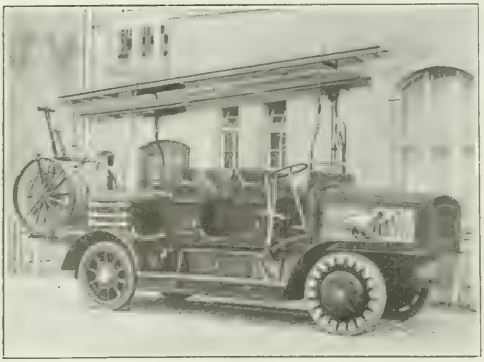


Fig. 3—Electric Ladder Truck.

On level pavement and at 15 miles per hour the energy

consumption of these trucks is 45 watt-hours per ton-kilometer. At this speed the truck can run 40 miles to 45 miles with a single charge. This is the ideal radius of action. However, because of using various speeds, acceleration resistance, etc., the actual radius of action is reduced about 15 or 20 per cent, so that with an average speed of 20 miles per hour a radius of 30 miles can be surely counted upon.

The initial cost of the complete outfit, consisting of four trucks such as used by the Berlin Fire Department, was $36,000. Fig. 3 shows one of these trucks which is used in Essen.

Central Station
Management, Policies and Commercial Methods

BINGHAMTON (N. Y.) INDUSTRIAL EXHIBITION.

That public-service companies best serve their own interests when they serve those of their clients was practically demonstrated in Thanksgiving week, when the Binghamton (N. Y.) Chamber of Commerce held an industrial exhibition. Both the gas and the electric light company engaged booths and with elaborate displays illustrated the new and best appliances for industrial and residential use. In this manner not only did the companies receive actual benefit in an advertising way but they added materially to the good feeling existing between them and the business men of the community, especially as both companies went to large expense and much labor in suggesting and providing show features and lighting facilities in addition to those in their own booths. As remarked by one of the officers of the Chamber of Commerce, this is another illustration of the principle that the better you know a man or corporation the better you like him.

BALTIMORE CENTRAL-STATION SHOWROOM.

"The House Electric" is the name of new showrooms recently opened by the Consolidated Gas, Electric Light & Power Company of Baltimore. The store, which is one of the most artistic in the city, is located at 325 North Charles Street, in the heart of the fashionable center of the city. A handsome display of fixtures is made, as well as everything for the comfort of the lady who is downtown on her holiday shopping expedition. Tea is served in one of the luxurious rooms, and there are a writing-room with telephone conveniences and other well-fitted rooms in which ladies may lounge and chat with their friends. An experienced maid is in constant attendance. An electric kitchen is a feature of the new store. Mr. Robertson, who was formerly with the Electrical Installation Company and who now has charge of the house and store-wiring department for the Consolidated company, is in charge of this innovation. The company will also establish a branch office at which bills may be paid.

RELATIVE ACCURACIES OF GAS AND ELECTRIC METERS.

The 1910 annual report of the Public Service Commission of the First District, New York, contains valuable data showing the relative accuracies of gas and electric meters. In the case of gas meters tested on complaint the law permits an error of 2 per cent, and an error of 4 per cent is allowed on electric meters. The year 1910 showed an increase over the previous year in the number of applications received for tests of gas meters and a decrease in the number of applications received for tests of electric meters, which is attributed to the frequent inspection and calibration of meters by the electric-lighting companies. The records of the commission show that of the 4428 gas meters tested by it upon complaint of customers, 2220, or almost exactly 50 per cent, were over 2 per cent fast, and 398, or 9 per cent, were over 2 per cent slow. In the case of electric meters, of the 637 meters tested on complaint, thirty-six, or less than 6 per cent, were over the error allowed by law and forty-seven, or approximately 7.5 per cent, were over 4 per cent slow.

LOUISVILLE "WHITE WAY."

Business men on Market Street, between First and Seventh Streets, in Louisville, Ky., celebrated the opening of the "Long White Way," as it was termed, on Dec. 1 by a parade with bands, burning red fire, giving away thousands of more or less valuable souvenirs and the purchase of scores of pages of newspaper space. Turning current on the lamps of the ornamental iron standards, each surmounted by five opalescent globes and ranged in boulevard effect along both sides of the thoroughfare, marked the most aggressive campaign of the merchants of that part of the Kentucky metropolis in a long while.

Market Street is one of the two principal retail thoroughfares, Fourth Avenue being the other. The latter is considered the more fashionable section, and the trend of trade has been south on Fourth and away from Market Street. Merchants in that part of the city decided that bright lights were the best weapon they could use to fight the competition of Fourth Avenue, and they therefore arranged for the installation of Federal standards, electricity being supplied by the Louisville Lighting Company and the Kentucky Electric Company.

The success of the idea is illustrated by the fact that 10,000 people turned out on the night of the opening and thronged the street for hours during the celebration.

GAS CONSUMPTION IN LAWRENCEVILLE (ILL.) PLANT.

The Lawrenceville Light & Water Company, of Lawrenceville, Ill., operates a combined steam and gas-engine plant, giving electric and water service, all of the fuel being natural gas from the Lawrence County fields. Gas engines are used for the greater part of the output, but steam is maintained in one boiler continuously to be ready for operating a steam pump in case of a fire alarm. A steam-engine-driven generator is also employed as a reserve in the plant for use when gas engines are being overhauled. The outputs of the various generators in the plant for the six months ended Oct. 1, 1911, were as follows, all of the generators being belt-driven:

[illegible]-kw gas-engine-driven generator	55,600 kw-hours
[illegible]-kw steam-driven generator	7,400 kw-hours
110-kw gas-engine-driven generator	152,800 kw-hours
Total output for six months	215,800 kw-hours

The consumption of gas for all purposes, including keep-

ing up steam and some steam water pumping, amounted to 42.4 cu. ft. per kw-hour of output.

A test made on the 150-hp Nash gas engine, with a load of 39.6 kw, constant, showed a consumption of gas on a five-minute run of 28.6 cu. ft. per kw-hour. The gas consumption was in each case reduced to what it would be at 4-oz. pressure, and the meters used were the regular watt-hour and gas meters through which the input and output are measured. The figures make no claim to extreme accuracy, but show commercial conditions as they exist in this particular small plant.

OBSOLESCENCE OF THE HORSE.

The illustration shown herewith accompanied a recent newspaper advertisement of the Boston Edison company, which included data indicating the great progress of the electric vehicle. Among the statements were that a St. Paul baking company had just ordered twenty electric wagons, and that nearly on the same day the American Express Company bought fifty electric wagons and immediately ordered fifty more from another maker. It is pointed out that the largest power-truck factory in the country makes electric trucks exclusively, and that the largest manufacturer of gasoline automobiles has recently begun making electric trucks. It is stated that in and around Boston there are now sixty public electric-vehicle charging stations and nearly 300 private charging plants, and that, whereas last January there were only two electric commercial and four passenger vehicles represented in Boston, the representation now includes sixteen commercial and passenger vehicles, while six other makers are negotiating for quarters.

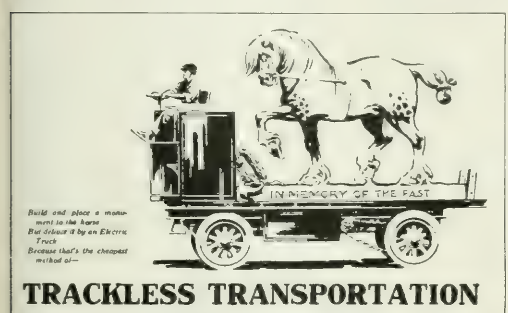


Illustration Accompanying a Newspaper Advertisement.

MEETING COMPLAINTS OF HIGH ELECTRIC-LIGHT BILLS IN THE MONTHS WITH LONG NIGHTS.

Every central-station operator is familiar with the fact that consumers, especially residence owners, are prone to complain of "mistakes in the lighting bill" when it is rendered in the autumn and winter months. The householder who has been paying $5 a month for light during the summer will immediately assert that he is being mistreated if his November bill amounts to $8. Just how to get rid of the multiplicity of complaints arising from the human failing of not taking changing conditions into account has been a matter of much thought among central-station men.

The Nashville (Tenn.) Railway & Light Company has been experiencing trouble along this line, and finally it decided to explain the whole situation in detail. A quarter page of advertising space in the Nashville dailies was purchased, and the company headed its announcement "Why Your Light Bill Is Higher at This Season of the Year." Then the following statement was made: "The days are getting shorter, the nights longer; the daylight hours are short, the electric-light hours long. The table given below gives the dark hours every month during the year. Study it carefully. It will explain to you why your light bill is higher in winter than in summer."

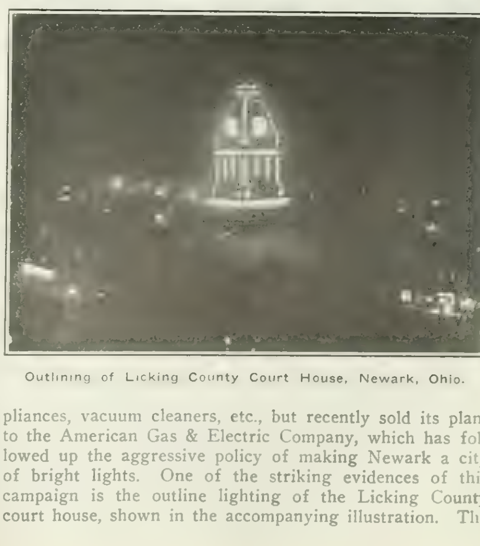
Following the presentation of the table an explanation of it was presented as follows:

"A 16-cp lamp costs two-thirds of a cent an hour to burn. If you burn one 16-cp lamp from dusk until 10 o'clock every night throughout the year it will burn 38 hours in June and 204 hours in December. At two-thirds of a cent an hour per lamp you would use 25⅓ cents' worth in June and $1.36 in December. You are getting the same amount of light for your money in each case, but in the winter you use electric light more hours. If you keep a store and close up every night at 6 o'clock in the summer you need no light whatever; but in December there are eighty hours from dusk until 6 o'clock, and it will cost you 53⅓ cents per lamp for the eighty hours. Whenever you think that your electric-light bills are too high, *we want you to tell us about it—but kindly take the above into consideration in contrasting your winter and summer bills.*"

It may seem to some absurdly superfluous to explain to the consumer that the longer he burns his lamps the more electricity he is going to consume, but the experience of many central-station companies shows that an explanation to that effect will meet a complaint satisfactorily, whereas silence would only increase the irritation.

CENTRAL-STATION PROGRESS AT NEWARK, OHIO.

Electrical progress in the city of Newark, Ohio, has been rapid since the advent of central-station service in the commercial lighting field, succeeding the former municipal lighting circuits. Newark is a bustling factory town of 28,000 population, and is also the site of the factory of one of the large illuminating-glassware manufacturers. The Licking Light & Power Company, composed of local capitalists, had prosecuted a number of active central-station campaigns to secure the general household use of electricity for sewing-machine motors, heating and cooking appliances, vacuum cleaners, etc., but recently sold its plant to the American Gas & Electric Company, which has followed up the aggressive policy of making Newark a city of bright lights. One of the striking evidences of this campaign is the outline lighting of the Licking County court house, shown in the accompanying illustration. The



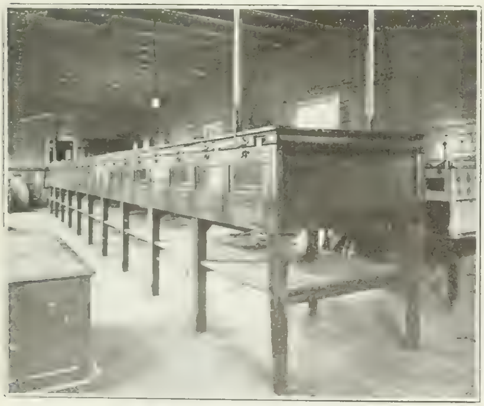
Outlining of Licking County Court House, Newark, Ohio.

principal architectural features of the spire are marked by rows of incandescent units, while the dials of the clock are similarly illuminated.

To meet the rapid increase in the demand for the company's service in the way of both lighting and electric power a number of important improvements are being made at the former Licking plant, which is now operated by the American Gas & Electric Company. A new 180-kw generator is being installed, and a modern switchboard capable of controlling about twice the present equipment of the station is being put in place. Poles and wires are being removed from the streets, to be replaced by circuits following the alleys. The efforts of the company in thus promoting the civic welfare of Newark are meeting with much appreciation from the members of the local Board of Trade and other citizens. Mr. George N. Tidd is vice-president and general manager of the holding company, Mr. H. L. Montgomery manager of the local company and Mr. Fred Morrison assistant manager.

A 6000-EGG ELECTRIC INCUBATOR.

The New Orleans Railway & Light Company has about sixty domestic-size electric incubators in use on its lines, besides several very large commercial equipments. The largest electric incubator in service in New Orleans, if not the largest anywhere, is a 6000-egg outfit recently built by the local Electric Manufacturing Company for Mr. A. Willoz, a professional poultry raiser. This incubator is 40 ft. long and 5 ft. wide, and contains forty separate compartments, each having a capacity of 150 eggs. Each compartment can be separately controlled so that all or any parts of the incubator can be operated, according to the number of eggs to be hatched. The controlling thermostats used do not completely break the heater circuit but introduce the comparatively high resistance of a small electric lamp when open. This avoids sparking at the contacts, while the flickering of the lamp makes easy the close



A 6000-Egg Electric Incubator.

adjustment of the thermostat. The maximum demand of the heater in each compartment is 60 watts, and the minimum, with the resistance in series, 7 watts, the average throughout the hatch ranging from 20 watts to 25 watts. The average consumption of energy is 10 kw-hours to 12 kw-hours per compartment per hatch, the cost of operating the incubator at the rate afforded by the New Orleans company being about 50 cents per compartment per hatch. Mr. Willoz, the owner, is reported to be very much pleased with the successful operation of his large electric incubator, which has now been in service six months. He formerly used both oil-heated and gas-heated incubators, but declares that under no conditions would he return to these types of heaters.

As already noted in these columns, June 8, Mr. W. E. Clement, contracting agent for the lighting company, believes that electric incubators make a specially desirable central-station load on account of their long-hour characteristic. A large window of the company's office has been given over to an electric incubator in process of hatching a number of eggs, and the chickens produced will be brooded in an electrically heated hover.

CUSTOMERS' PANELS FOR LIMITED-PEAK SERVICE AT MILWAUKEE.

Under the new rate schedule of The Milwaukee Electric Railway & Light Company customers who agree to keep off its lines during peak periods or to use limited demands during these times secure a substantial decrease in the cost of their electrical energy, amounting to a reduction of one-half the "demand" element of the charge.

For controlling the service of such limited-service customers Mr. O. M. Rau, electrical engineer of the company, has recently designed and had built special panels equipped with time-clocks and circuit-breakers, which are installed by the company at the expense of customers contracting for such limited service.

The panels used by the Milwaukee company provide for the three conditions of (1) limited demand in kilowatts, (2) peak-period disconnection of service with limited demand at other hours, and (3) two distinct and adjustable

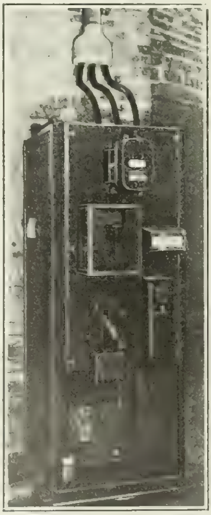


Fig. 1—Customer's Panel for Limited Peak and Off-Peak Service.

demand limits, for service during peak period and off-peak periods respectively. Each panel is equipped with a watt-hour meter which is furnished free by the company. The rest of the equipment, oil switch, relay, time-clock and panel, is furnished at the customer's expense (costing $100 to $200 each), but is entirely subject to the settings and supervision of the company's inspectors. The time-switch settings are corrected from month to month by these inspectors, to follow the time of peak load.

The simplest type of panel, as above noted, comprises

an oil switch with overload coils, causing the breaker to trip out at a demand above that contracted for. The second type, or peak-period cut-out panel, has a time-switch which during the hours of peak load completes the circuit to a shunt tripping coil, thus opening the oil switch and preventing its closure again during the peak period.

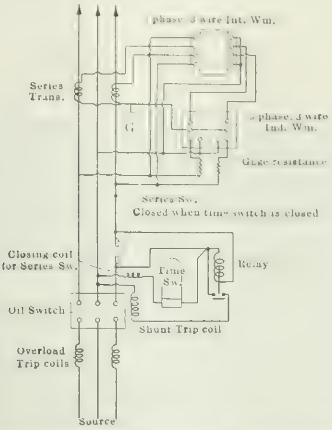


Fig. 2—Circuits for Limited Peak and Off-Peak Service Panel.

At the end of this time the handle can be thrown in as usual.

The accompanying photograph and sketch show the limited-peak panel. This provides one demand limit for off-peak hours and a lower limit during the peak. The series overload trip coils effect the high-limit opening. During the peak hours the time-switch completes the circuit to the shunt trip coil, which, however, includes the contacts of the adjustable relay shown. The operation of this relay, occurring when the time switch is closed, thus completes the shunt-coil circuit of the main oil switch, opening this switch and preventing its closure during the peak period. The customer may thus contract to use a certain limited demand during off-peak hours, obtaining a smaller amount of energy during the peak, for which he pays accordingly. A number of these panels have been put in service at Milwaukee.

ISOLATED-PLANT COSTS WHICH AN OWNER MAY OVERLOOK.

A large textile-mill owner about to equip a new factory was investigating the comparative expense of mechanical drive from a gas-engine plant and of motor operation using central-station drive. He found that the cost of the number of small motors required would be $8,000, while a gas engine of equivalent rating was quoted to him for $500. With a ratio of 16 to 1 thus in favor of the isolated plant there seemed no possible doubt of the kind of power to use, and the central-station solicitor was waved aside with a smile. The latter, however, soon got busy with his data on the cost of shafting, pulleys and belts, and returned to the mill man's office with figures to show that the cost of the mechanical transmission apparatus would in reality bring the total expense of gas-engine drive up to that of individual motor drive. Moreover, the loss of energy occasioned by the friction of the shafts, belts, etc., would represent a continual cost of $1,700 a year, which electric drive would save.

In general, the point was also made by the solicitor that the power cost here, as in many other businesses, actually amounted to only 3 to 4 per cent of the total manufacturing cost. Even if some other means of drive showed a saving of a few dollars on the hundred the proportional economy on the whole cost of production would be slight. And such a petty saving should be investigated for its effect on the other elements of production cost, such as convenience, comfort, simplicity, flexibility, reliability, etc. If it were found, for example, that motor drive cost a few per cent more than isolated-plant mechanical drive (though amounting only to a fraction of a per cent difference in the total manufacturing cost) the mill owner should consider whether such evils as the lack of reliability of a balky gas engine which might be shut down for repairs Tuesday and Thursday, the darkened rooms filled with overhead belts and shafts, the labor and time lost in routing goods according to the arrangement imposed by the mechanical drive, and the many other attendants of isolated service, might not, after all, contribute much more to the debit side of the ledger than the possible slight extra cost of modern drive.

Wiring and Illumination

UNIFORM DESIGN OF STREET-LIGHTING STANDARDS.

In view of the fact that the Sanitary District is preparing to install 10,000 additional arc lamps for street lighting in Chicago, the City Council of that city directed the Mayor to appoint a committee of aldermen, city officials and citizens, whose duty it should be to establish a uniform design of post, globe, etc., to which the new standards and all future city street-lighting installations shall conform. It is encouraging to note that the Chicago Plan Commission, which is moving slowly toward a more beautiful city, is represented on the committee. The Mayor has announced a committee of fifteen to select the design. The committee consists of Alderman Joseph F. Ryan, chairman; Aldermen Twigg, Brennan, Foell, Capitain, Utpatel and Janovsky; Messrs. W. D. Kerfoot, Henry E. Coonley and William Holabird, for the Chicago Plan Commission; Messrs. E. U. Kimbark, Edward M. Skinner and George Beaumont, for the Chicago Association of Commerce; Mr. William Carroll, city electrician, and Mr. E. B. Ellicott, electrical engineer of the Sanitary District.

THE ILLUMINATION OF TEXTILE MILLS.

The artificial lighting of textile mills is in fact a special field of engineering and one which offers great room for improvement, according to Mr. Frank W. Reynolds, who presented a paper on the general subject of mill engineering at the recent convention of the American Society of Mechanical Engineers in New York.

While electric lighting is now generally adopted, there are, said the speaker, many mills where gas lighting is still used and a few where the old oil lamp may be found. A white light is the best for all purposes, but with many forms of the incandescent bulb the light actually obtained is quite yellow. On all white work the Cooper Hewitt lamp has been used with very good results, since it is steady and gives a powerful illumination. It has been found very serviceable in machine shops, and it has the virtue of allowing one to concentrate his gaze without undue fatigue of the eyes. In cotton mills, however, the operatives generally prefer local to general lighting, but this involves many difficulties in securing the right arrangement of the different lamps. The placing of a hooded bulb close to that part of

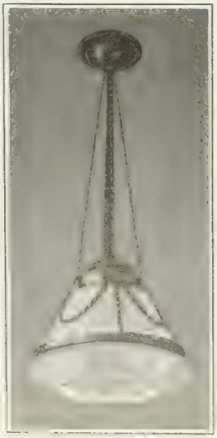
the machine which the operative must keep under his eye has been one solution of the difficulty of cross shadows which arises when a series of lamps are placed near a row of machines. This hooded local light, which seems at first sight desirable, probably tends to provoke accidents, owing to the deep shadow surrounding the machines. The alternation of the operative's gaze between the brilliantly lighted patch of his machine and the comparative darkness which surrounds that lighted patch has also been found to be hard on the eyes. This would seem inevitable, because a quick glance from a brightly lighted spot to a dark spot and then back again to the light spot involves two very rapid accommodations of the eye mechanism and a consequent excessive strain.

APPLICATION OF DIFFUSION TO ELIMINATE GLARE.

The accompanying illustration shows an unusual diffusing reflector recently developed in Switzerland under the patents of Ritter and Uhlmann, of Basle. Several installations of the system have been made in the industrial school of that city, where use is made of the new reflectors in the illumination of both exhibition rooms and auditoriums.

In principle this reflector insures that no direct rays from the filament shall leave the fixture without coming from one or the other of the supplementary diffusing surfaces, either the etched translucent glass or the matt reflector within. The lower globe, as shown, is made up of concentric, truncated-cone surfaces, alternately erect and inverted. The inwardly sloping surfaces of the inverted cones are lightly etched with acid. The outwardly sloping surfaces of the erect cones are of clear glass.

Direct rays of the filament thus pass through the inwardly sloping cone surfaces of the globe, which are lightly acid-etched so as completely to hide the light source. While this translucent surface hides the image of the filament, it is not dense enough to affect the efficiency greatly. Rays leaving the filament in the upper hemisphere strike a parabolic reflector surface of porcelain or matt aluminum. From this they are reflected back downward and



Improved Diffusing Fixture for Incandescent Units.

pass out through the outwardly sloping cone surfaces of the glass, which are clear. A maximum outlet for the whole spherical flux is thus provided through the lower surface, most of the light undergoing only a single diffusion. This, in addition to the very light acid etching or frosting of the translucent surfaces, contributes to the unusual efficiency reported with these new units. From no point beneath the fixture can the filament itself be seen through the clear glass surfaces.

DECORATIVE LIGHTING AT LOUISVILLE.

Upon the recent occasion of the visit of President Taft to Louisville, Ky., the Louisville Lighting Company paid a tribute to the head of the nation by means of a notable blaze of illumination surrounding its building. Incidentally

Building of Louisville Lighting Company, Louisville, Ky.

the display demonstrated to the public the quality and advertising value of three kinds of lighting—electrical, gas and electrical reflected. The lighting company is associated with the Louisville Gas Company.

The handsome three-story building which is the headquarters of the lighting company at 311 West Chestnut Street was draped with incandescent lamps extending up to the third story. The blazing strands formed United States shields, although the stars and stripes were lacking from the general outline. The upper cornice of the building was ornamented with ten upright electric globes of opalescent glass, illuminated from within by a 150-watt tungsten.

There were also ten pendent gas arcs along the upper edge of the wall, and a border of 25-watt tungstens fringed the cornice between the second and third floors. Two polished reflectors equipped with high-powered electric illuminants lighted up the sign of the company on the first-floor wall near the pavement.

RECENT TELEPHONE PATENTS.

RINGING SYSTEMS.

The harmonic type of selective ringing system is now pretty well established, and although there are a number of different systems, all of these follow the same general practice. The frequencies generally adopted are 16, 33, 50 and 66. As a fact, however, even these frequencies are only approximate, since as practically produced they must bear a definite fractional relation to each other, all being obtained from a single generator. The exact frequencies are thus proportional to the series 1, 2, 3 and 4; that is, two are in the ratio of the octave and two in the ratio of the fifth of the harmonic scale. This results in a marked tendency to interference, because of the overtone relation.

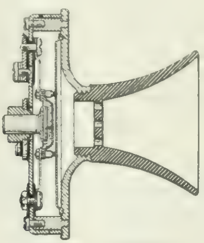
To overcome this tendency Mr. C. H. North, of Cleveland, Ohio, has produced a system in which the frequencies are chosen in the ratio of 5, 7, 9 and 11, or, more definitely, 30, 42, 54 and 66. The patent is assigned by him to the North Electric Company.

A ringing pole-changer forms the subject of a patent granted to Mr. H. N. Faris, of Kansas City, Kan. The vibrator is arranged to run continuously, obtaining its energy from a special battery. The main or ringing battery has its circuit open while connected to the vibrator and to the primary of a ringing transformer, until demand is made for ringing current. When this demand occurs the primary circuit is closed through the action of a relay. The secondary circuit then responds and this condition is maintained as long as the ringing current is required.

Messrs. E. Stout and J. S. Kupka, of Martinsburg, Ia., have patented a selective party-line system. Currents produced by hand generators at each station serve to control the action of clockwork switching mechanism, which runs synchronously at all of the stations. Arrangements are provided for signaling any or all of the stations as desired, as well as for setting back any motor which has got out of step.

TRANSMITTER.

Herewith is shown in section a transmitter patented by Mr. C. T. Mason, of Sumter, S. C., and assigned to the



Telephone Transmitter.

Sumter Telephone Manufacturing Company. The inside of the transmitter is shielded from moisture by a plate which incloses the back, while the rim of the diaphragm fits into a groove on the back of the face plate. In order to avoid electrolytic action the circuit is not led into the diaphragm, as is customary.

Letters to the Editor.

A Suggestion Concerning the Wireless Distress Signal.

To the Editor of Electrical World:

Sir:—Most of the ships now supplied with wireless apparatus carry but one operator. For this reason the apparatus is ready for receiving distress calls during only a portion of the time. It would therefore seem desirable that the distress call be so simplified as to be recognized without question by persons not acquainted with the telegraph code. If this were done, it would be possible for the captain of the ship to detail some one to wear the telephones while the operator is off duty. Of course, as soon as the distress signal was heard the operator would be called and communication established. The letter "S," which is the same in both Morse and Continental codes, consisting of three dots, would, in some definite combination, be a suitable distress call. For instance, "S S S" might replace the present "S O S" if the coming International Wireless Conference in London could be persuaded to make the change. This repeated a large number of times could hardly fail to be distinguished by even the most inexperienced.

Under the present conditions I believe it is often customary for the wireless operator to be off duty from midnight to morning, which is the period during which a large portion of the accidents take place. Any change which can make it possible to have every ship constantly ready to receive distress calls must vastly increase the usefulness of this safety device.

Louis W. Austin.

United States Naval Radio-Telegraphic Laboratory, Washington, D. C.

Office Buildings as Summer Central-Station Load.

To the Editor of Electrical World:

Sir:—In all of our large cities a most active struggle exists between central-station service and isolated electric plants for large office and mercantile buildings. There are some inherent reasons why office-building load is difficult for the central station to secure in some cases. The chief of these is the necessity of low-pressure steam for heating purposes during six months of the year or more, depending on the latitude. As this exhaust steam can be supplied through an electric-lighting engine acting as a reducing valve, with practically the same coal consumption as through any other reducing valve, the central station is "up against" the argument that during heating months the cost of coal for the isolated electric plant can be figured as zero.

Of course, this is only one side of the argument. Against the isolated plant is the necessity of operating in the summer during long periods of light load at very poor economy with no use for the exhaust steam. The same general arguments apply to the use of electric elevators supplied from central-station service as against hydraulic elevators with steam pumps exhausting into the heating system. There is an undoubted economy during the winter months and lack of it during the summer with the latter.

Another factor which has considerable influence is the policy of the building owner as to the supply of electric light. In far too many buildings it is supplied at a flat rate along with the rent. This practice gives rise to the usual dissatisfaction which accompanies flat rates and inevitably results in considerable waste, which the building owner makes up for by corresponding additions to the rent. Some building owners have come to realize that this practice is a handicap to them in renting space in competition with other office buildings where lighting service is furnished on a meter and costs the tenant considerably less than the additional rent for flat rate which he would pay under the other system. As a result some of the owners who formerly furnished electric light either with the rent or on a flat rate per lamp per month have installed meters and sell electrical energy to tenants on the same basis as if it were supplied by a central-station company. When the flat-rate waste is stopped the amount of exhaust steam obtainable from the electric-lighting service is, of course, much reduced. The lighting becomes more of a peak-load proposition and less valuable for supplying exhaust steam.

A logical method of handling this class of business which has been tried in some cities is to carry this office-building load on the building's own electric plant during the steam-heating season and turn it over to the central-station company during the summer months. In this way the central station obtains load to fill in the summer valleys of its load curve and the office-building owner is saved a lot of uneconomical operation when he has no use for exhaust steam.

Such a practice will, undoubtedly, increase in the future. At present it is in somewhat the same state as the securing of off-peak power business five years ago. A few central-station companies were carrying this kind of business and

improving their returns on their investment by it, but the majority thought it impracticable.

The main obstacle in the way of carrying summer business of office buildings on central-station service and turning it back to the isolated plants in the winter is the prejudice which some central stations have not outgrown against having anything whatever to do with isolated plants, in the fear that an isolated plant once installed will take the business for the whole year and thus cause a greater loss of revenue than if the isolated plants were kept out altogether. Nevertheless, off-peak business requiring but little additional investment to secure summer load and improve the yearly load factor seems more to be desired under the present state of central-station finances than carrying the modern office building through the winter peak. To be sure, the office-building peak does not coincide with the residence-lighting peaks in our large cities, but it is nevertheless a most important factor in the peak of the entire system. The central-station company which is seeking to increase the net returns per dollar invested will naturally seek the character of load which will most improve its load factor, and some improvement of this kind is to be found in purely summer load.

Boston, Mass. CHAS. L. DUTTON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Synchronous Machines for Automatic Voltage and Current Regulation.—ROBERT MOSER.—After a general introduction on some principles of voltage and current regulation of separately excited machines the author discusses first the synchronous machine shown in Fig. 1, in which 1

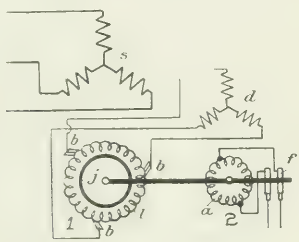


Fig. 1—Synchronous Regulator.

is the main machine (s being the stator and l the rotor in the form of a direct-current armature with commutator and three brushes b) and 2 is the exciter (d being the stator and a the rotor with distributed winding which is supplied with direct current through the slip rings f). The main machine 1 and the exciter 2 are coupled together. The stator d of the exciter is connected to the brushes b of the main machine. Exactly synchronous three-phase currents are, therefore, supplied to the rotor l and produce in it a magnetic field rotating exactly in synchronism, so that the rotor winding l behaves like a non-inductive resistance toward the polyphase current in it. By properly arranging a damping winding j (which is discussed in some detail) the commutation of the machine can be improved. By a

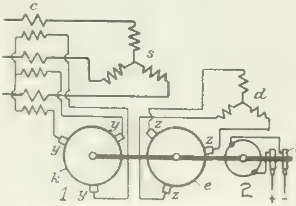


Fig. 2—Constant Voltage Regulator.

simple modification this machine can be made to yield constant voltage. For this purpose the rotor of the main machine 1 in Fig. 2 is provided with two direct-current armature windings k and e with their commutators. The winding e with the brushes z corresponds exactly to the winding l and the brushes b in Fig. 1. On the other hand, the winding k is supplied through the brushes y with three-phase currents from the secondary of the transformer c, the primary of which is the series with the stator winding s. In this way not only are the ampere-turns of the rotor of the main machine due to the current from the separate exciter, but there are additional ampere-turns derived from the current in the stator s. By properly selecting the transformation ratio of the transformer c and the position of the brushes it is possible to insure that the machine will

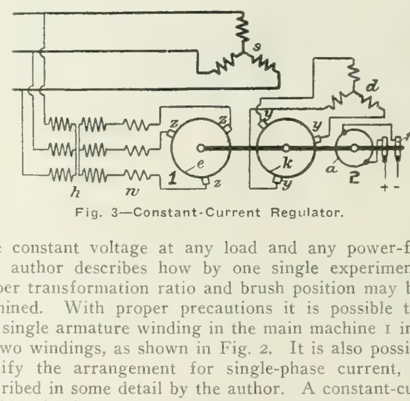


Fig. 3—Constant-Current Regulator.

give constant voltage at any load and any power-factor. The author describes how by one single experiment the proper transformation ratio and brush position may be determined. With proper precautions it is possible to use one single armature winding in the main machine 1 instead of two windings, as shown in Fig. 2. It is also possible to modify the arrangement for single-phase current, as is described in some detail by the author. A constant-current machine is simply a reversal of the constant-voltage machine, in that voltage is substituted for current and current for voltage. Fig. 3 shows a constant-current machine; the whole difference from Fig. 2 is in the arrangement and connection of the transformer h, which supplies the addi-

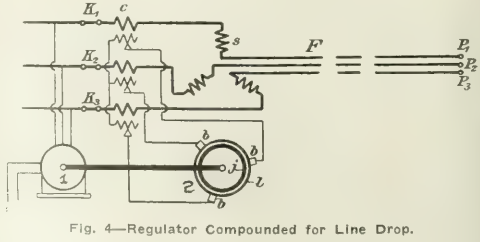


Fig. 4—Regulator Compounded for Line Drop.

tional ampere-turns to the rotor of the main machine. Finally it is possible to use the same principle for the construction of a booster which compensates the voltage drop in a long line, as shown in Fig. 4. F is a long transmission line, at the beginning of which (K_1 K_2 K_3) the voltage is maintained constant by some means. The problem is to

maintain at the other end (P_1 P_2 P_3) also constant voltage for any load and any power-factor. To solve this problem the stator s of a booster 2 quite similar to those described before is connected in series with this line. The rotor winding l of the booster is supplied through the brushes b with a current which is proportional to the current in the line F, being taken off the transformer c. This machine rotates synchronously, being driven by the synchronous motor 1. By properly adjusting the transformation ratio of the transformer and the position of the brushes it can be accomplished that at the end of the line, P_1 P_2 P_3, the voltage is constant and the same as at the beginning, K_1 K_2 K_3. The advantage of all these machines over constant-voltage or constant-current machines with purely separate excitation (Fig. 1) is that in the latter the magnet copper cannot be economically utilized, while this is possible with the arrangements described.—*Elek. Zeit.*, Nov. 9 and 16.

Rectifier for Charging Small Storage Batteries.—In a construction devised by a German company and illustrated in Fig. 5 the alternating current of the supply network a b is first transformed by means of the transformer T down to a voltage (4 volts to 20 volts) corresponding to the

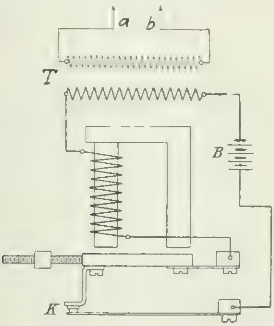


Fig. 5—Diagram of Connections of Rectifier.

number of cells in the battery B, and the low-voltage single-phase current is then rectified by means of a vibrating rectifier. To prevent sparks at the contact of the interrupter, the armature must vibrate in synchronism and in time-phase with the alternating current. For this purpose the electromagnet is excited by the pulsating direct current directly. The use of a polarized armature is thereby avoided. Without the use of condensers, etc., the operation of the interrupter is entirely sparkless. The apparatus itself has no definite polarity, but its polarity depends on the connections to the battery B. The vibrations of the armature depend on one hand on its mass and on the force of the spring which tears it off, and on the other hand on the magnetic forces which act on it. If now for a given frequency the apparatus is started in such a way that the circuit is closed at the moment in which the alternating emf is opposed to the battery emf, the time-phase of vibrations is definitely settled for this frequency. The apparatus always supplies charging current to the battery, and it does not matter with which polarity the battery is connected to the apparatus. Variations of the frequency by $\pm$ 5 per cent have no effect. The fact that the apparatus is independent of the polarity permits its use by laymen. The efficiency of the charging apparatus, including the transformer, is from 40 to 45 per cent, even with very small loads, such as 10 watts.—*Elek. Zeit.*, Nov. 23.

Direct-Current Turbo-Generators.—An account of the lengthy discussion which followed the reading of the paper of Roberts recently abstracted in the *Digest*. The various speakers dealt with a great many different mechanical difficulties in the design and construction of direct-current turbo-generators.—Lond. *Electrician*, Nov. 24.

Lamps and Lighting.

Neon Tubes.—George Claude.—A paper presented before the International Society of Electricians in Paris. The author first gives a historical sketch of the development of the neon tube lamp and then describes the different steps in the formation of a neon tube as follows: The tube is first filled with very pure neon (obtained from liquid air after separation of oxygen and nitrogen). The current is then passed through the tube while it is evacuated by means of a pump. It is then filled again with neon and evacuated again and this is repeated several times. Any other gases which may be in the tube besides the neon are then condensed by means of charcoal at the temperature of liquid air. The current is passed through the tube continuously during these operations. The tube is then ready for use. At an automobile exhibition in December, 1910, in Paris four tubes 36 m (118 ft.) in length were used for decorative lighting. Photometric tests were made with another tube 6 m (20 ft.) in length and 45 mm (1¾ in.) in diameter, which showed a specific consumption of 0.64 watt per cp. The author estimates that with a greater length of the tube the specific consumption could be reduced to 0.5 watt per cp, the power input being measured at the electrodes, or 0.6 watt per cp if the power is measured at the primary of the transformer. There was one more difficulty to overcome since the first tubes failed after a few hours on account of the absorption of neon by the electrodes. The remedy was found when the observation was made that the metallic deposits formed on the walls of the tubes opposite to the electrodes contained neon. Claude concluded that the absorption of the neon had to do with the volatilization of the electrodes and that if the latter could be overcome the absorption of the neon would stop. This could be done by using large electrodes. With electrodes having a surface of about 5 sq. decimeters (78 sq. in.) per ampere the life of a 5-m (16 ft.) tube is from 800 to 1000 hours. That is, such a tube will last under ordinary conditions for about a year. Under normal operations the tubes of 45 mm (1¾ in.) diameter consume from 0.8 amp to 1 amp and give 200 cp per meter of length. While maintaining a satisfactory efficiency, it is possible to reduce the luminous intensity to one-half by reducing the current in the same proportion. This can be done by adjusting the self-inductance in series with the tube. It is also possible to get a higher luminous intensity, but only at the expense of the length of life, since the electrodes begin to evaporate when the current is pushed above the normal value. The voltage at the terminals of the tube depends on its length. About 1000 volts are required for a tube 5 m (16 ft.) in length. Of these, 350 volts are absorbed in the immediate neighborhood of the electrodes and the rest in the luminous column. Side by side with ordinary lamps the neon tubes seem to give a light somewhat too red, but if used alone the light has a yellow-gold color which is quite agreeable. Claude prefers to use two or three tubes each 5 or 6 m (16 ft. to 20 ft.) in length, in series across the secondary terminals of a transformer with an adjustable self-inductance in the primary circuit. The secondary voltage is from 3000 to 4000. The efficiency may be easily increased by replacing two tubes 6 m (20 ft.) in length by one 13 m (43 ft.) in length. Such a tube in the form of a rectangle with sides 4 m (13 ft.) and 2.5 m (8 ft.) in length was exhibited in the lecture hall of the Society of Electricians. Including the transformer losses the specific consumption was 0.7 watt per cp.—*La Revue Elec.*, Nov. 24.

Train Lighting.—An illustrated description of the Silvertown train-lighting system which is being experimented with at present by one of the large English railway companies. The equipment consists of a generator driven from the car axle and carrying on its shaft a governor for operating the switchgear and a double battery of accumulators, one battery being normally connected to the ter-

minals of the lamp circuit, while the other is connected to the armature terminals for charging.—Lond. *Electrician.*

Generation, Transmission and Distribution.

Hamburg Traction Plant.—W. Wechmann.—A continuation of the long and profusely illustrated description of the recent steam-turbine extensions of the power plant of the Blankenese-Ohlsdorf single-phase road. In December, 1910, the consumption of coal per useful kw-hour was 1.64 kg (3.6 lb.), and the cost of the useful kw-hour in the power plant was 1.17 cents. The total number of useful kw-hours during that month was 2,172,236.—*Elek. Zeit.,* Nov. 23.

Electricity in Mines.—Philippi.—An illustrated review of the applications of electric energy in British mines, with special reference to the erection of one large common power plant for a number of mines, the use of electric main winding machines, the use of electric motors under ground, safety devices and wiring arrangements.—*Elek. Zeit.,* Nov. 23.

Traction.

Railway Electrification in Austria.—A. Hruschka.—The conclusion of the long and detailed illustrated report on preliminary investigations concerning the electrification of the Austrian State Railways. In the present instalment the results of this investigation are compared with those in other countries (Switzerland, Bavaria and Sweden).—*Elek. Kraftbetr. u. Bahnen.,* Oct. 24.

Installations, Systems and Appliances.

French Central-Station Statistics.—The yearly statistical tables on the status of central stations in France and its colonies in 1911. As stated in the introduction, it is rather a list of cities and towns in which electrical energy is available than a list of central stations. The statistics cover seventy-seven full pages, and in thirteen columns condensed information is given concerning the cities, companies, equipment, system used, etc. No summary of the statistics is given.—*L'Industrie Elec.,* Nov. 10.

Utilization of Waste Heat.—Otto Goertz.—The author discusses the advantages and economies of the sale of hot water or steam from central stations to municipal bath houses, apartment houses and industrial plants. If this can be satisfactorily developed the heat supply may become the main product of the stations and the electricity supply may be considered as a by-product, so that it would be possible to make a very low rate for the use of electricity for cooking and other domestic purposes.—*Elek. Kraftbetr. u. Bahnen.,* Nov. 4.

Isolated Plant.—An account of the electrical equipment of Whiteley's new building in London. The energy is generated in the firm's own station on the premises, there being six generators of 110 kw and one of 200 kw. Direct current is supplied at a pressure of 200 volts for all purposes. More than 2000 metallic-filament lamps of 200 volts are used. There are in use over twenty passenger elevators, various electrical conveyors for the transfer of goods from place to place, etc.—Lond. *Electrician,* Nov. 24.

Eddy-Current Brakes.—F. Niethammer.—An article on the design of eddy-current brakes. The article discusses the formulas of Rüdenberg for different types of eddy-current brakes, both with copper and iron brake disks, and compares them with the results of experience. He finally outlines how best to proceed in the calculation and design of such brakes.—*Elek. Kraftbetr. u. Bahnen,* Oct. 24.

Wires, Wiring and Conduits.

Electric Strength of Cables.—W. Deutsch.—The author gives a new and comparatively simple formula for calculating the "specific tension stress" (the potential gradient) in stranded cables. It is emphasized that there is a considerable difference between the behavior of a stranded cable and that of a solid conductor. It is shown that in single-phase or three-phase cables with stranded conductors the electrostatic field intensity (potential gradient) at the conductor surface is higher than with solid conductors of the same diameter, and that it increases with increasing number of strands and insulation thickness up to a maximum value which is about 30 per cent greater than the electrostatic field intensity at the surface of a solid cylindrical conductor of equal thickness. If the conductor cross-section differs from that of a circle the electrostatic field intensity is still considerably greater at the points of curvature with minimum radius.—*Elek. Zeit.,* Nov. 23.

Graphical Method for Calculating the Voltage Drop in Overhead Lines.—Nils Forssblad.—A description of a new and simple graphical method for calculating the voltage drop in the usual systems of overhead transmission lines. The fundamental new conception is the "voltage resistance" ("spannungswiederstand"), defined as the figure with which the effective current in the line, given in amperes per square millimeter, must be multiplied to get the voltage drop per kilometer of wire, if the resistance, reactance and power-factor are known. A diagram of curves is given, from which the voltage resistances may be taken, and numerical examples illustrating the method are given.—*Elek. Zeit.,* Nov. 23.

Electrophysics and Magnetism.

Inductance of Linear Conductors.—A. C. Jolley and A. F. Burgess.—The first part of an illustrated account of experiments undertaken to verify the formulas commonly used to express the inductance of a straight conductor. The limitations of the Neumann formula are pointed out, and an expression is obtained for the inductance of a couple of parallel wires as used in high-frequency measurements. Finally, the effect of neighboring bodies of iron is considered, and the effect of different types of slot as used in armature stampings is shown experimentally and for various currents. The article is to be continued.—Lond. *Electrician,* Nov. 24.

Electrochemistry and Batteries.

Manufacture of Carbon Electrodes for Galvanic Cells.—Otto Brandt.—A concise description of various methods of making carbon electrodes for primary batteries. Among them are Bunsen's method of making electrodes from coke and bituminous coal, a method of making electrodes from powdered graphite and bituminous coal tar, and Leclanché's method using hydraulic pressure. Various forms of carbon electrodes for different types of primary cells are described, among them a flexible carbon electrode with high current capacity in a small space.—*Elek. Zeit.,* Nov. 23.

Telegraphy, Telephony and Signals.

Automatic Telephony in London.—A note stating that the British Post Office telephone authorities have decided to make experiments with various automatic telephone systems. An exhibition was recently given in London of the Strowger system. It is stated that the number of telephones now operated automatically on the Strowger system in the United States is equal to half the number of telephones at work in Great Britain.—Lond. *Electrician,* Nov. 24.

Wireless Telegraphy.—The conclusion of the long detailed illustrated description of the Telefunken system of wireless telegraphy. In the present instalment various accessory apparatus and instruments are described, especially a sound intensifier, a calling apparatus, wave meters, and the buzzer.—Lond. *Electrician,* Nov. 24.

Miscellaneous.

Physiological Effect of an Alternating Magnetic Field.—S. P. Thompson.—At the recent meeting of the London Physical Society the author described his apparatus for

demonstrating in the laboratory the physiological effect of an alternating magnetic field. An alternating electric current with a frequency of 50 cycles per second is led into two large copper coils, producing an alternating magnetic field of an intensity of about 10,000 c.g.s. units in the space between the coils. If the head is placed in this space a singular sensation of a flickering bluish illumination is perceived. The effect is greatest if the direction of the lines of force of the field is through the temples.—Lond. *Electrician*, Nov. 24.

British Institution of Electrical Engineers.—Another long editorial discussing criticisms of the new proposed constitution of the (British) Institution of Electrical Engineers. There are also several letters relating to the subject.—Lond. *Electrician*, Nov. 24.

Book Reviews.

Brown's Directory of American Gas Companies. Gas Statistics. 641 pages. New York: E. C. Brown.

The 1911 and twenty-fourth issue of this standard gas directory lists 1126 artificial, 528 natural, 215 acetylene and 124 gasoline gas companies. The organization and operating data are given in the body of the book, the companies being listed alphabetically by states and towns. An appendix comprising about half of the book contains financial data of the companies reported and lists of the officers, directors, committees and members of gas associations. The value of this book as the directory of a great industry is unquestionable, and it is unfortunate that convenience in reference to its contents is subordinated to advertising considerations. It would appear that no sacrifice of advertisers' interests would be involved in printing their announcements in a separate section, and it certainly would be desirable to place the title page, preface and table of contents where they could be found without a search.

Maximum Production in Machine Shop and Foundry. By C. E. Knoeppel. New York: *The Engineering Magazine*. 365 pages, 34 illus. Price, $3.

A book directed to the systematic management of foundries and machine shops for the betterment of their productiveness and finance. It has been written by a practical man who has had abundant experience in foundry work, and is intended for practical and business men. It is written in an elementary and simple, if somewhat diffusive, style, and will be serviceable to foundry managers and others.

New Apparatus and Appliances

SELF-PROPELLING CRANE.

The accompanying illustration shows a self-propelling single-motor crane designed for the lighter operations required of this class of machinery, and applicable to factories and yards which have only a limited use for cranes and hoisting apparatus. The machine is known as the Browning Engineering Company's standard No. 4 four-wheel locomotive crane, and it is propelled by a motor, controlled by one man. It has a maximum lifting capacity of 15 tons at 10-ft. radius and 2.5 tons at 40-ft. radius. The working weight is approximately 35 tons. The drawbar pull of this machine is about 7600 lb., which enables it to handle six or seven cars on a level track. The crane is equipped with a Westinghouse direct-current motor, built especially for crane service and having its frame split horizontally so that all the parts are easily accessible. The shafts are extra large and strong and the area of the commutating service is ample for good commutation. The current density in the brushes is low. High starting torque and low flywheel effect permit the quick starting, stopping and reversing required by the service. The motor shown is rated at 50 hp, 220 volts, 470 r.p.m. Standard, reversing drum-type Westinghouse controller and grid resistors are used for controlling the motor.

Single-Motor, Self-Propelling Crane.

ELECTRIC CHAFING-DISHES AND FRYING-PANS.

The rapidly increasing use of electrically heated apparatus for domestic purposes has led to the design of various utensils and to modifications of those already designed. Examples of these are shown herewith in the frying-pan and the blazier-type chafing-dish manufactured by the Westinghouse Electric & Manufacturing Company.

The frying-pan is one of the most convenient cooking utensils that can be offered for use in homes, restaurants, hotels, etc. It is not only a complete frying-pan, capable of cooking everything that can be fried in the ordinary manner, but it can also be turned into an electric disk-stove by simply inverting it and is then suitable for all kinds of light cooking, toasting and similar uses. It is made of sheet steel and has a polished metal handle. The heating element is located in the bottom of the pan and is hermetically sealed between steel walls so that it is completely protected from oxidation. The pan can be easily cleaned.

Fig. 1—Blazier-Type Chafing-Dish.

The pan heats very quickly and can be run at three different temperatures—high, medium and low. The desired temperature is obtained by means of an indicating push-button switch. The stand is made of aluminum and is so

designed that the frying-pan can be run at full heat without injuring the surface of the table on which it is supported. The whole outfit is very light.

In the Westinghouse blazier-type chafing-dish the heat is uniformly distributed over the bottom of the pan, thus eliminating the overheated center and cold sides which are

Fig. 2—Electric Frying-Pan.

unavoidable when heat from a flame is used, as in the case of the corresponding alcohol utensil. The dish can also be operated at three heats—high, medium and low—and, as the temperature at each heat is always the same, results once obtained can always be duplicated. It is always ready for use and consumes so little electricity as to be more economical than the alcohol-heated dish. This chafing-dish is similar to the ordinary type except that it has three pans instead of two—a water pan, a food pan and a blazier. The water pan and the food pan are the same as used with the ordinary alcohol chafing-dish.

The blazier contains the heating element hermetically sealed in the bottom. It is similar to the food pan in appearance and can either be used as a food pan for operations requiring high temperature, as in frying, or it can be filled with water and used to heat the food pan, which fits within it, when mild heat is wanted. An indicating plug switch controls the temperature. The high heat is ordinarily used to bring the chafing dish to the desired temperature. The low heat will keep water boiling after the boiling point is once reached and is useful for

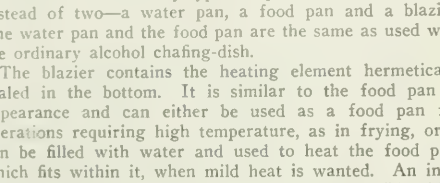


Fig. 3—Electric Frying-Pan Used as a Disk Stove.

keeping food warm. The medium heat is the highest that is usually wanted for cooking in the blazier.

All metal parts are handsomely finished in polished nickel or copper. The handles are of ebonized wood. The blazier is designed to fit the most popular sizes of chafing-dishes and contains all the parts necessary for electrical operation. By its use such alcohol chafing-dishes may be operated by electricity with no changes of any kind.

TILE AND FIBER CONDUITS.

By William D. Ligon.

Of the many types of underground electrical-conduit materials that have been employed only two are now in general use. These are the tile and the fiber conduits, a comparison of which is given below.

MULTIPLE AND SINGLE DUCT TILE.

The tile conduit has been in use for about twenty-five years. It is manufactured from vitrified clay in single duct and multiples of two, three, four and six ducts in either round or square bore. The ducts are laid end to end, with dowel pins to keep the alignment, and usually surrounded with an envelope of concrete about 3 in. in thickness, as a protection and reinforcement to the entire structure. The joints are staggered and wrapped with either burlap or iron and cemented with mortar.

This material, if properly vitrified and glazed, will last indefinitely; when free from iron it possesses high insulating properties and costs less per duct foot at the factory than any other conduit on the market to-day. It also possesses great mechanical strength and shows an average puncture test of 25,000 volts dry and 21,000 volts after immersion in water for 150 hours.

While the dielectric strength of tile is very high, the insulation of a system is greatly lowered, in consequence of the large number of joints to be closed with cement or other moisture-absorbing material, and instead of the entire system withstanding 21,000 volts it will be found when taking the joints into consideration that an installation will rarely be able to withstand more than 5000 volts, depending, however, on the general characteristics of the earth surrounding the ducts. In making the joints in multiple-duct tile it is impossible to prevent communication between the ducts, and owing to this condition multiple duct affords the lowest protection to the cables and the action of electrolysis is more liable to occur than in single-duct installations.

The weight of 3.5 in. tile is approximately 8 lb. per duct-foot, and the heavy weight therefore increases the cost of freight, handling, carrying and laying, and in propositions involving the use of tile the question of breakage is also an important item of consideration and may often amount to as much as one-tenth of the total shipment.

Owing to offsets, seams and roughness at the joints, extreme care must be exercised in pulling through the cables to prevent abrasion to the sheath, and if cables are not installed properly short-circuits and cable troubles will be encountered, thus resulting in shutdowns and expensive repairs, which increase the operating expenses to an excessive degree in the course of a year. Few manufacturers of vitrified clay recommend the use of tile bends in subway distribution, because of the roughness of the interior, and it therefore becomes necessary to replace them with manholes or hand-holes, which increases the cost of the entire system. It has been demonstrated by experience that the cost of subway installation where tile is used for conveying the cables is considerably higher than the same installation with the newer type of material, owing to the necessity of employing a higher class of labor and the large percentage of duct which is furnished without true ends and with seams, offsets, blowholes and improper glaze, and from these causes as well as others mentioned above the new class of material (fiber conduit) has rapidly come into general favor.

FIBER CONDUIT.

Fiber conduit is the most recent addition in materials for subway distribution systems that has been developed to meet the new conditions of service. It has been in use about eight years and is formed in cylindrical shape from fiber or wood pulp under pressure. The wood pulp is thoroughiy saturated with a bituminous compound, and any vegetable matter or bacteria which would tend to promote decay is killed by the presence of about 6 per cent of creosote salts in solution. There are at the present time two types in general use, known as straight-joint and bell-and-spigot-joint conduit, made in four styles of joint to meet the general conditions of service, namely, socket (mortise and tenon) joint, sleeve joint, drive joint and screw joint, furnished in either 1-in., 1.5-in., 2-in., 2.5-in., 3-in., 3.5-in. or 4-in. diameter. It has been shown that the fiber conduit made by the H. W. Johns-Manville Company will withstand an average puncture test of 32,000 volts dry and 24,000 volts after immersion in water for 200 hours.

In the introduction of this material on the market there were objections to be overcome, the most serious being as

to its length of life compared with the older styles of conduit which had been used, and during the eight years of development this point has been one subject to much discussion and observation, resulting in numerous laboratory and service tests. Samples recently excavated from the first installations show no deterioration, either mechanical or electrical.

TABLE I.—COST TO CONSTRUCT MULTIPLE-DUCT TILE CONDUIT IN STREETS PAVED WITH GRANITE OR EQUIVALENT PAVING, EXCLUSIVE OF MANHOLES.

Duct Sections.	1	2	[illegible]	4	6	8	12	16	20	24
Excavating, refilling, [illegible] and disposal of dirt	$0.230	[illegible]	[illegible]	[illegible]	[illegible]	$0.590	$0.637	$0.791	$0.867	[illegible]
Concrete	[illegible]	[illegible]	[illegible]	0.160	0.192	0.243	0.269	0.333	0.368	0.384
Cost tile delivered	0.053	0.106	0.159	0.212	0.318	0.424	0.636	0.848	1.060	1.272
Laying tile	0.030	0.040	0.060	0.080	0.120	0.160	0.240	0.320	0.400	0.480
Cleaning ducts	0.005	0.010	0.015	0.020	0.030	0.040	0.060	080	0.100	0.120
Water, bridging and shoring	0.005	0.007	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.060
Tool repairs and replacement	0.010	0.010	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.060
Incidentals	0.010	0.010	0.010	0.010	0.012	0.015	0.018	0.024	0.030	0.036
Supervision, inspection and time keeping	0.036	0.052	0.072	0.072	0.095	0.114	0.192	[illegible]	0.292	[illegible]
Total per trench foot	[illegible]	0.727	1.034	0.975	1.366	1.636	2.112	2.725	[illegible]	[illegible]

It has been found that about 90 per cent of all cable troubles are directly traceable to some injury to the lead casing when being drawn into the duct, due to the roughness of the walls and the cement which has seeped through the joint and formed cutting edges after hardening. Cable troubles are also due to high currents leaking through the joints, as a result of improper installation and the impossibility of securing perfect alignment. These objections, however, are eliminated by the use of fiber conduit, because of the smooth interior and watertight joints. Unlike joining tile conduit, the connection made with fiber conduit forms a correct alignment without the use of mandrels or dowel pins and without having to use cement, mortar or burlap at the joints.

It is also true that fiber conduit is impervious to moisture, gases, acids or other corrosive elements; thus water, gas and stray currents cannot reach the cable protected by this material. It is a good non-conductor, doing away entirely with the trouble with stray currents, and it also affords prevention against electrolysis. In the event of short-circuit the wall immediately surrounding the arc may char, but the fire will not spread, and hence the cables may easily be removed from the ducts.

In figuring on subway installations it has been fully demonstrated by the experience of the largest operating companies that on account of the lightness in weight large savings can be effected in freight, trucking, excavating, handling, laying and the amount of concrete necessary. In shipping and handling fiber conduit breakage is practically nothing, owing to the great tensile strength of the wall and the shock-resisting properties of the material

TABLE II.—COST TO CONSTRUCT SINGLE-DUCT TILE CONDUIT IN STREETS PAVED WITH GRANITE OR EQUIVALENT PAVING, EXCLUSIVE OF MANHOLES.

Duct Sections.	1	2	3	4	6	8	12	16	20	25
Excavation, refilling, paving and removing surplus earth	$0.259	$0.353	$0.494	$0.430	$0.536	$0.722	$0.788	$0.858	$0.996	$1.072
Concrete	0.105	0.145	0.185	0.192	0.239	0.287	0.348	0.412	0.474	0.540
Cost tile delivered	0.054	0.108	0.162	0.216	0.324	0.432	0.648	0.864	1.080	1.350
Laying tile	0.030	0.060	0.090	0.120	0.180	0.240	0.360	0.480	0.600	0.750
Cleaning ducts	0.005	0.010	0.015	0.020	0.030	0.040	0.060	0.080	0.100	0.125
Water, bridging and shoring	0.005	0.007	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Tool repairs and replacement	0.010	0.010	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Incidentals	0.010	0.010	0.010	0.010	0.012	0.015	0.018	0.024	0.030	0.037
Supervision, inspection and time-keeping	0.036	0.053	0.073	0.076	0.102	0.134	0.171	0.210	0.253	0.299
Total per trench foot	0.514	0.756	1.049	1.088	1.643	1.920	2.453	3.008	3.633	4.297

Samples of conduit which were placed in an oven and the temperature greatly raised show that at 135 deg. Fahr. softening of the compound began, and that at 205 deg. the compound became very soft, but the mechanical strength of the material was such that the samples retained their shape, the change taking place only in the impregnating compound. However, in actual service the high temperatures named are not likely to occur, as the cable insulation would give way.

TABLE III.—COST TO CONSTRUCT FIBER-PIPE CONDUIT IN STREETS PAVED WITH GRANITE OR EQUIVALENT PAVING, EXCLUSIVE OF MANHOLES.

Duct Sections.	1	2	3	4	5	8	12	16	20	25
Excavation, refilling, paving and removing surplus earth	$0.230	$0.343	$0.431	$0.381	$0.481	$0.601	$0.655	$0.716	$0.848	$0.919
Concrete	0.090	0.126	0.163	0.175	0.224	0.273	0.344	0.417	0.490	0.572
Cost fiber pipe delivered	0.051	0.102	0.153	0.204	0.306	0.408	0.612	0.816	1.020	1.275
Laying fiber pipe	0.010	0.020	0.030	0.040	0.060	0.080	0.120	0.160	0.200	0.250
Proving ducts	0.003	0.005	0.007	0.010	0.015	0.020	0.030	0.040	0.050	0.062
Water, bridging and shoring	0.005	0.007	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Tool repairs and replacement	0.010	0.010	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Incidentals	0.010	0.010	0.010	0.010	0.012	0.015	0.018	0.024	0.030	0.037
Supervision, inspection and time-keeping	0.031	0.047	0.061	0.063	0.085	0.101	0.138	0.169	0.205	0.243
Total per trench foot	0.440	0.670	0.875	0.907	1.223	1.548	1.977	2.422	2.943	3.482

In the accompanying tables are shown the actual costs of installing single-duct and multiple-duct tile and fiber conduits as compiled from experience by the H. W. Johns-Manville Company, New York.

In considering the merits of the two more important

materials for underground systems of distribution it must be understood that each has its important field, and the conditions which govern these installations are to be considered carefully from the standpoint of interest and depreciation on the investment and the best service that can be obtained without interruption. The question of mechanical strength of fiber or tile when laid in concrete is of little importance, as the best concrete to-day will withstand a compression test of about 3000 lb. to the square inch, which is ample to meet the most exacting conditions of service.

ELECTRICALLY HEATED PILLOW.

The comfort of a hot-water bottle for sick-room use is impaired by its rapid cooling. When first applied it is likely to be too hot, but it very shortly becomes so cold as to be of little benefit. The ideal means of local application of heat is, of course, the electric heating pad, which will remain at a uniform temperature for any desired period. To this end the Jupiter Electric Products Company, Cleveland, Ohio, has developed the electrically heated pillowette illustrated herewith. This pad measures 13 in. by 16 in. and is flat, thin and flexible so that it can be wrapped around any part of the body. Asbestos surrounds the electric heating element, and this is in turn inclosed in a rubber case and eiderdown slip. The eiderdown envelope can be removed for washing. A thermostatic cut-out prevents the temperature of the pad from rising unduly, and the three-heat switch enables any intermediate temperature to be held.

BATTERY-DRIVEN DELIVERY WAGON.

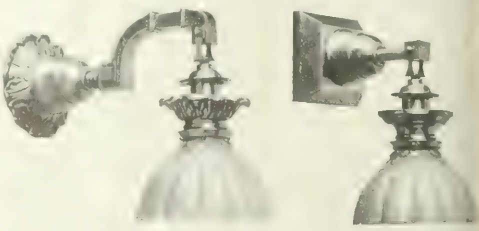
The electric delivery wagon is simpler to operate than any other motor-propelled vehicle, lasts longer than other cars, takes the place of two horse-drawn wagons, occupies the stable room of less than one, doubles the radius of horse-drawn delivery, consumes energy only when in use, is odorless and devoid of fire risk, and in general can be used to deliver goods more cheaply, quickly and dependably than any other form of delivery service.

The Hupp Corporation of Detroit, maker of the Hupp-Yeats pleasure vehicles, has recently added a commercial department, which is building 1000-lb. electric delivery wagons, weighing 2300 lb. and having an 86-in. wheel-base with solid tires. Motor and controller are of the Westinghouse vehicle type, and the standard battery equipment includes three trays of twenty-seven "Hycap Exide" cells with a capability of 27 amp for five hours. The wagons are designed for a delivery radius up to 20 miles and will run 50 miles per charge, depending on the condition of the roads. Front axles are of the inverted Lemoine type with wheel pivots fitted with imported ball bearings. The rear axle is of the semi-floating type, the motor being attached directly to the axle housing and driving through bevel gears. The car body has a total inside length of 44 in., a height of 54 in. and a width of 41 in.

SIDE-WALL ELECTRIC-LIGHT FIXTURES.

The side-wall fixtures illustrated herewith are an extension of the line of "T T C" tungstoliers, manufactured by the Tungstolier Company, of Conneaut, Ohio. Fixtures of this type are constructed on the sectional principle, all parts—arms, bodies, canopies and stems—being so interchangeable that with eighty-six parts it is possible to make up 1944 absolutely different fixtures, ranging in design from simple types for the small residence to the most ornate equipment for public buildings. It is also possible to increase the number of lights on a chandelier fixture from two to three, four or more, by simply inserting and repositioning the arms.

In addition to the chandelier types of these fixtures, there are now available a companion series of side-wall brackets, built up from the same sectional components as



Side-Wall Fixtures.

shown in the illustrations and as readily adaptable to all conditions of service. As contrasted with the traditional "inverted forest" that marks the showroom of the dealer in "regular" fixtures, these fixtures are packed in square pasteboard cartons, and the stock is stored on shelves out of the way and free from dust and danger, for the salesman demonstrates the line by the manipulation of a single complete set of fixture parts. From the salesman's point of view this is of the greatest advantage, as the customer sees one fixture type at a time, instead of a hundred. There is consequently less confusion and indecision, and the dealer's time is saved.

COMBINATION ELECTRIC STOVE AND TOASTER.

The accompanying illustration shows a two-burner combination stove and toaster manufactured by the Cadillac Electric Manufacturing Company, Cadillac, Mich. This is one of three types built by the company, the others having a single burner and three burners. In addition there is another form of two-burner stove made which differs from the regular stove only in that one of the units is equipped with a single heat burner, giving twice the heat for rapid cooking. In all of the stoves the heat is regulated by changing the relative position of the two plugs on the three pins at one side of the stove. The drawers underneath the heating coils may be used for broiling chops or for keeping toast or other food warm, as it is possible to regulate the stove for fast cooking, simmering or keeping food warm. In the three-burner type of stove the center burner gives twice as much heat as the outer burners and has a deep broiling drawer for a thick steak. The heating element being in the center between the drawer and the

Combination Stove and Toaster.

upper grid, it is possible to make toast or broil a chop in the drawer and at the same time brew tea or a pot of coffee on the grid above. The drawers are made of aluminum and the stove is finished in nickel. The three-heat burner is designed for consuming 550 watts and the single-heat burner for 1100 watts.

Industrial and Commercial News

The Week in Trade.

WITH moderate activity reported in most of the leading industries, the prospects for a period of good business appear very favorable. Transactions in pig-iron in the past few weeks have averaged 200,000 tons per week, and this figure gives signs of early increase. Consumers, attracted by low prices, are placing orders in encouraging amounts for present needs, and many are contracting for their requirements well into 1912. Unfilled orders on the books of the Steel Corporation as of Nov. 30 aggregated 4,141,955 tons, which represents a gain of 447,627 tons as compared with the tonnage shown in the October statement. Most of the contracts being placed at this time for steel are for shapes for bridges and buildings, and new business from this source is increasing rapidly. Negotiations are now in progress for some 100,000 tons of steel, and it is thought that the greater part of this will be placed this month. Slightly higher prices for cars have delayed closing of many railroad contracts, but as it is rather generally believed that these prices will not hold, substantial orders for cars and other equipment are expected to be given out within a short time. Work is now being resumed at many plants that have been idle since last May. Wire products have been advanced $1 per ton. The Department of Agriculture's official estimate of the 1911 cotton crop issued on Monday placed the total at 14,885,000 bales, which is 1,447,000 greater than the previous record in 1904. The Railroad Securities Commission, created in 1910 to investigate federal control of railroad securities, made its report on Monday, and strongly recommended publicity concerning all securities issued by interstate roads; but stated that it believed the time inopportune for federal control of railroad stock issues. The Supreme Court of the United States denied the petition of the independent tobacco companies asking review of the American Tobacco dissolution case, so that any further effort to open the case will have to be made through Congress. Business failures for the week ended Dec. 7, as reported by *Bradstreet's*, were 267, as compared with 216 in the previous week, 267 in the corresponding week in 1910, 250 in 1909, 268 in 1908 and 284 in 1907.

The Copper Market.

DECREASE of 23,212,454 lb. in surplus stocks was shown in the November statement of the Copper Producers' Association. This reduction, the largest reported in any month this year, was highly surprising in view of the lassitude shown in the market during the greater part of November. Production was placed at 111,876,601 lb., as compared with 118,225,-

Standard Copper	Bid.	Asked.	Settling Price.
Spot	13.15	13.40	....
December	[illegible]	[illegible]	13.27½
January	[illegible]	[illegible]	13.30
February	13.25	13.40	13.32½
March	13.25	13.50	13.37½
April	13.25	13.50	13.37½

The London market, [illegible]

	Noon.	Closing.
	£ s d	£ s d
Standard copper, spot	[illegible] 3	61 13 [illegible]
Standard copper, futures	[illegible] 11 3	61 8 [illegible]

Extreme [illegible]

	Highest.	Lowest.
Standard	13.27½c	11.57½c
London, spot	[illegible] 17 6	£53 7 6
London, futures	[illegible] 15 0	54 0 0
Best selected	[illegible] 0	57 5 0

442 lb. in October, and was the smallest reported since February, 1911, when the output was 109,828,297 lb. Total deliveries were 135,089,055 lb., as compared with 124,152,625 lb. in the preceding month. Domestic consumption was given as 68,039,776 lb., as compared with 64,068,307 lb. in October, and was the largest since January, 1910. Exports for the month were 67,047,279 lb. as compared with 60,084,349 lb. in October, and were the largest since last June. Stocks on hand at the end of the month, according to the report, were 111,785,188 lb., as compared with 134,997,642 lb. at the end of October, and were the smallest since February, 1910. In spite of the curtailed production, the rate of output is still too high for absorption under present conditions, and the attitude prevailing toward this phase of the copper industry was voiced this week by a prominent attorney, who expressed himself in favor of new legislation authorizing producers to make an agreement to reduce the copper output to a point where only the world's legitimate demands will be supplied. Prices have increased since the November report was issued, and electrolytic has been quoted at 13.45 cents to 13.50 cents cash, and 13.55 cents to 13⅝ cents delivered thirty days for January and February shipment. Exports for the month, including Dec. 13, aggregate 13,578 tons. The daily call on the Metal Exchange Dec. 13 quoted copper as per the accompanying table.

Industrial and Commercial Notes.

H. W. Johns-Manville Company to Build General Eastern Factory.—Plans are being made by the H. W. Johns-Manville Company, manufacturer of asbestos, magnesia coverings and electrical supplies, to move from its present plant at the foot of Thirty-ninth Street, South Brooklyn, New York. The chief reason for making this change is the desire of the company to establish a general Eastern factory which shall have ample capacity to meet all the requirements for its products in this part of the country and have room for expansion. The present site does not offer these possibilities, and was moreover condemned some five years ago by the city authorities to make way for sites for municipal ferries. While no further action has been taken by the city since that time, the company naturally would not care to develop the section further even if this were possible. No site has been decided upon for the new factory, but the company is considering a tract of 290 acres at Finderne, N. J., which is about half way between Bound Brook and Somerville, N. J., on the Central Railroad of New Jersey. The new factory will be modern in every respect and will be of fireproof construction throughout. The number of buildings has not yet been decided upon, but each will be 150 ft. wide and 1000 ft. in length and they will be 150 ft. apart. They will be one-story, of saw-tooth construction, and either of tile and asbestos stucco or brick, with steel framing throughout. A 10,000-kw plant will be installed by the company in the new factory, and this matter is now under consideration by several of the large manufacturers of power-plant equipment. The number of employees of the new plant will be between 2500 and 3500, and the present plans include the construction of houses for the working force. It will take about two years to construct the new plant, and it is hoped that ground will be broken by Jan. 1, 1912. Work is now progressing rapidly on the new office building for the H. W. Johns-Manville Company at the southwest corner of Madison Avenue and Forty-first Street, New York, which is to be used as an executive office by the company. There have been several delays on this work due to the strike of marble workers, etc., but the company now hopes to occupy the building shortly after Jan. 1.

Isthmian Canal Commission in the Market for Electric Supplies.—Sealed proposals in triplicate are sought by the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., by Jan. 6, 1912, for cross bonds, bond terminals, bare copper cable, bonds for steel conductor rails, galvanized-steel conduit, flexible conduit, combination couplings, box couplings and steel splice bars for conductor rails. Persons interested should apply for Circular No. 666. The material is required for rack railway and miter gates, the latter being operated by electric motors.

Pennsylvania May Electrify Pittsburgh Lines.—It is reported that the Pennsylvania Railroad Company has had surveys made with a view to electrifying about 15 miles of its main line out of Pittsburgh and that about $15,000,000 will be required for this work alone. Elimination of grade crossings, purchase of electric locomotives, etc., it is estimated, will increase this figure to over $30,000,000.

Great Western Power to Add 20,000 Kw to Big Bend [illegible] York and San Francisco, will add to the equipment at its Big Bend station on the Feather River, California, two 10,000-kw units similar to those now in service. The station will then have an aggregate rating of 60,000 kw in 11,000-volt, three-phase, 60-cycle units. During November the station carried its rated output continuously for thirty days without interruption, and, in order to provide reserve apparatus as well as to take care of additional load, it was decided to augment the equipment immediately. The company is also engaged in laying a cable across the Bay of San Francisco at the present time from its terminal station at Oakland. The cable is of the submarine type designed for 11,000 volts and to transmit 10,000 kw. It is 7 miles long. Preliminary work at Big Meadows having been completed, the Great Western Power Company will commence the erection of a great dam at that point in the spring. When completed the dam will have a 900-ft. crest and be 110 ft. high. It will be capable of holding one of the greatest artificial bodies of water in the world, impounding approximately 1,000,000 acre-feet. This with the normal flow in the Feather River will make it possible to generate continuously 400,000 hp. H. H. Sinclair will be in charge of the work on the dam, which will be only partly completed at present. It is questionable if the station at Big Bend will be enlarged much beyond 60,000 kw for some time to come. The probabilities are that as soon as a market for the energy is secured another station will be erected near the Big Meadows, where there is a fall of 2000 ft. in 10 miles. Between this site and the present station at Big Bend there is another site where a fall of from 300 ft. to 400 ft. is available. The Great Western Power Company owns all these sites; but their development will depend on the power market and the result of negotiations at present pending between it and the Pacific Gas & Electric Company.

East Creek (N. Y.) Station Ready to Turn Over.—The hydroelectric station of the East Creek Electric Light & Power Company, which Messrs. Viele, Blackwell & Buck, of New York, have been engineering, will start operating next week. The station is located at Ingham Mills, N. Y., where there is a head of 120 ft. The equipment at present installed consists of two 4000-hp Pelton-General Electric units wound for 2300 volts, three-phase, 25 cycles. The energy will be stepped up to a potential of 33,000 volts for transmission on steel towers to the Tribes Hill station of the Fonda, Johnstown & Gloversville Railroad. Space is provided in the station for another 4000-hp unit, and the line is built for a potential of 60,000 volts. Six conductors of No. 2 solid copper form the transmission circuits with a 3/16-in. steel ground wire overhead and two No. 6 telephone wires underneath. A 16,000-volt line connects the new station with the old station 3 miles below, where a frequency-changer is installed to receive the energy and transmit it at 60 cycles to Fort Plain and Canajoharie, the company selling energy in bulk to the companies operating in these towns. Eventually it is proposed to demolish the old station and supply the load direct from the new station. The General Electric Company is indirectly interested in the project.

Western Conduit & Manufacturing Company. — The Youngstown Sheet & Tube Company, Youngstown, Ohio, has acquired an interest in the Western Conduit & Manufacturing Company, of Chicago, which has resulted in a reorganization of that concern. The capital stock has been increased from $50,000 to $100,000 and the following officers have been elected: L. J. Campbell, president; W. J. McKay, vice-president and general manager; J. H. Rogers, secretary and general manager sales; C. C. Rose, treasurer. The above-named, together with Richard Garlick, constitute the board of directors. As soon as a new factory can be erected at Youngstown, Ohio, the company will move its headquarters to that place. This removal will probably occur some time next spring. It is the intention of the company to build at Youngstown a modern factory of large capacity for the manufacture of its well-known rigid conduit, "Harveyduct," as well as a factory for the manufacture of "Realflex," the new flexible armored conductor which the company has recently put upon the market. If the increase already made in the capital is not sufficient to take care of the improvements planned, it is probable that further additions to the capital stock will be made

Investigation of Tennessee Water-Power.—A party of capitalists interested in the development of hydraulic power and electric railway facilities throughout Tennessee is now touring that State in a private car, having made stops within the past week in Knoxville and Chattanooga. The party is investigating water-power development along the Ocoee River, and is also interested in the improvements which are being made in the properties of the Chattanooga Railway & Light Company. A comprehensive tour will probably result in the extension of investment in that portion of Tennessee. The party is composed of the following: Arthur Newbold, of Drexel & Company, Philadelphia, Pa.; A. H. Hodenpyl, of Hodenpyl, Hardy & Company, New York City; E. W. Clark, C. M. Clark, of E. W. Clark & Company, Philadelphia, Pa.; H. F. Reed, of J. G. White & Company, New York City; Clement Newbold, of Newbold & Company, Philadelphia, Pa.; George H. Richardson, of Richardson & Clark, Providence, R. I.; G. L. Estabrook and H. S. Hopkins, of E. W. Clark & Company, Philadelphia, Pa.

Proposed Hydroelectric Plant on Ohio River.—James M. Ashley, of Toledo, Ohio, president of the Auglaize Power Company, which is building a 6000-kw hydroelectric plant near Defiance, Ohio, as stated in these columns Oct. 7, is named as president of a new three-million-dollar company which has been organized for the purpose of installing a hydroelectric plant on the Ohio River, nead Letart Falls, Meigs County, Ohio. Several other leading interests in the Auglaize company are mentioned in connection with the new company, and it is believed that foreign capital will be represented in the new project. It is also stated that the minimum capacity of the plant will be about 50,000 hp, and while the field for sale of the energy generated has not been definitely arranged for, the plans of the company include furnishing energy to towns in the Ohio River valley and possibly Columbus or Cincinnati. Authority for building dams and locks is said to have been already secured from the War Department.

Warning Against Central-Station Swindler. — A forger who has operated under various aliases as a representative of the Kentucky Electric Company, of Louisville, Ky., in the South during the past few weeks, and who has succeeded in cashing a number of drafts and checks drawn on the Louisville concern, is now reported to be working the same plan in New York State. President Robert E. Hughes, of the Kentucky Electric Company, said last week that news of the swindler's depredations in the East had been recently received. A printed form of checks and drafts, to all intents and purposes standard with the company, is used, the stranger representing to the trade that he is selling electrical supplies of Kentucky Electric manufacture, the business of which, as a matter of fact, is exclusively that of a central station. One of the names given in the forger's operations is F. A. Delaney. Efforts are now being made by the police authorities to apprehend him.

Panama Hydroelectric Plant Award.—The Pelton Water Wheel Company has been awarded a contract for the complete hydraulic power equipment for the hydroelectric plant in connection with the Panama Canal. This will consist of three 3600-hp vertical-shaft Pelton-Francis turbines, operating under 75-ft. head at 250 r.p.m., for driving General Electric steam-turbine-type generators; three pipe lines, each 10 ft. 6 in. in diameter by approximately 300 ft. long; Pelton oil-pressure water-wheel governors and head gates. The plant will be located at Gatun Dam, and the power will be used by ship-towing electric locomotives and for operating locks, lighting and general power purposes on the canal.

New Aluminum Plant.—The Aluminum Company of America has purchased rights-of-way for 40 miles along the banks of the Little Tennessee River in Blount County, Tenn., and across the state line to North Carolina. It is reported that the company expects to expend between $12,000,000 and $15,000,000 in the construction of a series of dams in the stream and an electric power house which will furnish 200,000 hp to be used in the production of aluminum. The company is capitalized at $20,000,000, produces practically all the aluminum made in America, and has plants in East St. Louis, Ill., Niagara Falls and Massena, N. Y.

Roebling Company Not Handicapped by Recent Fire.—Reports of damage caused by a recent fire at the Trenton (N. J.) works of the John A. Roebling Sons' Company have been greatly exaggerated. The fire was confined to one shop, which was used in the manufacture of special wire, and the facilities of the other shops will be ample to take care of all work that would have been done in the burned shop.

Financial.

The Week in Wall Street.

Although the volume of trading has been rather light this week, prices have shown marked improvement. Following news that the Supreme Court would not reopen the American Tobacco case and publication of the report of the Railroad Securities Commission, Monday's market, after early dullness, assumed a vigorous tone, and considerable expansion took place in the transactions, accompanied by net gains of a point in many of the active stocks. This improvement in the scope of trading was not maintained on Tuesday, but prices went higher, though most of the gains were only fractional. Further bids by Berlin bankers for funds to carry over the end of the year were the feature of the money market during the day. After several hours of hesitation, the market became exceedingly active on Wednesday, following the issuance of a highly optimistic statement by an authority on the steel situation, who predicted the imminence of a boom in the steel trade equal to that in 1909. Among the items of general news attracting interest in the financial district on Wednesday were recommendations made to the Senate interstate commerce committee by a director of the Steel Corporation calling for the creation of a business court as a source of relief from present depression. Money rates on Dec. 13 were: Call, 3¾ @ 4 per cent; ninety days, 4 @ 4¼ per cent. The quotations in the tables are those at the close Dec. 13.

NEW YORK.

	Dec. 6.	Dec. 13.	Shares Sold.		Dec. 6.	Dec. 13.	Shares Sold.
All. Ch.	[illegible]	[illegible]	3,100	Int. Met., pf.	[illegible]	48	6,245
All. Ch., pf.	[illegible]	[illegible]	[illegible]	Mackay, Com.	[illegible]	[illegible]	[illegible]
Amal. Cop.	[illegible]	[illegible]	75,000	Mackay C., pf	[illegible]	[illegible]	[illegible]
Am. D. T.	33⅝*	[illegible]	—	Man. Elev.	135*	136	——
Am. Loco.	[illegible]	37	[illegible]	Met. St. Ry.	15*	15*	[illegible]
Am. Loco., pf.	102⅝	[illegible]	[illegible]	N.Y.&N.J.Tel.	[illegible]	[illegible]	——
Am. Tel. & C.	78*	[illegible]	—	Steel, com.	[illegible]	[illegible]	[illegible]
Am. T. & T.	139	140	9,150	Steel, pfd.	[illegible]	[illegible]	6,100
B. R. T.	77	[illegible]	[illegible]	W. U. T.	[illegible]	[illegible]	[illegible]
Gen. Elec.	[illegible]	154	1,900	West'h., com.	[illegible]	66	1,000
Int. Met.	[illegible]	[illegible]	[illegible]	West'h., pf.	113*	113*	——

PHILADELPHIA.

	Dec. 6.	Dec. 13.		Dec. 6.	Dec. 13.
Am. Rys.	46	45½*	Phila. R. T.	23½*	23
El. Co. of A.	[illegible]	[illegible]	Phila. Elec.	16	[illegible]
Elec. St. Bt'y	[illegible]	54	Phila. Trac.	84	84
Elec. St. Bt'y, pf.	50*	50*	Union Trac.	52½	51½

CHICAGO.

	Dec. 6.	Dec. 13.		Dec. 6.	Dec. 13.
Chi. City Ry.	186*	186*	Com. Edison	133½	135½
Chi. Elev. Rys.	29*	29*	Chi. Subway	[illegible]	[illegible]
Chi. Elev. Rys., pf.	94*	94*	Chi. Telephone	138¾	139
Chi. Rys. Ser. 1	95*	95*	Nat'l Car.	104*	103
Chi. Rys. Ser. 2	[illegible]	[illegible]	Nat'l Car, pfd.	118*	118

BOSTON.

	Dec. 6.	Dec. 13.		Dec. 6.	Dec. 13.
Am. T. & T.	139	140	Mex. Tel.	3¼*	3¼*
Cum. Tel.	157	157	Mex. Tel., pf.	6½*	6½
Edison	290	292	N. E. Tel.	154	[illegible]
Gen. Elec.	153	154	W. T. & T.	[illegible]	[illegible]
Mass. E. Ry.	22	[illegible]	W. T. & T., pfd.	104¼*	64¼*
Mass. E. Ry., pf.	93	93½			

*Last price quoted.
Shares sold for the week, Dec. 4 to Dec. 9.

Financial Notes.

Allis-Chalmers Reorganization.—With a view to placing the company on a more substantial basis, financially and physically, committees of preferred and common stockholders of the Allis-Chalmers Company have been formed in addition to a bondholders' committee, of which J. N. Wallace, of the Central Trust Company, is chairman, who may confer with the directors in regard to raising the necessary funds to meet the requirements of the company. As we go to press these committees have merely perfected their organization. The Allis-Chalmers Company has an authorized capital stock of $25,000,000 7 per cent cumulative preferred, of which $16,050,000 is outstanding, and $25,000,000 common, with $19,820,000 outstanding. There is an authorized 5 per cent bond issue of $15,000,000, of which $11,148,000 is outstanding, and in addition the company guarantees 6 per cent on $1,170,000 Bullock Electric Manufacturing Company 6 per cent preferred stock. No dividend has been forthcoming since February, 1904, and its securities have reached a very low level. The common stock, which in 1906 was worth 27⅜, was quoted as low as 1¾ on Monday, and the preferred, which was listed at 87½ in 1903, was sold for 8½ on Tuesday. On Wednesday the closing quotations on common and preferred were 1⅞ and 8, respectively. The bonds also broke, and although selling for 79 last May, were down to 51 on Wednesday. Before the first of the year the company will be obliged to raise $287,000 for bond interest; $80,000 to $130,000 for interest on floating debt, and $31,500 guaranteed dividends on Bullock Electric Manufacturing Company stock, in addition to securing new working capital to reduce the floating debt and to enable the company to accept whatever new business is offered. As is well known, the company has extensive works at Scranton, Cincinnati, Chicago, Milwaukee and West Allis, and manufactures chiefly heavy apparatus. Its products embrace steam, gas, water and electric machinery, and not having an extensive line of small apparatus and supplies, its prosperity is linked with the amount of new work undertaken in its respective fields from year to year. The electrical products form only a small part of the company's activities, and in this line it has stiff competition from the General Electric and Westinghouse companies. The destinies of the Allis-Chalmers Company are shaped by the following officers: E. H. Gary, of the United States Steel Corporation, chairman of the board of directors; W. V. Kelley, of Chicago, chairman of the finance committee; D. W. Call, president; Messrs. L. F. Bower and D. Van Alstyne, vice-presidents; H. Woodland, vice-president and treasurer; W. W. Nichols, vice-president and secretary; W. A. Thompson, controller; M. W. Babb, general attorney and assistant secretary; E. C. Welborn, assistant treasurer, and W. P. Harper, purchasing agent. The directors are Messrs. E. D. Adams, E. H. Gary, C. MacVeagh, W. A. Read, C. Vanderbilt, C. Allis, H. W. Falk, D. W. Call, W. H. Whiteside, H. Woodland, D. Van Alstyne, A. F. Banks, M. Pam, W. V. Kelley, K. K. Knapp, F. O. Wetmore and S. S. Palmer.

New York, New Haven & Hartford Transfers Its Control of Connecticut Lighting Companies.—Acting with the Connecticut Company, which operates its electric railways, and with the Housatonic Power Company, to which it had transferred all the gas, electric light and power companies formerly operated by the Connecticut Company, the New York, New Haven & Hartford Railroad Company has in the form of a sub-lease practically given up its control in the Connecticut lighting companies. The new lease is made to a corporation known as the United Electric & Water Company, which is a corporation chartered by the Connecticut Legislature, and is believed to represent the United Gas Improvement Company of Philadelphia, and practically the same interests that were active in getting the New Haven road to take the properties originally and that now take them back. The sub-lease calls for payment by the lessee of $365,000 per year.

Tri-City Railway & Light Earnings.—Substantial improvement was shown in the earnings of the Tri-City Railway & Light Company, of Davenport, Ia., in the twelve months ended Oct. 31, as compared with those in the corresponding period in the previous year. After deduction of all charges, including sinking-fund allowances, preferred stock dividends, replacement and renewal funds, there was left a surplus of $314,672, or 3.49 per cent on the $9,000,000 outstanding common stock. The deduction for renewal and replacement fund amounted to $83,000, whereas nothing was charged against earnings for this item during the previous year, when the surplus was equivalent to 3.54 per cent on the same amount of stock. As the surplus would have been equivalent to 4.42 per cent had conditions been the same, officials of the company regard the showing for the period as very favorable.

A Canadian Telephone Complication.—The Bell Telephone Company of Canada has withdrawn an offer made to the city of Windsor about Nov. 1 because the City Council insisted upon submitting it to a vote of the people. The company had agreed to pay into the city treasury $1,500 a year for five years in consideration of a grant for the exclusive right to operate in the city. Several members of the Council wanted further concessions, but it was finally decided to submit the matter to a vote in January. Local Manager Dewar states that the company can operate under its Dominion charter and that it is satisfied to go ahead without any exclusive right, rather than submit to the course the Council had decided upon.

Shawinigan Water & Power Company to Issue More Stock.—Stockholders of the Shawinigan Water & Power Company, of Montreal, Quebec, will meet Dec. 27 to ratify an issue of $500,000 4½ per cent debenture stock.

Will Rehabilitate United Wireless Telegraph Company.—The Hon. John Howard Hill and Philip G. Clifford, both of Portland, Maine, and Robert H. Montgomery, of New York City, trustees in bankruptcy for the United Wireless Telegraph Company, which went into bankruptcy last July, and several of whose principal officers were convicted of fraud in connection with the company's affairs and are now serving sentences in the federal penitentiary, as noted in these columns from time to time, have taken active steps to reorganize the company on a sound basis, and with this end in view they have called a meeting of the stockholders for Saturday, Dec. 16, at the office of Saul S. Myers, 60 Wall Street, New York. Mr. Myers is, with Woodman & Whitehouse, of Portland, Maine, counsel for the trustees in bankruptcy, and was active in bringing about the appointment of a federal receiver, following applications made by various groups of stockholders in a great many different states for receivers in these states, after the company's affairs became involved. The trustees are now operating some 500 wireless stations, valued at nearly $500,000, and in addition to these quick assets there are stated to be heavy claims in favor of the company against some of its directors, on which it is expected many times the indebtedness of the company can be realized. This applies not only to directors who are in jail, but also to directors who, it is claimed, participated in the transactions which led to the defrauding of the stockholders. In addition, there is important patent litigation pending which must be taken care of, and in the event of a successful termination the business will apparently be in better shape than ever before. The claims of the merchandise creditors amount to about $75,000, and there is also the cost of the bankruptcy proceedings, some $75,000, to be met. The reorganization plan provides for the payment of these claims in full, possibly by levying a small assessment upon the stockholders, and the formation of a new company to take over the assets of the present company. The trustees are also using every effort to locate the funds that were misappropriated by officials of the company, and with this object Christopher C. Wilson, former president of the company, is to be brought to New York from the federal prison at Atlanta within a short time and examined before a United States commissioner as to his knowledge of the whereabouts of these funds.

Interborough Rapid Transit Earnings.—Gross operating revenue of the Interborough Rapid Transit Company, of New York City, in October were $2,707,569, as compared with $2,547,654 in October, 1910. Passengers carried in October, 1911, and October, 1910, were 52,717,754 and 49,543,316 respectively. Operating expenses in October last were $1,079,598, as compared with $981,748, and net operating revenue was $1,627,972, as compared with $1,565,906. Deduction of fixed charges left a net corporate income of $595,946 for the month, as compared with $535,951. In the four months ended Oct. 31, 1911, gross operating revenue was $9,314,938, as compared with $8,968,020 in the corresponding four months in 1910. Operating expenses increased considerably, being $4,154,214, as compared with $3,727,518, and the increase is due in a large measure to extraordinary expenses, changes in equipment necessitated by operation of ten-car expresses and six-car local trains. Taxes in the respective periods were $655,021 and $611,871, leaving income from operation amounting to $4,505,702 in the 1911 period, as compared to $4,628,630 in 1910. Other income in the periods was $122,857 and $117,804, bringing total income to $4,628,559 in the four months ended Oct. 31, 1911, and to $4,746,434 in the four months ended Oct. 31, 1910. Deduction of fixed charges left net corporate income of $1,004,622, which compares with $1,188,464 in the period ended Oct. 31, 1910. The company carried 180,743,699 passengers in the 1911 period and 173,790,798 in the 1910 period.

Consolidation of Electrical Properties in Kentucky.—The Kentucky Public Utilities Company, of Frankfort, Ky., has been formed to take over the properties of the Capital Gas & Electric Light Company, Frankfort; Owensboro Gas Light Company, Owensboro; City Light Company, Hopkinsville, and the Bowling Green Gas Light Company, Bowling Green. All of the companies except that at Owensboro operate electric-light plants. H. C. Wood, the Rookery, Chicago, Ill., is interested in the enterprise, as well as Messrs. Kelsey & Brewer, of Grand Rapids, Mich. A New York house is stated to have reported on the engineering merits of the properties.

Important Electric Railway Legislation Foreshadowed.—The New England Investment & Security Company, which took over the street-railway properties in Massachusetts of which the New York, New Haven & Hartford Railroad Company had to divest itself a few years ago in consequence of a decision of the Supreme Court of Massachusetts, has filed a petition with the Secretary of State at Boston, Mass., for authority to sell its system to the New York, New Haven & Hartford Railroad Company. The company operates the trolley lines in the Berkshire, Springfield and Worcester district, and it is urged that New Haven ownership would secure a more systematic development of the property and industrial expansion of Worcester and Springfield.

To Combine Public Utilities in Southern Idaho.—J. S. & W. S. Kuhn, of Pittsburgh, who recently purchased the holdings of the Boise & Interurban Railway Company, operating a traction line between Boise and Caldwell, Idaho, as stated in these columns Oct. 21, have disposed of this company and their other interests in southern Idaho to a new company capitalized at $30,000,000 which has just been organized in Pittsburgh to effect a consolidation of all the water-power companies in southern Idaho and to acquire, develop and extend the properties of a number of lighting and traction companies in the section.

Financing Lehigh Coal Company's Electrical Project.—The Lehigh Coal & Navigation Company plans to issue $3,000,000 collateral trust 4½ per cent bonds for financing the electric plants it proposes to install at several of its mines in Pennsylvania for using waste coal as fuel and transmitting energy by high tension to various cities in Pennsylvania and New Jersey, as described in these columns March 16.

DIVIDENDS.

Canadian Westinghouse Company, Ltd., quarterly, 1½ per cent and an extra dividend of 1 per cent, payable Jan. 10.

Chicago City Railway Company, quarterly, 2½ per cent and an extra dividend of 1½ per cent, payable Dec. 30.

Duluth Superior Traction Company, quarterly, preferred, 1 per cent; common, 1¼ per cent, both payable Jan. 2.

National Gas, Electric Light & Power Company, quarterly, preferred, 1½ per cent, payable Jan. 1.

Tri-City Railway & Light Company, quarterly, preferred, 1½ per cent, payable Jan. 2.

Twin City Rapid Transit Company, quarterly, preferred, 1¾ per cent; common, 1½ per cent, both payable Jan. 2.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.					
October, 1911.......	$97,473	$45,091	$52,382	$30,529	$21,853
October, 1910.......	92,306	47,488	44,878	30,238	14,640
CAPE BRETON ELECTRIC COMPANY, LTD.					
October, 1911.......	$31,650	$15,246	$16,404	$6,176	$10,228
October, 1910.......	30,496	13,447	17,049	6,161	10,888
COLUMBUS ELECTRIC COMPANY.					
October, 1911.......	$44,451	$21,071	$23,380	$14,850	$8,530
October, 1910.......	42,736	16,923	25,813	13,707	12,106
DALLAS ELECTRIC CORPORATION.					
October, 1911.......	$182,459	$100,848	$81,611	$29,547	$52,064
October, 1910.......	165,372	89,153	76,219	23,748	52,471
EL PASO ELECTRIC COMPANY.					
October, 1911.......	$62,011	$34,111	$27,900	$8,427	$19,473
October, 1910.......	55,172	32,919	22,253	8,224	14,029
GALVESTON-HOUSTON ELECTRIC COMPANY.					
October, 1911.......	$132,645	$76,728	$55,917	$25,547	$30,370
October, 1910.......	113,476	65,937	47,539	25,565	21,974
HOUGHTON COUNTY ELECTRIC LIGHT COMPANY.					
October, 1911.......	$26,200	$10,875	$15,325	$6,248	$9,077
October, 1910.......	24,572	11,415	13,157	4,553	8,604
JACKSONVILLE TRACTION COMPANY.					
October, 1911.......	$49,743	$25,691	$24,052	$12,488	$11,564
October, 1910.......	48,366	27,087	21,279	9,346	11,933
LOWELL ELECTRIC LIGHT CORPORATION.					
October, 1911.......	$32,332	$17,320	$15,012	$5,034	$9,978
October, 1910.......	38,256	21,534	16,722	4,236	12,486
NORTHERN TEXAS ELECTRIC COMPANY.					
October, 1911.......	$168,512	$78,517	$89,995	$25,010	$64,985
October, 1910.......	154,007	71,123	82,884	20,290	62,594
RUTLAND RAILWAY, LIGHT & POWER COMPANY.					
Year, Nov., 1911..	$314,581	$163,433	$151,147	$91,413	$59,733
Year, Nov., 1910..	274,874	144,396	130,477	85,701	44,776
SAVANNAH ELECTRIC COMPANY.					
October, 1911.......	$59,843	$41,302	$18,541	$18,536	$5
October, 1910.......	53,794	35,517	18,277	18,221	56
SEATTLE ELECTRIC COMPANY.					
October, 1911.......	$461,501	$260,383	$201,118	$115,934	$85,184
October, 1910.......	469,033	239,640	229,393	109,913	119,480
SIERRA-PACIFIC ELECTRIC COMPANY.					
October, 1911.......	$49,538	$18,837	$30,701	$4,441	$26,260
October, 1910.......	49,206	13,845	35,361	6,020	29,341
WHATCOM COUNTY (WASH.) RAILWAY & LIGHT COMPANY.					
October, 1911.......	$34,506	$18,099	$16,407	$6,770	$9,637
October, 1910.......	35,620	18,142	17,478	7,153	10,325

General News

Construction News.

BIRMINGHAM, ALA.—The promoters of the Tidewater Railway Company have submitted a proposition to the City Council offering to supply electricity for commercial and municipal lighting purposes, to begin not later than July 1, 1912. The company agrees to furnish electricity for lamps to private consumers at a flat rate of 10 cents per kw-hour with 10 per cent discount.

CROWN KING, ARIZ.—Plans are being considered by the Pacific Copper Company, which operates the Pacific copper mine, for the installation of electrical operating machinery at its properties.

PRESCOTT, ARIZ.—The Arizona Power Company is reported to be contemplating the erection of a new transmission line to the Copper Basin Mining district.

WEAVER, ARIZ.—Plans have been adopted by the Arizona Power Company for the extension of its electric transmission lines to a number of mines in the Weaver district. The proposed line will pass through the Copper Basin district and the Peeples Valley and will terminate at Alvarado. Weaver has not a post office.

LITTLE ROCK, ARK.—The Southwestern Telephone Company, with headquarters in Dallas, Tex., has taken over the Ft. Smith independent line and all the state exchanges, excepting Little Rock, owned by the Southern Telephone Company. The purchase of the Little Rock exchange is awaiting action by the Little Rock City Council before it can be closed.

BOCA, CAL.—The Union Ice Company is contemplating the installation of a large power plant. Water for operating the plant will be secured from the Little Truckee River. The cost of the plant complete is estimated at $1,500,000.

DORRIS, CAL.—The Siskiyou Electric Power & Light Company is building a new substation and electric-lighting system in Dorris. J. W. Churchill, of Yreka, Cal., is president of the company.

FELLOWS, CAL.—Plans are being prepared by the Kern Mutual Telephone Company for the construction of a new exchange building at Fellows. Business from Fellows and Shale, heretofore handled at Taft, will be cared for at the new station. J. T. Maguire is manager of the company.

FULLERTON, CAL.—Bids will be received by the trustees of the Fullerton Union High School until Dec. 22 for the construction of a group of school buildings, which will include an electric-power plant, central steam-heating plant and electric wiring. The work will involve an expenditure of about $130,000 exclusive of equipment. Norman F. Marsh, Broadway Central Building, Los Angeles, Cal., is architect.

HAMMONTON, CAL.—One of the gold dredgers, including electrical operating machinery, belonging to the Yuba Consolidated Goldfields Company was recently destroyed by fire, causing a loss of about $100,000.

HOT SPRINGS, CAL.—The Pine Flat Company, recently incorporated, contemplates the installation of an electric-light plant to supply electrical service in this district. G. E. and E. M. Alderson, of Los Angeles, are interested in the company.

KENNETT, CAL.—The Sacramento Valley Power Company has commenced work on the erection of a transmission line to the properties of the Standard Mining Company, a distance of about 8 miles.

LONG BEACH, CAL.—A petition has been presented to the City Council by the property owners on Pine Avenue from Ocean Avenue to Sixth Street, requesting the installation of ornamental lamps. The cost of the system is estimated at about $7,500.

LOS ANGELES, CAL.—The City Council has authorized the preparation of an ordinance to place Moneta Avenue from Thirty-seventh Street to Manchester Avenue in the conduit district, requiring the removal of all overhead lines.

LOS ANGELES, CAL.—The contract for the electrical work in the new I. N. Van Nuys office building, located at Seventh and Springs Streets, has been awarded to the Foulkes Electrical Company, Story Building, Los Angeles, Cal., at $20,350.

LOS ANGELES, CAL.—The Public Service Commission has passed favorably on the petition of the residents of Lone Pine for the installation of an electric-lighting system, securing electric energy for operating the system from the aqueduct power plants. Under the decision of the commission the town must bear the expense of installing the distributing system, transformers, meters, etc. E. F. Scattergood, chief electrical engineer of the power bureau, is in charge.

MODOC, CAL.—The Provident Investment Company, of Los Angeles, Cal., is planning to build an electric-light plant and distributing system in Modoc. A telephone system will also be installed. Modoc has not a post office. C. B. Zimmerman is in charge of the work.

OAKLAND, CAL.—The Southern Pacific Railroad Company has awarded a contract to the Rickson-Erhart Construction Company, 1859 Geary Street, San Francisco, Cal., for the erection of a cable tower at its Fruitvale power station, to cost $2,800.

OAKLAND, CAL.—The United Properties Company of California, recently incorporated at Wilmington, Del., has filed articles of incorporation at Sacramento, with a capital stock of $200,000,000. The company operates the Key Route electric railway system and plans the construction of a line from Oakland to Sacramento. The incorporators are: Frank Smith, C. B. Seabrushie, H. R. Ewart and H. W. Davis. The headquarters of the company are in Oakland.

REDWOOD CITY, CAL.—Plans are being considered for the installation of a new street-lighting system in the business district of the city. The Pacific Gas & Electric Company furnishes the street-lighting service in Redwood City.

RED BLUFF, CAL.—The Sierra Electric Power Company, recently incorporated with a capital stock of $3,000,000, has acquired a power site at Mill Creek, near Red Bluff, where it proposes to build a hydroelectric power plant. Charles Gross and E. A. Herman, of Oakland, Cal., are interested in the company.

RIVERSIDE, CAL.—The Pacific Electric Railway Company has been granted a franchise to construct and operate a double-track electric railway on Magnolia Avenue from Main and Fourteenth Streets to Arlington Avenue.

SACRAMENTO, CAL.—Bids will be received by M. J. Desmond, city clerk, until Dec. 26 for the installation of an electric freight and passenger elevator between O and P Streets in the city of Sacramento. Specifications are on file at the office of the city clerk.

SACRAMENTO, CAL.—The Retail Merchants' Association has awarded a contract for the installation of an electrolier street-lighting system on forty blocks in the main section of the city to J. C. Hobrecht, 1012 Tenth Street, Sacramento, Cal. Many merchants contemplate placing similar standards directly in front of their property.

SAN DIEGO, CAL.—Plans have been prepared by Superintendent Adams of the street department for the installation of ornamental street lamps in the entire downtown district. The contract for lighting Fifth Street from A to University Street will soon be awarded. Electric lamps suspended on the poles of the street railway company will be used on Fifth Street.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has taken over the plant and holdings of the Metropolitan Light & Power Company in this city. The consideration is said to be about $2,000,000. The plant of the Metropolitan company is located at North Beach.

SAN LEANDRO, CAL.—The Town Trustees will soon call a special election to submit the proposition to issue bonds to the amount of $40,000 for the installation of a fire-alarm system and fire-fighting appliances to a vote of the people.

SANTA ANA, CAL.—The Board of City Trustees has appointed a committee to take charge of the installation of an ornamental street-lighting system in the business district. The cluster-lamp system will be used.

CRIPPLE CREEK, COL.—A trust deed has been filed for record in Cripple Creek conveying the franchises of the local light and power plant in Teller, Fremont and Pueblo Counties, the Colorado Light & Power Company and the Suburban Light & Power Company to the Arkansas Valley Light & Power Company.

WALSENBURG, COL.—The Southern Electric & Traction Company has awarded the contract for the construction of a large power house at Walsenburg to Fox & Smith. The cost of the plant complete is estimated at $75,000. The power plant at Hastings has been taken over by the traction company, which owns and operates the Trinidad street railway.

HARTFORD, CONN.—The Hartford Electric Light Company has made a reduction in its maximum rate for electricity for lamps of 1 cent per kw-hour, to take effect from Dec. 1. The rate has been reduced from 10 cents to 9 cents per kw-hour.

SIMSBURY, CONN.—The Simsbury Electric Light Company is extending its system to the village of Weatogue for the purpose of supplying electrical service in that village.

WESTBROOK, CONN.—The citizens have voted to enter into a contract with the Essex Light & Power Company for street lighting for a period of five years. Under the terms of the contract the company is to furnish forty 40-cp incandescent lamps in this village.

WASHINGTON, D. C.—Proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Dec. 18 for furnishing and installing a complete electric-lighting system in the James Ormand Wilson Normal School Building, No. 162, Washington, D. C.; also for heating, ventilating and electric generating system in same building. Forms of proposals, specifications and other information may be obtained from the chief clerk, Engineer Department, Room 427, District Building, Washington, D. C.

CHICORA, FLA.—The Amalgamated Phosphate Company is reported to be contemplating the installation of an electric-light plant at its mines.

[illegible] a new business to operate the electric-light plant and water-works system of the reservation [illegible] Williamsport, Va., [illegible] New Orleans, La., secured the contract for installing the pumps and for supplying water [illegible] the reservation at a cost of $9,200.

JACKSONVILLE, FLA.—The Sisal Hemp & Development Company, 58 Mutual Life Building, Jacksonville, Fla., is reported to be in the market for a 200-hp electrical equipment for rope and lath yarn mill and would like to receive prices on same.

[illegible] Electric Company have [illegible]ted to recommend that the capital stock of the company be increased from $1,700,000 to $1,870,000 at the annual meeting of the stockholders to be held Jan. 8, 1912.

WINTER HAVEN, FLA.—Preparations are being made for the erection of an electric-light plant in Winter Haven. The Town Council has granted a franchise to W. F. Boyd for the installation of a plant and erection of transmission lines.

ATLANTA, GA.—R. C. Turner, city electrician, has submitted a report to the committee of Council on electric and power control, in which he recommends that the city establish a power plant to supply electricity to certain buildings unless an agreement can be reached with the Georgia Railway & Electric Company whereby the city may secure a flat rate for all energy consumed. He also recommends that at the end of the present year the city's present contract with the company be annulled. He asks that the city demand a flat rate of 1½ cents per kw-hour for electricity for power purposes and 3 cents per kw-hour for lamps.

MANCHESTER, GA.—At an election held Dec. 5 the proposition to issue $15,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant, was carried.

GOODING, IDAHO.—The local substation owned by the Great Shoshone & Twin Falls Light & Power Company, of Twin Falls, Idaho, was recently destroyed by fire.

ILO, IDAHO.—The Grangeville Electric Light & Power Company, of Grangeville, Idaho, is installing an electric-light system in Ilo. An arc-lamp street lighting system will be installed.

MULLAN, IDAHO.—The National Mining Company is planning to install new electric motors at its property.

AURORA, ILL.—The Wheaton & Du Page Light & Power Company, which operates an electric-light and power system in Wheaton, Chicago and other points in Du Page County, is contemplating the erection of a transmission line into North Aurora. Applications have already been made for franchises in Batavia and Aurora Townships and to the Village Board of North Aurora to erect the line.

CHICAGO, ILL.—The deal for the purchase of the Interstate Telephone & Telegraph Company by the Illinois Tunnel and the Chicago Subway Companies has been completed. Extensive improvements will be made to the system.

CHICAGO, ILL.—Sealed bids will be received by the city of Chicago until Dec. 18, Room 406, City Hall, Chicago, Ill., for furnishing and installing complete in the Roseland pumping station two turbo-generator units, complete with appurtenances and accessories, including steam and exhaust piping foundations and pipe trenches, according to plans and specifications on file in the office of the Department of Public Works. L. E. McGann is commissioner of public works.

COLCHESTER, ILL.—The plant and holdings of the Colchester Electric Light & Power Company have been purchased by Harry R. Moore and J. Highland, of Chicago, Ill. The new owners have been granted a twenty-year franchise by the Council. It is said that a new plant will be built, work on which will begin at once.

WILLIAMSFIELD, ILL.—Application has been made to the Village Board by E. J. Le Hew, of Galesburg, Ill., for a twenty-year franchise to install and operate an electric-light plant. It is proposed to erect a steam-driven plant, to cost about $6,000.

ARCADIA, IND.—The local electric-light plant, owned by the Noblesville Light, Heat & Power Company, was destroyed by fire recently, causing a loss of about $3,000.

FAIRMOUNT, IND.—The local electric-light plant owned by the Central Indiana Lighting Company has been purchased by the Marion Light & Heating Company, of Marion, Ind.

BOONE, IA.—Work has commenced on the extension of the heating system of the Boone Electric Company. The cost of the work is estimated at about $20,000.

DES MOINES, IA.—The Ft. Dodge, Des Moines & Southern Railway Company is reported to have purchased the abandoned Newton & Northwestern Railroad, which it proposes to equip for electrical operation.

DES MOINES, IA.—The Des Moines River Power Company has applied to the Department of the Interior for permission to improve the Des Moines River between Des Moines and Keokuk for power purposes and to make the stream available for canal purposes. The company asks for a seventy-five-year grant and for permission to construct a series of fourteen dams between Des Moines and Keokuk. The proposed work would involve an expenditure of about $7,000,000 and would make the stream available for purposes of navigation, save that it would be necessary [illegible] The company does not propose to [illegible] by the government when it gets ready to utilize the stream for navigation purposes. It is estimated that 25,000 hp can be developed.

GLIDDEN, IA.—The Council has awarded the contract for the construction of the power house for the proposed municipal electric-light plant, to cost about $1,700.

HAMPTON, IA.—The Commercial Club has adopted a resolution recommending the purchase of the Hampton Electric Light & Power Company by the city. The proposed plan will involve an expenditure of about $30,000. The proposition will probably be submitted to a vote of the people.

HITEMAN, IA.—The Independent Order of Odd Fellows Lodge has passed a resolution to install a power plant and will supply electricity to residents desiring it.

JEWELL, IA.—A petition has been prepared by the residents of the city which will be presented to the City Council asking that a special election be called to vote on the proposition to issue bonds for the construction of a municipal electric light and power plant in Jewell.

LEGRAND, IA.—The installation of an electric-light plant in Legrand is reported to be under consideration.

MOUNT PLEASANT, IA.—The Iowa Power Company, which operates a hydroelectric power plant at Oakland, has submitted a proposition offering to furnish the city with energy to operate the municipal electric plant at the rate of 2.7 cents per kw-hour for a period of ten years. The Council some time ago rejected an offer made by the company to supply the service at 3 cents per kw-hour for the first five years and 2.5 cents per kw-hour for the second five years.

OAKLAND, IA.—The Iowa Power Company has submitted a proposition to the Council offering to supply electricity to light the city.

OSKALOOSA, IA.—Plans are being prepared by the Oskaloosa Traction & Light Company for the erection of an electric transmission line from Oskaloosa to New Sharon, a distance of about 12 miles.

SLATER, IA.—It is reported that a committee has been appointed to make investigations pertaining to the installation of an ornamental street-lighting system.

VILLISCA, IA.—The proposition to grant a franchise to the Lee Electric Light Company, of Clarinda, Ia., to erect an electric-light and power plant in Villisca will probably be submitted to a vote of the people. Rufus E. Lee, of Clarinda, is secretary and manager of the company.

HUTCHINSON, KAN.—Extensive improvements are contemplated by the Santa Fé Railway Company in East Hutchinson, which will involve an expenditure of about $250,000 and include a round house, machine shop, power house, etc.

KANSAS CITY, KAN.—The contract for furnishing materials for and erecting upon foundations furnished by the city an arc-lamp equipment and furnishing 450 arc lamps has been awarded to the Stave Electrical Company, of Chicago, Ill., for $22,212.

LEAVENWORTH, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 22 for installing electric wiring and a conduit system including lamps in the government building in Leavenworth, Kan.

McCUNE, KAN.—The installation of an electric-light plant in McCune is reported to be under consideration.

CADIZ, KY.—Alexander Brothers, of Cadiz, Ky., who were recently granted a franchise to install an electric-light plant in this town, will, it is understood, soon begin work on it. The plant will be operated in connection with their ice factory.

FALMOUTH, KY.—The Council, it is reported, has engaged Anderson & Frankel, of Lexington, Ky., engineers, to take charge of the engineering work in connection with the proposed electric-light plant, for which bonds to the amount of $7,500 were recently voted. N. C. Ridgeway is Mayor.

LOUISVILLE, KY.—It is reported that surveys are being made by H. M. Byllesby & Company, of Chicago, Ill., at Cumberland Falls, in Whitley County, about 110 miles from Louisville, Ky., with a view of establishing a hydroelectric power plant to supply electricity in Louisville and other cities.

LOUISVILLE, KY.—Bids will be received by the Commissioners of Hospital, 312 Columbia Building, Louisville, Ky., until Jan. 4 for erection of the Louisville Public Hospital, to cost about $900,000. Bids will be received for the construction of building complete; also for complete mechanical equipment, including electric work, power-plant machinery, heating, ventilating, elevators, laundry machinery, sterilizing apparatus, gas piping, etc. Plans and specifications can be seen at the office of the Commissioners of Hospital or at the office of D. X. Murphy & Brother, of Louisville, Ky., architects. John H. Leathers is chairman.

UNIONTOWN, KY.—The Home Lighting Company, it is reported, is planning to remodel its electric-light plant. The company is erecting a new building and will install two 125-hp boilers, generators and other machinery. G. W. Clements is manager.

WHITESBURG, KY.—Plans have been completed by D. C. Mullins & Son, of Partridge, Ky., for the installation of an electric light and power plant in Whitesburg, work on which will begin at once.

LAFAYETTE, LA.—The City Council is considering the question of issuing bonds to the amount of $50,000, the proceeds to be used for improvements and extensions to the municipal electric-light plant and water-works system.

RAYVILLE, LA.—It is reported that the Council has engaged W. H. Wright to prepare plans for an electric-light plant.

PORTLAND, MAINE.—Arrangements are being made by the Portland Light & Power Company for the construction of a substation, to be located on Hooper Street, between Sewall and Davis Streets, for distributing electric energy received from the hydroelectric plants at Bonny Eagle, West Buxton and North Gorham stations. The building will cost $40,000 and the initial equipment $60,000. Later the equipment will be duplicated, making the total cost of the station $160,000.

FREDERICK, MD.—Plans are being considered by parties who control the electric-railway properties and electric-power plants in Hagerstown and Frederick for securing electric energy from the large electric plant in Millville, on the Shenandoah River, above Harper's Ferry, W. Va., for operating the electric-railway systems and for lamps and motors throughout the territory in which they operate. Electricity will be distributed by the Frederick Gas & Electric Company, which is controlled by the Frederick Railroad Company.

BOSTON, MASS.—Plans have been prepared by the Boston Elevated Railway Company for the construction of a new substation for the Malden terminus of the proposed elevated railway from Sullivan Square to Malden.

CHARLTON, MASS.—The Webster & Southbridge Gas & Electric Company, of Webster, Mass., is preparing plans for the extension of its commercial lighting system into the center of Charlton, Mass. The company will soon supply electricity at the Masonic Home at Overlook for lamps, motors and pumping service. A number of mills, residences, etc., which are at present supplied with current by the local street-railway system as a matter of accommodation only, will be connected with the lighting company's circuits. If the patronage demands it, a substation will be erected at Charlton.

FALL RIVER, MASS.—Plans are being considered for the installation of an electric-light plant which will provide electricity for lighting the building of the State leper colony on Perikese Island, and to furnish power for operating the wireless-telegraph system. The cost of the proposed plant is estimated at $1,200.

FOXBORO, MASS.—The Norfolk & Bristol Street Railway Company is planning to purchase a 250-hp or 300-hp boiler for its power plant.

HOLDEN, MASS.—An agreement has been reached between the Selectmen of Holden, Mass., and the Connecticut River Transmission Company whereby the town will be lighted by electricity to be supplied from the West Boylston substation. About eighty 40-watt tungsten street lamps will be installed.

HYANNIS, MASS.—The Hyannis Lighting Company has installed its temporary lighting plant in the rear of John S. Blagdon's shop on Sea Street.

MILFORD, MASS.—The Standard Raincoat Company has acquired the M. F. Green factory, located at Northboro and Jefferson Streets, and will erect a new brick power station in connection with the property.

READING, MASS.—The Reading Municipal Electric Light Board has announced a reduction in the price of electricity for lamps and heating service, the new schedule to take effect from Dec. 7. The new rates are 12 cents per kw-hour for electricity for lamps and 4 cents per kw-hour for heating. The old rates were 15 cents per kw-hour for lamps and 6 cents for heating purposes. The minimum charge for lamps will be $1 per month, except during May to August inclusive, when the charge will be 50 cents per month. New rates are also announced for the towns of Lynnfield Center and North Reading, which are served by the Reading plant. These communities benefit by a 25 per cent reduction from former rates, the new prices being 15 cents per kw-hour for lamps and 4 cents for heating. New lines have been extended from the plant to Wilmington, which will be ready to supply electrical service on Jan. 1. The plant will also continue to furnish a twenty-four-hour service to the town of Wakefield during the coming year.

SOUTH DEERFIELD, MASS.—The Greenfield Electric Light & Power Company has purchased the electric-light plant in South Deerfield owned by J. B. Bridges & Company, and took possession of the plant Dec. 1. The Greenfield company proposes to replace the present poles with heavier ones, using the same poles for both electric and telephone wires.

WORCESTER, MASS.—The New England Corset Company has purchased a factory building in Worcester and is planning to install a power plant. The company contemplates an expenditure of about $10,000.

GRAND RAPIDS, MICH.—The Eastern Michigan Power Company has been granted permits to erect two substations in Grand Rapids, one to be located on Hall Street and the other on Wealthy Avenue, to cost $1,100 each.

HARTFORD, MICH.—Anderson Brothers, owners of the local electric-light plant, will probably apply for a franchise in Hartford, which may be submitted to the voters at the election next spring. It is proposed to make important improvements to the power plant, located at the Anderson mill, 1 mile north of the village, which will provide for a twenty-four-hour service. The firm is at present operating in Hartford practically without a franchise and has been doing so since the establishment of the plant thirteen years ago.

HASTINGS, MICH.—Plans are being considered for the construction of a dam 8 ft. high in the Thornapple River above the city. This improvement, it is said, would increase the water-power by at least 800 hp.

JACKSON, MICH.—The Commonwealth Power Company has applied to the State Railroad Commission for permission to issue $1,860,000 in bonds, of which the proceeds are to be used for improvements and extensions to the following plants: For the Saginaw Power Company, $90,000; Bay City Power Company, $27,000; Pontiac Power Company, $36,000; Flint Power Company, $54,000; Commonwealth Power Company, Jackson, $72,000; Grand Rapids-Muskegon Power Company, $450,000; Consumers' Power Company, of Owosso, $36,000, and $1,080,000 to refund a bond issue of the Grand Rapids Edison Company due in 1916, and $15,000 to refund an issue of the Lowell water plant due in the near future.

KALAMAZOO, MICH.—The special lighting committee of the City Council has asked the city engineer to prepare estimates of the cost of erecting ornamental lamp-posts on Burdick Street from the Michigan Central tracks to Lovell Street, on Rose Street for the same distance, on Main Street from the Lake Shore tracks to West Street, on South Street from Portage to Park Street, on the streets around Bronson Park, on Water Street from Rose to Edwards Street, on Edwards Street from Water to Main Street, and on Kalamazoo Avenue from Rose to Burdick Street.

MENDON, MICH.—It is reported that Seiver Brothers, of Burr Oak, Mich., have submitted a proposition to the Council offering to purchase the municipal electric-light plant and equipment, including Parkville dam, for $11,085, provided the town of Mendon will grant them a thirty-year franchise and a contract to light the town for a period of ten years. They agree to sell the plant to the town at the expiration of the franchise at a price to be agreed upon by experts. The town purchased the Parkville property in 1908, for which $10,000 was appropriated. It was proposed to utilize the power to operate the municipal electric plant, but the appropriation was not sufficient to carry out the project.

MENOMINEE, MICH.—The Menominee & Marinette Light & Traction Company has awarded the contract for the installation of the new generator at its plant in Ingalls to the General Electric Company. The Dayton Globe Iron Works, of Dayton, Ohio, secured the contract for the waterwheel. Contract for transformer and switchboard apparatus was awarded to the Westinghouse Electric & Manufacturing Company. The improvements to the plant will involve an expenditure of about $25,000.

STEVENSVILLE, MICH.—Plans are being considered for the installation of an electric-light system in Stevensville. Mr. Aimes, of St. Joseph, is interested in the project.

RED WING, MINN.—The Red Wing Gas Light & Power Company is reported to have been asked to submit a proposition for lighting the streets of the city under a new contract, including cluster lamps.

ROCHESTER, MINN.—It is reported that J. H. Sonntag and O. C. Decker are negotiating for the purchase of the municipal electric-light plant. Mr. Decker is president of the Rochester Light, Heat & Power Company.

TWO HARBORS, MINN.—Sealed bids will be received by Aug. Omtvedt, city clerk, Two Harbors, Minn., until Dec. 19 for furnishing and installing in the municipal water and light plant one 300-kw, 60-cycle, single-phase or two-phase electric generating unit. Proposals will be considered for a direct-connected engine and generator, also for a belt-driven unit, the engine to be condensing without condenser. Plans and specifications are on file in the office of the city clerk.

VIRGINIA, MINN.—The City Council has decided to engage Burns & McDonnell, of Kansas City, Mo., to make an appraisal of the electric and water plants of the Virginia Electric & Water Company, which is to be taken over by the city. The Council will appoint a committee of five to recommend to the judges of the district court the names of the freeholders as appraisers in condemnation proceedings.

WATERVILLE, MINN.—The City Council has granted the Consumers' Power Company, of Mankato, Minn., a franchise to construct and operate an electric-light plant in Waterville.

WINONA, MINN.—The Twentieth Century Transportation Company is planning to build power houses at Lancaster, Wis., and Watertown, S. D., in the spring to supply electricity to operate its proposed railway.

RICHTON, MISS.—The Richton Light & Power Company, it is said, is planning to build a new power house.

GRANDVIEW, MO.—It is reported that the installation of waterworks, sewer and lighting systems in Grandview is under consideration. J. E. Fred is said to be interested in the project.

KING CITY, MO.—At an election held recently the proposition to issue bonds for the installation of a municipal electric-light plant is reported to have been carried.

ST. LOUIS, MO.—Application has been made to the St. Louis County Court for a fifty-year franchise by David P. Leahy, Richard P. Baldwin and Philip A. Smith to erect transmission lines through St. Ferdinand and Central Townships. It is proposed to erect a power plant in Jennings for the purpose of supplying electricity in different parts of the country.

TRENTON, MO.—The controlling interest of the Citizens' Gas & Electric Company, of Trenton, Mo., has been acquired by Burdette L. Browne, of Pontiac, Mich., who, it is said, will make extensive improvements to the plant.

[illegible]

LEWISTON, MONT.—The Mountain States Telephone & Telegraph [illegible] Company, of Lewiston, Mont., for $150,000. Many improvements will be made to the system and a new exchange built. The Mountain States company will soon begin work on the erection of a telephone line from Judith Gap to Broadview, Mont., a distance of 100 miles. District Manager Owens, of Billings, Mont., will have charge of the work.

OMAHA, NEB.—The contract for furnishing and installing lighting fixtures for the new county building has been awarded to Hayden Brothers at $25,000.

OMAHA, NEB.—Plans are being considered by the Nebraska Transportation Company for the construction of a new power plant at Elk City. The proposed plant will have an output of 21,000 hp.

STANTON, NEB.—The City Council has decided to make extensions and improvements to the municipal electric plant, including the erection of an addition to the present power house and the installation of a 100-hp steam engine and 125-hp boiler and new generator. The gas engine now in use will be held for use in emergencies. C. A. Hickman, consulting engineer, is in charge of the engineering work.

WINNEMUCCA, NEV.—Plans are being considered by the Continental Lake Irrigation Company for the erection of a telephone line from Wild Horse, Ore., to Winnemucca. E. B. Hill is manager.

ANDOVER, N. J.—The electric-light plant owned by Samuel S. Willis was destroyed by fire on Dec. 7, causing a loss of about $14,000. It is understood that the plant will not be rebuilt.

FINDERNE, N. J.—The H. W. Johns-Manville Company, manufacturer of asbestos and roofing products, is reported to have acquired about 290 acres in Finderne, N. J., where it proposes to build factory buildings and about 200 houses for its employees. It is understood that the company will merge its three factories now located in South Brooklyn and Newark under one roof. The cost of the enterprise is estimated at about $2,000,000 and will include a power plant costing about $200,000. The executive offices of the company are located at 100 William Street, New York, N. Y.

FREEHOLD, N. J.—The Manalapan Light Company has been reorganized under the name of the Monmouth Light Company, with Nelson B. Hazeltine, of Philadelphia, Pa., president. The power plant is located at Englishtown. The new company proposes to increase the output of the plant and extend its transmission lines.

ROSWELL, N. M.—The Roswell Gas & Electric Company will soon complete the installation of its new power plant and the erection of its transmission system to the farms in this section. The transmission lines aggregate about 80 miles of cable and will furnish electricity to operate many irrigating pumping plants. The cost of the plant complete will be about $350,000.

SANTA RITA, N. M.—The Chino Copper Company has begun work on the installation of a large central electric-power plant at its mines.

ALBANY, N. Y.—It is reported that the Municipal Gas Company contemplates increasing its capital stock from $2,000,000 to $6,250,000.

BUFFALO, N. Y.—Orders have been placed by the Buffalo, Rochester & Pittsburgh Railroad Company with the Western Electric Company for telephone equipment for train dispatching over two divisions of its system. One of these will extend from Rochester, N. Y., to East Salamanca, N. Y., a distance of 110 miles, and the other from Buffalo, N. Y., to East Salamanca, a distance of bout 65 miles.

EASTPORT, N. Y.—The Southampton Town Board has granted the application of the residents of Eastport to establish a lighting district. A contract has been closed with the East Patchogue Electric Light Company to supply electricity for the service.

ITHACA, N. Y.—A committee has been appointed by the Business Men's Association to investigate the cost of installing an ornamental street-lighting system in Ithaca.

KEESEVILLE, N. Y.—The Public Service Commission, Second District, has authorized the Keeseville Electric Company to execute a mortgage on its property for $500,000. The company is also authorized to issue $70,000 in bonds, of which the proceeds of $30,000 are to be used to take up existing bonds at par, and the remaining $40,000 for the construction of a transmission line to Ausable Forks from Ausable Chasm and local lines in Ausable Forks, and for electrical equipment and improvements to its power house.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities until Dec. 21 as follows: (1) For furnishing materials and labor for underground-conduit system, transformer vault, electric elevator and other work in the metropolitan hospital district; (2) for complete electric wiring and fixtures for infirmary dining-room and kitchen, female tuberculosis building and sun tents, solarium pavilions Nos. 1 to 5, superintendent's residence, carpenter shop, coffin shop, stable, power house and laundry building for metropolitan hospital district; (3) for complete electric wiring and fixtures for new Roman Catholic church, male infirmary and sun tents, and electric motors for laundry for metropolitan hospital district; (4) for furnishing labor for ground wire and labor and materials for grounding system, lightning arresters and ant[illegible] district. Blank forms and further information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, N. Y., where plans and specifications may be seen. Michael J. Drummond is commissioner.

RICHFIELD SPRINGS, N. Y.—The Public Service Commission has authorized the Richfield Springs Utility Company to purchase the plant and distributing system of the Richfield Springs Electric Light & Power Company and to increase its capital stock to $20,000. The company is also authorized to execute a mortgage upon all its property and franchises to secure an authorized issue of $100,000 in bonds. The commission has given the company authority to issue capital stock to the amount of $13,600 and bonds to the amount of $34,000, to be sold at not less than 85, the proceeds to be used for the purchase of properties at Richfield Springs and the rehabilitation of same.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to erect a transmission line from the Float Bridge power house to Webster to connect with the lines of the Sodus Gas & Electric Light Company.

ROCHESTER, N. Y.—Plans have been completed for the erection of a transmission line to tap the system of the Rochester Railway & Lighting Company in Plymouth Avenue to supply electricity to the Iola Sanatorium. In addition to providing energy for lamps and motors, electricity will be used for charging the air with ozone in several of the hospital wards. The transmission line will be 3 miles long.

UTICA, N. Y.—The Board of Contract and Supply has directed Stuart F. Day, secretary, to advertise for bids for lighting the streets of the city for a period of one, three and five years, according to specifications filed with the city engineer and commissioner of public works. Bids will be received until Dec. 13.

UTICA, N. Y.—Preparations are being made by the Utica Gas & Electric Company for the erection of a transmission line from its plant at Trenton Falls direct to Rome to supply that city with electricity. Under the new arrangements it will be possible to furnish energy both to Rome and Utica over either of the two transmission lines. Surveys have been made for the new line.

CINCINNATI, OHIO.—The City Council has notified the director of service to instruct the Union Gas & Electric Company to extend its transmission lines and install the new type of street lamps on Reading Road, from McMillan to Paddock Road; on Madison Road, from Observatory Avenue to Williams Avenue, and from the east corporation line of Oakley to Deerfield Road; on Montgomery Road, from Blair Avenue to the Norfolk & Western Railroad; on Ohio Pike, from Beechmont Avenue to Mount Washington, and on Hillside Avenue, from Anderson's Ferry Road to the corporation line.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has applied to the City Council for a franchise to extend its hot-water and steam-heating system in the downtown section of the city in the vicinity of Euclid Avenue and East Fifty-fifth Street.

IRONTON, OHIO.—Plans are being considered for the consolidation of the electric operating companies under the name of the Ironton Electric Company. Application has been made to the Public Service Commission for permission to take over the property of the Ohio Valley Electric Railway Company and for approval of an issue of additional securities to consummate the deal.

LETART FALLS, OHIO.—A company has been formed with a capital stock of $3,000,000, which will eventually be raised to $15,000,000, for the purpose of building a dam across the Ohio River at Letart Falls, in Meigs County, and the construction of a large power plant to supply electricity for all towns in southern Ohio, including Cincinnati and Columbus. The company, it is said, proposes to construct a series of locks in the river that will make the river navigable. James M. Ashley, of Toledo, Ohio, has been elected president of the company. The office of the company will be located at 165 Broadway, New York, N. Y.

LIMA, OHIO.—A franchise has been granted to W. Kesley Schoepf, president of the Ohio Electric Railway Company, for the extension of the Fourth Street line in Lima to reach the Gramm motor-car works.

LYNN, OHIO.—Plans are being considered by the Merchants' Association, the Board of Trade and the Municipal Council for the installation of an ornamental street-lighting system on the principal streets of the center of the city. It is proposed to use the cluster lamp system.

PAINESVILLE, OHIO.—The city has decided to continue to generate electricity at the municipal electric plant, instead of purchasing it from the Cleveland, Painesville & Eastern Railroad Company. The company submitted a proposition offering to supply the service on a sliding scale, ranging from 2.5 cents per kilowatt to 1.9 cents per kilowatt for all energy consumed above 30,000 kw per month. On the basis of the amount now used by the city, electricity used under this offer would have cost 2.27 cents per kilowatt. The new rate for electricity to consumers is to be 7 cents per kw-hour.

TOLEDO, OHIO.—Plans have been prepared by Schenck & Williams, architects, for the large power building of the Toledo Factories' Company, which is to supply power and plant facilities for new industries in Toledo. Bids have already been received by the architect for the building. Isaac Kinsey is one of the promoters.

TOLEDO, OHIO.—Estimates have been submitted by Service Director Cowell to the City Council of the cost for the installation of

a high-pressure pumping station [illegible] with [illegible] that in the future it will be possible to use it to generate electricity. The cost of the plant is estimated [illegible] will cost $23,000 additional. The report also recommends the employment of a designing engineer [illegible] station. According to tentative plans, which have been approved by the Board of Control and the water-works superintendent, the station for the present will maintain a capacity of 4800 gal. per minute. Its maximum capacity will be 9600 gal. per minute. Gas-engine equipment is recommended.

HOBART, OKLA.—[illegible] of the H[illegible] Light & Power Company were sold Nov. 28 to W. S. Hiff, of Denver, Col., at a foreclosure sale, for $85,500.

SULPHUR, OKLA.—The Rapid Transit Interurban Company, it is reported, is considering plans for the installation of a power plant to supply electricity for operating its railway and for lamps and motors to residents along the route. J. W. Saxon, of Tecumseh, Okla., is president of the company, and Edgar M. Graham, of Muskogee, Okla., chief engineer.

BEND, ORE.—Plans are being considered by the Bend Water, Light & Power Company for the installation of new magnetite arc lamps in certain sections of the city.

LA GRANDE, ORE.—Plans are being considered by the Eastern Oregon Light & Power Company, of Baker City, Ore., for the installation of electric pumping machinery in the Grand Ronde district.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 6 for furnishing miscellaneous material for rack railway and miter gates, including track bonds, flexible and solid conduit fittings, steel splice bars, brass pins, sheet asbestos pads, etc. Blanks and general information relating to this circular may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

PHILADELPHIA, PA.—The Philadelphia Electric Company has announced a reduction in its price of electricity for lamps from 15 cents to 12 cents per kw-hour in the central business district of the city, to take effect from Jan. 1, 1912.

READING, PA.—Notice has been filed with the State Department of the sale of seven electric companies operating in Berks County, recently chartered, each with a capital stock of $5,000, to the Metropolitan Electric Company, of Reading, Pa.

PROVIDENCE, R. I.—Radical changes in the lighting system are recommended in the report submitted to the City Council by Prof. William D. Marks, illuminating engineer, engaged by the Council to investigate the city's lighting franchise and lighting system. Among the recommendations made in the report are: The substitution of 60-cp tungsten lamps for the 32-cp tungstens now in use; locating about 1000 6.6-amp magnetite arc lamps on streets where there are no trees; removal of arc lamps from tree-shaded streets; removal of arc lamps from high poles where they are shaded by foliage and the substitution of incandescent lamps, to be placed on iron or wooden posts in residential sections; the introduction of the 6.6-amp direct-current system; the use of newer forms of flaming-arc lamps with 10-amp current for open spaces demanding brilliant illumination; the spectacular and brilliant illumination of Exchange Place for the purpose of testing the public demand for such illumination; cutting down the number of incandescent lamps on the bridges and substituting magnetite arc lamps at each end of each bridge draw, with the centers of each draw lighted by a pair of large tungsten lamps of 350 cp each; a change in the system of commercial-rate charges based on the quantity consumed, regardless of the capacity or time of use of private installations of connected light or power, to the method of charge based on the hours of use, and the appointment of a municipal illuminating engineer.

MOBRIDGE, S. D.—B[illegible] be received by M. T. Woods, city auditor, until Dec. 18 for 6-in. pipe to connect the main to the power house and return.

MOUNT VERNON, S. D.—Plans are being considered for the installation of a new electric-lighting system in Mount Vernon.

GLEASON, TENN.—The Gleason Water Company, it is said, is contemplating the installation of an electric-light plant in Gleason. Equipment for the plant will be purchased at once. The company has increased its capital stock from $3,500 to $7,000. Dr. J. C. Ammons is secretary.

JACKSON, TENN.—Preparations are being made by the Jackson Railway & Light Company for extensions and improvements to its system, which will involve an expenditure of about $30,000. A contract has been awarded to the Allis-Chalmers Company, of Milwaukee, Wis., for the installation of a 1000-kw generator. John Windom is superintendent.

PARKSVILLE, TENN.—The Eastern Tennessee Power Company, which is completing a hydroelectric project on the Ocoee River, near Parksville, Tenn., is reported to be considering the construction of another dam farther up the river, which will increase the available power to 60,000 hp.

GRAND SALINE, TEX.—The local electric-light plant was recently destroyed by fire, causing a loss of about $5,000. It is understood that the plant will be rebuilt.

LONE OAK, TEX.—It is reported that a franchise has been granted to W. J. and J. C. Ross and J. R. Simpson, all of Kaufman, Tex., to construct and operate an electric-light plant and water-works system in Lone Oak. The cost of the equipment is estimated at $10,000, for which orders have already been placed.

SLATON, TEX.—The Commercial Club is promoting the installation of an electric-light plant in Slaton. It is also making arrangements for the establishment of an ice factory.

GREEN RIVER, UTAH.—Negotiations are under way by Twin Falls, Idaho, capitalists for using the surplus water-power at the plant of the Green River Irrigation Company, where 450 hp goes to waste after the water is distributed over 5000 acres by this system. It is proposed to utilize the power to generate electricity which will be distributed throughout the entire valley, as well as to furnish electricity for lamps and motors in this city. Eventually a water-works system will be established.

SALT LAKE CITY, UTAH.—A permit has been taken out by the Auerbach Company to build a large power plant to be used in connection with its new department store on East Second Street.

RUTLAND, VT.—The Clarendon Power Company has applied to the Public Service Commission for permission to increase its common stock, preferred stock and its bond issue to $1,000,000 each, in order to provide sufficient funds to develop a hydroelectric power plant to furnish electricity to adjacent towns in Rutland County.

ATTALIA, WASH.—Negotiations have been completed by the Pacific Power & Light Company for right-of-way for its proposed main transmission line to the transformer station in Attalia, also for its line to Wallula, 3 miles distant, where the company proposes to supply electricity for lamps and motors.

CONCONULLY, WASH.—The Reclamation Service is reported to be preparing plans for the construction of a hydroelectric power plant on the Salmon River, with an electric distributing system in the Okanogan district, in connection with its reclamation project in this territory.

OLYMPIA, WASH.—Plans are being considered for increasing the generating capacity of the electric-light plant in the Young Men's Christian Association building. It is understood that a new lighting system will be installed.

SEATTLE, WASH.—Borings have been started in the Cedar River Valley preliminary to the preparation of plans for the city's new power dam to cost $1,400,000. Surveys are also being made to determine the cost of constructing a tunnel for the water-pipe line.

WASHTUCNA, WASH.—It is reported that plans are being prepared by L. Campbell for the construction of a hydroelectric power plant on the Adams River to supply electricity to operate his proposed flour-mill plant.

FOND DU LAC, WIS.—The Water Works Commission is contemplating the installation of an electric plant to supply electricity for lighting the plant. The installation of three additional boilers is also under consideration.

FT. D. A. RUSSELL, WYO.—Proposals will be received at the office of the constructing quartermaster, Ft. D. A. Russell, Wyo., until Dec. 22, 1911, for furnishing and installing an electric elevator. Further information furnished on application to the above office. Captain F. S. Armstrong is constructing quartermaster.

KAMLOOPS, B. C., CAN.—The City Council has passed a by-law appropriating $300,000 for the Barrier River project, which includes the following work: dam and intake, including pipe, trench, locks and gates and terminals, to cost $57,550; power house and two 1200-hp turbines and two 600-kw generators, $55,000; transmission lines, telephones, etc., 45 miles, $152,775, and for 1¼ miles of 6-ft. wood pipe, $29,700. Herman & Burwell and Dutch & Maxfield, of Vancouver, B. C., are engineers.

EXETER, ONT., CAN.—The Council has decided to submit a by-law to the ratepayers on the question of securing electricity from the Hydroelectric Power Commission for Exeter.

OTTAWA, ONT., CAN.—Plans are being considered by the City Council for improvements to the street-lighting system in Hintonburg, Mechanicsville, Ottawa East and Ottawa South, suburbs of the city. The Ottawa Electric Company has submitted a proposition to Superintendent Brown offering to install tungsten lamps in all the suburbs at $15 each per year. There are at present 151 lamps of small candle-power, averaging $8.48 each per year.

STRATFORD, ONT., CAN.—It is reported that plans have been prepared by the promoters of the London & Northwestern Radial Railway Company, which proposes to build an electric railway between London and Sarnia, for the construction of a dam on the Au Sable River, at Rock Glen, in West Williams, to provide power to generate electricity to operate its proposed electric railway.

PEARSON, CHIHUAHUA, MEX.—Plans are being considered by Dr. F. S. Pearson, of New York, N. Y., and associates, who own the Mexico Northwestern Railroad and extensive timber interests in this section, for the construction of an electric railway to extend from Pearson to Colonia Juarez. It is proposed to build a large power plant to furnish energy to operate the proposed railway and also to provide electricity to operate the large lumber mills and other industries which are being established in this district.

Personal.

MR. P. H. MORTON, Sand Point, Idaho, has been appointed manager of the Oregon Power Company, with headquarters at Albany, Ore.

MR. CHARLES W. STONE has been appointed to succeed the late [illegible] the General Electric Company.

MR. JEAN BART BALCOMB, consulting electrical engineer, has been appointed executive engineer for the Alvord Irrigation Company, with headquarters at Alberson, Ore.

MR. DAVID FENNESSY, formerly manager of the Parral (Mexico) Power & Reduction Company, has accepted a position with the General Electric Company at El Paso, Tex.

MR. HENRY FLOY left for the South last week with a party of prominent engineers and financiers who are interested in a large irrigation and hydroelectric development.

MR. WILLIAM J. NORTON, of the Commonwealth Edison Company, Chicago, has been appointed secretary of the rate research committee of the National Electric Light Association.

MR. R. W. PUTZKER has been appointed manager of the Pacific Telephone & Telegraph Company, Marysville (Cal.) district. Mr. Putzker was formerly district manager for the company at Santa Cruz, Cal.

MR. JOHN S. NICHOLL, B.S., lately with the New York Edison Company and formerly acting manager for F. W. Horne, importer of American machinery, Yokohama, Japan, has joined the staff of Walter B. Snow, publicity engineer, Boston.

MR. SAMUEL H. GLUCROFT has resigned as consulting engineer and sales manager of the General Illuminating Company, New York, to become associated with the sales organization of the Helios Manufacturing Company, Philadelphia, Pa.

MR. SIDNEY G. KOON, M.M.E., has joined the staff of Walter B. Snow, publicity engineer, Boston. Mr. Koon was for four years editor of *International Marine Engineering* and later was metallurgist with the Jones & Laughlin Steel Company.

PROF. PHILIP S. BIEGLER, of the University of Montana, Missoula, Mont., is delivering a series of lectures on applied electricity to the employees of the Northern Pacific Railroad at Missoula. These lectures are in connection with the extension work being done by the School of Engineering of the university.

MR. RALPH BIRCHARD, formerly manager of the *Railway Electrical Engineer*, Chicago, has joined the staff of the Edison Storage Battery Company of Orange, N. J. Mr. Birchard is in the sales department at Orange, his duties including the preparation of bulletins covering the uses of the Edison battery.

MR. GEORGE D. LUTHER, who took part in the discussions at the meeting of the Boston Electric Vehicle Club on Nov. 15, is the representative at Denver, Col., of the Electric Storage Battery Company and not, as stated in the notice of the meeting in our issue of Nov. 25, of the Edison Storage Battery Company.

MR. HERBERT ALDEN SEYMOUR has been appointed editor of the *Edison Round Table*, which is the magazine published in Chicago by the Commonwealth Edison Section of the National Electric Light Association. Mr. Seymour has been editor of the *Electric City Magazine*, also a Commonwealth Edison publication, for several years.

MR. JAMES BRONIS, of West Orange, N. J., a member of the Illuminating Engineering Society, the National Sales Managers' Association and many fraternal organizations, and who has served in various capacities in the business development of the Moore Light Company during the past eight years, left that company on Dec. 15, to take up important work in a new organization.

MR. C. A. HAMILTON, who for the past six years has been vice-president and general manager of the Wisconsin Engine Company, Corliss, Wis., has resigned from that company to take an interest in the Lavigne Gear Company, a new corporation organized for the purpose of manufacturing automobile steering gears and accessories. Mr. Hamilton has been elected vice-president and general manager of this company, with general offices at Milwaukee, Wis.

MR. J. BOWYER, manager of the Anchor Cable Company, Ltd., of Leigh, Lancashire, England, is paying a flying visit to America to see what is being done in his line on this side of the Atlantic. Mr. Bowyer has been the guest of Mr. E. W. Stevenson, of Wilkes-Barre, Pa., a veteran in the insulated-wire business. After visiting several Eastern factories and inspecting the various plants where machinery and crude materials are supplied, Mr. Bowyer will return home in time for Christmas.

MR. GLENN MARSTON, of the Public Service Publishing Company, of Chicago, sailed Saturday, Dec. 9, on the steamship *Olympic* for a short investigating trip through England, Germany and France. Mr. Marston has made several former trips, and his present trip is for the purpose of studying the terms of the contracts which have been entered into by a number of municipalities whereby the municipal plants have been abandoned or leased to private power companies. In addition to his investigation in municipal ownership, Mr. Marston will act as representative for the 1912 Boston Electric Show, calling [illegible]nber of British manufacturers who contemplate exhibiting at the show, which will be held from Sept. 28 to Oct. 26, 1912.

COL. EDWARD D. MEIER, president of the American Society of Mechanical Engineers, was presented with an illuminated address of congratulation at the May meeting of the society in Pittsburgh. At that time Colonel Meier consented to sit for his portrait, at the request of a number of the members, and this portrait was exhibited at the recent meeting of the society in New York and attracted much attention. Colonel Meier was born in St. Louis in 1841, and has an honorable Civil War record. He organized the Heine Safety Boiler Company in 1884, and is also accredited with being responsible for the introduction of the Diesel engine into this country. He is a past-president of the American Boiler Manufacturers' Association and of the Metal Trades Association. His home is in St. Louis.

MR. THOMAS E. MITTEN, president and director of the Chicago City Railway Company, and one of the leading street-railway executives of the country, resigned both his positions with the Chicago company on Dec. 14. In his letter of resignation Mr. Mitten said that owing to his time being so fully occupied with similar undertakings in connection with the street-railway systems at Buffalo and Philadelphia, he should be glad to have his resignation made effective on Dec. 31. During Mr. Mitten's administration the Chicago traction settlement ordinances of 1907 were adopted. By these ordinances the street-railway companies pay into the city treasury 55 per cent of their "net receipts." In the case of the Chicago City Railway Company this payment has amounted, so far, to about a million dollars.

MR. S. GEORGE FREUND has opened an office as a consulting engineer for foreign trade at 100 Broadway, New York. His purpose is to act as a connecting link between American and foreign, especially German, industries in the mutual extension of their technical-commercial relations and the introduction in one country of enterprises and products which have been successful in the other. He is also prepared to assist American and German manufacturers in matters relating to import, export and manufacture and the exploitation of patents. Mr. Freund was connected with the electrical engineering department of the Interborough Rapid Transit Company during the construction of the subway. He has also engaged in other engineering work in this country and since 1901 has been American correspondent for the *Elektrotechnische Zeitschrift*. He has just returned from Europe, where he opened a European office at Grunewaldstrasse, 99, Berlin.

MR. FREDERICK JAMES VOLNEY SKIFF, M.A., LL.D., director of the Field Columbian Museum at Chicago for the past fourteen years, has accepted the appointment of director-in-chief of foreign and domestic participation in the Panama-Pacific International Exposition, which is to be held in San Francisco in 1915. Mr. Skiff is a member of the French Legion of Honor, and has been the recipient of decorations from the governments of Germany, Japan, Belgium, Austria, China, Italy, Turkey, Siam, Bulgaria and Portugal. He was national commissioner of the World's Columbian Exposition, 1893, and later chief of the department of mining and metallurgy and deputy-general of that exposition. He organized the award system of the Nashville Exposition in 1897, and was a director-in-chief of the United States Commission at the Paris Exposition in 1900, commissioner at the Turin Exposition, 1902, and director of exhibits at the Universal Exposition at St. Louis in 1904. He was also first vice-president of the superior jury of the St. Louis Exposition and a member of the board of administration of the International Congress of Arts and Sciences held in connection with that exposition.

MR. ALFRED C. EINSTEIN, for a number of years president of the King Electric Light Company, the St. Louis County Gas Company and the Suburban Electric Light & Power Company, which do the suburban utility business about the city of St. Louis, has been appointed general manager of the Union Electric Light & Power Company, of St. Louis. Mr. Einstein succeeds Mr. Alten S. Miller, who resigned last spring to join Dr. A. C. Humphreys, of Stevens Institute, Hoboken, N. J., in engineering work. The new general manager of the Union Electric Light & Power Company is a native of St. Louis, where he was graduated from the manual training school of Washington University in 1884. After varied engineering experience in railway and mining work, he organized his own construction and engineering company in 1894 for the construction of electric and gas plants. Later he removed to Paducah, Ky., where he served as president and general manager of the electric-light and street-railway properties until 1898. In the following years he invented a number of pieces of acetylene gas-generating apparatus and became president of the Eagle Generator Company, with which he served until 1907. Mr. Einstein had in the meantime become associated with the Suburban Electric Light & Power Company in 1901, and in 1906 purchased the King Elec-

[illegible] EINSTEIN.

tric Light Company. Until the appointment of a successor, Mr. Einstein will continue to administer the properties of the St. Louis County corporations, which are owned by the North American Company, the holding concern of the Union Electric Light & Power Company. Mr. James D. Mortimer, president of the Union Electric Light & Power Company, will continue to divide his time between St. Louis and Milwaukee, where he is also general manager of The Milwaukee Electric Railway & Light Company.

Obituary.

MR. FRANK RIDLON, [illegible] New England electrical field and a pioneer in the manufacturing branches of dynamo and motor work, died at his home in Brookline, Mass., on Dec. 1, after three years of illness following a paralytic stroke. He was born in Boston in 1838, and at an early age became interested in the study of electricity. For many years he was president of the Frank Ridlon Company, Boston, dealer in electrical supplies and specialist in the maintenance of central-station and railway equipment, holding this office at the time of his death, as well as the presidency of the Berlin (N. H.) Street Railway, which he built, and the Boothbay Harbor Electric Light & Power Company, of Boothbay, Maine. In his earlier days he was the Boston representative of the Brush Electric Company, of Cleveland, Ohio, later becoming connected with the Sun Electric Company, lamp manufacturer, of Woburn, Mass. Twenty-one years ago Mr. Ridlon founded the Boston Electric Light Club, being its president for eight years. At one time he was also vice-president of the National Electric Light Association. In face and figure Mr. Ridlon greatly resembled the late Denman Thompson, the actor, who was his close personal friend. He was for many years a member of the Ancient and Honorable Artillery Company of Boston and was an honorary member of the Hooker Association and Abington Post, G. A. R. He was regarded as the dean of the members of the New England Street Railway Club. A widow and one daughter survive him.

Trade Publications.

TRIPLEX PLUNGER PUMPS.—The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued Bulletin No. 103, describing its single-acting triplex plunger pumps. These are built for working pressures up to 1500 lb. and for a great variety of services.

CONVEYOR SYSTEMS.—The Robins Conveying Belt Company, New York, has issued Bulletin No. 46, containing an illustrated description of its factory equipment, its product and numerous instances of successful applications of belt conveyors, which, it is claimed, are handling in the aggregate at the present time 1,415,000,000 tons of various material annually.

TELEPHONE SUPPLIES AND CONSTRUCTION MATERIAL.—Bulletin No. 1003, published by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is virtually a catalog of such material used by telephone companies as is considered standard by the trade. It is arranged in conventional style and contains illustrations, short descriptions and prices, besides tables of various kinds of material.

WATERWHEEL ALTERNATORS.—The Westinghouse Electric & Manufacturing Company in Circular No. 1198 describes and illustrates its line of generators, both vertical and horizontal, for waterwheel drive. [illegible] types of construction are described in considerable detail. Other components of the waterwheel generators receive attention and many pictures of waterwheel-driven installations are shown.

ELECTRIC WASHING AND WRINGING MACHINE.—The Hurley Machine Company, Chicago, has issued a circular describing its "Red Electric" washing and wringing machine, recently designed and placed on the market. The machine is of the dolly type, but its special feature is the method of operating the dolly. All of the gearing and operating mechanism is mounted under the machine on a metal platform. The dolly in the machine is operated by an upright shaft extending up through a hollow sleeve in the bottom of the tub, which leaves the sides of the machine as well as both the inside and outside of the cover entirely free [illegible]

BUSINESS NOTES.

THE ALLIS-CHALMERS COMPANY has removed its Kansas City office to 1410-12 Waldheim Building.

NEW CUT-OUT CABINETS.—The New England Electric Company, of Denver, Col., has developed a line of adjustable-flange cut-out cabinets designed to be used flush with the plaster line and involving but a small amount of adjustment subsequent to installation.

MONKS & JOHNSON, architects and engineers, 7 Water Street, Boston, have associated themselves with Henry F. Keyes, architect, 161 Devonshire Street, Boston, for the preparation of plans and specifications for certain large industrial developments.

SPLITDORF AGENCIES.—Following removal to new quarters in Chicago and the establishment of a branch in Kansas City, the former quarters of C. F. Splitdorf in San Francisco have had to be abandoned owing to the lack of proper facilities for handling the volume of ignition business, and P. E. Kempton, branch manager on the Coast, will now be located in new headquarters at 430-436 Van Ness Avenue.

NEW DETROIT OFFICE OF FOSTORIA GLASS SPECIALTY COMPANY.—The Fostoria Glass Specialty Company, of Fostoria, Ohio, has recently opened a branch office at 414 Bowles Building, Detroit, Mich., where a large exhibit of its electric and gas shades and reflectors and of its other products will be kept on display. The office is in charge of Mr. H. E. Richards, who is well known to the fixture trade of the Middle West.

ADAMS-BAGNALL CHANGES.—Mr. J. G. Pomeroy, formerly Western sales manager of the Adams-Bagnall Electric Company, has been appointed sales manager of the company with headquarters in Cleveland. Mr. C. L. Eshleman has been appointed publicity manager of the company with headquarters in Cleveland. The company has opened a Boston office under the management of Mr. E. R. Bryant, formerly connected with the company's New York office. A stock of all Adams-Bagnall lines will be carried in Boston.

MR. J. ALLEN WORTH has recently resigned from the Weber Electric Company to become sales manager of the push-button switch and specialty department of the Cutler-Hammer Manufacturing Company, of Milwaukee. Mr. Worth has been engaged in this field of the electrical industry for the past seven years. He, with Mr. Henry D. Sears, sales agent for the Weber company, successfully marketed the first snapshell socket at a time when the trade was skeptical of the utility of this type. Mr. Worth's experience with the Weber company since this time fits him for the sales management of the rapidly growing Cutler-Hammer line of switches and specialties.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 5, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,010,409. APPARATUS FOR USE IN THE DISTRIBUTION OF ELECTRIC CURRENTS; A. F. Berry, Ealing, England. App. filed March 14, 1910. Transformer system improvements over Patents Nos. 796,555 and 800,538.

1,010,410. APPARATUS FOR USE IN THE DISTRIBUTION OF ELECTRIC CURRENTS; F. E. Berry, Hayes, England. App. filed May 6, 1911. Transformer system with successive switch operation.

1,010,412. SPEED-LIMIT-SIGNALING APPARATUS; F. M. Butler, David City, Neb. App. filed Jan. 21, 1910. Visible and audible signals for automobiles, etc.

1,010,413. TRANSMITTING APPARATUS FOR TELEGRAPH SYSTEM; A. C. Crehore, Yonkers, N. Y. App. filed July 23, 1904. For keyboard-operated system of Patent No. 773, 198.

1,010,414. THERMOSTAT; A. S. Cubitt, Pittsfield, Mass. App. filed June 16, 1910. Thermostatic switch and thermostatic lock to produce snap action.

1,010,415. COMBINED WATCHMAN'S CLOCK AND TELEPHONE SYSTEM; F. G. Duryee, Fort Wayne, Ind. App. filed March 8, 1910. Recording clock and time-limit device for calling the operator.

1,010,416. ELECTRICITY METER; S. Evans, Berlin, Germany. App. filed June 3, 1908. Indicates the maximum rate of consumption.

1,010,420. SYSTEM OF DISTRIBUTION; J. J. Frank, Pittsfield, Mass. App. filed Jan. 26, 1911. Busbars of different potential for "life-testing" incandescent lamps.

1,010,422. CIRCUIT-BREAKER; W. P. Hamlyn, Rugby, England. App. filed Nov. 30, 1907. Automatic free-handle type.

1,010,425. ELECTRIC SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed March 20, 1909. Protected tower switch for dividing a high-potential transmission line into sections.

1,010,448. PROCESS OF TREATING COILS; J. I. Mitchell, Pittsfield, Mass. App. filed March 12, 1910. The coils are japanned, then wound with tape and then oil-proofed.

1,010,449. SANITARY TELEPHONE TRANSMITTER; J. H. O'Connell, Boston, Mass. App. filed Dec. 5, 1908. Thin, imperforate front plate.

1,010,455. MERCURY-VAPOR LAMP; A. E. Richardson, Lynn, Mass. App. filed June 12, 1905. Starting filament moved by an electromagnet.

1,010,465. CLUSTER SOCKET; J. C. Tournier, Schenectady, N. Y. App. filed March 5, 1909. For series or multiple connection.

[illegible]

1,010,478. SUBSCRIBER'S TELEPHONE APPARATUS; H. P. Clau- [illegible] selective-system signaling for so-called "automatic" systems.

1,010,497. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J., and E. Van Wagenen, New York, N. Y. App. filed Dec. 27, 1906. Alternating-current system with storage-battery regulation. (Sixty-nine claims.)

1,010,500. TRANSFORMER; S. E. Johannesen, Pittsfield, Mass. App. filed Jan. 26, 1911. "Bell-ringing" type; the core may be used as a resistance.

1,010,504. THIRD-RAIL COVERING; F. H. Lindsley, Pawtucket, R. I. App. filed March 20, 1911. Side-guard plates.

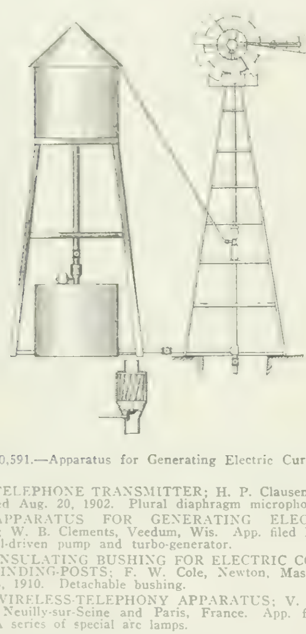
1,010,505. TELEPHONE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Oct. 9, 1907. Automatic line meter for measured service.

1,010,522. DYNAMO-ELECTRIC MACHINE; H. Roos, Berlin, Germany. App. filed April 29, 1910. Ventilated rotating field magnet [illegible]

1,010,529. ELECTRICALLY HEATED TOOL; G. E. Stevens, Lynn, Mass. App. filed Sept. 16, 1908. Soldering iron.

1,010,531. TELEPHONE INSTRUMENT; W. F. Taylor and V. Durbin, Brookline, Mass. App. filed May 17, 1909. Readily dismemberable desk standard transmitter.

1,010,533. DYNAMO-ELECTRIC MACHINE; E. M. Tormin, Brookline, Mass. App. filed June 17, 1910. Alternating-current generator for delivering different cycles for party-line telephone signaling.



1,010,591.—Apparatus for Generating Electric Currents.

1,010,590. TELEPHONE TRANSMITTER; H. P. Clausen, Chicago, Ill. App. filed Aug. 20, 1902. Plural diaphragm microphone type.

1,010,591. APPARATUS FOR GENERATING ELECTRIC CURRENTS; W. B. Clements, Veedum, Wis. App. filed Dec. 13, 1909. Windmill-driven pump and turbo-generator.

1,010,592. INSULATING BUSHING FOR ELECTRIC CONDUCTORS AND BINDING-POSTS; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Detachable bushing.

1,010,593. WIRELESS-TELEPHONY APPARATUS; V. Colin and M. Jeance, Neuilly-sur-Seine and Paris, France. App. filed Aug. 18, 1909. A series of special arc lamps.

1,010,606. COMBINATION LIGHTNING ARRESTER AND FUSE BLOCK; E. B. Fahnestock, New York, N. Y. App. filed Feb. 19, 1907. The fuse is supported only at the lower end.

1,010,620. ELECTRIC SWITCH; W. J. Crumpton, Superior, Wis. App. filed April 3, 1905. Inclosed and sealed mercury terminal.

1,010,638. ELECTROPLATING RACK; J. F. Kitchen, Meadville, Pa. App. filed June 26, 1909. Perforated yoke, cathode hanger.

1,010,639. ELECTROPLATING RACK; J. F. Kitchen, Meadville, Pa. App. filed June 26, 1909. Reel-like frame for strips, wire, corset stays, etc.

1,010,640. SWITCH DEVICE; O. K. Kjolseth, Schenectady, N. Y. App. filed Aug. 1, 1905. A switch and fuse for electric locomotive protection.

1,010,641. RESISTANCE UNIT; C. D. Knight, P. H. Zimmer and J. B. Ford, Schenectady, N. Y. App. filed Feb. 21, 1907. The resistance is embedded in an asbestos tube with porcelain ends.

1,010,647. ELECTROPLATING RACK; C. E. Leffel, Meadville, Pa App. filed June 26, 1909. A covered cathode hanger with hooks.

1,010,648. ELECTROPLATING RACK; C. E. Leffel, Meadville, Pa. App. filed June 26, 1909. A non-conducting cathode hanger with hooks.

1,010,651. TROLLEY-POLE ARRESTER; R. S. Lillico, Seattle, Wash. App. filed Oct. 17, 1910. Jumping of the pole releases a retrieving weight.

1,01[illegible] [illegible] troit, Mich. App. filed Oct. 31, 1910. Permutation lock to protect motor-vehicle ignition circuits, etc.

1,010,666. COMMUTATOR SWITCH; R. Miller, Ann Arbor, Mich. App. filed Sept. 28, 1910. For controlling the lighting of the two front lamps and the tail lamp of a motor vehicle.

1,010,668. VACUUM-TUBE LAMP; D. McF. Moore, Newark, N. J. App. filed Jan. 5, 1905. A portion of the electrode is heated by current independent of the discharge.

[illegible] WIRELESS TELEGRAPH APPARATUS; D. McF. Moore, Newark, N. J. App. filed May 8, 1906. Vacuum-tube receiver with automatic valve.

1,010,670. AUTOMATIC GAS-FEED FOR VACUUM TUBES; D. McF. Moore, Newark, N. J. App. filed May 8, 1906. By varying the temperature and porosity of a platinum tube.

1,010,693. BATTERY-ELEMENT SUPPORT; C. B. Schoennehl, Water- [illegible] App. filed Nov. 26, 190[illegible]. A disk of compressed copper oxide with a hanger.

1,010,695. BATTERY VENT PLUG; J. R. Sloan, Altoona, Pa. App filed June 9, 1911. A covered gas passage.

[illegible] SECTIONAL ROD; W. H. Stewart, Boston, Mass. App. filed April 19, 1909. For fishing conduits, etc.

[illegible] INSULATED ADJUSTABLE TROLLEY CROSSING; H. W. [illegible] and B. C. Edgar, San Francisco, Cal. App. filed March 18, 1911. For adaptation to different angles of cross-over.

1,010,753. ELECTRIC SWITCH; E. A. Halbleib, Rochester, N. Y. App. filed Dec. 16, 1910. Plurality of plugs with a key-locking device.

1,010,757. PULSOMETER; H. E. Heath, Hartford, Conn. App. filed Sept. 24, 1908. Spring arms having different natural rates of vibration.

1,010,7[illegible] OZONIZER; R. M. Leggett, Ann Arbor, Mich. App. filed Jan. 21, 1911. Tubular terminals and dielective.

1,010,814. COMBINATION LOCK FOR ELECTRIC LAMPS AND THE LIKE; G. I. Silbert, Chicago, Ill. App. filed July 18, 1910. Tumblers and a setting ring.

1,010,864. SWITCH INSTRUMENT; C. W. Coleman, Westfield, N. J. App. filed Oct. 9, 190[illegible]. The movement of a railway switch controls the block-signal circuits.

1,010,866. PROCESS OF MAKING COMPOSITE CONDUCTORS; W. D. Coolidge, Schenectady, N. Y. App. filed Sept. 23, 1908. A thoria thread is copper coated, then covered with tungsten. The copper is then driven off.

1,010,899. TROLLEY; G. Frivalszky, Chicago, Ill. App. filed June 10, 1911. The wheel has spiral replacing beads.

1,010,897. ELECTRIC GAS-LIGHTER; H. D. Grinnell, Pittsfield, Mass. App. filed July 14, 1910. For motor-vehicle lamps.

1,010,891. SOLDERING IMPLEMENT; C. W. Gamble, Montreal, Canada. App. filed Aug. 16, 1911. The tool is adapted to be readily attached to a current-supplying standard.

1,010,900. ARC LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed March 7, 1907. Plural flaming arcs with feed and control.

1,010,907. METHOD OF PREVENTING ALTERNATING-CURRENT ELECTROLYSIS; J. L. R. Hayden, Schenectady, N. Y. App. filed Jan. 4, 1907. The negative wave is made to overbalance and neutralize the positive destructive wave.

1,010,914. MACHINE FOR TREATING FILAMENTS; J. W. Howell, Newark, N. J. App. filed Oct. 17, 1903. The treating "bottle" is automatically charged with the proper amount of hydrocarbon.

1,010,920. HIGH-TENSION INSULATOR; B. D. Kenney, East Liverpool, Ohio. App. filed June 29, 1911. Suspended units have hinged connectors.

1,010,922. TROLLEY; C. and J. Kordek, Philadelphia, Pa. App. filed Sept. 1, 1911. Has side guide rollers above and behind the wheel.

1,010,936. ELECTRIC CONDENSER; M. Meirowsky, Cologne-Ehrenfeld, Germany. App. filed March 3, 1909. Sheets of tinfoil are rolled between layers of prepared paper while hot.

1,010,937. OIL SWITCH; J. F. Mennington, Oakley, Ohio. App. filed Dec. 30, 1907. Pivoted arms with ball and socket contacts.

1,010,938. RIVETING MACHINE; F. R. von Merkl, Vienna, Austria-Hungary. App. filed June 4, 1910. Magnetic clutch drive.

1,010,942. ARC-LIGHT ELECTRODE; B. Monasch, Berlin, Germany. App. filed Jan. 2, 1908. Iron anode with copper core and iron cathode with titanium oxide core.

1,010,961. SYSTEM OF DISTRIBUTION; G. B. Schley, Norwood, Ohio. App. filed Feb. 6, 1908. Multiple voltage system. (Improvement in Hall patent No. 883,195.)

1,010,982. NEUTRALIZING INDUCTIVE DISTURBANCES; J. B. Taylor, Schenectady, N. Y. App. filed Nov. 19, 1908. The current in the outgoing and return conductors is maintained equal by electromagnetic means.

1,010,984. ATTACHMENT PLUG; G. B. Thomas and F. E. Seeley, Bridgeport, Conn. App. filed July 25, 1911. The plug and fitting are relatively rotarily adjustable.

1,010,985. ELECTRIC-LAMP SOCKET; G. B. Thomas, Bridgeport, Conn. App. filed Aug. 11, 1911. A side-screw multiple is mounted on the porcelain inside the shell.

1,010,990. REGULATING DEVICE; E. A. Wagner, Fort Wayne, Ind. App. filed April 29, 1909. A transformer and reactance for regulating moving-picture-machine lights, etc.

1,010,998. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Milwaukee, Wis. App. filed April 22, 1910. Reinforced turbo-generator rotor.

1,011,018. METHOD OF INCREASING THE WORKING FACTOR (COS ϕ) AND THE STABILITY OF ELECTRIC FURNACES; K. Birkeland, Christiania, Norway. App. filed April 16, 1910. The current is divided into parts in parallel and out of phase.

1,011,020. NEUTRALIZING INDUCTION FROM ALTERNATING-CURRENT RAILWAYS; W. S. Bralley, Schenectady, N. Y. App. filed Aug. 7, 1907. A neutralizing conductor is placed near the conductors to be protected and connected in shunt to the rails.

1,011,045. SCOUND INTENSIFIER FOR TELEPHONE MOUTH-PIECES AND THE LIKE; H. Foss, Dombaas, Norway, App. filed Aug. 24, 1909. Spherical sound box.

1,011,088. ELECTRIC LIGHTING; C. P. Steinmetz, Schenectady, N. Y. App. filed April 25, 1900. Starting lamps requiring high starting voltage.

1,011,097. CIRCUIT-BREAKER; H. L. Van Valkenburg, Norwood, Ohio. App. filed Sept. 14, 1905. Magnetic and hand-operated.

1,011,118. INSULATING DEVICE FOR ELECTRIC CABLES; P. Carolan, Cleveland, Ohio. App. filed Dec. 9, 1910. Splicing device with a protection fuse.

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NEW YORK, SATURDAY, DECEMBER 23, 1911.

CONTENTS.

TRANSMISSION PLANT WITH ALUMINUM CONDUCTORS.

The Canadian Northwest is rich in waterfalls which need only a market to become valuable sources of power. This market has, as our readers know, been rapidly building up during the past few years with the phenomenal growth of population and enterprise in that part of our continent. The plant described elsewhere in our columns is particularly for the purpose of supplying the city of Calgary, although an auxiliary market has been found in Exshaw. The source of power is at Horseshoe Falls, about 50 miles from Calgary, where a head of 73 ft. has been made available. The present installation aggregates 9000 kw in three units, with space for an additional 4000-kw unit when it becomes necessary. Oddly enough, two types and sizes of generators are employed in this comparatively small plant and coupled each to a different type of turbine —a complication which on the face of things seems unnecessary.

Nothing specially out of the ordinary is embodied in the station equipment, which is worked out on the usual lines of remote control from a desk in the gallery overlooking the generator-room. The generating units themselves are of 12,000 volts for local service and the transmission to Exshaw, while for the long line leading to Calgary the voltage is raised to 55,000. The main transmission line is of very simple and economical construction, consisting of 40-ft. cedar poles. On the tops of these is carried a grounded steel cable on small insulators. The three-phase circuit is carried on two cross-arms, the lower an ordinary double arm, the upper an arm extending on one side of the pole only, so that the wires are arranged in a right-angled triangle. The spacing, vertical and horizontal, between wires is 5 ft. 6 in., and the insulators are of the large triple-petticoat variety usual for such a voltage. Seven feet below the lower conductors is a small cross-arm carrying a telephone circuit. A duplicate line to Calgary running most of the way over an entirely different route is now under insulation. Every tenth pole is double-armed and guyed. The poles are spaced forty to the mile, and the construction is certainly one both cheap and effective for a case where independent circuits are desired and the country is relatively clear. The line wires are No. 0 equivalent aluminum cable.

The aluminum-conductor feature, considering the severity of the climate, is of exceptional interest. With proper allowance for sag an entirely adequate factor of safety can be given to an aluminum line, and it is a constant source of wonder to many that aluminum is not more freely used in the United States. It has been exploited for line-wire purposes for some years past and has in practice proved economical and successful, yet it is only now and

been employed in this country, though largely used abroad. It would be interesting to know, if it were possible, the exact conditions which exist respecting the commercial side of its exploitation. There seems no doubt whatever that at foreign prices for aluminum it can compete with copper with a very considerable margin of profit. There is a rather heavy duty of 7 cents a pound—equivalent to about 50 per cent—on aluminum imported into the United States and, as is usual in the case of articles carrying considerable duty, the American price is regulated by the duty-paid price of the foreign article. Aluminum in this country is quoted at practically 7 cents a pound higher than the London figure, plus a small allowance of, say, 1 cent a pound to offset a sufficient portion of the transportation charges to make importation unprofitable. The American makers of aluminum do not seem to cultivate the manufacture of wire in a way that would introduce active competition with copper. Whether this arises entirely from the growing use of aluminum for other purposes or is due to some community of interest with those who control the copper situation is at the present time a matter of conjecture.

The known fact in the case is that the price of aluminum is kept just at a point where the extra trouble in erection to meet the existing climatic conditions is sufficient to make the engineer think twice before abandoning copper. Indubitably also the somewhat general use of tower construction with its long spans, for which hard-drawn copper is commonly used, has an influence on the situation. It would be interesting, however, to know the cost of the Calgary line per mile as compared with the ordinary practice on this side of the border. Some day the duty on aluminum is likely to be considerably reduced, and the economics of line construction will then be very suddenly altered.

ELECTRIC PUMPING FOR CITY WATER SUPPLY.

The feasibility of electric pumping for water-works of small cities is too well established to make argument necessary. The pumping costs of the average small water-works are so high that it is an easy matter to make a profitable rate for electric pumping considerably below the previous pumping costs. However, the larger the water-works plant the more difficult becomes the problem of securing this business for electric pumping at a profit. One speaker at the recent Illinois convention advanced the opinion that electrical operation of water-works should be undertaken by central-station companies at little or no profit, if necessary, because the existence of a steam-operated water-works is a constant temptation to the city to put in a plant for electric lighting as well. Such a course could probably only be justified before a public-service commission by the argument that such low rates were made to the city as a compensation for the franchise.

In the case of the majority of small cities the taking of such pumping business at no profit would be an altogether unnecessary proceeding, for the reason that in such cases there is usually no difficulty in saving considerable money for the city and at the same time making the rate profitable to the electric-service company. From the engineering standpoint and the financial standpoint as well, the greatest obstacle to be overcome when introducing electric pumping for water-works in small cities is that of providing for extra pressure and increased rate of pumping during fires. The provision of sufficient pump capacity for ordinary service requirements involves comparatively small cost. In most small cities, however, the pressure during fires must be maintained at approximately double the regular service pressure, coupled with a rate of pumping from three to five times the ordinary service requirements. Motor-driven pumps for such service are the most expensive items in connection with a change to electric pumping. If the attempt is made to get around this by maintaining steam pressure at the water-works plant for emergencies, the cost of banking the fires is likely to wipe out the difference between electric and steam pumping if the labor is figured in.

Some discussion also took place at the Illinois convention as to the relative advantage of taking city pumping contracts on the basis of kilowatt-hours on the one hand and per million gallons pumped on the other hand. Propositions based on million gallons pumped have the obvious advantage at the outset that the city officials frequently do not know the relation that is likely to exist between kilowatt-hours and million gallons pumped, and are more likely to be suspicious of a kilowatt-hour proposition; while, if the company supplying the electricity does not have control of the pumping apparatus and water supply, either deterioration of the apparatus or increased lift of water made necessary by changed conditions may wipe out all the profit of the undertaking. Furthermore, the meters necessary for water measurement will cost many times as much as the electric meters. Either the kilowatt-hour or million-gallon form of contract should be satisfactory if proper safeguards are provided. The possibility of changed pumping and water conditions, however, should be kept in mind when such contracts are drawn, and any loss caused by defective maintenance of apparatus should fall upon whichever party is responsible for such maintenance.

LAMPS OF LUMINESCENT NEON VAPOR.

It is well recognized that there is a better chance to develop a highly efficient incandescent electric lamp with a column of vapor than with a solid filament. This is for the reason that there is only one known way of making a solid filament give out light, and that is by heating it to the incandescent temperature. There is no known way of keeping a substance at the temperature of incandescence without radiating from the substance a relatively large amount of dark heat or non-luminous radiant energy. On the other hand, a gas can be made luminescent in such a way that it radiates energy selectively, and perhaps entirely in luminous form. In other words, the spectrum of a white-hot solid is a continuous spectrum all the way from the high frequencies, in the treble which the eye perceives, down to the deep bass of low-temperature radiation, and the treble notes cannot be held down without holding down the entire keyboard along with them; whereas a luminescent gas radiates in a certain line spectrum or band spec-

trum only, so that the treble frequencies sought for may be obtained without any wasteful and unnecessary bass accompaniment. In an article published recently in *La Revue Electrique*, as noted recently in the *Digest*, M. Blondin describes some recent developments of neon-vapor lamps, as made by M. Claude in France. A preferred size of such a lamp appears to be a tube about 6 m long and 45 mm in diameter, operating at an alternating terminal emf of about 1000 volts. It is claimed that these neon lamps can operate for 800 hours at a specific consumption of 0.8 watt per candle at primary terminals of the special step-up transformer. At lamp terminals this would be about 0.75 watt per candle. It is not clear, however, from the description whether reference is made to a cylindrical or to a spherical candle; so that, although the specific consumption is evidently very low, it is not certain just how it compares with that of other lamps. Many difficulties have had to be met in producing a neon-vapor lamp, and this low specific consumption is thereby the more remarkable.

THE DIELECTRIC STRENGTH OF CABLES.

The atmosphere in which we live is not only the universal store of oxygen, from which all living animals draw their stock of combustion energy, but it is also the great electric insulating medium, in which all organisms are enveloped. The influences of the atmosphere on organic life are hardly less important from the standpoint of a universal insulating medium than from that of a universal fuel storehouse. In electrical engineering there is no insulating substance so inexpensive, so convenient and so easily applied as air, notwithstanding the fact that its dielectric strength is relatively low. So lavishly does our environment offer insulating facilities for aerial wires that not until we are compelled to place wires underground do we realize how much it costs to replace air insulation by solid insulation of any kind in buried cables. The actual necessity of employing high electric stresses in cables and the commercial necessity of employing the least total amount of insulating material consistent with safety have led in recent years to a study of the laws of electric flux in cable insulation. The fundamental fact is that the stress upon a cable-insulating sheath, tending to rupture it electrically, depends upon the electric flux-density. In its turn the electric flux-density depends upon the nature of the material and upon the gradient of the electrical potential. If we confine attention to one and the same uniform insulating material, such as rubber, the dielectric strength of the insulating layer does not primarily depend upon the electric potential imposed on the layer, but on the rapidity of change of that potential in neighboring space. If the electric potential impressed upon the insulating layer were the same throughout the layer, so that there was no change in potential, then the electric flux-density would disappear, and there would be no break-down stress upon the layer, no matter how high the potential might be. On the other hand, a low electric potential or voltage applied to the conductor of a cable can produce a high break-down stress on the insulator if the gradient of potential in the insulator is rapid; that is, if within a little distance, of say 1 mm, the potential falls by many kilovolts, the electric flux-density being proportional to this potential gradient.

Between a pair of parallel metallic plates a layer of uniform insulating material necessarily develops a uniform gradient of potential at all points. For example, if a flat sheet of fiber 0.5 cm thick is clamped between a pair of parallel opposing metallic plates connected to a difference of potential of, say, 15 kilovolts, then, except near the edges of the plates, the gradient of potential in the sheet will everywhere be uniform at 30 kilovolts per centimeter, with a correspondingly uniform electric flux-density and intensity of break-down stress. But when the insulating sheet, instead of being flat, is bent or curved between correspondingly curved metallic conducting surfaces, the gradient of potential and the electric flux-density are always greater at the surface of greater curvature; so that the tendency to break down electrically is always greater at or near the surface of greater curvature. For the same reason, when a single round wire is placed at the center of a round leaden sheath and insulated by a uniform cylindrical coating, say, of varnished paper, the insulating layer has a greater curvature at its inner surface of contact with the central wire than at its outer surface of contact with the sheath; consequently, the gradient of potential, the electric flux-density and the break-down stress are all greater at the inside than at the outside layers, and if the insulating material is homogeneous it will always tend to break down first on the inside. Experiment amply confirms this generalization. The smaller the diameter of the central wire the greater the curvature of the inside layer of insulator and the more intense the break-down stress on that inside layer for a given potential impressed on the wire. High-potential cables, therefore, avoid the use of thin single-wire conductors.

The question arises as to what is the effect of stranding a conductor upon the break-down stress at the inside insulating layer, where that stress is sure to be the greatest. Mathematically speaking the question is, How is the potential distributed near to and outside of such a stranded conductor? If the potential distribution can be determined for any given set of cable dimensions, the gradient of potential and the break-down stress can be determined. Professor Levi-Civita first solved this problem mathematically, and Mr. E. Jona was the first electrical engineer to apply and check the mathematical formula experimentally. In general, the result is that the potential gradient is always steeper near the outside of a stranded wire than near the outside of a corresponding cylindrical conductor, so that the dielectric strength of a cable of given dimensions is always reduced somewhat by stranding the wires. In fact, some high-tension cables have been made with a thin leaden sheath over the stranded conductor, so as to cylindrize the conducting surface. In our *Digest* last week reference was made to an article by Herr W. Deutsch, appearing in a recent number of the *Elektrotechnische Zeitschrift*, on this subject. The paper indicates that in general the use of a stranded conductor, concentric with a leaden sheath, increases the potential gradient nearly 30 per cent with respect to a single cylindrical central conductor of the same diameter.

Scope of the National Electric Light Association.

Mr. John F. Gilchrist, president of the National Electric Light Association, addressed the Electric Club of Chicago on Dec. 13, taking as his subject the work of the National Electric Light Association. In an interesting talk Mr. Gilchrist remarked that the membership of the association has now passed the 10,000 mark, and that there are over 8000 Class B members; that is, employees of member companies. The speaker made a calculation to show that probably between 500,000 and 1,000,000 persons are interested in the electric central-station industry in the United States, either directly as employees of operating companies or as manufacturers, dealers or agents supplying apparatus to such companies. A similar computation in relation to street-railway, telegraph and telephone companies would swell the number to a very much larger extent, and, when the families of these persons are considered also, it will be seen that a respectable proportion of the inhabitants of the United States are in some way related to the electrical industry. An increasing number of people are coming into the industry, with its growth and development. The development of low-head water-powers and of water-powers available only a part of the year was spoken of as one avenue in which the industry would undoubtedly expand in the future.

Mr. Gilchrist believes in the sectionalizing tendency in the association and said that he thought there might be a section for electric vehicles and one relating to illuminating engineering. An effort should be made also to effect co-operation between the N. E. L. A. and the various electric clubs scattered throughout the country and perhaps with other electrical organizations. Interest and enthusiasm for the work of the association are now running high, and apparently there is no reason why the membership may not grow to 50,000 or 100,000. The American Medical Association, with its affiliated class of members, has a total membership of about 75,000. There seems to be no reason why the distinctive general society of the electrical industry should not become correspondingly strong and powerful. Mr. Gilchrist believes that the name of the society might well be changed to National Electric Association and that the organization should reach out and cover the entire industry. (It is interesting to note that President Gilchrist's advocacy of a change in name to the National Electric Association is in line with an editorial on the same subject which was printed in the *Electrical World* of May 25, 1911.)

Mr. H. H. Cudmore, of Cleveland, spoke of the work of the Electric League of that city. He said that under the auspices of that organization three pages of co-operative daily-newspaper advertising are now printed weekly. The success of the Cleveland club has been due to individual effort on the part of members. The speaker believed that some sort of co-operation might be arranged between the various electric clubs and the N. E. L. A.

Mr. Harry C. Rice, of Cleveland, made a little speech on co-operation and optimism. On the first subject he advised his hearers to get Maeterlinck's "Life of the Bee" as a book from which they could learn much on practical co-operation. On the second phase of his subject he asked the pertinent question, apropos of wailing about the economic tendency of the times, "Why blow out the candle to find out how dark it is?"

Mr. E. W. Bemis, formerly of Cleveland, who has been retained by a number of municipalities as expert adviser on public-utility questions, said that several years ago he favored municipal ownership of public utilities in many cases. He is now engaged in rate-regulation work, however, and it is curious to reflect that, so far as his work is successful in establishing equitable rates, he is himself helping to postpone the day of municipal ownership of public utilities.

Electric-Vehicle Banquet in Boston.

A rousing climax to the 1911 electric-vehicle campaign in New England was celebrated by the Electric Vehicle Club of Boston on the evening of Dec. 19, when a banquet was given at the Boston City Club to about 200 members and guests, including many prominent federal, State and city officials, merchants, educators and men of high standing in electrical circles. The object of the banquet primarily was to bring home to the guests of the club the remarkable progress of the electric vehicle within recent years, and to emphasize its great adaptability, flexibility and economy within the field of urban and suburban transportation. The gathering was the most enthusiastic in the history of the electric vehicle in New England, and the key to the discussion was furnished by the principal speaker, Mr. Hayden Eames, of Cleveland, Ohio, who declared that only the inherent conservatism and dislike of change common to the human race now stand in the way of one of the greatest triumphs electricity has ever been prepared to win.

President Day Baker, of the Boston Electric Vehicle Club, called the assemblage to order at the close of the banquet with a short address of welcome, introducing President W. H. Blood, Jr., of the Electric Vehicle Association of America, as chairman of the evening. Mr. Blood emphasized the practicability of the electric vehicle as contrasted with its status in its earlier days. He pointed out the great economic waste of horse traction as illustrated in the heated term of the past summer, when 3752 horses, having a total value of over $1,000,000, succumbed to the weather; touched upon the unanimity of brewers regarding the cash value of the electric truck in New York, and sketched the efficient application of the commercial machine to department-store and central-station requirements.

Telegrams of congratulation were read from Messrs. L. A. Ferguson, Chicago; Frank A. Frueauff, Denver, Col.; Herbert A. Lloyd, Philadelphia; Rausch & Lang, Cleveland, Ohio; E. C. Vickar, St. Louis, Mo.; R. B. Daggett, president Pacific Coast Electric Vehicle Association; Robert M. Searles and James T. Hutchings, Rochester, N. Y., and Harvey T. Robinson, New York. Great enthusiasm was aroused by the following special-delivery letter from Mr. Thomas A. Edison.

"To you, members of the Electric Vehicle Club of Boston, and your guests assembling, I send greetings. The educational work you are doing cannot fail to convince finally the great public that the universal power will be given out by electric motors. Already cotton mills, machine shops, iron works, mines, street cars, steam roads and all are going electric. Vehicle transportation in cities and suburbs will ultimately be done by electric storage-battery vehicles. There is no escape from the fact that an electric motor has but one moving part, and that rotating, whereas all other motors have hundreds of parts, mostly reciprocating."

The toastmaster of the evening, Mr. La Rue Vredenburgh, of the Boston Edison Company, called upon Major H. F. Crowley, of the Governor's staff, for a brief salutation and then introduced Mr. Hayden Eames, who delivered an address upon "The Electric Vehicle for City and State." He reviewed the development of motor transportation in Europe, emphasizing the influence of good roads and high freight rates upon the progress of the industry. The steam-motor haulage of goods in England from the railroad into the surrounding districts had been successfully based upon a cost of 3 cents per ton-mile. The day is almost at hand in this country when the strength of bridges and the character of roads will have to be improved to permit the passage of much larger trucks than are now in use. Mr. Eames said that the United States government is well in advance of European governments in the development of military automobile applications. Turning to the electric machine, the speaker pointed out the great importance of detachable mechanism and fittings. He contended that the

gasoline car meets the demands of interurban service and that the urban field belongs to the electric truck and pleasure vehicle. For city transportation the horse has been at a disadvantage for ten years. Even the earlier storage battery was a better chemical appliance than the horse. Proper installation and operation are vital to the success of the motor-wagon. The electric truck means decreased labor and maintenance charges in competition with gasoline, although the latter is more mobile and speedy where long distances are involved. An increase in the size of trucks means a saving in wages per unit of merchandise handled. Ten-ton trucks are likely to be in use within two years. About $10,000,000 worth of electric trucks have been purchased thus far in this country, about one-fourth of this sum having been expended in the past year. It is estimated that sixteen times as much freight is handled on wagons and trucks as on railroads, and that in Boston alone 76,500 kw-hours would be daily required merely to convey retail freight away from the terminals to the receiving warehouses. The electric vehicle is no heavier for the required service than is the gasoline truck.

Mr. Eames dwelt at length upon the value of synthetizing the costs in selling electric vehicles and contended that wide experience enables the expense of such service to be determined with high accuracy in advance of the installation. He presented the following broad figures of electric truck economy:

	Packing House.	Packing House.	Department Store.	Department Store.
Electric investment	$166,[illegible]	$56,000	$53,000	$51,000
Horse investment...........	94,000	26,000	36,000	21,000
Yearly saving by electrics	23,000	15,000	21,000	11,000

In closing he pointed out that the maintenance of the modern electric truck is sometimes only 50 per cent of the allowed total, and prophesied that the inertia of the human race will soon be absolutely unable longer to stem the tide of electric vehicle advance.

New York Jovian Luncheon Club.

At the second meeting of the New York Jovian Luncheon Club, which was held Wednesday, Dec. 13, at Kalil's Restaurant, 18 Park Place, the attendance numbered 137, the attendance at the first meeting having been 104. Mr. C. A. S. Howlett, of the General Electric Company, of Schenectady, was the speaker of the day.

Mr. Howlett, after complimenting the chairman of the meeting, Mr. F. E. Watts, on his enthusiasm and industry in his work in connection with the organization, spoke forcibly on the necessity of such an organization having some work of a practical nature to do in order to bind it more firmly together. He used as an illustration the organization of the first luncheon club in Chicago, showing that, while the first meetings were of benefit from the co-operative "come together" spirit which was engendered among the members, the fact that there was nothing practical to do led in a short time to the dissolution of the organization. He contrasted this with the great success of the present Electrical Club of Chicago, composed of exactly the same class of men as those in the former organization. The fact that it had been in existence now for several years and that it was successful and had a constantly growing enthusiastic membership of practically all the live wide-awake electrical men in the city of Chicago was, in his opinion, due entirely to the fact that the Electrical Club of Chicago was doing things of a practical and definite nature. At each one of its meetings, which are held weekly, there is always one speaker who has something to say of interest to the electrical men of Chicago, something which the Chicago men should know about, should discuss among themselves and work together on, either for or against.

The next meeting is to be held Wednesday, Dec. 27, at Kalil's Restaurant, when there will be a Jovian rejuvenation. While the organization is composed at present of Jovians, the plan is not to limit the luncheon club to members of the order, but to invite and welcome to each luncheon all who are interested in any way in the development of the electrical industry.

Regulations Regarding New Code Rubber-Covered Wire.

Beginning Jan. 1, 1912, the rubber-covered wire specifications promulgated by the National Fire Protection Association at its meeting last March become effective. No wire manufactured after that date which does not meet the specifications as printed in the 1911 edition of the National Electrical Code will bear the stamp of approval of the Underwriters' Laboratories, except that representing bona fide stock or contracts placed or taken prior to Jan. 1, 1912. The old Code wire represented by the latter will not bear the new label, and contractors, dealers, etc., will have until July 1, 1912, to dispose of such stock or to fulfil such contracts. After that date, however, no old Code rubber-insulated wire will be approved at all.

After Jan. 1, 1912, there will be a single label factory inspection service, this service representing a merger of the Wire Inspection Bureau service on National Electrical Code rubber-covered wire with that of the Underwriters' Laboratories and being under the direct operating control of the latter organization. This inspection will not only be thorough at the factory but will also comprise a rigid follow-up system in the field.

Central-Station Activity in the Electric-Vehicle Field.

At the meeting of the Electric Vehicle Association of America in New York, Dec. 19, Mr. Stephen G. Thompson, of the Public Service Electric Company, Newark, N. J., presented a paper which reflected to a marked degree the activity of the central-station industry in the electric-vehicle field. The author stated that approximately 40 per cent of the estimated total of 5000 electric commercial vehicles at present in use are employed in some forty-odd installations, indicating a tendency on the part of the manufacturer to concentrate his efforts in the larger cities and on a few customers, thereby neglecting the less thickly populated territories. The gasoline commercial vehicle manufacturers have cultivated this neglected field, with the result that in the past year they marketed 200 per cent more machines than did the electric-vehicle makers since their first entry into the market, this fact being due not to any particular superiority of the machines themselves, but to the energy of the vehicle salesmen and agents. It is because of its faith in the ultimate triumph of the electric vehicle that the central-station industry is justified in actively promoting this type of vehicle, in the same manner that it has promoted the introduction of other energy-consuming devices; and did its activity meet with an equivalent co-operation on the part of vehicle manufacturers an unprecedented electric-vehicle boom would result.

Although Mr. Thompson contends that the argument that central stations should themselves operate electric machines in order to demonstrate their faith in them is not of itself a

legitimate one, unless their application in the transportation department is attended by economies sufficient to offset the increased investment over horse-drawn vehicles, the enormous investments by central stations in electric vehicles emphasize their appreciation of the economic value of the commercial machines.

The establishment of boosting stations, the author felt, might ultimately come within the scope of central-station activity, but the question of whether the central station should maintain public garages is a moot one. Where the number of vehicles is so small as to make the employment of a competent battery man unwarranted in a garage, Mr. Thompson felt it would be justifiable for the local lighting company to subsidize such garages until such time as the vehicle manufacturers themselves shall have placed enough machines in the territory to warrant their operating their own garages.

As indicative of the results to be expected from the establishment of garages by central stations, the author cited the case of the Union Electric Light & Power Company, of St. Louis. In that city the number of vehicles in use increased from eleven, in 1907, to over 450, because of the company's fostering care. The number of public electric garages in St. Louis has increased 62.5 per cent since October, 1910, and there are at present over sixteen commercial garages.

In view of the expenditures of central-station companies for promoting the use of electric vehicles, the sums invested in machines, the reductions made in rates, the establishment of boosting stations, garages, inspection departments and automobile bureaus, Mr. Thompson feels that the manufacturers themselves will soon be hard pressed to care for the business which the central stations are developing. Correspondence has disclosed that, in the main, central stations have emphatically decided that their activity in the electric-vehicle field has been justified, and the increase in the number of vehicles used is sufficient to warrant the belief that continued co-operation will produce a demand far in excess of the ability of the manufacturers to supply it. The author closed with the prophecy that the time is not far distant when the general use of the electric vehicle may be expected to tax to the limit existing central-station installations, in spite of the fact that this particular demand for energy is essentially off-peak.

Discussion.

The paper was discussed by Messrs. Arthur Williams, Frank W. Smith, N. T. Wilcox, W. E. Curtis, Jr., P. S. Young, J. Richards, R. L. Lloyd, F. B. Neely, E. J. Ross, Jr., W. B. Stoughton, T. I. Jones, F. E. Queeney, E. L. Howland and S. S. Phillips.

The consensus of opinion was that the central station has been very liberal in the expenditure of money, time and facilities upon the electric vehicle, and this in spite of the fact that actual returns from established garages were not sufficient to cover the cost of service and interest on the investment in very many instances.

Mr. Wilcox said that his company expected to have nothing but electric vehicles in Lowell and also in Brockton by 1913. Mr. Young said that the Public Service Electric Company, of Newark, would eventually have from 50 to 100 electrics, using these in preference to all other types. His company will devote a portion of its old office building for exhibition purposes of electric machines of various types. Both Mr. Young and Mr. Wilcox spoke of the difficulty of convincing electric operating men and superintendents of the utility of the electric vehicle for their work.

Mr. Jones told of the visionary claims of early manufacturers of electric pleasure cars, and how their unfilled promises have militated against the introduction of electric pleasure vehicles in Brooklyn, stating that there are at present eighty-three inoperative old electric vehicles whose owners, owing to past experience, would not entertain propositions for the modern electric vehicle at any cost. The decorative tungsten street posts in front of his company's branch offices are equipped for charging electric vehicles, and all of the tungsten street posts now being installed are designed so that each may become a charging station eventually. He commented on the dearth of reliable operating data showing the superiority of the electric over the gasoline and horse-drawn vehicles.

Mr. Stoughton suggested that manufacturers have apprenticeship courses, somewhat similar to those of the large electric manufacturing companies, where high-school graduates and others could receive a shop training and be sent out to operate machines.

Mr. Howland spoke on the general subject of publicity and the desirability of co-ordinating all the various branches of the industry. The electric-vehicle people, he maintained, do not make enough noise and do not advertise the excellent qualities of the electric vehicle, especially for commercial work. This field, which was entirely in the hands of the manufacturers of electric vehicles, is fast being entered by manufacturers of gasoline commercial cars, who now build self-starting attachments and attempt to make their machines fool-proof. He maintained that manufacturers lacked a broad-minded spirit, and that what was needed was a campaign for educating the public to know what the electric vehicle can do. In this respect, he said, the central-station industry was more energetic than the manufacturers of vehicles and of storage batteries, but the best results could only be obtained when all three could forget their individual fields and concentrate their efforts toward securing for the electric vehicle that wide adoption which was its due.

The secretary announced that the membership of the association at the present time was 233.

Electric Vehicle Meeting at Lynn, Mass.

By invitation of the General Electric Company a meeting of the New England Section of the Electric Vehicle Association of America was held at Lynn, Mass., in the company's River Works, on the evening of Dec. 14. A large party assembled at Park Square, Boston, late in the afternoon, and made the run of about 15 miles over the Metropolitan Parkway to the center of Lynn in about one and a quarter hours, all the transportation being by electric pleasure vehicles under the direction of a committee headed by Mr. P. E. Whiting, of S. R. Bailey & Company, Boston. Upon reaching Lynn a parade took place through the business district, after which the party steered for the River Works. Mr. Fred M. Kimball, manager of the small-motor department, and Mr. H. S. Baldwin, factory engineer, acted as hosts, and shortly after the arrival of the party a luncheon was served in the works restaurant. Brief addresses emphasizing the bright future of the electric vehicle were made by President E. S. Mansfield, of the New England Section; Day Baker, president of the Boston Electric Vehicle Club; Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology; Mr. W. H. Francis, purchasing agent of the Boston Edison Company; Prof. Elihu Thomson, Mr. Frank J. Stone, Boston, chairman of the membership commitee of the Electric Vehicle Association; Mr. W. B. Potter, chief engineer of the railway department of the General Electric Company, and Mr. Louis D. Gibbs, superintendent of advertising of the Boston Edison company.

Mr. Francis said that the Boston Edison company has now ordered eight electrics for passenger service, after careful investigation of the possibilities of these machines in covering a territory of about 20 miles radius from Boston. He pointed out that the lack of speed, high friction, clumsiness and extreme weight of the electric vehicles of a few years ago were largely responsible for the difficulties encountered and which seem now to be surmounted. Mr.

Stone emphasized the value of the electric-vehicle charging load to the central station during the night hours when the output curve slumps into a deep valley of relatively inefficient production. He pointed out that 100 electric pleasure cars are as valuable revenue producers as about 600 residences consuming electricity for lighting.

In the evening a technical meeting was held in the apprentice lecture-room, papers being read by Messrs. H. S. Baldwin and Alex. Churchward on the latest developments in electric-vehicle motor design. Among the recent improvements which have become well standardized are the use of high-carbon steel shafts ground within one four-thousandth of an inch; construction of armature cores on a quill; use of a cylindrical field casting and undercut commutator; employment of laminated poles with chamfered tips to reduce noise; use of copper-plated, drop-forged terminals and cast-iron resistance grids of flexible characteristics and varied size; adoption of one-piece mica cones in supporting commutators; use of graphite brushes to secure long commutator wear, and the adoption of ball bearings, which saves space and improves the efficiency of lubrication. By the oil treatment of shafts twice the former elastic limit is being secured. The use of the one-piece magnet frame has done much to simplify the question of appearance, cost, quick delivery and adaptability for meeting varied specifications. Aluminum heads are being used on vehicle motor frames in some cases, these being simple in design, a disk shape being provided to carry the bearing pocket. Four-pole motors are now general, and the use of formed coils and rectangular wire has been continued. Special attention has also been given to the simplification of controller details, and an important improvement has been effected in the use of transition points in passing through the various series-parallel combinations, avoiding the breaking of the circuit under load. Vehicle motor insulation is tested at 1000 volts. The largest vehicle motor built by the company now weighs 660 lb. and is rated at 60 amp at 85 volts, its speed being 900 r.p.m. Special care is taken to secure full engineering details from the purchaser before admitting a motor to actual service. Even before bids are made, an outline of the duty proposed is required. With a properly designed motor the addition of ten stops per mile in the vehicle service cuts down the mileage which can be obtained from a given charge from 30 to 35 per cent. Following a short discussion the party adjourned to the testing floor and spent the rest of the evening making detailed examinations of equipment arranged for special inspection and test. About eighty-five persons attended the meeting.

Lighting the Panama Canal.

Work on the construction of a lighting system for the Panama Canal is under way. The scheme of illumination contemplates the use of range lights and beacons to establish direction on the longer tangents, and of side lights spaced about 1 mile apart to mark each side of the channel. The project also includes lighthouses and fog signals and lighted buoys, the latter using acetylene gas. For the beacons in the Atlantic, Pacific, Miraflores and Culebra Cut sections electricity or acetylene gas will be used. The range lights are situated on land, and it is necessary to cut clearings in dense jungle to obtain suitable locations for the lights. This work is now in progress.

A central construction plant will be established at Balboa, and here the smaller beacons, buoy sinkers, electric transmission poles and interior fittings for the towers will be constructed of reinforced concrete. The electric transmission lines required for the range lights and beacons will be installed during the year ending June, 1913. It may be explained that the beacons for use in Gatun Lake will be equipped for acetylene gas, while the remainder necessary for canal operation will be electric-lighted. The candle-power of the lights will vary, according to the length of the range, from about 2500 cp to about 15,000 cp. The most powerful lights will be those marking the sea channels at the Atlantic and Pacific entrances, which are to be visible from 12 to 18 nautical miles. The beacons and gas-buoy lights will be about 950 cp each. To eliminate the possibility of conflicting lights, all the range lights, beacons and buoys will have individual characteristics formed by combinations of flashes at certain intervals.

Inauguration of "White Way" in New Haven.

The new "White Way" of New Haven, Conn., was ushered into being with elaborate exercises on Dec. 15, accompanied by the greatest night parade ever held in the Elm City. A boulevard luminous-arc system, the first of its kind, was lighted on that night as well as a slogan sign reading "Old Elms, but New Ideas," and it is estimated that more than 100,000 people witnessed the ceremonies.

New Haven Post.

Seventy-eight inverted 6.6-amp lamps on 11.5-ft. posts similar to that shown herewith are spaced at intervals averaging 87 ft. and staggered on opposite sides of Chapel Street from State to York and of Church Street from Chapel to George. The din at the time the Mayor closed the switch which placed the lamps in circuit was akin to that on New Year's Eve, for the church bells were rung and the whistles of almost every factory were tied down in honor of the occasion.

Every militia company of the city was in the parade which followed, and nearly every line of business was represented either by representatives of the firm or by trucks, automobiles or floats, and many by quite a number of them. The New Haven Business Men's Association had more than 200 men in line, and a delegation of 100 or more from the Bridgeport Business Men's Association and Board of Trade came with bands to swell the throng. Buildings along the line of arch were decorated with bunting and vari-colored incandescent lamps.

The line of march extended over 3 miles, and the parade took an hour to pass the reviewing stand. Among the floats were many equipped by those directly interested in the installation.

The United Illuminating Company, of New Haven, had a number of floats entered, the most striking of which was one having a sample of the new post, together with a number of electric heaters and stoves. The Okonite Company, which supplied the cable, had a large reel outlined in light on an electric truck. The General Electric Company also was represented in the parade, as well as Mr. F. T. Ley, who styled himself "the man who laid the ducts." Altogether it was a gala night for New Haven.

Panama Canal Hydroelectric Plant at Gatun.

Contracts have been awarded for the principal machinery for the hydroelectric Panama Canal generating plant at Gatun. There will be three 2000-kw water-turbine units in all. From the generating station, which will be located in the center of the Gatun dam at the spillway, energy will be supplied for operating the motors controlling the gates, valves and other machinery for the canal locks, the regulat-

ing works of the spillways of Gatun and Miraflores dams, as well as other motors and electric lighting along the canal. Water for the operation of the plant will be taken from Gatun Lake at a head estimated at 75 ft. From a concrete forebay in the spillway dam water will be carried in penstocks, equipped with headgates and regulators, to the turbines. The amount of water available for station operation when the storage of the lake has to be drawn upon during the dry season will be 275 cu. ft. per second, which is equivalent to about 1390 kw at the switchboard.

The turbine waterwheels will be of the single-runner, scroll-case, vertical-shaft type, turning at 250 r.p.m. Final delivery is promised within five months. The three main generators are to be directly coupled to the vertical turbine shaft, the bearings for the rotating parts being placed on the top of the generator case. Final delivery of the generators is promised in 200 days.

Hydroelectric Development on the Clackamas River.

The Portland (Ore.) Railway, Light & Power Company has been making extensive additions to its hydroelectric system, and has just placed in operation a new plant on the Clackamas River at River Mill near Estacada. The dam is 686 ft. in length, 80 ft. high and 150 ft. wide at the base. It is of the Ambursen type, with its sloping face on the upstream side to permit the water to exert a downward pressure on the foundation. The structure is hollow and is provided throughout its entire length with passageways, which afford convenient access to the interior. The generating station is built directly in connection with the dam. It occupies a ground area of 173 ft. by 60 ft., and is of sufficient size for housing five 3300-kw generating units, three of which have already been installed.

Between the River Mill plant and Portland the company has constructed a transmission line 28 miles in length, carried on steel towers, of which 316 are used at an average spacing of about 500 ft. The towers have a normal height of 64 ft., which is increased to 84 ft. where the line crosses other transmission systems. The towers are 12 ft. square at the bottom and about 3 ft. square at the first cross-arm. The main legs of the towers are composed of angle irons, and the cross-arms of two channels. The arms are spaced 6 ft. apart in the vertical plane. At one point where the line crosses the Willamette River and a span of 1800 ft. is necessary use is made of specially designed towers. The tower on the east bank of the river is 100 ft. high and the one on the other bank 85 ft. high, the piers of both being set in concrete. These extra high towers bring the transmission wires about 75 ft. above the mean low-water level of the river. The line at this point consists of three nineteen-strand No. 9 copper-clad cables with a 10-ft. spacing in the horizontal plane. The maximum pull at the top of each of these two towers is about 42,000 lb.

The weight of the standard towers is about 4000 lb., and they were assembled at the spot and set 7 ft. in the earth with a special foundation shoe. It was not necessary to use concrete foundations, the legs being merely run down the required distance in the natural clay soil. The strength of these towers is as follows: Horizontal pull, 12,500 lb., taken parallel to or at right angles with the line, with the load at the ends of any of the cross-arms; horizontal pull applied at the ends of any of the cross-arms, 4000 lb.; horizontal pull in the direction of the line, with the load applied at the ends of any of the cross-arms, 6000 lb.; vertical load applied at the ends of any of the cross-arms, 1500 lb. The towers cost $150 apiece delivered on the spot. They are equipped with Ohio Brass Company's suspension insulators, placed three in series for the line conductors and four in series for the strain. The towers are arranged for two circuits with a grounded wire on the top, and they also carry a telephone circuit. The conductor wires are 250,000-circ. mil hard-drawn copper cables, and the ground wire is of 3/8-in. extra galvanized iron. The entire line will cost approximately $160,000.

Cleveland Central-Station Situation.

At a banquet last week Mayor-elect Newton D. Baker of Cleveland, Ohio, made the assertion that within two years the city will own electric plants which will be furnishing the homes with energy at something like, if not something under, 3 cents per kw-hour. He said that he had been studying the question with lighting experts and that his knowledge was now much broader than before the election, when he could not make promises so definite. He also attacked the bond dealers of the country and said that they had in the past refused to purchase bonds that were sold to secure funds for municipally owned plants of this kind. If the bondmen do not want the $2,000,000 of securities that are to furnish the money for the lighting plant, he said these would be sold in small lots to the people, who would then not only receive the benefits of reduced rates, but would own the plant.

In an interview Vice-President Samuel Scovil of the Cleveland Electric Illuminating Company said that the Mayor-elect is already hedging. Before the election, he said, Mr. Baker made the positive assertion that his proposed municipal plant would furnish energy at 3 cents, but now he has changed his promise to "something like 3 cents." He will hedge again before he is able to put his promises into execution, Mr. Scovil said.

Mr. Scovil said that his company is not going to stop growing merely because the city threatens to put in a two-million-dollar plant. A year ago $1,300,000 stock and $1,000,000 bonds were sold to secure funds for needed extension, he said, and next year $3,000,000 more would be needed for the same purpose, and to that end a request for authority to issue stock and bonds has been made to the Public Service Commission. Additions must be made to the Lake Shore plant, he said, and money must be spent for underground and overhead work in order to accommodate the demand for service.

Councilman F. S. Haserodt has suggested that the property of the Cleveland Electric Illuminating Company be purchased by the city at once. He says that the $2,000,000 from the bond issue may be applied as a payment down and a mortgage given for the remainder. Stockholders could be guaranteed a certain income upon their holdings until payment in full is made. The city would thus have the advantage of the large plant at once, with the reduced rates that the coming administration expects to give arbitrarily.

Public Utilities and Progress.

The Commonwealth Edison Section of the National Electric Light Association, Chicago, met at Handel Hall Dec. 5 to hear an address by Mr. H. M. Byllesby on "Public Utilities and Progress." The meeting was called to order by the new president of the section, Mr. R. F. Schuchardt, who made a brief address announcing plans for the section for the coming year. The commercial division will be under the direction of Mr. O. R. Hoge and the technical division under Mr. P. B. Juhnke. A competition among the members of the section was announced for the prize of a free trip to the Seattle convention of the association. Markings for this competition are to be based on a number of things, such as performance of duty, attendance at meetings, etc., and are to be announced in the next issue of the *Edison Round Table*. The membership committee announced 164 applications for membership received during November, 1911, a large increase over November, 1910.

After music by a quartet which alluded both in a graceful and an amusing way to the speaker of the evening, Mr. Byllesby, President Schuchardt called upon Mr. Samuel Insull to introduce the speaker of the evening because of his lifelong business acquaintance with Mr. Byllesby, both having been in at the beginnings of the electric-lighting industry. In his introduction Mr. Insull mentioned the interesting coincidence that Mr. Byllesby, prominent in electrical finance in Chicago, and Mr. Frederick Sargent, equally prominent in engineering and the designer of Chicago's greatest power plants, successively filled the same positions when they started in the electrical business. When Mr. Byllesby left a position as draftsman for the Wetherell Corliss Engine Works Mr. Sargent was his successor, and when Mr. Byllesby left his next position with the Edison Illuminating Company Mr. Sargent again was his successor.

Mr. Byllesby in his address on "Public Utilities and Progress" recalled some of the advances made in the thirty years that he had been connected with the electric public-utility business. These advances of themselves were sufficient evidence of the remarkably progressive character of the men engaged in the business. He made the assertion that no greater progress has been known within a short time than that in the electrical business, and that men of the most progressive character are engaged in this business. Not only are the utility companies in themselves progressive, but they have had a decided influence in waking up the communities in which they conduct their business. Time and again he had seen progressive, up-to-date management of a public-utility property replace former indifferent, incompetent management, with a result that influenced the whole business character of the community. In fact, no single concern in a community like Chicago does as much business in dollars and cents as the public utilities, with the possible exception of the tax collectors. The influence of electric public-utility management and the progressiveness of its men have been felt by other industries. The gas business was at a standstill at the time electric light began to come into the field. Under the stimulus of competition great improvements have been made in gas apparatus and business methods. Public opinion in this country, he said, is rapidly crystallizing in the idea that a public utility should be a regulated and protected monopoly. This is the idea toward which most of the great pioneers have been working.

Appealing to his audience as composed of those responsible for conducting the business of a great public-utility corporation, he called attention to the dignity and responsibility of such positions. Great as have been the developments of the last thirty years, as he had already recited, there will be correspondingly great opportunities in the coming thirty years, with great rewards for those who measure up to the requirements.

At the close of the address President Schuchardt announced that a program of addresses by captains and leaders in public-utility work has been arranged for the coming season, including addresses by Messrs. Samuel Insull, president of the Commonwealth Edison Company; B. E. Sunny, president of the Chicago Telephone Company; B. I. Budd, president of the Chicago elevated railway companies, and Judge Peter S. Grosscup, in whose court many important public-utility cases have been decided.

German Central Stations.

The central-station statistics just published by the Verband Deutscher Elektrotechniker give exact figures on 2526 stations as to their status on April 1, 1911. It is estimated that the stations which were not heard from would swell the total number of stations in Germany to about 2700.

The development of the central stations and their connected load is shown graphically in Fig. 1. On April 1, 1911, the reporting stations had a connected load of 810,-046 kw in 16,209,233 incandescent lamps; 130,175 kw in 245,772 arc lamps; 1,621,676 hp of motors, 417,897 hp of which was in street-car motors, and 73,120 kw in heating

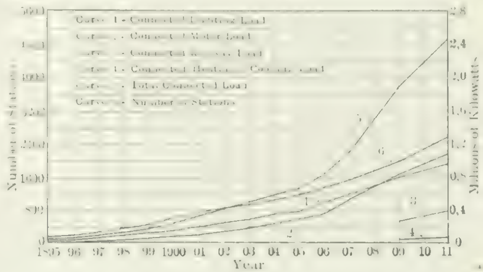


Fig. 1—Curves Showing Central-Station Developments in Germany.

and cooking apparatus, making a grand total of 2,477,-849 kw.

For this connected load there is provided a total station power rating of 1,466,418 kw, of which 1,271,250 kw is furnished by generators and 195,168 kw by storage batteries. Of this total power rating 352,964 kw is in the form of direct current, 461,387 kw in the form of single and polyphase alternating current and 652,067 kw in mixed systems. The number of kilowatt-hours produced per year by 543 stations was 1,245,541,000 for 1910, against 951,033,-000 for 1909, which corresponds to an increase of 15.5 per cent per year.

Classified according to kind of current the stations are divided as follows: Single-phase energy, 57, with a rating of 51,836 kw; polyphase energy, 345, with a total rating of 403,822 kw; direct-current energy, 1771, with 259,341 kw in generators and 93,723 kw in storage batteries; mixed direct-current and alternating-current systems, 353, with 556,351 kw in generators and 95,716 kw in batteries.

Classified according to type of motive power the sta-

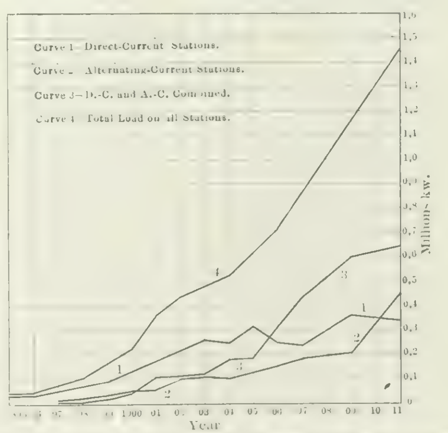


Fig. 2—Increase in Station Rating Classified According to Kind of Current.

tions are divided as follows: Steam, 799; water, 253; internal-combustion engines, 383; water and steam, 402; converters or transformers, 107; other types of machines, 582. The table gives the division of stations according to rating.

It is interesting to note that the number of gas and oil stations is now considerably higher than that of the pure

[illegible] as the of the combined water and steam stations. As to the number of meters in use there were employed, as far as the available information goes, 508,868 meters for lighting circuits alone, 108,636 meters for power circuits alone, and 337,511 meters for power and lighting circuits together.

[illegible]

Rating, Kilowatts	Stations	[illegible] Kilowatts.	Number of Stations.
0–100	[illegible]	2001–5000	[illegible]
101–500	[illegible]	5001–10,000	[illegible]
501–1000	141	Over 10,000	29
1001–2000	[illegible]	Unknown	[illegible]

The number of kw-hours sold was available only for 543 stations and was 951,033,000 kw-hours in 1909 and 1,245,541,000 kw-hours in 1911. This means an increase of 31 per cent in two years, or an increase of 15.5 per cent per year, as compared with an increase of 15.8 per cent during the last year in the volume of gas produced by gas plants. As to the voltage used, 258 two-wire direct-current stations use 105 to 125 volts, 601 stations 220 to 260 volts, and nineteen stations other voltages. In three-wire direct-current stations a tension of 2 × 110 volts is used in 543 stations, one of 2 × 220 volts in 470 stations and other voltages in twenty-nine stations. Less uniformity exists in alternating-

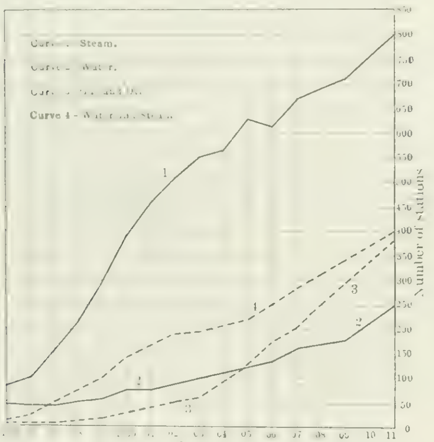


Fig. 3—Increase in Stations Classified According to Prime Movers.

current stations. Among single-phase stations forty-one use a voltage of from 110 to 120, ten from 150 to 170, twenty-one from 220 to 250; seventeen use 2000 volts, nine use 3000 volts, five use 5000 volts, three use 10,000 volts, and 127 stations use other voltages. Among three-phase stations 295 stations use 110 to 127 volts, 372 stations use 210 to 225 volts, thirty-six stations 380 volts, forty-six stations 500 volts, thirty-four stations 2000 volts, ninety-three stations 3000 volts, eighty-seven stations 5000 volts, forty-three stations 5500 to 6000 volts, fifty-two stations 10,000 volts, nineteen stations 15,000 volts, and 149 stations other voltages, the highest being 50,000 volts.

With regard to ownership the stations are classed as follows: Seventy per cent are owned by private persons or corporations and 30 per cent are owned by municipalities or provinces.

Of the 2526 stations, 2055 are devoted exclusively to the production and distribution of electric energy, 56 stations have side lines (bathing-houses, wash-houses, ice factories, etc.), 246 stations are sawmills, smelters, and factories which make electric energy as a side issue.

The Berlin Elektricitätswerke leads with 156,933 kw then follow, in order, Hamburg with 42,246 kw, Oberschlesischen Elektricitätswerke with 34,967 kw, Rheinische Westfälische Elektricitätswerke with 24,200 kw, Munich with 24,159 kw, Frankfort with 23,989 kw, Bergische Elektricitätswerke in Ohligs with 20,500 kw.

Apparatus for Artificial Respiration.

A device has recently been placed on the market in Europe to perform mechanically the operations of artificial respiration in reviving persons overcome by electric shock,

Fig. 1—Respiratory Apparatus in Lowered Position.

by the inhalation of poisonous gases, drowning, etc. The apparatus is for the application of the Sylvester method, and greatly mitigates the labor incident to direct manual operation. It is claimed that the apparatus is easily applicable, that it can be operated by any person and requires only one person to do all the work, including attention to the tongue.

The apparatus and its operation may be readily under-

Fig. 2—Respiratory Apparatus in Raised Position.

stood from the accompanying illustrations. The injured person is placed on a board, which is raised a little at the head end, and the arms are strapped to the levers, the latter being made of ordinary pipe. Across the chest a broad pad is placed, which serves to compress the chest and is connected with and operated by the levers. Wires running

from the end of the levers through small pulleys are connected to the pad by hooks. Several holes at each end of the pad allow for adjustment.

Referring to Fig. 1 it will be seen that the operator is holding out the tongue with one hand and operating the levers with the other. In this position the chest of the injured person is expanded to its fullest extent, no pressure being exerted by the pad. In raising the levers the chest is compressed partly by the movement of the arms of the patient, but more by the pressure of the pad, which is pulled down by the wires. The uniform movement obtained in moving the lever up and down is stated to have a more beneficial effect than in manual operation. The apparatus is reported to have been tested with very satisfactory results at the following institutions of Stockholm, Sweden: Karolinska Institutet, Swedish Association of Physicians (Svenska Läkaresallskapet), the Life-Saving Association and the Royal Hospital. It is manufactured by Aktiebolaget Stille-Werner, Bergsgatan 2, Stockholm, Sweden.

Turin International Electrical Congress.

Telephony and Telegraphy.

In Section VI of the Turin International Electrical Congress papers on telephony and telegraphy were presented. Abstracts of these papers follow:

EFFICIENCY OF WIRELESS-TELEGRAPH APPARATUS.

Dr. J. Erskine-Murray distinguishes four different efficiencies in wireless telegraphy, namely: (1) Commercial efficiency; (2) telegraphic efficiency; (3) operation efficiency; (4) energy efficiency. In a paper he defined each of these efficiencies and stated that they resulted from a very complete analysis of the entire subject. These definitions should serve as a guide to others, and will lead them to pursue systematic methods in the solution of very practical problems in commercial wireless telegraphy.

HERTZIAN AZIMUTHAL COMPASS.

Dr. E. Bellini described a wireless receiver capable of distinguishing the direction of the sending station, and gave results of experiments that have been carried out by the French government.

This device enables a vessel to determine its angular position with reference to a wireless sending station, and the experiments show an average error of only 2 degrees. The device may be installed at points along the shore or on board the ship. The latter method is preferable because it allows the ship's officers to make their own observations. As a result of these experiments the French navy has installed several equipments, and two ships of the Compagnie Générale Transatlantique have also been equipped. Furthermore, the French government, realizing the value of this device in foggy weather, has begun the installation of four wave stations along the coast, which send out waves just as a lighthouse sends out light. These waves have a length of only 80 m and will not interfere with any other wireless systems. Each station has a characteristic frequency and signal and can be instantly recognized by any wireless receiver.

The radio-compass is not capable of receiving waves having a length of several thousand meters, except at very short range; 600-meter waves will operate it at distances up to 20 miles, 300-meter waves up to 50 miles, and so on, the range of operation increasing as the wave-length decreases.

MULTIPLE TELEGRAPHY.

The different systems of multiple telegraphy that have been tried under commercial conditions form the subject of a paper presented by Major W. A. J. O'Meara. The character of each system is briefly set forth and the practical results from actual service are given. The systems covered are: Morse quadruplex, Mercadier system, Phonophone system, Picard system, Delaney system, Baudot system, Murray multiplex, Munier system, and Rowland system.

In conclusion the author referred to the competition between multiplex systems as a class and high-speed automatic telegraphs. He divided telegraphic messages into two classes: (1) Short telegrams relating to business or domestic affairs; (2) long telegrams for the press.

The long telegrams are better adapted to the high-speed system than are the short ones. The author was of the opinion that short telegrams should preferably be treated as separate units in order to facilitate the tracing of errors and to save time in sending and delivering the message. The Baudot multiplex printer has been successful in England, and preparations are now being made to install a sextuple duplex between London and Birmingham. If this installation comes up to the expectations it will be the most rapid printer yet invented for handling large numbers of messages.

Two additional contributions were incorporated in this paper as a supplement—one a short discussion of the "decrement method" of Morse quadruplex with a complete circuit diagram, by Mr. C. C. Vyle, and the other a theoretical analysis of the currents in the "increment method" of Morse quadruplex, by Mr. C. E. Hay.

The report was discussed by Messrs. Duran, di Pirro, Strecker and Carletti.

LONG-DISTANCE TELEPHONY IN AMERICA.

Much information relating to the equipment and operating practices of the Associated Bell Telephone Companies was given in a paper by Mr. Frank B. Jewett. At the present time the Bell telephone system comprises twenty-six local operating organizations, covering all of the United States and a large portion of Canada. About 2,000,000 wire-miles of long-distance telephone lines are in use. Of this total wire mileage about 80 per cent is in the form of open-wire circuits, on 168,000 miles of pole line, and the remainder is in cable circuits, principally underground. In addition to the equipment used exclusively for long-distance business, the equipment for exchange service and for connecting individual subscribers with the toll system comprises about 9,700,000 miles of wire.

Practically all of the open-wire mileage is in the form of hard-drawn copper metallic circuits, many of which are equipped with Pupin loading coils. The copper wire ranges in weight from about 102 lb. per wire-mile to 430 lb. per wire-mile, the most common size weighing approximately 173 lb. per wire-mile. Many of the open-wire circuits are arranged to secure a third talking circuit from two metallic circuits by the phantoming process. The arrangement of open-wire circuits for phantoming is being extended with great rapidity, and with the more intimate development of a combined commercial telegraph and telephone system the compositing and simplexing of total circuits for simultaneous telephone and telegraph operation is being generally applied to all long-distance lines.

In the case of long-distance toll lines in paper cable the soft-drawn copper wires vary in weight from 21 lb. per wire-mile to 166 lb. per wire-mile. The latter size is used in the New York-Washington cable which is now being installed. Whether the wires employed for long-distance circuits in cables are large or small, they are invariably equipped with Pupin loading coils. The same is almost invariably true of all cable circuits employed for bringing open-wire toll lines into cities, whenever the length of such cable circuits is sufficient to warrant the use of loading coils.

The New York-Philadelphia underground cable, which has been in service since the latter part of 1905, is laid in a

subway of standard vitrified-tile duct construction, with six through-ducts and varying numbers of additional ducts to provide for local requirements along the route. The cable has an outside diameter of 2⅝ in., and has a lead-tin alloy sheath ⅛ in. in thickness. It contains ninety-three pairs of No. 14 B. & S. and nineteen pairs of No. 16 B. & S. conductors, and is equipped with inductance coils at intervals of approximately 1¼ miles. A cable 83 miles long will shortly be installed between New York and New Haven. This cable will contain thirty-seven pairs of No. 13 B. & S. conductors for the entire distance, and a varying number of the same and smaller gage conductors along different portions of the route. A cable from Chicago to Milwaukee, a distance of approximately 90 miles, is now in use. This cable contains fifty pairs of No. 14 gage conductors, with smaller conductors where needed for long-distance business to intermediate points. During the present year it is expected that a subway being run between New York and Boston will be completed, and that the cable between Philadelphia and Washington, approximately 140 miles in length, will be installed and equipped with loading coils. At the beginning of 1912 there will therefore be a continuous underground cable from New Haven to Washington, a distance of 315 miles. It is expected that the entire equipment between Boston and Washington will be installed and ready for service by 1914. The cable now being installed between Philadelphia and Washington is of standard mechanical dimensions, and contains fourteen pairs of No. 10 B. & S. gage conductors, arranged to operate twenty-one telephone circuits; forty-two pairs of No. 15 gage conductors, arranged to operate sixty telephone circuits, and eighteen telephone circuits in No. 16 B. & S. gage pairs. The total number of telephone circuits within the lead sheath will be ninety-nine, of which twenty-five will be phantom. All of the circuits will ultimately be equipped with inductance coils, which will be suitable for composite or simplex telegraph work. The paper was discussed by Messrs. O'Meara, Strecker, di Pirro, Saleri and Salvadori.

SELECTIVE WIRELESS TELEGRAPHY.

Prof. P. O. Pedersen briefly outlined the different methods employed or proposed for increasing the degree of secrecy in wireless communication. Simple electrical resonance is of value principally when combined with other methods. Electrical resonance with two slightly different frequencies, one used for transmission of messages and the other for the intervening time, has many advantages over the simple resonance method. The author demonstrates that frequencies that differ by one-half of 1 per cent give entirely satisfactory results. Resonance methods all have the advantage of being little affected by disturbances set up by other stations.

Directed waves limit the interference to a restricted area and when combined with resonance should provide comparatively secret transmission.

Brill's method of sending out predetermined series of waves is too slow to become of any very great importance.

A method devised by Mr. M. A. N. Hovland, a Norwegian naval officer, provides for automatic transmission in secret characters, the sender and the receiver being arranged to translate automatically from the usual to the secret characters and *vice versa*. This system permits a comparatively high speed of transmission.

Finally the author advocated the passage of laws to protect wireless-telegraph systems from interruption and interference, and to punish persons who steal messages or interfere with their transmission. He believed that such laws would be effective in their operation against interference from large and well-equipped stations, and that by using speeds of 100 words per minute and signals that require sensitiveness to a variation of one-half of 1 per cent in the frequency little need be feared from the amateurs and others with small installations and crude apparatus.

In summing up the author recommended the following methods of attaining secrecy of transmission:

(1) Use of secret code.

(2) Use of Hovland's system for short distances and restricted service.

(3) Use of high speed and secret code for long distance or in cases where secrecy is of extreme importance.

The paper was discussed by Messrs. Bellini and Artom.

AUTOMATIC AND SEMI-AUTOMATIC TELEPHONY FOR LARGE CITIES.

A paper by Mr. H. Milon dealt with the advisability of using automatic and semi-automatic telephones in large cities. He briefly described the mode of operation of the manual, the automatic and the semi-automatic, and then proceeded to a comparison of the three systems on the score of quality of service and economy of operation.

Taking the New York Telephone Company's system as giving the best service that can be attained with the manual system, namely, twenty-one and a half seconds for a connection and four seconds for a disconnection, the semi-automatic takes twelve seconds for connection and no time for disconnection, and the automatic takes only eight seconds for a connection and none for a disconnection. Reliability of apparatus seems at present to be in favor of the manual system, but lack of data renders this assumption somewhat doubtful.

On the score of operating expense, the semi-automatic is superior to the manual, and the full automatic is superior to both in medium-size and very large systems, the advantage increasing with the number of calls handled. The author analyzes the various items of expense and plots them with number of calls per day for a 100,000-subscriber system and for a 10,000-subscriber system.

In conclusion the author states that while all telephone experts are not in accord regarding the relative merits of these various systems, it is doubtless true that the future will see a continual improvement and simplification of the automatic systems, while the recruiting of good operators will in all probability become more and more difficult as social conditions improve.

WIRELESS TELEPHONY.

A brief résumé of the present state of development of wireless telephony was given in a paper by Dr. Valdemar Poulsen.

Wireless telephony began in 1878, when Alexander Graham Bell established wireless communication over short distances by utilizing the action of light on selenium. However, this branch of telephony as well as those systems which operate by electromagnetic induction is extremely limited in application.

Electromagnetic waves such as are used in wireless telegraphy offer an entirely satisfactory means of transmission, but up to the present time no thoroughly useful transmitter or receiver has been produced. Probably the best method of generating the wave trains employs the hydrogen arc and the microphone. The mechanical oscillators are very expensive, and the author was of the opinion that they would find little use in the future.

The inability to construct a microphone capable of handling comparatively large amounts of energy constitutes the only present limitation of transmission distance. With a suitable microphone it would be perfectly feasible with present apparatus to transmit wireless telephone messages over the same distances now employed in wireless telegraphy.

The author mentioned different expedients that had been employed for increasing the power capacity of microphones and then gave circuit diagrams of typical transmitting and receiving stations now in use.

One distinct advantage of wireless over ordinary telephony lies in the fact that the timbre of the voice is not

changed with distance; therefore the use of suitable relays offers great practical possibilities.

One of the disadvantages of wireless telephony is the inability to receive messages at a station simultaneously with the sending of messages from the same station. Indeed, an attempt to do so will probably result in the destruction of the microphone.

In its present state of development wireless telephony may be used commercially for distances up to 100 km or 200 km.

The following is an abstract of a paper presented in Section IV. Abstracts of other papers presented in this section appeared in the issue of Dec. 9.

INCANDESCENT LAMPS.

Dr. Berthold Monasch contributed a brief outline of the development of the incandescent lamp, beginning with the carbon-filament lamp shown at the Paris Exposition in 1881 and ending with the drawn-filament tungsten lamp of to-day.

The first practicable metallic-filament lamp is credited to Dr. Auer von Welsbach in 1898. It was an osmium filament and had a specific consumption of 1.5 watts per candle and a life of from 1000 to 2000 hours. However, it was not made for voltages higher than 35 or 40.

The tantalum lamp was placed on the market in 1905 and was followed by the tungsten lamp in 1906.

The low resistivity of tungsten imposed great difficulties on the manufacture of filaments for low candle-power and 110 volts. These difficulties have been overcome and now 110-volt to 150-volt lamps may be had of almost any candle-power between 16 and 1000, and 200-volt to 250-volt lamps may be had of candle-powers between 25 and 1000.

The author remarks that 130-volt lamps could be made for candle-powers as low as 10 were there any demand for such sizes. This led to the observation that the intensity of illumination employed by a people is a general index of the degree of culture of that people.

It was predicted that high-candle-power tungsten lamps will displace all carbon arcs. The tungsten will fill all needs up to 1000 cp, and from that point on to 5000 cp the mineralized electrode arc will hold the field. The author expresses interest as to the behavior of the drawn-tungsten filament under the action of alternating current—whether it will behave as other tungsten filaments or as drawn-tantalum filaments.

Committee on Gas and Electric Schedules in New York State.

A draft of a report by the committee on gas and electric schedules of the Public Service Commission for the Second District of New York State has been sent to companies in the district with a letter by Mr. Charles H. B. Chapin, secretary of the committee.

The committee was appointed on Sept. 7, 1910, at a hearing before the commission and after numerous meetings and much study the draft of a report to be submitted to the commission has been adopted tentatively and sent to each gas and electrical corporation and municipality operating in the district, with a request to hold a meeting for its discussion. Any suggestions should be forwarded to the secretary not later than Jan. 1, 1912, in order that the committee may have an opportunity to consider them before a meeting to be held in the Hotel Ten Eyck, Albany, at 10 a. m., on Jan. 17, 1912.

The report is comprehensive and includes extracts from the Public Service Commission's law relating to the subject of schedules. The obvious purposes of the sections of the law quoted, as stated by the committee, are: (a) To permit reasonable discrimination in the making of rates, justified by special conditions and circumstances unusual so far as general service is concerned, and to prevent such discrimination in rates or otherwise as shall be unjust to any or all consumers or to the public served; (b) to enable the commission in its discretion to require schedules of rates to be filed and published; (c) to enable the commission to prescribe the form of every schedule, and from time to time to make such changes as it may deem wise; (d) to enable the commission to establish such rules and regulations as it may deem necessary, and to modify them from time to time.

In making a complete investigation of the subject the committee found it essential to analyze the circumstances and conditions in respect to the furnishing of gas and electricity, the service rendered and use thereof; to consider the existing methods of charge and define the appropriate meanings of terms used; to classify the purchasers of gas and electricity according to the provisions of the statute and conditions of service and use; to consider the practicability of filing and publishing schedules of rates; to devise forms and methods for the construction and use of such schedules

In a section of the report devoted to the subject of service and service conditions the committee calls attention to the manufacture of commodities by general manufacturers and the practice of railroads and street railways in furnishing a service. The public-service corporations and municipalities operating gas and electric plants, however, produce and sell the commodities gas and electricity, but are permitted to do so only under the condition that an adequate supply shall be available at all times to meet the demands of the public. They, therefore, also render a service, and in this connection the word "service" is commonly used to include both the commodity and the availability of the supply. It consists of not only the commodity but also the plant capacity which may be drawn on at any time. The extent of the service furnished to the consumer consists, therefore, of the quantity of gas and electricity consumed plus the amount of plant capacity maintained on his account and subject to his demand. These two fundamental factors, to which the committee refers as quantity and demand, constitute the basis of all methods of charging.

Gas and electric service may be sold under different conditions. These conditions create six fundamentally different kinds of service, as follows: Continuous service, which is available at any and all times; limited-period service, which is available only at certain specified hours or seasons; optional service, which is to be rendered or discontinued for periods at the call of either the producer or the consumer; re-sale service, which is furnished by one corporation or municipality for distribution and re-sale by another; auxiliary service, which is rendered for limited or unlimited periods as auxiliary to the consumer's plant, and emergency service, which is rendered only in case of break-down of the consumer's plant.

Certain characteristics are more or less constant for all installations in which the uses of the service are the same or very similar. Such facts must be taken into consideration in rate-making. In a description of the various classes of service it is necessary that the kind of service should be stated, and that the circumstances and conditions surrounding the use of the service should be indicated clearly.

In the section relating to methods of charge the committee mentions the fact that many different methods of charge for electric service are in use, while there are comparatively few for gas service. To obtain uniformity of expression, and to explain definitely these different methods, the committee has adopted definitions of terms. These are given in an appendix and relate to flat rate, meter rate, quantity meter rate, demand meter rate, load factor or two-charge rate, three-charge rate, uniform or straight line, block and step. The committee recommends that the definitions be approved by the commission and shall receive as wide publicity as possible, for while these terms are in common use, their exact meaning varies in different localities.

A classification of purchasers is made. The four classifications specified are, in brief: (a) Municipalities, state and federal governments; (b) persons or corporations requiring service under the same or substantially similar circumstances and conditions to those under which service is furnished generally; (c) those who require service for new uses and under conditions which are unknown and cannot be determined until after a trial period; (d) street or other railroad corporations taking service primarily for the propulsion, lighting and heating of cars, and gas or electric corporations taking service primarily for re-sale.

In the consideration of the advisability of a requirement that schedules of rates be filed and published, and of the practicability of such action, the committee discussed separately the conditions governing each of the four classes of purchasers.

In accordance with the statute provision that rates for Class A purchasers may not be required to be filed or published, the committee omits this class from further consideration.

It appears to be practicable to prepare schedules uniform in construction and arrangement of matter contained, showing their service classifications, so far as may be practicable, and the rates, rules and regulations applying to each such classification under Class B. To a greater or less extent there is continual competition with substitutes for service. However, there will be consumers of this class where in order to fit the business new service classifications must be provided. Where there is active competition with respect to isolated plants, the gas and electrical corporations and municipalities must be prepared to act with promptness if they are to have a reasonable chance to secure the business. There will also be instances where service will be required immediately and under urgent conditions. It is, therefore, believed to be desirable that every reasonable opportunity be afforded to secure such business.

The business done with purchasers of Class C is of an experimental nature. It is recommended that the requirements for the filing and publication of schedules be flexible enough to allow new service classifications to be established on short-time notice under some general regulation of the commission. It is recommended that for business taken on with consumers of this class a copy of the contract be filed with the commission, but not published, and that the corporation or municipality making such contract shall, on or before the expiration of one year, either establish in its schedule a classification applicable or give notice that the contract will be terminated at expiration. For the publication of the service classifications, rates, rules and regulations which apply generally throughout the territory served by a corporation or municipality, the committee has formulated schedules of rates which are shown in an appendix to the report. It is believed to be practicable that all changes, other than those for the establishment of new service classifications, should become effective only after thirty days' notice to the commission and the public, or upon shorter notice under special permission from the commission. It is recommended that the commission provide a general regulation permitting the establishment of new service classifications, rates, rules and regulations applying thereto upon one day's notice.

The committee deems it appropriate and desirable that copies of all contracts with purchasers of Class D be filed with the commission. It sees no necessity, however, for the inclusion in schedules of the service classification, rules, regulations and rates applying to purchasers of this class.

In case a final order is entered, it is recommended that where unexpired contracts at special rates exist the rates need not be included in the schedules, but that a list of such contracts be filed with the commission, giving the date of execution and the unexpired period which each has to run. At the expiration of any such contract it should be terminated, or if renewed shall be considered as new business and the general provisions applying to such business shall be included in the schedule.

The form recommended for the filing and publishing of a schedule of rates and an outline of the manner in which it is to be constructed are given in an appendix to the report. Three primary considerations guided the committee. The schedules should show in uniform order of arrangement such information in regard to service classifications, rates, rules and regulations as actual or prospective consumers may need in order to determine for themselves the service best adapted to their conditions and the rate therefor. The schedules should give to the commission full information regarding service and rates. The form for schedules should be such as to cover all classes of business available for a single service or a great variety of services, and its preparation should not impose any unreasonable financial burden upon any reporting corporation.

For such schedules the committee submits detailed recommendations. The schedules should be of loose-leaf form and the size of the sheets 8 in. by 11 in. The loose sheets should be supplied to the corporations and municipalities by the commission, and full and explicit instructions should be prepared by the commission showing the proper method for filling out the schedules and filing, and for posting for public inspection. The filing of schedules should not be considered as preventing the publication of all or any part of such schedules in pamphlet or other form for advertising purposes.

The committee does not feel prepared to recommend to the commission the advisability of entering at this time a final order requiring that the schedules of rates be filed and published. It is recommended, however, that a supply of blank forms be prepared by the commission and furnished to each corporation or municipality. The forms could then be filled out according to instructions and returned, and thereafter all changes should be reported to the commission as required in the instructions, but without regard to the statutory requirement of notice or to the clause requiring special permission from the commission. This course, the committee believes, should be followed for a period of at least one year.

The committee is composed of the following: Messrs. J. C. DeLong, chairman, Syracuse Lighting Company; T. R. Beal, Newburgh Light, Heat & Power Company; J. T. Cowling, Westchester Lighting Company; H. H. Crowell, engineer division of light, heat and power, Public Service Commission, Second District; W. E. Griggs, chief of division of tariffs, Public Service Commission, Second District; C. F. Hunter, chief electrical inspector Public Service Commission, Second District; J. T. Hutchings, Rochester Railway & Light Company; M. W. Offutt, Schenectady Illuminating Company; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; A. C. Smith, Cataract Power & Conduit Company; C. H. B. Chapin, secretary, 29 West Thirty-ninth Street, New York City.

System of Accounts in New Jersey.

A hearing was held on Dec. 5 by the Board of Public Utility Commissioners of New Jersey in reference to a tentative system of accounts applicable to all utilities. Objections were raised by representatives of electric railway, electric light and power, and gas companies to the plan of the commission to require a full compliance with the proposed system of accounting to be adopted by the board for the year beginning Jan. 1, 1912.

It was decided by the board that for the current year the companies should file reports consistent with their present systems of accounting. It was agreed by the board and representatives of the companies present that a committee should be appointed representing each class of

utility, that the statistician of the board should be ex officio a member of each committee, and that on April 1, 1912, the committees should be called upon to make a report of the progress attained in the formulation of a new system.

The committee appointed on behalf of the electric-light companies to consider the complete tentative system of acounts, so far as it is applicable to companies of that character, is composed of the following: Messrs. E. J. Allgaert, J. G. Campbell, F. W. Drawge, E. E. Eysenbach, Frank J. Pryor, Jr., and J. B. Thompkins.

In the complete system of accounts prepared by the board a tentative scheme of general balance sheet and income accounts applicable to all utilities was included. This provided for a division of fixed assets acquired prior to Jan. 1, 1912, from the fixed assets acquired since Dec. 31, 1911. Provision is made for a reserve for accrued amortization. It was provided in the tentative scheme that on and after Jan. 1, 1912, every public utility should carry a reserve for accrued depreciation of tangible fixed assets and for accrued amortization of intangible assets. Separate accounts under the tentative plan were to have been carried for depreciation accrued prior to Jan. 1, 1912, and for depreciation accrued since Dec. 31, 1911, or, in the case of those utilities for which depreciation accounts had already been prescribed, since Dec. 31, 1910.

The classification of construction accounts for electric plant and equipment is based on the standard classification of the National Electric Light Association. The classification of operating expenses for electric operations is also based on the standard classification of the National Electric Light Association. Two classifications of operating expenses are provided, one for companies having gross annual revenues from electric operations of more than $50,000, and the other for companies having gross annual revenues of less than $50,000. The classification for companies with the smaller revenues is capable of still further condensation for companies with gross annual revenues of less than $15,000.

The classification of operating expenses for telephone operations is the same as that contained in the uniform system issued recently by the Interstate Commerce Commission.

Treatment of Depreciation in New York Accounts.

A petition has been filed with the New York Public Service Commission, First District, similar to the petition filed with the Second District commission to which reference was made in these columns on Dec. 9, 1911. It asks for changes in the system of accounts, relating principally to the treatment of depreciation, and similar to those requested in the accounting system of the Second District commission. Nearly all of the electrical and gas corporations under the jurisdiction of the First District commission, including the Consolidated Gas Company, the New York Edison Company and the Edison Electric Illuminating Company of Brooklyn, signed the petition.

Important Hydroelectric Power Decision by Massachusetts Public Service Commission.

The Massachusetts Gas and Electric Light Commission has issued a decision admitting the Connecticut River Transmission Company to the town of Clinton for the purpose of supplying electricity for general power service on a large scale, following the conclusion of hearings upon an appeal to the board by the Clinton Gas Light Company against an order of the Selectmen granting the Transmission company locations in certain public highways. No objection was made by the Gas company to the erection of the Transmission company's line through Clinton on the location granted. The only issue between the two companies was as to what limitations should be imposed upon the distribution and sale of electricity for power by the Transmission company. The town through its counsel urged that the Transmission company should not be restricted to the supply of large power users and that it should not be permitted to sell electricity to the Gas company.

The Connecticut River Transmission Company has constructed a high-tension (66,000-volt) transmission line from the New Hampshire boundary to Gardner, Fitchburg, Clinton, Marlborough and Worcester, where it is selling hydroelectric energy for the most part generated at the South Vernon (N. H.) plant of the company. The system supplies either primary or secondary power, and the company has recently acquired an additional source of such supplementary power in its contract for the output of the State hydroelectric plant installed at the Wachusett dam in Clinton. The company's main transmission line passes through Clinton on its way to Worcester. At this point a substation has been erected in which the current is transformed from 66,000 volts to 13,000 volts. This reduced pressure is carried through Clinton on the locations granted on the order appealed from to the Lancaster Mills, and thence to Berlin, where a connection is made with the system of the Marlborough Electric Company. The Transmission company has but one customer in Clinton, viz., the Wachusett Mills, to which electricity is supplied for mechanical and manufacturing purposes. The Clinton Gas Light Company has been selling electricity since 1887, the power business, however, being very small for a manufacturing town of about 15,000 inhabitants. In June last it supplied but twenty-six motors with an aggregate capacity of 111 kw. Regarding the power rates of this company, the board states that "under the schedule a power customer making a substantial use of a motor of a size reasonably suited to his needs is entitled to a price not necessarily excessive as compared with the prices offered by other electric-light companies of similar size."

The amended charter of the Transmission company incorporates it for the purpose of "generating, manufacturing, storing, transmitting, furnishing, purchasing and selling electricity for mechanical, manufacturing, railroad, railway and heating purposes, and for the use of municipalities * * * engaged in the business of furnishing electricity." Counsel for the town claimed that the company was not incorporated or authorized to distribute and sell electricity exclusively for power. The board points out that the town's contention calls for a construction of Chapter 617, Acts of 1908, which provides that municipal authorities may impose restrictions upon companies securing locations for the sale of electric power exclusively, subject to appeal to the commission. The board points out that it appears clear that the Legislature did not intend to describe a use of electricity confined to the operation of motors, but rather its use for mechanical and manufacturing purposes generally. This broader significance of the term "power" is in keeping with recent developments of the industry. In the rapid and varied extension of electrical applications the terms "light" and "power" are becoming inadequate. The largest electric-light company in the State has found it necessary in its rate schedule to define "power" as "general motor service, cooking, heating, electroplating, charging storage batteries, and similar service, but not including the running of dynamos for lighting purposes." The board therefore concludes that the Transmission company is authorized to sell electricity for "power" within the meaning of the foregoing act. The board says that the purpose to supply large as distinguished from small users is to be tolerated only during such time as may be necessary to establish the public character of the business which the Transmission company is undertaking

and properly to adjust the relations between it and the local agencies for electrical distribution.

The commission further states: "The distribution of electricity through the public streets and its sale for lighting purposes has been recognized as a public service for more than twenty years. This conception of the character of the business has not changed, even though electricity so distributed has come to be applied to other important uses. For the same period it has been the established legislative policy of the State that so long as such an agency for the distribution of electricity in any given territory is adequately and properly performing its public duty the public interest is better served by public supervision and regulation than by competition. The advent of the Transmission company into communities already supplied for the purpose of selling electricity primarily to large consumers for manufacturing and mechanical uses and to a considerable extent as 'secondary power' has developed a novel and important phase of the problem. * * * In each instance which has been brought to the attention of the board the local authorities, as in this case, have attempted to preserve competitive relations between the new company and the one already established, but have hesitated to compel it as a condition of admission to observe all the duties and obligations of a public servant, namely, to serve all with adequate facilities without discrimination and for no more than a reasonable compensation, since such a requirement, being obviously not included in the company's purpose, might discourage or wholly prevent the entry of the new company into the field for any purpose whatever. Anything short of an insistence on this condition must, however, inevitably fail to give the entire community the advantage of two sources from which electricity for mechanical and manufacturing purposes may be purchased. On the other hand, an insistence upon this condition will probably ultimately result in no greater advantage to the community than its supply by one public-service agency properly regulated and supervised. * * *

"Unless compelled by law, any sale of electricity by it (the Transmission company) to small power users will be casual and incidental to its primary purpose. If compelled by law to supply any one customer, there is no sound reason why it may not be required to supply all who may desire its service and to extend its lines so far as may be reasonably necessary. * * * In that event there is at least doubt whether it can charge much if any less than the price at which the Gas company can afford to sell. * * * Inasmuch as experience has developed that low prices for electricity for light are directly dependent upon the extent and diversity of the use of electricity for other purposes, it seems fair to conclude that any attempt to compel these two companies to observe competitive relations may not result in any advantage to small users of power, and, if it does, then only at a corresponding disadvantage to the community as a whole.

"The board has for some time been of the opinion that the public interest in the distribution of electricity by means of the public streets is not to be measured by the use to which electricity is put after its delivery to the customer. If cheap power is to be made available to a community, it must be through some common public-service agency. It is for this reason that the board believes that the Transmission company should not be excluded from selling to the Gas company, but rather should be free to do so and the latter company should be willing to buy if thereby it can obtain its electricity cheaper than it can generate it. * * * For the time being at least an arrangement similar to that followed in Worcester is in the judgment of the board sufficient. Under it the Transmission company may supply customers whose requirements are too great to make it profitable for the Gas company with its present plant and business to undertake their supply. * * * The pr[illegible] n's decision by which the rights granted by them are to terminate at the end of twenty-eight years is a distinct departure from the legislative policy and practice of many years, which has been to grant indeterminate, revocable franchises in cases similar to the one under consideration. The only advantage of the provision in question from any standpoint is that at the expiration of the term a certain measure of control may revert to the Selectmen. If this condition was thought to be of importance, it is difficult to understand why so long a period was named. * * * The board believes that such a provision is inexpedient, and that its effect if employed would be to weaken the public control of the situation, and to discourage rather than to encourage the highest development of the properties involved and the lowest charges for their service."

The commission therefore gives the Transmission company authority to occupy the locations laid down by the town, subject to the general jurisdiction of the latter. Joint occupancy of poles is recommended, with a 14,000-volt limitation under normal working conditions. The Transmission company is authorized to supply electricity to the Gas Light company, electric railways and railroads, but is not permitted to supply to any other customer whose apparatus does not offer a connected load of 300 hp, or whose annual energy consumption is less than 450,000 hp-hours, as in the late Fitchburg and Worcester decisions. In case the town acquires a municipal lighting plant the company, on request, is ordered to supply energy to it to an amount not exceeding 800 hp of maximum demand, and at a rate not exceeding the lowest rate given by the company to any other municipality in the State.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has authorized the Northern Westchester Lighting Company to issue $72,000 of its 5 per cent bonds due Jan. 1, 1955. The bonds are to be sold at not less than 95 and the proceeds used to discharge matured bonds of the Sing Sing Gas Manufacturing Company for the purchase and cancellation of the bonds of the Sing Sing Electric Light Company.

The Newfane Electric Company has been authorized to issue additional stock to the amount of $7,000. The proceeds derived from the sale of the stock are to be used for the payment of expenditures incurred for proper capital expenses.

The Jamestown Lighting & Power Company has been authorized to exercise rights and privileges conferred upon it by a franchise granted by the Town Board of Ellicott, Chautauqua County, for the furnishing of electricity for all purposes.

The Warwick Valley Light & Power Company has been ordered to show cause before the commission at Albany on Jan. 8 why an order should not be entered requiring it to improve its distribution system in accordance with recommendations made to the commission by one of its inspectors, and to place the system in safe condition so that it will properly serve the public. The complaint was received by the commission from the Village Trustees of Warwick, and an inspector, after examining the plant, has pointed out various things necessary to put the plant in proper condition.

The Meridian Telephone Company, of Meridian, Cayuga County, N. Y., has submitted a petition asking that the New York Telephone Company be required to show cause why it should not be ordered to connect with the Meridian Telephone Company for interchange of traffic and communication. The petition states that in 1905 it made a contract as a connecting company with the New York Telephone Company, but that in September, 1911, that company canceled

the contract because of arrears for rentals of telephones for a period of more than thirty days, but agreed upon payment to it of said arrears to enter into an agreement with the Meridian Telephone Company, but that after the indebtedness was paid the New York Telephone Company refused to ratify the contract between the two companies for the reason that it had given to the Cato & Meridian Telephone Company the exclusive contract for interchange of traffic in that district; that by reason of this refusal the members and patrons of the Meridian Telephone Company have been discriminated against illegally and unconstitutionally, and that no valid reason exists why the New York Telephone Company should not enter into an agreement or contract for one year with the Meridian Telephone Company under the same terms given to other connecting companies. The New York Telephone Company has been required to answer the complaint within ten days.

A complaint has been entered by the Lenham Mercantile Company and others, of the city of Lackawanna, N. Y., directed against the New York Telephone Company. The complaint alleges that for the past ten years telephone service has been furnished for the sum of $108 per year, which included communication in the city of Lackawanna and any part of the city of Buffalo; that the company has inaugurated a new rate schedule which provides for a flat rate with subscribers within the corporate limits of the city of Lackawanna, the village of Blasell and part of the towns of West Seneca and Hamburg for $50 per year, the new local area to be known as Lackawanna, and providing for a toll rate of 5 cents per message between Lackawanna and Buffalo, Gardenville, Hamburg, Orchard Park and Wanaka; that the rate of $50 per year for service within the Lackawanna area is unjust and unreasonable because of the small number of subscribers within that territory. The complaint has been served upon the company with an order to answer the same within ten days. Pending a decision of the case upon its merits the commission has suggested to the complainants that they sign the new contract as drafted by the company, having induced the latter to incorporate a ten-day cancellation clause.

MASSACHUSETTS COMMISSION.

The Gas and Electric Light Commission has approved the issue of new capital stock to the amount of $5,000 par value by the Seekonk Electric Company for the purpose of purchasing the lines of the Narragansett Electric Lighting Company, of Providence, R. I., within the town. The company plans to purchase energy from the Narragansett company and to distribute it in Seekonk and Swansea. The estimated value of the existing lines in Seekonk is about $1,000, and extensions will be made to the extent of about $5,400. The proceeds of the sale of ten shares are to be devoted to the purchase of the present lines, and the proceeds of forty shares to the construction of the extensions.

Much interest has been aroused by the publication of the recent decision of the commission admitting the Connecticut River Transmission Company to the town of Clinton, subsequent to the appeal of the Clinton Gas Light Company. The action of the commission in cutting out the limited franchise restriction granted the company by the municipality and substituting therefor an indeterminate franchise has received favorable comment in many quarters.

MARYLAND COMMISSION.

The Maryland Public Service Commission received last week from the Consolidated Gas, Electric Light & Power Company, of Baltimore, a report of the valuation of its property. The total is $44,072,415, divided as follows: Physical property, $26,400,845; working capital, $1,000,000; investments, $222,537; intangible assets, $16,379,033. The report includes the actual investment in the Baltimore Electric Company and the present value of the property, the value of the Consolidated Gas, Electric Light & Power Company, electric division, assets and liabilities of the Baltimore Electric Company, and the combined assets and liabilities of the Consolidated and the Roland Park Electric companies. The report argues at length that the company should be allowed to earn dividends on intangible assets which represent money spent in the early years of the company and losses of various kinds in development. It is explained that in the early years of the company sufficient sums were not set aside for depreciation, and that allowances had to be made for these losses when it came to make renewals. In support of this contention the company cites a decision of the Wisconsin Public Service Commission which allowed intangible assets to be considered. Figuring on the Wisconsin basis the company reaches the conclusion that its intangible assets amount to $31,313,318, and that the lesser sum claimed is purely arbitrary in order to make the company's assets equal its liabilities. The valuation of the property is based on the amount it would cost to reproduce it new. Referring to the intangible assets, it is stated that they constitute the additional investment necessary to build up the business, much in the same way as that in which the cost of construction represents the cost of the physical plant. This appears to hold good at least until the deficits or the investments occasioned by them have been made good and restored to the investors either through surplus profits or in some other form. It is held that such treatment of the cost of building up the business is equitable as between the investors and the consumers, and that in the long run it is necessary in undertakings of this character in order to obtain the capital that is required.

No date has been set by the commission when the hearing on the Consolidated case will begin. At present Chief Engineer Charles E. Phelps and Auditor John A. Tompkins of the commission are at work on certain data which when completed will enable them to test the accuracy of the company's figures. It is probable that the commission will make efforts to get the city of Baltimore to share the burden of expense incident to the hearing of the case, such as the employment of gas and electric experts who may be required. It is recognized at the office of the commission that the principal issues hinge on the valuation placed by the Consolidated on its intangible assets, upon which it claims the right to earn dividends just as upon its physical assets.

OHIO COMMISSION.

General E. B. Finley, attorney for the Bucyrus Light & Power Company, has secured permission from the Ohio Supreme Court to file a motion for a writ of mandamus to compel the Public Service Commission to hear the case of the company against the city of Bucyrus, the City Council of which has enacted a franchise ordinance fixing rates for service that are considered unreasonable. A petition was filed with the commission, but it was afterward dismissed without consideration on the ground that the ordinance was passed before the commission was organized. The question for the Supreme Court to decide is whether the commission can be compelled to take up cases in which the causes and grounds existed before its organization. Members claim that if this were true it would open the way to review acts that took place in the distant past, and perhaps result in the damage of securities that were based upon conditions as they existed before the public utilities law was enacted. General Finley criticises the law as crazy-patchwork, and says that it is made up of parts of laws of other states, and that it would take a Philadelphia lawyer to interpret it. On the other hand, it is held that the law was purposely framed to render it difficult of application, and it is pointed out that the appropriation for its enforcement is so small as to nullify its execution. The decision will be of great importance to public service corporations throughout the State, as the question has been raised several times.

The Cleveland Electric Illuminating Company, of Cleveland, has asked for permission to issue $1,500,000 of 5 per

cent bonds to be sold at a price the commission may fix, and the same amount of common stock to be sold at par. The company states that $663,612.85 of this is to be used to refund expenditures from income for betterments and extensions, while the remainder, with other funds now on hand, will be used in making additions to the generating and distribution facilities. The company is building a new central station, but declines to go into details as to just what the funds will be used for further than is covered by this statement.

The Columbus, Urbana & Western Railway Company has asked for authority to issue $50,000 stock and $5,500,000 bonds, from the proceeds of the sale of which it is the intention to extend the line from Fishinger's Mill to Findlay and build a line between Wapakoneta and Kenton. This would give Columbus direct connection with Toledo and the western part of the State. S. A. Hoskins, of Wapakoneta, who represented the company, said the bonds would be sold at 80. It is said that if permission is granted to issue the securities the property will be sold and work will be begun on the extensions at once.

The Cleveland, Painesville & Eastern Railway Company has requested authority to issue $211,000 forty-year 5 per cent bonds to reimburse the company for expenditures from income for betterments and extensions.

CURRENT NEWS AND NOTES.

American Institute of Consulting Engineers.—The annual meeting of the American Institute of Consulting Engineers will be held on Jan. 16, 1912, at the Aldine Club, Fifth Avenue and Twenty-third Street, New York, at 8 p. m. Preceding the meeting an informal dinner will be served at the club, beginning at 6:30 p. m. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary of the Institute.

* * *

Wood Preservers' Association.—The eighth annual meeting of the Wood Preservers' Association will be held at the Hotel Sherman, in Chicago, Ill., Jan. 16-18, at which several papers will be presented relating to line poles and electric-railway ties. This association has nearly doubled in membership since the last meeting and a large attendance at the meeting is anticipated. Mr. F. J. Angier, First National Bank Building, Chicago, is secretary.

* * *

Probable Telephone Merger in San Francisco.—At the meeting of the Board of Supervisors of San Francisco on Dec. 4 an ordinance was introduced at the request of the Bay Cities Home Telephone Company granting that company permission to dispose of its interests to the Pacific Telephone & Telegraph Company, which is the Bell company, controlled by the American Telephone & Telegraph Company. The negotiations leading up to this stage of the proposed merger have been in progress for several months.

* * *

Electrical Contractors' Association of New York.—The annual meeting of the Electrical Contractors' Association of New York will be held in the Building Trade Club, New York City, Jan. 16, 1912. No stated program has been arranged, legislation at Albany and routine business being all that will be considered. There will be two sessions, divided by a luncheon. After the meeting the association members will be the guests of the Electrical Contractors' Association of New York City, which will give a tea and reception at the Building Trade Club at 4:30 p.m. and a theater party at the Winter Garden in the evening. After the performance the guests will be taken in automobiles through the "Great White Way" to the Building Trade Club again, where supper will be served, followed by a smoker and other entertainment. Mr. J. R. Strong is chairman of the local committee having the affair in charge.

* * *

Electric Vehicles at the National Automobile Shows.—Eighteen different makes of electric vehicles will be exhibited at the New York and Chicago automobile shows this winter. Eight of these will be displayed at the Madison Square Garden Show from Jan. 6 to 20, six others at the Grand Central Palace Show from Jan. 10 to 17, and thirteen makes at the Chicago Show in the Coliseum and First Regiment Armory from Jan. 27 to Feb. 15. There will be no duplication of exhibits in the two New York shows, which will be open concurrently, but many of the makers who exhibit in these shows will make displays also in Chicago. Four of the electric-car companies will exhibit passenger cars during the first week and commercial vehicles during the second week, both in New York and Chicago.

* * *

Recent Additions to Boston Edison System.—The Edison Electric Illuminating Company of Boston has lately added a synchronous motor-generator installation at Atlantic Avenue to facilitate the economical handling of the three-wire underground direct-current service which centers at that point. By means of these machines, of which there are five having an aggregate rating of 4500 kw, it is possible to shut down the steam-driven equipments at periods of light load, carrying the service entirely through the L Street connections with the motor-generators; while in emergencies it is possible to utilize these machines to supply alternating current to the system. Another recent improvement in the company's service covers the installation in numerous substations of mercury-arc rectifiers and constant-current transformers, and the consequent subdivision of the arc-lighting load, in place of the former plan of handling it all from L Street through synchronous motor-generator sets located in the original steam-engine-driven section of the station.

* * *

Northern Mexico 75,000-hp Hydroelectric Plant.—Further details of the plans of the Compañia Hydro-Electrica Mexicana for the installation of hydroelectric plants and the construction of power-transmission systems in Northern Mexico have been made public. The concessions which the company has taken over give it the right to utilize the water of the Rio Blanco in the States of Tamaulipas and Nuevo Leon and of the Rio de los Naranjos in the San Luis Potosi for the development of electric power. The company, which has a capital stock of $15,000,000 gold, is now having surveys made preparatory to beginning the work of constructing the first two hydroelectric plants upon these streams. It is stated that the plans call for the development of approximately 75,000 hp. The transmission lines will be extended within a radius of 150 miles of the hydroelectric plants and will supply the cities of Monterey, Saltillo, Tampico, Victoria, Montemorelos, Linares and San Luis Potosi, as well as a number of smaller places and thriving mining camps. It is announced that contracts have been let for hydraulic and electric works. The carrying out of the present plan will involve the expenditure of more than $10,000,000 gold, it is stated. Under the concessions held by the company from the government, it has available water supply sufficient to develop more than 100,000 hp of electrical energy, and this full power will be ultimately reached. The officers of the company are: Mr. Thomas Makinson Sanders, president; Mr. Manuel Migoni, secretary, and Mr. José Romero, manager. The above information supplements that given on the same project in the Nov. 25 number.

National Independent Telephone Convention.—The next annual convention of the National Independent Telephone Association will be held in Chicago on Feb. 7, 8 and 9, 1912.

* * *

Byllesby Convention.—The annual convention of H. M. Byllesby & Company will be held in the Congress Hotel, Chicago, on Jan. 2 to 5. The Byllesby conventions have come to be large and successful gatherings, with representatives of over 100 public-service properties in attendance.

* * *

Louisiana Electrical Contractors.—At the last annual meeting of the Louisiana Electrical Contractors' Association, held in New Orleans, the following officers were unanimously re-elected: Mr. Roydan Douglas, president; Mr. Thomas J. Burke, vice-president; Mr. Henry Widner, treasurer; Mr. W. H. B. Spangenberg, secretary, and Mr. W. H. Earl, sergeant-at-arms.

* * *

Powerful Italian Wireless Station.—A wireless-telegraph station has just been completed at Coltano, Italy, which was designed and built under the direction of Mr. Marconi, and has a 1000-kw equipment. The aerial is nearly 4000 ft. long and has a range, it is calculated, over a radius of several thousand miles. It is stated that the Marconi station at Clifden succeeded during Mr. Marconi's recent visit to Argentina in communicating with him in Buenos Aires, a distance of nearly 7000 miles. The Coltano station has considerably higher power available than that at Clifden. It has already communicated with Clifden and Glace Bay.

* * *

Hydroelectric Developments in Spain.—A concession has been granted to a company under the name of the Energia Eléctrica de Cataluña for the utilization of certain waterfalls in the Pyrenees for electrical generation. The company has been organized by French and Swiss financiers with a capital of $1,800,000, which sum later will be considerably increased. At first it is proposed to furnish the city and province of Barcelona with electrical energy and later to extend the system to supply energy for various Catalonian industries. The company has already started work to develop two waterfalls, one of which has a height of 2490 ft. and a capacity of 30,000 hp. The construction of a stand-by steam plant and double transmission lines has also been started.

* * *

Illinois Legislative Public Utilities Commission.—The joint committee of Senators and Representatives of the Illinois Legislature which is investigating the subject of public-utility regulation, with the idea of recommending to the Legislature the establishment of a public service commission in the State of Illinois, will resume its work after Jan. 1. At that time it is proposed that the committee, which bears the title "Illinois Legislative Public Utilities Commission," shall make a tour of Illinois cities for the purpose of studying public-service conditions and conferring with managers of public utilities at first hand. Senator John Dailey, of Peoria, is chairman of the committee, and Representative William R. Holaday, of Danville, Ill., is secretary.

* * *

Baltimore A. I. E. E. Section.—The December meeting of the Baltimore Section of the American Institute of Electrical Engineers was held at the Raleigh on Dec. 15, Dr. J. B. Whitehead, chairman of the local section, presiding. A banquet in the private dining-room of the hotel followed the meeting. Dr. Whitehead was toastmaster, and after an elaborate menu had been served he addressed the gathering, giving an account of his visit to the International Electrical Congress of Turin, Italy. When he finished speaking he introduced Mr. A. S. Loizeaux, who spoke about the new storage battery now being used by the Consolidated Gas, Electric Light & Power Company, an account of which appeared in these columns last week. Mr. C. G. Edward, of the Public Service Commission, described the latest thing in telephones, the auto-manual telephone, which is now on exhibition in the Public Service Department in the city hall. Several other speakers followed, after which a toast to Dr. Whitehead was drunk. Forty-two engineers attended the affair.

* * *

New York Section, I. E. S.—"The Conservation of Vision" formed the subject of discussion at a meeting of the New York Section of the Illuminating Engineering Society held on Dec. 14, the paper of the evening being presented by Dr. Ellice M. Alger. The author described several of the many causes for impaired vision and outlined the work undertaken by the American Association for the Conservation of Vision, which is co-operating with all societies in the accumulation of data and dissemination of knowledge among the general public. Arrangements have already been made for four of the future monthly meetings of the section. In January the subject will be "Street Lighting." In February the effect of light on the eye will be discussed. "Light for Photography" will be the subject at the March meeting. At the April meeting mine lighting and marine lighting will be discussed. Mr. G. H. Stickney was elected chairman of the section to succeed Mr. Bassett Jones, who resigned on account of pressure of other business.

* * *

New England N. E. L. A. Section to Hold Convention.—At an executive committee meeting of the New England Section of the National Electric Light Association held on Dec. 14 it was decided to hold a convention in March, 1912, in connection with the annual meeting. The place has not yet been determined, but will be outside Boston, as the fall convention next year will be held during the Boston 1912 Electric Show, probably in October. New quarters have recently been established by the New England Section on the eleventh floor of the Lawrence Building, 149 Tremont Street, Boston, in charge of Miss O. A. Bursiel, secretary of the section. Committee meetings are held here, and the office is designed to be utilized as a clearing house of information for the section, which now has a membership of nearly 800. A vigorous campaign for additional members is now under way, considerable friendly rivalry being in evidence between the section and the new geographic branch of the association in the Northwest, each branch being determined to muster the largest number of adherents before the Seattle convention in June.

* * *

The Magnet and Lines of Force Defined.—In a printed circular received from A. E. Mellick, Dunedin, New Zealand, entitled "Why Does a Magnet Attract?" the following definition of a magnet occurs: "A magnet is a hoop of metal with a hiatus, that it is endowed with a complete orbital gyronic movement through its fabric and hiatus, which in its action attracts cosmogonic gyrons in a certain ratio to the feebleness of intensity of the orbital gyronic movement: that the gyrons, still continuing their journey through the space of the hiatus, continue to attract cosmogonic gyrons to the extent of attracting the gyrons of pieces of metal which may be in their neighborhood." Lines of force, the writer says, are constituted by a continual procession from pole to pole resulting from the orbital gyrons following their course. "The lines of force are broken by the revolution of the armature, conducted to the commutator, collected by the brushes, conducted to the magnet, thus stimulating it to an excessive degree to attract a larger number of cosmogonic gyrons, and at length sent on their errand of usefulness in providing us with power, light and heat."

[illegible] meeting of the Maine Electrical Association will be held Jan. 18 at Bath, Maine, at which several papers will be presented. The entertainment will include a "shore" dinner. Mr. W. S. Wyman, Waterville, is secretary.

* * *

Armour Institute Branch of A. I. E. E.—At a meeting of the Armour Institute of Technology Branch of the American Institute of Electrical Engineers held on Dec. 13 Mr. P. A. Strong, of the class of 1912, read a paper on "Chicago & Northwestern Railway Terminal Signal Equipment."

* * *

Subway Project in Chicago.—The finance committee of the City Council has approved an appropriation of $202,200 for salaries and expenses of the subway commission for the ensuing year. In addition an appropriation of $2,000,000 for actual construction work on the subway was approved, subject, however, to a possible referendum to the voters of the city at the election of next April.

* * *

Northwestern Cedarmen's Association.—The next annual convention of the Northwestern Cedarmen's Association will be held in Minneapolis on Jan. 23 and 24. This association is of interest to electrical men from the fact that it is composed of producers of white-cedar poles. Mr. T. H. Partridge, of Minneapolis, is president, and Mr. H. H. McKinney, 743 Lumber Exchange, Minneapolis, is secretary.

* * *

Publications of American Society of Civil Engineers.—In the future only one volume of the *Transactions* of the American Society of Civil Engineers will be issued annually, instead of four volumes as heretofore. This volume will contain approximately as much material as the four quarterly volumes combined, but its bulk will be less than for the others on account of the use of thinner "Bible" paper.

* * *

Peoria Electrical Show.—Mr. Leroy A. Mills, president of the Mills Electric Company, of Peoria, Ill., announces that an electrical show will be held in the Coliseum in Peoria during the week of Jan. 22-27, 1912. In view of the fact that there will be no Chicago electrical show this winter it is thought that there is an especially good opportunity for a successful exhibition in Peoria. It is said that the indorsement of a number of prominent electrical manufacturers and dealers has been secured. A small admission fee will be charged, and several entertainment features are planned to make the show popular.

* * *

Chattanooga Electrical Exposition.—The Chattanooga (Tenn.) Chamber of Commerce has under consideration plans for an electrical exposition which is intended to mark the completion of several hydroelectric power projects in eastern Tennessee. Mr. G. H. Patten is chairman of the committee in charge of the project, and a meeting of the committee and officers and directors of the chamber will be held soon to discuss details of the plan. The idea at present is to organize a stock company to put the exposition on its feet and to hold the event some time in the fall of 1912, when it is expected that the Eastern Tennessee Power Company and other water-power companies will have their plants in operation. The capitalization of the exposition company will probably be $50,000.

* * *

Electrolysis Danger Slight in Chicago.—Addressing the Chicago Real Estate Board at a recent luncheon, Mr. Ray Palmer, the consulting engineer who made a recent report to the commissioner of public works of Chicago on the subject of dangers to underground metallic structures from corrosion due to the electrolytic action of stray electric currents (*Electrical World,* Dec. 2, 1911, page 1342), said that there is no cause for any particular apprehension as to the result of electrolysis in that city. The city authorities are taking the necessary steps to meet the condition by requiring the electric-railway companies to improve their return-circuit conditions to such an extent that the drop in the return circuit will not exceed a maximum allowable drop of 12 volts. The electric "drainage" system recommended by Mr. Palmer was explained.

* * *

Sludge in Chicago Drainage Canal May Affect Power-Plant Operation.—The trustees of the Sanitary District of Chicago have adopted resolutions directing that settling tanks be placed at the mouths of sewers emptying into the Chicago River and the Drainage Canal. It is asserted that sludge is forming so rapidly in the Drainage Canal that the present system of purification of sewage by dilution will soon reach its maximum capacity. It is pointed out that new methods of sewage disposal are urgent because the forebay of the hydroelectric power station at Lockport is already clogged to some extent by sludge, the deposits extending 2 miles north to the controlling works in the rock section of the cut. The seventh Crocker-Wheeler 4000-kw generating unit at the Lockport station has been completed recently at a cost of $24,369, making the total rating of the station generators 28,000 kw.

* * *

Engineering at Northwestern University.—Considerable new equipment has been added recently to the various laboratories of the College of Engineering of Northwestern University, Evanston, Ill. Small Corliss and high-speed engines, a steam condenser with engine-driven vacuum pump, a gas engine, a hydraulic ram, a centrifugal pump, a small 60-cycle generator, an oscillograph, an electric blueprint machine and other appliances have been placed in position in this recently established department of the university. The engineering society has changed its name, and is now known as the Engineering Society of Northwestern University. It has listened to a number of addresses, including that of Mr. Frank F. Fowle on "Problems of the Engineering Graduate," and "Principles Involved in the Artificial Production of Light," by Prof. W. C. Bauer. The plans of the society for this winter embrace inspection trips to the Hawthorne works of the Western Electric Company and to the Milwaukee factory of the Cutler-Hammer Manufacturing Company.

* * *

South Shore Plan in Chicago May Hasten Illinois Central Electrification.—An agreement between the South Park Commissioners of Chicago and the Illinois Central Railroad Company, which will no doubt be approved by the city authorities, provides for relinquishment by the railroad company of its riparian rights along the shore of Lake Michigan in Chicago and the establishment of a lake-front park strip connecting Grant Park and Jackson Park. The plan involves the erection of a large and handsome building for the Field Museum of Natural History, now located in Jackson Park, at the foot of Twelfth Street, which will be boulevarded. It would seem to be natural that these extensive plans for improving the city, following out to some extent the Chicago Plan, should almost necessarily involve the electrification of the Illinois Central terminal service. President Markham of the railroad company says that the present plan has no connection with the electrification investigation, which is being considered separately. However, it is hoped that the beautification of Chicago's lake front from Twelfth Street to Fifty-first Street will not be marred by the smoke, noise and cinders of steam-railroad locomotives.

CALGARY HYDROELECTRIC PLANT.

Development at the Horseshoe Falls, Bow River, 50 Miles West of Calgary, Alberta, of the Calgary Power Company.

Single-Circuit, 60,000-Volt Aluminum Transmission Line Between the Generating and the Terminal Station Energy Sold to Large Cement Mills and Also to Municipality for Railway and Lighting Purposes.

THE following is a short description of the plant of the Calgary Power Company, which was put into operation during the past summer and which is now supplying energy to the city of Calgary and to two large cement mills, one in Calgary and the other in Exshaw, Alberta, Canada.

GENERATING STATION.

The generating station is located on the Bow River at Horseshoe Falls, about 50 miles west of Calgary, Alberta. A double-circuit, 12,000-volt, three-phase, 60-cycle transmission line runs from there to Exshaw, about 8 miles west, to a substation located near a large cement mill. Two 55,000-volt, three-phase, 60-cycle, single-circuit pole lines run over different routes to the terminal station at Calgary. The accompanying photographs illustrate the location of the plant and some various phases of the construction work.

A concrete dam was constructed across the river just above the falls in order to take advantage of the high banks which extend upstream for a few miles from this point. The dam is provided with four hydraulically operated sluice gates, also with stop-log and flash-board spillways and with an ice run. After passing through the screens the water enters the steep penstocks and is carried to the turbines in the power house and discharged into the river below the lower falls, giving a total head of 73 ft.

The sluice gates are of steel and each is raised or lowered by means of two pistons operated by oil under pressure. Two direct-connected, motor-driven pumps are installed for the operation of these gates, and together with the piping and valves are located in the house built over this portion of the dam. A special grade of non-freezing oil is used. Butterfly valves and stop-logs are provided in the concrete head-block at the entrance to each penstock.

The present installation in the power house consists of two 3750-hp Jens Orten-Boving turbines direct-connected to two horizontal-shaft 2500-kva, three-phase, 60-cycle, 12,000-volt, 300-r.p.m. generators; one 6000-hp Wellman-Seaver-Morgan turbine direct-connected to one 4000-kva, three-phase, 60-cycle, 12,000-volt, 225-r.p.m. horizontal-shaft generator, and two 330-hp Jens Orten-Boving turbines direct-connected to two 175-kw, 125-volt, 700-r.p.m. exciters. The transformer equipment consists of two 3000-kva, three-phase, 55,000-12,000-volt oil-insulated, water-cooled transformers and three 43.7-kva, single-phase, 12,000-550-volt self-cooled transformers for station service. Provision is made for a fourth generator unit of 4000-kva capacity and two additional 3000-kva transformers and for a 175-kw motor-driven exciter set for future installation. The generators and exciters were furnished and installed by the Canadian General Electric Company. All switching equipment and the transformers were supplied and erected by the Canadian Westinghouse Company.

CONTROL.

The switching equipment is electrically operated and is controlled from a control desk located on a gallery overlooking the generator-room. The main instrument board is directly in front of the control desk and is supported on columns at a sufficient height to allow the operator a clear view of the generator-room floor. At the rear of the gallery is the recording instrument and relay board, containing all the curve-drawing and integrating instruments and the inverse time-limit, overload relays for all the automatic line and transformer switches. On the main floor and in such a position that it can be seen by the operator on the gallery is the direct-current board controlling the exciters and the generator fields and containing the Tirrill regulators. The generator-field switches are electrically operated from the control desk, while the field ammeters are of the illuminated dial type, so that they may be read from the gallery. At the rear of the direct-current board are the station service-distributing panels, the space between the two boards being closed in with expanded metal screens. Two Tirrill regulators are installed, with provision for a third if necessary, in order to regulate the voltage at Calgary and Exshaw.

The cables from the generators run in conduit to a basement under the center of the generating-room, thence on open shelves along a subway passage to the basement of the switchroom, where the generator instrument transformers are located in a concrete structure. The oil switches and busbars are located on the floor above in concrete compartments. Two sets of busbars are used, one

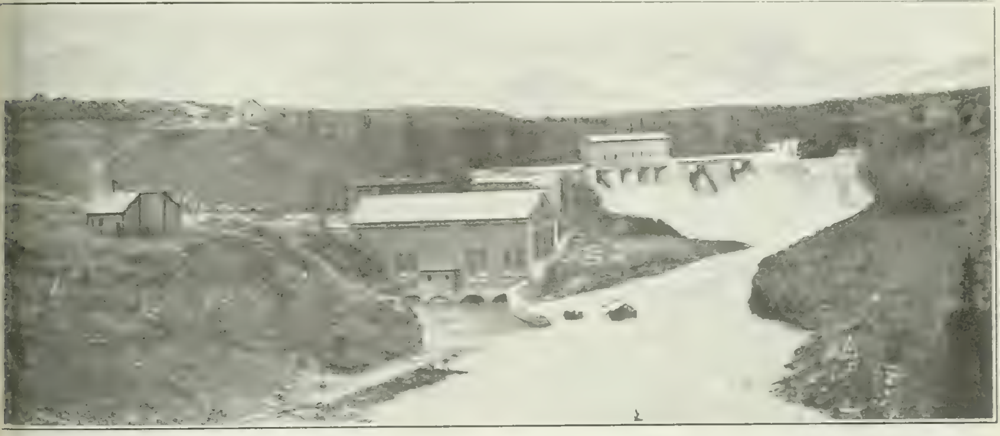


Fig. 1—General View of the Development of Calgary Power Company.

for the Exshaw and local service, the other for the step-up transformers. The Exshaw bus may be fed direct by either of the 2500-kva generators, or it may be connected to either section of the main bus through an oil switch. This bus feeds the two outgoing 12,000-volt lines and the feeder to the station service transformers. The single main bus

Fig. 2—Penstocks, Transformer and Switch Rooms and Power House.

is sectionalized into two sections. Each section is fed by a 4000-kva and a 2500-kva generator, and supplies two 3000-kva transformers.

The transformers are installed in pockets on the lower floor of the transformer building, two pockets being built on either side of a central passageway. The transformers are provided with wheels in the base to enable them to be run out on a transfer truck in the passageway and either placed in another pocket or shifted to a position under a

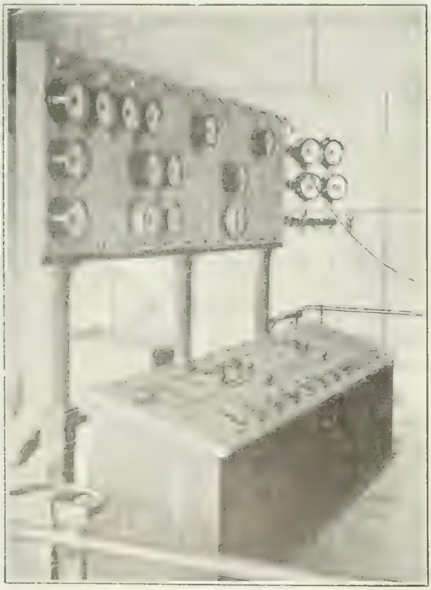


Fig. 3—Control Desk and Instrument Board on Gallery of Generating Station.

chain hoist for dismantling. The upper floor of the transformer building contains all the 55,000-volt busbars and switches and arresters. The busbars are of No. 0000 hard-drawn copper supported on porcelain insulators on a pipe framework which also carries the disconnecting switches. The leads from the transformers on the floor below pass

up through large floor openings, which are protected wit a pipe railing and wire screens 6 ft. high. The 55,000-vol busbars are in two sections, one along each side of th room and tied together through a non-automatic oil switch The line oil switches are at one end of the busbars, and from these switches the outgoing leads pass upward

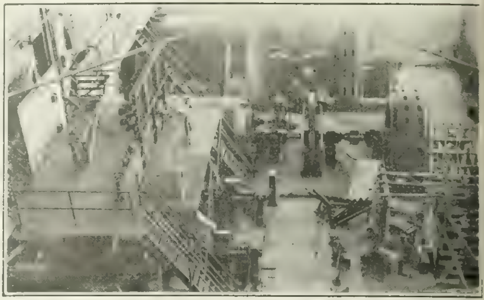


Fig. 4—Interior View of Horseshoe Falls Station During Construction.

through disconnecting switches and air-type choke coils through the roof outlet bushings and over the roof to the pole line. Electrolytic lightning arresters are installed on these lines, the horn gaps being mounted on the roof with the tanks in the high-tension room below. On each outgoing line 55,000-volt series transformers are installed for use with the relays and Tirrill regulators.

The low-tension switchroom, besides containing the bus and switch structures, also contains the three 43.7-kva

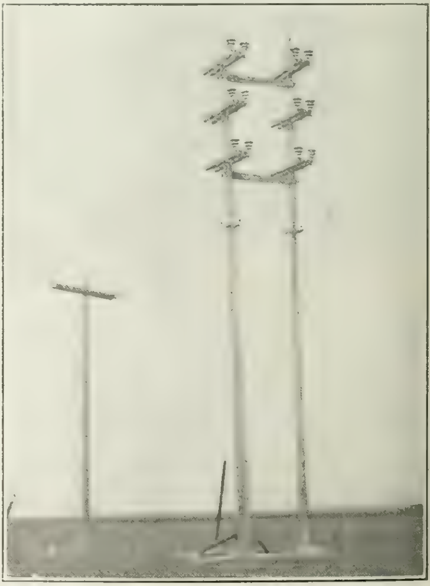


Fig. 5—Crossing Near Calgary and Grounding Net Protecting Government Telephone Line.

transformers, a room for a storage battery and the electrolytic lightning arresters for the outgoing 12,000-volt lines.

The buildings are heated throughout by steam, generated in a boiler in a small annex to the transformer building. Two 5-ft. motor-driven exhaust fans are provided in either end of the generating-room near the roof for summer use.

Oil tanks are provided in a pit below the transformer-room, and the piping is arranged so that the oil from any transformers may be quickly drained into one of these tanks and then filtered and pumped back to the transformer. The cooling water for the transformers is taken from the cross-connecting pipe between penstocks No. 2 and No. 3, there being sufficient head to make pumping unnecessary. A motor-driven Rand air compressor is installed in the basement under the generator-room, and air outlets are provided at convenient places about the building for use in cleaning. The generator rheostat resistances are also located in this basement.

TRANSMISSION LINES.

The transmission lines to Exshaw cross the river in a long span at the power house and run along the north side of the river to the town of Exshaw. This line consists of two three-phase circuits of No. 00 aluminum cable on a single pole line. The poles are of cedar, spaced forty to the mile, the standard length being 30 ft. A steel ground wire is carried along the top of the poles on insulators, and a private telephone line is also installed 4 ft. below the lowest cross-arm.

The transmission line to Calgary is a single-circuit line of No. 0 aluminum cable supported on wooden cross-arms on wooden poles spaced thirty-five to the mile. The standard length of pole is 40 ft. and the standard spacing of conductors is 5 ft. 6 in. Locke insulators were used on this line. A steel ground wire is carried on insulators at the tops of the poles and is grounded at every third pole. A private telephone line is also installed 7 ft. below the main conductors. A second line to Calgary is now under construction, running for the greater part of the way over a separate route. For a short distance both lines will be carried on the same poles, one circuit on each side of the pole on three two-pin cross-arms. Every tenth pole of the transmission line is double-armed, head-guyed and side-guyed, while special constructions are used at angles and railway crossings.

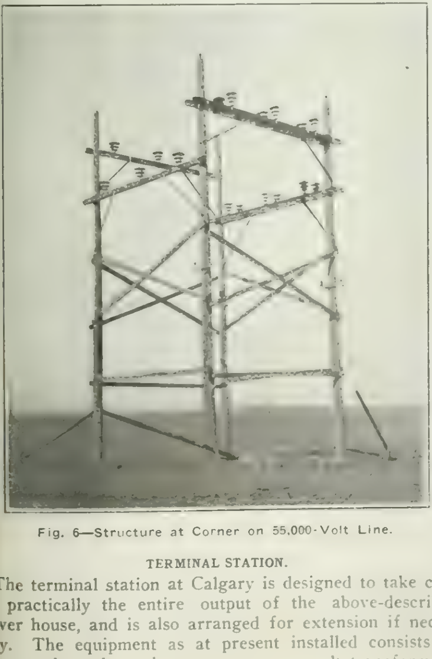


Fig. 6—Structure at Corner on 55,000-Volt Line.

TERMINAL STATION.

The terminal station at Calgary is designed to take care of practically the entire output of the above-described power house, and is also arranged for extension if necessary. The equipment as at present installed consists of two 3000-kva, three-phase, 55,000-12,000-volt transformers, one 3000-kva, three-phase, 55,000-2400-volt transformer and two 1250-kva, three-phase, 55,000-2400-600-volt transformers, with space for one additional 3000-kva unit. The transformers are arranged in a room in separate compartments, with the exception of the 1250-kva transformers, which are both in one pocket. A passageway is provided in front of the transformers with a transfer truck in order to shift the transformers to a position under the chain hoist.

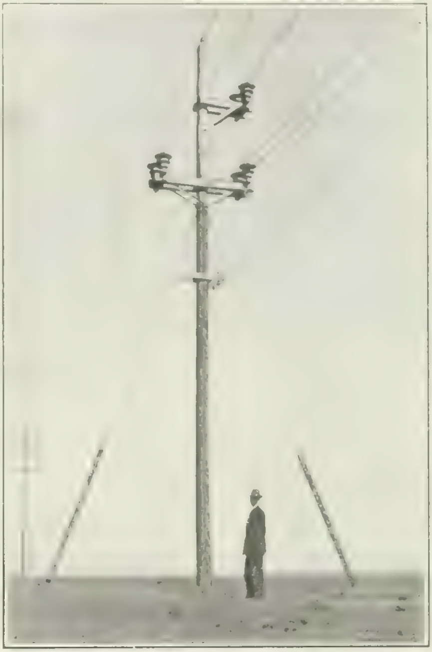


Fig. 7—Standard Double-Armed Pole. Head and Side Guyed.

The 55,000-volt lines enter the building through roof inlet bushings and are connected through automatic oil circuit-breakers to the 55,000-volt bus which runs along the rear wall, supported on insulators mounted on a pipe framework. This bus is arranged for sectionalizing through an oil switch, one transmission line being connected to each section. The taps to the transformers on the floor immediately below pass down through large floor openings protected with screens. Disconnecting switches are installed in each tap. The electrolytic lightning-arrester horn-gaps are mounted on the roof, and the tanks are placed in two small rooms along the middle wall of the building.

From the transformers the leaded cables pass to the basement under the front part of the building, thence through the floor to the switch and bus structures on the main floor, from them back to the basement ceiling to the inside of the front wall, and thence up the wall to the line outlets near the roof. Provision is made in the basement for the future installation of feeder potential regulators.

There are three sets of bus structures in the low-tension switchroom. The 12,000-volt bus, although installed as a single bus at present, is arranged for a final double bus. The 2400-volt bus is a single bus and is really a short transfer bus. The 600-volt busbars are mounted directly above the transformer oil switches on pipe framework and the leads pass off from them through knife switches to the line outlets directly behind and above them.

The switchboards are located on the upper floor and are arranged in sections. All the switches are electrically operated and are provided with relays for automatic operation, with the exception of the high-tension bus tie switch. The main switchboard is located along the middle partition wall and controls the incoming lines, the bus tie switch

Fig. [illegible]—Exterior of Calgary Terminal Station.

and the transformer switches. The 2400-volt feeder board is located along the opposite or front wall, the feeder busbars being mounted above the switches, which are supported on a framework behind the panels. Provision is made for thirteen feeders. The 12,000-volt feeder switchboard is in the same line as the 2400-volt board and controls the outgoing 12,000-volt feeders, provision for five overhead feeders being made. A station service board is installed on the opposite side of the room with a 5-kw motor-generator set and the service transformers. A storage battery is also installed in a compartment on this floor. The 12,000-volt feeders are provided with electrolytic lightning arresters, while the 2400-volt feeders have the spark-gap type of arrester.

The basement contains the heating boiler, three oil tanks and the cooling-water pumps, which are motor driven. The piping system is arranged similarly to that in the power house, the cooling water, however, being obtained from a reservoir close at hand.

The complete electrical equipment for the terminal station was furnished and installed by the Canadian Westinghouse Company. The switching is so arranged that the future additional 3000-kva transformer shall have a secondary interchangeable for 2400 volts or 12,000 volts, so that it may be switched in as a spare for either service by simply changing the connection on the terminal board inside the case.

EXSHAW SUBSTATION.

The substation at Exshaw contains four 700-kva, three-phase, water-cooled, 12,000-600-volt transformers manufactured by the Allmänna Svenska Electriska Aktiebolaget of Sweden, through its agents, Messrs. Kilmer, Pullen & Burnham, of Toronto, Ontario. The switching equipment consists of a 12,000-volt bus and switch structure controlling the incoming lines and the transformers and a low-tension switchboard with 600-volt bus mounted directly on the panels. A transfer truck is provided for shifting the transformers, and an oil tank with suitable piping arrangements is also installed. This station is designed to supply one customer only, a large cement mill close at hand. The switching equipment here was furnished and erected by the Canadian General Electric Company.

The energy delivered in Calgary from the terminal station is used by the city of Calgary at 2400 volts and 12,000 volts and by the Canada Cement Company at 600 volts in its mills adjacent to the terminal station.

This plant went into operation on May 1, 1911, first supplying energy to the Canada Cement Company's mill at Calgary, and shortly afterward to the city of Calgary. Th city uses the energy for the municipal street-railway an electric-lighting service. The Exshaw substation wa placed in operation some little time afterward. The loa at present is in the neighborhood of 5000 kw.

The engineering firm of Smith, Kerry & Chace, o Toronto, designed and supervised the construction of th entire development.

DELRAY STATION OF DETROIT EDISON COMPANY—II.

14,000-kw Turbo-Generators in Plant No. 2—Specia Type of Steam Valve—Electrical Switching Arrangements, Loop Buses, and Substation.

In last week's *Electrical World* a detailed account wa given of the 11,000-kw boilers in the Delray statio of the Detroit Edison Company, tables of test dat relating to which are reproduced herewith. These result were obtained by Dr. D. S. Jacobus in the course of a extended investigation of the Detroit steaming unit equipped with both the rocking-grate and underfeed type of stokers, and were reported by him to the American So ciety of Mechanical Engineers at its New York convention Dec. 5 to 8, as noted in these columns Dec. 9 and 16.

STEAM PIPING AND SPECIAL VALVES.

The presence of the few large units in the No. 2 boiler room has greatly simplified the high-pressure steam piping Attention should be called, however, to the use of an un usual English form of valve throughout the Delray station These Hopkinson valves are, in general, of the gate type but have a total opening of only one-half the diameter and hence one-quarter the area, of the pipe in which they are inserted, the transition in size being made by a pai

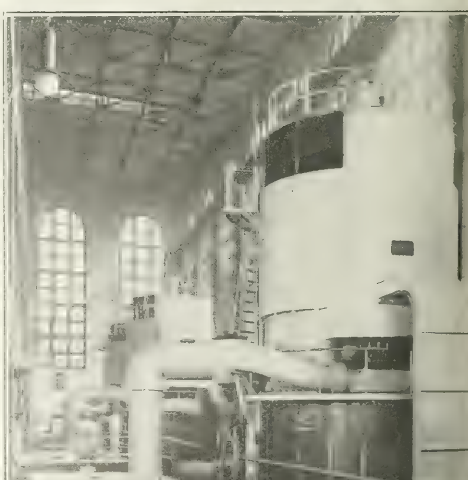


Fig. 10—14,000-kw Turbo-Generators in No. 2 Station.

of opposed cone-shaped funnel chambers in the casting. At the valve the pressure head of the steam is thus in part converted into velocity head for traversing the diminished opening at high speed, again regaining its pressure in the increasing cone chambers on the far side.

For use with steam flows in both directions the valves are

made with two similar cone chambers, while those for unidirectional flow have a short and steep approach chamber and a longer, tapering after-chamber for restoring the pressure head to the steam. These valves are in use at Delray in sizes ranging from 14 in. to 4 in. in nominal dimensions. In the case of some of the 14-in. valves at

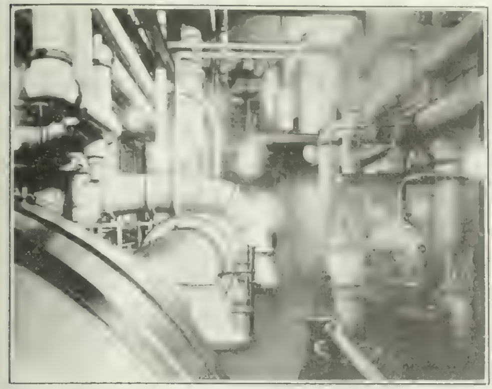


Fig. 11—Pump-Room Containing Auxiliaries of 14,000-kw Turbines.

Delray it has been estimated that the steam velocities at the gate reach 10 miles per minute. The valves have the advantage of affording a direct path for the steam, the gate mechanism when open concealing its own sills so that no eddies are produced in the restricted cross-section. The material of the valves is of a special hard steel which

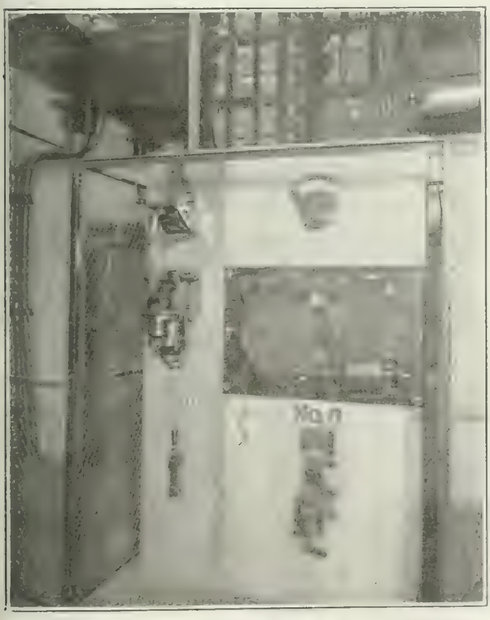


Fig. 12—Remote-Controlled Exciter Panel in Bus Compartment.

resists wear. For operating, the valves are equipped with a gear and pinion, so that one man can manipulate even the largest, the 14-in. size. Aside from their ease of operation and decreased weight, the imported valves, with 40 per cent duty, cost only about three-quarters as much as the ordinary domestic steam fitting.

The No. 1 and No. 2 boiler-rooms are tied together by 10-in., 12-in. and 14-in. steam header lines.

COAL HANDLING EQUIPMENT.

The coal-handling equipment of the Delray plant is common for the two boiler-rooms. Coal is received by rail,

Fig. 13—Control Switchboard.

the cars being delivered to the Delray terminal railroad, which is owned by the Edison company. An inclined trestle raises the dump-bottom cars over the receiving hopper, from which the coal is hoisted by a pair of 2-ton skip hoists to the top of the coal tower. These skip hoists dump automatically into the crusher hoppers from which, after being crushed, the coal is delivered by narrow-gage, cable-drawn cars to the bunkers located over the boilers.

These bunkers are arranged with partition walls and bifurcated spout entries so that different grades of coal may be stored in the two sections, one being used during ordinary loads and the other for the peak periods of the day, in this way utilizing each to its best advantage. The bins of the older boiler-room have a capacity of 5000 tons, and those in the new room one of 3500 tons. Twenty thousand to 30,000 tons are kept in open-ground storage. These piles are reached by the 2 miles of track of the terminal railroad already mentioned, which has two locomotives, four locomotive cranes and a number of cars.

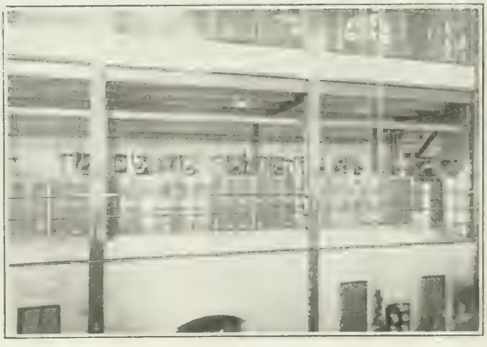


Fig. 14—High-Tension Switch Gallery.

14,000-KW TURBINE-GENERATORS IN NO. 2 STATION.

Three of the four 14,000-kw Curtis turbine units for which the No. 2 plant was designed are already installed. Like the other machines in the No. 1 room, they furnish 4600-volt, 60-cycle, three-phase energy, but run at 720 r.p.m. Steam at 180 lb. per sq. in. pressure, superheated

150 deg. Fahr., is used, the turbines exhausting into 25,000-sq. ft. base-type, two-pass surface condensers. The total weight of one of these 14,000-kw units is about 400 tons, the ten-pole field and revolving part of the turbine alone weighing about 90 tons.

Although ventilated by forced draft, as is necessary in turbo units of this size, these sets are unique in having the usual direction of the flow reversed, air being taken directly from the engine-room through the 90-deg. apertures shown in Fig. 10 and discharged outside. This arrangement has contributed greatly to the comfort of the engine-room in mild or warm weather, while as a result of the wide inlet opening the cooling effect obtained is practically the same as that from the usual duct intake of limited cross-section. Dampers are provided so that in cold weather the warm air from the turbo-generators can be deflected back into the plant for heating the engine-room.

Water for the condensers of the large turbines is circulated by 36-in. double-suction volute pumps, each delivering 25,000 gal. per minute. The pump engines use 200-lb. steam containing 150 deg. of superheat and exhaust into the open feed-water heaters. The Laidlaw-Dunn-Gordon rotative dry vacuum pumps have each a displacement of 2100 cu. ft. of air per minute. All of the pumps for the No. 2 station, including the two turbine-driven and one motor-driven centrifugal boiler-feed pump, are installed in the pump-room below the turbine floor proper.

Each 14,000-kw turbine has a 10,000-hp Cochrane open feed-water heater receiving the discharge from its hot-well pump and the exhaust of its auxiliaries. In turn each pair of these heaters receives its make-up water through a common heater of the same size, which acts to pre-warm the incoming raw water (taken from the hot-well which receives drips), boiling off its dissolved air and precipitating its impurities. These joint make-up heaters discharge automatically into the pairs of main heaters below.

The hot-well pumps are of the two-stage centrifugal type and are driven by 25-hp steam turbines. Auxiliary hot-well pumps, driven by 35-hp induction motors, are also provided for emergency service.

ELECTRICAL AUXILIARIES, SWITCHING APPLIANCES, ETC.

Exciting current for the large turbo-alternators is supplied by two horizontal, non-condensing Curtis turbines driving General Electric high-speed-type generators. The 150-kw unit runs at 2000 r.p.m. and the 125-kw machine at 2400 r.p.m. The panels for these exciters (Fig. 12) are entirely remote-controlled, the field switches, rheostats, etc., being all located in the bus compartments beneath the oil-switch gallery. The concrete-cell busbar compartments and oil switches of both plants are situated on their first mezzanine galleries, the second galleries being occupied by the control boards. Each switchboard generator panel is equipped with two wattmeters, one voltmeter, one ammeter, one field ammeter, one governor-controlling switch, one rheostat-controlling switch, oil-switch control contacts and a watthour meter.

The 4600-volt bus for each station is arranged in the form of a loop closed across its ends by tie oil switches and broken into two halves by sectionalizing switches. This gives the advantage of a double bus without its duplications. The generators are so arranged that part of the number can be connected to one bus section and the remainder to the other side of the loop. In addition to the regular machine oil switches and disconnects on the bus-compartment level, the generator leads are brought through auxiliary oil switches on the floor below, insuring positive rupture of the circuit in case of the failure of the main switches. The loop buses in each power house are connected together by tie switches and the two plants operated as a single system at all times.

The number of 4600-volt trunk lines and feeders radiating from Delray to the various substations of the system are tapped off the main bus loops through motor-operated oil switches similar to those for the generator units. Each feeder panel is equipped with wattmeters,

[illegible] RESULTS OF TESTS WITH OSCILLATING-GRATE STOKER.

[illegible]	Length, Hours.	Per Cent [illegible]	[illegible]	Per Cent Ash in Dry Coal	[illegible]	Per Cent Steam Used by Stokers and Jets.	Per Cent Combustible in Ash.	Temperature of Flue Gases, Deg. Fahr.
[illegible]	25	105.0	14,362	5.98	[illegible]		19.6	576
[illegible]	[illegible]	80.0	14,225	[illegible]	[illegible]	[illegible]	17.9	480
[illegible]	[illegible]	[illegible]	[illegible]	7.40	[illegible]	0.63	24.4	542
[illegible]	[illegible]	[illegible]	13,756	[illegible]	[illegible]	[illegible]	30.8	670
[illegible]	[illegible]	[illegible]	13,896	[illegible]	81.15	[illegible]	31.6	483
[illegible]	[illegible]	[illegible]	14,037	[illegible]	75.28	1.45	26.7	662
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80.98	[illegible]	34.1	460
[illegible]	[illegible]	[illegible]	14,493	[illegible]	[illegible]	[illegible]	24.6	636
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75.57	1.32	23.2	694
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76.13		25.8	572
[illegible]	[illegible]	[illegible]	13,977	[illegible]	76.23		29.4	575

[illegible]

TABLE II.—PRINCIPAL DATA AND RESULTS OF TESTS WITH UNDERFEED STOKER.

Test.	Length, Hours.	Per Cent Rating.	Heat Units [illegible] Coal	Per Cent Ash in Dry Coal.	Efficiency.	Per Cent Steam Used by Stoker Auxiliaries.	Per Cent Combustible in Ash.	Temperature of Flue Gases, Deg. Fahr.
7	24	151.2	14,000	7.03	77.07	2.61	31.5	575
[illegible]	24	107.9	13,965	6.34	80.28	2.44	27.1	493
[illegible]	[illegible]	162.8	[illegible]	6.75	77.85	2.87	31.3	574
[illegible]	48	92.9	14,188	9.90	77.90	2.63	27.2	487
[illegible]	26.5	211.3	14,061	9.55	75.84	3.41	36.1	651
12	..	121.3	14,010	8.09	79.24	2.57	27.6	535
[illegible]	..	185.5	14,272	8.71	76.42	2.95	28.8	647
[illegible]	109	140.0	13,983	7.22	77.66	2.68	30.0	545
[illegible]	80.5	132.8	14,095	9.58	75.66	3.04	31.1	542

†Including periods between tests.

ammeters, watthour meters and oil-switch controlling contacts.

The generated pressure of 4600 volts was, however, found rather low for transmitting to the distant north and west parts of the city, a higher voltage being also required

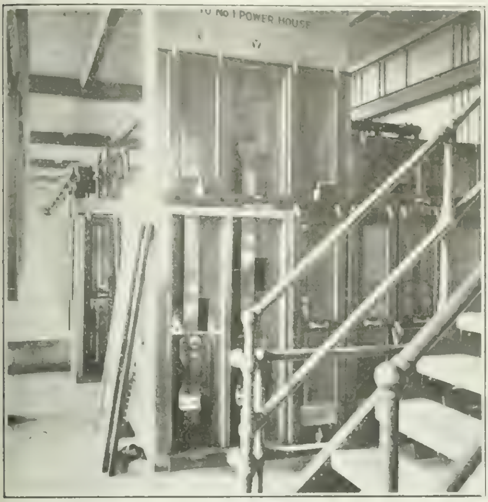


Fig. 15—Busbar Gallery of No. 2 Station

for the long distances over which Delray energy is delivered to customers of the Eastern Michigan Edison Company in the suburban territory surrounding Detroit.

The step-up transformers for this purpose are installed in a substation 500 ft. north of the Delray power houses. This station contains six 3000-kw, three-phase air-blast transformers, with 4600-volt primaries and 22,000-volt secondaries. As the 22,000-volt load had increased with the parts of the system undergoing the most rapid growth, it soon became evident that a large number of trunks would be required between the station buses and this nearby substation. To save this duplication of cable lines, it was decided to extend the plant buses themselves directly to the substation, and from them at that point oil switches similar to those already mentioned will tap off to the transformer units. The bus extension is carried on the steel bridge structure between the plant and substation shown in Fig. 16. When completed, as it soon will be, this bus will thus save the installation of numerous present and future short cable trunks and their switches. The 22,000-volt lines are carried from the substation in underground cable.

In addition to the step-up transformers, switches and aluminum-cell lightning arresters, the substation contains one 1000-kw and one 500-kw motor-generator set for supplying 600-volt railway direct current, and the switchboard and regulators for the local 2300-volt, single-phase, and 4600-volt, three-phase circuits.

The operating roll of the Delray station numbers 200 men, while at the present time 200 others are employed on construction work under the direction of the operating staff. For the benefit of its men at Delray the company has just installed an attractive restaurant, where each day

Fig. 16—Steel Bridge Carrying Bus Extension to Substation

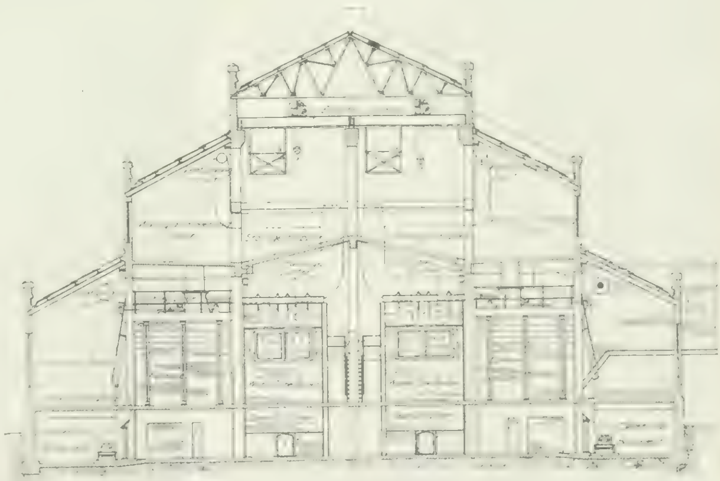
about 300 meals are prepared on an electric range and served to employees at cost.

Mr. Alex. Dow is general manager of the Edison Illuminating Company of Detroit, and Mr. B. J. Denman is acting chief engineer of the Delray station

MILWAUKEE CITY GARBAGE ELECTRICAL PLANT.

The city of Milwaukee is now installing a 600-kw turbo-alternator to use steam from its garbage destructor plant on the lake front, the electrical output of this machine to drive the huge screw pumps which flush the Milwaukee and Kinnickinnic Rivers. The garbage destructor was erected eighteen months ago, and the turbine installation will be completed by April, 1912.

The flushing pumps are at present engine-driven. These



Cross-Section of Milwaukee Destructor Plant.

engine units will be replaced by 350-hp motors energized over 4000-volt, 60-cycle, three-phase transmission lines from the garbage plant. The pump discharging into the Milwaukee River is capable of raising 500,000,000 gal. of lake water per day, through a height of 3 ft. This pumping station is 4 miles distant from the power plant. The

Kinnickinnic station, about 1 mile distant, contains a 435-r.p.m. screw pump almost equal in size to the Milwaukee River pump. To secure interchangeability of parts this pump will be similarly driven by a 350-hp motor.

Steam from the destructor boilers has been hitherto wasted by blowing into the atmosphere, except for some small auxiliary service in two 50-kw engine-driven sets used to operate the plant cranes and hoists and for lighting. With the addition of a small quantity of coal to smooth out the irregularities in the steam-output curve, about 19,000 lb. of steam is available each hour. The 600-kw Allis-Chalmers turbine will use steam at 135 lb. pressure, and will exhaust into a Le Blanc jet-type condenser. The new power-generating equipment is being installed in an addition to the destructor plant. Near by it is also planned to erect a fuel-burning power house to contain two 1600-kw turbines to furnish energy for the city's street lighting, the 4000-volt, 60-cycle garbage-plant equipment being operated in connection with this lighting system.

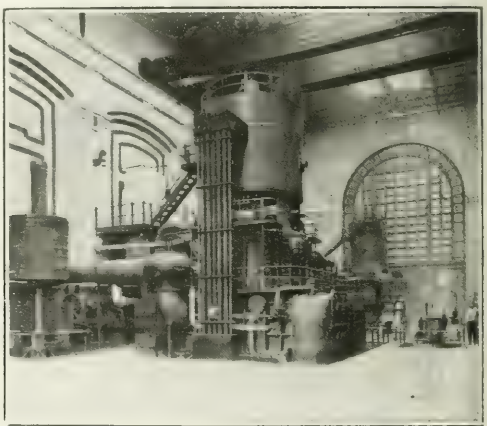
The run-of-refuse fuel used in the incinerating plant comprises a mixture of household ashes, manure, garbage and rubbish, which is sorted into bins and dried preparatory to mixing it into proportions for firing to the special furnaces. The ordinary household cinders and ashes contain 18 to 25 per cent carbon and have a fuel value of about 3700 lb.-Fahr. heat units per pound. Manure consists of 25 per cent carbon and 25 per cent volatile matters, and contains 2700 heat units per pound. Garbage has 8 per cent of combustibles and contains 2000 heat units. Rubbish contains 25 per cent carbon and 5000 to 7500 heat units per pound. Garbage makes up the principal refuse material in summer, and ashes in winter, the mixed material as fed to the furnaces averaging 3000 to 3350 heat units per pound. The furnaces are supplied with air at 300 deg. and maintain temperatures of about 1500 deg., evaporating 1.1 lb. of water per pound of refuse.

THE LARGEST CENTRAL-STATION TURBINE IN NEW ENGLAND.

THE Edison Electric Illuminating Company of Boston is now operating in regular service the largest central-station turbine in New England, the machine being rated at 15,000 kw and located at the south end of the principal generating plant of the company, at L Street, South Boston. The new unit is a six-stage vertical Curtis machine, direct-connected to a ten-pole, 7000-volt General Electric revolving-field, 60-cycle, three-phase alternator, and it is the sixth machine of this general type to be installed in the station. The L Street plant is now equipped with turbo-alternators aggregating 66,000 kw in capacity, besides 9000 kw in vertical cross-compound engine-driven alternators. A view of the new unit is shown in the accompanying photograph.

The turbine and its auxiliaries are supplied with steam from eight 512-hp Babcock & Wilcox boilers, the operating steam pressure being 200 lb. and the superheat about 150 deg. Fahr. The boilers are newly installed and are fired by Murphy automatic stokers. The machine delivers current to three Y-connected compensators rated at 2500 kw each, which step up the potential to 14,000 volts for delivery to the station busbars connected with the transmission of energy to the more distant portions of the Edison system. The turbine is equipped with a base condenser of the Worthington surface type, having about 22,500 sq. ft. of cooling surface and supplied with circulating salt water by a 36-in. volute centrifugal pump direct-driven by a vertical Atlantic engine. The speed of this pump is varied from about 150 r.p.m. to 200 r.p.m., depending upon the temperature of the circulating water. This varies from about 30 deg. to 70 deg. Fahr., depending upon the season. The pump is of the horizontal type, and enables the company to secure economy in space by its combination with a vertical direct-connected driving engine. The other principal auxiliaries include a duplex 14-in. x 3½-in. x 18-in. step-bearing pump, a 12-in. x 31-in. x 24-in. combination horizontal and vertical Laidlaw-Dunn-Gordon single-cylinder reciprocating dry vacuum pump, a 26-hp centrifugal 5-in. wet vacuum pump direct-driven by a Curtis turbine, a Goulds triplex oil pump gear-driven by a 7½-hp General Electric 550-volt induction motor, a Kinney jacket water pump of 600 gal. per minute capacity driven by a 5-hp induction motor, a 4-in. centrifugal boiler-feed pump and two accumulators for step-bearing service. Water is used on the step bearings of all the turbines in the L Street station.

The new turbine was placed in service for the first time on Sept. 26 of the present year. The turbine section of the plant comprises separate fire-rooms for every three batteries of boilers and separate turbine-rooms for every four turbines, it being the intention to extend ultimately the building to accommodate twelve units of 12,000 kw or greater capacity. Three 12,000-kw turbines and two 5000-kw units, maximum rating, are now in service besides the 15,000-kw equipment, and the original engine-driven plant is used only in handling peak service for short periods during the fall and early winter season. In the newer section of L Street a separate building is provided for the installation of motor-driven switching apparatus of the most modern design, located in fireproof compartments with barriers and other suitable separating devices in all positions where there is any possibility of dangerous conditions arising. With the increase in output rating of generating units it became necessary to abandon manually controlled switching apparatus. All the instruments and control switches are now located in a centralized operating-room, from which the energy supplied throughout about 600 sq. miles covered by the company's territory is controlled. In connection with the extension of service to points lying from 20 to 25 miles from Boston three three-phase water-cooled transformers have lately been installed to enable the earlier machines to be operated on the 14,000-volt bus. These units are rated at 5882 kva each, and are located in a compartment also containing the compensators connected in the phases of the 15,000-kw turbine.



15,000-kw Turbo-Alternator in Boston Edison Station.

The greater portion of the company's output is now handled by the turbines at L Street, only a small percentage being produced by engine-driven generators at L Street and in [illegible] Atlantic Avenue station in Boston proper.

THE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY—V.

Transmission Lines of the Utah System Aggregating 541 Miles Carried on Wooden-Pole Towers System Designed for Operation at 88,000 Volts Aluminum Conductors Used in Part.

IN these columns have previously been described the Colorado system of the Telluride Power Company and the various generating stations of the Utah system. The following account of the transmission lines of the Utah system, including a description of the pole-line and tower construction and substation data, forms the conclusion of the series of articles describing the pioneer high-tension transmission system of the world.

TRANSMISSION SYSTEM, UTAH DEPARTMENT.

The general arrangement of the transmission system, which consists entirely at present of 44,000-volt, three-phase lines, comprises two trunk lines carried on separate pole or tower structures from the Grace generating station in Idaho through the Logan station in Utah and thence southward through the outskirts of Salt Lake City to Jordan Narrows. From Jordan Narrows a loop line is carried westward through Bingham and Garfield to the Salt Lake switchrack, a cross-connection also being made from an open-air switching point at West Jordan direct to Bingham. South of Jordan Narrows one line is carried to Olmsted station by way of Battle Creek and a second by way of Lehi. From Olmsted southwest a loop line is run through Provo, Benjamin, Eureka and Topliff to Mercur, returning to Lehi by way of Cedar Fort. Between the latter point and Bingham a high-tension tie circuit is in service. The principal market of the company lies in the district including and south of Salt Lake City, and in general between the southern borders of Great Salt Lake and Utah Lake. Salt Lake and Jordan Narrows are the two principal centers of high-tension distribution, and, as stated above, the Logan and Olmsted stations are the principal regulating stations.

HEADQUARTERS.

The operating headquarters of the system are at Olmsted, a load dispatcher being on duty at all times and responsible for the maintenance of continuous service, regulation, apportionment of loads between stations, inter-switching of transmission lines and repairs. About 400 miles of metallic circuit telephone lines are required for the service of the company, and in general these lines are carried on about 220 miles of pole lines separated from the transmission system. Simultaneous telephony and telegraphy are operated on important trunk lines. Connections with the local Bell system are maintained throughout the property. In no case does the company permit the location of telephone and transmission circuits on the same supporting structure.

The total length of transmission lines on the Utah system aggregates 541 miles, nearly half of this being covered by two parallel trunks extending 128 miles from Grace station to Salt Lake. It is planned to operate these trunks at 88,000 volts at a later period. Steel-tower, wooden-tower and pole lines are employed on the system, about 75 per cent the total length of transmission service being of the last-named type. Steel-tower and wooden-tower lines have been used by the company for about two years, and the various types of pole line employed range from the early designs placed in service in 1898 to the types standardized in the last three years.

STANDARD POLE-LINE CONSTRUCTION.

This consists of a wooden pole from 30 ft. to 50 ft. long, according to conditions, the regular height being 35 ft. over all and the height above ground 30 ft. The pole is 8 in. in diameter at the top, the cross-arm 7 ft. long and the conductor spacing triangular, with separation of 72 in. The approximate height of the lower conductors above the ground is 25 ft. The cross-arm braces are of wood, 3 ft. 4 in. long. Cross-arms are framed around the pole, the ends being bolted to cobble blocks and the whole arm being treated to give additional insulation. The standard span is 300 ft., and each pole is equipped with a No. 9 iron ground wire attached to a clamping ring at the top and run to the bottom of the pole, the lower end being wrapped

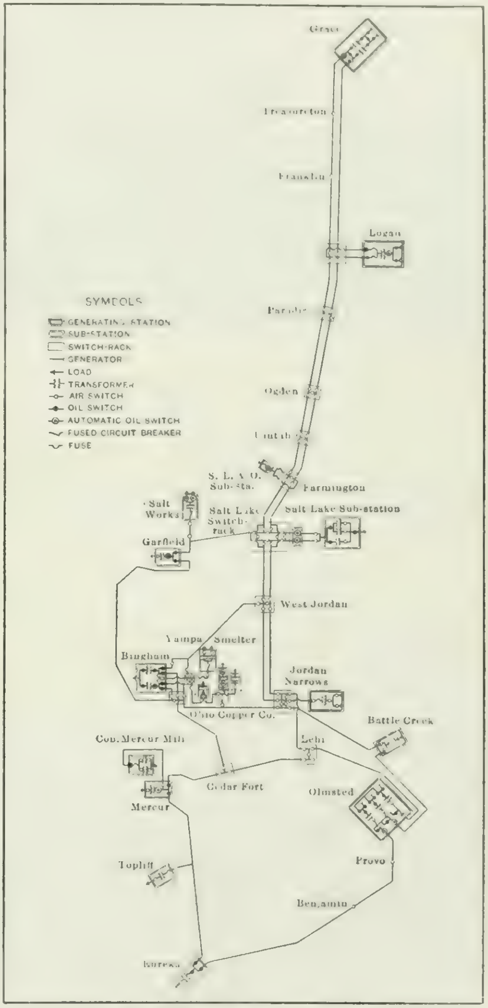


Fig. 35—Diagram of Utah System.

around the pole butt three times and stapled. Paraffined locust pins 3 in. in diameter and 22.7 in. long are used, these being fitted into the pole tops and secured by machine bolts and fitted into cross-arm pin blocks and bolted through. From a point 2 ft. above the surface of the ground to the butt end the pole is treated with carbolineum. In the company's earlier work solid wooden cross-arms were employed, with "Provo" glass insulators and spans of from 120 ft. to 200 ft. The insulators on the standard pole line are three-part Locke units, 12 in. in diameter.

[illegible] ... [illegible] by two 50-ft. poles of Idaho cedar, the phase wires being carried in a horizontal row and spaced 11.5 ft. apart, this also being the separation of the poles. The latter are tied together by

F[illegible]—Dead-ending Stee[l] T[o]wer.

Fig. 37—Steel-Tower Construction.

a 24-ft. framed cross-arm of treated timber, cobble blocks being used to carry the insulators in the manner described under the standard pole-line construction. Eight-inch poles are used, and each is capped by a lightning rod about 5 ft. long, with ground wire on each pole. The butts are treated with preservative, and four wooden braces are used. The normal span is 600 ft. and the height above the ground [illegible]

STEEL-TOWER CONSTRUCTION.

Rectangular towers built of steel are employed, the height being 57 ft. and the conductor spacing 12 ft., all wires being carried in a horizontal plane about 50 ft. above the ground. The standard span is 900 ft., and the tower members are galvanized, the foundation being of concrete, steel or wood, according to local conditions. The pins are of paraffined wood, 25 in. long and 4 in. in base diameter, the same type being used on the wooden tower lines. The insulators are Locke three-part units, as described above. At the top of each tower a truss has been installed, with lugs for the attachment of suspension insulators in case these are used in the reconstruction of the line for 88,000-volt service. The steel-tower construction extends from Salt Lake to Farmington on the west trunk line and from Farmington to Ogden on the east line. The standard conductor used on the steel-tower lines is stranded copper of 8 per cent larger area than No. 0, the cable being attached to the insulators by double ties of No. 2 copper. Provision has been made for raising the cross-arms on wooden towers when suspension insulators are installed for 88,000-volt operation.

Fig. 38—Wooden-Tower Construction.

OUTLINE OF LINE CONSTRUCTION.

The Grace-Logan transmission trunk lines were completed in 1909 and are pole lines from end to end, with 10-ft. cross-arms, the section from Logan to Salt Lake being of steel and wooden-tower construction. The conductors on these lines are cable of seven strands No. 8 copper, seven strands No. 6 aluminum and No. 2 solid copper. The Olmsted and Jordan Narrows lines are of standard pole type, No. 2 copper, No. 5 copper and No. 2 aluminum cable being used. These lines are from 19 miles to 22 miles long. The Bingham-Garfield line is of standard-pole construction, No. 2 solid copper being used, and No. 4 copper is used on one line between Salt Lake and Jordan Narrows, the other being strung with No. 2 aluminum cable. The Eureka-Mercur lines are of the early wooden-pole type, No. 2, No. 3 and No. 00 aluminum cable and No. 5 copper being employed. The principal lengths of line on the southern section of the system are, besides those given above: Salt Lake to Jordan Narrows, 21.4 miles; Salt Lake to Garfield, 11.8 miles; Garfield to Bingham, 22.8 miles; Bingham to Jordan Nar-

F[illegible]—Switch Rack at Salt Lake.

rows, 11.5 miles, Lehi to Mercur, 17.[illegible] miles, Bingham to Cedar Fort, 13.8 miles; Mercur to Eureka, 27.6 miles, and Eureka to Olmsted, 40.6 miles.

SALT LAKE SWITCHRACK.

The switchrack of the company in the suburbs of Salt Lake City is one of the largest in the world, being about 90 ft. long, 60 ft. wide and 45 ft. high. It is built of treated timber, the principal members being 6 ft. x 8 ft. x 20 ft. in dimensions. From this rack two lines radiate to Grace station, two to Olmsted by way of Jordan Narrows and two to Garfield. All lines can be cross-connected or paralleled, as the conditions require. Sixteen open-air rotary switches are installed, all being controlled by levers, wires or rods

Fig. 40—Wooden-Pole Construction

mounted in the adjacent substation after the manner of a railroad signal tower. The substation is a temporary structure, containing two automatic oil switches of the 45,000-volt type, controlling two three-phase lines feeding the system of the Utah Light & Railway Company through a substation belonging to the latter organization located on the Jordan River in the east part of Salt Like City. Series and shunt-instrument transformers, choke coils and electrolytic lightning arresters are installed in the Salt Lake substation.

SUBSTATIONS.

The low-tension distribution of the company is handled through various substations, some of which are owned by consumers and others by the Telluride organization itself. In general, the substations are provided with high-tension oil switches, choke coils and electrolytic lightning arresters The principal data are shown in the following table:

Substation	Dimensions in Feet.	Building Material	Main Transformers	Kilowatts.	Notes
Salt Lake	33 x [illegible]	Cor. Iron		None	Control and metering point
Salt Lake..		Brick and Concrete	6 3	375 500	Owner Utah Light & Ry. Co.
Bingham	58 x 62	Cor. Iron.	8	1000	26 miles 5000-volt distribution.
Mercur	25 x 50	Brick	[illegible]	100	[illegible] miles 5000-volt distribution.
Topliff	18 x 22	Cor. Iron.	4	100	2.5 miles 5000-volt distribution.
Eureka..........	28 x 40	Brick.	[illegible]	250	11 miles 5000-volt distribution.
Garfield..........	60 x 70	Rein. Con.	[illegible]	1000	Owner Boston Con. Mining Co.
I. C. Salt Co......	18 x 20	Brick		125	Owner Inland C'st'l Salt Co
Logan	17 x 25	Brick.		50	Local 2300-volt and 5000-volt service.
Provo.	16 x 16	Cor. Iron	[illegible]	250	5000-volt Electric Co. of Provo.
Farmington .. S. L & O. Ry.		Brick	[illegible]	150	Owner S. L. & O. Ry. Co [illegible] supplied through Farm[illegible]

Automatic oil switches of the inverse-overload, time-limit type are installed in the high-tension circuits at Grace, Olmsted and Battle Creek generating stations and at the Salt Lake, Garfield and Bingham substations.

The officers of the Telluride Power Company are: President, Hon. Andrew Squire, Cleveland, Ohio; vice-presidents, Messrs. O. M. Stafford, Cleveland, and C. D. Walcott, Washington, D. C.; general manager, Mr. L. L. Nunn, Provo, Utah; chief engineer, Mr. P. N. Nunn, Provo, Utah.

EXPERIMENTS WITH ELECTRIFICATION DURING GROWTH OF GARDEN AND GREENHOUSE PLANTS.

THE interesting possibility of planting corn on land from which the crop of winter wheat has been gathered in July, and then stimulating the growth of this corn by electrical means so that it will fully mature before cold weather, has been suggested as a means of

Fig. 1—Network of Charged Wires Over Acre Plot

doubling the productiveness of a given acreage by Mr. William Stahl, of Evanston, Ill., who has planted corn successfully as late as July 25, during a series of experiments conducted by him with the electrification of growing crops near his home at Evanston. Several local newspaper accounts have referred, with various degrees of accuracy, to Mr. Stahl's experiments, which are being carried out with the assistance of a practical florist and gardener, Mr. Richard Gloede, and both gentlemen testify to the increased healthiness, shortened growing period and resistance against drought shown by the electrified plants.

An unidirectional potential of about 250,000 volts is used in these experiments. The initial work was done with a

Fig. 2—Comparison of Electrified and Ordinary Plants. Corn and Beans Planted July 25, Taken Up Aug. 18.

static machine, but this was found to give trouble from mechanical causes and failure to generate during periods of humidity. Central-station service from the 60-cycle lines of the North Shore Electric Company is now used, being stepped up to approximately 250,000 volts by a high-tension

[illegible] by a mechanical [illegible] motor.

A [illegible] apart is mounted at a [illegible] ground selected for

Fig. 2—Arrangement of Network in Greenhouse.

the tests. On this plot were planted a great variety of vegetables, including Indian corn, popcorn, tomatoes, cantaloupes, cucumbers, eggplant, lettuce, radishes, onions, peppers, cauliflower, cabbage, carrots, etc. Although planted late, these vegetables, according to Mr. Stahl, came through a severe drought much better than similar unelectrified plants and reached maturity in a period much less than the usual time. The potential was turned on the plot only from two to six hours daily, morning and evening, during hot, dry weather, although for longer periods when the air was moist. The energy consumption was almost negligible, it appears, for, although no indicating instruments were used, the electricity bills averaged only $2 to $3 per month during the treatment of the acre.

As an example of the superior growing power of plants when subject to electrification, the experimenters report that even newly laid sod along pathways through the acre plot was found to thrive and grow green, while during the dry weather that was being experienced at the time the old, rooted grass at other parts of the grounds was burned badly. Mr. Stahl also asserted that the electrification tends to kill fungus growths which often attack greenhouse vegetation. As to the manner in which the presence of the electric field acts to stimulate the growth of plants he attempts no explanation. The large size and excellent quality of radishes, tomatoes, melons, beets, corn and other garden products have convinced the experimenters, however, that they are following on the trail of a well-defined law of plant growth.

The same scheme of electrification has also been applied to greenhouse benches, a network of high-tension wires being suspended on insulators at a height of 50 in. above the beds, while a ground wire is buried in the earth of the boxes. According to Mr. Stahl, this greenhouse electrification has resulted in growing much larger and fuller chrysanthemums, etc. Electrification treatment, he adds, is found to open gladiolus bulbs in thirty-six hours, which ordinarily require a week. Experiments on an enlarged scale will be carried out at the Evanston plot during the coming season, while the greenhouse installation will be in use all winter to accelerate flower growth under artificial conditions.

Central Station
Management, Policies and Commercial Methods

ELECTRIC HEATERS TO PREVENT FREEZING OF WATER PIPES.

The New York Edison Company has just supplied five electric heaters which will be used to prevent freezing of water pipes in one of the loft buildings owned by the Trinity Corporation. Four of these heaters are of the 1200-watt size, and will be placed under the pipes leading from the roof tank to the house supply system, and the other, an 800-watt heater, will be set in the pump-room. Thermostatic control is included.

THEFT OF ELECTRIC-SIGN LAMPS.

The Louisville (Ky.) offices of the Federal Electric Sign System, as well as the owners and operators of electric signs throughout that city, are suffering considerable loss from the depredations of incandescent-globe thieves, and every effort is now being made by the Louisville police department to break up the practice of stealing globes from signs throughout the city.

A big sign maintained by the Federal Electric system at Second Street and Broadway has been peculiarly the prey of miscreants, several dozen bulbs having been carried off from the structure within the past week. Inasmuch as the lamps cost anywhere from 60 cents apiece upward the loss of a score or so at one swoop constitutes a noticeable item in the expense of upkeep of the sign for the company.

"We believe that misguided youngsters about the city are the cause of the lamp thefts," said Mr. R. A. Brian, of the Federal system in Louisville. "One or more of these youthful burglars shins up the framework of the sign and drops incandescent lamps to his comrades below. The police have a hard time coping with the juveniles, so we are figuring upon the preventive method of erecting the signs upon such a high framework that ordinary climbing efforts will be defied. That will mean considerable extra cost for installation, but we are obliged to put a stop to our losses from theft."

CONTRACT ORDER ROUTINE.

In large electric-service companies where a formidable number of contracts, orders, discontinuances and changes have to be handled every day the routine of handling this large volume of business becomes of considerable importance. It is of interest to note that the Commercial Section of the National Electric Light Association has appointed a committee, known as the contract order routine committee, to make a study of this subject and point out if possible where a saving of time may be effected in handling a large volume of routine work of this character.

Mr. [illegible] L. Jones [illegible] of the [illegible] Illuminating Company of Brooklyn [illegible]. A recent change has been put into effect in the contract department of the [illegible] Company of Chicago [illegible] which the work of handling contract orders is expedited to a marked degree. An effort is now made to give service to a new customer on the day on which the order is placed, provided the company's mains are on the street where the customer's premises are located. This is done by waiving an examination into the credit of the applicant where the company has good reason to believe that the new customer is a reputable person. The connection is made at once, and the investigation as to credit, requirement of a deposit, etc., is made afterward. In a very few cases it is found necessary to discontinue the service, but the percentage of unsatisfactory customers secured by this quick-order method is very small.

COSTS OF OPERATING INTERNAL-COMBUSTION-ENGINE PLANTS.

At the recent meeting of the American Society of Mechanical Engineers at New York Mr. H. R. Setz, of Warren, Pa., presented figures comparing the operating and investment costs of various types of internal-combustion-engine plants. These figures consider the load at which the equipment is operated, on a basis of 4500 hours per year.

[illegible] OF INTERNAL-COMBUSTION-ENGINE PLANTS.

	PRODUCER PLANT			[illegible]			[illegible]			[illegible]		
	[illegible]	Three-quarter Load.	Half Load.	[illegible]	Three-quarter Load.	Half Load.	[illegible]	Three-quarter Load.	Half Load.	[illegible]	Three-quarter Load.	Half Load.
1 Fuel per hp-hour	1.25 lb	1.5 lb.	1.8 lbs.	10 cu. ft.	12 cu. ft.	15 cu. ft.	1 lb.	1.25 lb.	1.6 lb.	0.50 lb.	0.55 lb.	0.60 lb.
2 F[illegible]	[illegible]	[illegible]	[illegible]	45,000 cu. ft.	54,000 cu. ft.	67,500 cu. ft.	643 [illegible]	803.5 [illegible]	1028.5 [illegible]	[illegible]	[illegible]	[illegible]
[illegible]		$[illegible]			30 cents per 1000 cu. ft.			[illegible]			3 cents per gallon	
[illegible]	[illegible]	$[illegible]	$[illegible]	$13.50	$16.20	$20.25	$[illegible]	$[illegible]	[illegible]	[illegible]	$[illegible]	$11.[illegible]
[illegible] hour.		[illegible]			0.25 cent			0.25 cent			0.30 cent	
6 Cost of attendance per year		[illegible]			$11.25			$11.25			$13.50	
[illegible]		0.006 pint			0.006 pint			0.006 pint			[illegible]	
[illegible]		$[illegible]			$[illegible]			[illegible]			$0.98	
[illegible]		[illegible]			[illegible]			[illegible]			[illegible]	
[illegible]		$[illegible]			$0.90			[illegible]			$[illegible]	
11 [illegible] 4, 6, 8, and 10	[illegible]	[illegible]	[illegible]	$2[illegible]	$2[illegible]	[illegible]	[illegible]	[illegible]	$[illegible]	$2[illegible]	$2[illegible]	$26.[illegible]
12 Saving by Diesel engine	[illegible]	[illegible]	$[illegible]	$[illegible]	[illegible]	[illegible]	$[illegible]	$[illegible]	$[illegible]			
13 Interest, depreciation and maintenance respectively in percent of investment		[illegible]			[illegible]			[illegible]			[illegible]	
14 A[illegible] per hp, the yearly fixed charges will be		$[illegible]			$12.00			$12.00			$15.20	

The price of oil quoted for the Diesel plant is probably high, as many of these engines are operating on fuel purchased for less than 3 cents per gallon. As was pointed out, the Diesel engine's economy gains with long-hour operation, since its high initial cost and interest charges are then offset by its operating economies.

EXAMINING SOLICITORS TO ASCERTAIN THEIR GENERAL QUALIFICATIONS.

The Edison Electric Illuminating Company of Brooklyn has just held a written examination for its outside selling force in order to advise the outside salesman of some things it is necessary for him to know in the conduct of his business and also to ascertain the salesman's knowledge on the subjects covered by the questions asked. Two hours was allowed for the examination and every outside salesman was obliged to take it. Incidentally the examination also gave information on the general qualifications of the sales force of the company. Some of the requirements made of the general salesmen were as follows: "Note on the map attached the boundaries of your district." "Mark by a full black line on the map all of the direct-current lines in your district." "Mark by a dotted line on the map all of the alternating-current lines in your district." "Give name of owner and address of every private plant within your district, whether oil, gas or steam, of less than 50 hp." "Given an installation of 150 50-watt lamps burning five hours every business day, state the best form of contract and compute the monthly bill giving the rate earned."

Three of the requirements from the power salesmen were as follows: "Note on the map attached the boundaries of your district." "Give name of owner and address of each private plant within your district, whether oil, gas or steam, over 50 hp." "Given an installation of two 5-hp, three 10-hp and one 50-hp motor, with a load factor on the complete installation of 40 per cent and a maximum demand of 60 hp, figure cost of service for a twenty-five-day period on a maximum-demand power contract and the net rate earned."

Salesmen in the new installation bureau were asked for statements, of which the accompanying are typical: "Give cost per hour of burning an open-flame gas jet consuming 4 cu. ft. of gas, with gas at 80 cents per 1000 cu. ft." "Give cost per hour of burning a standard erect Welsbach mantle; also an inverted Welsbach mantle." "Give cost per month of burning two 25-watt tungsten lamps with energy at 10 cents per kw-hour, including cost of lamps, the rate of burning per night being five hours. In this answer give the average life in hours of the lamps and the proper percentage of this life to indicate the lamp cost for its use during the month."

ELECTRIC SIGN CAMPAIGN IN ST. LOUIS.

The campaign in St. Louis undertaken by the Advertising Men's League and others interested in electric signs to permit the installation of such signs over the sidewalks of that city to a point within 4 ft. of the curb is proceeding with unabated vigor. The present ordinance restricts the extension of signs to a limit of 18 in. from the building line, and was put into effect before the World's Fair of 1904, when many tawdry and inartistic signs projected over the sidewalks. It is pointed out, however, that since that time the art of installing and illuminating signs has made great progress, so that the electric signs of the present day are not to be judged by those of ten years ago.

It is declared that the electric signs of a great St. Louis brewery are to be found in New York and Washington, but not in St. Louis itself. The "Great White Way" of New York, Pennsylvania Avenue in Washington, the Campus Martius of Detroit and Grant Park in Chicago are cited as localities made more attractive and brilliant by electric signs. It is said that only two cities in the country, St. Louis and Washington, D. C., restrict projecting illuminated signs to less than half the distance between the building line and the curb. Washington, however, is not a business city, while St. Louis is. In New York signs are allowed to extend 6 ft. beyond the building line. In Chicago the limit is the curb. In Philadelphia electric signs are restricted to within 3 ft. of the curb, and in Boston to within 2.5 ft. Pittsburgh gives them one-half of the width of the sidewalk, while Detroit allows the liberal distance of 14 ft. In St. Louis, as previously stated, it is proposed to allow signs to extend to a point within 4 ft. of the curb.

The proposed ordinance in St. Louis also provides that the signs must be at least 10 ft. apart and that they shall not be installed in alleys. Further, they must be attached to the buildings in a secure manner by solid supports, and provision is made for inspection and supervision by the city. All signs shall be illuminated from sunset to 11:30 p. m. every night, and it is provided that there shall be an inspection tax of 2 cents a year for each square foot of the surface of signs, applying not only to signs projecting over sidewalks, but to all display electric signs of whatever description. It is not proposed to encourage the erection of signs in residence districts, but rather to illuminate the dark canyons of masonry in the "downtown" district. Other points made in favor of electric signs are that they increase the general illumination of streets without cost to the public, and also that they act as landmarks in making it more easy for strangers to find their way about.

BROOKLYN EDISON CHRISTMAS TREE.

The general public is beginning to appreciate the fact that a safe and sane Christmas may be enjoyed without

Christmas Tree in Edison Shop, Brooklyn.

imminent danger and constant fear of conflagration by the use of the decorative lighting outfit which eliminates the menacing candle and makes the tree much prettier and more artistic. In order to demonstrate the attractiveness and safety of these outfits the Edison Electric Illuminating Company of Brooklyn has for a number of years equipped a 30-ft. tree with all the appurtenances which go to delight the heart of the child at this season of the year and set it off with miniature incandescent lamps. The tree in the Edison Shop this year is shown herewith. It is fitted with 264 lamps of various colors and shapes representing fruits, flowers, stars, crosses, birds, clowns, etc., in addition to the plain red, white, blue and green bulbs. Last year the company loaned to the various churches of the city Christmas-tree outfits for their Yuletide festivals, with the result that this year these outfits are being purchased in large numbers for church and home use. The Edison Shop is also being kept open at night for the benefit of those who desire to purchase electrical gifts for presentation on Christmas.

CORRECTING CUSTOMERS' BILLS FOR POWER FACTOR.

In its new wholesale schedule of rates for electricity, which applies to customers having demands from 5 kw to 1000 kw, the Cleveland Electric Illuminating Company sets the following base power factors for loads of various sizes: 5 kw to 50 kw demand, 75 per cent; 50 kw to 250 kw, 80 per cent; 250 kw to 1000 kw, 85 per cent; above 1000 kw, 90 per cent.

These power factors are measured at periodical tests, and if the percentages obtained depart from the values stated the customer is accordingly penalized or credited, his demand as billed being obtained by multiplying his maximum fifteen-minute demand by the allowable power factor divided by the observed average power factor. Expressed as a formula

$$\text{Demand as billed} = \frac{\text{observed demand} \times \text{allowable power factor}}{\text{observed power factor}}$$

This clause protects the company against undesirable loads of very low power factor, for which its investment costs in line and apparatus capacity would not be adequately recompensed by the comparatively low energy consumption obtained.

On the other hand, the customer with a high power factor gains a corresponding reduction in his bill. In many cases a profitable investment may be made in synchronous apparatus of some kind to produce a corrective condenser action on the customer's side of his service mains. Idle rotary condensers may be installed, or a synchronous motor-generator set put into service to furnish direct current to part of the load. The advantages of adjustable-speed drive with direct-current motors in machine shops offer additional reasons for installing synchronous motor-generator sets which act to improve the power factor. One large motor user in Cleveland has increased the actual power factor of his demand to as nearly unity as the company's test instruments can register, and accordingly gets a substantial reduction on his demand charges.

Under the Cleveland wholesale schedule no customer is billed at less than 5 kw demand. The rate charges are made up of a demand element plus an energy cost as follows:

Rates per month for the kilowatt demand: For the first 15 kw, \$2.60 per kw; next 10 kw, \$2.25; next 25 kw, \$1.75; next 200 kw, \$1.55; next 750 kw, \$1.50; next 4000 kw, \$1.25.

Rates per kw-hour used per month: For the first 600 kw-hours, 3.25 cents; next 600 kw-hours, 2.60 cents; next 600 kw-hours, 2.50 cents; next 600 kw-hours, 2.40 cents; next 600 kw-hours, 2.10 cents; next 600 kw-hours, 1.25 cents; next 100,000 kw-hours, 1 cent; next 3,500,000 kw-hours, 0.50 cent.

Wiring and Illumination

THE PABST THEATRE, MILWAUKEE.

Application of Indirect Illumination to an Old Theatre Auditorium.

It is essential to the evening's pleasure of an audience assembled at the play or concert that its sensibilities shall be assailed by no jarring note of sound, vision or personal discomfort to distract from the passive enjoyment of the production. In the revision of the illuminating scheme of the Pabst Theater, of Milwaukee, a German-American playhouse, the scene of high-class concerts, opera and stock-company productions, special emphasis was laid on the elimination of all glare-producing filaments from the field of the audience's vision, and though the auditorium is of the older pattern with high ceiling, dark walls and deep-red plush chairs and carpet, a pleasing arrangement of indirect lighting has been worked out which combines good illuminating efficiency with visional comfort.

The Pabst auditorium measures 75 ft. in length, with a clear height of 60 ft. to its old-fashioned, domed ceiling, once the setting of a huge central gas chandelier. The room now receives its principal illumination from a great suspended reflector bowl 7 ft. 6 in. in diameter containing 5000 watts of tungsten lamps, the light from which is reflected upward onto a 12-ft. white diffusing disk at the ceiling (Fig. 2). This disk was required on account of the dark ceiling of the auditorium as well as the necessity of closing the old flue shown in the cross-section sketch (Fig. 1). To prevent the lamps on the front side of the bowl from being visible from the top seats of the gallery, a sheet-metal partition has been introduced bisecting the

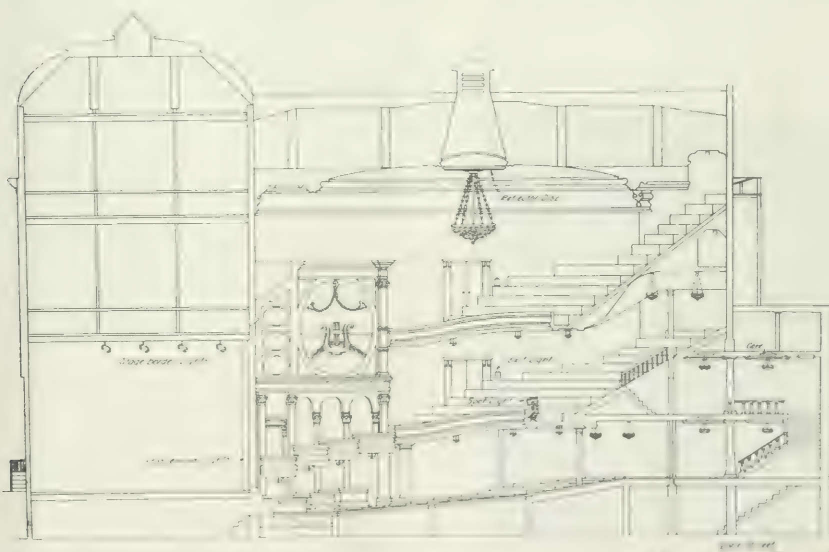


Fig. 1—Sectional Elevation of Pabst Theater, Showing Arrangement of Indirect-Lighting Units

bowl parallel to the footlights. Since the reflector bowl is nearer the balconies than the proscenium, fourteen 250-watt lamps were used on the stage side of the dividing partition, while on its balcony side there are only ten 150-watt units. These lamps are supplied through ten circuits, so that any desired degree of illumination can be obtained. The dome with its lamps can be lowered to the floor, 50 ft below, by a windlass and cable, the push plugs of the ten circuits being slipped out of their sockets so that the fixture comes away without wires or connections.

The upper tiers of boxes are supplied from indirect re-

Fig. 2—Principal Fixture in Auditorium, Containing 5000 Watts in Tungsten Lamps.

flector bowls on the balcony boxes, the low headroom requiring the design of these special fixtures with but 6-in. clearance between the bowls and the reflecting surface. Each bowl contains a single 60-watt tungsten lamp with side-type reflector, the electrical parts being cradled on insulating rests separating them from the fixture proper, which is grounded. A similar solution of close-quarter conditions was made in the case of the front row of indirect fixtures beneath the balconies which must not obstruct the view from the rear seats. Here 15 in. was available between bowl and ceiling, and to produce a graceful fixture vertical silken cords were substituted for the usual

[illegible] Each occupies the [illegible] the central portion of [illegible] to improve reflection. [illegible] two 60-watt lamps. The row of deeper bowls behind them, shown at the right

Fig. 3—Special Indirect Fixtures Over Boxes.

in the same illustration, contain four 150-watt lamps each. Their depth and position prevent any of the lamps from being seen.

Besides their use as places of entertainment, theaters have to be worked in, cleaned, repaired, etc., and for this purpose a special circuit of "working lamps" is provided at the Pabst. These are all of the direct-exposed type and are so placed as to give a good working illumination over the room, with the aid of a short "working" or rehearsing border, which can be dropped from the flies of the stage. A Milwaukee ordinance requires that a number of "panic" lamps be installed in each theater, these lamps to be used for no other purpose than in emergencies. Those at the Pabst are mounted in a row over the proscenium and are controlled from two switches connected in multiple and set

Fig. 4—Illumination of Foyer from Recessed Domes.

into recesses in the walls, one at the stage electrician's post and the other at the main entrance. Wax candles in recesses in the walls are used for exit lights and are found to be economical as well as dependable. The idea of emergency service has also been extended to the balcony stairways, two-lamp electric fixtures being used where one would be sufficient, the idea being that both lamps will not be likely to burn out at the same time.

The handsome entrance and foyer of the Pabst have also received the application of indirect lighting. The recessed

Fig. 5—Types of Indirect Units Under Balconies.

domes shown in Fig. 4 were formerly lighted by concealed lamps in the coves, but as these were insufficient a number of studded exposed units were also added. Each of the present indirect bowls in the foyer, including those over the stairway and upper level, contains four 60-watt lamps. In narow rectangular panels between the stair domes linolite units have been used. Linolite units in reflectors are also employed to light the box office window counter, a fixture being mounted on each side of the partition wall outside of the angle of vision of ticket agent and patron, thus again obtaining partly the effect of indirect illumination. Similar care has been taken in working out the lighting of the dressing-rooms, the light being projected on the face and figure of the user without visual discomfort.

Fig. 6 shows the distribution of intensities on the Pabst stage in the horizontal and vertical planes due to the footlights and border lamps. The vertical intensity is seen to fall off rapidly as the rear of the stage is approached, suggesting that this decrease in brightness may have some connection with apparent perspective and depth of stage as the actor passes from high intensity up stage into a lower intensity. Illuminometer tests with the Pabst arc spot lamp, operated from the balcony, show it to give an intensity of about 85 ft.-candles at the stage when used as a "spot light" and 2.5 ft.-candles when used as a "flood light."

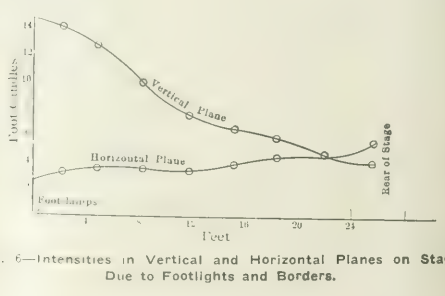


Fig. 6—Intensities in Vertical and Horizontal Planes on Stage, Due to Footlights and Borders.

The lighting fixtures in the Pabst were furnished by Mr. G. Kuehn, with the exception of the huge main inverted dome, which is a replica of the one in the Eighth Church of Christ, Scientist, Chicago (see account of indirect lighting, *Electrical World*, Oct. 7) and was furnished

by the National X Ray Company, which also supplied the reflectors used throughout the Pabst installation. Mr Hermann Beming was the architect for the redecoration, the illuminating engineers being Messrs. Vaughn & Meyer, also of Milwaukee

RECENT TELEPHONE PATENTS.

ADVERTISING SYSTEM.

The well-recognized inefficiency of the average telephone line, when considered from the standpoint of actual talking time, has led to many suggestions for the introduction of some by-product use. Such suggestions have covered a considerable field, but that now brought forward by Mr. A. Pictet, of Geneva, Switzerland, is novel.

He proposes to introduce upon the lines advertising comment which will be heard by the caller while waiting for the response of the operator and again after connection is established while waiting for the response of the called party. A patent has been granted for this system.

PRIVATE EXCHANGE FEEDER SYSTEM.

Private branch exchanges of moderate size used with common-battery systems have usually been arranged to receive their energy supply from the central-office source.

To obviate the necessity for separate feeders, Mr. C. A. Simpson, of Chicago, has arranged his circuits so that the talking lines or so-called trunks serve as battery feeders when not in use for conversation. The patent is assigned to the Kellogg Switchboard & Supply Company.

METER SYSTEM.

For measured service, where a charge is made for each completed call, economy demands for each line a counting device which may be operated from the switchboard. After various vain attempts at an automatic counter which would respond only to that sequence of voltage changes incident to an originated and completed call, the counter controlled by the operator was adopted. This counter is electromagnetic, and responds to a special current introduced at the will of the operator by pressing a push-button.

While in general practice counting may be effected only during the existence of a call from the line charged, Mr. R. H. Manson, of Elyria, Ohio, has felt that there should be means to prevent more than one count on any call. To this end he introduces a relay which locks upon the first counting impulse and remains locked throughout the connection. This patent is assigned to the Dean Electric Company.

LOCK OUT SYSTEM.

Mr. H. G. Webster, of Chicago, has obtained a patent for a lockout system which he has assigned to the Kellogg Switchboard & Supply Company. At each station a relay is so associated with the talking circuits that these are opened unless the relay be de-energized. A latch on the switch hook mechanically operates the relay armature as the hook rises, and the relay then locks in this position. Meanwhile, just at the instant of locking the latch releases its hold upon the armature. When the operator responds the potential on the line is reversed and the relay armature drops back at this moment, closing the talking circuit. This reversal and release will never occur for any station attempting to break in on a conversation.

TRUNK CIRCUIT.

Mr. C. S. Winston, of Chicago, has invented a trunk circuit for use between two two-wire switchboards. The feature of the invention lies in the arrangement of the disconnect lamp, so that the lighting of this lamp occurs after disconnection by the "A" operator, irrespective of the condition of the line to which the incoming end of the trunk is plugged. The patent is assigned to the Kellogg Switchboard & Supply Company.

LETTERS TO THE EDITOR.

Lamp and Reflector Cleaning in Machine Shops.

To the Editor of Electrical World:

Sir:—Your issue of Oct. 28 contains a short article on the subject "Cost of Lamp Cleaning in a Large Establishment." Reference is made therein to a tungsten system of lighting in an office where a large reduction in illumination was noted after a period of service without cleaning, due to dirt on lamps and reflectors. This instance emphasizes the necessity of frequent cleaning in connection with lighting systems from the point of economy, not to speak of the aid which such care renders the employees through the ease with which work can be performed on account of improved artificial lighting facilities.

In offices the accumulations of dirt are often simply a coating of light dust on the surface of lamp and reflector. In the shop, however, the dirt which gathers on lamps and reflectors is usually such as to form optical or very close contact with the glass or metal, often, moreover, being of an oily nature and reducing the light to a large extent. The importance of reflector cleaning may not appeal to the shop manager, but the losses in light due to neglect of this maintenance item are very real in their reduction of the shop economy on dark days and in the early morning and late afternoon hours throughout the winter. Actual measurements in an average shop have shown losses of light equal to 40 and 50 per cent when the systems have been allowed to go for three or four months without cleaning.

The point, however, on which the writer desires to lay special emphasis is the fact that entirely practical methods have been developed for taking care of reflector washing in large factory-lighting systems. It has been found that on an average about 3 cents will cover the entire cost of removing, washing, drying and reinstalling a soiled glass or metal reflector even under the rough conditions surrounding work of this kind in the factory. When distributed, for example, over two months this expense becomes very small indeed in terms of the hours of service and is an item fully warranted in connection with the lighting operation and maintenance.

This work may easily be developed in connection with the other items involved in the shop-lighting upkeep, and when it receives careful and systematic attention it is readily accomplished. In one factory small installations of tungsten lamps are cleaned at fairly brief intervals by the aid of small hand racks, on which the soiled reflectors are carried to a central washing station. These racks are filled with a dozen or more clean reflectors, which are taken to the location in question. The soiled reflectors are removed and the clean reflectors substituted at once, after which the soiled reflectors are returned to the lamp department for washing and temporary storage until the next installation is in need of cleaning.

The development of practical methods for systematically maintaining shop-lighting systems should be encouraged and may often be the means of producing satisfactory results from what might otherwise have been an unsatisfactory condition of affairs.

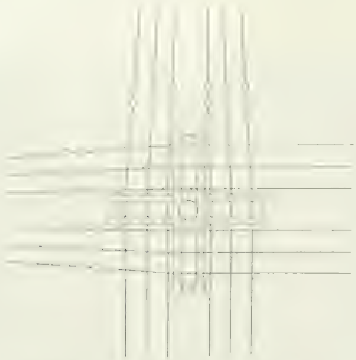
East Pittsburgh, Pa. C. E. Clewell.

Heavy Feeder Construction.

To the Editor Electrical World:

Sir:—In the issue of Nov. 4 an article and sketch appeared giving the method of construction used on the lines of the Cincinnati Union Gas & Electric Company for making turns in No. 2-0 feeder lines. There is no doubt that this construction will lengthen the life of pins, since it

practically eliminates them, but it is open to one criticism, namely, that the strain is all thrown upon the cross-arm, and even though the ends of the arms be guyed back to



Method of Making Turns in Feeder Construction

take the strain the time comes when the arms must be renewed, and for this purpose the entire construction must be torn down.

The accompanying sketch shows the construction that I have used very successfully for making turns in No. 4-0 feeder lines. Top-grooved porcelain insulators are used, and each wire is guyed separately, being insulated from the guy wire by three guy-strain porcelain insulators. As the wires on the upper cross-arm pass over all the wires on the lower arm before reaching the strain insulators, vertical jumpers are used. For this purpose stranded cable of the same area as the solid feeder has been found to work more readily, save time and make a good appearance. The cost of strain insulators to make a turn in six No. 4-0 wires will be less than $2.50. No. 4-0 solid wire being rather difficult to make up around the guy strain insulator, the end of the wire is simply looped around it and held by a wire-rope clip or U-bolt.

The lines do not have to be torn down in order to renew a cross-arm; and since the arms are under no strain except the weight of the lines, they do not have to be renewed so often, and a standard arm can be used. Moreover, the pins do not break off, as they are under no lateral strain.

While the operation is quite dangerous and not to be recommended, it is possible to renew the cross-arms in this construction without interrupting the service. An arm equipped with pins but no insulators is placed under the wires, the pins holding the wires apart. The tie wires are then removed and the temporary arm is raised, carrying the wires with it, just high enough to allow the old arm to be removed and the new one put in place.

Raleigh, N. C. C. E. D. Egerton.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Compensated Three-Phase Commutator Machines.—F. Niethammer and E. Siegel.—A mathematical article illustrated by diagrams giving the theory of the compensated three-phase commutator machine, the characteristic curve of which is that of a shunt machine ("Scherbius shunt machine"). In a second paper the authors show that this motor type can give a "series" characteristic if the rotor current be passed through the excitations winding so that the flux depends on the load at any moment. The theory of this type ("Scherbius series machine") is given with the aid of diagrams.—*Elek. u. Masch.* (Vienna), Oct. 22, Nov. 5 and 12.

Frequency Changers.—P. Bunet.—A concise review of the different types of frequency changers.—*La Lumière Elec.*, Nov. 25.

Lamps and Lighting.

Universal Portable Photometer.—Clayton H. Sharp and Preston S. Millar.—The authors refer to their standard universal photometer described in the *Electrical World*, Jan. 25, 1908. They have now designed a much smaller instrument which is intended especially for field work on account of its greater portability. In some respects it is slightly less accurate than the standard instrument. The length is 14.5 in. (37 cm) and the cross-section 2.5 in. by 2.5 in. (6.3 cm by 6.3 cm). The plan of the small model is illustrated in Fig. 1, showing the essential features. *P* is the reversible tube, bearing test plate and diaphragm; *T* is the elbow tube; *G* and *G* are absorbing screens; *S* is the photometric device, *D* the diffusing glass, *I* the interrupter for the telephone circuit, *L* the comparison lamp carriage, *R* an adjustable rheostat, *W* a screw-driven cursor on slide wire in bridge, *K* the knob for the comparison lamp drive. The troublesome feature in all small portable photometers is the comparison lamp. In the new design the large resistance-temperature coefficient of the tungsten filament is taken advantage of. The lamp is connected so as to constitute one arm of a Wheatstone bridge. The other arms are composed of small coils of manganin wire. Between one lamp terminal and one coil a portion of this wire is extended to form a slide wire, and a scale is arranged to indicate the position of the cursor on this wire. The coils have such a resistance that when the lamp is receiving its proper current its resistance will be such that the balance point of the bridge will come within the range of the cursor on the slide wire. Any change in the current through the lamp is accompanied by a corresponding change in its resistance and the bridge is thrown out of balance. As a convenient means of detecting the point of balance of the bridge, a low-resistance telephone receiver is used. In series with the receiver is an interrupter consisting of a wheel into the periphery of which pieces of insulating material have been set at frequent intervals. The two bridge arms which are in parallel with the lamp and its corresponding arm have approximately five times the resistance of the latter, so that the amount of additional current which they require

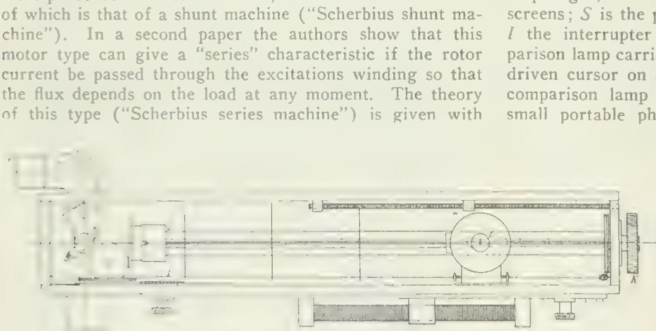


Fig. 1—Portable Photometer

produces [illegible] The telephone receiver is provided with a head band so that both hands are left free for the operation of rotating the contact wheel and adjusting the external rheostat until a condition of silence in the telephone is attained. The adjustment of current in this way can be made to within about 1 milliampere (one-third of 1 per cent), which is substantially the limit of accuracy of a high-grade ammeter. Therefore the measurement involves in the shape of apparatus external to the photometer only the telephone receiver, which can be readily carried in the pocket if desired. The optical system has been somewhat changed. In place of the modified Lummer-Brodhun prism as a photometer screen, a circular mirror of thin glass, silvered on the back, with a small round hole cut in the silvering, is employed. The mirror is placed at an angle of 45 deg. to the axis of the box and is viewed through the eyepiece in the ordinary way. A single small storage cell or two dry cells give the current for the lamp. The calibration and the use of the instrument are described.—*Illuminating Engineer*, December.

Arc-Lamp Electrodes.—A note on a recent British patent (No. 17,723, Nov. 23, 1911) of the British Thomson-Houston Company (General Electric Company of this country). In the practice of mixing a steadying material with the lighting material for steadying the arc it is found that the arc takes up the former before vaporizing the latter, with the result that the proportion between the amounts of these vapors in the arc does not remain constant, thus producing a wide variation in either the intensity or the color of the light, or both, from the materials. According to the present invention, which is particularly applicable to alternating-current working, the light-giving material is introduced into the arc from one electrode during the first half period of the current, while the steadying material is introduced during the second half period from the other electrode, thereby fattening and giving conductivity to the arc. In one form titanium carbide is inclosed in a thin iron shell, while the other electrode is made of carbon impregnated with potassium biborate and then dried.—Lond. *Elec. Eng'ing*, Nov. 30.

Train Lighting.—R. T. Smith.—A paper read before the (British) Institute of Civil Engineers on "the electric lighting of railway trains and the brake-vehicle method." The method of train lighting considered in this paper is that in use on the Great Western Railway, where axle-driven generators and storage batteries, controlled by an automatic regulator, are installed in some of the passenger cars. The lamps throughout the train receive energy from these equipments, which work in parallel, as is usual with systems of electric supply at constant voltage. In general, apparatus and batteries are installed on brake vehicles only, several other cars receiving energy from them under complete automatic control as to voltage. There is a consequent appreciable reduction in the initial cost and in the cost of upkeep of plant, with what is of chief importance from the railway point of view, greater reliability.—Lond *Electrician*, Dec. 1.

Generation, Transmission and Distribution.

Manchester.—An abstract of last year's financial account of the municipal electric station of Manchester, England. The sales of energy increased by 12,000,000 kw-hours over the preceding year. The total number of kw-hours generated during the twelve months was 115,400,446, of which 83,308,848 were sold and 8,843,846 used on the works. The quantity lost in distribution was, therefore, 23,247,734 kw-hours, or 20.15 per cent of the total generated. The corresponding figures for the two preceding years were 18.10 per cent and 16.96 per cent respectively. The steady increase during the last year or two is probably accounted for by the greater proportion of the output now being transmitted as high-tension energy from the Stuart Street [illegible] The total [illegible] kw-hours [illegible] private consumers for lighting, heating and motor service, 167,001 for public lighting and 28,423,527 for the tramways. The maximum load recorded during the year was 28,210 kw for lighting and stationary motor service, and 9310 kw for the traction supply, a total of 37,520 kw. The load factor was 25.35 per cent, as against 24.18 per cent in the previous year. The total rating of the generating plant installed was 47,300 kw. The total costs, excluding capital charges, have decreased from 1.22 cents to 1.08 cents per kw-hour sold, this decrease being spread over several items. The cost of fuel is 0.40 cent per kw-hour sold. The new storage battery installed contributes considerably to the reduction in the cost of production. The total cost, including capital charges per kw-hour sold, was 2.04 cents, against 2.28 cents in the preceding year. The total revenue per kw-hour sold was 2.32 cents; hence there was a surplus balance of 0.28 cent per kw-hour. Separate figures are given for the generating cost in the three stations in the city. These figures are of interest as indicating the economies possible in a large station. Thus salaries and wages at the Stuart Street station total only 12 per cent more than at the other stations, although the output is nearly three times as great.—Lond. *Electrician* Nov. 24.

Swiss Water-Power Plant.—Freyer.—A profusely illustrated description of the Loentsch water-power plant in Switzerland, which is equipped with six Pelton wheels coupled to 5250-kva, 8000-volt, 50-cycle, three-phase generators. The transmission emfs are 8000, 27,000 and 48,000 volts. The plant is working in parallel with the Beznan power plant, at a distance of 85 km (51 miles). The Beznan plant is uniformly loaded, while the Loentsch plant supplies the energy for peak loads.—*Elek. Kraftbetr. u. Bahnen*, Nov. 4.

Electric Supply for Christiania.—A note stating that a special committee appointed to consider the question of supplying Christiania in Norway with electric energy has recently issued its report, and recommends the exploitation of the waterfalls belonging to the city, and the acceptance of an offer from the Vamma Power Company to supply 25,000 hp at a price agreed upon. The transmission installations proposed are to have a rated equipment of 56,000 hp, and at the expiration of the contract time they will pass into the possession of the town, in the year 1948, for a sum of $1,200,000, which sum the town will hand over to the company free of interest until 1919 and after that time subject to an interest of 4.5 per cent. It is estimated that the town's waterfalls in the River Glommen will yield 28,000 hp.—Lond. *Electrician*, Dec. 1.

Eddy-Current Brake.—J. M. G. Schaeffer.—An account of an experimental investigation of an eddy-current brake of the Tasqualini system. The analogy between the induction phenomena in the brake disk and in the short-circuit armature of an induction motor is shown. The author concludes that copper is unsuitable for a brake disk and that bronze is more suitable. He further discusses the occurrence of a certain undesirable axial pressure and means of avoiding it.—*Elek. u. Masch.* (Vienna), Nov. 12.

Refuse Destruction.—E. de Fodor.—A review of the present status of refuse destruction in connection with the generation of electrical energy. This method has made progress especially in England. The author thinks that most of the cities of Continental Europe can count on the average on 1 kg of steam per kilogram of refuse burned.—*La Lumière Elec.*, Nov. 18.

Traction.

Mine Locomotives.—G. Bright.—An article on the determination of the weight and equipment of mine locomotives.—*Elec. Journal*, November.

Installations, Systems and Appliances.

Automatic Reversible Battery Boosters.—R. Rankin.—

[illegible] paper read before the (British) Institution of Electrical Engineers. A short account is first given of the uses and advantages of a battery-booster plant and the savings likely to be effected by its employment. Boosters are classified under three main divisions. Under class A are described the plain differential Pirani, Crompton and Lancashire systems. Under class B are the Highfield and E. C. C. systems. The advantages of boosters controlled by external regulators over those of the diverter type are briefly mentioned. Such boosters belong to class C, which includes the Entz, B. T.-H., Taylor, Scotson, Tilney, Thury and Brown-Boveri boosters, while the systems of Lincoln and Bijur are also referred to. Some methods of using a battery-booster plant are then considered more fully, and several methods of adapting such a plant to the control of winding gear are described. The employment of batteries on alternating-current systems is next treated, while finally some figures are given relating to the plant at the Gary Steel Works, and a short description follows of the Hucknall colliery plant.—Lond. *Electrician,* Nov. 24.

Cooking by Gas and Electricity.—F. Meurer.—A very long paper presented before a society of gas engineers. The author criticises the conclusions of Ritter and Dettmar, which had been in favor of electricity, and describes a series of experiments from which he draws the following conclusions. The latest electric cooking apparatus and the latest gas cookers were used. The comparison shows that the heat requirements with electric cooking are about 65 per cent of those for gas cooking. Hence the costs of electric and gas cooking will be the same if gas costs 2.5 cents per cu. m (or 71 cents per 1000 cu. ft.) and electricity 0.74 cent per kw-hour; if gas costs 3 cents per cu. m (or 85 cents per 1000 cu. ft.) and electricity 0.88 cent per kw-hour; if gas costs 3.5 cents per cu. m (or 99 cents per 1000 cu. ft.) and electricity 1.03 cent per kw-hour; or if gas costs 4 cents per cu. m (or $1.13 per 1000 cu. ft.) and electricity 1.18 cents per kw-hour. Hence, he concludes that in most cases the electrical energy would have to be sold at a rate below cost of generation in order to make electric cooking as cheap as gas cooking.—*Journal f. Gasbeleucht.* Nov. 25.

Electric Heating.—C. A. Rossander.—A review of the present status of electric heating with special reference to the design of electric-heating apparatus and the different types of electric resistors used in them. The author also discusses at some length the tariff question and thinks that the central stations should not be expected to make all the concessions, but that the subscribers themselves should arrange the use of the heating apparatus in such a way that they would not use these appliances during the hours of the day that bring the peak load on the central station.—*La Lumière Elec.* Nov. 25.

Electric Installation of a Country House.—F. H. Davies.—An illustrated description of the electric installation in a country house some miles out of London. The special feature is that energy for lighting, heating and cooking is derived from an automobile engine without in any way interfering with the regular use of the car. The generator is a 5.5-kw machine driven by the automobile engine at 1650 r.p.m. by means of a 13-in. special split pulley fixed to the shaft on the engine side of the clutch. The length of the drive is 6 ft. A battery of 200 amp-hours rating is used. As there is ample margin in the generating and battery plant, it is proposed to extend the use of the equipment to water pumping and lawn mowing. A double-voltage supply is provided, 50 volts being used for lighting and the cooking apparatus being operated at 70 volts off the whole battery. Three bare overhead wires, about 35 ft. long, transmit energy to the house, where the supply is tapped off at 50 volts or 70 volts, as may be required. The total cost of installation has been $500.—Lond. *Elec. Review,* Dec. 1.

Wires, Wiring and Conduits.

Phasophone Control of Insulation Resistance of Three-Phase Networks.—H. Osten.—To prevent the break-down of a network the continuous control of the insulation conditions are of great importance. The author describes an instrument, called the phasophone, devised to detect the development of an insulation failure in its incipiency. By localizing the fault it is then possible to repair the fault before the break-down actually occurs. The connections of the phasophone are shown in Fig. 2. C and C are two condensers. Between 1 and 2 is inserted a telephone T

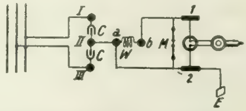


Fig. 2—Diagram of Connections.

in parallel with a micrometer spark-gap for protection. Between a and terminal 1 there is a non-inductive resistor w of about 1 megohm resistance, while terminal 2 is connected to earth E. To investigate the condition of the line, one has to listen in the telephone for at least ten minutes. The sound heard is uniform and quiet as long as the network is in good condition. Faults, sparks, poor operation in parallel of machines, poor contacts, etc., are recognized by a change in the telephone sound.—*Elek. Kraftbetr. u. Bahnen,* Oct. 24.

Cables Connected with Overhead Lines.—J. Grosselin.—The author investigates how far the manufacturers of cables can satisfy the regulations in force in the different countries. The question of the safety coefficient is a debatable one. It seems that the safety coefficient required in France is too high, since in Germany and Italy the regulations are less rigorous. The author thinks that it would be good to adhere to the formula given by Marchena at the Marseilles congress of 1908 for alternating-current cables of 25,000 volts to 50,000 volts, while beyond that the coefficient 1.5 should be adopted. For direct-current cables the coefficient 1.25 would be sufficient. The author discusses especially the question of dangerous rises of voltage in cables connected with overhead lines and sums up briefly some of the protection devices used in such cases.—*La Lumière Elec.,* Nov. 18.

Neutral Point of Alternating-Current Networks.—F. Leprince-Ringuet.—The author discusses mathematically the problem how to illustrate graphically the changes of the neutral point of an alternating-current network due to the variation of one of the elements of the network, especially when the insulation resistance of one of the poles with respect to earth is varied. He shows that the graphical solution is given in all cases by circular diagrams. The result of experiments is in agreement with the theory.—*La Lumière Elec.*—Nov. 25.

Electrophysics and Magnetism.

Vacuum Oscillation Valves.—R. S. Willows and S. E. Hill.—The rectifying action of vacuum oscillation valves depends upon the fact that the glowing filament emits negative ions readily. If this emission can be increased, the sensitiveness of the valve should also rise. This can be effected by having a layer of, say, incandescent lime on the filament. The effect is increased by having a substance such as aluminum phosphate giving positive ions on the second electrode. The authors investigate the effect of a polarizing emf on this arrangement. Such an emf is beneficial or disadvantageous according to its value. The effect is discussed and explained.—Lond. *Electrician,* Dec. 1.

Direct Current and Alternating Current in the Same Circuit.—W. Vieweger.—A simple experimental proof for

demonstration purposes that a direct current and an alternating current can be at the same time in the same circuit. The method depends on the use of three instruments, of which a Weston direct-current voltmeter measures only direct current; a Ferraris voltmeter, operating on the rotary-field principle, measures only the alternating current, and a hot-wire instrument measures both.—*Elek. u. Masch.* (Vienna), Oct. 22.

Inductance of Linear Conductors.—A. C. Jo[illegible] and A. F. Burgess.—A continuation of their illustrated paper on the experimental determination of the inductance of linear conductors.—Lond. *Electrician*, Dec. 1.

Electrochemistry and Batteries.

Storage Batteries.—H. Beckmann.—A review of the present status of stationary and portable storage batteries.—*La Lumière Elec.*, Nov. 11.

Alkali Accumulator.—J. A. Montpellier.—A comparison of the Edison storage battery and the Gouin battery, both of which use an alkaline solution and iron and nickel electrodes. The author's conclusions favor the Gouin battery.—*La Lumière Elec.*, Nov. 25.

Units, Measurements and Instruments.

Measuring the Slip of Induction Motors.—E. Schneckenberg.—If a disk rotates synchronously with the rotor of an induction motor and a stationary pencil is pressed against the disk in such a way as to plot a spiral line on it, it is possible to count the number of complete revolutions c which the disk has made in a certain time. If now in some way a special mark is made in this spiral line once during every period of the alternating current and if there are b such marks while the disk has made c revolutions, then the slip in per cent is $(1 - cp/b) \times 100$, where $2p$ is the number of poles of the motor. Andrault uses as disk a circular copper sheet covered with chemically prepared paper (for instance, impregnated with potassium iodide and starch). As pencil he uses an iron rod, which is connected with one terminal of the motor, while the other terminal is connected with the copper disk, an incandescent lamp being placed in series as a resistor. By electrolytic action the potassium iodide is decomposed and the iodine acts on the starch, giving a blue color. In this way a blue line is obtained on the paper. But in the moments when the current wave passes through zero there is no decomposition and the paper is not colored blue in these moments. Hence twice in every complete cycle of the alternating current there is a white mark. If there are b such white marks for c revolutions of the spiral the slip is $(1 - 2\,cp/b) \times 100$ per cent. Slip-meters of this kind can be made as simple and convenient in construction as speedmeters, and, like the latter, they are simply pressed against the end of the motor axle. By using simultaneously a slip-meter and a revolution meter the frequency can be found. It is $bn \div (120\,c)$ periods per second, if n is the number of revolutions per minute. The author describes a very simple construction of such a slip-meter.—*Elek. Zeit.*, Nov. 16.

Alternating Current Motor Meter.—W. Rogowski.—An article illustrated by diagrams on the phenomena in the braking disk of an alternating-current motor meter. By means of Maxwell's fundamental equations the author discusses the current distribution in the motor disk when at rest and calculates the torque, the Joulean loss and the reaction of the motor disk.—*Elek. u. Masch.* (Vienna), Nov. 5.

Two-Wattmeter Method.—D. H. Ogley.—An article on the two-wattmeter method of measuring power in three-phase circuits. With the aid of formulas and diagrams the author shows why the readings of the two meters may vary considerably although they are connected in a precisely similar matter to the supply.—Lond. *Elec. Review*, Dec. 1.

Compass.—A fully illustrated description of the Anschütz gyro compass exhibited by a British firm at the recent electrical exhibition in London.—Lond. *Elec. Review*, Dec. 1.

Telegraphy, Telephony and Signals.

[illegible].—E. Sauvage.—In a former article the author has compared the shunt connection of the microphone with the series connection. In the present article the author discusses the general conditions under which the Wheatstone-bridge arrangement can be used in telephone transmission. He determines mathematically the effect of this method of connection on the efficiency of transmission and the best values to be given to the resistances in order to get as high an economy as possible. The results of his analysis are given in a series of diagrams.—*La Lumière Elec.*, Nov. 11.

Wireless Telegraphy.—A fully illustrated description of the wireless telegraph station in Nauen, Germany, using the Telefunken system.—Lond. *Electrician*, Dec. 1.

Distant Vision.—A. A. Campbell.—His illustrated presidential address to the (British) Röntgen Society on distant electric vision. The proposed system is based on the illumination produced on a phosphorescence screen in a vacuum tube by the impact of a pencil of cathode rays deflected by a magnetic field.—Lond. *Electrician*, Dec. 1.

Miscellaneous.

Association of Consulting Engineers.—An editorial on the proposed formation of an association of consulting engineers in Great Britain. One of the chief points of the policy is "the restriction of membership to those qualified by experience and freedom from trade ties to act as consultants in unbiased fashion."—Lond. *Electrician*, Dec. 1.

Book Reviews.

Cyclopedia of Telephony and Telegraphy. Four Volumes. Chicago: American School of Correspondence. Price, $12.80.

The first volume of this set of elementary textbooks on telegraphy and telephony as employed on the North American continent treats of telephony under the heads of fundamental principles, substation equipment, party-line systems, protection and manual switchboards. Volume II also deals with wire telephony topics, namely, manual switchboards, automatic systems, power plants and buildings, special-service features, telegraph and railway work (telephonic). The third volume discusses the following telephonic subjects: Line construction, engineering and maintenance, electrical measurements and storage batteries. The fourth volume takes up the electric telegraph, wireless telegraphy and telephony, the elements of electricity, the electric current, the telautograph and the telegraphone.

The text of these books is clear and well edited. The illustrations are excellent and abundant. The books are particularly strong on the practical, constructive and descriptive sides. Switchboard mechanisms, both manual and automatic, are particularly well treated. On the other hand, the chapters on electrical measurements are several grades ahead of the rest of the work, in regard to the preparation required for their proper study. The books will be especially useful to students of telephonic and telegraphic materials, apparatus and systems as used in the United States.

Electric Crane Construction. By Claude W. Hill. Philadelphia: J. B. Lippincott Company. 308 pages, 366 illus. and 23 tables. Price, $8.

A good textbook on electric cranes, incidentally containing much valuable engineering information on the mechanical features of cranes in British construction and service. An excellent feature of the work is the large number of

of actual working cranes. The book would be valuable merely as a compendium of dimension drawings of these constructions. The chapters relate successively to the following subjects: Overhead cranes, portable jib cranes, derrick cranes, transporters, sheer legs, revolving cantilever cranes, cableways, power required for crane-driving, starting torque and acceleration, design of crane structures, design of machinery, brakes, toothed gearing, hooks, ropes and chains, design of magnets, motors, controllers and collectors, crane installations. The book will be of value to both mechanical and electrical engineers, as well as to factory engineers, besides being a textbook on crane construction

Statistik der Electricitätswerke in Österreich. Vienna: Electrotechnischen Verein. 108 pages. Price, 3.80 kronen.

This work contains very complete statistics of all central stations operating in Austria and also those under construction. It also gives a summary showing their development in recent years. The data are arranged in a practical way and in such a manner that any information desired can be found easily.

Statistics are given for only those stations that sell electric energy for public purposes or to private consumers. Isolated plants and traction plants are not included. There were 740 stations with an aggregate rating of 378,736 kw (against 675 stations with 318,614 kw in the preceding year). Two hundred and eighty-seven stations were municipal; 453 were owned by private persons or corporations. Of these stations 332 were operated by water-power, 129 by steam-power, 77 by gas, 92 by water and steam, 54 by water and gas, 19 by steam and gas, 11 by steam, water and gas, and 26 bought electricity in bulk; 425 stations used overhead wires, 21 cables, 216 cables and overhead lines, while no information about this point was available from 78 stations.

New Apparatus and Appliances

ELECTRIC STEERING GEAR FOR SHIPS.

Among all the varied applications of electricity on board ship one of the belated substitutions of motors for steam power is in the steering gear itself. The clumsy and inefficient steam-rudder mechanism has heretofore been standard in marine construction, but several battleships of the United States Navy are now equipped with electric steering gear and similar apparatus is being installed on some new merchant vessels.

The application of electricity to the steering problem has made possible a number of simplifications and niceties of control which the practical mariner has not been equally quick to appreciate. For example, the pilot accustomed to his huge wheel looks doubtfully on the little electric tiller handle to which the 20,000-ton battleship responds like a rowboat.

Two types of electric steering gear are employed. In the first and simpler a reversing switch operates the rudder motor either to port or starboard until the desired angle is reached as reported by an independent indicator in front of the helmsman. With the other system, known as the "follow-up" gear, the steering wheel is moved over to the desired angle and the rudder follows until this position is reached as in the familiar steam gear. This latter "follow-up" system, of course, involves greater complexity of wiring and mechanical connections, and it seems likely that the first method will gain favor as mariners become more accustomed to electrical steering.

The accompanying illustration shows the tiller switch used by the Cutler-Hammer Manufacturing Company, Milwaukee, in connection with its electric steering gear for naval and merchant vessels. The controller contacts handle only small auxiliary currents which actuate the magnet contactors of the rudder motor. Throwing the handle to port causes the rudder to move in that direction as long as the switch is depressed, the advancing position of the rudder being reported back to the pilot by an indicator as already mentioned. Two speeds are provided in each direction, one for ordinary steering and the other for quick rudder movements.

The speed requirements made by the United States Navy stipulate a rudder swing from hard aport to starboard in twenty seconds. The rudder has a maximum swing of 35 deg. in each direction, at the end of which travel limit switches shut off the motor if the helm handle is still held off center. The controller is also provided with a deadman's handle and returns to its neutral position when released. Several such controller helms as that shown can be placed in an equal number of locations about the vessel, since only a few small control wires are required to connect them with the steering gear. Besides this possibility of steering from any one of several positions, the electric gear operates much more rapidly than the steam apparatus. It

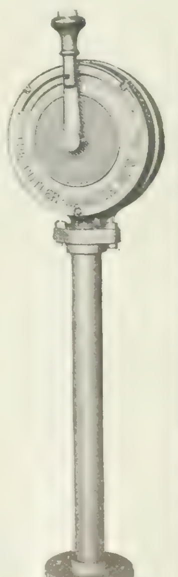


Fig. 1—Electric Steering Controller on Bridge of "Texas."

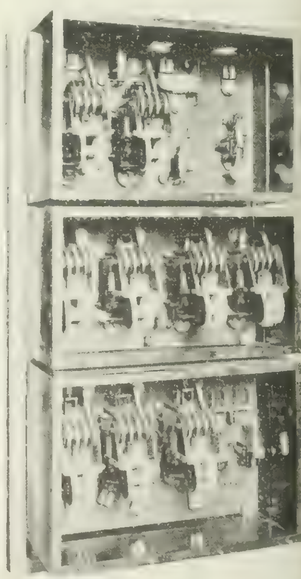
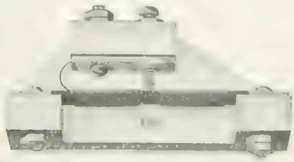


Fig. 2—Main Steering Control Panel and Contactors in Steering-Engine Room on "Texas."

also occupies less space and is more efficient. A 300-hp motor-driven gear installed on one battleship replaced the 900-hp steam gear formerly in use. The size of motor required depends, of course, on the size and speed of the ship, ranging from 300 hp for the large vessels down to 50 hp for the slower merchant steamers.

NEW ONE-LAMP FLASHER.

A simple "motorless" lamp flasher recently produced by the Phelps Manufacturing Company, 265 Jefferson Avenue, Detroit, Mich., is illustrated herewith. This small flasher, which is only 2⅝ in. in greatest dimension and weighs but 1½ oz., is of the thermostat type. It is a one-lamp flasher



New One-Lamp Flasher.

having a rating of ½ amp. The expansion bar of the thermostat is of aluminum, provided with shunt winding and platinum contacts. A lock nut is provided for holding the adjustment permanently, and both ends of the monometallic thermostat are securely bolted so as to prevent vibration. The non-metallic parts are of porcelain. This flasher is intended for small window signs, novelties, Christmas-tree lighting and the like.

INSULATED SCREWDRIVER.

The friction-drive screwdriver made by the Benjamin-Sellar Manufacturing Company, 559 West Quincy Street, Chicago, is now available in insulated form for electricians. The entire blade, with the exception of the point, is covered with hard-rubber tubing molded securely into the handle. It is asserted that the insulation has been tested to 11,000 volts, but the manufacturer takes pains to say that linemen working on high-potential circuits should not depend entirely upon the insulation of any tool unless they are well insulated from ground. The insulated portion of the blade is ⅜ in. in diameter throughout its length, and blades may be 3 in. or 6 in. long. The tool is of the patented friction-drive type of screwdriver, provided with friction cap which moves with the hand, engaging the handle, but returning in reverse movement with the motion of the hand, without backing the screw.

AUTOMATICALLY CONTROLLED ELECTRIC RANGE WITH HEAT STORAGE.

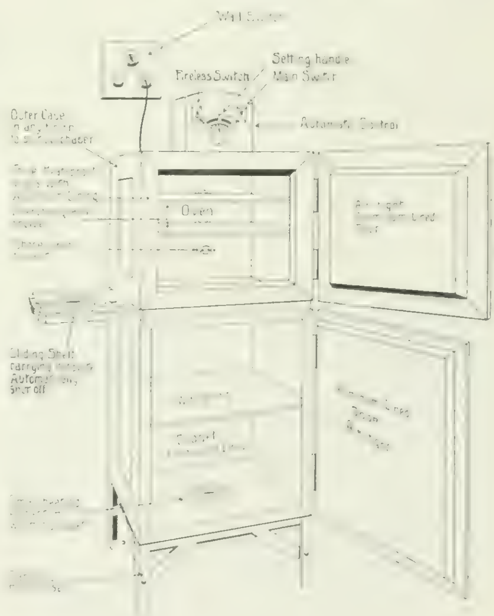
An electric range which possesses many novel features and which should appeal to the housewife because of the convenience of its arrangement and the automatic control of the heat, not to mention its conservation, is shown herewith. The illustration tells its own story. The cupboard-like arrangement has an oven, at a workable height from the floor, which is heavily lagged so as to store the heat. The inside of the oven is fitted with shelves, upon which the articles to be cooked are placed and in which the heating elements are embedded. The shelves are interchangeable and reversible, and are placed in circuit by merely pushing them in the oven as far as they will go. By slightly withdrawing any of them so that it does not touch the socket in the back of the oven it becomes an ordinary shelf. By this means the oven may be heated at special points or the heat may be distributed evenly over the whole oven.

The interior is lined with aluminum, which, retaining its luster, reflects the heat back to the food. The oven door fits air-tight and, being lagged, prevents any escape of heat through the door. Underneath the oven at the side and, although not shown in the engraving, also at the front are sliding shelves, each of which contains a circular hot-plate. Until these shelves are pulled out from beneath the oven they are not in circuit; but when they are pulled out as far as they will go they automatically connect themselves in circuit and may be used for frying and broiling. If it is desired to employ them as ordinary shelves without heat, a switch is provided for cutting them out of circuit when in their outward position.

The heat in the oven is controlled by means of a thermostatic switch located above it, as shown, and the switch is adjustable for various temperatures. Thus when baking bread, for instance, the chart at the side of the oven indicates that a temperature of 300 deg. is required. The switch is set at that figure, and when the heat in the oven reaches the desired temperature the circuit is automatically opened.

When the food has absorbed enough heat to lower the temperature 3 deg. the circuit is again automatically made, and throughout the operation there is this automatic cutting off and switching out of the energy, so that uniform heat is obtained. Should it be desirable to shut off the energy permanently after a certain temperature is reached the dial may be set to bring this about, and, the heat being conserved, the oven is in this way converted into a fireless cooker.

Beneath the oven is a commodious warming closet. The compartment is lagged on all sides so as to retain the heat, and in addition there is a small heating element at the



Automatically Controlled Electric Range.

bottom which may be placed in circuit when desired, only a small amount of energy being required to warm the compartment. The range may be finished to match the decorations in the kitchen, although ordinarily the aluminum and nickel finish of the standard article are not incongruous. The outfit is manufactured by the Automatic Electric Cook Company, Ltd., Temple Building, Toronto, Ontario, Canada.

AUTOMATIC AUTOMOBILE LIGHTING SYSTEM.

An improved automatic electric-lighting system for automobile use has recently been developed by the Ward Leonard Electric Company, Bronxville, N. Y. In addition

Fig. 1—Automobile Completely Equipped with Electric Lamps.

to a number of other special advantages, this new system avoids the use of centrifugal governors, friction drive, automatic rheostats, additional brushes or armature windings, differential field windings, belt drive or permanent magnets. The generator is of the wound-field type, insuring superior power and efficiency. A silent chain, or other equivalent positive driving means, operates the generator from the engine shaft.

As the speed of the engine, and consequently that of the generator, rises, the generator emf becoming greater than the storage-battery emf causes an electrically operated voltage switch to close automatically, connecting the batteries to the generator. Should the generator voltage fall below that of the cell, the same switch automatically opens, preventing back-discharge of the battery.

At increased car speeds, when the generator voltage becomes so high that the charging current flowing into the battery exceeds a predetermined amount, an automatic series switch opens to insert a single step of resistance into

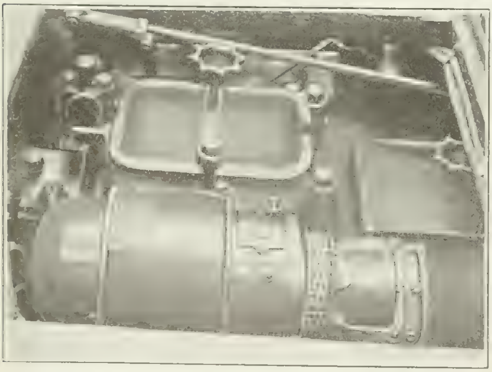


Fig. 2—Generator Chain-Driven from Engine.

the dynamo field. The result is to reduce the generator current output to a point where the switch again closes, short-circuiting the generator field resistance. This action continues intermittently in a way generally similar to that of the automatic field regulation of alternators. Thus, regardless of any high speed that the engine may attain, the charging current delivered by the generator remains between predetermined limits proper for charging. The generator is arranged to charge the battery at car speeds above 10 miles an hour.

A feature of the system is the provision of duplicate batteries, each smaller than the ordinary battery and either one of which can be thrown into circuit by a double-throw switch. While one battery is being used for ignition, the other is employed for lighting, thus insuring that the grounded ignition system and the ungrounded lighting system be kept entirely separate. The importance of this provision is realized, as a grounded circuit might "kill" the ignition system and "stall" the car, to the serious inconvenience of its occupants.

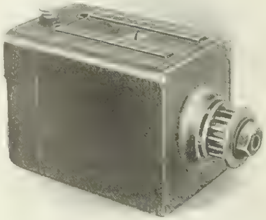
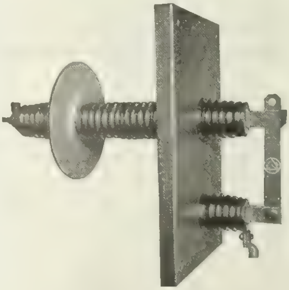


Fig. 3—Automobile Lighting Generator.

DISCONNECTING SWITCH.

The demand for an increased factor of safety in high-tension transmission systems has developed the need of station entrances which not only permit ready access to the equipment, but also incorporate a disconnecting feature, thus enabling an operator to isolate quickly a given feeder or set of busbars.

One of recent development for this service is the type of entrance tube and disconnecting switch illustrated herewith and manufactured by the Delta-Star Electric Company, Chicago. The disconnecting switch is of the combination front-and-back-connected type, the long insulator being carried back through the supporting base and in turn having mounted upon it a disk insulator. This insulator is provided with a copper core, to one end of which is attached a locking type switchblade, the other end being provided with



Disconnecting Switch.

a suitable lug, to which the incoming line wire is soldered To mount the device in position, it is simply necessary to leave a circular hole in the station wall and secure the mounting base in position by means of four expansion bolts or studs. With this combination a permanent entrance is secured and one which is proof against entrance of moisture, dust or insects.

LIGHTING OF A MODERN STORE BUILDING.

In planning details for the new store of Bonwit, Teller & Company, located at the corner of Fifth Avenue and Thirty-eighth Street, New York City, which was recently opened for the exclusive sale of women's, children's and infants' apparel, it was realized that the artificial light must be of the very best. To this end Mr. Alfonse Kaufman, consulting engineer, in co-operation with engineers of the General Electric Company, selected the intensified arc lamp, and it is claimed that the lighting is without question the most remarkable achievement in interior arc lighting to date.

The color value of the light is excellent and the artistic treatment is handsome and unique. When entering most stores illuminated by arc lamps the attention of the customer is usually diverted from the merchandise to the long row of glaring lamps. This objectionable feature is also noticeable in some recent installations in department stores where spherical incandescent lamps are suspended from the ceiling in numberless rows, no consideration being given to the selection of glassware to diffuse the light. Each illuminated sphere plays the part of a spotlight to the eye and is very conspicuous. To avoid this unpleasant effect it is necessary to keep the source of light out of the direct line of vision.

Mr. Kaufman conceived the idea of recessing an arc lamp in the center of each of the false beams forming the bays and, as the ceiling of the first floor is 19 ft. high, it was decided to suspend a hanging arc lamp with bronze ornamental casing in the center of each bay. The object of this arrangement was to have the recessed lamps provide the principal illumination, while the hanging lamps, fewer in number, were to serve mainly as ornaments, since the store would have an unfinished appearance without them. In all, twenty-six recessed and seventeen hanging lamps are installed on the first floor. The arrangement, as outlined, gives a very uniform distribution, and the light shows the true daylight color of the merchandise. The bottoms of the recessed lamps and of the hanging lamps are respectively 17 ft. 6 in. and 11 ft. from the floor.

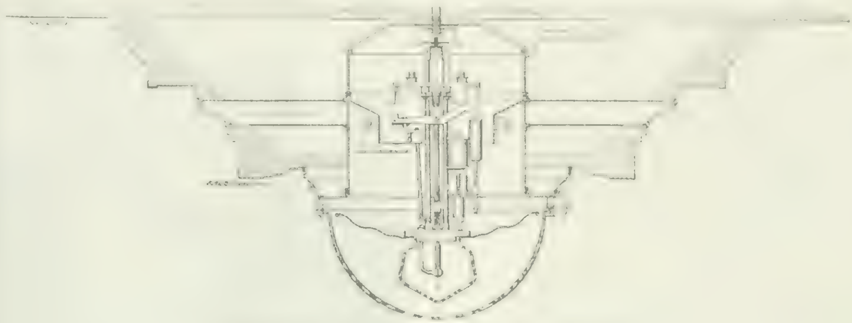


Fig. 1—Section Through Recessed Intensified Arc Lamp.

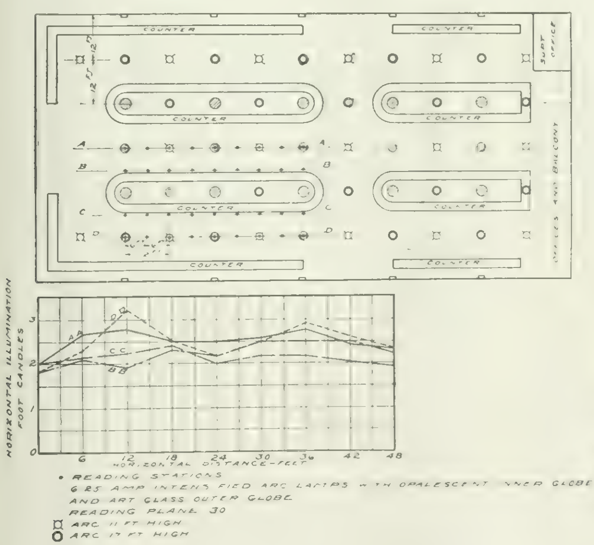


Fig. 2—Intensity of Illumination and Plan of Lighting.

Fig. 3—Pendent Arc Lamp

The recessed lamps are of special design with two vent ducts terminating in a small register. The coils of the lamp, of which there are four, are placed in a ring of spun copper, forming a ventilating chamber so arranged that the heat causes a current of air to pass through the vent ducts at a fairly high velocity, thus preventing any dust from settling on the plaster ceiling. This has proved to work very effectively.

The selection of the glassware was of great importance, and after many trials a light granite opal glass was chosen for the outer globe and an opalescent glass for the inner globe. The granite opal glass is not uniform in color, but is of varying density, this giving a very pleasing effect; in fact, the glass diffuses the light so thoroughly that there is an entire absence of the glare so common with ground glassware. A nickel reflector is provided to throw the light downward.

The lamps were wound specially for about 6¼ amp, in order that higher intensity than that obtained from the commercial lamp might be realized. At first thought the power consumption may be considered high, but the benefit to be derived from having a properly illuminated store

... the additional power required. The lamp is supported by a bayonet joint from a cast-iron box embedded in the plaster work of the false beam. The lamp is accessible for repair, and, since the outer globe is hinged, trimming is easily accomplished.

The lighting of the other floors is effected by means of intensified arc lamps in bronze casings, suspended from the ceiling by chains in conventional arrangement. In the French room, where evening gowns are displayed, tungsten-filament lamps set in crystal chandeliers and side brackets are used. Carbon and tungsten-filament lamps are used in the display cases and stockrooms. The worktables are lighted with tungsten lamps fitted with reflectors, one lamp for each operator. The show windows are lighted by means of Holophane-D'Olier steel reflectors set alternately at 30 deg. and 15 deg.

The castings for all arc lamps were made by the Amboy Works, Perth Amboy, N. J., and the arc lamps were made by the General Electric Company.

AN EQUALIZER-SYSTEM HOISTING SET.

The Calumet and Arizona Mining Company has completed an elaborate set of tests on the electric hoisting system which has been in operation at its mine in Bisbee, Ariz., since the latter part of September, 1909. The installation has been highly satisfactory in every respect, and those who have seen it remark on its ease and completeness of control. The tests have shown that, even under severe operating conditions, where the hoist is running a great portion of the time, the average input to the system over a day's run will not exceed 20 to 25 per cent of the maximum load, the rate of input being practically constant.

With small hoists alternating-current induction motors can be applied directly, but where heavy loads are to be handled at high speed the peak due to the acceleration of the rapidly moving parts is always greatly in excess of the average requirements of the hoist. If the supply is obtained from a line carrying a lighting load, the resulting fluctuations of voltage prove most objectionable. In most cases such hoists are at the ends of long transmission lines, so that an excessive amount of copper must be installed to prevent drop in the voltage during maximum demand.

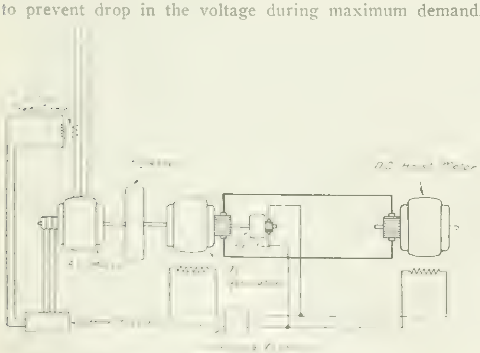


Fig. 1—Arrangement of Circuits for Flywheel-Hoist Set.

The result is that the line must be equipped for peak instead of average load, at a greatly increased expense.

These undesirable conditions have been overcome by the Westinghouse equalizer-system hoisting plant, the essentials of which are diagrammatically shown in Fig. 1. This consists of a direct-current motor, direct-connected to the hoist-drum, and a flywheel motor-generator set which includes a direct-current generator, a laminated flywheel, an alternating-current induction motor and an exciter. The auxiliary equipment comprises a reversing controller for the generator field, a speed regulator, a series transformer and the switchboard.

The hoist at Bisbee was built by the Denver Engineering Works, and it has a normal lifting power of 6000 lb. unbalanced load. Its speed is 1000 ft. per minute, and the ultimate depth of the shaft 1200 ft. The armature of the generator and the hoist motor are directly connected electrically. The field of each machine is excited separately,

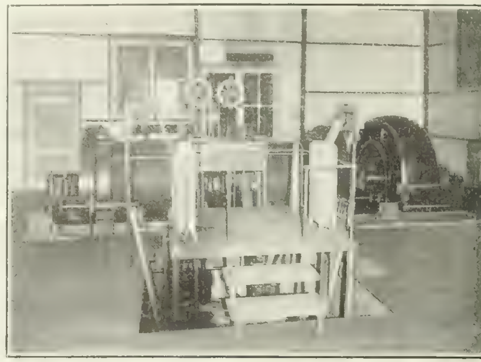


Fig. 2—Hoisting Motor in Mine at Bisbee, Ariz.

constant full-field being maintained in the motor. The hoist is started by gradually increasing the field of the generator and so delivering a proportional voltage to the hoist motor. When the load on the alternating-current motor reaches a certain point resistance is automatically applied to its secondary circuit, reducing the speed of the set so that the energy stored in the flywheel is used to overcome the peak of the hoisting cycle.

The hoist is stopped by gradually weakening the generator field, thus allowing the kinetic energy in the descending cage, the rotating hoist motor and the drums to be returned to the flywheel through the generator, which momentarily acts as a motor, the hoist motor meanwhile serving as a generator.

Over-all efficiencies of hoists of this type are generally from 50 to 60 per cent under normal operating conditions. With these sets it is a simple matter to devise reliable safety devices which do not depend on mechanical brakes. Such devices have been put in practice in Germany, where the government allows men to be hoisted at speeds of 2500 ft. per minute in this type of hoist, although with steam hoists provided with the best available safety devices the maximum speed allowed is but 1200 ft. per minute.

The first cost of such an installation is, of course, somewhat greater than for a small motor hoist with rheostat control, but the reduction of energy cost due to the equalization of the demand is such that the initial expenditure becomes a secondary matter, especially when energy is purchased on a maximum-demand system.

Fig. 2 shows the hoist motor, the drums and the operator's platform at the Calumet & Arizona Company's Bisbee plant, where the set consists of a 220-hp, 550-volt, shunt-wound, commutating-pole, direct-current motor, direct connected to drive the hoist drum at 63 r.p.m. This motor is supplied with power from a flywheel motor-generator set which includes a 180-kw, 575-volt shunt-wound, commutating-pole, direct-current generator, running at 1200 r.p.m.; a 22,700-lb. laminated flywheel, and a 180-hp, 2200-volt, three-phase, 60-cycle, six-pole induction motor for operation at 1020 to 1200 r.p.m. Besides the 15-kw, 125-volt exciter, there are, of course, the necessary controlling and regulating devices, all of the equipment being of Westinghouse manufacture.

Industrial and Commercial News

The Week in Trade.

A [illegible] contraction in many lines of business, but this condition is regarded as only temporary. As stocks are low in more than one branch of industry and prices attractive, and commercial interests in general are diverting their attention from political matters to methods of securing new business, the outlook for the coming year is considered very favorable. Much of the briskness shown in the steel trade in the last few weeks has been checked by the nearness of the holiday season, but a large amount of good business is in sight, and much of this, it is hoped, will be closed within the next few weeks. Steel orders this week, while numerous, were chiefly in small lots, with those for railroad equipment predominating. Few contracts of importance for pig-iron have been placed since last report. In both of these branches, however, there are sufficient orders on hand to assure activity for some time to come. Resumption of operations at several tin mills that had lain idle for many months was an encouraging incident of the week. Slight increases are being shown in the tonnages carried by the railroads, indicating gradual return to normal conditions. Another favorable influence in the trade situation was the final crop report for the year, issued on Monday by the Department of Agriculture. This placed the total value for the eleven important farm crops, not including cotton, at $3,769,562,000, an increase of nearly $190,000,000 over the 1910 total. Business failures for the week ended Dec. 14, as reported by *Bradstreet's*, were 309, as compared with 267 last week, 290 in the corresponding week in 1910, 273 in 1909, 311 in 1908, and 300 in 1907.

The Copper Market.

Following announcement of the November report of the Copper Producers' Association, a campaign for higher prices began, with 14-cent copper as the slogan. This figure has been freely quoted by the leading agencies during the week, though fractional concessions have been made. Most of the sales of electrolytic in the past few days have been made at 13⅞ cents, cash, and at 14 cents for thirty days. The domestic market became very animated upon the first advances in price, and substantial sales were made at the higher figures. Under constant forcing, however, interest has waned, and the upward movement has reacted upon itself for the time being. Very little future business developed this week, and most of

Standard [illegible]	Bid	Asked	Settling Price
Spot	13.87	14.10	[illegible]
December	[illegible]	[illegible]	13.92
January	[illegible]	[illegible]	[illegible].12
February	[illegible]	14.37	[illegible]
March	[illegible]	14.37	[illegible]
April	[illegible]	[illegible]	[illegible].17

The London market Dec. [illegible] was a [illegible]

	[illegible]	[illegible]
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for [illegible]

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
Best selected	[illegible]	[illegible]

the orders placed in the past few days had been pending for some time. Standard copper has been very active both in London and New York, and prices have been very irregular, declining slightly in the middle of the week. The fortnightly statistics showing stocks of standard copper in Great Britain and France as of Dec. 15 reported a decrease of 1,263 tons as compared with the total on hand Nov. 30, this reduction bringing the supply to 127,088,640 lb. Estimates on the December report of the Copper Producers' Association are being made, and many in the trade are expecting a showing even more favorable than that in November as regards reduction of surplus stocks. Exports during the week have been heavy, and shipments for the month, including Dec. 20, aggregate 23,426 tons. The daily call [illegible] companying table.

Industrial and Commercial Notes.

Electric Motors for Steel Works.—The Youngstown Sheet & Tube Company, of Youngstown, Ohio, has recently placed an order with the Westinghouse Electric & Manufacturing Company for a total of ninety-nine motors to be used in connection with its open-hearth plant. They will be used on cranes, charging machines, strippers, transfer tables, screwdowns and blooming mills. The Youngstown company formerly used the Bessemer process, and is now installing the open-hearth process with a blooming mill for taking care of the process output. An interesting point of this order is that fifty-six of these motors are the new Westinghouse direct-current mill-type motor equipped with commutating poles. This line has been designed to parallel the company's well-known alternating-current motor, which has proved so successful in mill service.

Long Acre Case Up Again.—The Public Service Commission for the First New York District and the Long Acre Electric Light & Power Company have asked for a dismissal of the writ of certiorari obtained by the New York Edison Company to review the proceedings under which permission was given to the Long Acre company to issue $4,000,000 in bonds and $2,000,000 in stock after a long fight by the latter to establish the validity of the franchise giving it right to operate in New York City. Counsel for the New York Edison Company, in asking the court to sustain the writ, stated that "the case is a proper one for the court to establish the precedent that no issue of securities shall be approved until the Public Service Commission has decided in the applicant's favor upon the question of public necessity and convenience." Decision was reserved.

East Tennessee Power Company's Plant Nearing Completion.—The East Tennessee Power Company, which is now completing the equipment of a large plant station on the banks of the Ocoee River near Parksville, Tenn., expects to furnish energy to Knoxville, Tenn., by Jan. 15. The big dam across the Ocoee is practically completed and nearly all the dynamo and turbine equipment of the station is installed and ready for use, so that lines from the dam to Knoxville and Chattanooga may be extended within thirty days. The energy generated will aggregate about 35,000 hp. Franchises have been awarded to the East Tennessee company by practically every city and town within a considerable radius.

New Telephone Company in Pennsylvania.—It is announced that an application will be made on Jan. 8 for the charter of a new company to be known as the North American Telephone & Telegraph Corporation. The purposes of the proposed company are said to be the construction, buying, leasing and operating of telephone and telegraph lines and the maintenance of a general telephone and telegraph business.

Water-Power Merger at Halifax.—A new company is being formed with a capital of $6,000,000 to take over the various water-power companies operating on the Mersey and Gaspereau Rivers in Nova Scotia. The Halifax Electric Tramway Company will be included in the merger. The new company plans to transmit energy to Halifax and to other localities in the western part of the Province.

New Turbine Equipment for Warren, Ohio.—The Trumbull Public Service Company, of Warren, Ohio, recently formed to take over a number of Ohio properties and in which H. L. Doherty, of New York, is interested, has ordered a 1500-kw, three-phase, 60-cycle Allis-Chalmers turbine equipment and a 500-hp Erie City boiler. The new equipment will be installed in the steam station at Warren.

Chilean Possibilities.—F. C. Enright, the South American representative of the Chicago Association of Commerce, made a trip to Chile recently and, among other things, he reports that there is some demand for electrical appliances and electric signs in that country.

United Wireless Meeting.—About 130 stockholders of the United Wireless Telegraph Company met in New York, Dec. 19, to discuss plans for reorganization of the company in accordance with plans outlined in these columns in the previous issue. A rather lengthy discussion took place upon nominations for a committee to investigate the facts in the case, and A. P. West, R. M. Owen, F. G. Lee and R. H. Armstrong, of Seattle, Wash., were finally appointed for the purpose. A statement of the financial condition of the company as of Nov. 20 was read, and this showed assets of $505,673 and liabilities of $45,328. It was stated that $300,000 will be needed to put the company's affairs in a satisfactory condition, pay off debts, meet obligations for $75,000 that was raised for carrying on the business, and furnish $100,000 working capital. According to the views of counsel for the trustees, from three to six months will be required to take the company out of bankruptcy.

French Broad (N. C.) Hydroelectric Plant Completed.—The new power plant of the North Carolina Electrical Power Company, which has been in the course of construction just below the town of Marshall, near Asheville, N. C., for the past two years, has been finished, and the plant of the Champion Fibre Company, at Canton, 27 miles away, is now being run by electrical power. The plant is situated on the French Broad River and represents an expenditure of $500,000. Contracts have been signed whereby the new plant is to furnish electrical power for a number of the towns of the western part of North Carolina. The plant has a capacity of 5500 hp.

Public Service Company of Northern Illinois.—The recently formed Public Service Company of Northern Illinois has given a mortgage to the Illinois Trust & Savings Bank, of Chicago, for $13,459,000. This mortgage covers all the properties of the company and secures an issue of first-mortgage gold refunding 5 per cent bonds issued in denomination of $1,000. The mortgage was dated Oct. 1, 1911, but was not recorded until Dec. 12. The bonds will be used to refund the bonds and notes of the various companies merged into the new company.

Automatic Telephone Company for England.—Announcement is made of the registration in England of the Automatic Telephone Manufacturing Company, Ltd., with a capital of £1,000,000, divided into 1,000,000 shares of £1 each, half of which are 6 per cent preferred stock. The new company will acquire from the Automatic Electric Company, of Chicago, certain patents for inventions relating to automatic telephone service, and from the British Insulated & Helsby Cables, Ltd., certain lands at Edge Lane, Liverpool, England.

Dividends of Louisville Companies.—The Louisville Lighting Company, which is controlled by the Louisville Gas Company, has declared a 2 per cent semi-annual dividend payable Jan. 1. The dividend is payable on a capitalization of $3,000,000, and follows a payment of equal amount last June after several dividends had been passed. The Louisville Gas Company has also put its stock upon a dividend basis, announcing a 3 per cent payment to shareholders.

Toledo Railways & Light Company Valuation.—Frank B. Ford, of Ford, Bacon & Davis, New York City, has been selected by officials of the Toledo Railway & Light Company to assist John M. Killits and Edward W. Bemis, the city's representatives, in placing a value upon the company's property for use in the franchise negotiations now pending.

New Steam Auxiliary Plant at Sacramento, Cal.—Contracts have been awarded for the erection of a new steam auxiliary plant at Sacramento, Cal., by the Pacific Gas & Electric Company. This plant will have a rated output of about 12,500 kw, and the cost for the building, exclusive of machinery, will be about $56,000.

Georgia Railway & Power Securities.—The Georgia Railroad Commission has approved the $47,000,000 stock and bond issue of the Georgia Railway & Power Company, which was organized, as stated in these columns Sept. 23, to acquire a number of public utilities in the State of Georgia.

Aluminum Notes and Prices.—The aluminum market continues to be very quiet. Quotations, Dec. 19, held ingots for remelting at 18½ to 19½ cents, rods and wire at 31 cents, and sheets at 33 cents. London prices, Dec. 6, placed ingots at 13 cents, wire at 22 cents and sheets at 25 cents.

Ohio Hydroelectric Development.—A company has been formed to improve water-powers on the Big Miami River at Woodsdale, Ohio, for electrical generating purposes. It is estimated that 5,000 hp can be developed at this site.

Financial.

The Week in Wall Street.

TRADING on Monday was very quiet as compared with that on the closing days of the previous week, and declines of over a point from Saturday's quotations were made in several of the leading issues. Although the final government report on the yield of the more important cereals was made public, and showed very favorable results, it was not of sufficient moment to check the reaction of the market. The only feature of interest was a slightly easier tone in the money market. Announcement of a receivership for the Wabash Railroad did not figure as a market factor on Tuesday, nor did the shares of the company experience severe loss in consequence of the announcement. The volume of trading declined still further from that on the preceding day, but prices, after irregularity in the earlier transactions, became firmer, and numerous gains were made, including a one-point advance in United States Steel common. Shipments of gold to South America were the chief development in the money market. Price changes on Wednesday were very few in number, and trading throughout the day was exceedingly irregular. The Census Bureau's report on cotton ginning from Dec. 1 to Dec. 13, which was issued on Wednesday, showed that 13,759,652 bales had been ginned in that time as compared with 10,695,443 bales in the corresponding period of 1910, and it was favorably received. Failure of the Lehigh Valley directors to announce a special dividend, contrary to general expectation, was the most conspicuous incident of the day, and resulted in a decline of nearly a point in the stock. Rates in the money market, Dec. 20, were: Call, 3¾@4 per cent; ninety days, 4@4½ per cent. The quotations in the tables are those at the close Dec. 20.

NEW YORK.

	Dec. 13.	Dec. 20.	Shares Sold.		Dec. 13.	Dec. 20.	Shares Sold.
All. Ch.	1¼	1½*	5,650	Int. Met., pf.	48	48¾	14,700
All. Ch., pf.	8	8	1,600	Mackay, Cos.	81½*	82*	200
Amal. Cop.	64⅝	66⅞	127,290	Mackay C., pf.	72⅜*	72*	200
Am. B. S.	33¾*	33½*	———	Man. Elev.	136	134	300
Am. Loco.	37	37	1,400	Met. St. Ry.	15*	15*	———
Am. Loco., pf.	103	104*	125	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	78*	78*	———	Steel, com.	66⅛	68⅝	988,364
Am. T. & T.	140	139⅞	9,630	Steel, pfd.	110⅞	111⅛	15,002
B. R. T.	76¾	77¼	7,100	W. U. T.	79	78¾	18,600
Gen. Elec.	154¼	155	2,700	West'h, com.	66	68¾	6,760
Int. Met.	15¼	15⅜	6,600	West'h, pfd.	113*	117½	———

PHILADELPHIA.

	Dec. 13.	Dec. 20.		Dec. 13.	Dec. 20.
Am. Rys.	45½*	45¼	Phila. R. T.	23	23½
El. Co. of A.	12	12⅛	Phila. Elec.	15¾	16¼
Elec. St. Bt'y.	54½	54⅜	Phila. Trac.	84½	84½
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	51¼	51¼

CHICAGO.

	Dec. 13.	Dec. 20.		Dec. 13.	Dec. 20.
Chi. City Ry.	186*	186*	Com. Edison	135½	135¼
Chi. Elev. Rys.	29*	30⅛*	Chi. Subway	⅞	⅞
Chi. Elev. Rys., pf.	94*	92*	Chi. Telephone	139	†137¾
Chi. Rs., Ser. 1	95*	99	Nat'l Car	103	103*
Chi. Rs., Ser. 2	34⅝	37½	Nat'l Car, pfd.	118	118*

BOSTON.

	Dec. 13.	Dec. 20.		Dec. 13.	Dec. 20.
Am. T. & T.	140	140	Mex. Tel.	3¼*	3¼*
Cum. Tel.	157	156½	Mex. Tel., pf.	6½	6½*
Edison	292	295	N. E. Tel.	163¼	157
Gen. Elec.	154	155	W. T. & T.	27½*	27½*
Mass. E. Ry.	21⅝	22¾	W. T. & T., pfd.	64¼*	64¼*
Mass. E. Ry., pf.	93½	95¼			

*Last price quoted.
†Ex-dividend.
Shares sold for the week, Dec. 11 to Dec. 16.

Financial Notes.

Chicago Railways Bonds.—New York and Chicago banking interests are offering $6,000,000 consolidated-mortgage, series A, 5 per cent gold bonds of the Chicago Railways Company. The bonds are in denomination of $1,000, are dated Feb. 1, 1907, and are due Feb. 1, 1927, with interest payable April 1 and Oct. 1 in New York or Chicago. A letter from Henry A. Blair, chairman of the board of directors of the company, to the bankers offering the bonds, states that the company owns and operates without surface competition 460 miles of electric railway, measured as single track, serving the downtown districts as well as the entire North and West Sides of the city. The capitalization of the company, as of Jan. 5, 1912, is given as follows: First-mortgage 5 per cent bonds issued to date, $45,955,000; series A consolidated-mortgage bonds, $16,359,800; purchase-money bonds, series B and C consolidated-mortgage bonds and

adjustment income bonds, $26,099,911. Except for $1,006,200 series A bonds reserved for the acquisition of additional property, as stated below, the series A mortgage is now closed. The capital stock of the company has been made the basis of an issue of four series of participating certificates. The $16,359,800 outstanding series A bonds include $498,000 of the $832,000 series A bonds which are deposited to secure the payment of $498,000 5 per cent collateral-trust notes due Feb. 1, 1913, and not subject to call. In addition to the above, $1,006,200 series A bonds are held in the treasury of the company, which may be issued if deemed advisable by the company, but only for the acquisition of additional property. On the principal trunk lines and those covering the downtown district and on all other property of the company except 128 miles of track in the outlying districts recently acquired, the lien of the mortgage securing the series A bonds is subject only to that of the first mortgage. The company's franchise runs until Feb. 1, 1927, and grants the city the option to purchase all of the property for municipal ownership and operation at any time during the life of the franchise for an amount equal to the original valuation fixed by the franchise ordinance, plus the cost of construction and rehabilitation since Feb. 1, 1907, including any amounts which may be advanced to the city for the construction of subways in the downtown business district. The city is entitled to 55 per cent of the surplus earnings after first providing for all operating expenses, including taxes and full charges for maintenance and depreciation and 5 per cent per annum upon the official valuation. Gross earnings in the year ended Oct. 31, 1911, were $16,671,315; operating expenses, including taxes and renewal fund required by ordinance, were $11,678,771, leaving net earnings $4,992,543. The annual interest charge on the first-mortgage fives was $2,297,750; annual interest charge on 5 per cent, series A bonds was $817,990, and annual interest charge on purchase-money bonds was $162,920, making total charges of $3,278,660; the balance applicable to payment of interest on junior securities and percentage of surplus earnings to the city of Chicago was $1,713,883.

Kings County Electric Light & Power Company's Statement.—The combined statement of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn, for November, and for eleven months ended Nov. 30, 1911, compares very favorably with that for the corresponding periods in the previous year. Gross earnings in November, 1911, were $454,190, as compared with $403,933 in November, 1910, an increase of $50,257. Operating expenses, including general, technical, production and distribution expenses, were $197,111, as compared with $178,780, an increase of $18,331. Net earnings were $257,079, as contrasted with $225,153, a gain of $31,925. Bond discount written off was $1,689, leaving balances of $255,390 and $223,464, respectively. Depreciation was $64,052 in November, 1911, and $52,890 in November, 1910. Fixed charges, including bond and interest on unfunded debt, were $70,546, as compared with $63,198, leaving a profit and loss surplus for the month of $120,791, as compared with $107,376, a gain of $13,414. The statement covering operations from Jan. 1 to Nov. 30, 1911, inclusive, shows gross earnings of $4,309,408, as compared with $3,905,675, an increase of $403,733 over the gross in the corresponding period of the previous year. Operating expenses, including general, technical, production and distribution expenses, were $2,130,049, as against $1,871,307, an increase of $258,741, and net earnings were $2,179,358, as compared with $2,034,367, a gain of $144,991. Bond discount was $18,579, depreciation charges were $538,323 and $476,155 respectively, and fixed charges were $734,222, as compared with $669,296. These deductions left a profit and loss surplus of $888,232 for the eleven months ended Nov. 30, 1911, as compared with $870,335 in the corresponding period of 1910, a gain of $17,897.

Platt Iron Works Company Affairs.—The trustees of the Platt Iron Works Company, Dayton, Ohio, have issued a statement relative to reports circulated to the effect that the Dayton plant is to be shut down and the business discontinued. Such reports are denounced as without foundation and absolutely untrue. Under the order of the court, it is stated, the business is to be continued and, when sold, is to be sold as a going concern. On Aug. 5 the receivers of the Platt Iron Works Company sent out a letter setting forth that the placing of the company in the hands of receivers, while unavoidable, was the first step toward a reorganization. At a meeting of a majority of the creditors, on Nov. 20, trustees were elected, who are now in charge of the property, with full authority to conduct and carry on the business, which has been in existence for a period of over thirty years, during which time it has built up, in addition to a thoroughly modern plant, a valuable asset in the form of good-will, and at the present time has so large a quantity of work on hand as to require upward of 750 employees. It is stated that the organization, including the engineering, sales and mechanical departments, remains intact, and that the property is and has been operated on a profitable basis. In conclusion the statement says that any business intrusted to the trustees will receive the very best attention and that extraordinary effort is being put forth to give the very best possible service in the repair department, which is recognized to be so important to patrons.

Philadelphia Rapid Transit Report.—At the meeting of the board of directors of the Philadelphia Rapid Transit Company, Dec. 18, the report of operation for the month of November and for the five months of the fiscal year to Nov. 30, 1911, was submitted and approved. The November report gave gross passenger earnings as $1,804,353, an increase of 6.07 per cent over those in November, 1910; receipts from other sources were $77,621, an increase of 9.31 per cent, and total earnings were $1,881,975, an increase of 6.2 per cent. Operating expenses were $1,136,731, leaving net earnings from operation of $745,254. Fixed charges were $740,631, leaving a surplus for the month of $4,623. Gross passenger earnings in the five months of the fiscal year to Nov. 30, 1911, were $8,971,466, an increase of 5 per cent; receipts from other sources were $408,669, an increase of 16.93 per cent. Total gross earnings were $9,380,136, an increase of 5.47 per cent over those in the same period in the previous fiscal year. Operating expenses were $5,690,194 and net earnings from operation $3,689,942. Fixed charges were $3,688,821, leaving a surplus of $1,120 for the period. Completion of a number of extensions promised by E. T. Stotesbury, chairman of the board of directors, in a letter under date of April 10, 1911, to the chairman of the financial committee of the City Council was announced, and a number of important changes in operation, effective Jan. 1, 1912, were also made public.

New Interborough Bonds Approved.—The Public Service Commission for the First New York District has authorized the Interborough Rapid Transit Company to issue $12,755,000 forty-year 5 per cent first-mortgage bonds, payable Nov. 1, 1952, or on any interest day, at 105 and accrued interest. The company has applied for permission to issue $17,123,611 at this time, and further hearings will take place on the question of authorizing the balance between this total and the $12,755,000 authorized. The bonds are secured by a first mortgage for $55,000,000 authorized April 23, 1908, under which $30,552,000 had been issued, and the new issue brings this to a total of $43,302,000. Proceeds from the new issue will be used for meeting outstanding notes and for general refunding purposes and improvements.

Toledo Railways & Light Extension.—The Toledo Railways & Light Company has arranged with Blair & Company, New York, for extension to Jan. 1, 1913, with interest at 6 per cent, of the time of payment of the Toledo Traction Company's consolidated first-mortgage bonds due Jan. 1, 1912, and the Toledo Electric Street Railway Company's first-mortgage bonds due Feb. 1, 1912. Holders of these bonds who do not wish to take advantage of this extension will receive par in cash for their bonds upon delivery at maturity. The extension privilege for the Toledo Traction and the Toledo Consolidated bonds expires on Dec. 28, and for the Toledo Electric Street Railway on Jan. 28.

Sheboygan (Wis.) Railway & Electric Company Sold to New Jersey Interests.—It is announced that controlling interest in the Sheboygan Railway & Electric Company, of Sheboygan, Wis., has been acquired by F. W. Roebling, of Trenton, N. J. The company operates an interurban line 33 miles in length between Sheboygan, Sheboygan Falls, Plymouth and Elkhart Lake, and furnishes energy for the local lighting and power service. It is successor to the Sheboygan Light, Power & Railway Company.

Springfield Street Railway Financing.—The Springfield Street Railway Company, of Springfield, Mass., has presented a petition to the Railroad Commissioners asking permission to issue $200,000 4 per cent twenty-year gold bonds, under date of April 1, 1903. Authority was granted in that year to issue $1,700,000 bonds, and $1,500,000 was issued under that authority. The proceeds of the $200,000 now applied for will be used for meeting indebtedness arising from cost of improvements that have been made to the properties of the company.

Southern California Edison Bonds Offered.—A Boston [illegible] bonds of the Southern California Edison Company, a corporation organized under California laws and owning and operating the gas and electric properties formerly owned by the Edison Electric Company of Los Angeles, serving a population in excess of 600,000. The capitalization of the company is as follows: Preferred stock authorized and issued, $4,000,000; common stock authorized, $26,000,000, issued, $7,900,000; debentures authorized and issued, $1,000,000; general mortgage 5 per cent bonds authorized, $30,000,000, issued, $9,336,000; closed mortgages, $8,898,000, from which is deducted $4,674,000 held by trustee as additional security to the general mortgage 5's, leaving a balance of $4,224,000 outstanding in the hands of the public. The company generates the greater part of its energy in hydroelectric plants, the largest hydroelectric development being that known as Kern River No. 1, which is rated at 30,000 hp and transmits energy to Los Angeles, a distance of 116 miles. The company is also operating hydroelectric stations of 12,000-hp capacity in the Santa Ana, Lytle Creek and Mill Creek cañons. It also has steam generating stations at Los Angeles, Pasadena, San Bernardino, Redlands, Long Beach and Santa Monica, with a combined capacity of 34,000 hp. The total capacity of the company's stations at present is approximately 75,000 hp, and additional capacity will be provided as required by installation of units in the Long Beach station, which was described in these columns May 11 of the present year. Gross earnings of the company in the year ended Oct. 31, 1911, were $3,659,786, as compared with $3,329,094 in the year preceding. Operating expenses, including taxes, maintenance and renewals, were $1,792,089, as compared with $1,643,246, and net earnings in each of these two years were $1,867,696 and $1,685,847 respectively, representing this year more than two and three-quarters times the $678,630 interest on $13,560,000 bonds. Deduction of this interest left a balance of $1,189,066, from which was taken $60,000 interest on debentures, and $680,000 for depreciation, leaving a balance of $449,066 for the year's operations. The connected load in incandescent lamps in 50-watt equivalent, as of Oct. 31, 1911, was 1,208,946; the number of motors was 4,902, aggregating 70,994 hp, and there were 64,169 electric meters on the lines. Substantial gains were made in these items during the year. The preferred stock of the company is 5 per cent cumulative, and the common stock is now paying 5 per cent. The bonds are offered at 96½ and interest, to yield 5¼ per cent.

Washington, Baltimore & Annapolis Company's Earnings.—The November statement of the Washington, Baltimore & Annapolis shows gains in both gross and net income. Gross operating revenue for the month was $56,119.67, as contrasted with $53,441.82 in November, 1910, a gain of $2,677.85, and operating expenses were $28,954.51, as compared with $29,798.47, a decrease of $843.96. Net operating revenue was $27,165.16, as against $23,643.35, an increase of $3,521.80. The total gross income for November, including miscellaneous income, was $27,550.34, as against $23,768.72 for the preceding November, a gain of $3,781.62. Deductions from income, including interest, taxes, etc., amounted to $22,114.52, as compared with $30,152.45, a decrease of $8,037.93, leaving a net income of $5,435.82, as against a deficit of $6,383.73 in November, 1910. The percentage of operating expenses to gross operating revenue was 51.59 per cent, as compared with 55.75 per cent in November, 1910. Gross operating revenue of the company for eight months ended Nov. 30 was $495,108.65, as against $487,698.41 in the corresponding months of the preceding fiscal year, an increase of $7,410.24. Operating expenses for the period were $234,315.95, as contrasted with $237,696.04, a decrease of $3,380.09, making the net operating revenue $260,792.70, as against $250,092.37, a gain of $10,790.33. Gross income for the eight months, including miscellaneous income, was $262,535.62, as compared with $251,282.69, a gain of $11,270.93. Interest, taxes, etc., amounted to $117,700.77, leaving a net income of $84,852.85, as against $4,590.56 for the corresponding period of the previous fiscal year. The percentage of operating expenses to gross operating revenue was 47.32 per cent, as contrasted with 48.74 per cent. From the record made by the company during the eight months of the fiscal year it can be seen that the predictions of a surplus of $100,000 for the fiscal year, which ends March 30, 1912, made by President George T. Bishop when the reorganization plan was put into effect, will probably be more than realized. With four months of the fiscal year yet to be reported, the company has so far earned a surplus of $84,652.85, which is just about $3,000 short of the 6 per cent dividend on its $1,460,000 preferred stock. President Bishop recently came to Baltimore to inspect the company's property, and expressed himself as being well satisfied with the showing that has been made.

Postal Telegraph-Cable to Build Lines for Use of Independent Telephone Companies.—Minor M. Davis, who was recently appointed superintendent of telephones of the Postal Telegraph-Cable Company, announced Dec. 20 that his company had issued instructions to its construction department to proceed with the erection of additional heavy copper wires between all important points on the system of the company for the purpose of extending the telephonic use of the same to the independent telephone companies.

Brooklyn Rapid Transit Gains.—During the first half of December gross earnings of the Brooklyn Rapid Transit Company increased at rate of $4,000 per day, which compares with an average of $3,000 in November and $2.800 in October. Even greater improvement is expected in the totals for the second half of the month owing to holiday traffic.

DIVIDENDS.

American Cities Company, initial semi-annual, preferred, 3 per cent, payable Jan. 2.

American Gas & Electric Company, quarterly, 1½ per cent, payable Jan. 2.

American Power & Light Company, quarterly, preferred, payable Jan. 2.

American Telephone & Telegraph Company, $2 per share, payable Jan. 15.

Buffalo General Electric Company, quarterly, 1½ per cent, payable Dec. 30.

Carolina Power & Light Company, quarterly, preferred, 1¾ per cent, payable Jan. 20.

Chattanooga Railway & Light Company, quarterly, preferred, 1¼ per cent, payable Jan. 2.

Cincinnati Gas & Electric Company, quarterly, 1¼ per cent, payable Jan. 1.

Dayton Power & Light Company, quarterly, preferred, 1½ per cent, payable Jan. 15.

Detroit Edison Company, quarterly, 1¾ per cent, payable Jan. 15.

Electrical Utilities Corporation, quarterly, preferred, 1¼ per cent, payable Jan. 15.

El Paso Electric Company, semi-annual, preferred, $3 per share, payable Jan. 8.

Louisville Lighting Company, semi-annual, 2 per cent, payable Jan. 2.

Manila Electric Railroad & Lighting Corporation, 1½ per cent, payable Dec. 30.

Western Electric Company, quarterly, $2 per share, and an extra dividend of $2 per share, payable Dec. 30.

Western Union Telegraph Company, quarterly, three-fourths of 1 per cent, payable Jan. 15.

REPORTS OF EARNINGS.

ATLANTIC CITY ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
November, 1911.....	$33,770	$13,906	$19,864	$8,506	$11,358
November, 1910.....	30,085	15,000	15,085	6,736	8,349

BUFFALO GENERAL ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
10 m., Oct., 1911....	$969,675	$611,919	$398,205	$125,563	$272,642
10 m., Oct., 1910.....	867,526	531,095	369,537	111,512	258,025

KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
November, 1911.....	$454,190	$197,111	$257,079	$136,288	$120,791
November, 1910.....	403,933	178,780	225,153	117,777	107,376
11 m., Nov., 1911.....	4,309,408	2,130,049	2,179,358	1,291,126	888,232
11 m., Nov., 1910.....	3,905,675	1,871,307	2,034,367	1,164,032	870,335

MUNCIE ELECTRIC LIGHT COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
November, 1911.....	$33,126	$16,685	$16,441	$6,076	$10,365
November, 1910.....	29,039	17,406	11,633	4,438	7,195

ROCKFORD ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
November, 1911.....	$38,400	$18,250	$20,150	$7,729	$12,421
November, 1910.....	35,697	19,487	16,210	6,722	9,488

SCRANTON ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
November, 1911.....	$72,810	$29,167	$43,643	$11,681	$31,962
November, 1910.....	67,086	26,621	40,465	9,269	30,196

General News

Construction News.

MONTGOMERY, [illegible] thorized Commissioner E. B. Joseph, in charge of the Water Works Department, to purchase a new electric compressor, to cost about $16,500.

KINGMAN, ARI[illegible] the Aracy Engineering Company a franchise to operate on various places on the Colorado River in the vicinity of Kingman, especially in the vicinity of the McCracken mines. A large hydroelectric plant will be built on the Colorado River and will supply electricity to the McCracken mines and other properties in this vicinity.

ALAMEDA, CAL.—It is reported that no bids were submitted to the City Council on Dec 5 for the erection of electroliers. The work will be done by the managers of the municipal electric-light plant. F. E. Browning is city clerk.

BAKERSFIELD, CAL.—The city clerk is advertising for bids for the installation of a street-lighting system to consist of about 200 luminous arc lamps and energy for same with an all-night service.

BEAUMONT, CAL.—T. J. Barker and C. L. Nye, of Riverside, Cal., have acquired the Highland Home Ranch, in Beaumont, and propose to install a power plant.

BODIE, CAL.—The Crystal Lake Gold Mining Company has commenced work on the reconstruction of its electric-power plant, which was destroyed by a snowslide early in 1911.

CHICO, CAL.—B. F. Hudspeth, clerk, it is reported, has been instructed to advertise for proposals for electricity for lighting the streets of the city for a period of three years. Energy used for the electroliers will be on the meter system and will be included in the contract.

FRESNO, CAL.—Funds are being raised by the property owners on K Street and Van Ness Avenue for the installation of an electrolier lighting system with bronze columns, to cost approximately $100 each.

FRIANT, CAL.—The Pacific Light & Power Corporation, of Los Angeles, has commenced work on the survey for an electric railway from Friant to a point near Shaver, the site of its Big Creek hydroelectric power plant, a distance of about 50 miles. The cost of the proposed railway is estimated at about $1,000,000. The Stone & Webster Engineering Corporation, of Boston, Mass., is in charge of the work. J. M. Thebo is chief engineer for the company.

LOS ANGELES, CAL.—The Southern California Edison Company is erecting a new transmision line from a point near Los Angeles to Van Nuys.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has been granted permission by the Board of Public Utilities to equip the Southern Pacific line from Sentous to Los Angeles, a distance of about 8 miles, for electrical operation.

LOS ANGELES, CAL.—The City Council has granted a franchise to W. P. Story to construct a tunnel beneath the city streets from the Story Building to the Garland Building for the purpose of furnishing electricity and heat from the power plant located in the Story Building.

LOS ANGELES, CAL.—The Arctic Mining & Power Company has called a special meeting of the stockholders to be held Feb. 6, 1912, to vote on the proposition to increase the capital stock of the company from $500,000 to $1,000,000, the proceeds to be used for extensions and improvements to its system. J. P. Flint is secretary.

LOS ANGELES, CAL.—The Wright & Callender Building Company has made application for a permit to construct a conduit connecting its power plant in its office building located at Fourth and Hill Streets with the new office building of the Black Fireproof Building Company, now being erected on the opposite corner, for the purpose of furnishing light, heat and power to the new building.

OROVILLE, CAL.—The Oro Electric Light & Power Company has appropriated $7,000,000 for the construction of a large dam near Belden, work on which will begin next April. It is estimated that about 50,000 hp can be developed. The company, it is said, proposes to supply water and power to irrigate 10,000 acres in the vicinity of Oroville. Pumps will be used for irrigation purposes. R. Leo Van der Naillen, manager, will have charge of the work.

PASADENA, CAL.—The City Council has authorized an expenditure of about $1,500 for fuel-oil operating supplies and construction material for the municipal electric-light plant. C. W. Koiner is general manager.

PORTERVILLE, CAL.—Application has been made to the City Council by the Tulare County Power Company, recently organized, for a fifty-year franchise to erect and operate an electric distributing system in Porterville.

REDDING, CAL.—The Mammoth Copper Company is contemplating the construction of a surface tramway system, with the cars [illegible] by electric motors. The cars will have a capacity [illegible] tons each.

SACRAMENTO, CAL. The State Board of [illegible] will [illegible] the State institutions during the year 1912.

SAN BERNARDINO, CAL.—Negotiations have been closed whereby the Southern Sierras Power Company has acquired the property of the Lytle Creek Power Company, San Bernardino, and the Corona Gas & Electric Company, of Corona. These companies supply electricity for lamps and motors to all cities and towns in San Bernardino and Riverside Counties and numerous irrigation projects. The Southern Sierras Company is planning to erect a transmission line 70 miles long, to connect Corona and San Bernardino with several nearby towns. The Sierras company is a subsidiary of the Nevada-California Power Company.

SANTA ROSA, CAL.—The California Telephone & Light Company, recently incorporated with a capital stock of $10,000,000, will take over the plant and holdings of the Northwestern Electric Company, the Russian River Light & Power Company, the Sonoma Valley Company and the Clear Lake Consolidated Company; also, the Healdsburg Telephone Company, the Valley Telephone Company, the Cotati Company and other companies operating rural telephone lines. The Bennett Valley telephone lines will be rebuilt and the service improved. The company also proposes to erect an electric transmission line through Bennett Valley to supply electricity in many places in the valley. A transmission line will also be erected to Cotati and throughout the Cotati section. The California Telephone & Light Company obtains electricity for its systems from the Pacific Gas & Electric Company and from the Snow Mountain Power Company. Substations will be located at Fulton and at Sebastopol. John E. Bennett, of Palo Alto; F. C. Wright, of Santa Rosa; M. S. Sayre, of Lakeport, and others are interested in the company.

SUISUN, CAL.—The Great Western Power Company, which has erected a transmission line from the Sierra Nevada Mountains to the bay, is said to be considering the erection of a cable across Carquinez Straits for the purpose of distributing electricity in Solano and Napa counties.

WATSONVILLE, CAL.—Plans have been approved by the Board of City Trustees for the installation of a street-lighting system in Watsonville. The Coast Counties Light & Power Company, it is said, will install about 350 arc lamps of the Mazda type.

WOODLAND, CAL.—Surveys have been completed by the Dozier Engineering & Contracting Company, of Sacramento, for the proposed railway of the Sacramento Valley Westside Electric Company from Woodland to Red Bluff, a distance of about 140 miles. The company has been granted franchises through Yolo and Glenn Counties.

CREEDE, COL.—The Cyrus Miller Leasing Company, of which J. H. Berkshire, of Kansas City, is president, has decided to undertake the sinking of a deep shaft on the old Amethyst property. It is said that the work will include the construction of an electric-power plant, work on which will begin immediately.

DENVER, COL.—Arrangements have been completed by the business men on Larimer Street between Cherry Creek and Seventeenth Street for the installation of an ornamental street-lighting system. The lamps will be suspended from trolley poles by means of ornamental brackets, to which will be suspended arc lamps similar to those on Sixteenth Street.

NEW LONDON, CONN.—Bids will be received at the office of the United States Engineer, New London, Conn., until Dec. 26 for furnishing insulated cable. Further information on application.

NORWICH, CONN.—Preparations are being made by Superintendent W. F. Bogue, of the municipal electric-light plant, to erect a transmission line from the city line in North Washington Street to Norwichtown for the purpose of supplying electricity for lighting that town.

WASHINGTON, D. C.—The American consulate at Quebec has forwarded copies of tenders for electric lighting called for by the city of Quebec. Under the prevailing conditions it will be impossible for American concerns to submit tenders for the lighting system, but the requirement calls for certain lamps and arc lamps, and American firms may desire to correspond with the successful bidder for supplying the lamps, arc lamps and such other devices as may be required to comply with the tender. About 300 ornamental iron or metal posts will also be required. The consul desires catalogues from American manufacturers, giving prices, etc. Copy of complete report and form of tender may be obtained upon application to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C. Applicants should refer to No. 7686.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 26 for furnishing the following supplies: At San Juan, P. R., Schedule 4146—two wireless telegraph towers for the naval wireless station. Bids will also be received at the same place until Jan. 2 for furnishing at the various navy yards and stations supplies as follows: Norfolk, Va., Schedule 4147—one set water-tube boilers. Puget Sound, Wash., Schedule [illegible] set water-tube boilers. Brooklyn, N. Y., Schedule [illegible] main feed-water heaters; Schedule 4153—electrical equipment; Schedule

[illegible]

Schedule 4161—5500 lb. condenser tubing; Schedule 4157—17,000 lb. crucible steel wire. Proposals will also be received until Jan. 9, 1912, at the same place for the following: Mare Island, Cal., Schedule 4149—one wireless telegraph set. Philadelphia, Pa., Schedule 4193—24,100 lb. copper tubing, 1600 lb. sheet copper, etc. Applications for proposals should designate the schedule desired by number.

FORT PIERCE, FLA.—At an election held Dec. 12 the proposition to issue bonds to the amount of $90,000 for public improvements, including the installation of an electric-light plant, was carried.

JACKSONVILLE, FLA.—Bids will be received by the Board of Trustees for the Water Works and Improvement Bonds of the City of Jacksonville, Fla., until Jan. 4, 1912, for furnishing complete the following: Electric-conduit work and wiring and fixtures for lighting new power station and certain wiring and fixtures for old power station. Plans and specifications are on file at the office of the board in Jacksonville and at the office of the Scofield Engineering Company, Philadelphia, Pa., copies of which may be obtained upon deposit of $25, which will be refunded on return of same. W. M. Bostwick, Jr., is chairman.

MACON, GA.—Plans are being considered by the City Council for the installation of electrical equipment to operate the water-works pumping station. The Central Georgia Power Company has submitted a proposition to the Council offering to supply electricity to operate the pumps at $45.95 per 5,000,000 gal. per day. Under the present system, which is operated by steam, it costs $50.40 to pump nearly 1,000,000 gal. less. It is understood that the contract with the Central Georgia Power Company will be for a term of twenty years.

BOISE, IDAHO.—Proposals will be received at the office of the United States Reclamation Service, Boise, Idaho, until Jan. 10, 1912, for furnishing four electric derrick hoists and four stiff-leg derricks for the Boise Project, Idaho. For further information address the United States Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. Newell is director.

BOISE, IDAHO.—Final surveys are being made by James A. Green & Company, 226 South La Salle Street, Chicago, Ill., and 509 Overland Building, Boise, Idaho, for the electric pumping plants and irrigation project in the vicinity of Snake River, Malheur County, Ore. The company, it is reported, is in the market for pumping machinery, etc., to be used in connection with this work.

TWIN FALLS, IDAHO.—The Twin Falls, Artesian City & Oakley Interurban Railway Company, recently incorporated with a capital stock of $500,000, is planning to build an electric railway from Twin Falls to Oakley, by the way of Artesian City. The company, it is said, contemplates the construction of an electric-power plant. H. T. West is president of the company.

CHICAGO, ILL.—Sealed proposals will be received by the Board of Directors of the Municipal Tuberculosis Sanitarium of the city of Chicago, 105 West Monroe Street, Chicago, Ill., until Jan. 5, 1912, for the erection of the dining hall and service building, including electric wiring, steam heating, etc., for the Municipal Tuberculosis Sanitarium of the city of Chicago, located at North Fortieth and Bryn Mawr Avenues, Chicago; also for work in connection with the power house of the said institution, which is being readvertised, as follows: Heating and power-plant apparatus, marble and tile work, electric wiring and transformer station, electric generator, engine to drive generators; also for outside sewer system, according to plans and specifications which are on file and may be obtained at the above office. Frank E. Wing is general superintendent.

FOREST PARK, ILL.—Sealed proposals will be received by the Board of Village Trustees of Forest Park, Ill., until Jan. 2, for the sale of the following machinery now in use at the village water and light plant: One Erie City, four-valve, 21-in. x 21-in. engine, rated at 420 hp at 185 r.p.m. with 125 lb. steam, equipped with a 9-ft. x 26-in. face cast-iron pulley, and one 24-in. endless dynamo belt 51 ft. long; also one 180-kw, single-phase Warren induction generator, 800 r.p.m., with 5-kw, 120-volt exciter and belt, and 23-in. x 24-in. face pulley and one white marble switchboard panel complete.

HENRY, ILL.—The Turner-Hudnut Company, which operates a chain of elevators along the Illinois River, has entered into a contract with the Public Service Company of Northern Illinois to supply electricity to operate its elevators at Hennepin, Henry, Lacon and Chillicothe. The Public Service Company contemplates extending its transmission line from Streator to Hennepin.

HILLSBORO, ILL.—Eleven farmers living northeast of Butler have organized an "electric syndicate" and have made arrangements with the Hillsboro Electric Light & Power Company to extend its transmission line into that section. Electricity will be used for motors as well as lamps.

LITCHFIELD, ILL.—M. Bishop has submitted a bid to the City Council for lighting the streets of the city. He offers to furnish eighty-five lamps on a moonlight schedule for $70 per lamp per year for a period of five years. A proposition has been submitted by Harry Tinkelpaugh offering to supply eighty-five lamps on a moonlight schedule at $75 each per year and on an all-night schedule for $90 per lamp per year for a period of five years.

MOKENA, ILL.—A movement is on foot to organize a stock company for the purpose of installing and operating an electric-light plant in Mokena.

PEORIA, ILL.—The Board of County Supervisors is contemplating remodeling the Peoria County court house and the installation of new electrical equipment.

CONNERSVILLE, IND.—The Commissioners of Fayette County have granted the Hydro-Electric Light & Power Company permission to erect transmission lines along the highways in the county. The company, it is said, proposes to extend its system to every part of the county.

FAIRMOUNT, IND.—Application has been made to the Town Board by the Indiana Union Traction Company, of Anderson, Ind., for a franchise to supply electricity for lamps in Fairmount. The company submitted a proposition for furnishing street lamps.

GOSHEN, IND.—H. E. Bucklin, owner of the St. Joseph Valley Traction Company, is planning to build three dams on the St. Joseph River to furnish power for his electric railway, now operated by gasoline motors. Work has already commenced on the first one. Power obtained by means of the first dam will be utilized to operate pile-drivers and machinery used on the second and third dams. The power plant will be erected near the third dam to be located near Pigeon Creek, which will supply energy to operate the railway system.

NOBLESVILLE, IND.—A company has been formed under the name of the White River Corporation to take over and complete a dam in White River for power and storage purposes. The company will also build a power plant to generate electricity for lamps and motors. The company is capitalized at $60,000 and the directors are: Alexander R. Holliday, John H. Holliday, Thomas C. McReynolds and others. One-half of the stock is owned by the Indianapolis Water Company and the other half by the Noblesville Heat, Light & Power Company.

OTTERBEIN, IND.—The County Commissioners have granted the Otterbein Light & Power Company, recently organized, a franchise to erect a transmission line from Lafayette, Ind., to Otterbein. The company will secure energy of the Indiana Lighting Company, of Lafayette, to operate its system in this town. Henry Blot is president of the Otterbein Light & Power Company.

ALLISON, IA.—At an election held recently the proposition to grant a franchise to Claude E. Mackey to erect and operate an electric-light plant in Allison was carried.

DUBUQUE, IA.—Sealed proposals will be received at the office of the Board of Trustees, Dubuque, Ia., until Jan. 22, 1912, for furnishing and erecting a 2,000,000-gal. duplex, double-acting, motor-driven pump at the level pumping station. Copies of proposal, contract and specifications may be obtained at the office of the city water-works. B. F. Stedman is superintendent and R. P. Melendy, engineer.

KEOKUK, IA.—The Keokuk Electric Company, recently incorporated, has taken over the property and holdings of the Keokuk Gas & Electric Company, the Keokuk Electric Railway & Power Company, the Hamilton Light & Power Company and the Western Illinois Electric Company, the last-named company controlling the interurban trolley line from Keokuk to Hamilton and Warsaw. The new company is capitalized at $650,000 and is controlled by the Stone & Webster Corporation, of Boston, Mass. It is understood that A. D. Ayres will be retained as manager.

MAQUOKETA, IA.—Application has been made to the City Council by J. Frank Barnes, of the Barnes Electric Light & Power Company, for a franchise to build and operate an electric-light plant. It is proposed to use crude-oil-burning engines to drive the plant. The plant of the Maquoketa Electric Light Company was formerly operated by water-power, but since the dam was washed away several months ago it has been trying to operate its plant by steam-power. The service has not been satisfactory. If granted a franchise, Mr. Barnes promises to improve the service.

STRATFORD, IA.—The installation of an electric-light plant in Stratford is reported to be under consideration.

ATCHISON, KAN.—The installation of a municipal electric-light plant is under consideration by the City Council. The Council has demanded a material reduction in the present rates for electrical service furnished by the Atchison Railway, Light & Power Company, and unless granted will probably take steps toward the construction of a municipal plant.

HILLSBORO, KAN.—Plans are being considered for the installation of an electric-light system in Hillsboro. It is proposed to secure energy from the municipal electric plant at McPherson. The cost of the transmission line is estimated at about $14,000. Under the present plan it is proposed that the towns of Hillsboro, Lehigh, Canton and Galva unite in the project to secure electricity from the McPherson plant.

MANHATTAN, KAN.—Contracts will be placed by the Manhattan City & Interurban Railway Company for the construction of a new power house. The company expects to purchase an oil or steam engine, two or three large boilers, a 200-kw direct-current belted or direct-connected generator and a 75-kw 125-volt direct-current belted generator.

PERRY, KAN.—At an election held Dec. 9 the proposition to issue bonds to the amount of $5,000, the proceeds to be used for the installation of a municipal electric-light plant, was carried.

ISLAND, KY.—The installation of an electric street-lighting system is reported to be under consideration. Electricity for operating the system may be secured from the plant of the Memphis Mining Company, located about a half mile from the town.

MITCHELLVILLE, LA.—At an election to be held Jan. 9, 1912, the proposition to grant a franchise to George T. Gibson to install an electric-light plant will be submitted to a vote.

ATHOL, MASS.—Exten[illegible] are being made by the Athol Gas & Electric [illegible] in Athol and Wendell, [illegible] additions to the plant at Wendell, which will cost about $20,000, have been made necessary [illegible] ice in Athol and Orange and also the street-railway system of the Athol & Orange Street Railway Company. New equipment is being installed at the Wendell station, including a 500-kw Curtis steam turbine, a 450-hp Sterling boiler, the construction of a concrete boiler house and a concrete smokestack. Provision has been made in the plant for the installation of two more waterwheels with a large generator and two large rotary converters in case they should be needed when the new railway between Orange and Millers Falls is completed. The present improvements will increase the output of the plant to 1500 kw. The improvements to the plant in Athol include the installation of a 425-hp engine to replace an engine of 225 hp and of a 425-kw converter to replace a 225-kw machine.

CAMBRIDGE, MASS.—Plans are being considered for the installation of ornamental street lamps on Massachusetts Avenue between Lafayette Square and City Hall. It is proposed to erect thirty-six posts carrying two lamps each. It is estimated that the new system will cost the city $82.44 per post yer year, making the annual cost $2,967.

SEEKONK, MASS.—The Gas and Electric Light Commissioners have approved the issue of new capital stock by the Seekonk Electric Company to the amount of $5,000, the proceeds to be used to purchase the transmission lines of the Narragansett Electric Lighting Company, of Providence, R. I., within the town. The Seekonk company proposes to purchase energy from the Narragansett company and to distribute same in the villages of Seekonk and Swansea. The value of the existing lines is estimated at about $1,000, and extensions will be made involving an expenditure of about $5,400.

ANN ARBOR, MICH.—It is reported that all bids for the proposed power house have been rejected by the Board of Regents, plans for which were prepared by Smith, Hinchman & Grylls, engineers, Washington Arcade Building, Detroit, Mich.

CLARA CITY, MICH.—It is reported that a franchise has been granted to Charles Bush and E. Behrends for the installation of an electric-light plant in Clara City, Mich.

GRAND RAPIDS, MICH.—Plans to do away with the West Side power canal are again under consideration. It is proposed to deepen and widen the canal and to erect an electric-power plant between the canal and river, just above the Pearl Street bridge, about opposite the plant of the Powers & Walker Casket Company. It is estimated that about 1000 hp can be developed.

LUDINGTON, MICH.—The Stearns Lighting & Power Company has submitted a proposition to the City Council in connection with a renewal of the street-lighting contract for a term of five years. The company offers to replace the arc-lamp system on East Ludington Avenue with five ornamental lamp standards, each carrying five lamps, which would do away with all electric-light poles in the business center.

ROMEO, MICH.—The Village Council has accepted the proposition of the Eastern Michigan Edison Company to purchase the municipal electric-light plant at $18,000. The proposition will be submitted to a vote at an election to be held Dec. 27. The plant originally cost $35,000 and has been in operation for the past fourteen years. The people demanded a twenty-four-hour service, and it was decided it would be better to sell the plant than to equip it for the additional service.

ALBERT LEA, MINN.—The name of the Albert Lea Light & Power Company has been changed to the Minnesota Gas & Electric Company. The capital stock of the company has also been increased to $750,000. The new company is planning to enlarge its plant and extend its system into the surrounding villages and into the farming districts to supply electricity for lamps and motors. It is understood that the company proposes to remove its power plant to the outskirts of the city, where a larger plant will be erected. Ludwig Kemper is secretary and treasurer.

FEDERAL DAM, MINN.—The Council, it is reported, has been petitioned for a franchise to construct and operate an electric-light plant in Federal Dam.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company, it is said, will submit a new proposal to supply electrical energy to operate the municipal filtration plant, giving the city a lower rate. The city agrees to reduce the amount used while the company is carrying its peak load daily. The cost of erecting a transmission line to the plant is estimated at $10,000.

MORRISTOWN, MINN.—The Consumers' Power Company is reported to have been granted a franchise to supply electricity for lamps and motors in Morristown.

ROCHESTER, MINN.—H. M. Byllesby & Company, of Chicago, Ill., are reported to have submitted a proposition to the City Council for a franchise to supply electrical energy to operate the municipal electric-light plant.

GULFPORT, MISS.—The Gulfport & Mississippi Coast Traction Company is planning to purchase a 2500-kva turbo-generator set for its power house in Gulfport in the near future.

KOSCIUSKO, MISS.—The Planters' Oil & Gin Company, of Kosciusko, Miss., it is reported, is in the market for a 75-kw to 100-kw, 1100-volt, 125-cycle, single-phase, second-hand generating unit.

MOKANE, MO.—C. E. Moseley is reported to be interested in the establishment of an electric-light plant in Mokane.

TWIN BRIDGES, MONT.—The Madison River Power Company has completed all arrangements for lighting the streets of the town. Owing to the Town Council being unable to come to an agreement upon the street-lighting question the streets are still in darkness.

KEARNEY, NEB.—Plans are being prepared by the Oscar Claussen Engineering Company, of St. Paul, Minn., for the installation of a municipal electric-light plant in Kearney. It is proposed to operate this plant in connection with the water-works system. The plans include the installation of an ornamental street-lighting system in the business district. It is said that oil engine, gas producer and steam-power equipment will be considered. J. F. Druar, engineer, is in charge of the work.

OSMOND, NEB.—The Village Board has granted a franchise to B. S. Leedon & Son to install an electric-light plant in Osmond. It is understood that the plant will be installed by the Alamo Engine & Supply Company, of Omaha, Neb.

GOLDFIELD, NEV.—Plans are being considered by the Goldfield Deep Mines Company, recently incorporated, for the installation of a 250-hp electric hoist and air-compressor plant. Senator W. A. Clark and others are interested in the company.

WASHOE, NEV.—The Commonwealth mine is remodeling its hydroelectric power plant. New equipment will be installed. C. N. Miller is general manager of the company.

HOBOKEN, N. J.—Plans are being considered by Wilson Taylor, president of the Hoboken Board of Education, to establish a power plant to supply electricity for lamps and motors for all the schools throughout the city. The cost of the proposed plant is estimated at about $25,000. Mr. Taylor places the annual saving at $6,000 per year.

BROOKLYN, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, New York, until Dec. 29 for furnishing, installing, maintaining and reserving for use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 1830 kw of three-phase, 6600-volt, 25-cycle power and furnishing and delivering this power under the terms of this contract from Jan. 1, 1912, to Dec. 31, 1912, both inclusive, at each of the high-pressure fire-service pumping stations located in the borough of Brooklyn, at Furman and Joralemon Streets and at Willoughby and St. Edward's Streets respectively. Blank forms may be obtained at the office of the department, Room 2339 Park Row Building, New York, N. Y. Henry S. Thompson is commissioner.

CATSKILL, N. Y.—Application has been made to the Public Service Commission, Second District, by the Schoharie Light & Power Company, the Catskill Illuminating & Power Company and the Upper Hudson Electric & Railroad Company for approval of consolidation of these companies and for authority to issue capital stock and bonds.

JAMAICA, N. Y.—Sealed proposals will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until Jan. 2, for installing electric equipment in the new Public School 40, located at the corner of Pacific and Union Hall Streets, Jamaica, borough of Queens. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Hall of Board of Education, Park Avenue and Fifty-ninth Street, New York, and also at branch office, 69 Broadway, Flushing, borough of Queens.

JAMESTOWN, N. Y.—The Public Service Commission, Second District, has granted the Jamestown Lighting & Power Company permission to exercise rights and privileges conferred upon it under a franchise granted by the Town Board of Ellicott for furnishing electricity for lamps and motors in that town.

NEWFANE, N. Y.—The Newfane Electric Company has received authority from the Public Service Commission, Second District, to issue additional capital stock to the amount of $7,000, the proceeds to be used for payment of expenditures incurred for proper capital expenses.

NEW YORK, N. Y.—Bids will be received by the commissioner of bridges, Department of Bridges, 13 to 21 Park Row, New York, N. Y., until Dec. 28, for furnishing and installing electrical feeder cables on the westerly track of the upper deck of the Manhattan Bridge. Blank forms and specifications may be obtained at the above office. Arthur J. O'Keefe is commissioner.

NEW YORK, N. Y.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 13, 1912, for furnishing three 200-kw motor-generator sets and controlling panels at the navy yard, New York, N. Y. Specifications can be obtained on application to the bureau or the commandant of the navy yard named. The cost of the work is estimated at $16,000. R. C. Hollyday is chief of bureau.

NEW YORK, N. Y.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 13, 1912, for extension of underground compressed-air mains at the navy yard, New York, N. Y., plans and specifications for which may be obtained on application to the above bureau or to the commandant of the navy yard named. The cost of the work is estimated at $8,500. William M. Smith is acting chief of bureau.

NEW YORK, N. Y.—Proposals will be received by the president of the Board of Trustees of Bellevue and Allied Hospitals, New York, N. Y.,

reconstruction of the electric-light system at the main building and overhauling of same at the ambulance building, power house and laundry building of the Harlem Hospital, situated at 136th to 137th Street and Lenox Avenue, New York, N. Y. Blank forms may be obtained at the office of the contract clerk, 400 East Twenty-ninth Street, New York, N. Y. John W. Brannan is president of board of trustees.

NEW YORK, N. Y.—Bids will be received by the commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, New York, N. Y., until Dec. 29 for furnishing, maintaining, installing and reserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle electric power and furnishing and delivering this power under terms of this contract from Jan. 1, 1912, to Dec. 31, 1912, both inclusive, at each of the high-pressure fire-service pumping stations located in the borough of Manhattan, at Oliver and South Streets and at Gansevoort and West Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York, N. Y. Henry S. Thompson is commissioner.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities until Jan. 2 (extension of date from Dec. 21) as follows: (1) For furnishing materials and labor for underground-conduit system, transformer vault, electric elevator and other work in the metropolitan hospital district; (2) for complete electric wiring and fixtures for infirmary dining-room and kitchen, female tuberculosis building and sun tests, solarium pavilions Nos. 1 to 5, superintendent's residence, carpenter shop, coffin shop, stable, power house and laundry building for metropolitan hospital district; (3) for complete electric wiring and fixtures for new Roman Catholic church, male infirmary and sun tents, and electric motors for laundry for metropolitan hospital district; (4) for furnishing labor for ground wire and labor and materials for grounding system, lightning arresters and automatic switches for metropolitan hospital district. Blank forms and further information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, N. Y., where plans and specifications may be seen. Michael J. Rrummond is commissioner.

SODUS, N. Y.—The Town Board has granted a franchise to Omar Curtis, representing the Northern Wayne Electric Light Company, to install an electric light and power system in the town of Sodus, east of the substation. The company also contemplates erecting electric systems in Rose, North Rose, Wolcott and possibly Red Creek, to supply electrical service in those places. The franchise granted by the Town Board of Sodus will enable the company to furnish electricity in the villages of Sodus Point and Sodus Center, in addition to Wallington and Alton.

ALBEMARLE, N. C.—Proposals will be received by the Mayor and the Board of Commissioners of the town of Albemarle, N. C., until Jan. 16 for the construction of a water-works system, which will include the erection of a pumping station, clear-water basin, deep well, two motor-driven turbine pumps having a capacity of 750 gal. per minute each, switchboard and 1 mile of pole line, tower and tank and about 5 miles of 6-in. to 10-in. pipe line. Plans and specifications are on file at the office of the Mayor in Albemarle and at the office of Gilbert C. White, engineer, Charlotte, N. C. Copies of specifications, proposal blanks, etc., may be obtained on application to the engineer. A complete set of blueprints will be furnished on payment of $3 to cover cost of same. M. J. Harris is Mayor.

MAIDEN, N. C.—The Council is reported to be considering the installation of an electric-lighting system in Maiden. It is proposed to obtain electricity from the substation of the Southern Power Company at Charlotte, N. C., to operate the system.

WENTWORTH, N. C.—Bids will be received by the County Commissioners of Rockingham County, North Carolina, for furnishing a modern lighting plant for the court house and jail. For further information address J. P. McMichael, clerk of County Commissioners, Wentworth, N. C.

MILTON, N. D.—The installation of an electric street-lighting system in Milton is reported to be under consideration.

ALLIANCE, OHIO.—It is said that Mayor Speidel in his annual message will recommend to the new Council that initial steps be taken toward the installation of a municipal electric-light plant in order to have the plant ready for operation by the time the franchise of the Alliance Gas & Power Company expires.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company submitted the only bid for lighting the streets of the city. The company offered to supply arc lamps at $51.56 each per year, which is a reduction of $1.92 per lamp paid under the present contract.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has applied to the Ohio Public Service Commission for permission to issue common stock to the amount of $1,500,000, to be sold at par, and to issue $1,500,000 in first-mortgage bonds, to be disposed of for cash and at par. The proceeds are to be used to provide for improvements, betterments, etc., and to liquidate certain existing indebtedness.

COLUMBUS, OHIO.—The report of the special committee appointed by the Council to determine the number of new street lamps required has been accepted by the Council with a recommendation that it be turned over to the new director of public service after the first of the year. The committee recommends the installation of 214 additional lamps.

GREENVILLE, OHIO.—Sealed proposals will be received by the director of public service, Greenville, Ohio, until Dec. 30 for furnishing electric street lamps and gas lamps for alleys and public places for a term of years beginning Jan. 1, 1912, and ending June 17, 1920. D. W. Shively is director of public service.

NILES, OHIO.—Plans are being considered by the City Council for the installation of an ornamental street-lighting system on the principal streets of the city, bids for which will be called for in the near future.

TROTWOOD, OHIO.—The County Commissioners have granted the Dayton Light & Power Company a second franchise, giving the company permission to extend its transmission line from Fort McKinley to Trotwood for the purpose of supplying electricity for lamps and motors in Trotwood. The company was recently granted a franchise to extend its system to Fort McKinley.

KINGFISHER, OKLA.—The Benham Engineering Company, of Oklahoma City, Okla., is preparing plans and specifications for extensions to the municipal electric-light plant and water-works system in Kingfisher. Bids for material will be received about Jan. 15.

OKLAHOMA CITY, OKLA.—Plans are being considered by the Chamber of Commerce and the Oklahoma City Retailers' Association for the installation of an ornamental street-lighting system in the downtown district of the city.

PONCA CITY, OKLA.—Plans and specifications are being prepared by Burns & McDonnell, of Kansas City, Mo., for the municipal electric-light plant in Ponca City, for which bonds to the amount of $30,000 were recently voted.

WAGONER, OKLA.—Plans and specifications are being prepared by the Benham Engineering Company, of Oklahoma City, Okla., for extensions to the municipal water-works system and electric-light plant at Wagoner, Okla. It is expected that bids will be called for material about Feb. 1, 1912.

LAKEVIEW, ORE.—The proprietors of the Ramona Hot Springs, located near Lakeview, are said to be planning to install an electric power plant.

LINTON, ORE.—The electric power plant of the Western Oregon Lumber Company was recently destroyed by fire, causing a loss of about $200,000.

PORTLAND, ORE.—The Oregon Electric Railway Company, it is reported, is planning to construct an electric railway from Portland to McMinnville, via Newberg, a distance of about 40 miles, work on which will begin at once. The line will eventually be extended to Dallas, 25 miles distant.

CONNEAUTVILLE, PA.—Plans are being considered for the installation of an electric-light plant in Conneautville. Electricity for operating the system will be secured from the plant at Meadville.

JOHNSTOWN, PA.—The board of directors of the Dale Light, Heat & Power Company has authorized extensive improvements to its plant, which will involve an expenditure of about $12,000. At the annual meeting to be held Jan. 5 the stockholders will be asked to vote on the proposition to increase the capital stock of the company from $30,000 to $250,000. The plant of the company is located in the newly annexed portion of Stonycreek Township. C. F. Lancaster is manager.

MAUCH CHUNK, PA.—Plans have been prepared by the Lehigh Valley Coal & Navigation Company for the construction of a large electric generating plant in its mining region for the purpose of supplying electricity to manufacturing industries in the territory adjacent thereto within a radius of 40 miles and for use on its own mining properties.

MERCER, PA.—The Borough Council has granted the Mercer County Electric Light & Heat Company a franchise to build and operate an electric-light plant in Mercer. Under the terms of the franchise the company is to begin work on the proposed system within thirty days and to have the plant in operation within six months. It also provides that arc lamps are to be furnished for street lighting at $75 each per year up to twenty in number and $65 each per year for all above that number. Electricity for lighting the fire department is to be furnished free of charge. The Mercer County Electric Light & Heat Company has recently acquired the capital stock of the Greenville Electric Light, Heat & Power Company.

PHILADELPHIA, PA.—Sealed proposals will be received by Joseph R. C. McAllister, president Board of Recreation, City Hall, Philadelphia, Pa., until Dec. 26 for furnishing electric-arc lamps and incandescent electric lamps for lighting the miscellaneous playgrounds in the city of Philadelphia, Pa. Approximately 100 arc lamps and 700 incandescent lamps will be required.

PITTSBURGH, PA.—The committee on public works of the Council has recommended that the Mayor and director of the Department of Public Works be authorized to advertise for bids for electricity for lighting the streets for a term of one year, and also for furnishing incandescent mantle lamps for the same period.

SHARON, PA.—Plans and estimates have been submitted to the City Council by D. M. Hosford, of Cleveland, engineer, for the proposed municipal electric-light plant. The cost of the plant is estimated at $83,322. Provision is made for 250 6.6-amp magnetite arc lamps for a street-lighting system and for a commercial load sufficient to supply a population of 18,000.

WEATHERLY, PA.—A special election will be called Jan. 8, 1912, to vote on the proposition to issue bonds to the amount of $14,000, the proceeds to be used for the installation of a power plant in connection with the municipal electric-light plant.

TIVERTON, R. I.—[illegible] have voted to increase the capital stock of the company from $12,000 to $36,000, the proceeds to be used for extension of transmission lines and additional equipment to meet the increasing demand for electrical service. The company purchases electrical energy from the Fall River Electric Light Company to operate its system.

MENNO, S. D.—The Town Board has granted a twenty-year franchise for the installation of an electric-light plant. Under the terms of the franchise the system must be completed and in operation not [illegible]

WAKONDA, S. D.—The Wakonda Light, Power & Heating Company, recently organized, will apply for a twenty-five-year franchise to install an electric-light and heating plant. The company is capitalized at $10,000.

BRISTOL, TENN.—The City Council is considering a proposition submitted by the Bristol Gas & Electric Company for the erection of fifteen arches, one to be erected over each of the principal streets of the city.

COWAN, TENN.—The insta[illegible] is reported to be under consideration.

JOHNSON CITY, TENN.—[illegible] and Henry College, Johnson City, Tenn., it is reported, would like to receive estimates on cost of electric-light plant for the community.

KNOXVILLE, TENN.—The Aluminum Company of America, of Pittsburgh, Pa., has purchased the right-of-way for a distance of 40 miles along the Tennessee River in Blount County, Tenn., and across the state line in North Carolina. The company proposes to build a large power plant and utilize the water-power to generate electricity to operate a large aluminum plant. It is understood that 200,000 hp will be developed at a cost of $12,000,000. As yet the company has not decided whether to erect its refining plant near the power dams or in Knoxville.

LEXINGTON, TENN.—Bonds to the amount of $50,000 have been sold by the city, the proceeds of which will be used for the installation of an electric-light plant and water-works system in Lexington. R. C. Houston, engineer, of Memphis, Tenn., will have charge of the work.

CALVERT, TEX.—The City Council has granted the Calvert Water, Ice & Electric Light Company a new franchise for a period of fifty years. The company has agreed to make a number of improvements to its light and water systems, which will involve an expenditure of about $14,000.

DALLAS, TEX.—A power plant will be installed in the basement of the twelve-story concrete office building for physicians to be erected by J. Ashford Hughes at Commerce and Pearl Streets. Lang & Witchell are architects.

DECATUR, TEX.—At an election to be held Jan. 2, 1912, the proposition to issue $18,000 in bonds, the proceeds to be used to purchase the water and light plant of the Decatur Water, Light & Power Company, which was recently damaged by fire, will be submitted to a vote. It is proposed to purchase the plant at $10,000 and expend $8,000 for improvements.

DENISON, TEX.—The City Council is considering the question of extending the street-lighting system in all parts of the city.

DONNA, TEX.—It is reported that plans are being considered to establish a combined electric-light plant and cottonseed-oil mill and ice plant. B. H. Hooks is said to be interested in the project.

HUNTSVILLE, TEX.—Bids will be received until Jan. 5 by the Prison Commissioners, J. A. Palmer, secretary, for electrical machinery for shops and power plant at Huntsville. For specifications and further information address Benjamin E. Cabell, chairman.

SEADRIFT, TEX.—The Council is reported to have granted a franchise to G. W. Huff, of Corpus Christi, Tex., to install and operate an electric-light plant in Seadrift.

TIOGA, TEX.—C. B. Glasscock is reported to have been granted a franchise by the Council to construct and operate an electric-light plant in Tioga.

PROVO, UTAH.—The County Commissioners have granted the United States government a twenty-five-year franchise to erect a transmission line from the government power plant in the mouth of the Spanish Fork Canyon to Salem, Payson and Lincoln. Preparations are being made by the government to supply electricity for lamps and motors in the south end of Utah County and also for the farming districts under the Strawberry project.

TREMONTON, UTAH.—Negotiations are under way between the Town Board and the Utah Nevada Sugar Company, whereby the latter will supply electricity for lighting the town of Tremonton. The company offers to deliver power to the city limits if arrangements can be made for the installation of a distributing system.

WINOOSKI, VT.—The Board of Village Trustees has granted the Burlington Light & Power Company permission to replace the present street lamps with luminous arc lamps. There are forty-one lamps to be replaced.

ABERDEEN, WASH.—The Mutual Heat & Light Company, recently incorporated, has been granted a franchise for the installation of a distributing system in Aberdeen, including the erection of overhead lines and a conduit system.

BELLINGHAM, WASH.—The contract for the installation of a lighting and heating system in the federal building in Bellingham has been awarded to Christopher & Blythe, of Bellingham, at about $40,000.

DUVALL, WASH.—Plans are being prepared by Roy W. Comegys, of Duvall, recently granted a franchise for an electric plant and water- [illegible] power plant and transmission system, which, it is said, will involve an expenditure of about $200,000.

LEAVENWORTH, WASH.—It is reported that plans and estimates are being prepared for the Washington Steel & Iron Company, of Spokane, Wash., for the construction of a concrete dam on the Wenatchee River in Leavenworth. A franchise has been granted the company to supply electricity for lamps in Leavenworth. R. J. Zell, of Spokane, is engineer.

NORTH YAKIMA, WASH.—Plans are being considered by the North Yakima & Valley Railway Company, which operates between North Yakima and Naches, a distance of about 12 miles, to equip its railway for electrical operation, at a cost of approximately $350,000. George Donald is president of the company.

REPUBLIC, WASH.—The North Washington Power & Reduction Company has commenced work on the installation of new boilers, generator and other equipment at its property. J. E. McFarland is general manager of the company.

SEATTLE, WASH.—The chief object of the Seattle Northeast Improvement Club, recently organized by the property owners in that portion of the city, is to obtain street lamps for that district of the city. R. W. Douglas is president of the club.

SPOKANE, WASH.—Plans are being prepared by the Spokane & Inland Empire Railroad for the installation of a 500-kw motor-generator set, for which orders will soon be placed.

SUNNYSIDE, WASH.—Work will soon begin on the installation of a street-lighting system in Sunnyside, consisting of magnetite-arc lamps.

WHITE BLUFFS, WASH.—The Pacific Power & Light Company has completed the installation of an electric-light system in White Bluffs. The company has been granted a fifty-year franchise in Benton County and proposes to erect transmission lines to all sections of the valley to supply electricity for pumping and irrigating work.

MATEWAN, W. VA.—It is reported that G. T. Blankenship is preparing plans for the installation of an electric-light plant in Matewan. It is understood that material for the proposed plant has been purchased.

MILLVILLE, W. VA.—It is reported that plans are being made for the erection of a high-tension transmission line from the electric plant of the Winchester & Washington City Railway Company at Millville, W. Va., to Brunswick, Md. For further information address D. M. Swink, of Millville, W. Va., general manager.

JUNEAU, WIS.—The Theresa mill in Juneau has been purchased by Nathan Haessby. Extensive improvements will be made to the mill. It is understood that an electric-light system for the village will be installed as soon as the [illegible]

MILWAUKEE, WIS.—The Common Council has directed the Commissioner of Public Works to advertise for bids on machinery for the proposed municipal electric-light plant.

WAUWATOSA, WIS.—The Board of Supervisors of Milwaukee County is reported to have prepared tentative plans for a central heating plant and power station for the group of county buildings at Wauwatosa, to replace the present individual systems. The plans involve an expenditure of approximately $75,000. Martin Blehn is county clerk.

VANCOUVER, B. C., CAN.—The City Council is considering plans for the installation of ornamental street lamps on about 20 miles of prominent thoroughfares. City Electrician Hughes is in charge of the improvement.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of the Board of Control, Winnipeg, Man., until Dec. 29 for furnishing and installing complete a vertical centrifugal pump driven by an induction motor, direct-connected, the pump to be capable of pumping 1,000,000 gal. per twenty-four hours. Instructions to bidders, specifications and form of tender may be had at the office of the city engineer.

BRIDGEBURG, ONT., CAN.—The Village Council is negotiating with the Canadian Niagara Power Company, of Niagara Falls, Ont., for the installation of an electric-lighting system in Bridgeburg.

PARIS, ONT., CAN.—An estimate of the cost of installing a system to utilize electricity to be furnished by the Hydroelectric Power Commission in Paris has been submitted by Harry Acres, government engineer, to the Board of Trade. The cost is estimated at $13,000. It is expected that a by-law will be submitted to the ratepayers in the near future.

TORONTO, ONT., CAN.—On New Year's Day at least twenty-eight municipalities will vote on the proposition as to whether they will enter into agreement with the Hydroelectric Power Commission for electrical energy. It is proposed to develop water-power on the Maitland and Saugeen Rivers, where it is estimated that 15,000 hp is available. As these rivers are practically dry during the summer months, the systems will be augmented by a loop attached to the Niagara system, so that power will be available at all times of the year. New transformer stations will be erected at Guelph and Seaforth in order to augment the supply from the Maitland and Saugeen Rivers. If the western lines are erected, one will extend from Seaforth to Goderich, Clinton, Bayfield, Hensall, Exeter, Zurich, Dashwood, Crediton, Leith, Brussels, Wingham

[illegible] Arthur, Mount Forest, Harriston, Palmerston, Listowel, Durham, Shallow Lake, Owen Sound, Meadford, Thornbury, Wiarton and Collingwood. From these two trunk lines branch lines will run to every town and village in the district. In the Trent Canal district all towns from Whitby to Cornwall will be served. More than 4000 hp will be developed on the Trent Valley Canal, and on the Ottawa River at Chat's Falls there is a possible development of 100,000 hp. The cost of the proposed system is estimated at $5,000,000.

BUCKINGHAM, QUE., CAN.—The town of Mont Laurier, located on the Du Lievre River, about 100 miles above Buckingham, is installing a water-works system, to cost about $35,000. An electric-light and power plant will be installed in the near future.

MONTREAL, QUE., CAN.—The power station of the Saraguay Electric & Water Company, at Cartierville, was destroyed by fire recently.

[illegible] the Shawinigan Water & Power Company will be held Dec. 27 to ratify an issue of $500,000 in debentures, making the total $4,500,000.

MONTREAL, QUE., CAN.—The Citizens' Committee of Greenfield Park has petitioned the Town Council to enter into negotiations with the Montreal Light, Heat & Power Company in order to induce the company to extend its service to this town. The Council is also asked to secure an extension of the Southern Counties Railway Company's street-car system to Greenfield Park next year.

PARRAL, MEX.—The Parral Power & Reduction Company has sold its electric-power plant, located near Parral, to the Alvarado Mining & Milling Company. Extensions and improvements will be made to the plant.

PARRAL, CHIHUAHUA, MEX.—Plans are being considered for the installation of a gas-producer plant at the Capitanena mine, in the San Francisco del Oro district. D. H. Bradley, Jr., is manager of the property.

PUENTE GRANDE, JALISCO, MEX.—The Chapala Hydro-Electric Company is planning to install a new insulating system on its transmission lines in the Hostotipaquillo and Etzatlan mining districts.

New Industrial Companies.

THE AMERICAN ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $10,000 by R. A. Love, P. G. Winter and Robert Steven.

THE BATTERY ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated by William J. Rabert, S. and D. A. Battl[illegible]. The company proposes to deal in electri[illegible] devices of all kinds, install and equip electric plants, telephone [illegible] railways and all kinds of electrical construction work.

THE BROOKS CONSTRUCTION COMPANY, of Fort Wayne, Ind., has been chartered with a capital stock of $25,000 for the purpose of building electric and steam railroads and general construction work. John F. Brooks, L. E. Ginn and C. J. McGee are directors.

THE CHICAGO RAILWAY SIGNAL & SUPPLY COMPANY, of Carpentersville, Ill., has been chartered with a capital stock of $10,000 by John F. Fierke, H. Howard C. McNeil and Charles E. Griffith. The company proposes to manufacture and deal in railway signals, apparatus, etc.

New Incorporations.

OAKLAND, CAL.—Articles of incorporation have been filed for the Merced River Power Company, with a capital stock of $10,000,000, by Leon M. Gave, H. L. Breed, Charles Gross, J. E. Bowes and Milton S Hamilton.

SAN FRANCISCO, CAL.—The Feather River Power & Irrigation Company has been incorporated with a capital stock of $10,000,000 by R. K. Barrows, of Lakespur; A. N. Lewis, Jr., of Alameda; A. L. Dohlf, of San Francisco, and F. C. Devine, of Berkeley. The company proposes to develop a water-power on the Feather River Canyon along the line of the Western Pacific Railway.

YOLO, CAL.—The Yolo Water & Power Company has filed articles of incorporation with a capital stock of $10,000,000 for the purpose of building power plants, impounding water and developing electricity in the Sierras.

SPRING VALLEY, ILL.—Articles of incorporation have been filed for the Spring Valley Gas & Electric Company by C. H. Brown, Harry E. Brown and Roy W. Brown. The company is capitalized at $30,000 and proposes to generate and distribute gas and electricity.

ANGOLA, IND.—The Angola Light & Power Company has been chartered with a capital stock of $50,000 by D. M. Vesey, A. J. Vesey and W. E. Mossman. The company, it is said, will take over and operate the plant of the Angola Railway & Light Company.

HOLLAND, IND.—Articles of incorporation have been filed for the Home Electric Light Company with a capital stock of $15,000 by J. H. Heitman, J. H. Miller, H. W. A. Hemmer and J. F. Overbeck. The company proposes to install a power plant to supply electricity for lamps and motors in the town of Holland and in Dubois County.

Personal.

[illegible], manager for the Pacific Telephone & Telegraph Company at [illegible], Cal., has resigned.

[illegible] H. [illegible], manager of the supply department of the Guarantee Electric Company, Chicago, has resigned to engage in other business.

MR. EDWARD WRAY has been appointed secretary of the Chicago Section of the Illuminating Engineering Society, succeeding Mr. A. L. Eustice, resigned.

MR. FRED L. JOHNSON, formerly city engineer, Santa Barbara, Cal., has been appointed supervising engineer of the Southern Sierras Power Company at San Bernardino, Cal.

MR. ROSSITER HOLBROOK, of New York, read a paper entitled "The Gas Engine and the Central Station" at the annual convention of the National Gas Engine Association held in Cleveland on Dec. 4 and 5.

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company and the Western Union Telegraph Company, has been making an extended inspection tour in the West. He is reported to have said that telephone communication between New York and San Francisco will be made within a year.

MR. EDWIN R. ROCKWELL, president of the Guarantee Electric Company, of Chicago, has resigned from the company, both as director and president, his resignation taking effect Jan. 1. Mr. Rockwell retains his financial interest in the company, with which he has been connected for the last nine years, first as secretary and treasurer and for the last six years as president. His plans for the future are undetermined.

BRIG.-GEN. GEORGE H. HARRIES, recently elected president of the Louisville Lighting Company, of Louisville, Ky., furnished an interview last week which was the basis of a full-page feature story in the magazine section of the *Louisville Herald* on Sunday. A half-page drawing by the newspaper's artist set off the article, it representing General Harries, in full-dress uniform, touching off an old-time cannon which directed a fusillade of electric-light bulbs into space.

MR. A. T. MACDONALD, general sales manager of the Louisville Lighting Company, who is prominent in the affairs of the Kosair Temple of the Mystic Shrine of that city, has been elected delegate of the Gateway City Shrine to the 1912 convention of the national organization, which will be held in Los Angeles, Cal., next May. Mr. Macdonald is an active worker toward the establishment of a magnificent temple in the Falls City, such as that which now graces Indianapolis, Ind.

PROF. WILLIAM C. BAUER, professor of electrical engineering in Northwestern University, Evanston, Ill., has been appointed acting director of the College of Engineering during the absence of Professor J. F. Hayford, who has been appointed a member of an international commission of engineers to report on the disputed boundary line between Costa Rica and Panama. The American members of the commission will leave for Central America in January to take advantage of the dry season.

MR. WILLIAM H. THOMSON, JR., operating engineer with the Illinois Traction System, has been appointed general manager of the Des Moines Electric Company to succeed Mr. P. B. Sawyer, who will become general manager of the Union Electric Company, Dubuque, Ia. Mr. Thomson was graduated from Cornell University in 1898. For four years after leaving Cornell he was assistant to the general manager and engineer of the St. Paul Gas Light Company. He then held the position of general manager of the Union Light, Heat & Power Company, of Fargo, N. D., and was promoted from that position to be assistant general manager of the San Antonio Gas, Electric & Traction Company, of San Antonio, Tex. Mr. Thomson has also acted as general manager of the Corsicana Gas, Electric & Traction Company, of Corsicana, Tex., and for the last year has been occupying the position of operating engineer of the Illinois Traction System.

MR. B. A. BEHREND has been awarded the John Scott Medal by the Franklin Institute for his contribution to the advancement of the electrical industry. This award recognizes the prominent part which the work of Mr. Behrend has played in the development of alternating-current machinery in this country, both from the manufacturer's and the user's point of view. In introducing high peripheral speeds for water-wheel alternators, and in insisting upon the proper voltage margin of generators for low-power-factor loads, rather than extremely close regulation under hypothetical conditions; upon proper kva to kw proportioning of prime mover and generator, and upon cool operation under actual, rather than hypothetical, operating conditions, he became conspicuous thirteen years ago by adopting an attitude which now appears commonplace. In embarking upon turbo-generator construction in 1902, after careful deliberation, Mr. Behrend determined upon, and developed in this country, a general type which, while then in use only sparingly in Europe, and not at all here, has since been adopted almost universally in Europe and shows signs of similarly taking the field here. In regard to the theory of the practical and commercial design of induction motors, it is only necessary to recall the important work done by Mr. Behrend in Europe at a time when the few manufacturers of this apparatus were groping in the dark.

Obituary.

[illegible] at Bath, [illegible], [illegible] ninety. Mr. Fuller was the inventor of the Fuller bichromate battery. He was born in Bristol in 1821, but went to London when he was quite young. He became fascinated with the study of electricity, and about 1854 he became connected with the Electrical & International Telegraph Company, with which he continued for a number of years. Later he assisted Mr. W. T. Henley, the submarine-cable manufacturer, and thereafter he founded his own firm, John C. Fuller & Son.

MR. C. C. COKEFAIR, president and general manager of the Great Northern Development Company, died at Duluth, Minn., on Dec. 13, after an illness of about two weeks, of pneumonia. Mr. Cokefair was born in Bloomfield, N. J., sixty-three years ago, and went to Duluth in 1899. He was the originator and promoter of the Great Northern Power Company, and after the completion of that enterprise became interested in other water-power projects in the Northwest, principally on the Mississippi River. He recently began grading work on Mississippi River frontage owned by him at Coon Creek, 12 miles from Minneapolis. He announced that he would build a dam at Coon Creek and later one at Anoka and would furnish the Twin Cities with electric energy. He was one of the men behind the Mississippi River Improvement Company and the Minnesota Power and Trolley Company.

MR. DANIEL C. HEMINGRAY, secretary and treasurer of the Hemingray Glass Company, of Covington, Ky., and Muncie, Ind., died at the Queen City Club, Cincinnati, Ohio, on Dec. 14, from apoplexy. The preceding Tuesday Mr. Hemingray was taken ill in an [illegible] after leaving his office in Covington, Ky., and was taken to the Queen City Club. The following day his condition appeared to improve, but during the night he suffered a relapse and he died at 5 o'clock on Thursday morning. Mr. Hemingray, who was fifty-four years old, was born in Covington, Ky. He attended the Woodward High School in Cincinnati, where he was a classmate of President Taft, and later entered the Massachusetts Institute of Technology. Before graduating he returned to Covington and entered business with his father and brother, Mr. Ralph Hemingray, now president of the Hemingray Company. Mr. Hemingray was a member of the principal Cincinnati clubs and a non-resident member of many clubs throughout the country, much of his time being passed in traveling in connection with his business. He was a director of the Cincinnati Trust Company and of the Suspension Bridge Company and one of the first stockholders of the Latonia Racing Association. At one time he was a member of the Covington Water Works Department. Mr. Hemingray was extremely popular in Cincinnati and had large circles of friends in different sections of the United States. His jovial disposition and hale good-fellowship were particularly appreciated in his club life. As remarked by a friend, "There were no dull moments in his company, and many are the Queen City club members who, oppressed by the cares of business, found momentary rest from their worries in the optimistic, jovial and happy temperament of 'Dan' Hemingray."


DANIEL C. HEMINGRAY.

MR. E. C. NORTON, of Escanaba, Mich., vice-president and general manager of the Norton Logging Company and vice-president of the Northwestern Cedarmen's Association, died at his home in Escanaba on Dec. 9. Mr. Norton, who was but thirty-six years of age, was a native of Burlington, Wis. He went to Escanaba thirteen years ago as cedar-pole inspector for the Kinloch Telephone Company, of St. Louis. He afterward organized an inspection bureau for a number of telephone companies and later was placed in charge of the pole department of the Kellogg Switchboard & Supply Company, of Chicago, with headquarters at Escanaba. He continued in the last-named capacity until three years ago, when he bought out the Kellogg company's pole business and conducted a pole and post business under his own name. He also organized the Norton Logging Company. He was elected vice-president of the Northwestern Cedarmen's Association at the convention of last January. He was also prominent in the Masonic order, being a Knight Templar and a Shriner. His death was the result of an illness of two weeks and followed an operation for peritonitis undertaken as a last resort. Mr. Norton is survived by a widow and two daughters. He was a man of high character who was admired and respected by his friends and acquaintances. At a meeting of the board of directors of the Northwestern Cedarmen's Association held in Minneapolis on Dec. 9 appropriate resolutions on the death of Mr. Norton were adopted and spread upon the records of the association.

Trade Publications.

RIGID CONDUIT INSTALLATION.—The National Metal Molding Company, Pittsburgh, Pa., has issued a folder to the trade illustrating various buildings throughout the country in which the wiring is installed in "Sherarduct" conduit. The latter is made of annealed iron zinc treated and galvanically protected on the inside as well as the outside against corrosion.

PLASTIC INSULATING COMPOUND.—Condensite, a phenolic condensation product, adapted for use as an impregnating substance for electrical apparatus, wood and other fibrous or cellular matter and which can also be employed for molding, is described in a pamphlet published by the Condensite Company of America, Glen Ridge, N. J. Tests showing its dielectric and mechanical strength are given, as well as illustrations of some of the molded products made from the material.

ELECTROPLATING DYNAMOS.—Bulletin No. 100 issued by the Munning-Loeb Company, Matawan, N. J., describes the company's "Optimus" electroplating dynamos. Two and three-wire units in both belt and direct-connected types are illustrated and test curves showing the performance of each are included. The machines are compounded to give uniform voltage from no load to overload and the efficiency curve from half load to one-quarter overload approaches a straight line. Data of value to [illegible]

BUSINESS NOTES.

MOHAWK ELECTRIC COMPANY, Newark, N. J., will [illegible] Pacific Coast branch in San Francisco, Cal. Mr. H. V. Mooney, who has been associated with the company for the past two years, will have charge of the establishment of the new branch. A complete stock of Rollinson specialties and a repair and testing department will be maintained in San Francisco, whence all Western orders will be shipped. The Mohawk Electric Company was formerly located in Albany, N. Y., and manufactures rectifying sets, toy transformers, lamp-testing watt indicators, etc.

AUTOMOBILE ELECTRIC LIGHTING.—The Ward-Leonard Electric Company, of Bronxville, N. Y., reports great progress in the manufacture and sale of the Ward-Leonard automatic dynamo lighting system for automobiles. It has recently received an order from the Cole Motor Car Company, of Indianapolis, to equip all of the cars of that company for 1912 with this dynamo lighting system. Agency arrangements for the sale and installation of Ward-Leonard automatic generator lighting systems have been completed with the following firms: Wheeler-Green Electric Company, Rochester; Morton Havens, Jr., Albany; Conduit Electric Company, Syracuse; Johnson-Fay Electric Company, Buffalo; Baldwin-Stewart Electric Company, Hartford; Auto Appliance Company, Cleveland, and United Electric Company, Baltimore.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 12, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,011,141. ILLUSTRATIVE TELEGRAPHY; N. S. Amstutz, Cleveland, Ohio. App. filed Aug. 30, 1901. Transmitting and reproducing sketches, etc., by varying the rate of propagation of electrical impulses.

1,011,160. MERCURY RECTIFIER; F. P. Coffin, Schenectady, N. Y. App. filed March 3, 1909. Metal envelope with mechanical details.

1,011,164. INSULATOR; S. S. Cornelius, McDowell, Mo. App. filed June 8, 1911. Metal bracket and porcelain block for line wires.

1,011,165. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed June 21, 1911. Generator and storage-battery system.

1,011,166. ELECTRIC INCANDESCENT LAMP AND HOLDER; C. Damey, London, England. App. filed Sept. 22, 1910. A lock for preventing the removal of a lamp from the socket.

1,011,168. TELEPHONE SYSTEM; W. W. Dean, Elyria, Ohio. App. filed Nov. 2, 1908. Local battery party line with tuned vibrators.

1,011,169. IGNITION DEVICE; W. W. Dean, Elyria, Ohio. App. filed Oct. 14, 1910. Electromagnetic vibrator and system.

1,011,175. COMBINED ELECTRIC DOORBELL AND FIRE-ALARM; C. E. Egan, Lafollette, Tenn. App. filed Oct. 26, 1910. Push-button switch and heat-operated diaphragm switch.

[illegible]. SHADOWER OR INSULATOR; F. A. Feldkamp, Vailsburg. [illegible] of structures such as automobile radiator plates.

[illegible] WITH OTHER METALS; S. Jahn, Charlottenburg, Germany. App. [illegible]

1,011,210. CABLE RELAY APPARATUS; I. Kitsee, Philadelphia, Pa. App. filed Dec. 4, 1908. For transposing the positive and negative impulses of a cable system to the dot and dash system.

1,011,212. ALTERNATING-CURRENT CONTROLLER; D. Larson, Yonkers, N. Y. App. filed Oct. 2, 1905. Electromagnetic switch.

1,011,232. ELECTRICAL SAFETY FUSE; G. Müller, Schwabisch-Gmünd, Germany. App. filed Nov. 29, 1910. Central-bolt plug fuse.

1,011,240. ELECTRICAL CONTROLLING APPARATUS; O. H. and A. F. Pieper, Rochester, N. Y. App. filed March 6, 1911. Dental [illegible]

1,011,258. GALVANIC BATTERY; E. C. Smith and E. L. Marshall, Fremont, Ohio. App. filed Aug. 7, 1909. Caustic electrolyte; closed-circuit cell.

1,011,267. MOTOR CONTROL; A. Sundh, Yonkers, N. Y. App. filed March 13, 1908. Manual, mechanical and pneumatic elevator motor control.

1,011,268. MOTOR CONTROL; A. Sundh, Yonkers, N. Y. App. filed Dec. 17, 1908. Push-button-controlled electric elevators, etc.

1,011,291. RAILWAY SIGNALING SYSTEM; H. A. Wallace, New York, N. Y. App. filed June 15, 1911. "Home and distant" system with "block" sections.

1,011,328. THERMOSTAT DAMPER REGULATOR; R. E. Dewey, Grand Rapids, Mich. App. filed Nov. 27, 1909. Improvement on Patent No. 926,391.

1,011,357. ELECTRIC LIGHTER FOR CIGARS; T. P. Moody, Chicago, Ill. App. filed Oct. 27, 1910. Double-spark vapor ignition.

[illegible] RHEOSTAT; [illegible], Indianapolis, Ind. App. [illegible] Jan. 14, 1910. A rod with insulated resistance coils.

[illegible] METHOD OF AND APPARATUS FOR THE TREAT[illegible] OF LAMP FILAMENTS; W. G. Abbott, Jr., Schenectady, [illegible] App. filed Oct. [illegible] Filaments are fed progressively [illegible]

1,011,402. AUTOMATIC ELECTRIC TRAIN-LINE COUPLING; W. L. Bliss, Brooklyn, N. Y. App. filed Jan. 6, 1905. A longitudinally movable member is supported on a pivoted member and carries a movable coupling member.

1,011,405. TELEPHONE DESK SET; P. C. Burns, Chicago, Ill. App. filed March 9, 1905. Lazy-tongs extension bracket.

1,011,413. PROCESS OF ELECTRICALLY DECOMPOSING FLUIDS; W. H. Cone, Chicago, Ill. App. filed March 16, 1910. Electric current is passed in the direction of flow of the liquid and the products withdrawn at different points; NaCl, etc.

1,011,439. MAGNET TERMINAL; W. Kaisling, Chicago, Ill. App. filed March 2, 1906. Projecting split tube.

[illegible] PROCESS FOR EXTRACTING METALS FROM THEIR ORES; H. S. McKay, Riverside, Cal. App. filed Jan. 20, 1910. Electrochemical process, particularly for copper ores.

1,011,462. TROLLEY; W. E. Marshall, Logansport, Ind. App. filed March 8, 1911. Oscillating frame for holding the wheel.

1,011,485. ELECTRIC BATTERY; G. Pfleiderer, Gross-Lichterfelde, Germany. App. filed June 21, 1911. Dry battery.

1,011,493. LIGHTNING ARRESTER; C. Robinson, Schenectady, N. Y. App. filed June 19, 1907. A series of oil-immersed carbon balls resting in metal troughs.

1,011,503. ELECTRIC OZONIZER; S. Shepherd, Ottawa, Canada. App. filed April 18, 1910. The layers are separated by corrugated metal [illegible]

1,011,526. VIBRATING RECTIFIER; E. Thomson, Swampscott, Mass. App. filed July 1, 1911. A body of mercury free to vibrate in the air-gap of a magnet.

1,011,527. ELECTRIC SIGNAL SYSTEM; W. V. Turner, Edgewood, Pa. App. filed Feb. 23, 1907. Single wire annunciator for railwa[illegible]

1,011,538. LIGHTNING ARRESTER; E. Weintraub, Lynn, Mass. App. filed Sept. 5, 1911. A vapor device with conductive deionizing bodies in the path of the arc.

1,011,544. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; H. C. Wirt, Plymouth, Mass. App. filed Oct. 12, 1910. A groove for holding the lining in a cap.

1,011,546. CIRCUIT-CONTROLLING DEVICE; J. E. Woodbridge, San Francisco, Cal. App. filed May 20, 1910. A circuit-breaker and switch in series with an alarm device.

1,011,554. RAILWAY-SWITCH INSTRUMENT; C. O. Anderson, Omaha, Neb. App. filed Feb. 14, 1911. Indicating and controlling device operated by a railroad switch.

1,011,559. CARBON ELECTRODE FOR GALVANIC ELEMENTS; S. Benko, Budapest, Austria-Hungary. App. filed June 17, 1909. A carbon disk is impregnated with metal at its periphery.

1,011,574. ELECTRIC-HEATED GLOVE; A. L. Carron, Binghamton, N. Y. App. filed Sept. 9, 1911. Coils of wire in the fingers with contacts to engage conductors on a steering wheel.

1,01[illegible] [illegible] DEVICE FOR TELEPHONE AND OTHER CIRCUITS; C. B. Forrest, Middleport, Ohio. App. filed March 19, 1910. A pole with contact clips.

1,011,602. AUTOMATIC BLOCK-SIGNAL SYSTEM; W. E. Foster, Chicago, Ill. App. filed July 22, 1910. Relay construction and circuits.

1,011,607. SURGICAL IMPLEMENT; J. A. Fulton, Astoria, Ore. App. filed Oct. 22, 1909. A tube for internal heat treatment and an external temperature indicator.

1,011,616. ELECTRIC INSTRUMENTS; E. A. Halbleib, Rochester, N. Y. App. filed Dec. 16, 1910. Electric valve having an electro magnet and armature and a polarizing fixed magnet.

1,011,639. ELECTRIC SWITCH; T. E. Murray and W. T. Dempsey, New York, N. Y. App. filed July 1, 1911. Gang-plug oil switch.

1,011,652. STRAIN INSULATOR; L. Steinberger, New York, N. Y. App. filed May 25, 1910. A metal tube with insulated anchors.

1,011,662. SWITCHBOARD CONSTRUCTION FOR ALTERNATING-CURRENT CONTROLLERS; A. Sundh, Yonkers, N. Y. App. filed May 27, 1908. The magnet is supported on rubber to absorb vibration and avoid humming.

1,011,663. ALTERNATING-CURRENT ELECTROCHEMICAL CONTROLLER; A. Sundh, Yonkers, N. Y. App filed Aug. 11, 1908. A series of switches are operated by cams on a power-driven shaft.

1,011,710. TERMINAL CLIP FOR ELECTRIC BATTERIES; C. E. Avery, Jersey City, N. J. App. filed July 17, 1911. Bent spring wire with securing eye.

1,011,723. TROLLEY WHEEL AND FINDER; B. R. Beach, Fieldsboro, N. J. App. filed March 21, 1911. Spirally grooved roller.

1,011,732. CURRENT-LIMITING DEVICE; D. Broido, Berlin, Germany. App. filed May 25, 1908. Make-and-break type for use where electricity is sold on a flat-rate basis.

1,011,741. DEVICE FOR GROUNDING TROLLEY CORDS; F. E. Case, Schenectady, N. Y. App. filed Sept. 25, 1908. The cord passes through a permanently grounded guide laterally movable on the car roof.

1,011,754. SNAP SWITCH; A. S. Cubitt, Pittsfield, Mass. App. filed March 18, 1911. Reciprocating snap action with bow spring.

1,011,756. DEVICE FOR AUTOMATICALLY OPENING AND CLOSING VALVES; G. Dalen, Stockholm, Sweden. App. filed July 20, 1907. Light buoy, etc.; gas valve is closed by action of daylight.

1,011,757. MOTOR-CONTROLLING DEVICE; M. W. Day, Schenectady, N. Y. App. filed July 16, 1909. Starting mechanism, speed-regulating mechanism and an auxiliary short-circuiting switch.

1,011,758. SAFETY DEVICE FOR ELEVATORS; J. F. Dean, Scranton, Pa. App. filed April 8, 1911. Controlling switches are held closed by the doors.

1,011,769. INDUCTION FURNACE; E. F. Gehrkens, Pittsfield, Mass. App. filed July 14, 1910. The wall of the furnace is part of the secondary.

1,011,771. SUPPORTING FRAME FOR INCANDESCENT LAMPS WITH METAL FILAMENTS; L. Glaser, Berlin, Germany. App. filed March 13, 1907. Encircling protecting loops.

1,011,774. CENTRIFUGAL SWITCH; C. H. Haddrell, Lynn, Mass. App. filed May 14, 1910. For small single-phase induction motors.

1,011,777. WIRELESS TELEGRAPHY; J. Harden, Schenectady, N. Y. App. filed Oct. 10, 1904. Sending apparatus and mercury spark-gap device.

1,011,778. REVERSING SWITCH FOR ELECTRIC MOTORS WITH OPPOSITELY ROTATING MAGNETS AND ARMATURES; V. Harborn, Friedenau, Germany. App. filed March 11, 1911. For road wheels of motor vehicles.

1,011,783. INDUCTION MOTOR; R. E. Hellmund, Hinsdale, Ill. App. filed June 22, 1907. A plurality of sets of windings with a switch for producing different speeds.

1,011,784. CIRCUIT-BREAKER; E. M. Hewlett and C. H. Hill, N. Y. App. filed March 28, 1905. A plurality of switches with a common tripping device.

1,011,785. CIRCUIT-BREAKER; C. H. Hill, Schenectady, N. Y. App. filed Nov. 9, 1905. Hand-setting device with a lock-out.

1,011,791. INSULATION OF WINDINGS IN ELECTRICAL APPARATUS; G. Honold, Stuttgart, Germany. App. filed Oct. 18, 1909. Double layers for the armatures of magneto ignition devices.

1,011,801. SIGNAL FOR RAILWAY SWITCHES; A. H. Johnson, Epsom, England. App. filed June 9, 1911. Mechanical details of a "point" signal device.

1,011,809. ELECTRICAL WATER-HEATER; L. Katz, San Francisco, Cal. App. filed Feb. 8, 1911. The water runs through a chamber containing the resistance coils.

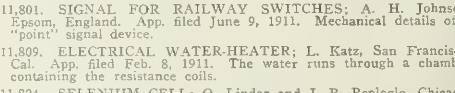
1,011,824. SELENIUM CELL; O. Linder and J. B. Replogle, Chicago, Ill. App. filed Jan. 26, 1911. A resistance unit affected by the intensity of light.

1,011,825. RESISTANCE UNIT; W. J. Lloyd, Lynn, Mass. App. filed Aug. 6, 1910. Concentric tubes with interposed coil. For electric meters, etc.

1,011,842. ELECTRIC SOCKET; A. Pikoos, Baltimore, Md. App. filed Aug. 26, 1911. Incandescent-lamp switch.

1,011,855. FEEDER VOLTAGE REGULATOR; B. P. Rucker, Charlotte, N. C. App. filed Sept. 20, 1910. Non-automatic transformer regulator.

1,011,879. ELECTRIC HEATER; A. M. Wentworth, Pittsfield, Mass. App. filed July 15, 1909. A flatiron with flat resistance element between mica sheets.



1,011,825.—Resistance Unit.

1,011,890. INCANDESCENT ELECTRIC LAMP; J. L. Rooney, New York, N. Y. App. filed Jan. 5, 1910. Multiple-filament "turndown" effected by partial rotation of the lamp.

Patents Delayed in Receipt.

1,002,563 (Sept. 5). SENDER FOR AUTOMATIC TELEPHONE SYSTEMS; E. E. Clement, Washington, D. C. App. filed Nov. 11, 1905. Special finger holds for the operating member.

1,003,337 (Sept. 12). METHOD OF RELAYING ELECTRICAL CURRENTS; E. E. Clement, Washington, D. C. App. filed June 16, 1898. To eliminate the "time constant" in telegraph and telephone work.

1,008,809 (Nov. 14). INCANDESCENT LAMP WITH DRAWN-METAL-WIRE FILAMENT; K. Farkas, Glen Ridge, N. J. App. filed June 23, 1911. The filament is divided into sections to avoid expansion and contraction difficulties.

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CONTENTS.

PROTECTION AGAINST LIGHTNING.

A recent note read before the French Academy of Sciences gives some curious details with reference to lightning protection at high elevations. There are two little observatories on Mount Blanc. The earlier one founded by the late M. Janssen, stands on the perpetual snow of the mountain-top, and in arranging to protect it from the lightning storms, which are not infrequent there, it was necessary to make an earth connection by a cable 100 m in length. With the observatory thus insulated on snow except for this earth connection, protection against lightning has proved to be practically out of the question, and in spite of all the efforts made to install protective devices the observatory has been repeatedly struck and both instruments and observers have been injured. The other observatory stands on rock and the metal work practically surrounds it and is grounded on the rock. This structure has never been struck, at least in any way that has produced injury. The indications seem to be that the long earth connection is very unfavorable, possibly owing to its choking effect, perhaps also to the fact that it, with the building to which it is connected, affords the only easy path to ground over a considerable area, which would perhaps insure its getting struck more often than would naturally be expected. A discharge of the violence commonly found in lightning is very apt to do incidental mischief even when a fairly good path to earth is provided, and 100 m of cable is certainly not a good ground compared with the direct connection of what amounts to a metal cage to the rock on which it is founded.

It must not be supposed, however, that even a metallic cage offers complete protection against injury from lightning, as it is only a few years since a small party took refuge in a sheet-steel crib in Lake Michigan and was annihilated by a lightning stroke. The men were in a practically closed conducting shell grounded in a large lake, but nevertheless received a sufficient amount of the discharge to be fatal. The long and short of the matter is that with discharges of sufficient voltage to have a striking distance of half a mile or more, as frequently happens in case of lightning, all moderate insulation spaces and insulators are too trivial to insure relief from the violence of the discharge. Only very complete protection, and that under favorable circumstances, seems to be able to avert mischief. The most that can be said on the subject is that, on the whole, the better the ground the less likelihood of serious damage. Lightning protection for buildings or even for aerial lines is not yet exactly worked down to a science or even an art. The investigation of cases such as the one here considered is a thing very well worth while, since it at least gives a clew to some of the more conspicuous difficulties of the situation.

MOTOR GENERATORS, CONVERTERS AND RECTIFIERS.

One of the reports presented at the Turin International Electrotechnical Congress was by Prof. Silvanus P. Thompson, on "Motor Generators, Converters and Rectifiers," and was written in the lucid and forceful literary style that characterizes the books of this well-known writer. There is perhaps no subject in the field of electrotechnics which needs international standardization of nomenclature so much as the subject of Professor Thompson's paper. Thus, the machine which is called in our A. I. E. E. standardization rules a "motor converter" is called in the paper, and generally throughout Europe, a "cascade converter." On the other hand, what the paper calls "converters" we call "synchronous converters," although both the paper and our own rules recognize the unfortunate prevalent use of the term "rotary converter." It is to be hoped that before very long such unnecessary differences in names for one and the same type of machine may be eradicated by mutual international agreement.

The paper alludes to the long controversy waged between the advocates of motor generators and synchronous converters respectively, but sums up in favor of the converter. In this country the controversy was of short duration only, and the converter soon dominated the field, almost to the exclusion of its rival. In Europe, on the contrary, the motor generator has always been more popular, and even at the present time remains in extensive use. A description is given of a type of converter called the "revolving-field converter," which in this country has not come into use, and which is not very common in Europe. It consists of a dynamic inversion of the ordinary converter. That is, instead of having a stationary field-magnet system and commutator brushes, with a rotary armature, it has a stationary armature and a rotary magnet and brushes. The advantages claimed for this structure of converter are not specified in the paper, except that the rotor field-pole need not be wound, being magnetized by the stator winding.

Special attention is given in the paper to a recent type of converting machine not mentioned in our standardization rules, namely, the "auto-converter," also called the "split-pole converter." This machine employs two sets of separately excited poles in the field-magnet system. The two sets of poles co-operate side by side and behave as though each main pole were subdivided into two portions. Consequently, two north poles follow and alternate with two south poles, instead of the single north pole and the single south pole in the usual type of machine. By exciting the two sets of poles in different ways, a variety of different types of machine can be and already have been produced. Thus, the applications specified are for direct-current balancers, boosters and three-wire generators, variable-speed generators for train lighting, synchronous converters for supplying two different direct-current voltages, constant-current machines, step-down direct-current converters, voltage-regulating machines, converters from constant potential to constant current, etc. It is evident that this principle, which has also been employed in the United States for regulating the delivery voltage of converters, is a fecund one for many other purposes.

INDUCTION-MOTOR DESIGN CONSTANTS.

The squirrel-cage type of polyphase induction motor possesses input characteristics identical, except as to relative magnitude, with a stationary transformer of equivalent rating, and its output characteristics are even more nearly similar to those of a shunt-wound direct-current motor built for the same service. It is logical, therefore, for the designer to employ with this machine methods representing compromises between the corresponding methods used in designing transformers and direct-current motors. One feature never considered in direct-current motor design and often ignored in designing transformers, but of almost predominating importance in determining the proportions of induction motors, is the power factor, the value of which depends largely upon the depth of the air-gap and dimensions of the primary coils. Closely related to the power factor are the starting characteristics and the operating temperature. The former depends largely upon the mechanical arrangements of the primary coils and upon the variable losses, while the latter relates to the magnitude of the exciting current and the constant losses. The interrelations between the many variables connected with the performance of an induction motor are indicated in a clear manner in the simple circle diagram, which possesses sufficient accuracy for all commercial-design purposes. The use of the simple circle diagram in connection with simplified design constants is described in an article by Prof. A. Miller Gray in this issue. The constants given are based on standard induction motor designs, and for use with such machines should prove of much interest and value. However, as is true with all design constants, it would be unsafe to assume them to be applicable with a high degree of accuracy to machines departing widely in proportion from standard lines.

ELECTRICAL RESISTANCE OF SOLID-METAL SOLUTIONS.

It is now generally supposed that the essential difference between a substance in the solid, liquid and gaseous states is merely in regard to the freedom of motion of its molecules. In the gaseous state these are free to oscillate over a relatively long mean free path, whereas in the liquid, and particularly in the solid, state the range of free molecular movement is very much more restricted. In other respects there is reason for supposing that the behavior of the molecules of a substance in these three states is very much alike. The "gas constant" is found to be a characteristic constant of certain phenomena of the same substance in liquid states, and the "liquid constant" is likewise found to make its appearance in certain attributes of the solid state. Diffusion, or the property of unaided mutual interpenetration, is essentially and markedly a characteristic of gases. Two different gases brought into volume juxtaposition without disturbance are found speedily to diffuse into each other across the surface of original separation. The same property, although greatly reduced in intensity and rapidity, is manifested between a pair of different liquids placed in mutual contact. Ordinarily it is supposed that diffusion does not occur between solids, but the property is still possessed by solids, although to a relatively very feeble extent. The rapidity with which diffusion can occur be-

tween the molecules of solid bodies in contact depends on the nature of the substances, the pressure exerted across the area of intercontact and the temperature of the contact layers. In general, high pressures and temperatures favor the process.

An article printed on page 1605, based on the work of Messrs. Bruni and Meneghini, describes an interesting experiment tending to show that a compound wire of nickel and copper, the former forming the core and the latter the external coating, was converted into an alloy wire of "constantan" after about a week's exposure to a steadily maintained temperature of 1000 deg. C. In such a case the diffusion of the molecules of the two metals into each other would continue until there ceased to be any discontinuity of metallic quality at the original bounding surface of contact. In this case the electrical resistance of the heated wire enabled its average molecular state to be estimated as the experiment continued, since the resistivity of constantan alloy is much greater than that of either of its two constituent metals. But in the ordinary process of metallic diffusion at ordinary room temperatures the action is extremely slow and very much more difficult to detect.

THE SENSITIVENESS OF WIRELESS-TELEGRAPH CONTACT DETECTORS.

There are two kinds of contact detectors recognized in the art of wireless telegraphy; namely, loose-contact detectors and tight-contact detectors. This classification sounds very simple, and indeed applies wonderfully well; but the subject is much more complicated than the classification suggests, and its ultimate ramifications run into the yet unknown properties and laws of matter in various directions. The original coherer of Onesti, Branly and Popoff, as developed by Lodge, Marconi and others, was a loose-contact detector, in which the loose contact occurred between adjacent particles of the same substance, or at least between essentially similar adjacent particles. The loose contact had a very high normal initial resistance, until the impact of the received electromagnetic wave broke its resistance down. This typical and original form of coherer had to be agitated back to its initial non-conducting state, ready for the reception of the next impulse. Later varieties of loose-contact detectors developed special peculiarities, deviations from the original type. There were some, called anti-coherers, that had an initial and normal lower resistance, which became increased on the impact of the received wave. There were both coherers and anti-coherers which were automatically self-restoring, and which needed no jar or agitation after the reception of each signal. In nearly every case such detectors employed loose contacts between different materials, as, for instance, an oil-film contact between metal and mercury, or a contact between carbon and mercury. In every case the mechanical contact had to be loose and flimsy, so as to produce a poor electrical contact, with a relatively high resistance in the same, which contact resistance became modified suddenly by the impact of the received electric wave.

As practical signal-receiving instruments all of these loose-contact devices gave more or less trouble, owing to the inherent flimsiness and delicacy of their adjustment. Looking back upon their use, it is wonderful that they worked as well as they did. When they were "Hobson's choice," and no better devices were available, they had to be coaxed into operation by dint of patience and vituperation, a combination of rare efficacy in times of trouble. In the corresponding history of the development of the telephone there was first a time in which the only available transmitter was a receiving telephone used as a generator—a very imperfect makeshift. Then came the stage in which the carbon microphone imperfect-contact transmitter was discovered, and finally a stage in which, instead of there being no independent available transmitter, there was a superabundance of transmitters. A few iron nails thrown together haphazard or a hot wire fastened to a diaphragm would serve. It seemed hard to avoid producing a telephone transmitter. So there was a stage in the development of loose-contact wireless-telegraph receivers when it seemed hard to avoid producing receivers on assembling conductors in loose contact. A complete change came, however, in the history of detectors when the loose-contact devices were rejected in favor of constant-resistance, tight-contact, current-operated devices.

At first tight-contact devices were less sensitive than the coherers; but later they surpassed the best coherers in sensitiveness. One type of such device is the "crystal" receiver, which is a misleading term; for, although many crystalline substances enter as an element into this type, yet some amorphous substances enter also. The essential elements of this type are a lump of suitable substance, such as carborundum, and a tight contact, over a circumscribed area, between this and the active electrode. Just how this device acts is a debatable matter in detail, but it is clear that current passes through the contact more easily in one direction than in the other. Unquestionably heat is produced at the restricted contact area, and it is supposed that, under the influence of this heat, the crystalline, or quasi-crystalline, substance develops unilateral conductivity at the tight contact. The curious fact is that the effect is highly localized, because the blunt contact needle pressing on the crystal, and carried from point to point over the surface of the latter, encounters successively little areas of strong and weak action, although no difference in the surface quality of the crystal can be detected in any other manner. It became evident at a later stage in the development of the crystal receiver that the effect could be produced, at least to some extent, in a great variety of substances, and it began to rain crystal receivers. Thus, the old Hughes microphone, employing a steel needle resting delicately in contact with a carbon plate, and intended to operate as a loose contacter, was found capable of producing some effect as a tight-contact detector, although an effect very small by comparison with that of the best crystals. The article by Messrs. Harris and Hogan on page 1602 of this number gives experimental evidence of the essential difference between the action of loose-contact detectors, like that of the Hughes microphone, and current-operated, tight-contact crystalline detectors. With the former the sensitiveness is a maximum at very light pressure of contact and diminishes rapidly as pressure is applied. With the latter the conditions are reversed.

Overhead-Line Construction.

At the December meeting of the executive committee of the National Electric Light Association a resolution presented by the special committee to which was referred the report of the overhead-line construction committee was unanimously carried. The resolution adopted is as follows:

"*Resolved*, That the executive committee commend the able and exhaustive report of the committee on overhead-line construction submitted at the last convention of the association to the favorable consideration of member companies. It sets out with great clearness and particularity a high standard of practice, which, in the opinion of this committee, should be regarded as a standard toward which all companies should strive. Local conditions or special considerations may, however, in particular cases, make the adoption of the recommendations of the report in whole or in part impracticable or inadvisable, and non-compliance therewith in such cases would not necessarily be bad practice. Upon the whole, however, we consider the report as embodying the best standard of overhead-line construction which has been suggested, and indorse it with the qualifications hereinbefore set forth."

It will be recalled that at the time the report was presented at the convention in New York last May certain features of it were subjected to criticism. The American Electric Railway Engineering Association objected to the section on the joint use of poles without further conference, and certain Class A members found fault with the fourth section of the report, dealing with crossings, and also questioned the advisability of adopting the recommendations of the committee without giving minute consideration to the legal questions involved. After much discussion it was agreed to thrust the responsibility of final action on the executive committee, and a motion recommending to the executive committee the adoption of the report was carried. Subsequently the Pennsylvania Electric Association, at its convention in Exposition Park, Pa., in September, feeling that it would be unjust to commit the smaller electric-light companies to any standard which might jeopardize investments or rights, asked that its objections be given consideration in connection with the adoption of the national committee's report. Many Class A members in addition had their lawyers report on the legal status of the report in case of lawsuits involving questions of standard construction. It would appear from the wording of the resolution of the executive committee that the objections raised were not without weight.

Resuscitation from Electric Shock.

Through the co-operation of the National Electric Light Association, the American Medical Association and the American Institute of Electrical Engineers plans have been perfected for a thorough study of methods of resuscitation from electric shock and the preparation of a set of rules for the practical application of the best means for resuscitation, the rules to be issued by the National Electric Light Association.

The members of the committee to carry on the work were appointed by the American Medical Association at the request of the National Electric Light Association and represent these two bodies and the American Institute of Electrical Engineers. It is probable that the scope of the investigation will be made international in character by the appointment of an international commission to report on some important details or of an advisory committee consisting of foreign authorities on the subject of electric shock. Following is the membership of the general committee which will have direct charge of the work:

Nominated by the American Medical Association: Chairman, Dr. W. B. Cannon, professor of physiology, Harvard University; Dr. Yandell Henderson, professor of physiology, Yale University; Dr. S. J. Meltzer, Rockefeller Institute, New York; Dr. George W. Crile, professor of clinical surgery, Western Reserve University, Cleveland, a distinguished authority on heart action; Mr. W. D. Weaver, editor *Electrical World*, secretary. *Nominated by National Electric Light Association:* Dr. Edward A. Spitzka, professor of anatomy, Jefferson Medical College, Philadelphia, who has made a special study of electrical accidents; Mr. W. C. L. Eglin, past-president National Electric Light Association, Philadelphia Electric Company. *Nominated by American Institute of Electrical Engineers:* Prof. Elihu Thomson; Dr. A. E. Kennelly.

Service-Annuity System Presented to Employees of Commonwealth Edison Company at Christmas.

Dated Dec. 23, 1911, and sent out by Mr. Samuel Insull, the president, with the compliments of the season, the board of directors of the Commonwealth Edison Company of Chicago made an announcement of unusual interest. This announcement is to the effect that at a meeting held on Nov. 21 the board of directors of the company adopted a plan for the creation of a service-annuity system, with a view of making some provision for faithful employees who have completed a certain term of service. The plan contains the following provisions:

First—That any employee who shall have reached the age of fifty-five years and shall have been in the service of the company for thirty years or more next preceding his retirement shall, upon his request, if approved by the service-annuity committee, be retired from active service with a service annuity.

Second—That any employee who shall have reached the age of sixty years and shall have been in the service of the company for fifteen years or more next preceding his retirement shall, upon his request and at the discretion of the service-annuity committee, be retired from active service with a service annuity.

Third—That any employee who shall have reached the age of sixty-five years and who shall have been in the service of the company for fifteen years or more next preceding the date upon which he shall have reached the above age shall be retired from active service with a service annuity unless the board of directors shall, for special reason, continue any such employee in active service without a service annuity.

Subject to the provisions of the plan, the amount of the service annuity to be paid each year to an employee retired under the system shall, in general, be as follows:

Two per cent of the average annual pay of such employee during the particular consecutive five years of service when his average pay was the highest, multiplied by the number of years of his service, provided that in no case shall the service annuity paid to any employee in any year be less than $240. Service in the company, as defined in the plan, includes service in the Commonwealth Edison Company and in any company which has been wholly merged into or acquired by the Commonwealth Edison Company or any of its predecessor companies prior to June 1, 1910.

The system is to be administered by a committee of five, of which the president of the company is ex officio a member and the chairman and the secretary of the company (Mr. W. A. Fox) is ex officio a member and the secretary. The other three members of the committee for the first year have been appointed by the board and are Messrs. Louis A. Ferguson, W. L. Abbott and J. H. Goehst. The system will become effective on Jan. 1, 1912.

The service-annuity system of the Commonwealth Edison

Company is based to a large extent on the report of the public policy committee of the National Electric Light Association, and it is one of the most important results of the very important work in this direction which that committee has carried out, along with other aspects of welfare work. One significant feature of the new service-annuity system of the Commonwealth Edison Company is that the company bears all the expense. No deductions whatever are made from the salaries or wages of employees in order to create a fund to defray, or partially defray, the annuities. The company has at the present time about 3200 employees.

Program of Byllesby Convention.

The third annual convention of H. M. Byllesby & Company and affiliated companies will be held in the Congress Hotel, Chicago, on Jan. 2, 3, 4 and 5. Mr. T. K. Jackson, of Mobile, is chairman of the convention, and the executive committee consists of Messrs. H. M. Byllesby, A. S. Huey, O. E. Osthoff, J. S. Cummins, J. J. O'Brien and R. J. Graf. There will be addresses by Mr. Byllesby, Mr. Jackson, Mr. George B. Caldwell, Mr. J. R. McKee, Gen. George H. Harries, Mr. Osthoff, Mr. B. E. Sunny, Mr. T. C. Martin and others. Technical and commercial papers on the program are as follows: *Steam Heating*, Mr. A. E. Stevens; *High-Pressure Gas*, Mr. H. H. Jones; *Profitable Business in Small Towns*, Mr. H. F. Morton; *Contact with the Public*, Mr. W. H. Hodge; *Accounting*, Mr. B. W. Lynch; *Staff Co-operation*, Mr. W. R. Molinard; *Jurisdiction of State and Municipal Bodies*, Mr. Isaac Milkewitch; *Appraisal Work*, Mr. Harold Almert; *New-Business Methods*, Mr. E. L. Callahan; *The Manager and the New-Business Department*, Mr. A. F. Douglass; *Byllesby Investment Club*, Mr. R. J. Graf. There will be a reception at the home of Mr. Byllesby on the evening of Jan. 3 and a banquet at the hotel, with prominent men as speakers, on the evening of Jan. 5. Mr. F. H. Tidnam is chairman of the committee on arrangements, Mr. R. M. Jennings of the reception committee, and Mr. Lincoln Beerbower of the entertainment committee.

Proposed General Traction Consolidation in Chicago.

Negotiations having for their purpose the ultimate general consolidation of the elevated and surface railway companies in Chicago are proceeding slowly. A valuation commission is at work to determine the valuation of the properties of the elevated-railway companies, the valuation of the surface-railway companies having been determined in the traction settlement ordinances of 1907. The present commission consists of Mr. John Ericson, city engineer; Messrs. E. C. Shankland and J. J. Reynolds, members of the Subway Commission of the city of Chicago; Mr. George Weston, the city representative on the Board of Supervising Engineers, Chicago Traction, and Prof. George F. Swain, of Harvard University, who represents the companies. Professor Swain is the engineer of the Massachusetts Board of Railway Commissioners and is also a member of the Boston Transit Commission. It is interesting to note that the valuation commission is instructed to consider the following elements of cost:

(1) The cost of reproducing the tangible physical property new at the present time.

(2) The present depreciated value of the tangible physical property.

(3) The value of the franchises, leases, contracts, etc.

(4) The loss of interest in the past below what would be a fair return on the capital invested.

(5) The treatment of obsolete or abandoned property.

The suggestion that the commission report on all these [illegible] the companies [illegible] city agreed to make these valuations, without, however, binding itself to take into consideration any other items than the actual physical value of the present tangible physical property. In a communication dated Dec. 18 the representatives of the companies made it clear that on their part this stipulation was understood and agreed to—that is, that the report of the valuation commission, while going into all the details mentioned, was not to be considered binding either on the city or the companies. This communication was signed by Mr. Henry A. Blair, representing the Chicago Railways Company; Mr. Ira M. Cobe, representing the Chicago City, Southern Street and Calumet & South Chicago Railway companies, and Mr. Samuel Insull, representing the Chicago Elevated Railways.

The project of combining all the elevated and surface railways of Chicago is intimately connected with the building of the proposed subway. Very likely the subway will be built by the city and leased to the companies for operation, but no conclusion has been reached on the subject. While the negotiations are proceeding so far in an amicable spirit, the interests involved are very large and important, and it will be some time before a plan of settlement can be worked out in all its details.

Chicago Investigation of Smoke Abatement and Electrification of Railway Terminals.

At the "municipal dinner" given by the Chicago Association of Commerce on the evening of Nov. 28 the first official progress report of the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals was made public. This report, prepared under the supervision of the chief engineer for the committee, took the form of a sketch of the origin and progress of the investigation of the subjects mentioned in the long title of the committee.

By way of introduction to the report a brief history of smoke abatement in Chicago was given, leading up to the statement that in the report of the smoke inspector of Chicago for 1910 it was declared frankly that there was necessity of a radical change in existing conditions of smoke abatement, so far as the railways are concerned; in fact, the electrification of railway terminals within the city was recommended in explicit form.

FORMATION OF THE COMMITTEE.

The recent history of the agitation for railway-terminal electrification in Chicago is recounted, both as taken up by the city authorities and by the Chicago Association of Commerce. In October, 1909, a committee of experts appointed by the latter reported favorably on electrification as a mechanical problem, but was less confident as to the financial feasibility of the proposal. About that time co-operation between the city administration and the Association of Commerce was suggested, with the formation of a joint committee of investigation. It was understood that the railways would provide the funds for the promotion of the investigation.

At a meeting of the association held in September, 1910, the leading representatives of a dozen different railways declared that the electrification of the railway terminals in Chicago would involve an enormous expense which would have to be borne by the commerce of the city and that immediate electrification was premature. Smoke abatement, it was added, need not depend wholly upon electrification. At a meeting of the Chicago Association of Commerce held on March 18, 1911, a general committee of eighteen was appointed to investigate the whole subject. This committee consisted of representatives of the city, steam-railway executives and other citizens. Its personnel has been

given in this journal, but it may be repeated that Mr. Jesse Holdom is chairman and Mr. Frederick H. Rawson secretary. It is this committee under whose auspices the present elaborate investigation is being conducted.

ENGINEERING STAFF AND SCOPE OF INVESTIGATION.

The engineering staff organized to do the work of this committee is as follows: Chief engineer, Mr. Horace G. Burt; electrical engineer, Mr. Hugh Pattison; terminal engineer, Mr. Louis H. Evans; mechanical engineer, Mr. Theodore H. Curtis; consulting electrical engineers, Messrs. Gibbs & Hill, of New York; consulting mechanical engineer, Mr. George R. Henderson, of Philadelphia; assistant engineer, Mr. James Walker; editor for the engineers' staff, Mr. Benjamin C. Burt. Headquarters are maintained in the People's Gas Building, Chicago.

The scope of the investigation includes: (1) A determination as to the necessity of changing the motive power of steam railways to electric or other power; (2) the mechanical or technical feasibility of such a change; (3) the financial practicability of such a change. In the scope of the investigation as to the necessity of changing the motive power of steam roads to electric or other power are embraced the following heads: (1) Safety, (2) health, (3) comfort and convenience, (4) questions of loss and damage. Under each of these heads are included the subdivisions "passengers," "employees" and "the public." Each of these subdivisions is in turn subdivided.

WHAT HAS BEEN DONE.

One feature of the investigation is the obtaining of information on yard locomotives, freight trains, freight transfer trains, passenger transfer trains and passenger trains operating within the city and in and out of the city. Much of the attention of the engineering staff so far has been devoted to the smoke-abatement portion of the problem. A great deal of information has been collected on the subject. A definite conclusion has been reached in relation to the use of coke as locomotive fuel, and it has been decided to eliminate coke entirely from further consideration.

Such subjects as brick arches and stack blowers in locomotives, as well as down-draft furnaces, steam jets and under-feed stokers, have received much attention. Various printed documents have been issued by the committee and a memorandum of maps has been prepared for the study of the territory or territories covered by the investigation. Various advisory committees to the general committee have been formed.

GENERAL STATEMENT.

In concluding its progress report the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals says that the investigation so far (the report is dated Nov. 24, 1911) has been chiefly occupied with the subject of locomotive-smoke abatement. It is expected that in the course of the next few months tangible developments will appear in the handling of the matter of electrification. The concluding sentences of the report are as follows:

"In proportion as it has progressed the problems presenting themselves for solution have rather increased than diminished in number, and it is sufficiently clear, even at the present stage, that for the accomplishment of definite and valuable results much labor and considerable time will be required. The task imposed upon the committee proves to be one that is rather special, even unique, in scope and character, and while much may be learned from what has already been accomplished in various lines, yet much will have to be done *de novo* or for the first time. It is confidently hoped, and even believed, that if that which has to be done is well done the results will be of interest and value not only for the present time and place, but for other times and places as well."

Increased New York City Street Lighting.

Work is nearing completion on the installation by the Department of Water Supply, Gas and Electricity of New York City of new and additional street lamps in extensive districts, which has been made possible by the saving early this year of $70,000 by Commissioner Henry S. Thompson in obtaining from the New York Edison Company a reduction in the price per kilowatt-hour for electric lighting in public buildings. When the work is all completed the principal sections to be lighted by means of this saving will have their illumination doubled, and on some avenues the mantle type of gas lamps will be replaced by electric lamps. A great many additional arc lamps are also being installed throughout the city, which are being paid for by money that has also been saved by the department, this time through the reduction in the price to the city of arc lamps which went into effect in the latter part of the first year of Commissioner Thompson's administration. An arrangement was obtained by which when a certain number of arc lamps were installed the price should be reduced from the old figure of $100 to $95. This gave a saving which, when the work is completed, will enable the installation of 550 new arc lamps. This arrangement is so drawn that this proportionate reduction will continue year by year, the next reduction being from $95 to $90 per lamp, and will enable the installation of many more arc lamps.

Illuminating Engineers Undertake a Civic Service in Chicago.

At a joint meeting of the Chicago Section of the Illuminating Engineering Society and the Car Lighting Club of Chicago held on Dec. 20 the subject of the hanging of the powerful 10-amp flaming-arc lamps for street lighting now on test in the Loop district of Chicago was brought up. It was held that the lamps as temporarily installed (many on elevated-railway structures) are too low, not only dazzling the eyes of the people on the streets, but not attaining their maximum efficiency as light-giving sources. It was thought that the men who have made a technical study of illumination might do a practical service to their fellow citizens by giving their advice on this subject to the city authorities. Two committees were appointed to make an investigation of the subject jointly and to report their conclusions to their respective organizations. These committees are: For the Chicago Section of the Illuminating Engineering Society, Messrs. James R. Cravath, T. H. Aldrich and Prof. William E. Barrows; for the Car Lighting Club, Messrs. C. R. Gilman, Edward Wray and George W. Cravens. Mr. Cravath is chairman of the joint committee. The joint committee was also requested to confer with the officers of the elevated-railway companies of Chicago to see if measures cannot be taken to improve the lighting of the cars on the elevated-railway lines.

Present Status of the Patent Monopoly.

In a recently issued circular George H. Benjamin, Esq., of New York City, discusses the bearing of recent court decisions on the scope of the patent monopoly. The general impression, he says, seems to prevail that the terms of the Sherman act and the construction of such act by the Supreme Court in the Standard Oil and tobacco cases are directly opposed to the terms of such sections of the United States statutes as grant protection to inventors for their inventions for a specific term, and he pronounces this impression to be incorrect. In no one of the petitions filed by the Attorney General is there, he says, any allegation that

the exercise of a monopoly specified in a patent or patents is in violation of the terms of the Sherman act, and the only attempts on the part of the government to restrict the right of inventors are as follows:

First—In the consent decree entered into in the case of the electric lamp trust. In this case the government contended that after a manufacturer working under a patent had sold the article manufactured his right to exercise any further control over it (either as regards its use or price for which it might be sold) ceased, and the General Electric Company accepted this contention notwithstanding the fact that the United States circuit courts had held to the contrary.

Second—In the language used in the showing, preliminary to indictment, in the case of the United States versus Sidney W. Winslow and others (so-called shoe-machinery trust). In this case the government takes the position that consolidation of patents all relating to a single industry is unlawful where such consolidation acts to produce a restraint which would not be possible were such patents in the hands of individual owners—the statement of the government being that by reason of the consolidation of shoe-machinery patents the monopolies and rights created under such patents are extended and expanded unreasonably at the expense of shoe manufacturers, and that the combination is used oppressively as a means of building up monopolies over and above the power and control warranted and permitted by the letters patent, and to use the power and control when so built up for grasping and drawing to the combination the rights which might have been carried on by others for controlling and enhancing the prices of such shoe machinery and discouraging and preventing others from inventing or manufacturing other devices and machines for doing the work done by the machines, etc.

From the above, Mr. Benjamin says, it will be seen that the attack by the government is not against monopolies created by patents, but against agreements, combinations and the like based upon the patents and intended to exercise a control in an industry beyond that conveyed by the patent grants. In short, the government takes the position that an inventor may exercise an absolute monopoly in the thing covered by his patent grant, but that neither he nor any combination of individuals or interests may use such patent grant as a basis for exercising a monopoly or control in an industry which is beyond and external to the monopoly of the patent grant. To keep within the Sherman law, therefore, manufacturers should, Mr. Benjamin states, remember: (1) That they can make no agreement with purchasers, agents or distributors by reason of which the use of the re-selling price of the articles is fixed and determined; (2) that no agreement may be made between individual owners of separate patents, or business conducted by the single owner (be it individual or corporation) of a group of patents in an industry, where the purpose of the agreement or the nature of carrying on of the business is such as to obtain an extension of the monopoly created by the patents, or, in other words, effect a control or partial control of an industry and thus unreasonably restrain and hamper the trade of others.

Mr. Benjamin also calls the attention of manufacturers to the fact that, as it is evident that it is the intention of the government to cut off all exterior aids to business in the form of agreements, such protection as may be had through the means of patents and trade-marks should not be neglected. The principal manufacturing companies of the country have, he says, recognized this fact and are now applying for patents, not only for the articles manufactured by them, but for the processes and the machinery employed in producing the articles.

The circular also discusses the present Patent Office status. It is stated that inventors have much to complain of in the condition of affairs in the Patent Office and the general tendency of the United States courts as regards patents. "In the last *Official Gazette*, published Oct. 24, 1911, it is authoritatively stated that there are some 20,403 applications awaiting action; that is, applications which have not even been considered by the Patent Office. This number does not really represent all the applications pending in the Patent Office, as a large number of applications are involved in interferences or in other proceedings by reason of which their consideration is delayed. It is probably within the facts to state that fully 35,000 applications are awaiting action. This condition of affairs is certainly outrageous, as the American inventor pays the entire cost of operation of the Patent Office and yearly turns a surplus into the Treasury. The reasons for the delays are (1) an inadequate, underpaid force, and (2) the indisposition of the present officials of the Patent Office to exercise that liberality in the treatment of inventors which is recognized both in the constitutional provision and in subsequent statute laws relating to patents as warranted and proper.

"The trouble in the courts seems to be largely due, as recently stated by an eminent judge, to the fact that the judges are called upon to decide questions about which they have no technical information and their unwillingness to accept the statements of petty and prejudiced so-called experts. The judges naturally desire to understand an invention or a question of infringement before rendering a decision, and they very frequently find it quite impossible to do so. As a result, the decisions depend largely upon the personal prejudices of the judge before whom the case is tried. If he is favorable to patents, he will sustain a patent or find an infringement; if, on the contrary, he is opposed to patents, he will not sustain the patent, will find no invention and in very many cases no infringement.

"There can be no doubt that before long the situation in the Patent Office and the courts must be radically changed. The proceedings in the Patent Office should be very materially simplified, and the judges who hear patent cases should be given the advantage of technical counsel to be selected by themselves upon whose advice they can rely."

The statement as to the present condition of business in the Patent Office is at variance with a statement on the same subject by the Commissioner of Patents in his annual report, recently issued under date of Oct. 20, from which the following extract is made:

"The work of this bureau is at present in a very satisfactory condition and practically up to date in all its branches. Of course the work naturally falls into arrears during the period of the year from July 1 to Oct. 1, which is the time when the force is taking its annual leaves of absence; but it is always brought up to date by Dec. 31 each year, and continues so until the next vacation period comes around.

"Congress has been fairly liberal in its appropriations for the Patent Office by increasing its force and salaries and providing new positions, and I have thus been able to bring about, during my incumbency of the office of commissioner, many needed reforms. I think I may safely say that the bureau is in better condition than ever before as regards the transaction of business and the salaries paid employees."

The report refers to the accumulation of applications as follows, in connection with a recommendation of legislation to require that an application for a patent shall be prosecuted within six months after any action by the Patent Office:

"The present period within which the applicant is allowed to amend is one year, and under the existing practice there have been many instances of cases being amended just within the one-year limit, in order to keep them alive, they thus serving as dragnets in many cases to catch inventions along similar lines which may be subsequently applied for, thereby involving inventors in expensive interference proceedings. It has been the effort of the office

cases out of the office whenever possible consistently with good work. The office has been severely criticised recently, especially in the last year or two, for allowing applications, particularly those owned by corporations, to rest in the office for such long periods as really to have the effect of extending the patent period in case such applications are later passed to issue. Instructions have been repeatedly given to the examining corps to get rid, as far as possible, of all such cases as are delayed apparently by the applicant or his attorney. Had this bill passed it would have almost entirely overcome that criticism."

Extension of an English Patent.

By an English Legal Contributor.

The American inventor who has obtained protection in England must needs take care that his monopoly does not expire before he has time to reap the fruits of it. No doubt an additional stimulus to manufacture in Great Britain was given by the "compulsory working" act which was passed a few years ago; but, nevertheless, for some inventions the period of fourteen years is sometimes too brief.

A thousand causes may operate to prevent a patentee bringing his wares to market at once. It may be an invention which involves the construction of a large machine which will only be used in one or two cities in a state. Again he may be hampered by the laws of his own or of foreign governments.

For instance, suppose a patent facilitated the use of the telegraph. Such a patent could not be worked in England at all unless the Postmaster-General—who has a monopoly in telegraphic matters—could be persuaded to take it on and he would be able to ask his own price. The same now applies to telephones in England, because the Postmaster-General is about to acquire the entire business of the National Telephone Company.

In these circumstances it is of interest to inquire when, if ever, and in what circumstances, an English patentee can obtain a prolongation of his patent beyond fourteen years. The material section of the relevant English statute provides that a patentee may, after advertising in manner provided by rules of the Supreme Court his intention to do so, present a petition to the court praying that his patent be extended for a further term, but such petition must be presented at least six months before the expiration of the patent. Any person may give notice to the court of objection to the extension.

On the hearing of any petition under this section, the patentee and any person who has given such notice of objection shall be made parties to the proceeding, and the comptroller shall be entitled to appear and be heard, and shall appear if so directed by the court. The court, in considering its decision, shall have regard to the nature and merits of the invention in relation to the public, to the profits made by the patentee as such, and to all the circumstances of the case.

If it appears to the court that the patentee has been inadequately remunerated by his patent, the court may, by order, extend the term of the patent for a further term not exceeding seven, or in exceptional cases fourteen, years, or may order the grant of a new patent for such terms as may be specified in the order and containing any restriction, conditions, and provisions the court may think fit to impose.

This provision partly re-enacts an older law and partly introduces new matter. The principles on which the court will act have been summarized by Mr. Roberts in his work on English patents as follows:

1. The nature and merits of the invention in relation to the public must be of an exceptional nature. "Merit" does not refer to the moral claim of the inventor to be rewarded for personal trouble, but to the value of the invention he has given to the public. This must be much more than what is required to support the validity of a patent. But the conduct and position of the inventor or applicant is also a matter for consideration. For instance, extension was refused where the British patent was held merely to protect the market and the patented articles were made and imported from abroad. In another case where the patentee had kept secret the exact proportions necessary for carrying out his invention, and as the Privy Council were of opinion that these were the essence of the invention, they refused a prolongation on these grounds.

2. In order to ascertain the profits made by the patentee as such, proper accounts must be kept. They must be so kept and exhibited to the court that it may be apparent what profit, if any, has been made from the patent as distinguished from mere profits of manufacture. Where profits of manufacture are attributable to the existence of the patent they must be disclosed and will be considered.

3. Where the applicant for an extension is an assignee of the original inventor he must show that he has done something to merit the grant, as, for instance, by incurring large expenditure in bringing the invention into public notice, or otherwise assisting the inventor. He must also show that the inventor has been adequately remunerated, and will derive further remuneration by the proposed extension.

4. In considering the question of remuneration of the patentee, the profits arising from foreign patents or from articles made for sale abroad will be included. The books must be kept and accounts exhibited so as to include them.

5. The utmost good faith must be shown, and the history of the patent fully disclosed. Delays in working must be explained. The existence of licenses, the facts connected with the formation of companies when applicants, the value of their shares as shown by dealings in them and like matters should be fully stated.

6. The validity of the patent is not considered, although the question of novelty may be gone into in order to determine the merit of the invention.

A comparatively recent case in the English courts has drawn from the judge who generally tries this class of case a further expression of opinion. He said: (a) The court must consider the nature and importance of the disclosure made in the specification to the public, and for that purpose questions of novelty and subject matter are material; and it is the duty of the petitioner for an extension of term to bring to the notice of the court all that may in any way affect the judgment of the court in those matters. But if after hearing the evidence of the petitioner's witnesses, there is in the opinion of the court a *prima facie* case for upholding the validity of the patent in respect of novelty and subject matter, the court need not, as a general rule, investigate the matter further, it being always open to an objector to challenge the validity of the patent in proceedings more appropriate for that purpose.

(b) For the purpose of considering whether a patentee has been adequately remunerated, profits on his corresponding foreign patents as well as on his English patents must be taken into account, and some allowance ought also to be made for profits which will in all probability be received in respect of both before their expiration.

(c) It is incumbent on a patentee who petitions for an extension of his patent to prove that he has done all that a patentee could do to launch his invention on the British market. He ought also to state all facts which are within his knowledge and which it is obviously material that the court should know.

(d) When the comptroller of the Patent Office opposes the extension of a patent on the ground that the traders of this country will, if the patent is prolonged, be put at a disadvantage compared with the traders of some other

country, proper statistics or other information ought to be supplied to the court as to the nature and extent of the competition which is feared.

It will be seen from this that to obtain an extension, an American patentee must be prepared to show that he has taken active steps in England to do what he can to further his invention.

In conclusion, it may be said that an extension is a privilege not easily obtained or lightly granted by the court. All the circumstances of the case have to be considered; and the fact that the patentee has already made a large profit out of the invention in the States would militate against his chances.

The Drawn-Wire Tungsten Lamp.

A joint meeting of the Chicago Section of the Illuminating Engineering Society and of the Car Lighting Club of the same city was held on the evening of Dec. 20. Mr. C. W. Bender, commercial engineer of the National Electric Lamp Association, addressed the meeting on "The Drawn-Wire Mazda Lamp." The discussion, however, which was of a rather desultory character, took a wider range than the title of the address would indicate.

Mr. Bender described the process of drawing tungsten wire from ingots through diamond dies. Drawn-wire tungsten filaments have been found to be stronger at the end of the life of the lamp than pressed filaments of the same metal after a few hours' burning. The drawn-wire filament may be used in any position in which carbon or tantalum lamps are used, and is well adapted for lighting street cars. A recent test in street-car operation showed an average life of a large number of 40-watt drawn-wire lamps of 1452 hours. The drawn-wire lamps are almost exclusively used now in all of the new installations for automobile and car lighting. The filaments are mounted on a central spider in much the same manner as the tantalum filament is mounted. As the result of a number of tests it seems to be established that with energy at 10 cents a kw-hour the best consumption of the drawn-wire lamp varies from 1.03 watts to 1.22 watts per candle.

One objection to the drawn-wire lamp is its comparatively early blacking compared with the pressed-filament lamp, but even with this drawback the lamp still exhibits a life of 1000 or more hours up to 80 per cent of the initial mean horizontal candle-power. Further, as this blacking effect increases the tip lighting by some reflection from the inside of the blackened zone, the figure for 1000 hours' burning is 85 per cent for mean spherical candle-power. It might be well, said Mr. Bender, if the lamp were rated in mean spherical candle-power.

In discussion Mr. T. H. Aldrich asked why in American drawn-wire lamps the filaments are not put near the central support, as in foreign lamps. Mr. Bender answered that all lamp design is a compromise. If a spider of smaller diameter is used there is a greater opportunity for the filaments to short-circuit. Furthermore, this contracted spider results in greater heating of the central glass stem and so causes blacking from that source. In answer to other questions Mr. Bender said that he believed 220-volt drawn-wire lamps are entirely satisfactory. He added that one of the advantages of the drawn-wire lamp over the pressed-filament lamp is its greater uniformity, which makes both for better efficiency and better candle-power maintenance. Another interesting statement made by the speaker of the evening was that the lamp manufacturers are now able to offer 15-watt drawn-wire tungsten lamps for 110-volt circuits.

In relation to car lighting Mr. C. R. Gilman asked about the relative advantages of 30-volt and 60-volt drawn-wire lamps. Mr. Bender answered that as far as the lamps were concerned there was little to choose between them, but probably for head-end train-lighting systems the 60-volt layout is more practical. Either one, however, is to be preferred to the 110-volt system for train lighting. A number of the railroad men present complained of the theft of lamps from cars. One advantage of a 60-volt or 30-volt lamp is that it cannot be used on the ordinary 110-volt circuits, and so the car-lamp thief is not apt to repeat his larcenous enterprise a second time. Mr. Gilman favors the 60-volt system for head-end lighting, but said that the 30-volt car-lighting system is probably the best where axle lighting is employed. Later on Mr. A. J. Farrelly, who presided at the meeting, made the interesting announcement that the Harriman lines, the Chicago & Northwestern and the Northern Pacific railroads are all going to adopt the 60-volt train-lighting system as standard.

One gentleman asked Mr. Bender what advantages, if any, were possessed by the drawn-wire lamp over the modern types of pressed-filament tungsten lamps in installations where there is no vibration, as in residence lighting. Mr. Bender said that in this case the newer type of lamp possesses hardly any advantages over the more familiar pressed-filament tungsten lamp, provided the pressed filament is properly mounted.

There was some discussion on the advantages of lock sockets to prevent the theft of lamps, but several of the gentlemen present seemed to think that the cost of the sockets would be greater than the loss of the lamps. Mr. J. R. Cravath asked when illuminating engineers and users of lamps might expect the distance between the center of the drawn-wire filament and the base of the lamp would be standardized for the various sizes. Mr. Bender contended that this standardization had been reached already by the lamp manufacturers, but Mr. Cravath remarked that while the drawings of the lamps showed standard dimensions in this respect, the lamps themselves did not.

Electric Propulsion of Ships.

At a joint meeting of the Boston Society of Civil Engineers and the Boston sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers held on Dec. 20 Mr. W. L. R. Emmet, of the General Electric Company, Schenectady, N. Y., delivered an illustrated lecture upon the electric propulsion of ships. The speaker reiterated his well-known views upon the subject and emphasized the importance of securing trial installations in large ships, which offer the most attractive savings under operation by electric motors. The general advantages of the motor drive for high-powered propellers were reviewed, including a substantial reduction in the strains upon shafts, certainty of decreased fuel consumption through increase in prime-mover efficiency, extension of cruising radius and diminution in the weight of boilers, machinery and fuel to be carried.

Mr. Emmet contended that the engineering problem of ship propulsion by electric motors supplied with energy from turbo-generators is beset by no serious difficulties. The conservatism of large ship-builders and governmental officers appears to be the chief obstacle to the early application of a representative electrical installation on the large scale necessary for a striking demonstration of economy. It appears certain that when such an installation is made it will be done at a great decrease in initial cost as well as accompanied by radical reductions in operating expense. After several years of sustained effort permission has been secured from the United States government to equip the 20,000-ton collier *Jupiter* with electrical propulsion machinery, and, although delays are being experienced on account of the scarcity of suitable labor, the construction of the ship is now under way at the Mare Island Navy Yard. The

Jupiter will be equipped with 7000 hp in induction-motor propeller drives, the speed of the vessel being 14 knots. The equipment will weigh only 145 tons and will be located practically on the ship's bottom. It is expected that power will be delivered at the shaft with a steam consumption of 12 lb. per hp-hour. It will be impossible for the turbo-generator to deliver much more current upon short-circuit than the full-load current of the propeller motors. The apparatus is simple in the extreme. The turbine speed will be about 2000 r.p.m., which is high enough to enable the full economy of the turbine to be realized.

Taking up the problem of direct propeller driving of turbines, Mr. Emmet said that this involves speeds below the most efficient range of the prime movers, resulting in a great increase in size and cost, as well as a larger fuel consumption. The mechanical difficulties of driving propellers of large ships through gearing are very serious. In very small vessels gear drives may be reasonably successful, but in meeting the power demands of battleships and transatlantic liners the gearing problem is one of almost insuperable difficulty. High turbine speed is the secret of economical operation, and this can only be positively secured under present conditions by the electric motor drive. The weight of the 6800-hp triple-expansion engines of the similar collier *Cyclops* is 335 tons, or more than twice the weight of the propulsive equipment of the *Jupiter*, and the steam consumption of the former is probably about 14½ lb. per shaft hp-hour, or nearly 21 per cent more than is expected in the case of the electrically driven ship. For the same power the *Jupiter* turbine will weigh but one-tenth that of the direct-connected propeller turbines used on the *Lusitania*. The latter deliver 30,000 hp and are obliged to run at the low speed of 180 r.p.m., which prohibits securing the legitimate economy of this type of prime mover.

The speaker showed that the electrical equipment of a 17,000-hp liner built to run at 17.5 knots would save the owner $20,000 a year in fuel alone, without allowing for any reduction in boiler weight. In the transatlantic service this would enable the vessel to carry 900 tons additional cargo. The estimated steam consumptions were 14½ lb. with quadruple-expansion engines and 11 lb. with the turbo-electric drive. The cost of installing the latter would be at least $50,000 less than the bare expense of the engines. The labor cost of operating large marine engines is also far greater than the expense of handling the turbo-electric equipment. So great is the fuel saving possible with the electric drive that it is estimated that the battleship *Wyoming*, if electrically propelled, could travel at cruising speed two-thirds of the distance around the world with a single coaling. The details of auxiliary apparatus in connection with electric propulsion are being carefully developed, special attention having been given to the successful production of a form of salt-water-cooled resistance capable of absorbing large amounts of energy in connection with the reversal of the driving machinery. Over 350 kw have been absorbed by such an apparatus incased in a cylinder about 12 in. high and 6 in. in diameter. The speaker stated that as soon as the electrical equipment is completed at the factory it will be subjected to economy tests in which the conditions of propeller service will be to a large extent duplicated. Preliminary enginering analyses and many former turbine tests indicate that a great field for electrical service is close at hand.

Work of the Illuminating Engineering Society in London.

At a meeting of the Illuminating Engineering Society in London on Nov. 17, which opened a new year of work, Mr. Leon Gaster, honorary secretary, presented a summary of the progress made during the vacation. A feature of the work of the society from its commencement in 1909 has been its co-operation with other bodies. The secretary mentioned that during the vacation the society had been represented at quite a number of different congresses. For example, one of its members, Mr. J. Darch, read a paper on hospital lighting at the annual congress of the Royal Sanitary Institute in Belfast. During this gathering another paper on school lighting, by Mr. W. H. Webb, made special reference to the discussions of the Illuminating Engineering Society on this subject during the previous year and recommended the conclusions then arrived at to the attention of school inspectors. The society also encouraged the sending of exhibits on illumination to the International Hygienic Congress at Dresden.

The most important work carried out, however, was at the International Electrical Congress in Turin and at the meeting of the International Electrotechnical Commission in the same city. Secretary Gaster was present at these meetings, as were also Dr. A. E. Kennelly and Dr. C. H. Sharp, of the Illuminating Engineering Society in the United States.

At the meeting of the International Electrotechnical Commission the following resolution was passed unanimously: "Resolved, That the national committees should co-operate with the illuminating engineering societies in their respective countries in studying the questions of symbols, nomenclature and other matters relating to illumination."

At the congress in Turin Mr. Gaster read a paper entitled "The International Outlook in Scientific Illumination," in which he pointed to the vast field for concerted international action in illuminating engineering. He suggested that not only the more or less scientific matters connected with symbols, units, etc. (important as they are), but also many matters of industrial consequence, such as the hygienic aspects of lighting, the illumination required for different classes of work, etc., should be studied. He also drew attention to the variety of committees and institutions in different countries concerned with illumination and working on separate lines. This suggested the desirability of forming one central international commission which could deal with illumination in a thoroughly impartial and international manner. On such a commission the various committees interested should be represented.

This suggestion was subsequently embodied in a resolution which received unanimous support and was as follows: "Resolved, That this congress deems it desirable that an international commission should be appointed in order to study all systems of lighting and technical problems in connection therewith; and, having been informed that the Illuminating Engineering Society of London has the intention of forming such a commission and of putting itself in touch with the other existing national and international committees, approves their taking the initiative in this respect."

This, of course, is a most important recognition of the importance of the illuminating engineering movement, and it is also a remarkable precedent for an electrical congress to have considered it desirable for a commission to be appointed dealing with all illuminants.

Another matter of international interest which was mentioned in this report was the formation of a government committee on the hygienic aspects of lighting in France. On this committee prominent oculists, physiologists, engineers and factory inspectors are represented. It is intended to deal with the framing of standards of illumination for industrial purposes, the study of the nature and causes of defects in vision and their relation to lighting conditions, the measurement of illumination, etc. It is hoped that other countries will follow the example set by France. The Home Office in Great Britain has recently been paying special attention to this matter and has arranged for systematic tests of the illumination in factories.

Among other matters mentioned in the summary of progress was the work of the committee on the standard specifications for street lighting, which is still meeting in London and on which representatives of the (British) Illuminating Engineering Society, the institutions of gas and electrical engineers and the Association of Municipal and County Engineers are taking part. The (British) Illuminating Engineering Society has also nominated permanent committees to deal with school and library lighting. On these committees a number of members of the (British) Illuminating Engineering Society will act, and delegates from the Library Association, the Association of Technical Institutions, the Association of Teachers in Technical Institutions and the London Teachers' Association will also co-operate.

One other matter mentioned was the courses of lectures on illuminating engineering which have been arranged, under the direction of the London County Council, at three of the technical institutions in different parts of London. These lectures will deal with all illuminants, illumination and the eye, the measurement of light and illumination, practical lighting problems, etc., and will be delivered by experts in their respective departments. Two of these courses have already commenced (at the Battersea and Regent Street Polytechnics), and it is hoped that in the future lectures on these lines will become an integral part of the courses at many colleges and institutions, and that more advanced courses will ultimately be arranged.

The society has therefore been very active during the vacation, and an interesting series of papers has been arranged for the next session. The first of these, by Dr. H. R. B. Hickman, dealt mainly with different types of head-lamps, lens and mirror combinations, etc., an attempt being made to define the "glare" from these lamps and to discuss how far it can be avoided. Representatives of firms interested in the manufacture of automobile headlamps and of the Royal Automobile Club were also present and joined in the discussion. Letters were read from the police authorities who had been interrogated regarding the effect of glare on traffic, and extracts on the regulations on this point, which demanded absence of glare and adequate lighting in general terms, were also read in the course of the discussion. The opinion was expressed that more precise definitions and tests were desirable.

Other points discussed were connected with the desirable width and spreading effect of beams of light, their effect on fog, the value of swiveling lamps in turning corners, etc.

In concluding the discussion the chairman, Mr. F. W. Goodenough, alluded to the program of papers to be read during the coming session, which included railway lighting, color discrimination by artificial light, and the lighting of shops and printing offices, respectively.

De Romas and the Lightning Kite.

By Brother Potamian.

The inhabitants of Nérac, a town 75 miles south of Bordeaux, showed their appreciation of an electrical pioneer of undoubted merit by erecting a statue in honor of their townsman, de Romas. The statue was dedicated quite recently with appropriate ceremonies and addresses in the presence of M. Armand Gauthier and M. d'Arsonval, both members of the Académie des Sciences.

In the middle of the eighteenth century the subject of atmospheric electricity attracted widespread attention. Franklin in America, d'Alibard and de Romas in France, Divisch in Bohemia, Toaldo in Italy and Richmann in Russia believed in the efficiency of pointed conductors for the purpose of exploration and protection; yet, in spite of the results which they obtained and the explanations which they gave, it was a long time before leaders and people took kindly to the "Franklinian" rod.

Franklin, be it said, was derided by the sapient Fellows of the Royal Society for his views on the nature of lightning, and the points of the royal conductors were covered with knobs by order of George III; but when truth prevailed over prejudice and personal hostility the knobs were removed, the points exposed to the clear view of heaven, and the American philosopher was ultimately honored by the Royal Society.

In the heart of Bohemia popular opposition ran high and strong against the new device to protect life and property against the bolts of heaven. The pastor of Prenditz, Divisch by name, was an expert electrician, considering his time. After experimenting privately in Prenditz and publicly in Vienna on the discharging power of points, he erected his "meteorological machine," as he called it, in an open space in the middle of the parish on June 15, 1754. It bristled with points, 323 in all, for this Bohemian wizard was convinced that fifty points would be more efficacious than five in discharging an ugly-looking cloud.

The day of trial finally came to the good parish priest of Prenditz, and from members of the flock for whose protection the "machine" had been erected. Unlike their electrical pastor, they distrusted the weird-looking mast with its multiple points and chains for ground connections. The conspiracy grew apace, and a day was fixed by the malcontents for the destruction of the evil-boding machine. In came a body of farmers from the surrounding district, who were led to attribute the failure of their crops to the influence of the evil-looking mast. There was mischief in their eye and grim determination in their Bohemian visages. At a sign from the leading demagogue they attacked the lightning conductor and wrecked it completely.

As a consequence of this act of vandalism Divisch, heeding the advice of his Premonstratensian Superiors, withdrew from the unscientific and unfriendly villagers of Prenditz and left them to the spiritual ministrations of another who probably would not seek to protect them against the destructive effects of lightning by any kind of a "meteorological machine" or "Franklinian" rod.

De Romas was more fortunate in his experience, for the people of Nérac and the country folk for miles around flocked to his experimental station to see the vivid flashes and hear the noisy discharges which he got from his tall, insulated rod.

But when he flew his electrical kite his troubles began. He was careful, as a man of science mindful of his reputation should be, to send detailed accounts of his achievements to the Académie of Bordeaux for insertion in its *Actes,* or transactions. Franklin was at the time rapidly ascending the meridian of fame; just a year before this he had, with the assistance of his son, raised his spiked kite in one of the fields of Philadelphia and definitely proved, by unassailable experiments made in that field and under the canopy of heaven, his contention that the electricity of the atmosphere was identical in kind with that of the frictional machine of his laboratory. This was in the month of June, 1752.

From the *Actes* of the Bordeaux academy we learn that de Romas raised his first electrical kite in May, 1753, but with no result, although rain fell and wet the hempen cord. Attributing the failure to want of conductivity, de Romas, like a good electrician, wrapped a fine copper wire round the entire length of the cord before he again went afield to test the electrical gradient of the atmosphere. This was on June 7, 1753. The day was stormy, threatening clouds came and went, and at the same time the lower end of the wire-wound cord gave out torrents of vicious sparks, to the delight of the magistrate-physicist.

De Romas repeated his dangerous experiment from time to time, not only to supply the *Actes* with new data and thereby enhance his reputation for all time, but also for

the instruction and entertainment of an ever-growing class of spectators. It is said that he used kites 7½ ft. long and 3 ft. wide; and, reeling out some 400 ft. or 500 ft. of wire-wrapped cord, obtained pistol-shot flashes reported to be 9 ft. long and 3 ft. thick—truly spectacular. Professor Richmann, of St. Petersburg, lost his life for much less. Franklin was fortunate, though imprudent, in taking sparks from his key-like prime conductor; but de Romas must have had a charmed life when drawing electrical energy at such a forbidding rate from passing clouds.

His disappointment remains to be told. He thought that the honor of using a kite to explore the electrical conditions of the atmosphere belonged to him and his country; he could not admit the possibility of a colonial one-time journeyman printer anticipating a magistrate of Nérac and electrical expert in such an important matter. He put forward his claims for priority and urged them with pertinacity; but the savants in Paris, the dispensers of fame, did not altogether share his opinion. Perhaps they were dazed with the extraordinary results on insulated rods obtained by d'Alibard, de Lor and de Buffon. He appealed to the academies of Bordeaux and Paris for recognition of the originality of his experiments, but in vain; and so the declining years of the life of this pioneer in lightning work were surrounded with sadness and the thickening gloom of bitter disappointment.

Doubtless this disappointment was deepened from the day when the countrymen of de Romas, gathered in solemn academical conclave in Paris, rose to their feet as Franklin crossed the threshold of the assembly room of the Académie des Sciences and the president greeted the American Prometheus with the first half of Turgot's hexameter "*Eripuit coelo fulmen.*"

The facts of the case are that Benjamin Franklin flew his lightning kite in a field outside the city of Philadelphia in June, 1752, while de Romas raised his kite for the first time to the sky in May, 1753, without result, his initial success being obtained in the following month of June, 1753.

Turin International Electrical Congress.

Electrochemistry, Rates and Legislation.

In Section VII of the Turin International Electrical Congress papers on electrochemistry, electrometallurgy and storage batteries were presented, and in Section VIII papers on rates, taxation and legislation. Abstracts of these papers follow.

ELECTRICAL PHENOMENA IN THE INDUCTION FURNACE.

Treating the induction furnace as a special transformer, Dr. Sigm. Guggenheim develops a vector diagram of the emfs and currents, and discusses the effects of various design and operative factors upon the performance of this type of furnace. The earliest type of induction furnace, namely, the Kjellin type, is studied first. This type has a serious disadvantage in its extremely low power-factor, which decreases rapidly as the amount of the charge which forms the secondary circuit increases. For instance, a 1.5-ton furnace working at 25 cycles has a power-factor of 0.75 at 900-kg charge, which drops to 0.48 at 1800-kg charge. In order to keep the power-factor as high as practicable it is necessary to resort to very low frequencies. In large furnaces it would be necessary to go as low as 5 cycles per second in order to obtain a favorable power-factor. In this respect the Roechling-Rodenhauser furnace is a great improvement over the Kjellin furnaces. It has, in addition to the molten metal, a closed secondary circuit of relatively great resistance, which consists of a secondary winding leading to two large cast-iron pole pieces located at opposite sides of the hearth. These pole pieces are protected by a fire-resisting mass that is a very poor conductor at ordinary temperatures, but becomes a fairly good conductor at higher temperatures. This auxiliary secondary circuit serves several useful purposes; it increases the power-factor; it equalizes the heating, and it performs from 20 to 30 per cent of the total work. With the Roechling-Rodenhauser furnace frequencies as high as 50 cycles are used and the working power-factor is about 0.80.

The author next takes up the magnetic forces acting in the molten iron of both the Kjellin and the Roechling-Rodenhauser furnaces. The latter furnace under certain conditions is troubled with disturbances due to pinch effect. However, this has been overcome recently by an extremely ingenious expedient. The walls of that portion of the furnace where the molten metal is torn asunder by the electromagnetic force are made of a slightly conductive substance, and when the cross-section of the iron circuit becomes reduced more and more current is carried by the walls, and thus the rupture is avoided. This type of structure is also advantageous in starting, since it forms a closed circuit of high resistance and will carry the starting current until sufficient iron to form a closed circuit has been melted. Formerly it was necessary to start such furnaces with molten iron.

THE IRON-NICKEL BATTERY.

In reviewing the present status of the alkaline battery Mr. J. A. Montpellier gave Mr. M. Darrieus, a sea captain, credit for having first called attention to the principle of operation of the iron-nickel alkaline battery in 1893. In 1901 Jungner and Edison took out patents on this type of cell, and Edison placed his battery on the market. After this Edison continued his studies and introduced several important improvements at this time. Mr. Paul Gouin also worked on this type of battery, and to-day the Edison and Gouin cells are the ony alkali cells made on a commercial scale.

The author follows the historical introduction with a technical description of the Edison and Gouin cells, and then the two are compared. The Gouin cell has a slightly greater capacity per unit weight and also experiences no trouble from the precipitation of the active material from the positive plate, and the resistance changes very little after the battery has been in service.

Comparing the alkaline cell with the lead cell, the former has many points of superiority. It will stand more abuse than the lead battery without suffering any serious damage. For instance, with an alkali battery the rate can be carried to 20 watts or 25 watts per kilogram, while in lead batteries it should not exceed 7 watts or 8 watts. Alkali batteries for traction may be charged in two or three hours and stationary batteries in from three to five hours, while lead batteries require from three to five hours for vehicle work and from eight to ten hours in stationary work.

The total useful capacity per kilogram of the Gouin cell is from 20 to 25 per cent greater than the best lead cell, and on the volume basis the lead batteries for traction have a useful capacity of only 48 or 50 watt-hours per cu. dm. and those for stationary work have a capacity of from 12 to 15 watt-hours per cu. dm. On the other hand, the alkali cell for traction has a total capacity of from 55 to 60 watt-hours per cu. dm, and the stationary alkali battery has a total capacity of from 30 to 40 watt-hours per cu. dm.

On the score of efficiency it is said that the alkali battery compares very favorably with a lead battery, especially when the latter is old. Referring to the Gouin battery, the author states that its efficiency will remain constant ten times as long as the efficiency of a lead battery, the period being measured in terms of the number of discharges. As an example of efficiency it is stated that a stationary Gouin battery having a weight ratio of 18 or 20 watt-hours per kilogram will give an efficiency of from 60 to 62 per cent, while a lead battery under the same con-

ditions and when new its ... efficiency greater than 65 per cent and its weight ratio will be only 5 or 6 watt-hours per kilogram.

Another point is the scrap value of the plates. The nickel plates are very valuable, while the lead plates have practically no value when exhausted.

STATIONARY AND PORTABLE BATTERY PRACTICE

The present state of the art of storage-battery engineering was the subject of a report by Dr. H. Beckmann. He distinguishes two types of battery design, according to whether the battery is stationary or portable. In the stationary class the design has become fairly well standardized and perfected, and to-day this type of battery is regarded as one of the most reliable of all electrical appliances. Many companies guarantee the care for the upkeep of the battery for a given amount per year. This practice places the cost of maintenance at a low and definitely fixed value, and has done much to establish confidence in storage-battery installations.

The largest and most important use of storage batteries is in connection with continuous-current distribution plants to care for the peak loads and to assure continuity of service. In Germany there has grown up a practice among large central-station customers of installing storage-battery plants, which are charged during off-peak hours at a very low cost. In Berlin there are fifty such batteries, having an aggregate capacity of 13,000 kw-hours at the three-hour rate.

An interesting application of a storage battery is afforded by a spinning mill in Italy, which is operated by electricity from a water-power. The mill had been running twenty-four hours a day when a law was passed forbidding the employment of women on night shifts, and therefore the plant had to be doubled, and by installing a storage battery to be charged during the night the same power plant was able to operate under the new régime. This battery has been in continuous service for about six years.

Installations which have as a prime object the maintenance of continuity of service rather than economy are more popular in the United States than those installed to improve economy of operation. The forty-four batteries of the New York Edison Company, with a total capacity of 32,000 kw-hours, are cited as exemplifying this practice.

Passing to the buffer batteries used in connection with boosters to maintain good regulation, the author briefly mentions various systems used in the operation of direct-current and alternating-current systems. Examples of the use of batteries on single-phase railway lines are cited, and the opinion is offered that the single-phase railway must give way to the high-tension, direct-current railway operated in conjunction with storage batteries, because of the technical as well as the economical superiority of the latter.

Portable storage-battery practice is more diverse, there being several distinct types, some of which, like the Edison, are adapted exclusively for this kind of service. In Europe the storage-battery locomotive has made great strides. The Prussian railroads have been using it since 1896, and they now have 140 such machines in actual service.

The electric vehicle is having its greatest development in the United States. In Cleveland alone there are almost twice as many electric vehicles as in the whole of Germany. This enormous development in the use of storage-battery motor cars is credited to the concerted efforts of the makers and the central station, and special credit is given to the publicity campaign of the *Electrical World*.

In conclusion the author remarks that of the total battery production of the world over 75 per cent is of the Tudor type. There are 13,000 persons employed in the manufacture of batteries, and the total quantity of lead used is estimated as over 70,000 tons per year.

ELECTRIC PURIFICATION OF WATER

Dr. G. Erlwein presented a comprehensive report on "Electrical Methods of Purifying Water."

Beginning with a mere mention of the old electrolytic process of Webster and Hermite, he briefly outlined the chlorine process and described the modern methods of water treatment with hypochlorites prepared in electrolyzers, such as that of Kellner or that of Siemens & Halske. The author then took up the two methods which now possess the greatest practical value in sterilization of drinking water, namely, the ozonization process and the ultra-violet radiation process.

Taking up the ozone process first, the author reviewed the chemical and physical properties of ozone, with special reference to its action on different disease microbes. He then described commercial forms of sterilizers that utilize these principles and gave practical results attained in plants installed in various large cities of Europe.

The author next gave the results of tests with quartz-tube mercury-vapor lamps and described the construction of several commercial forms of mercury-vapor sterilizers, giving the energy consumption per cubic meter of water treated.

In conclusion the author compares the ozone and the ultra-violet-ray processes as to bacteriological effects and energy consumption.

ELECTRICAL PRODUCTION OF STEEL

In a paper entitled "The Direct Production of Steel from the Ore by Means of Electric Furnaces," Mr. Remo Catani briefly reviewed results attained with the furnaces that have been tested under actual operative conditions.

Before taking up the electric processes the author outlined the non-electric processes now in use and gave data on the amount of materials consumed. The following electric furnaces were included in the discussion: Stassano (1898); Chaplet-Néo Métallurgie (1909); Lash (1908); Roechling-Rodenhauser (1910). In studying these furnaces the author tabulated the material and energy required to produce a ton of metal, the calculations having been made from data given by the respective inventors. From this table there was compiled another table giving the itemized cost of the various materials, the energy and the labor required for the production of a ton of steel by each of these different processes.

The total costs per ton of steel were as follows: Stassano with 65 per cent ore, 121.5 lire; Stassano with 48 per cent ore, 183.41 lire; Chaplet-Néo Métallurgie, charcoal, 105.0 lire; Chaplet-Néo Métallurgie, anthracite, 92.75 lire; Lash, 104.75 lire; Roechling-Rodenhauser, 91.15 lire. In conclusion the author said:

(1) All electric furnaces used thus far utilize solely the thermal effect of the current but not the electrolytic effect. The latter phenomena should be studied.

(2) The electric furnaces used for direct production of steel are all of small capacity as compared to the ordinary furnaces—electric or non-electric—used for the production of pig-iron or for the refinement of steel.

(3) The total production of steel by direct electric processes is practically negligible in comparison with that of other processes now in use.

(4) The direct production of steel by electric processes is much more convenient than by any other process.

(5) The quality of the steel is good, especially that of hard steel.

(6) The direct production of steel in electric furnaces does not appear to be more economical than by processes which involve two or three furnaces, one or all of which may be electric or of the ordinary type.

STERILIZATION OF WATER BY ULTRA-VIOLET RAYS

Dr. M. von Recklinghausen gave an extremely interesting account of the action of ultra-violet rays in the sterilization of water.

He showed how nature keeps micro-organisms under control by the germicide action of the sunlight due to its content of ultra-violet rays.

There are very few artificial sources of ultra-violet rays that have any practical value; indeed, the quartz-tube mercury-vapor lamp is the only source that is adapted to industrial use. In classifying the radiant energy of the ether ultra-violet rays were given as all those of lengths between 0.40μ and 0.10μ. The quartz absorbs all waves below 0.2μ. The earth's atmosphere absorbs all rays up to 0.28μ or 0.3μ. Therefore the living beings of the earth are accustomed to the ultra-violet waves that pass the atmosphere, while waves shorter than 0.3μ, such as are absorbed by the atmosphere, are extremely injurious to them.

In studying the efficiency of production of ultra-violet rays the author found that a 220-volt lamp transformed 6.4 watts out of 100 watts into rays of a length inferior to 0.32μ. When immersed in water this same lamp, owing to the cooling effect, transformed only 0.13 watt per 100 into ultra-violet light. Therefore it is impracticable to immerse the lamp in the water to be sterilized. Lamps which have been in continued use for several years show that after 7000 hours of operation the efficiency is practically unchanged.

In studying the germicide power of the rays it was found that the rapidity of effect of the rays on paper treated with citrate of silver is an exact measure of the sterilizing power, and results of tests were given which showed the effect of distance on the germicide power and the relative vitality of the different kinds of germs. The effectiveness of the rays is greatest in clear water; therefore in industrial plants rapid filters are used to clear the water before subjecting it to the action of the rays.

The author in conjunction with Messrs. Henri and Helbronner developed an apparatus using the Cooper Hewitt quartz lamp. This apparatus handles between 500 and 600 cu. m of water per day of twenty-four hours. There is only one lamp, but the water passes it three times, being automatically stirred all the time. Where more water must be taken care of several of these units are connected in parallel. To prevent the passage of contaminated water in event of failure of the lamp an automatic stop valve is interlocked with the lamp circuit. Several of these plants are now in actual service and more are being installed in various cities in France. They have all been rigorously controlled by microscopic examinations, and in every case have given complete satisfaction.

ELECTRIC STERILIZATION OF WATER AT ROVIGO.

Without any reference to the relative merits of the various electric systems of purifying drinking water, Mr. Luigi de Andreis gave a technical description of the plant recently installed at Rovigo for sterilizing the drinking water taken from the Adige River.

The water of this river has been used for drinking purposes for centuries and has been noted for its purity, and recent analysis showed it still to be perfectly safe to drink under normal conditions. However, it is subject to floods, and at such times the water carries much solid matter in suspension and might easily carry harmful germs. In view of this danger it was thought wise to install a water-purifying plant, and the Siemens-De Frise ozone process was adopted.

The water is taken from the river, decanted, filtered and then sterilized in iron columns, the water falling from the top and the ozone rising from the bottom. The air is delivered to the ozonizers through refrigerating machines.

The energy required for the operation of the plant is derived from a 220-volt distribution circuit, and a reserve unit driven by a 35-hp Diesel engine is provided to avoid shut-down. The drying apparatus, the compressors and the pumps are driven by motors. Motor-generator sets transform 220-volt, 42-cycle energy to 42-volt, 300-cycle energy, and then transformers step the voltage up to 7000, at which tension the ozonizers operate. The plant will handle 1000 cu. m of water in twelve hours, and if necessary can sterilize a much larger quantity.

ELECTRICAL LEGISLATION IN AUSTRIA.

Dr. Heinrich Schreiber in a paper entitled "Legal Regulations for the Generation and Distribution of Electrical Energy in Austria" severely criticised the government of that country for the backwardness of its legislators as compared with the progress of its engineers. He outlined some of the points that should be covered by such laws and made some recommendations.

TAXATION OF CENTRAL STATIONS.

Mr. Mario Bonghi made a comparative study of direct and indirect taxation of electrical properties in various countries and suggested improvements in the present laws of Italy.

The report was discussed by Messrs. Civita, Piazzoli and others.

LOAD-FACTOR IMPROVEMENT.

Mr. G. Sartori submitted a report entitled "Filling in the Load Curve," the data for which were gathered from an extensive canvass of European and American central stations.

In the report the author took up the different kinds of load and discussed their value in improving the load-factor of the system. He distinguished two fundamental methods of accomplishing this result, namely:

(1) To find uses of electric energy which will require energy at times of light load.

(2) To utilize methods of storing energy.

Among the expedients of the first class he discussed the following: Interurban roads with storage batteries to take the peak demands; motor applications; pumping city water; refrigeration; night industries, of which a number were mentioned; irrigation; electrochemical processes; heating and cooking. The development of these various applications has given extremely good results in many cases, and the future for improvement along these lines is very bright.

Methods which involve the storage of energy are not always practicable, and on account of high investment, low efficiency of transformation and expense of operation their advantages are often seriously offset. The storage battery offers the most practical means of storing energy at times of light load. It may be used in the power house, in substations or on the premises of the consumer. The Berlin Elektricitätswerke has successfully introduced this last practice with some of its largest consumers, and gives them special rates at times of light load.

The author also mentioned thermal and hydraulic storage of energy produced at times of light load, but as yet no practical results have been attained along this line.

At the end of the paper the author reproduced the letter and forms sent out for information, and gave values of load-factors and data on load characteristics compiled from the information obtained.

SALE OF ELECTRIC ENERGY.

Under the title of "Rational Methods for the Commercial Measurement of Electric Energy," Mr. Gian-Giacomo Ponti made a general study of the sale of electric energy. He enumerated the factors which enter into cost of electric energy and gave detailed characteristics of production for various kinds of loads at the busbars. After having called attention to the importance of the annual load-factor he made some remarks about the necessity of developing the load-factor, and pointed out the usefulness of special contracts and special apparatus in this direction.

He then named the measuring appliances in most common use, and briefly reviewed the electrical and mechanical characteristics which such energy meters should possess, the errors to which they are subject and the inconvenience

experienced in their operation. The author then briefly discussed laws and regulations in use in various countries for the control of the sale of electric energy, and suggested a number of points which if properly embodied into such regulations would result advantageously to central stations and consumers alike.

A RATIONAL RATE OF CHARGE FOR ELECTRIC SERVICE.

Prof. Riccardo Arnò read a paper on his system of measuring electric service.

There are three factors, each one of which represents energy, namely, the real energy delivered, the energy lost in the line due to Joulean effect of the quadrature current, and the excitation energy necessary to supply the inductive drop. The first is measured by the ordinary wattmeters and the rates are made high enough to cover the other two factors. In ordinary practice the excess energy of excitation is negligible, but the Joulean loss of the quadrature current is not, and therefore it is desirable to devise an equitable means of charging for this energy which is proportional to the volt-ampere-hours. Professor Arnò made assumptions based on average practice and developed an equation which expresses the rate of charge thus:

$$C = \tfrac{2}{3} W + \tfrac{1}{3} W_a.$$

where W is the real watt-hours and W_a is the apparent watt-hours or the volt-ampere-hours.

He then describes a method by which electromotor and induction-type watt-hour meters can be modified to give indications proportional to two-thirds of the real energy and to one-third of the apparent energy.

This system puts a premium on high power-factor and yet involves no extra measuring apparatus and no extra calculation or accounting. In operation it is exactly the same as the straight energy rate.

LEGISLATION ON ELECTRIC TRANSMISSION.

Mr. L. M. Barnet-Lyon limited his paper on the subject of transmission legislation to rights of way, the rights of crossing other public utilities, and responsibility for accidents. He gave a short historical sketch of the development of electric energy transmission, beginning with the demonstration by Marcel Deprez at the electrical exposition in Munich in 1881, where ½ hp was transmitted 7 km. The first successful demonstration of the economic value of energy transmission was made by von Dolivo-Dobrowolski at Frankfort in 1891, when several hundred horse-power was transmitted 170 km at 15,000 volts. The author then showed how the rapid development of electric energy transmission has naturally involved many conflicts, due to interference with telephone and telegraph systems and to danger from high-tension lines, such as are necessary in long-distance work; hence the necessity of legislation. Taking up the question of right of way, the author discussed the laws of Switzerland, France, Italy, Spain and Austria. He then briefly outlined legislation regarding the protection of pre-existing lines from danger or disturbance, and described the laws of Germany, Switzerland, France and Austria. In order to settle disputes satisfactorily and to keep pace with engineering development the author recommended the creation of a technical body which should draft those regulations that require expert engineering knowledge. France and Switzerland have organizations of this kind.

Finally the question of responsibility was taken up and the laws of Switzerland, France and Austria were briefly described.

The paper was discussed by Messrs. Lombardi, Bonghi, Gérard and others.

LEGISLATION ON ELECTRICAL TRANSMISSION.

Mr. E. C. Ericson outlined some of the most important points to be covered by legislation on electrical transmission of energy, namely, safety and control of transmission and distribution lines, responsibility in case of damage, utilization of public highways, control of service furnished to the public, tax on energy, and electrical commissions.

He then briefly reviewed the legislation of Germany, Austria, Belgium, Denmark, Spain, the United States, Finland, France, Great Britain, Italy, Japan, Mexico, Norway, Russia, Sweden and Switzerland. In conclusion the author voiced the following sentiments:

(1) Too little legislation is better than too much.

(2) The state control and supervision of electric systems should be concentrated on the points where it is most needed.

(3) Practical experience should have a reasonable influence in the formulation of laws and rules.

(4) All legislation or lack of legislation which tends to increase the cost of electric energy opposes a very important factor in the development of the industries and comfort of the community.

The report was discussed by Messrs. Gérard, Bonghi and others.

Public Service.

A joint meeting of the Los Angeles Section of the American Institute of Electrical Engineers and the Engineers and Architects' Association of Southern California was held following an informal dinner in Los Angeles, Dec. 19, with an attendance of about 150 members from both societies. The meeting was opened by Mr. Frank A. Wolff, Jr., of the National Bureau of Standards, Washington, who in the course of his remarks said that he intended to report favorably relative to the establishment of a branch of the bureau on the Pacific Coast.

The subject of the evening was "Public Service," which was treated in a paper by Mr. T. B. Comstock, M. E., engineer for the Board of Public Utilities of Los Angeles. The paper dealt with the subject from its first stages, tracing it to the point where the individual, and later the corporation, controlled public utilities owing to the great sums of money involved. Mr. Comstock said that proper and considerate regulation would only be brought about by the engineer, able and well trained, and by a regulating board free from any taint of politics. Mr. Comstock does not believe that municipal ownership will ever adequately fulfil the mission of the private corporation.

Mr. George A. Damon, dean of Throop Polytechnic Institute, Pasadena, spoke of capitalization, over-capitalization, and of funds derived from stock and bond issues and the proper disposition thereof. He said that the time was not far distant when surplus earnings, instead of being used as dividends, would be employed to decapitalize, development cost thus being removed from the capitalization. Mr. Damon believes that the time will come when the seal of the government will be placed upon the securities of public-service corporations to secure the investor.

Mr. R. H. Ballard, of the Southern California Edison Company, entered into the discussion by explaining the real object of a corporation, which is an association of individuals and not an octopus, as the average citizen imagines. Mr. Ballard said that the citizen may think well of the president and the officers of such company and consider the employees "fine," but nevertheless have no use for the corporation. He further stated that placing public utilities under the control of the California State Railroad Commission in the manner now provided might confine that body to regulating service and extensions, a municipal utility board establishing rates.

Prof. C. L. Cory, University of California, pointed out that service is far more important than rates, and that any fair-minded citizen would pay any reasonable charge, even above that now asked, if service were supplied in accordance therewith. Mr. Cory deplored the fact that

the public seemingly will not pay the price that expert engineering talent warrants. He believes that until this feature is improved the fair and consistent regulation of public utilities cannot be brought about.

Mr. O. H. Ensign, chairman of the local section, who presided, spoke of the misappropriation of funds derived from bond sales and the like which had come under his notice, and referred to the short-lived corporation, organized simply for the purpose of robbing the small and unsuspecting investor. Mr. Ensign said that by such operations the reasonably fair corporation was often brought under suspicion.

The meeting was in session four and one-half hours and proved one of the most interesting of the present season. It is planned to hold similar sessions during the winter. The next regular meeting of the local section will be held on Jan. 16, when "Illumination" will be the subject for discussion. Papers will be presented by Mr. E. Y. Porter and Mr. S. B. Lewis.

California Public Utilities Law.

As provided for in the recent amendments to the state constitution passed at a special election in October, a law creating a State Railroad Commission of five members and defining its powers and duties has been enacted by the Legislature at a special session called by the Governor. The bill, technically known as the Railroad Commission act and commonly referred to as the public-utility law, abrogates the Railroad Commission law passed at the last regular session of the Legislature. It was drafted by a committee appointed at the Governor's legislative congress recently held in San Francisco, consisting of Messrs. J. M. Eshleman, president of the State Railroad Commission; Max Thelen, attorney for the commission; Senators L. G. Burnett, L. R. Hewitt and J. W. Stetson; Assemblymen Arthur Joel, C. L. Preisker and W. A. Sutherland. When signed by the Governor, which action is assured, the act becomes operative in ninety days after the adjournment of the special session.

The bill as passed makes use of the wide plenary powers granted the Legislature by the new constitutional amendment. It is modeled after the public utilities measures of New York and Wisconsin, and is said to be even more comprehensive than any of the others in the regulation of state utilities. The State Railroad Commission is increased from three to five members, appointive by the Governor, with an annual salary of $6,000 each. The three present incumbents will serve out the period for which they were elected by the people, and two additional commissioners will be immediately appointed. The power of the commission is augmented to include all public utilities, which term the bill defines as including "every common carrier, pipe-line corporation, gas corporation, electrical corporation, telephone corporation, telegraph corporation, water corporation, wharfing and warehouseman, as those terms are defined in this section, and each thereof is hereby declared to be a public utility."

The commission has the power to fix rates for service, to regulate the standards of equipment and service, to review all stock and bond issues offered for sale, and to see that funds so derived are invested as stipulated. It has the authority to annul bond issues upon evidence of fraud or possible injury to investors, and to prevent over-capitalization. A drastic measure of the bill denies corporations the right of appeal from the commission's ruling on writs of certiorari; it is provided that such appeals may go before the Supreme Court only on questions of law and not of facts, the latter being determined solely by the commission, which may adopt its own procedure in taking testimony and is not governed by rules of evidence.

In the application of street railways a "certificate of public necessity" must accompany a petition. The law provides that municipalities may at a special or regular election vote to retain jurisdiction over the public utilities within the corporate limits. The Legislature appropriates the sum of $210,000 for the use of the State Railroad Commission in carrying out the provisions of the law.

Public Service Commission News.

NEW JERSEY COMMISSION.

The Board of Public Utility Commissioners of New Jersey will hold several hearings next week. On Jan. 2 the board will hear the complaint of the township of Bordentown against the Riverside Traction Company in reference to the refusal of the company to provide reduced-rate transportation for school children and free transportation for certain township officials. The board will also hear the complaint of the Maple Shade Improvement Association against the Public Service Railway regarding the rates of fare between Camden and Maple Shade. On Jan. 3 the board will continue at Newark its investigation into the reasonableness of rates charged by the Public Service Gas Company. On Jan. 5 the board will hear the complaint of Edward J. Dusel against the New York Telephone Company in regard to alleged failure to supply service in the borough of Dunellen.

OHIO COMMISSION.

In the case of Denny Cross against the Central Union Telephone Company the Ohio Public Service Commission has issued a decision to the effect that companies cannot terminate service to subscribers at will, but must frame a set of rules by which to be guided in such action, and that these rules must be incorporated in the contract. Cross complained that the company had "cut out" his telephone on Dec. 18 on the allegation that he had not paid his bill for the month. It developed that the only rule the company had in regard to the payment of bills is that a discount would be allowed if they were paid before the tenth of the month. Failure to pay, however, usually brought a discontinuance of service about the eighteenth of the month, but this was shown to be solely a matter of practice without definite rule or contract as to terms. The company was ordered to restore the service to Mr. Cross pending the settlement of the difficulty over the account and was told that it must put in use a set of definite rules and regulations before it could discontinue service for any cause.

The Circuit Court has reversed the decision of the Common Pleas Court in the case of the Tiffin Art Metal Company against the Tiffin Consolidated Telephone Company, Tiffin, in which the authority of municipal councils to fix rates for service was brought into question. The decision of the higher court is to the effect that this authority does not extend to fixing rates under the public-utilities act passed by the last Legislature. This decision follows similar findings made several years ago so far as the authority of municipal councils is concerned. The case originated in an ordinance passed by the City Council of Tiffin on Oct. 4, by which a material reduction from the old rates was made. The ordinance was ignored by the telephone company, and the Art Metal Company instituted suit in Common Pleas Court asking for an injunction, which was granted. The case was then carried to the Circuit Court. The telephone company some time ago filed a petition with the Public Service Commission asking for a hearing on its schedule of rates to determine whether they are reasonable and to prevent the city from enforcing the ordinance. This is still pending, and the company is under bond of $30,000 to guarantee a rebate should the lower rate be decided upon by the commission.

MARYLAND COMMISSION.

The Maryland Public Service Commission has held a hearing in the case of the Consolidated Gas, Electric Light & Power Company against the Paper Mills Company, arising out of the controversy between the two companies about charges of electricity. The Paper Mills Company asserts that it was assured by the Gas & Electric company that its bill would not exceed $100 a month and refused to pay more than that. The Gas & Electric company said there was no such agreement, though it had been estimated that the bills would not exceed that amount, and contended that to allow a flat rate of that amount would be to make a discriminatory rate in favor of the Paper Mills Company, which was forbidden under the Public Utilities act. The commission gave no decision in the case.

Mr. Charles E. Phelps, chief engineer of the commission, reports a valuation of the property of the Chesapeake & Potomac Telephone Company in Baltimore city as follows: Land and buildings, $810,973.38; exchange equipment, $1,203,929.99; subscribers' equipment, including installation, $781,414.30; underground conduits, $1,142,839.97; pole lines and distribution, $196,225.74; underground cables, $917,340.40; interior block district, $108,704.67; aerial wire, $314,445.52; aerial cable, $198,089.24; rights-of-way, $28,231.22; total, $5,702,194.43; miscellaneous property, $79,162.45; gross capital investment, $5,781,356.88; depreciation for four months, at rate of 5.95 per cent yearly, $113,714.78; net capital investment as of April 1, 1911, $5,667,642.10; depreciation for four months at rate of 6 per cent yearly, $115,627.14; net capital investment as of April 1, 1911, $5,665,729.74. The figures given above were taken as of Nov. 30, 1910. As the valuation was as of April 1, 1911, there was a depreciation of four months to be deducted. The rate of depreciation figured is 6 per cent per annum, making the rate for four months 2 per cent. Investigation by the commission's experts of the figures from the company as to cost, charges and service is steadily progressing.

Baltimore city has directed Deputy City Solicitor Alexander Preston, formerly associate counsel for the Consolidated Gas, Electric & Power Company, to devote his entire time to the case to come before the Public Service Commission relating to rates for electricity and gas. It was explained by Mr. W. Cabell Bruce, of counsel to the commission, that the commission and its counsel would act at the hearing as potential prosecutors. That is, if the commission had questions that were not asked of witnesses by the city solicitor, then the commission itself would ask them.

Chairman Ambler of the commission has been selected to succeed Judge Niles, who recently resigned from the Supreme bench, and it is the general belief that Commissioner Phillip D. Laird, whose regular term expires next May, will be named as his successor. If a new man were appointed to Mr. Ambler's place it would probably delay the settlement of the investigations now under way, as at the expiration of Mr. Laird's term next May the Republican Governor will in all likelihood name a Republican in his place, thus leaving Dr. Hering, the layman of the commission, as the only member who had followed pending cases through their entire course. Mr. Laird has been probably the hardest worker of the members, and by many is considered peculiarly adapted to his duties. He is a man of broad learning, a deep student and possesses a strongly analytical mind. The names of Mr. Marion V. Brewington, of Wicomico County, who was mentioned for appointment at the time the present commission was named, and Mr. William Cabell Bruce, at present general counsel to the commission, have also been mentioned. If a Republican is to be named it is believed that the place will first be offered to Mr. Morris A. Soper, for whom Governor Crothers has expressed high admiration. It is presumed that Mr. Goldsborough also would gladly welcome the opportunity of acknowledging Mr. Soper's services to his party by re-[illegible] him in May.

NEW YORK COMMISSION.

The hearing on the complaint made by certain organizations of stationary engineers that the New York Edison Company gives discriminatory rates to large customers was resumed Dec. 26 before Commissioner Maltbie of the Commission for the First District. The complainants had again secured counsel, and the latter called the general auditor of the New York Edison Company, who was examined as to the compiling and meaning of certain parts of the annual reports of the company. The next hearing is scheduled for Jan. 3, 1912, at 2:30 p. m.

CURRENT NEWS AND NOTES.

CAR-LIGHTING 60-VOLT STANDARD.—The Harriman lines, the Chicago & Northwestern and the Northern Pacific railroads have decided to adopt 60 volts as the standard for car lighting.

* * *

COLORADO ELECTRIC CLUB.—At the Thursday luncheon of the Colorado Electric Club on Dec. 21 an unusually large attendance, 194, listened to a strong plea for the grand jury system by ex-Senator T. M. Patterson, owner of the *Denver News*. The club will give a New Year's ball and entertainment in the banquet hall of the Brown Palace Hotel, Denver, at 8:30 p. m., Dec. 29.

* * *

COMMONWEALTH EDISON SECTION OF N. E. L. A.—In carrying out its policy of inviting men prominent in public-service affairs to address it, the Commonwealth Edison Section of the National Electric Light Association will listen to Mr. L. C. Fritch, chief engineer of the Chicago Great Western Railroad, on Jan. 3, at Association Hall, 19 South LaSalle Street, Chicago. Mr. Fritch's subject will be "The Chicago Railway Terminals."

* * *

LUNCHEON CLUB FOR BOSTON.—A luncheon club was started in Boston Wednesday, Dec. 20, at the Hotel Thorndike. The New England Section of the National Electric Light Association, together with several electrical manufacturers and supply men, has been instrumental in getting the club started, but it will be composed of members of all lines of the electrical industry. It is the intention to arrange to have a speaker of prominence at the luncheons, which will be given weekly.

* * *

PRESIDENT TAFT'S REFERENCE TO ILLINOIS-MISSISSIPPI WATERWAY.—In his message to Congress of Dec. 21 President Taft said that the project for a navigable waterway from Lake Michigan to the mouth of the Illinois River and thence, by way of the Mississippi, to the Gulf of Mexico is one of national importance. He speaks of the Chicago Drainage Canal, connecting the Chicago River with the Desplaines River, which in turn flows into the Illinois River, as an asset of the nation. In view of the fact that the people of Illinois have authorized the expenditure of $20,000,000 to carry this waterway 62 miles farther, to Utica, Ill., the head of navigation on the Illinois River, the President thinks that this work should be supplemented by the national government. He recommends that the term of service of the special board of government engineers which has studied this project be continued, and that it be empowered to negotiate with the State authorities, with the idea of constructing the navigable waterway from Lockport, Ill., to the mouth of the Illinois River. The project is of interest to electrical men, in northern Illinois particularly, because of the hydroelectric possibilities of such a waterway, if constructed.

Wichita (Kan.) Municipal Lighting Plan Defeated.—At a special municipal election held recently at Wichita, Kan., a proposal for the erection of a municipal electric-light plant was defeated by a vote of 2345 to 790.

* * *

Gas-Engine Central Stations.—In a recent paper read before a gas-engine association Mr. Rossiter Holbrook stated that there is over 60,000 hp from gas engines in the central stations of this country, and that there are over 170 central-station gas-producer plants in England.

* * *

Tests of Meters.—Of 6309 tests of meters made by the New York Public Service Commission, Second District, in September, 1911, 333, or 5.28 per cent, were fast; 5089, or 80.66 per cent, were accurate, and 887, or 14.06 per cent, were slow. Of 237 companies 41 did not report, and, of the remainder which reported, 103 made no tests.

* * *

Brooklyn Company Section, N. E. L. A.—At the meeting of the Brooklyn Company Section of the N. E. L. A. to be held at the Johnson Building Jan. 8, 1912, the speakers will be Mr. T. I. Jones, whose topic will be "Development of Our Business During 1911," and Congressman W. C. Redfield, who will speak on "Industrial Contracts Here and Abroad."

* * *

[illegible] Company Founds a School.—The New York Edison Company has established a school for the education of the 512 employees who constitute its contract and inspection department. It opened on Dec. 27 in the Edison Auditorium. The plan follows the general lines of the educational system started by big business enterprises, especially in Germany, to teach employees business details and fit them for promotion. The term will be for six months and the class sessions will be held daily except Friday between 4 and 5:30 p. m.

* * *

Isolated Electric Plants.—In a paper presented by Mr. Rossiter Holbrook before the annual meeting at Cleveland on Dec. 6 of the National Gas Engine Association it is stated that in fifteen of the principal states, which were mentioned by name, there is 5,544,888 engine horse-power in isolated electric plants, with which is contrasted the United States Census figure of 4,862,921 for the total horse-power of the central stations of the United States. It is stated that the isolated plants of Ohio aggregate over 800,000 hp. and those of Cleveland over 390,000 hp.

* * *

New York Jovian Lunch Club.—At the luncheon of the Sons of Jove held in New York Dec. 27 there were 152 in attendance, this being the largest number present at any of the luncheons thus far. The speaker on this occasion was Mr. T. C. Martin, secretary of the National Electric Light Association, who spoke on "Co-operation in the Electric-Lighting Field." Mr. Martin told of the benefit of the co-operative get-together methods of the association both to the lighting companies and to the general public, and which had led to an increase of the membership of the association from a little over 3000 three years ago to over 10,000 at the present time.

* * *

P[illegible] and Production in United States.—According to Mr. Waldemar Lindgreen, of the United States Geological Survey, the placer mines in Oregon and California, from which the entire output of crude platinum in the United States is recovered, produced 390 troy ounces of platinum, valued at $9,507, in 1910, against 673 oz., valued at $12,803, in 1909. A considerable quantity of refined platinum, estimated to be 4800 oz., valued at $156,960, is produced from imported crude platinum, the largest part of which comes from Colombia and Russia. The total output of refined platinum in the United States, of both domestic and foreign origin, was about 5573 fine ounces, valued at $182,237.

* * *

Philadelphia Section, I. E. S.—At a meeting of the Philadelphia Section of the Illuminating Engineering Society held on Dec. 15 a paper on institutional lighting was presented by Dr. W. M. L. Coplin, medical director of the Jefferson Hospital and professor of pathology, Jefferson Medical College. The author has made a thorough study of the problem of correct and efficient illumination, especially of wards and operating rooms in hospitals, both here and abroad, and a great many new ideas in regard to what is required in hospital lighting were obtained from him. The paper was discussed by Dr. William Spitzka, Professor Hoadley, of Swarthmore College, and Messrs. C. B. Regar, C. O. Bond, F. N. Morton and G. B. Muth. The attendance totaled 139 members and guests.

* * *

Tests of a Suction Gas Producer.—Bulletin No. 50 of the engineering experiment station of the University of Illinois gives the results of twenty-five tests made on a small suction gas producer for the purpose of obtaining data on the efficiency, reliability and operation of suction producers of small size using anthracite as a fuel. The theory of gas producers is discussed at some length. The conclusion is reached that a producer of the above type is a practical piece of apparatus for a class of work not requiring close regulation; also that the percentage of CO_2 in the gas can vary within wide limits without affecting the efficiency of operation. A very complete set of forms for reporting tests has been drawn up, and the formulas for calculating the trials have been deduced.

* * *

Philadelphia Electric Company Section, N. E. L. A.—At the meeting of the Philadelphia Electric Company Section of the N. E. L. A. Dec. 18 Mr. A. H. Armstrong, of the General Electric Company, gave an interesting talk on "The Coming of the Electric Locomotive." During the month the commercial and meter department branches held meetings, the former being addressed by Mr. C. J. Russell, who spoke on "Corporations," and the latter being addressed by Mr. E. L. Kyle, who read a paper on the "errometer." The instrument is essentially of the high-speed, motor-driven recording type, having a multiplicity of siphon pens operated by electromagnets, and is used for determining the accuracy of the various methods of meter testing. It was constructed by the meter department of the Philadelphia Electric Company.

* * *

Panama Canal Drydock to Be Electrically Operated.—Plans for the completed Panama Canal include a large graving dock, or drydock, which will be located at Balboa, at the Pacific entrance to the canal. The design of the dock has been placed under the immediate charge of Canal Commissioner H. H. Rousseau, civil engineer, U. S. N., who has recommended a dock with a length sufficient to receive vessels 1000 ft. in length, with a clear width at the entrance of not less than 110 ft. and a depth of 39 ft. over the sill, as compared with mean sea level. Miter gates of design similar to the miter gates of the Panama Canal locks are recommended for the drydock. These gates will be operated by electric motors. Along each side of the dock will be tracks for a 40-ton locomotive crane, and the dock will be provided with the usual capstans, electrically operated. The pumping plant will consist of not less than three vertical centrifugal pumps of large size and two small drainage pumps. These will be driven by electric motors, and energy will be obtained, no doubt, from the hydroelectric plant at Gatun. Repair shops equipped with electrically operated machine tools will be placed alongside the drydock.

HYDROELECTRIC ENERGY FOR IRRIGATION.

Minidoka (Idaho) Federal Project, Utilizing 10,000-hp for Electric Pumping.

Water for Irrigating 48,000 Acres Lifted 66 ft.—Detailed Cost of Construction and Operation of Generating Plant, Transmission Lines and Pumping Stations—Energy Sold for Heating at 0.14 Cent per Kw-hour and for Lighting at 7 Cents per Kw-hour.

THE development of irrigation in Idaho has reached a state such that the desirable lands which can economically be reached by gravity ditches are now nearly all covered. In many cases, too, the upper benches, when watered, are even more valuable from an agricultural standpoint than the lower gravity lands.

On the Minidoka Project in southern Idaho the United States Reclamation Service has in operation the largest pumping system that has been undertaken. Here water is pumped for approximately 48,000 acres, the average lift being 66 ft. Mr. Barry Dibble, electrical engineer, United States Reclamation Service, in charge of the Minidoka power and pumping system, presented a paper describing the electrical equipment of the completed project before the Idaho Society of Engineers at Boise, Nov. 25, from which address the present account is abstracted.

POWER PLANT AT MINIDOKA.

The Minidoka Project, as a whole, takes water from the Snake River at the diversion dam near Minidoka. This dam is about 50 ft. in height and forms a backwater known as Lake Walcott, which at the level of the spillway crest [illegible] approximately 10,000 acres and holds [illegible] acre-ft. About 200 miles further up the river is the Jackson Lake storage reservoir, the water from which is used during the low stage of the river.

At the diversion dam is located the hydroelectric plant which supplies the power required for pumping and for other purposes about the project. The development uses just about the minimum flow of the river, to which there are prior claims below, so that the water must be allowed to pass downstream.

The power house is a reinforced-concrete structure with steel roof trusses and purlins covered by matched lumber and galvanized corrugated iron. It measures 149 ft. long by 50 ft. wide and 90 ft. high from the bottom of the tailrace to the peak of the roof. It contains five main generator units of the vertical type, each of 2000-hp rated capacity, and operating under heads of 46 ft. from forebay to tailrace. There are also two 180-hp turbine-driven exciters.

Fig. 1—Main Generator Floor and Transformer Gallery, Minidoka Power House.

Each main unit consists of a single Francis runner, 54 in. in diameter, operating at 200 r.p.m., direct-connected to a 1400-kva, three-phase, 2200-volt generator. The weight of the rotating parts is supported from a thrust bearing mounted above the generator and consisting of two cast-iron disks in a water-cooled oil bath, the oil being circulated by vanes cut on the rotating face.

Each generator is directly connected to a three-phase air-blast transformer which has a step-up ratio of 2300 volts to 33,000 volts. The 33,000-volt side of the transformer is star-connected, its neutral point being grounded. There are no 2200-volt power-house buses, each turbine with its generator and transformer operating as an independent unit, while all switching is done from the 33,000-volt side. Here each transformer feeds out through disconnecting and oil switches to one of two sets of busbars. Either bus can

be connected, through disconnecting and oil switches, to either one of the two outgoing transmission lines. At the power plant each transmission line is provided with a bank of electrolytic lightning arresters designed for 19,000 volts from line to ground.

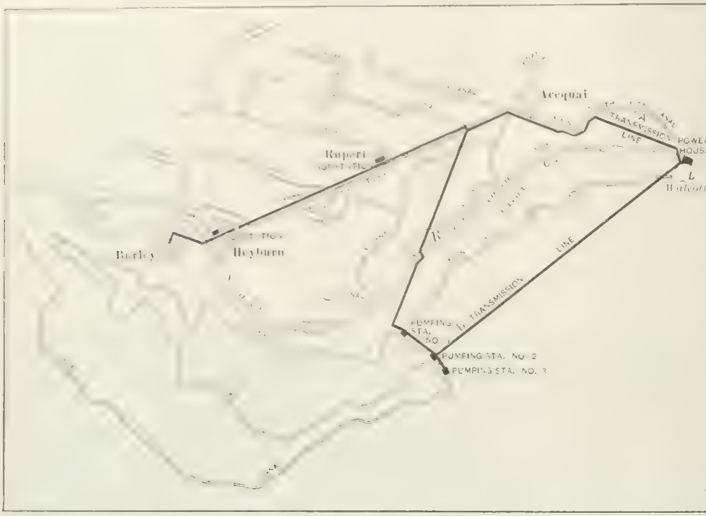


Fig. 2—Map of Minidoka Project, Idaho.

POWER HOUSE, CAPACITY, 1000 KW.

	Total Cost.	Per Kilowatt.
[illegible]	$82,000	$11.70
[illegible] machinery	[illegible]	[illegible]
Electric machinery.	[illegible]	11.80
[illegible] and hauling	26,200	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Roads and telephone lines	[illegible]	1.40
[illegible]	[illegible]	3.30
Engineering and incidentals..	[illegible]	[illegible]
Administration charges, etc.	[illegible]	2.10
[illegible]	[illegible]	[illegible]

The power house is now completed, and in round figures the cost of the plant and its accessories is as shown above.

TRANSMISSION LINE "B."

	Tower Line Cost		Pole Line Cost	
	Total	Per Mile of Line	Total	Per Mile of Line
Surveys and location....	$18	[illegible]	[illegible]	[illegible]
[illegible]			356	[illegible]
[illegible] conductors:				
Material	1,035	2,070	2,129	[illegible]
Freight and hauling	[illegible]	510	1,333	[illegible]
Labor	[illegible]	1,606	1,685	161
[illegible] phone):				
Material	610	1,220	[illegible]	[illegible]
Freight and hauling	83	166	557	[illegible]
Labor	75	[illegible]	670	[illegible]
[illegible]	[illegible]	36	200	[illegible]
Miscellaneous	40	80	[illegible]	[illegible]
Engineering	23	[illegible]	220	21
Total	[illegible]	$5,920	$10,377	[illegible]

TRANSMISSION LINES

The transmission system consists of 38.4 miles of 33,000-volt line. Of this 29.7 miles, costing $34,000, is required for the pumping system. One line extends down the north side of the river and furnishes power to several towns on the project. The second line has been built direct to the pumping stations, a distance of 11 miles across country. A tie line also connects the first line to the pumping stations. The ordinary spans, varying from 175 ft. to 250 ft., are carried on wooden poles, and at the river crossings spans varying from 700 ft. to 1100 ft. are supported on steel towers. The new construction is borne on heavy poles 35 ft. to 45 ft. in length, spaced 250 ft. apart. Each of the three copper conductors is a hard-drawn three-strand cable equivalent to No. 5 B. & S. in cross-section.

Herewith is given the cost of the line built in the last season direct from the power house to the second pumping station. It crosses the river just below the spillway, on five steel towers, 49 to 57 ft. high, with spans of 800 ft. and sag allowances of 35 ft. On the towers seven-strand copper cable is used, equivalent to No. 2/0 in cross-section. The towers themselves are erected on concrete foundations on small rock islands. The locations are difficult of access and this made the delivery of material expensive. The rest of the line is a tangent across a rolling country for a distance of 10½ miles on heavy cedar poles, as described above. On this section either rock or hard pan was encountered at an average depth of 2 ft. below the surface, and 95 per cent of the holes were drilled and shot. The pole holes alone cost on the average $3 each.

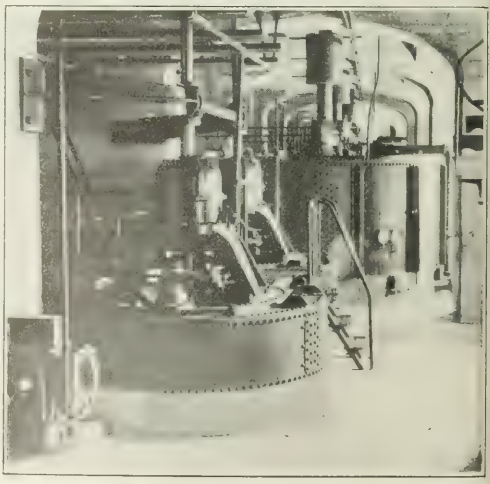


Fig. 3—Exciter and Alternator Water Turbines Below Generator Floor.

PUMPING STATIONS

There are three pumping stations, the first located at the end of the gravity canal and lifting the water to the first level, the second about 1.75 miles distant, lifting a portion to the second level, and the third, another 0.75 mile distant,

raising a final portion to the third level. The first station has a maximum capacity of 600 cu. ft. per second at normal speed. The lift at this station and at each of the others varies from 30 ft. to 31 ft. The stations are of the same general design and a description of the first will in general apply to all.

The buildings are of reinforced concrete with concrete roofs. The first is 140 ft. long by 18 ft. and 30 ft. wide and

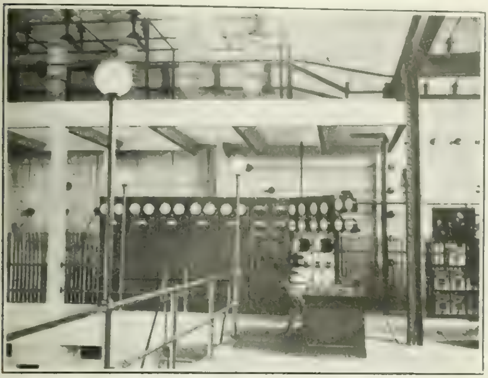


Fig. 4—Switchboard and Lightning Arrester.

45 ft. high. It contains four pumping units, each delivering 125 cu. ft. per second, and one delivering 75 cu. ft. per second. Each pump is located in an independent concrete chamber 17 ft. x 16 ft., protected by steel trash racks and steel gages. The pumps are of the vertical-shaft type and have both top and bottom suction. The impellers are 44 in. in diameter and run at 300 r.p.m. When starting a unit the pit gates are lowered and the pit is pumped out, thus reducing the power required from the motors. When operating the pump is submerged in the water. The discharge is controlled by a cylinder gate between the impeller and diffusion vanes, the pumps discharging through a tapered casting into a reinforced-concrete pressure pipe 5 ft. 6 in. in diameter. At the discharge end each pipe is closed by a steel-plate flap valve, which floats on the water when the pump is operating.

Each pump is driven by a 600-hp, three-phase synchronous motor, wound for 2200 volts and provided with auxiliary squirrel-cage windings to increase its starting torque. At starting 600 volts is applied to the motor armature, with the field coils short-circuited. The motor is brought up in this way to nearly synchronous speed as an induction motor, and then the field switch is closed and the motor is automatically synchronized at low voltage. It is then thrown on to the 2200-volt buses.

Originally a small pump delivering 1 cu. ft. per second was provided for emptying the pump pits. This pump took forty minutes to empty one pit, interposing at least this interval between starting successive pumps. To get the pumps back on to the line in rapid succession, a discharge pipe with a valve has been fitted to the manhole of each pump, the pump being thus made to clear its own pit. Before a unit is started this 18-in. valve is opened. Then the unit is started as before and the pit is pumped out while the pump is running at slow speed. As soon as the water level has fallen the pump speeds up and can be synchronized. As the result it now takes only two minutes from the time the pump is started until it can be thrown on to the line, ready for raising the pit gates and beginning pumping. The actual interval between starting successive pumps is about ten minutes, with one operator to perform all the work.

The 30,000-volt transmission lines enter the pumping station through disconnecting switches, to a single set of 30,000-volt busbars. From this bus disconnecting and oil switches lead to five 500-kw air-blast step-down transformers feeding a common 2200-volt bus.

The second pumping station contains four pumps, each rated at 125 cu. ft. per second. Here the transformers for the third station are also installed, together with the shop equipment for all the stations and the principal camp for the operators. At the third lift are two 125-second-ft. and one 75-second-ft. pumping units. At present the last pump in each station is being installed.

The final total pumping-station costs will be about as follows:

PUMPING STATIONS.

	[illegible]	Number 2.	[illegible]
[illegible]	[illegible]	$5,300	$2,000
[illegible]	[illegible]	40,000	[illegible]
[illegible]	[illegible]	23,000	16,200
[illegible]	[illegible]	42,800	[illegible]
[illegible]	[illegible]	9,600	[illegible]
[illegible]	[illegible]	14,600	9,300
[illegible]	[illegible]	11,000	500
[illegible]	[illegible]	3,000	2,000
[illegible]	[illegible]	7,000	5,500
Total	$152,600	$156,300	[illegible]
[illegible]	[illegible]	500	325
Cost per second-foot capacity	$265.40	$312.60	[illegible]
Pressure pipes, including administration charges	$21,400	$16,500	$20,200
[illegible]	[illegible]	540	825
Cost per foot	$23.90	$30.30	$24.50
Cost per second-foot of capacity, in- [illegible]	[illegible]	$346.00	$301.00

[illegible]erage, $318.00.

OPERATION OF THE SYSTEM

In testing the waterwheels at the plant the size and the water necessary to operate them made it impracticable to measure the flow in the ordinary way. A frame flume 40 ft. long with a submerged cross-section of 120 sq. ft. was accordingly constructed, floated in front of the trash racks, and loaded with anchors to hold it in place. The water flowing through the flume was then measured with current meters, the quantities varying from 250 cu. ft. to 507 cu. ft. per second.

The operation of the entire system has been very satisfactory. There have, of course, been minor troubles to be eliminated, but these are gradually being disposed of, and each year shows more satisfactory results than the previous one. The load has been increasing very rapidly. When it was determined to install the final pumping units in each of the pumping stations it was intended that this should be reserve capacity. It is now thought, however, that all the

Fig. 5—Forebay of Pumping Station No. 1.

units will be required during the height of the irrigation period, at least until the settlers learn to use the water economically.

The accompanying curves, Fig. 7, show in a general way the distribution of the load throughout the year. During the period of heavy load the daily average practically equals the maximum, resulting in a yearly load-factor of 35 per cent. Besides the pumping load, electrical energy is

furnished to several towns on the project. Of course these are small as yet, but their motor-service demand is rapidly increasing, and low rates are made to encourage this business. The retail electrical heating business in particular is given the very low flat rate of $1 per month for each kilo-

[illegible]

	Full-Load Efficiencies, [illegible]	[illegible] from Water Behind the Dam, [illegible]
Turbines	81.5	[illegible]
[illegible]	96.0	78.2
[illegible]	98.4	77.0
Transmission line	90.0	69.3
Step-down transformers	98.0	67.9
[illegible]	[illegible]	63.8
Pumps	[illegible]	[illegible]

watt of connected capacity. If used continuously this is equivalent to 0.14 cent per kw-hour. Lighting is given a rate of 7 cents per kw-hour, with a further reduction for consumption over 25 kw-hours per month. In the one year since this commercial business was begun the gross annual income has been increased to $12 per inhabitant, in spite of the low rates charged, and the future is very encouraging. The plant is kept in operation all winter for this load.

In figuring the annual cost of operation to be charged to the pumping system this commercial service is allowed for. It is apparent, however, that there would be considerable expense to maintain the station, requiring a watchman and repair crew, even though the plant were not operated during the winter. Therefore, one-half of the winter operating cost is charged to the pumping system. At all the stations and on the transmission line operation is carried on at high pressure during the summer, with the expectation of thoroughly overhauling all the equipment between seasons. This makes it possible to cut down the operating force to a minimum, besides keeping a considerable portion of this force busy the year round, with obvious advantages to the organization.

At the station the regular operating crew consists of two men, one in general charge of the power station operating the switchboard, and a helper to take care of the machinery and watch the bearings. A foreman is in charge of the operation of the power house. On the transmission line one

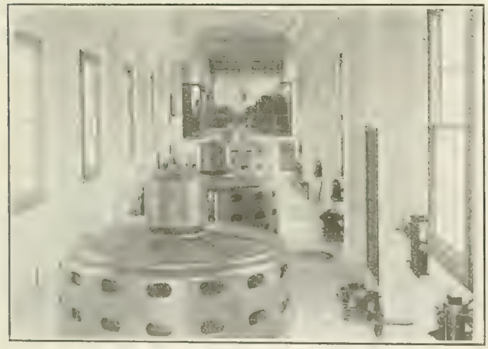


Fig. 6—Interior of Pumping Station No. 1.

man is able properly to patrol the entire system and do other work besides. During the pumping season all the transmission lines are patrolled twice a week. At each pumping station there is one man on each eight-hour shift, making nine regular operators. These men are under a foreman, who has a helper to use on miscellaneous work around the stations. The men are paid comparatively high wages, considering that their work is on an eight-hour basis, but in return they are expected to give more than usual attention to the work and to keep the stations in first-class condition.

UNIT COSTS OF OPERATION.

Cost of operation depends on many conditions. The cost at Minidoka during the past year has been very low, but it

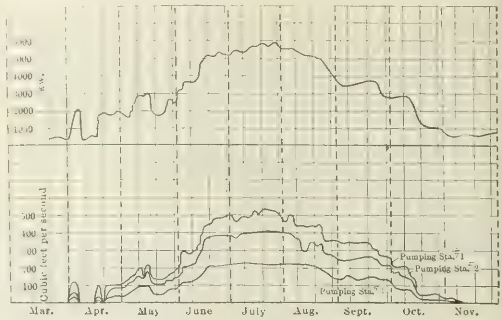


Fig. 7—Yearly Curves of Station Demand and Water Pumped.

might be increased at any time by a serious accident to an important piece of machinery. It is here that intelligent and alert operators can make themselves worth a good salary by catching the troubles before they develop to a serious extent.

The depreciation of equipment is an important item, although often overlooked. In the following table a rate of depreciation of 5 per cent per annum has been applied to the stations and 10 per cent to the transmission lines. No interest is included, as the money for the work comes from the reclamation fund, which is practically loaned to the settlers without interest. In the table allowance for repairs, etc., has been increased over that so far needed, as this item will undoubtedly increase with time. It is not intended to include the item of depreciation in the annual charge made

OPERATION AND MAINTENANCE OF POWER AND PUMPING SYSTEMS.

	Power House.	Transmission Line.	Pumping Stations. No. 1.	No. 2.	No. 3.	Total
Operation:						
Labor	$5,700	$700	$2,100	$2,100	$2,100	
Supplies	950	100	200	200	150	
Repairs:						
Labor	900	600	600	600	400	
Supplies and material	300	100	100	100	80	
Superintendence, clerical, camp, etc.	1,700	200	700	700	500	
General expense and administration	450	50	150	150	100	
Total operating expense	$10,000	$1,750	$3,850	$3,850	$3,280	$22,730
Depreciation	21,700	3,400	7,600	7,800	3,900	44,400
Total	$31,700	$5,150	$11,450	$11,650	$7,180	$67,130
Annual cost per acre, including depreciation	$0.660	$0.108	$0.239	$0.243	$0.150	$1.40
Operating expense per acre (48,000 acres)	0.208	0.037	0.081	0.081	0.068	0.475

against the settlers. However, this item will have to be met as time goes on and the machinery wears out. This can be done by paying for replacements as they are needed, and in the meantime the settlers will have the use of their money, which is worth 10 to 12 per cent interest, whereas if the government collected a depreciation fund it would have to hold it without interest.

During the season of 1911 114,000 acre-ft. of water were pumped to the average height of 66 ft., equivalent to 7,560,000 acre-ft. lifted through 1 ft. The operating cost for this pumping was about \$0.003 per acre-ft. lifted through 1 ft., and the depreciation amounted to \$0.006. Next year more water will be pumped at practically the same total cost, and therefore the unit cost will be reduced.

SUMMARY OF INSTALLATION [illegible]

Power [illegible]	[illegible]
Transmission line..................	[illegible]
Pumping stations with pressure pipes	444,800
Total [illegible]	\$912,100
Investment [illegible]	[illegible]

SUMMARY OF ANNUAL CHARGES

Operation	[illegible]
Depreciation	[illegible]
Total	[illegible]
Per acre [illegible]	[illegible]

A total of 14,000,000 kw-hours was delivered to the pumping stations during the year at a cost of \$37,000, including depreciation, or \$0.0026 per kw-hour. If, as would be necessary in the case of a commercial company, interest, taxes, etc., amounting to, say, 10 per cent on the investment in the power house and transmission line, were added, the cost would have been perhaps \$0.006 per kw-hour.

INDUCTION MOTOR DESIGN CONSTANTS.

A Simplified Algebraic Expression of Theoretical Relations and Empirical Constants Applicable in Designing Standard Induction Motors.

By A. MILLER GRAY.

IN what follows there will be described a method whereby the principal dimensions of an induction motor, and also its characteristics, may be determined with a minimum amount of labor. The method should be of interest to designers in general and particularly useful to estimating engineers on induction-motor work.

The fundamental formula used in the design of electrical machinery is that which connects the output with the diameter and length of the machine, namely,

$$C = \frac{hp}{r.p.m. \times D^2L} \qquad (1)$$

where C is called the output factor.

This formula is derived as follows:

$E = 2.22\, k_1 Z \Phi f\, 10^{-8}$

$hp = nEI\,(\cos\theta)\,\eta_1 = n\,(2.22 k_1 Z\Phi f\, 10^{-8})\, I\,(\cos\theta)\,\eta_1$ [illegible]

$= n \times 2.22\, k_1 Z B \tau L \frac{r.p.m. \times p}{120}$ [illegible] $(\cos\theta)\,\eta_1$

from which

$$\frac{hp}{r.p.m. \times D^2L} = B \times q \times 2.3 \text{ [illegible] } \cos\theta \times \eta_1 \text{ [illegible]} \qquad (2)$$

In the above equations and in those developed below the symbols have the following significance:

B = average flux density in the air-gap $= \frac{\Phi}{\tau L}$ lines per square inch.

D = rotor diameter in inches.

E = effective emf per phase in volts.

hp = horse-power output.

I = full load current in amperes.

I_o = magnetizing current in amperes.

I_D = ideal short-circuit current (see Fig. 7) in amperes.

L = [illegible] in inches.

$r.p.m.$ = synchronous speed in r.p.m. = [illegible]

V = peripheral velocity of rotor in 1000's of feet per minute.

Z = conductors in series per phase.

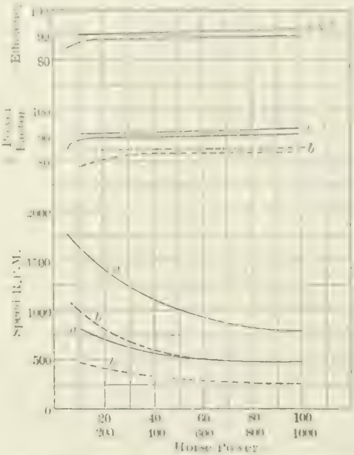


Fig. 1—Efficiency, Power-Factor and Speed.

a = conductors per phase per pole.

b = conductors per slot.

k_1 = distribution factor = 0.96 for three-phase and 0.91 for two-phase.

l_f = length of end connections in inches (see Fig. 3).

n = number of phases.

p = number of poles.

q = ampere conductors per inch $= \frac{nZI}{\pi D}$

s = slots per phase per pole.

x = reactance of windings per phase in ohms.

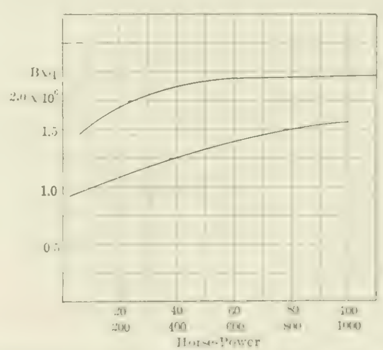


Fig. 2—Product of Ampere Conductors per Inch and Flux Density.

δ = gap length in inches = difference between stator and rotor radii.

Φ = magnetic flux per pole.

Φ_f = leakage lines per amp-conductor per inch of end connections.

Φ_s = leakage lines per amp-conductor per inch of slot length.

f = cycles per second.
η = efficiency.

It is usual in direct-current machines and in alternators to plot C, the output factor, on a horse-power basis. This is not satisfactory in the case of induction motors, because

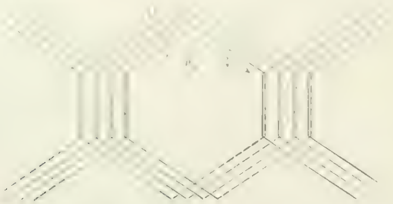


Fig. 3—Winding of One Phase of a Three-Phase Machine.

while $(B \times q)$ and η have definite relations to the horse-power, the power-factor, $\cos \Theta$, depends both on the horse-power and the speed, being high for high-speed machines and low for low-speed machines of the same horse-power output.

Fig. 1 shows the values of power-factor and efficiency which may be expected from a line of 60-cycle squirrel-cage motors with open-slot stators. It will be noticed that there are two power-factor curves a and b; these correspond to the speed curves a and b. Motors above a in speed are high-speed motors, those below b are low-speed motors. The power-factor does not increase very rapidly for speeds above those of line a, but it drops very rapidly for speeds below b. The efficiency is practically independent of the speed.[1]

Hence for induction motors instead of plotting C, the output-factor, against horse-power it will be found more satisfactory to plot $(B \times q)$ to horse-power abscissas. This is done in Fig. 2 for a line of 60-cycle motors.

Then from formula 2:

$$D^2L = \frac{10^{6}\ hp}{2.36\ r.p.m.} \times \frac{1}{(B \times q)} \times \frac{1}{\cos \Theta \times \eta} \qquad (2a)$$

The necessary information for the above equation is taken from Figs. 1 and 2.

The magnetizing current of an induction motor is obtained from

$$I_o = \frac{\Phi \times \delta \times k_2 \times k_3}{\tau L \times 0.91 \times nak_4}$$

where k_2 is a fringing constant used when the slots are open, in which case the air-gap area is not τL, but $\tau L \div k_2$; for open slots on the stator with closed slots on the rotor $k_2 = 1.5$ approximately.

k_3 is a constant to allow for the exciting current necessary to send the flux through the iron part of the magnetic circuit; it is almost constant for all sizes of motors, because, while the gap is larger in machines of large diameter, yet in these same machines the teeth are long, $k_3 = 1.2$ approximately.

$k_4 = 0.96$ for three-phase machines and 0.9 for two-phase machines.[2] Thus for three-phase machines

$$\frac{I_o}{I} = 2.05 \times \frac{B}{q} \times \frac{\delta}{\tau} \qquad (3)$$

The Value of δ, *the Air-Gap Length.*—There have been a number of formulas proposed for finding the length of air-gap of the form $\delta = m + cD$, where m and c are constants. These were satisfactory when machines of large diameters and short lengths were popular and before much experience had been obtained with very high-speed motors for direct connection to centrifugal pumps, etc. It will be found that the air-gap increases with the diameter, with the length and with the peripheral speed. That is,

$$\delta = f + gD + hL + kV, \qquad (4)$$

where $f = 0.005$, $g = 0.00035$, $h = 0.001$ and $k = 0.003$. These values give the smallest air-gap that will be satisfactory mechanically.

The ideal short-circuit current I_D of an induction motor is determined as follows:

Fig. 3 shows the winding of one phase of a three-phase machine covering a distance of two poles; the winding is a double-layer one.

Φ_f = the leakage flux per amp-conductor per inch of free length of end connections, considering these as a belt.

Φ_e = the total flux threading the coils due to the current in the end connections

$$\Phi_e = \frac{a}{2}\Phi_f \times 2l_f \times I$$

so that the coefficient of self-induction of the end connections $= \left(\frac{a}{2}\right)^2 \Phi_f \times 2l_f$, and the reactance per phase of winding due to the end connections $= 2\pi f a^2 \left(\frac{\Theta_f l_f}{2}\right) p$.

Φ_1 = the lines per amp-conductor per inch of embedded length; this includes the stator slot, the rotor slot, and zig-zag leakage.[3]

The flux linking the conductors in one slot $= \Phi_1 bIL$, coefficient of self-induction of conductors in one slot $= b^2\Phi_1 L$, reactance per phase due to the slot part of the winding $= 2\pi f b^2 \Phi_1 L \times sp$, and total reactance per phase

$$x = 2\pi f a^2 p^2 n \left(\frac{\Phi_1 L}{snp} + \frac{\Phi_f l_f}{2pn}\right) \qquad (5)$$

Now $\frac{\Phi_1}{snp}$ is approximately constant for a given diameter of machine because if the slots were made double the original width so that Φ_1 would have one-half its original value, yet on the same diameter there would be room for only one-half the initial number of slots.

It is advisable at this point to show the fallacy of the statement which is often made that increasing the number of slots, say, 20 per cent decreases the reactance 20 per cent. For a given voltage and magnetic flux the number of conductors per phase per pole $= a$ is unchanged, so that

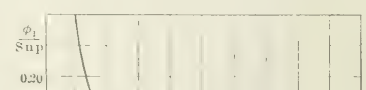


Fig. 4—Variation of $\Phi_1 \div snp$ with Diameter.

if s = the slots per phase per pole be increased 20 per cent b = the conductors per slot will be decreased 20 per cent, Φ_1 = the lines per amp-conductor per inch will be increased 20 per cent because the slot is now 20 per cent narrower. The reactance per slot is proportional to $b^2\Phi_1$, and hence is decreased 20 per cent, but the number of slots per phase

[1] Goldschmidt, *Journal of the British Institution of Electrical Engineers*, January, 1908.

[2] McCormick, *Trans. A. I. E. E.*, May, 1906.

[3] Adams, *Trans. A. I. E. E.*, June, 1905.

per pole is increased [illegible] per [illegible] since the windings in these slots are in series the reactance of the whole winding is unchanged. As a matter of fact, Φ_1 contains the zig-zag leakage which is proportional to the width of the

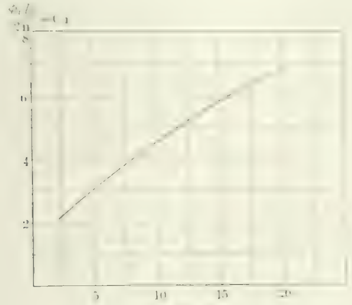


Fig. 5—Variation of C_1 with Pole Pitch

tooth, and hence decreases as the number of teeth is increased, but for machines with open-slot stators this zig-zag leakage flux is only about one-fourth of Φ_1.

In Fig. 4 $\frac{\Phi_1}{snp}$ is plotted against the diameter and in Fig. 5 $\frac{\Phi_f l_f}{2n}$ is plotted against the pole pitch from the results of tests on three-phase, 60-cycle machines.

With two-phase windings the length of path around the belt of conductors of one phase is approximately 50 per cent greater than for three-phase machines of the same pole pitch, and hence Φ_f is reduced 50 per cent, and the ratio $\frac{\Phi_f}{n}$ is independent of the number of phases—that is, Fig. 5 may be used for both two-phase and three-phase windings.

Now

$$\frac{I_0}{I} = \frac{E}{xI} = \frac{2.22\, k_1 Z \Phi f\, 10^{-8}}{2\pi f a^2 p^2 n L \left(\frac{\Phi_1}{snp} + \frac{C_1}{pL}\right) I}$$

$$= \frac{0.337}{p} \times \frac{B}{q} \times \frac{1}{\left(\frac{\Phi_1}{snp} + \frac{C_1}{pL}\right)} \qquad (6)$$

when $C_1 = \frac{\Phi_f l_f}{2n}$ (see Fig. 5).

by the heating of the machine to about 80,000 lines per square inch for 60-cycle machines and 105,000 lines for 25-cycle machines. The ratio of slot-width to tooth-width in the stator is approximately 1 to 1.1, being slightly greater for machines of small diameter and slightly smaller for machines of large diameter. The average gap density = the

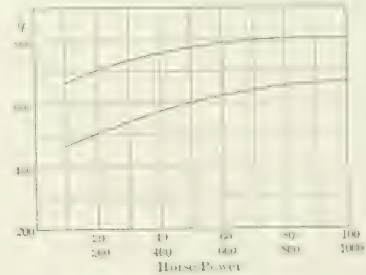


Fig. 6—Ampere Conductors per Inch

maximum tooth density $\times \frac{2}{\pi} \times \frac{1}{2.1}$ and hence has a value of about 22,000 lines for 60-cycle and 29,000 lines per square inch for 25-cycle machines. Since the magnetizing current is directly proportional to B it is sometimes necessary to use lower values of B than the above in order to keep the magnetizing current low. Twenty-five-cycle motors can have higher gap densities than 60-cycle motors because, for the same diameter and speed, the pole-pitch and therefore the ratio $\frac{\tau}{\delta}$ is larger for 25-cycle than for 60-cycle motors, and so the ratio $\frac{I_0}{I}$ is smaller.

The value of q is limited by heating. Thus in a motor whose coils have an area of M circ. mils and a mean turn of l inches the copper loss in watts is $= \frac{l}{2} \times \frac{ZnI^2}{M}$ since the resistance of copper = 1 ohm per circ. mil-in. Hence $\frac{\text{watts}}{\pi D \frac{l}{2}}$ = watts per square inch radiating surface

$$= \frac{q}{M \text{ per ampere}}$$

The value of amp-conductors per inch is obtained from Fig. 6. It is plotted against horse-power and not against speed because, for a given horse-power, if the speed in r.p.m. is high the machine is small in diameter, but at the same time the peripheral velocity is high and the ventilation

Horse-power.	Revolutions per Minute.	f	$B \times q$	$\eta \times \cos\theta$	D^2L	D	L	V	[illegible]	δ	q	B	$\frac{\Phi_1}{snp} + \frac{C_1}{pL}$	$\frac{I_0}{I}$	[illegible]
50	1,800	60	1,330,000	0.81	1,100	12	7.6	[illegible]	[illegible]	0.034	600	22,200	.215 + .147 = .362	0.275	8.6
50	1,800	60	1,330,000	0.81	1,100	14	5.6	6.6	11.0	0.036	600	22,200	.195 + .221 = .416	0.25	7.5
50	1,800	60	1,330,000	0.81	1,100	[illegible]	4.3	7.6	12.6	0.038	600	22,200	.18 + .31 = .49	0.23	[illegible]
50	900	60	1,330,000	0.79	2,240	16	8.7	3.8	6.3	0.031	600	22,200	.18 + .051 = .231	0.37	6.7
50	900	60	1,330,000	0.79	2,240	[illegible]	6.5	4.4	7.3	0.031	600	22,200	.163 + .075 = .238	0.32	[illegible]
50	900	60	1,330,000	0.79	2,240	21	5.0	5.0	8.3	0.032	600	22,200	.15 + .104 = .254	0.29	6.1
50	514	60	1,330,000	0.74	4,200	23	7.9	3.1	5.2	0.03	600	22,200	[illegible]	0.44	5.3
50	514	60	1,330,000	0.74	4,200	[illegible]	6.2	3.5	5.8	0.031	600	22,200	[illegible]	0.40	[illegible]
50	514	60	1,330,000	0.74	4,200	29	5.0	[illegible]	[illegible]	0.032	600	22,200	[illegible]	0.37	5.2
50	514	60	1,330,000	0.74	4,200	32	4.1	4.2	7.2	0.033	600	22,200	[illegible]	[illegible]	[illegible]
50	514	60	1,330,000	0.74	4,200	35	3.4	4.7	7.9	0.035	600	22,200	[illegible]	0.33	4.7
1,000	900	60	1,950,000	0.86	28,000	32	[illegible]	[illegible]	[illegible]	0.066	800	24,400	.112 + .024 = .136	0.33	[illegible]
1,000	900	60	1,950,000	0.86	28,000	36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.102 + .033 = .135	0.29	[illegible]
1,000	900	60	1,950,000	0.86	28,000	40	17.5	9.4	15.7	0.065	800	24,400	.095 + .042 = .137	0.26	[illegible]
1,000	240	60	1,950,000	0.80	113,000	100	11.3	6.3	10.5	0.07	800	24,400	.051 + .014 = .065	0.42	[illegible]
1,000	240	60	1,950,000	0.80	113,000	110	9.3	6.9	11.5	0.073	800	24,400	.049 + .018 = .067	0.40	[illegible]
1,000	240	60	1,950,000	0.80	113,000	120	7.8	7.5	12.6	0.077	800	24,400	.047 + .023 = .070	0.38	[illegible]

Discussion of Equations (3) and (6).—The average flux density in the air-gap bears a definite relation to the maximum flux density in the stator tooth. This latter is limited

good. If the speed in r.p.m. is low the diameter is large and there is free access to the air; moreover, the slots are deep to allow the use of large conductors.

In many cases a lower value of q than that determined by heating from Fig. 6 may be necessary in order that the short-circuit current and hence the permissible overload may be sufficiently large (see formula 6).

Fig. 7 shows the simple circle diagram for a reasonably

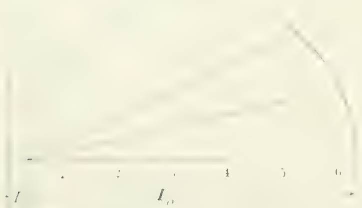


Fig. 7—Simple Circle Diagram.

good induction motor. It has a full-load power-factor of 90 per cent, a starting torque 1.5 times full-load torque, a maximum torque 2.9 times full-load torque and a maximum output 2.3 times full-load rating. To obtain such characteristics as may be seen from the diagram the magnetizing current should not exceed 33 per cent of the full-load current nor should the short-circuit current be less than six times the full-load current.

Examples of Application of the Formulas.—Designs for motors of the following ratings are worked out in the accompanying table:

(a) 4 pole, 50 hp, 60 cycle, 1800 r.p.m.
(b) 8 pole, 50 hp, 60 cycle, 900 r.p.m.
(c) 14 pole, 50 hp, 60 cycle, 514 r.p.m.
(d) 8 pole, 1000 hp, 60 cycle, 900 r.p.m.
(e) 30 pole, 1000 hp, 60 cycle, 240 r.p.m.

The order of calculation is as follows:

(1) Find $B \times q$ from Fig. 2.
(2) Find $\cos\theta \times \pi$ from Fig. 1.
(3) Find D^2L from formula 2 *a*.
(4) Take different trial values of D and L.
(5) Find the peripheral velocity V, and also the pole pitch τ.
(6) Find δ from formula 4.
(7) Find q from Fig. 6.
(8) Find $\frac{\Phi_1}{snp}$ and $\frac{\Phi_1 l}{2n}$ from Figs. 4 and 5.

Referring to the results which are shown in the accompanying table, it should be noted that the smaller the diameter the lower the peripheral velocity for a given speed in r.p.m., and therefore the greater the heating for a given value of q. It is also important to know that the smaller the diameter of the machine the lower the cost for a given value of D^2L.

Design (a) with a diameter of 12 in. would probably get hot because, owing to the small diameter, it would be difficult to get the air necessary for ventilation in and out of the machine, hence a diameter of about 14 in. would probably be chosen in this case, and as the magnetizing current is only 25 per cent of the full-load current the air-gap would probably be increased to 0.045 in. and still the power-factor would be high.

Design (b) with a 16-in. diameter has too large a magnetizing current for a motor of this speed and thus would not meet the power-factor guarantees demanded by the trade for a motor of this rating. An 18.5-in. diameter machine would be satisfactory and would be cheaper than one 21 in. in diameter.

Design (c) is shown with five different values of D and L in order to disprove the fallacy that the greater the peripheral speed of a motor the better are the characteristics of the machine. As the diameter increases the effective length of the machine decreases, but at the same time the leakage due to the end connections increases. Designs (c) and (e) also show the important fact that low-speed machines cannot be made to have the same characteristics as high-speed machines, but must necessarily have lower power-factors and smaller overload ranges. This is shown in the well-known formula

$$\frac{I_0}{I_D} = K\frac{\delta}{\tau}$$ developed by Mr. B. A. Behrend,[4] where the value of K can be found from formulas 3 and 6.

[4]Behrend, "The Induction Motor."

OPERATION OF DETECTORS IN WIRELESS-TELEGRAPH SERVICE.

Sensitiveness of Wireless-Telegraph Contact Detectors as a Function of the Contact Pressure.

By L. H. Harris and John L. Hogan, Jr.

The results of two independent but similar investigations which, when taken together, make it possible to draw a new distinction between two classes of wireless detectors should be of especial interest at the present time. Loose contact or microphonic detectors were the first known in the wireless signaling art, and until the advent of the "current-operated" detector were used exclusively. The merits of this latter type of detectors, which give responses in proportion to the total energy of the received signal, were recognized at once, and at the present time one class of detectors of this type, the so-called "crystal rectifiers," is receiving much attention.

As a representative of the self-restoring microphonic detectors, the one discovered by Hughes,[1] consisting of a loose joint caused by a bright steel needle resting lightly on a pencil of gas carbon, may be taken. This is most effective when used in circuits of the type shown in Fig. 1, where A is the antenna, B and C the primary and secondary of an oscillation transformer, D an earth connection, E a condenser, F the detector, G a head telephone, H a potentiometer and I a cell of battery. From the numerous "good" or firm-contact detectors there may be chosen as examples those consisting respectively of a joint between tellurium and aluminum,[2] between silicon and any

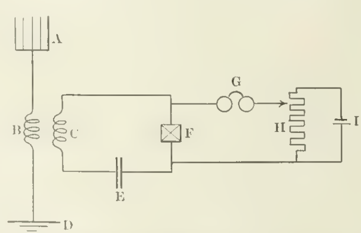


Fig. 1—Arrangement of Circuits with Hughes Detector.

ordinary metal,[3] and between the minerals zincite and chalcopyrite.[4] These detectors operate well in the circuit

[1]See the [illegible] of Hughes' 1879-1886 work in the London *Electrician* of M[illegible]; in the London *Electrical Review* of June 2, 1899, and in Appendix D of J. J. Fahie's "A History of Wireless Telegraphy," Dodd, Mead & Company, third edition, 1902.

[2]L. W. Austin's paper in the *Physical Review*, 1907, page 508, and *Bulletin* of Bureau of Standards, Vol. V, No. 1, April 27, 1908, page 133.

[3]United States Patent No. 836,551, G. W. Pickard; application filed Aug. 30, 1906; patent issued Nov. 20, 1906.

[4]United States Patent No. 912,726, G. W. Pickard; application filed Oct. 15, 1908; patent issued Feb. 16, 1909.

shown in Fig. 1, but are very nearly of the same effectiveness in that of Fig. 2, where no battery is used.

The operation of all these good contact detectors is such that when electromagnetic waves set up alternating currents in the antenna circuit ABD and these currents are conveyed to the detector by way of C and E a unidirectional pulsating or partially rectified current is set up in the circuit containing the detector and the telephone G and thus an audible signal is given. The action underlying this operation is not thoroughly understood. In the case of the microphone detectors, it is believed that the

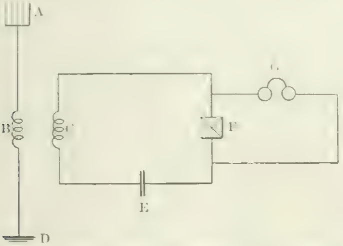


Fig. 2—Arrangement Without Battery in Detector Circuit.

received-wave currents or voltages alter the resistance of the loose joint so that the amount of battery current flowing through the telephone circuit is altered and the signal thereby produced. This explanation obviously cannot apply to the second type of "good" or firm-contact detectors when used without a battery (Fig. 2), and hence a well-demonstrated theory of rectification of the pulses of high-frequency alternating current is generally accepted as explaining the phenomenon even when a local battery is used. Why or how this rectification occurs is still conjectural, though the indications are that the basic action is a peculiar type of thermal regeneration at the contact.

In handling any of these detectors one of the first things that attract notice is that the sensitiveness varies greatly as the point of contact is changed—that is, as different parts of the surfaces of the elements forming the detector are brought into action. It is not so obvious, however, that there is a distinct relation between the sensitiveness of the detector and the force with which the two elements are brought into contact. To show these variations of the sensitiveness of the two types of detectors was the purpose of the investigations here described.

The first tests considered were carried on during 1908 at the graduate physical research laboratories of the Sheffield Scientific School, Yale University, while those on the Hughes device were performed only a few months ago at the University of Pittsburgh.

EXPERIMENTS WITH THE CRYSTAL DETECTORS.

Referring to Fig. 3, a buzzer J of constant frequency was arranged in a circuit with a key and battery, and

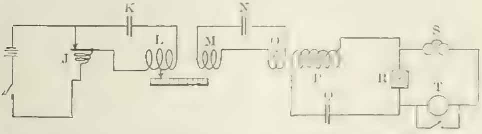


Fig. 3—Circuit Arrangement for Experiments with Crystal Detectors.

across its intermittent contact was placed a condenser K of 0.12 mf in series[6] with a small primary L. This primary was arranged in variable inductive relation to a secondary M, which with the condenser N and primary O formed a closed intermediate circuit transferring the high-frequency energy to the detector circuit (secondary P, condenser Q,

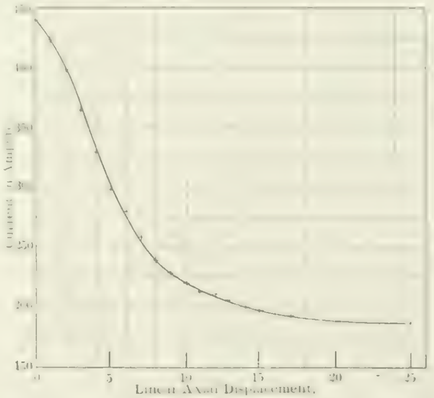


Fig. 4—Variation of Current with Separation of Coils.

and detector R). Across the detector were shunted a telephone S and a galvanometer T, the latter having a short-circuiting switch.

The detector holder R was made to take interchangeably any pair of the elements under test, and a scale pan was arranged on a balance arm so that the contact pressure of the detector might be varied by changing the weights in the pan.

It will be seen from Fig. 3 that at each opening of the buzzer contact the condenser K will be charged, and that it immediately afterward discharges through the primary L. This discharge excites the circuit MNO, causing it to oscillate at its natural frequency and with an amplitude depending upon the closeness of the coupling between L and M. The high-frequency oscillations of the circuit MNO operate the detector in the associated circuit PQR and give a galvanometer deflection or a telephone signal depending in amount upon the coupling between L and M. Thus, when a scale was placed so as to indicate the distance between the coils M and L it was possible to determine the change of energy in the circuit PQR due to variations in the coupling. The relation between the current in R and the axial displacement of the coil L is shown by the curve of Fig. 4.

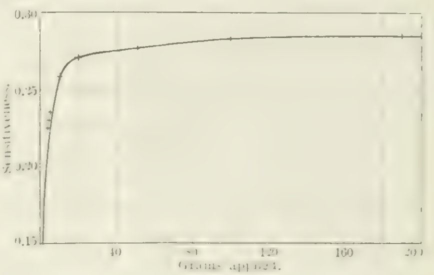


Fig. 5—Variation of Sensitiveness of Silicon-Brass Detector with Pressure.

From the above it appears clearly that if, when a detector is in circuit and adjusted, the displacement between L and M is increased until the signal in the telephone becomes just audible, the displacement, referred to in Fig. 4, will show (as the square of the corresponding ordinates) a quantity proportional to the energy required to operate

[6]This is a modification [illegible] W. [illegible] pages 149-152 of the *Bulletin* of Bureau of Standards, Vol V, No. 1, April 27, 1908.

the detector. The reciprocal of this may be defined as the sensitiveness of the detector, and so long as there are no great changes in the electrical dimensions of the circuits the single calibration of Fig. 4 may be used with several different detectors with a very fair degree of accuracy.

Method of Test.—A consideration of what has been described developed the following method of procedure. A

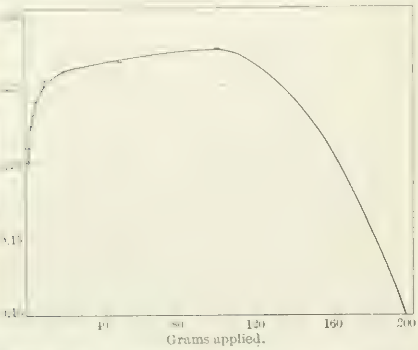


Fig. 6—Relative Sensitiveness of Tellurium-Aluminum Detector.

small weight was placed in the scale pan, and the detector was adjusted to give the loudest possible signal under this pressure. In the course of the adjustment the signal was gradually weakened by reducing the coupling *LM*, and when the final condition of maximum sensitiveness was reached the coils were separated until the signal was just audible, and then the displacement for that pressure was noted.

This process was repeated in the case of each different applied weight for each detector, and the result was checked by further repetition. A special experiment showed the variation in the buzzer's output to be somewhat less than 0.5 per cent when precautions against changes in frequencies were taken. It should be noted that the variation of transformer displacement to the "just audible" point was made without watching the scale of the coupling, so that the possibility of influenced readings was guarded against.

Results.—The transformer displacements were referred to the curve of Fig. 4 for each measurement, the corre-

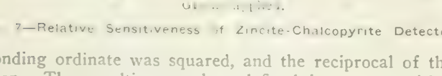


Fig. 7—Relative Sensitiveness of Zincite-Chalcopyrite Detector.

sponding ordinate was squared, and the reciprocal of this taken. The resulting number, defined here as sensitiveness, is expressed as

$$S = \frac{1}{I^2K}$$

where I is the current required to operate the detector and K is a constant involving the detector's effective resistance and the galvanometer's sensibility. This number was plotted against the gravity mass acting on the contact, the curves for the three good-contact detectors being shown in Figs. 5, 6 and 7. It is interesting that each shows its maximum sensitiveness at about 100 grams and has low sensitiveness at small pressures.

The abscissas are not truly pressures in any common unit, but merely weights that are acting on the contacts. The contact area over which the weight was distributed is practically indeterminate. The value of the results in showing the relation between pressure and sensitiveness is, however, in no way decreased by the necessary use of unknown units.

EXPERIMENTS WITH THE HUGHES DEVICE.

These tests were made with the same purpose in mind as those previously described, but without knowledge that such tests had previously been made. The device as used consisted of a polished steel sewing needle in contact with a pencil of gas carbon. The method employed consisted in supplying energy at a constant rate, in the form of high-frequency alternating currents, to the detector, which was shunted by a local circuit containing a telephone receiver

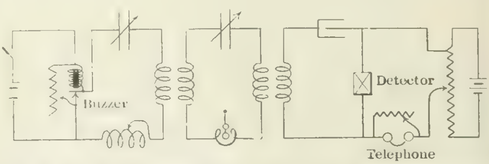


Fig. 8—Circuit Arrangement for Tests with the Hughes Device.

and a battery, as indicated in Fig. 8. An audible signal was produced in the telephone in the manner previously described. The receiver itself was shunted with a resistance, by varying which the current through the receiver, and thus the loudness of the signal, could be changed at will. The sensitiveness of the detector for a given pressure is then indicated by, and is inversely proportional to, the resistance which must be placed in shunt with the receiver to reduce the signals to bare audibility. A sensitive alternating galvanometer in the intermediate tuned circuit indicates the amount of energy being transferred to the detector circuit.

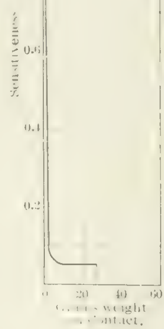


Fig. 9—Relative Sensitiveness of Hughes Device.

One of the elements composing the detector was fixed while the other was carried on the end of a balanced beam, which also carried a weight pan. Small masses in the form of ordinary milligram weights were added to the pan, thus varying the magnitude of the contact pressure. The results of these tests were plotted in the form of curves, a typical curve being shown in Fig. 9.

In every instance the Hughes device showed a maximum sensitiveness at a minimum pressure, the sensitiveness falling rapidly to a moderate value with slight increase in pressure and at a comparatively light pressure failing altogether. This would seem to bear out the opinion expressed in the first part of this article as to the nature of the action of this type of detector. In the case of the "good" or firm-contact detectors the sensitiveness is a minimum at the minimum pressure, rises rapidly and remains nearly constant over a wide range of pressure.

That there is a fundamental difference in the method of operation of these two types of detectors will become evident if a comparison be made of the forms of the resulting curves, Figs. 5, 6, 7 and 9

ELECTRICAL RESISTANCE OF SOLID-METAL SOLUTIONS.

DIFFUSION between solid bodies, especially metals, has been shown to take place under suitable conditions, this striking phenomenon being ascertained by chemical analysis or micrographical observation. In a paper recently read before the Accademia dei Lincei Messrs. G. Bruni and D. Meneghini suggest another method, based on the physical properties of the solution formed, and especially on variations of the electrical resistance of the two metals in contact with one another.

It is a well-known fact that the specific resistance of an alloy generally is considerably greater than that of any one of the component metals. A constantan wire (40 per cent nickel, 60 per cent copper) thus possesses a resistance forty-seven times as high as that of a copper wire and six times as high as that of a nickel wire of equal length and cross-section. These remarkable variations in resistance thus allow the diffusion between two metals to be watched in all its phases.

Repeated resistance readings show two solid metals in contact with one another to give rise under suitable conditions to a phenomenon of diffusion, both of them assuming in the end all the properties of an alloy, inclusive of an increase in specific resistance.

The author coated a nickel wire 0.5 mm in thickness by electrolysis in a bath of potassium copper cyanide at very low current intensity (0.1 amp) with a very compact copper layer, the thickness of which was so chosen that the two metals are present at the same ratio as in constantan.

Time After Heating, Hours	Resistance, Ohm
2	0.0256
6	0.0279
10	0.0290
18	0.0723
34	0.1372
48	0.1641
70	0.1883
90	0.1980
115	0.2065
135	0.2097
157	0.2105

The wire was inserted for about 20 cm length into a thin porcelain tube located in a Heräus resistance furnace capable of maintaining the temperature at 1000 deg. C. with very little fluctuation. The wire is thus maintained at 80 deg. below the melting temperature of the most fusible metal. Any trace of melting would, by the way, have been immediately detected, this metal being situated outside. A current of dry hydrogen which was forced through the porcelain tube prevented the occurrence of any oxidation.

Before heating the wire had a resistance of 0.0260 ohm. After being heated for various lengths of time the electrical resistance was ascertained at given intervals, the result of a number of tests being as summarized in the table.

At this point the electrical resistance shows the copper-nickel to have been converted entirely into constantan. In fact, the curve expressing the increase in resistance in terms of time here becomes nearly parallel to the X-axis. Chemical analysis shows the wire to contain for each 0.2909 gram of alloy, 0.716 gram, or 58.9 per cent, of copper, which percentage agrees with that of constantan, having the same specific resistance. The slight decrease in resistance which will be observed at the beginning of the table is attributable to the action of heating on the surface layer.

ELECTRIC PUMPING FOR IRRIGATION.

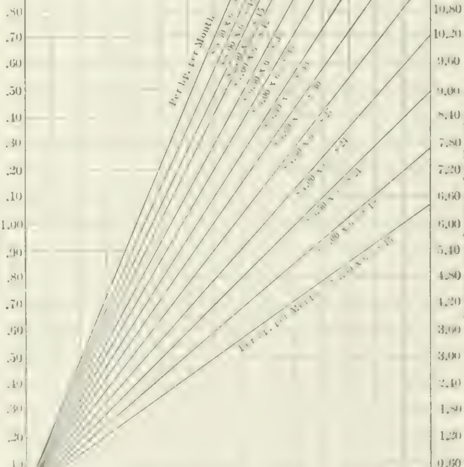
[illegible]

W[illegible] there is a considerable proportion of land above the reach of the ditches. Some of this may be in blocks of land for which therefore water rights cannot be sold. Much of it is made up of parts of the holding of each individual farmer, such part being consequently out of cultivation. Usually some allowance is made in the water-right charges for this elevated land. Both parties to the contract are therefore anxious to irrigate this higher land, the farmer in order to get the whole of his holding under cultivation, and the irrigation company in order to increase its revenue from water rights, and every facility is usually given to the individual farmer or group of farmers to pump water from the gravity ditches to their higher lands.

In most districts where there is irrigation on an extensive scale electric power is developed either at the irrigation dams or at nearby points by separate companies, and as this pumping occurs only at times which do not overlap with the winter load of the power stations, energy can usually be obtained at low rates.

The lifts required vary from 2 ft. or 3 ft. to 100 ft. and sometimes more; the price of energy varies in every district with the amount required and the distance to which it has to be transmitted; also the actual cost of delivering the water on the land depends directly on the height of lift as affecting the amount of energy taken, and the total cost is affected by the length of season during which irrigation is required.

The diagram given herewith takes all these factors into consideration and enables any man unfamiliar with the technical side of the question to determine whether a given area of land at a known height above the water supply can be profitably irrigated at a given charge per hp-month or season of six months.



Cost of Irrigation per Acre at [illegible]0 Per Cent Efficiency

If the charge per hp-month includes, as is often the case, the installation and rent of the pumping sets, then the

diagram gives all the information necessary to come to a decision, except as to cost of shed and piping from the low level to the nearest point on the high-level ditch. If the land owner has to supply the pumping equipment allowance must be made for interest and depreciation on the cost. If well-chosen electrically driven centrifugal pumping sets are installed the cost of repairs should be very small, and the cost of attendance for such an application as is under consideration would be quite negligible.

The diagram shows the cost per acre for any given lift at any charge per hp-month, assuming 50 per cent over-all efficiency for electric motor and centrifugal pump and one-eighth of a cubic foot of water per acre per second, and is figured thus:

$$\frac{1 \times 62.35 \times 1}{8 \times 550} \times \frac{100}{50} = 0.0283 \text{ hp per foot of lift.}$$

Having determined the charge per acre that the land will stand, a reference to the diagram will show at what price the power must be supplied for any given lift to keep within this charge. Thus $2.40 per acre per season would pay for a 47.5-ft. lift with energy at $3 per hp per month, but would pay for only a 41-ft. lift if energy cost $3.50 per hp per month.

Careful consideration must be given to the efficiency of the pumping set as affecting the cost of watering the land. A 5-hp pumping set may have an over-all efficiency of only 40 per cent, while a 400-hp to 500-hp set may have an over-all efficiency of 70 per cent. The cost per acre shown on the table must therefore be corrected proportionately for other efficiencies than 50 per cent, the efficiency depending on make and size of pump and motor and on the height of lift.

Central Station

Management, Policies and Commercial Methods

INDUSTRIAL ELECTRIC SIGN FOR LEOMINSTER, MASS.

A large electric sign 100 ft. long and 10 ft. high will shortly be erected at Leominster, Mass., by the Leominster Electric Light & Power Company, for the purpose of calling attention to the advantages of the town as a manufacturing center. The sign will be located within easy reading distance of the principal trunk-line railroad reaching the community.

CENTRAL STATION RECONSTRUCTED IN TWENTY-SIX DAYS.

The Campbellsville (Ky.) Lighting Company believes that it established a record recently in putting its plant in operation just twenty-six days after a fire had practically destroyed it. The plant was burned Nov. 15 by a fire of unknown origin, the building being entirely consumed and the main dynamo apparently put out of commission permanently. The morning after the blaze a big force was put to work and within twelve hours foundations for the new structure were being laid. The new building was completed within six days, night and day shifts of builders being employed in order to rush the construction job through. The dynamo had meanwhile been shipped to Louisville for repair and additional parts of the new equipment ordered. Delivery took longer than had been expected, but the work was finally completed Dec. 11, and lights were turned on amid the whistling of every manufacturing plant in the town. The local papers, of course, declared that the power house had arisen "phœnix-like from its ashes."

CENTRAL-STATION COMPANY'S SIMPLE LABORATORY FOR TESTING APPLIANCES.

W. S. Barstow & Company, New York, engineers, and managers of the Associated Gas & Electric Company, which operates a number of gas and electric companies in New York State, have installed a simple laboratory in their New York office for testing the relative merits and economy of various makes of gas and electric appliances before putting them in the different showrooms. The equipment for testing the gas appliances is merely a test meter and taps to the gas lines in their office building, and the equipment for testing the electric appliances consists of an ammeter, a voltmeter, the lighting circuit in the office building, and a rheostat to regulate the voltage of the latter to correspond with voltages of the various electric plants. The energy consumed by different makes of toasters, irons, etc., is easily determined, and before instituting an appliance campaign the company is able to ascertain whether the cost of energy for operating a particular appliance is going to be excessive and its introduction unwise.

TECHNICAL JOURNAL CLIPPINGS IN NEW BUSINESS WORK.

By H. W. Brunell.

The writer has found that in many instances articles appearing in technical journals have proved very beneficial in securing new business for central stations, and especially power business. In soliciting the latter class of business power solicitors encounter prospective customers who are desirous of making some kind of change, but, owing to a limited knowledge of electricity, are somewhat skeptical about taking up the electric drive. Those who have solicited for any length of time have doubtless found persons with whom, it was felt, contracts could be closed if they could only bring out some convincing argument to eliminate the doubt as to the feasibility of the electric drive in the particular class of business under discussion. I do not know of a better or more forcible argument in such cases than to present data, photographs and descriptions of installations along the same lines as that of the prospective customer.

Articles appearing in the electrical journals and other publications giving detailed information and data of various motor installations prove very valuable in inducing the adoption of the electric drive. The pages in journals can be removed, clipped together and then filed, according to their class, ready for reference or to submit to those interested. Where it is a question of doubt regarding the electric drive, if the prospective customer sees or reads of other manufacturers using electricity, it goes without saying that it has a great effect in influencing him. A good way to get power business is to submit the customary specifications and then supply the manufacturer with the names of all local manufacturers in his line who use electric power. If there are no local concerns, then one can draw on his clippings to show that others have installed motors

and found them satisfactory. An article clipped from one of the many publications and mailed to the prospective customer's home which describes an installation similar to the one which it is proposed to install will be read and receive consideration when another communication might find a place in the waste-paper basket.

MOTORCYCLES IN REPAIR DEPARTMENT.

The Louisville Lighting Company has purchased two motorcycles for use in its repair department. They will be used in special cases of emergency where it would require too much time to get fully equipped wagons to the desired location. Each of the two machines is specially equipped with a carrier for repair kits and auxiliary parts. Motorcycles are well adapted for the hurry-up work of the big electric company because of their utility in sections where poor highways make progress for larger vehicles next to impossible, as well as on account of their low upkeep expense.

ORNAMENTAL STREET-LIGHTING SYSTEM IN WILMINGTON, DEL.

In the presence of an immense throng of people assembled in front of the City Hall, Dec. 18, Mayor H. W. Howell closed the switch which illuminated Market Street, Wilmington, from Front Street to Tenth Street, and marked the beginning of a new era of progressiveness in the chief city of Delaware. The celebration accompanying the inauguration of the new lighting system was most enthusiastic. Every business house and public building along Market Street was illuminated and decorated for the occasion, and a monster automobile parade of more than 200 cars added materially in celebrating the occasion. The tungsten-lamp posts replaced the old arc lamps, and in that section of the street illuminated 172 80-cp lamps were required. It is the purpose of the Street and Sewer Department to burn half of the lamps all night and the other half until midnight or 1 a. m. The rate per lamp per annum of 4000 hours is $21.48, and the rate per lamp burning until 1 a. m. is $16.32 a year.

CENTRAL-STATION SOCIAL AFFAIR.

On Dec. 21 the Louisville Lighting Company and the Louisville Gas Company, which are operated jointly, gave an informal dance and reception in their building to enable their employees to meet Gen. George H. Harries, who assumed the presidency of the companies recently. Handsomely engraved invitations were sent out to office employees, salesmen and others, including friends of the company.

The third floor of the handsome building on Chestnut Street, near Fourth Avenue, was devoted to the occasion, and it was beautifully decorated with incandescent lamps, flags, flowers, etc. A complete ball orchestra was provided, and President Harries and the officers and directors of the company formed the receiving line. The affair began at 8:30 o'clock and terminated about midnight.

Dancing was arranged following the reception, and a program of vaudeville specialties filled up an intermission. These included a Highland fling danced to the music of a bagpipe, songs and selections on the harp by noted entertainers. Euchre and whist games were provided for those who did not care to "trip the light fantastic." The feature of the evening was a short talk made by President Harries to the employees of the companies.

"A public-service corporation," he said, "is in one respect no stronger than the personal bearing of its employees. A discourteous action or hasty speech on the part of anyone connected with the company, no matter how unimportant he may seem to be, invariably reflects discredit upon the entire institution in its work of serving the people.

"You are all members of a big system, each one being a very important unit. Wherever trouble meets you you simply have to smile broadly and do your level best to accomplish the seemingly impossible in righting that trouble. You can't please everybody, but you can do the best you know how, and in this way you will be doing your share toward the big things which Louisville has in mind."

Gen. Harries' emphasis upon the importance of the employee maintaining right relations with the public may explain why the company went to such pains and expense in preparing the event just recorded; for it is certain that the interest and loyalty of those connected with the lighting company has been measurably stimulated.

COMMONWEALTH EDISON COMPANY ORDERING TWENTY-FIVE ELECTRIC VEHICLES.

Practising what it preaches in relation to the use of electric vehicles, the Commonwealth Edison Company has sent out specifications asking electric-vehicle manufacturers to submit bids for twenty-five commercial electric vehicles to be used by the company in addition to the large number already in service. Proposals for these vehicles will be received until Jan. 4 by the purchasing department of the company at 120 West Adams Street, Chicago. The twenty-five vehicles required are divided into these six classes:

No. 1—Eight vehicles for the stores department, each to have a carrying capacity of 4000 lb., 95-in. wheel-base and canopy cover.

No. 2—Two vehicles for the stores department, each to have a carrying capacity of 1000 lb., 76-in. wheel-base and panel cover.

No. 3—One vehicle for the street department, to have carrying capacity of 4000 lb., 95-in. wheel-base and frame cover.

No. 4—Eight vehicles for the street department, each of 4000 lb. carrying capacity, 106-in. wheel-base and frame cover.

No. 5—Five vehicles for the customers' repairs department, each of 4000 lb. carrying capacity, 106-in. wheel-base and frame cover.

No. 5—Five vehicles for the customers' repairs department, each of 1000 lb. carrying capacity, 76-in. wheel-base and panel cover.

No. 6—One vehicle for the sign department of 1000 lb. carrying capacity, 95-in. wheel-base and frame cover.

All vehicles must develop a mileage of 40 miles with lead battery or 50 miles with Edison battery on one battery charge. The speed requirement is from 12 to 14 miles per hour on level, smooth pavement when carrying half the rated load. Lots 2, 5 and 6 of those enumerated above may be equipped with any number of lead cells, from forty to forty-four. In case an Edison battery is used sixty cells shall be furnished with each vehicle. Bids on both lead and Edison batteries must be furnished in each class. Each vehicle must be provided with one headlight, one taillight, one odometer, one Sangamo ampere-hour meter, one foot-operated gong, one charging plug with connecting lead, hood and curtains for protection of driver and the necessary repair tools. Additional information may be obtained from the chief operating engineer of the company. The bodies of the vehicles have been specially designed for the requirements of the various departments, and blueprints accompany the specifications, although considerable latitude is allowed as to the chassis.

CONTRACTOR'S MOTOR-OPERATED SAND AND GRAVEL HOISTING PLANT.

The E. T. Slider Company, of Louisville, Ky., dealer in coal, sand and gravel, has erected a motor-driven hoist runway for unloading its materials from river barges and depositing them in separate piles in its yards, 20 ft. above [illegible]. The structure consists of an

Fig. 1—Hoist Housing, Incline and Runway.

elevated runway, 500 ft. long and 30 ft. above the ground, extending the length of the yard and approached by an incline with a grade of 40 per cent from the water's edge. Up this incline the automatic side-dump cars, running on industrial-gage tracks, are hoisted by a 112-hp Westinghouse slip-ring motor, which drives two 6-ft. cable drums.

After reaching the top of the runway the loaded car is run out onto the level trestle work to the point where it is to be dumped. There, with the aid of a track tipple, its swinging sides are released and the material is discharged into the piles at the base of the trestle. In this way sands and gravels of different fineness can be delivered to their appropriate piles or bunkers.

On its return trip the car is propelled by a 1000-lb. weight acting through a Chinese-windlass cable gearing with a reduction of 16 to 1. The weight is raised during the car's passage, while loaded, from the top of the incline to its dumping position, and is then ready to return the car over the level track to the head of the incline. Beyond this point, of course, the car can be lowered by its own weight to the water's edge. The counterweight mechanism is ingeniously arranged with a clutch and cable which engages the car during its travel on the horizontal portion, releasing again

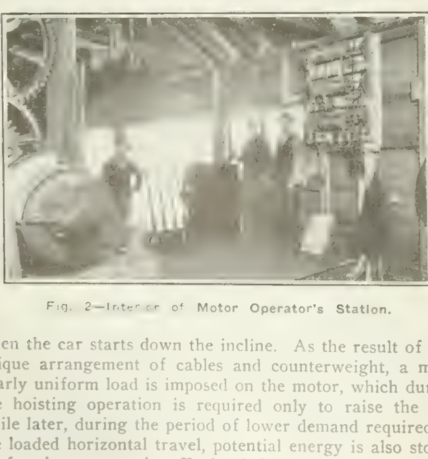


Fig. 2—Interior of Motor Operator's Station.

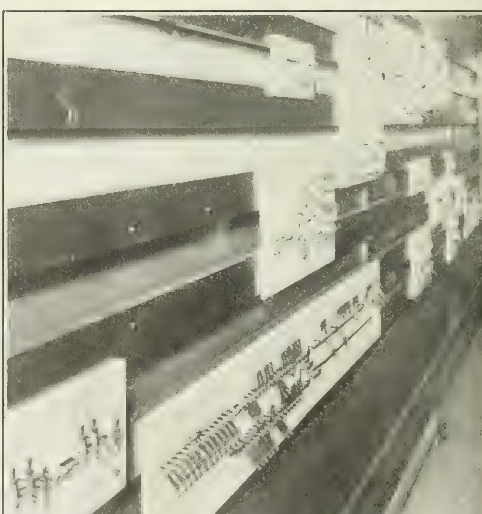
when the car starts down the incline. As the result of this unique arrangement of cables and counterweight, a more nearly uniform load is imposed on the motor, which during the hoisting operation is required only to raise the car, while later, during the period of lower demand required by the loaded horizontal travel, potential energy is also stored up for the return trip. Each of the cars in use weighs 2 tons empty and will hold about 5 tons of sand or gravel, making a total load of 7 tons to be hoisted up the 50 per cent incline. The motor is operated from the lines of the Louisville Lighting Company, and the installation is expected to save a large amount over the former methods of hauling the sand up the levee with mule teams.

Another interesting application of motor power in Louisville is the operation of the concrete mixer used for construction purposes by the Louisville Railway Company. Until recently the concrete used by this company, which does all its own construction work, was prepared by hand, an immense amount of labor of course being required. Recently the company purchased a mixing machine, which was installed on a construction car. Instead of utilizing the usual steam-engine power plant, the company installed a motor, connecting it with overhead trolley wires, and has since used this outfit with excellent success.

LOAD DISPATCHER'S RECORD BOARD.

The office of the load dispatcher of the Detroit Edison Company has just been equipped with a complete record board on which every oil switch and the principal disconnecting switches and jumpers of the system are represented by miniature knife switches, as shown in the accompanying illustration. The position of all oil switches is shown by small-handled knife switches, while the disconnects are similar tiny blades with hook eyes.

The new record board is mounted on a background of white enamel, the buses being represented by metal strips and the circuits by colored lines corresponding to the voltages. The 22,000-volt system is reproduced in red, the 4600-volt circuits in black, and the 2300-volt lines in green.



Circuits of Delray Stations and Nearby Substations in Miniature.

This nomenclature is similarly carried out to the machines, transformer windings, etc., which are diagrammed by the usual symbols, so that the condition of the system is evident at a glance. All oil switches are manipulated under orders from the operating department in the downtown offices of the company, which also receives reports of the operation of any plant switches.

Each panel of the board represents a generating station

or substation. At the lower [illegible] is seen [illegible] long panel reproducing the principal Delray plant of the company. The No. 1 power house is shown at the right and the No. 2 station at the left, the two station buses being linked by a tie switch. The illustration also shows the loop bus construction used at Delray. Part of the generators are arranged for connection to each side of the bus, so that much of the flexibility of a double bus is obtained, although its duplication is avoided. Nearly 200 miniature knife switches are used to reproduce the Detroit system, a single-pole dummy switch representing each three-pole oil switch or trio of disconnector transfer switches.

Wiring and Illumination

AWNINGS THAT OBSCURE "WHITE WAY" MUST COME DOWN.

The city of Fort Worth, Tex., recently installed a handsome "white way" of tungsten standards, the energy for operating which is furnished by the Fort Worth Power & Light Company. A number of awnings extending out from adjoining buildings obstruct the view of this special lighting in places, so that the City Commission has ordered their removal. Some question has been raised as to the power of the commission to remove the awnings, but it is declared that the shades prevent the light from reaching the sidewalks, and the commission, after granting a two-week respite on account of Christmas shoppers, has ordered every awning down by Jan. 1.

SPECIAL CABLE POTHEADS USED IN CLEVELAND.

Where the 2300-volt and 6600-volt lines of the Cleveland Electric Illuminating Company are transferred from open-wire to cable construction, use is made of the special bell-covered potheads shown herewith, which were developed by the company's engineers to meet local conditions. The inner block of the pothead carries three double connecting lugs separated from each other by the porcelain body and vertical barriers and shielded from the weather by the inclosing bell which is dropped over the pothead. The cable

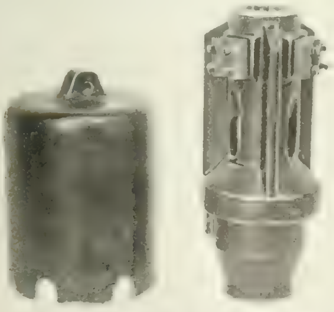


Fig. 1—Protecting Cap and Pothead Body

end is prepared by removing the covering to a point within the pothead bushing, the exposed end being taped with varnished cambric tape. The separate cable conductors are led out through the slots at the middle of the body and made fast in the lugs, which will take wire sizes up to No. 0. The lugs are held in place by bolts through the body wall, the chamber at the top, for access to the bolts, being filled with insulating compound. When very large conductors [illegible] flanged over the wires and then bolted, the insulating compound being poured with the wires in place. The leads to the overhead lines are looped downward from the lugs and pass beneath the bell, which is dropped over the pothead body. For inserting small wires in the lugs sleeves are first soldered on their

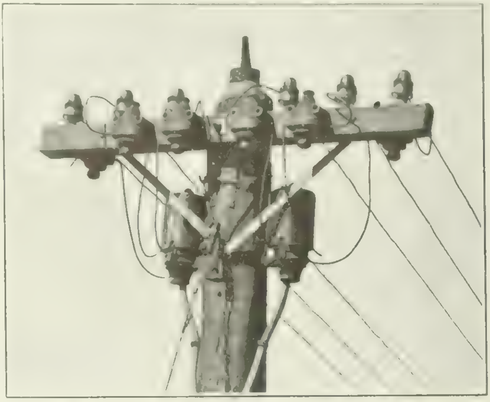


Fig. 2—Potheads on Customers' Cable Service Line.

ends and then tightened under the bolts. The nitches in the bell are so spaced as to hold the wires away from the pole.

About 1000 of these potheads are in use in Cleveland and appear thoroughly successful in service, in addition to the simplicity of preparing and installing them. A number may be noticed in use along Euclid Avenue, Cleveland's famous residence street, where the cable-house services are tapped off from the overhead street lines. Some of these potheads have even been accidentally left in service without the protection against the weather afforded by their shelter caps, but this has resulted in little trouble before being discovered. Another pothead was tested for a year on 13,200 volts near the smoke from a salt-refining plant, which might be expected to give the part pretty severe service. The pothead was designed by Mr. H. L. Wallace, electrical engineer, and Mr. E. E. Noble, superintendent of construction, of the Cleveland company.

THE EFFECT OF FROSTED LAMP TIPS ON LIGHT DISTRIBUTION.

By Albert Scheible.

Lamps with either part or all of the bulb frosted have been used ever since incandescent lamps came into general service, being usually chosen either for the increased decorative effect of the frosted bulb or because the glare of the light is reduced by the frosting. Lately lamps in which only the hemispherical tip is frosted have been growing in popularity for use with prismatic glass shades and even more so with the bowl-shaped opalescent shades which have been offered in increasing variety during the last few years.

From an artistic standpoint, the softening of the glare by thus veiling that part of the lamp through which the filament would otherwise be directly visible is certainly a great improvement. However, the suppression of glare and the improved artistic effect are not the only reasons for the use of the so-called "bowl-frosted" lamps, as this frosting affects the distribution of the light to an extent not generally appreciated even by some of those interested in planning effective illumination.

Thus, in the case of hemispherical bowls, some of the rays of light striking the frosted portion are reflected upward against the bowl and, when redirected by the latter, add to the light immediately under the lamp. In some instances the difference is surprising, as, for example, in the case of the bowl reflector from which the accompanying

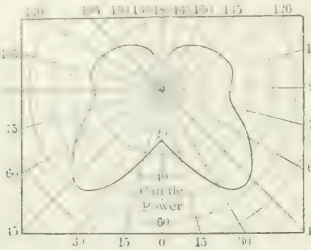


Fig. 1—Photometric Curve of a 60-Watt Clear-Bulb Tungsten Lamp in a Bowl Reflector.

photometric curves were made. With a clear-bulb 60-watt tungsten lamp this gave about 24 cp vertically under the lamp and a maximum of about 57 cp at an angle of about 42 deg. from the vertical (Fig. 1). On substituting a bowl-frosted lamp of the same wattage and size of bulb the vertical candle-power was increased to 36 and the

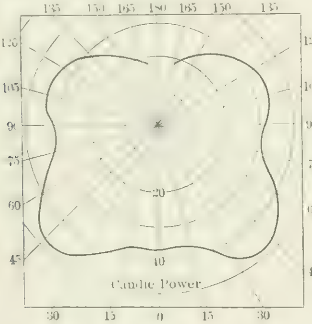


Fig. 2—Photometric Curve of a 60-Watt Bowl-Frosted Tungsten Lamp in the Same Reflector as Used for Fig. 1.

maximum to about 48, the latter being still at about the same angle from the vertical (Fig. 2).

Fig. 3 shows the resulting light distribution, the dotted curve plotting the calculated foot-candles on a plane 5 ft. below the clear-bulb lamp. This dotted line clearly shows a drop in the illumination immediately under the lamp, which drop cannot readily be leveled by any overlapping

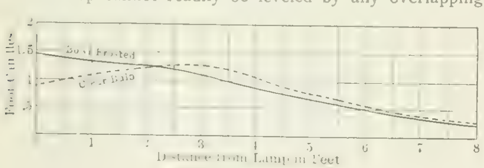


Fig. 3—Calculated Distribution with Clear and Bowl-Frosted Bulb Lamps.

of light from other units or by diffusion from walls and ceilings. On the other hand, the same bowl reflector with a bowl-frosted lamp gave almost a straight-line effect (as shown by the solid line) which would lend itself readily to a leveling of the light distribution by the joint action of a number of such units when suitably spaced and by the diffusion of light from walls and ceilings.

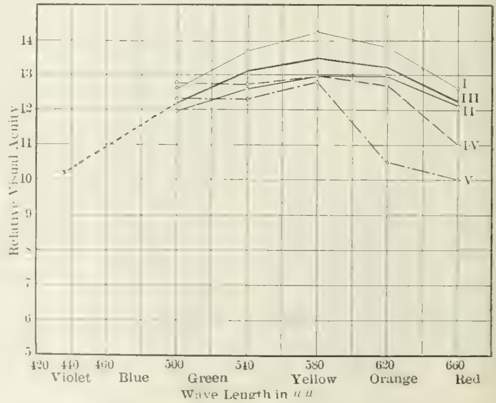
Three conclusions will be evident: First, that the frosting of lamp tips offers an easy means of improving certain classes of light distribution curves; second, that with every photometric curve of an incandescent-lamp unit it should be stated whether the lamp bulb was clear or frosted; and, third, that where the light distribution was carefully planned for bowl-frosted lamps the user should understand this and should be urged not to substitute lamps with clear bulbs. Unless this point is emphasized, some will always be found ready to insert clear-bulb lamps when the original frosted ones have burned out.

Letter to the Editor.

Visual Acuity.

To the Editor of Electrical World:

Sir:—As I have allowed myself to become interested in that branch of electromagnetic waves called light or optics, I was naturally interested in reading the articles and letters that have recently appeared in your columns on the subject of visual acuity. I must confess that I do not exactly understand what Mr. Luckiesh means by the term, which does not seem to imply merely acuteness of vision. His article in your issue of Nov. 18 refers especially to the effects of color or wave-length. I think we are all familiar with the diagram of the spectrum indicating intensity as measured by the heat effect, chemical effect and by the visual effect, which I suppose very plainly shows the variation of the ability of the eye to perceive the different colors or wave-lengths. Fig. 2 in that article, reproduced herewith, seems to agree with the old diagram. The limit of vision, if of a single object, is not given by its size, as we all know, for if bright enough it will be seen, as the stars are seen, no matter how small. That is the principle involved in ultra-microscopy. But if we take a series of equidistant ruled lines, then the limit is between 100 and 400 lines to the inch at a distance of 10 in., the standard distance for reference. Now, we come to the part that will, I suppose, be the most interesting and surprising to those who have not looked far enough into the matter to learn



Variation of Visual Acuity with Wave-Length of Light.

that the factors that govern are not the acuteness of the eye, but the same ones that govern in the great majority of optical instruments, notably the camera, the telescope and the microscope. To put it in another way, the eye is so perfect that the limit of vision is fully reached by its powers or fineness of structure. The limit is given by optical considerations or the laws of light.

It was the common idea that with sufficient magnification anything could be seen, but we now know that it is not so. We now think of the light as being (electromagnetic) waves, and know that, as waves may be added together to give increased effect or to obliterate each other, the limit is given by those arrangements that cause the obliteration of fine details. This is the aperture or diaphragm of the camera, the telescope, the microscope and the eye It is also a function of the wave-length, which, of course, we have to call color. Mr. Ives has exhibited the increased resolving power of the microscope given by light of the blue end of the spectrum over the red or yellow. It may be of interest to state these limits in a few cases. In the telescope the limit of useful magnification is about nine times the aperture in inches, and in the microscope the number of lines to the inch that may be seen is about 80,000 times the aperture expressed in a function of the circle, which will figure out a little over 100,000 lines to the inch.

As the average wave-length is about one-fifty-thousandth of an inch, we can see two lines in the length of a wave of light. As the blue light has a wave-length of a little more than one-half the red, it enables us to see more lines to the inch, but not quite twice as many. For the telescope the formula is given by Lord Rayleigh in the article on "Wave Theory" in the Encyclopædia Britannica (tenth edition). Helmholtz probably first showed the application of the principle to the microscope, but Abbe, who was the head of the best known firm of German opticians, has the credit of working the matter out very elaborately. A piece of microscopic apparatus that bears his name does not pretend to be achromatic.

Helmholtz did speak of the eye as not being perfect, but our celebrated American scholar Robert W. Wood thinks Helmholtz was too critical and refers to the wonderful fact that it is an optical instrument with a perfect automatic diaphragm or iris. I would call attention to another automatic adjustment that tends very largely to correct any slight imperfection it may have, namely, that the eye always centers itself on whatever is looked at and the errors are negligible at the center.

The camera lens has seven distinct aberrations or errors which have to be corrected to make it perfect, without counting those due to the color, and there are half as many again under that head. The seven cannot be all corrected perfectly at once, and a compromise is made in some way to meet given conditions. The eye is known not to be perfectly achromatic, but it is so nearly so that its defects are seldom or never noticed in ordinary life. I have noticed that a bright-colored window such as is common in the churches sometimes gives an effect whereby the parts of different color appear to be in different planes.

Somehow I cannot get rid of the thought that it is rather odd to criticise the eye, to which we must look as the judge in these matters. Still, if these gentlemen can in any way improve our powers of vision no one would welcome it more than I.

Brooklyn, N. Y. J. P. WINTRINGHAM

Digest of Current Electrical Literature

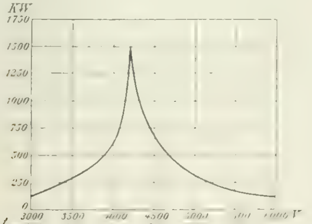
ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Parallel Operation of Alternators.—L. SCHÜLER.—In the parallel operation of alternators oscillations may be produced by resonance between the natural oscillations of the dynamo and the periodic impulses of the prime mover. For the period t of the natural oscillations of a dynamo Rosenberg has given the formula

$$t = c \sqrt{\frac{GD^2\, n}{p\, C\, \text{kva}}}$$

where GD^2 is the moment of inertia in kilogram-meter units, n is the number of revolutions per minute, p the number of pairs of poles, C the ratio of the short-circuit current (for the exciting current required to give normal



Resonance Curve for Two Three-Phase Generators.

voltage at no load) to the normal current, kva the normal kilovolt-amperes, and c a coefficient for which Rosenberg found the theoretical value of 0.032. The author has tested this formula by experiments carried out as follows: Two identical machines are operated in parallel and gradually their excitations are changed until oscillations occur. A resonance curve is then plotted with the amplitudes of the oscillations of the wattmeter as ordinates and the voltages as abscissas. The cut shows such a resonance curve for two three-phase generators driven by double-acting tandem gas engines, where the resonance maximum occurred at 4200 volts (the period t of the natural oscillations of the generators being then equal to the period T of the disturbing impulses of the gas engines). From this experiment the author finds that c in the above formula has the value 0.0264. By similar experiments with former different machines, values of c were found which varied between 0.0254 and 0.0273 instead of Rosenberg's theoretical value 0.032. For the predetermination of the oscillation period t the value of the ratio C of the short-circuit current to the normal current is unknown. But, since the short-circuit current depends on the ratio of armature ampere-turns to field ampere-turns multiplied by the stray coefficient, and since the stray coefficient may be taken as 0.8 on the average, the above formula may be changed into

$$t = 0.03 \sqrt{\frac{GD^2\, n\, R}{p\, \text{kva}}}$$

where R is the ratio of armature ampere-turns to field ampere-turns and t is the period of the oscillations at no load. The value of t for inductive full load is about 15 per cent smaller. The author then gives two interesting tables for the values of t and T which occur in practice with the usual types of machines. When $t = T$ there is resonance. No trouble may be expected if $t \div T$ differs from unity by at least 20 per cent. If two electric machines operating in parallel have the same natural periods of oscillations, t_1 and t_2, so that $t_1 = t_2$, then the resulting period of oscillations also equals $t_1 = t_2$. But if t_1 and t_2 are different, then the resulting period of oscillations has a value between t_1 and t_2 and is generally nearer to the value of the smaller machine. This is of importance, for instance, if the case of two machines of equal capacity, for one of which $t \div T = 0.7$ and for the other $t \div T = 1.3$.

Both values taken alone are satisfactory. But when both machines are to work in parallel $t \div T$ will be approximately unity and there will be resonance trouble. This should be taken into consideration when manufacturers guarantee good parallel operation. Before doing so they should know the value of t of the existing machines with which the new machines have to work in parallel, or they should know at least whether for the existing machines $t \div T$ is greater or smaller than unity. The author finally describes a simple method for preventing oscillation troubles which has proved satisfactory especially with small rotary converters connected to small transformers, for which the danger of oscillations is great on account of the large ohmic voltage drop. He places loosely on the axle of the machine a flywheel which is tuned to the period t. It is not rigidly connected with the axle, but loosely by means of springs. When properly dimensioned this flywheel will make oscillations differing in time-phase by 180 deg. from the disturbing impulses and will thus compensate them.—*Elek. Zeit.*, Nov. 30.

Short-Circuits of Alternators.—P. Boucherot.—A discussion of the electric phenomena which result from a sudden short-circuit of an alternator. As a result of the development of the turbo-alternator with its high speed, small magnetic stray fluxes and large effects of short circuits the problems of sudden short-circuits have become of importance. The author first discusses the different induction coefficients which are to be considered in the circuits of an alternator and then discusses sudden polyphase short-circuits, sudden single-phase short-circuits, and finally partial short-circuits. The article is illustrated by oscillographs.—*La Lumière Elec.*, Dec. 2.

Alternating-Current Turbo-Dynamos.—A. Thomaelen.—A profusely illustrated description of various features of the mechanical construction of alternating-current turbo-generators of the Siemens-Schuckert company.—*Elek. Zeit.*, Nov. 30.

Lamps and Lighting.

Filament Supports.—A note on a recent British patent (No. 26667, Nov. 30, 1911) of E. R. Grote, who uses a mica disk instead of platinum or iridium wire for the filament support. Thin mica disks attached to the central rod are perforated at regular intervals along the edges to take the filaments and are slit radially between each pair of filaments to render them elastic. The upper disk is provided with conductors for joining each adjacent pair of filaments together. Instead of slitting the disks, they may be mounted with springs above and below the point of support, or mica rings held in spring-wire supports may be used instead of the disks.—Lond. *Elec. Eng'ing*, Dec. 7

Generation, Transmission and Distribution.

Generating Station at Coal Mine.—A. Feldsmann.—The first part of an illustrated description of the electric plant at the bituminous coal mines near Hamberg on the Rhine, in Germany. At three of the pits electrical energy is generated from the excess of coke-oven gases which is not used for heating the coke ovens. There are four gas engines, one steam engine and three steam turbines having an aggregate rating of 10,700 kw. The generating emf is 5000 volts. The transmission voltages are 5000 to 10,000. The paper is to be concluded.—*Elek. Zeit.*, Dec. 7.

Single-Phase Commutator Motor for Printing Presses.—E. Piernet.—An illustrated article on the use of the Deri single-phase commutator motor, which is a repulsion motor with several pairs of brushes short-circuited. Speed regulation is obtained by displacement of one set on the brushes. In the present articles the use of this motor for driving presses is especially discussed and diagrams are given showing characteristic test curves of the motor.—*La Revue Elec.*, Dec. 8.

Traction.

London.—An abstract of last year's financial report of the underground railways of London.—Lond. *Electrician*, Dec. 8.

Installations, Systems and Appliances.

Rates and Popularity of Electric Light.—Kraetzer.—The author emphasizes that of the propositions made to increase the popularity of electric light none has proved more successful than that to facilitate the first installation. The author gives the results of several small central stations which make the first installation free of charge to the consumer. Niederramstadt is a suburb of Darmstadt, with 2000 inhabitants, of whom two-thirds are workingmen. In the very first year not less than 3000 lamps have been installed with 300 meters. The rate is 12.5 cents per kw-hour and a monthly rent of from 5 cents to 75 cents per meter. Use is made of electrolytic meters, which have proved very successful. The difference between the master meter in the central station and the sum of the readings of the electrolytic meters at the consumers' premises is only about 5 per cent for the whole year. Out of 300 consumers, 27 consumed more than $12.50 during the last year, 40 consumed between $7.50 and $12.50, 60 consumed between $5 and $7.50, 65 consumed between $3.75 and $5, and 108 consumed less than $3.75 worth of electrical energy Thus, in spite of a 12.5-cent per kilowatt-hour rate, more than half of the consumers spent less than $5 per year The 16-cp metallic-filament lamp is largely used. The net earnings of the central station during the first year were 7 per cent. In the city of Dillenburg, in Hessen, with 5000 inhabitants, where there is a municipal gas plant, the municipality has also undertaken the sale of electrical energy, buying the energy in bulk from a transmission system and distributing it at 3×120 volts. The city paid during the first year for the installation of two lamps for every consumer who wanted them. As a compensation the consumer had to guarantee that he would buy for five years at least $4.50 worth of energy yearly. The consumer may select his own wireman, but he must have a license in the city. This method was successful beyond expectations. In the first year 500 meters and 4000 lamps were installed The net earnings of the electrical department in the first year were almost $1,500. On the other hand, the net earnings of the gas plant were reduced by $1,000 to $2,625 The net earnings of the two departments together are, however, now greater than those of the gas plant before alone. In a small out-of-town place, Baumholder, with 1700 inhabitants, a generating plant has been installed with two Diesel engines of 40 hp and 25 hp, and electric energy is distributed at 2×120 volts. The wiring of the residences and installation of two lamps per meter are paid for by the township. Energy totaling 27,500 kw-hours was furnished to the busbars, and the sum of the readings of the electrolytic meters showed a consumption of 26,400 kw-hours. The tariff is 12.5 cents per kw-hour and 6.25 cents meter rent per month. Out of 278 living houses, 258 are connected to the station, with 2233 lamps and seven motors. In connection with the generating plant there is a bath-house in which the exhaust heat of the Diesel engines is utilized. The total first cost was $3500. After deducting interest and amortization the net earnings in the first year were $925. The use of kerosene seems to have been almost given up even in small residences in this town.—*Elek. Zeit.*, Nov. 30.

Tariff.—H. Bergmann.—An account of the rates charged for electrical energy by the upper Silesian electricity works, which are one of the few German generating stations which have not changed their tariff since they began operation. The rate is based essentially on the cost of generating the energy and considers both the maximum load and the yearly hours of using the energy. To large consumers discounts are allowed according to the yearly bill. For small consumers flat rates are charged, which are based on an assumed number of 1500 hours of use of electricity per year. Out of 15,750 consumers there are 9818

using flat rates. They have no meters, but limiting devices which limit the amount of power taken from the supply network. Out of these 9819 flat-rate consumers, 772 use from 30 to 50 watts, 2852 use from 50 to 100 watts, 2345 use from 100 to 150 watts, 1333 use from 150 to 200 watts, and 2516 use from 200 to 2500 watts. The consumption of electrical energy per capita is much higher in upper Silesia than anywhere else in Germany, even in the largest cities. The consumption of gas for lighting is losing ground in upper Silesia.—*Elek. Zeit.*, Nov. 30.

Automatic Reversible Battery Boosters.—R. Rankin.—The conclusion of his paper read before the (British) Institution of Electrical Engineers discussing the uses and advantages of a battery-booster plant and the savings likely to be effected by its employment. Boosters are classified under three main divisions. Under class A are described the plain differential, Pirani, Crompton and Lancashire systems; under class B are the Highfield and E. C. C. systems. The advantages of boosters controlled by external regulators over those of the diverter type are briefly mentioned. Such boosters belong to class C, which includes the Entz, B. T. H., Taylor-Scotson, Tilney and Brown-Boveri boosters, while the systems of Lincoln and Bijur are also referred to. The conclusions of the author are as follows: In the installation of a battery and booster on a highly fluctuating load, both the generator and battery are operated under satisfactory conditions, for batteries working under such circumstances usually remain in very good order indeed. With regard to boosters there can be little difference between the actual results obtained from the use of those of class B and the Lancashire booster in class A. The author thinks that the other members of class A described in the paper certainly cannot be so satisfactory as those referred to. Boosters of class A and class B must be more sluggish in action than those of class C, certainly more than those of this class in which an overshooting effect, suitably checked, can be arranged for. Where considerations of field copper are the cause of an exciter being used with a class A booster the sluggishness becomes still more pronounced. The main factor causing the lag in diverter boosters is the use of the diverter itself. When a variation—say, an increase—in line current occurs the first increment must perforce come from the generator, and, the diverter being non-inductive, this increment may be, and usually is, very considerable. It is obvious, too, that throughout the entire action the booster voltage is dependent on a previous variation in line current, and the above-mentioned effect has continually to be reckoned with. This will help to make it clear why lamination of the entire field system of such boosters is considered by many to be absolutely essential. With regard to the respective merits of boosters in class C the authors have little to say as far as regulation obtained is concerned, the Entz booster being the only one which has been used to any extent in England, and it is said that it possesses the great advantage of extreme simplicity and the other equally important advantage that it employs no moving electrical contacts.—Lond. *Electrician*, Dec. 1.

Electrophysics and Magnetism.

Thermal Conductivity at High Temperatures.—M. F. Angell.—The author gives an account of measurements of heat conductivities at high temperatures, using a method in which the flow of heat from the electrically heated inside of a long cylinder to its outside was determined. The results of determinations of the thermal conductivity of nickel between 300 deg. C. and 1200 deg. C. and of aluminum between 100 deg. C. and 600 deg. C. are given. There is no constant ratio between electrical and thermal conductivities for these metals at high temperatures. At high temperatures the thermal conductivity of aluminum increases, and of nickel up to 700 deg. C. decreases, more rapidly than from 0 deg. C. to 100 deg. C.; above 700 deg. C. the thermal conductivity of nickel decreases very slowly up to 1225 deg. C. A third allotropic state for nickel exists at about 700 deg. C., with a change in the form of the electrical and thermal conductivity curves at this point. The magnetic critical temperature of nickel is shifted through a range of 130 deg. by heat treatment, annealing from high temperatures giving a low value and sudden cooling, producing values as high as 420 deg. C. The results are given of determinations of the electrical resistance of nickel between 0 deg. C. and 1200 deg. C. and of aluminum between 0 deg. C. and 600 deg. C.—*Phys. Review*, November.

Selenium.—F. C. Brown.—The author has formerly shown that the general behavior of the four known varieties of selenium under the action of light could be explained by assuming that the different varieties were merely differently proportioned mixtures of three components in equilibrium with each other. Whereas it was shown in his former paper that the general behavior of all the known varieties of light-positive and light-negative selenium could be explained by the proposed theory, it is shown in the present paper for one of the light-positive varieties, namely, that found in the Giltay selenium cell, that the change of conductivity during both exposure and recovery can be explained quite accurately by the same theory. Only one of the three components is conducting. Very direct experiments show that for at least one case the change in the conductivity is proportional to the amount of the changing component. Temperature action in the Giltay selenium cell is essentially the same as light action, but not identical with it.—*Phys. Rev.*, November.

Photoelectric Effect Caused by Incident and Emergent Light.—O. Stuhlmann.—If the metals are arranged in the order of their atomic weights and also according to their position in the periodic system, there is a periodic increase in the ratio of the emergent to the incident photoelectric effect as one ascends through the periods of the table. It would seem that the ratio has a constant value in each period, although this is hardly a universal law. Since it is known that the incident photoelectric effect increases with decreasing wave-length of the incident light, it may be that the ratio of the emergent to the incident effect would be constant for monochromatic light, so that the present variations in the above ratio of emergent to incident effect for the various metals might be attributed to a selective photoelectric activity on the part of the films used.—*Phil. Mag.*, December.

Radium.—H. Lieber.—The author first gives a brief summary of the properties of radium and its emanations and then describes his method of "radium coatings," which permits the use of only small amounts of radium to yield all the emanations and the radiations for physiological or any other purpose desired.—*Jour. Franklin Inst.*, December.

Electrochemistry and Batteries.

Electroplating.—A note on the Marino plating process, which permits electrodeposits on china and other nonconductors. The articles to be plated, say, a china tea pot, has its surface roughened by a sand blast and is then painted with a paste consisting of a mixture of the chloride, or other salt, of the metal to be deposited and hydrofluoric acid. This mixture is said to form what may be termed a preparative surface on which metal can be deposited from an electrolytic bath by the usual means. In this way a thick plate of metal is obtained, which can be polished and worked, while at the same time it considerably increases the strength of the china interior. This arrangement, it is claimed, also makes the cold galvanizing of such articles as screws, chains and other machine parts possible at a less cost than the present process.—Lond. *Electrician*, Dec. 8.

Reduction of Nitrobenzine.—R. C. Snowden.—An account of an experimental investigation the chief results of which are as follows: Nitrobenzine can be reduced elec-

trolytically to aniline in ferrous chloride solution at 100 deg. C. between iron electrodes. For a current density of 15 amp per square decimeter only 2.2 volts is needed. Massive iron reacts chemically with nitrobenzine and aqueous ferrous chloride at 100 deg., provided the stirring is sufficiently intense to bring all these substances into intimate contact. The presence of an iron salt, preferably ferrous chloride, seems to be essential. The rate of corrosion of the iron depends on the concentration of the iron salt, but is not proportional to it. The concentration of the ferrous chloride remains unchanged throughout the run. The catalytic action of ferrous chloride is apparently due to its being a reducing agent and to its keeping the iron from becoming passive. Nitrobenzine is reduced at 100 deg. by alkaline sodium sulphide, ferrous hydroxide and sodium arsenite solutions, but not by alkaline potassium ferrocyanide solution. With sodium sulphide a yield of from 92 to 97 per cent. aniline can be obtained; with ferrous hydroxide a yield of from 60 to 80 per cent aniline is obtained; with sodium arsenite the chief product is azoxybenzine, of which a 90 per cent yield can be obtained—*Journal Phys. Chemistry*, December.

Chemical Elements.—J. W. NICHOLSON.—A paper giving a preliminary account of a structural theory of the chemical elements, which derives them as compounds, in a certain sense, of primary forms of matter. The simple elements from which, or rather from the constituents of which, the author proposes to construct all the others consist of single rings of electrons rotating round small nuclei of positive electricity. These nuclei are small compared with the electron and furnish nearly the whole mass of the atom. The weight of an atom, always determined from its inertia, is regarded as the sum of the inertias of all its positive and negative charges.—*Phil. Mag.*, December.

Units, Measurements and Instruments.

Inductance of Linear Conductors.—A. C. JOLLEY ,ND A. F. BURGESS.—The conclusion of their paper giving the results of an experimental determination of the inductance of linear conductors. The chief conclusion reached is that the Neumann formula applies only to the field whose principal section is an area extending from the axis of the conductor to infinity, and which is literally bounded by two normals to the axis at a distance apart equal to the length of the conductor, and that it does not, when applied to a finite conductor, take account of the magnetic field extending beyond the ends of the conductor, and hence the values for such cases calculated by it will be too low. The method of direct integration employed by the authors gives results which agree with the experimental facts with considerable precision. Considerable masses of iron do not affect the value of the inductance of a finite conductor if situated at a distance greater than 10 cm from it, provided that they do not form closed, or approximately closed, magnetic circuits about the conductor. Placing the conductor in an open or semi-closed slot increases the inductance, which then becomes virtually independent of the current in the conductor, but is dependent upon its position in the slot. The same conductor in a tunnel which completes the magnetic circuit through a narrow iron bridge has an inductance which depends to a very considerable extent upon the conductor current and hardly at all upon its position in the slot. The presence of polar iron causes a further increase in the inductance, dependent upon the length of the air-gap, the conductor current again becoming an important factor. The magnetic saturation of the teeth causes considerable variation in the inductance in all cases, a rapid fall being shown as the saturation increases, but in all cases tending toward a limiting value of five lines per centimeter per ampere.—Lond. *Electrician*, Dec. 8.

Thermopile.—W. W. COBLENTZ.—An illustrated article on a bismuth-silver thermopile. The thermoelectric emf of the bismuth-silver thermocouple is 89 microvolts per degree, as compared with an iron-constantan couple, which is from 51 to 53 microvolts per degree. The temperature sensitivity of Bi-Ag is, therefore, about 74 per cent greater than an iron-constantan thermopile. Whether the radiation sensitivity is increased in like proportion will depend upon the selection of the proper diameters of wires. In the present case the radiation sensitivity of the bismuth-silver thermocouple is two to three times that of the constantan pile. Details of construction are given.—*Jour. Franklin Inst.*, December.

Measuring Temperature.—J. RAUTENKRANZ.—A paper describing various types of electrical instruments for measuring temperature, including (1) resistance thermometers, (2) thermoelectric pyrometers, and (3) instruments depending on optical effects.—Lond. *Electrician*, Dec. 8.

Meter.—An official communication of the Reichsanstalt on a new construction of the rotating direct-current motor meter of the Allgemeine Elektricitäts Gesellschaft. The construction of the meter is described and illustrated in diagrams and the method of calibrating it and the properties of the meter are dealt with.—*Elek. Zeit.*, Nov. 30.

Telegraphy, Telephony and Signals.

Wireless Telegraphy in Balloons.—MOSLER.—An account of experiments made on a German balloon concerning the best arrangement of the receiving wire. Great precautions must be taken to prevent explosions due to sparks. Messages were received with certainty and clearness over distances of 1000 km (600 miles). It also seems that the intensity of the receiving current is practically independent of the height of the balloon, at least within the limits of the heights employed in aeronautics. If a balloon which receives a message at a low height has to rise quickly, it will, therefore, be able to continue receiving the message with the same intensity. The decrease of the intensity of the electromagnetic waves with distance appears to be directly proportional to the distance.—*Elek. Zeit.*, Nov. 30.

Miscellaneous.

Exhibition.—C. PAULUS.—The first part of a description of the exhibits at last summer's exhibition in Munich on uses of electricity in households, in small workshops and in agriculture. In the present instalment the author deals with exhibits relating to telephony, signals, fire alarms and burglar alarms, electric clocks, the uses of electricity in therapeutics, measuring instruments, automatic switches (for instance, for closing and opening lighting circuits at certain predetermined hours) and wiring installations.—*Elek. Zeit.*, Nov. 30.

Hygiene Exposition.—HEILBRUN.—A review of the various electrical apparatus in the different departments of the hygiene exposition recently held in Dresden. Applications of electricity were made for lighting, heating, motor service and therapeutic purposes.—*Elek. Zeit.*, Dec. 7.

BOOK REVIEW.

MAGNETISMO E ELETTRICITA. By Francesco Grassi. Milan: Ulrico Hoepli. 878 pages, 398 illus. Price, 7.50 lire. Fourth edition.

A good elementary treatise on applied electricity and magnetism, which occupies an intermediate position between a book on descriptive physics and a book on descriptive electrical engineering. Mathematics is hardly employed. Nevertheless, a good general insight is offered in the sciences of experimental magnetics, electrics and electromagnetics, as well as in their relation to electrical engineering. The work is divided into thirty chapters, of which the first half relate to the fundamental sciences and the second half to the engineering applications. The chapters on terrestrial magnetism and on radioactivity are particularly well treated.

New Apparatus and Appliances

THE COMMERCIAL VALUE OF THE MAXIMUM-DEMAND-INDICATOR SYSTEM.

By A. [illegible] R[illegible]

The question of rates for electric service has recently been the subject of investigation and analysis by the rate research committee of the National Electric Light Association, and much space has been devoted to a discussion of the problem in the technical press. The rather sudden interest of central stations in the rate question has been largely precipitated by the rapid introduction of the tungsten lamps and the loss of revenue which was feared as a result.

It is true that the increased use of light due to the new lamps soon more than compensated for the reduction of energy taken, but the effect has been to bring the subject of rate analysis to the attention of central-station managers. One fact which was at once recognized was that so far no adequate provision had been made for the fixed charges or the cost of supplying the service, and, as a consequence, any increase in the efficiency of lamps or other apparatus, while reducing the cost to the customer just that much, does not reduce the cost of supplying him in the same proportion. Since in most cases the fixed charges are a large share of the total expense, it becomes absolutely necessary that the rates be adjusted to take care of this item.

The problem, therefore, is to devise a system which, without being too complicated, shall equitably take into account the various factors entering into the cost of electric service, and which shall be flexible enough to meet different conditions, while being attractive to the customer.

The old flat rate and the straight meter rate have both been recognized as inadequate for these purposes and there have been many other plans suggested of more or less value. One common plan is to give varying discounts according to the size of bill. Another is to give different meter rates according to the guaranteed monthly consumption, and still another is the two-rate system, either with or without the use of the maximum-demand indicator. A fourth plan which has received a good deal of attention and has been introduced in many places is the controlled flat rate with the use of the "Excess" indicator. So far this system has been used almost exclusively for residences, though a few companies have extended it to small commercial business.

With the "Excess" indicator the demand is limited, but the hours of burning are not. The customer may have any number of lamps in the house, but makes a contract for a certain demand, say 100 watts, which will permit him to use four 25-watt tungsten lamps anywhere at any one time; but if more than this number are turned on the indicator will automatically interrupt the circuit, turning the power off and on at frequent intervals until the excess demand ceases. The customer is usually limited to the use of tungsten lamps, for his own benefit, for although carbon-filament lamps can be used if desired, yet because they take so much more current the results would be anything but satisfactory to him.

Neglecting any discussion as to the equity of this rate, it may be interesting to consider some of the practical results secured by the use of this device. The writer, as contract agent of the Harrisburg (Pa.) Light, Heat & Power Company, has assisted in inaugurating and conducting a "new-business" campaign with the aid of the "Excess" indicator, the results of which have been both productive and instructive. In the first place, from the cus- [illegible] to know what one's electric-light bill will amount to. Many customers will submit to even a small increase in the guaranteed amount of consumption for the sake of immunity from worry as to the probable winter bills; and since the customer does not have to worry over the possibility (and frequently the reality) of high bills, and since he is not constantly suspicious of the accuracy of the meter, his relations with the company are apt to be more pleasant.

Furthermore, since in most instances the use of the tungsten lamp is compulsory, this very fact enables him to secure more light for the same outlay than would be possible under any other system. We have found that our residence customers using the controlled flat rate always have well-lighted houses, which in itself is perhaps as good an advertisement as the lighting company could have. The statement sometimes made, that since the customer has to pay for his own lamp renewals he will be careful to economize in the hours of burning for the sake of saving the lamps, I do not believe to be founded on fact. We find that our flat-rate customers use the light very freely, though not, as a rule, extravagantly.

Another advantage to the customer is that the "Excess" indicator does not have to be read monthly, and this relieves the housewife of much inconvenience, especially in winter time, when mud and snow are likely to be tramped through the house. This is particularly an advantage in case the meter happens to be in the attic or some other place difficult of access.

From the standpoint of the central station, we are relieved of the expense of meter reading, testing, repairing, calculation of the bills, as well as the loss of revenue from slow meters, which may be considerable. It is also a source of satisfaction to be relieved of the necessity of attending to high-bill complaints, which otherwise are sure to come in and which call for check readings, special tests and frequently rebates in order to keep the good will of the customer, and sometimes necessitate the removal of the service altogether on account of refusal to pay an unusually high bill.

Our experience has been that it is possible to secure a large number of customers on this basis that we could not get in any other way. The proposition appeals to them. Some central-station managers, while admitting this to be true, have looked upon the controlled flat-rate system as a sort of bait with which to get customers on the line with a view finally to changing them over to meters. While it is true that the new business attracted by the "Excess" indicator consists largely of persons who have not heretofore used electric light, and while undoubtedly some of these will eventually use meters, yet I do not think that the indicator should be looked upon in this light, as there is a great deal of business within the reach of every central station which could not only be secured, but profitably retained, on this basis. We have also quite a few customers now on the flat rate who formerly used meters, but who discontinued the latter service on account of high bills or for a similar reason.

We have found, under the local conditions obtaining, that, when the two systems are impartially explained to prospective customers, of those who have previously been users of electricity about half will choose each plan, but of those who have previously been using oil or gas a large majority choose the "Excess" indicator.

Were it not for the complications caused by the demand for heating, cooking and other appliances, I believe the

controlled flat rate would be ideal for residence use. As it is, I believe that we should make efforts toward perfecting some system by which these appliances may be used on a special flat rate, in connection with the indicator; for it is quite certain that the neglect to do this will serve as a restraint upon their use, as there are quite a number of flat-rate customers who will postpone the purchase of electric irons, washers, cleaners, sewing-machine motors, and other such articles, rather than give up the benefits of the "Excess" indicator.

In regard to changing from meters to indicators by present customers, I would say that we have had quite a number of requests for such changes. While we have not refused any of them, yet we have rather discouraged any such change except where it clearly appears that the indicator is what the customer needs and ought to have. The majority of our meter customers are used to that system; most of them are using some kind of appliances, and it is almost certain that if they were encouraged to change over in large numbers it would not be long before a great many would want their meters back again, thus entailing needless expense upon the central station. The number of changes from meter to indicator and from indicator to meter has been trifling as compared with the total business secured.

In general, I feel that the "Excess" indicator is of great commercial value to the central station, bringing in a large revenue per unit of demand; and while the gross revenue may be somewhat smaller per customer, yet this will be more than offset by the increased number of customers which it is possible to serve with the same plant and line equipment. As applied to residence business, it certainly does a great deal toward making the use of electric light universal, and every customer added to the line is a standing advertisement. Our customers who have this system are all well pleased. They talk to their friends and neighbors, and we can trace a considerable amount of unsolicited new business to this source.

THE RECONSTRUCTION OF A 20,000-HP HYDROELECTRIC PLANT.

The Borel plant of the Pacific Light & Power Company, Los Angeles, possesses several features of interest, especially with reference to the development and installation of modern water turbines. The plant, which is located on the Kern River, consists of five 2500-kw Bullock generators, which are waterwheel-driven and form a part of the generating system of the above company, furnishing Los Angeles with electricity through upward of 150 miles of transmission line. The water for driving the turbines is carried through a cemented canal 12 miles long to a forebay located directly above the power house. In this way a drop of 260 ft. is created. The water is taken from the forebay through five 5-ft. steel pipes each 500 ft. long to the turbines. The plant is reached by an old mountain road 35 miles long which attains an altitude of 4000 ft., and the plant itself has an elevation of 2500 ft. above sea level.

The original installation of the plant consisted of five impulse turbines of the Girard type. The wheels were mounted overhung on the 16-in. shaft extension of the generators, and the speed of the wheels was 231 r.p.m. As the power house is located on a bank about 25 ft. above the river, the wheels were provided with draft tubes, and by means of an air inlet into the casing, which was regulated through a float valve in the tailrace, the water in the draft tube was to be kept a certain distance below the wheels. After about four years' operation it was decided to take the Girard turbines out, as they did not operate at the desired high efficiency.

The Pelton Water Wheel Company, of San Francisco, was awarded the contract for four Pelton-Francis units, the purchaser taking the precaution to have the first unit built and installed and very thoroughly tested, in compliance with guarantees, before authorizing the manufacture of the other three units. In the design of these turbines a runner of rather large diameter (84 in.) was

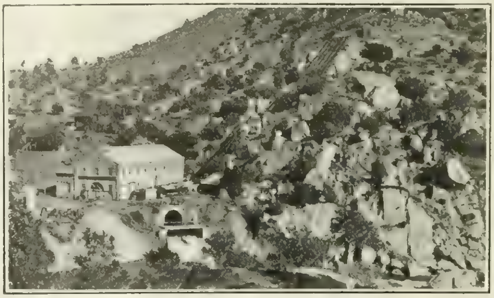


Fig. 1—Borel Power Station.

necessary, thus making the surface friction and runner and casing clearances rather critical. In other words, the runner is of necessity what is known as an extremely low-speed type for the attainment of best efficiencies. The large diameter of the runner of course makes necessary a large diameter of spiral casing weighing upward of 30,000 lb. and standing 16.5 ft. high. This is parted horizontally. The flow of water to the turbine may be controlled by a 42-in. hydraulically operated gate valve. The water passage to the runner is under the control of thirty-two cast-steel wicket gates or guide vanes outside packed and of carefully determined curvature, to insure good efficiencies at fractional loads. A cast-steel gate ring actuated by the governor controls the synchronous movement of these wicket gates through suitable levers and links. The turbine runner is of manganese bronze and great care was taken in the molding to insure smooth surfaces, the instrument being hand-scraped and machined with this object in view. The runner is hydraulically balanced by means of balance chambers on each side, but a double disk thrust bearing with automatic ring oiling supply is also provided. The runner discharge occurs over a fixed conical thimble surrounding and protecting the shaft and extending into the draft elbow. The reaction from the runner is thus taken up by this stationary discharge thimble, which reduces the end thrust on the bearing. The draft tube ex-

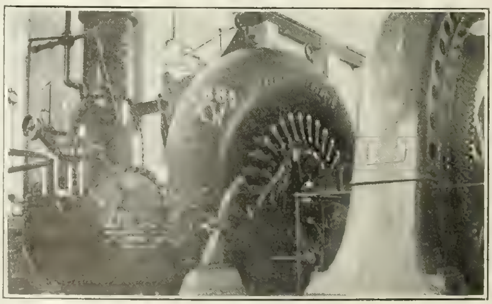


Fig. 2—Turbine at Plant Showing Governor Connections.

tends from the flange outlet of the draft elbow a distance of 27 ft. below the shaft center line, flaring suitably to reduce the discharge velocity to a minimum. The casing covers are made parting to facilitate access. The shaft where it extends through the packing glands is protected from wear by a suitable parting bronze wearing shield, which can be

readily replaced. The water passage between the wicket gates and runner is protected by bronze liner plates readily replaceable in the event of wear. Aside from the adjustment provided for the wicket gates, the connecting rods between the gate ring and governor rockshaft are adjustable.

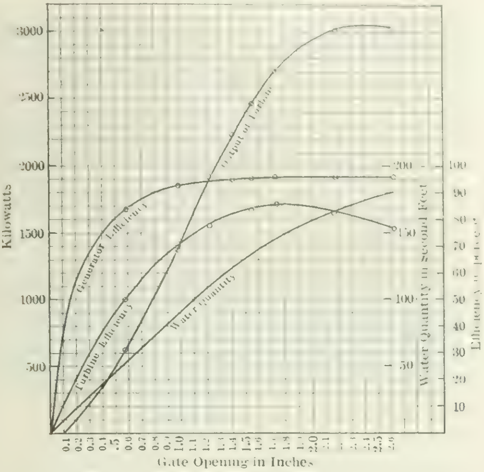


Fig. 3—Efficiency Test of 4000-hp Pelton-Francis Turbine.

In most installations a synchronously operated relief valve is directly connected to the rockshaft to prevent water ram in the pipe line on the governor's action at load changes. In this particular plant, however, the governor works directly on the wicket gates, but is set to make the stroke slow enough to prevent a material rise of pressure in the short pipe line.

The first unit was completed and installed in March, 1911, and on April 21 and 22 an elaborate test was made by Mr. James H. Wise, representing J. G. White & Company, acting hydraulic engineers for purchaser. The efficiency was found to exceed the guarantees, the maximum efficiency being 85.5 per cent, and the construction of the other three units was started at once. A record of the test is indicated in Fig. 3. The generator tested was paralleled with the transmission line and partly loaded, but it was found that its voltage could not be raised above 2000 volts with a unity power factor on the generator. As it was desirable to run the test with as near the normal terminal voltage of 2200 for the generator as possible, a second generator was also paralleled with the transmission line. Then the water of the turbine of this unit was shut off, allowing the generator to float on the line; by over-exciting its field the transmission voltage was raised, so that the generator under test could be run at practically nominal terminal voltage. All the other generators were shut down during the entire test.

In order to determine the iron loss and the friction and windage losses, both of the generators were connected to the transmission line and then the water was shut off from one generator and both generators were then disconnected from the transmission line. In this way the generator under test was run as a synchronous motor and was given an increased field excitation for each point of the test. The voltage of the driving generator was varied so as to give a unity power-factor input to the synchronous motor. The speed of the driving generator was held at the value corresponding to 50 cycles by operating the turbine gates manually. From the curves of Fig. 3 it will be seen that the maximum efficiency of the generators ran as high as 95.7 per cent at full load and 92 per cent at half load.

The above test results show that a reaction turbine can give excellent results and high efficiencies under extremely unfavorable conditions, where even impulse wheels have been considered.

A MODERN ELECTRICALLY OPERATED BRICK PLANT.

By [illegible]

One of the most modern electrically driven brick plants is that of the Oakland Paving Brick Company, to which the accompanying illustrations refer. This is said to be the largest paving-brick plant in the United States, having a capacity of 100,000 paving bricks per day. Its total capacity is 200,000 of all kinds of bricks per day. The plant is located near Niles, Cal., in the beautiful and prosperous country touching the Coast Range foothills, on the east shore of San Francisco Bay. Plenty of good clay is at hand here, requiring only to be opened up by the removal of 3 ft. of the rich top-soil.

The brick-plant building is of mill construction, covered with corrugated iron, and has the shape of an L, with its longer member 1000 ft. in length. A runway carries a 10-ton, 62-ft. traveling crane, which serves the entire building. This crane is operated by 220-volt alternating-current motors, and was built by the American Clay Machinery Company, which also furnished all the brick-making machinery. The plant is electrically driven throughout and is also lighted by electricity. Many new and interesting features have been introduced, as shown by the accompanying illustration, which will give some idea of the completeness of the details.

The electrical equipment, which was furnished entirely by the Allis-Chalmers Company, includes motors, controlling apparatus and transformers. Practically all the motors are of the 2200-volt induction type, which has been used very extensively in cement mills, crushing plants, brick factories, and other places where there is a large amount of dust, in all cases giving extremely good service. Motors of lower voltage have frequently been employed, mainly because they were believed to be somewhat safer for the operatives, but it has been found that where proper care is taken in the installation there is no serious danger from this source. A very considerable saving of wiring copper is effected, and the cost of step-down transformers is saved in many cases.

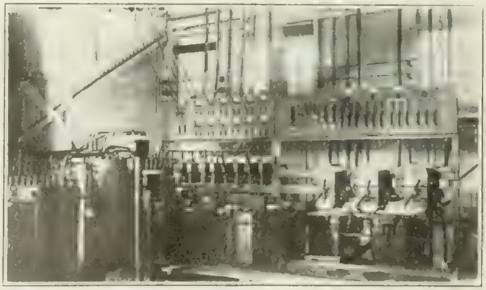


Fig. 1—Interior of Substation Showing Transformers and Starters for 2300-Volt Induction Motors.

Energy is delivered to the plant by the Pacific Gas & Electric Company over a 60,000-volt, three-phase transmission line. Outside the substation, which is adjacent to the main plant building, is a heavy framework which carries the terminal insulators, air-brake switches and pole-top fuses. From this framework the high-tension lines

are carried into the substation to the 60,000-2300-volt oil-filled, water-cooled transformers, the secondaries of which feed directly to the starters for the 2200-volt motors and to the primaries of the low-voltage transformers, which step down to 220 volts for the potential starters controlling the crane-type low-voltage motors. All of the motors in the plant, with the exception, of course, of those on the cranes, are controlled directly from the substation. An annunciator in the switch house is connected by a bell circuit to push-buttons at each motor, so that by a system of signals the machine operator can notify the switch attendant when to start or stop a motor. All the starting and switching apparatus is thus kept in an atmosphere free from dust, and under the care of a single skilled electrician. All wiring is carried in metal conduits.

The lighting of the plant is in general by means of lamp standards placed beside the machine and protected by lamp guards. This arrangement leaves all overhead space free for the movement of the cranes. In parts of the building where cranes do not operate drop cords or conduit is used.

The plant has been located quite near the clay pits. At present the top layer of earth is removed from the clay deposits by a horse-drawn scraper, the same means being used to excavate the clay. It is planned later to install an electric shovel for this work as soon as the plant is in full operation. From the hopper into which the clay is dumped a belt conveyor carries the material to a 24-in. disintegrator, where it is thoroughly broken up. From the disintegrator a chain conveyor then carries the finely divided clay to a hopper above the pug mill into which it is fed as needed. Here it is finely ground and mixed with a suitable amount of water to give the consistency for making brick. From the pug mill the clay mixture is discharged into a brick machine, immediately below it, in which dies form the brick to its approximate dimensions. The green bricks are then delivered to a rotary cutter which trims them to exact size. An off-bearing conveyor belt thence delivers the paving brick to the front of a row of four automatic re-presses into which they are fed by hand. Common red building brick or sewer brick require no repressing, the bricks being taken by hand directly from the conveyor and piled in units of 500. All rejections are left on the conveyor belt, to be dropped from its end into a

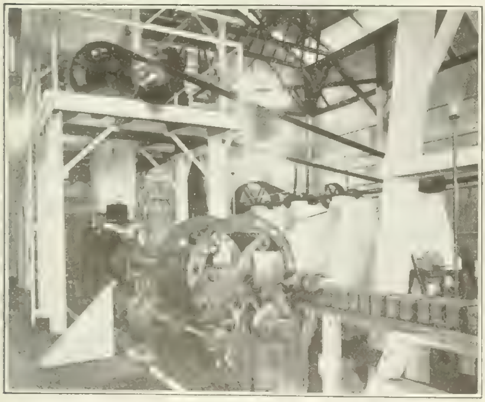


Fig. 2—Brick Machine and Rotary Cutter.

second conveyor beneath the floor, which returns them to the pug mill. All of the machinery thus far mentioned, together with the connecting conveyors, is driven from a line shaft, which in turn is operated by a 250-hp motor.

One of the greatest labor-saving devices in the plant is the automatic brick-setting machine, by which the crane picks up the bricks in units of 500 and stacks them in a double, continuous drier. Each of these concrete driers holds 150,000 bricks. Wooden covers borne on wheels close the tops of the driers. After the driers are filled with brick and closed hot air is blown in through bottom apertures by a 20-ft. fan driven by an adjustable-speed motor.

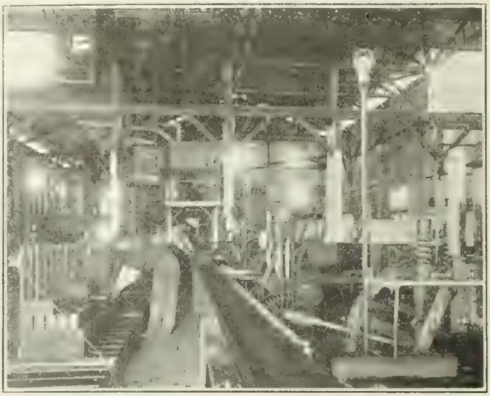


Fig. 3—Automatic Re-presses.

This speed control enables the amount of air supplied to be regulated at will. Two 7-ft. disk fans, driven by 10-hp constant-speed motors, draw the moist air from the driers.

Crude oil is used throughout the plant for heating purposes. A duplex 14-in. by 10-in. Clayton air compressor, driven by a 50-hp induction motor, furnishes all the air needed for various purposes, including that used for atomizing the oil in the burner for the kilns and hot-air furnaces. Compressed air is also utilized for blowing the dust from the motors and for cleaning the dies and presses.

After drying for twenty-four hours the bricks are removed from the drier again by the brick-setting machines and stacked in the kilns in similar units of 500. As soon as they are thoroughly burned the brick-setting machines are again brought into play and the bricks removed to be cooled and finally loaded on cars. Through the use of these machines it is thus seen that the minimum amount of labor is employed in handling the brick. The only points at which they are individually handled are where they are fed into the presses, stacked upon the brick-setting trays, or piled in the cars. This means a very great reduction in the expense of operation.

The bricks broken in the driers or kilns are later ground up in a 9-ft. dry pan, driven by a 40-hp motor. From here they are delivered to the pug mill, where they are again worked up into brick. This method of handling, of course, greatly reduces the waste.

A 6000-gal. oil tank located a little distance from the plant stores sufficient fuel oil to operate it for long periods. It also makes possible the purchase of oil in large quantities, securing a correspondingly better price. The oil is delivered from the tank by three Gould oil pumps driven by a 10-hp motor. The same motor also drives a deep-well water pump which supplies all the water needed about the works.

This California plant has now been in operation for about a year and has given complete satisfaction in every detail. The owners are reported to be highly gratified at the success attending their choice of apparatus and their decision to use electric drive throughout. The president of the Oakland Paving Brick Company is Mr. L. G. Burpe, and the vice-president is Mr. E. A. Heron, who is president of the Oakland Consolidated Traction Company. The secretary and treasurer is Mr. D. K. Halloway.

Industrial and Commercial News

The Week in Trade.

With attention directed, as is customary at this time, toward the taking of inventories, the compiling of the results of the year's operation in many cases, and with planning for the coming year, business transactions in the majority of lines have shown a slight curtailment during the week. Retail lines are still reflecting the activity of the holiday season, and the turnover in this direction is close to the normal. The buying of steel throughout the holidays has been greatly beyond expectations, and has contributed to an important degree in making the fourth quarter in the steel business the most satisfactory of the year. Railroad interest in the steel markets is unabated, and orders for fair tonnages for 1912 delivery are now pending from this source. The plants of the Steel Corporation are understood to be operating at approximately 80 per cent of capacity, and with continuation of the present rate of buying increase to nearly 85 per cent in the early part of 1912 is probable. The pig-iron market is fairly active considering the period of the year, although inquiries at present are rather light. A slight degree of hesitation in general trade still prevails in the West, and buying for the future is being done on only a narrow scale. The recent improvement in the wool industry has been of decided benefit to trade in New England, and the prospects for the coming year in that section of the country are regarded as unusually good. The tone throughout the country, with the exception of that in the West, as above, is generally optimistic, and with the greater part of the influences that have retarded progress this year already removed, there is no good reason why a period of good business should not be ushered in with the coming year. Business failures for the week ended Dec. 21, as reported by *Bradstreet's*, were 294, as compared with 309 in the preceding week, 271 in the corresponding week of 1910, 264 in 1909, 196 in 1908, and 294 in 1907.

The Copper Market.

Interest in the copper market has been very light this week both here and in Europe on account of the holiday, but prices have held rather firmly in spite of the small amount of business transacted. Quotations for electrolytic during the week have been in the neighborhood of 14¼ cents per pound for thirty days. Many dealers are expecting considerable improvement in prices and demand to appear with the first of the year. Just what form the price manipulation will assume in the next few months remains to be seen, but it is more than likely that the response of consumers will continue to be governed by their understanding of the relations between supply and demand in the copper industry and not by any fear that substantial advances in price are forthcoming. It is more than likely that selling interests will appreciate the advantage of keeping prices in the neighborhood of 14 cents, at which price they can make a profit, rather than run the risk of decreasing demand by further advances. The outlook for the coming year in general business is very fair, and improvement in the affairs of the country will of [illegible] of the copper industry. It is hoped that a plan for the rational curtailment of output will be devised in the coming year, and that the situation will be further improved by healthy increase in demand due to application of the metal to many uses and purposes in which it is not at present employed. Exports for the month, including Dec. 27, aggregate 29,001 tons. The daily call on the Metal Exchange Dec. 27 quoted copper as per the accompanying [illegible]

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	[illegible]	14.00	
December	[illegible]	14.00	[illegible]
January	[illegible]	14.10	[illegible]
February	13.95	14.15	14.05
March	[illegible]	14.15	[illegible]
April	[illegible]	[illegible]	[illegible]

The London market, Dec. 27, was as follows:

	Noon.	Closing.
Standard copper, spot	[illegible]	[illegible]
Standard copper, futures	[illegible]	[illegible]

Extreme fluctuations for the year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
London, spot	[illegible]	[illegible]
London, futures	[illegible]	[illegible]
Best selected	[illegible]	[illegible]

Industrial and Commercial Notes.

Active Competition by Postal Telegraph Company.—The German Cable Company and its ally, the Commercial Cable Company, have announced a 50 per cent reduction in rates, effective Jan. 1, 1912, on public and press messages between New York and Berlin and intermediate points. Messages in plain language will be accepted by the companies after that date at 12½ cents per word in place of the existing rate of 25 cents, messages being subject to a possible delay of twenty-four hours. Press messages will be taken at 6¼ cents per word in place of the present rate of 12½ cents, messages being subject to a possible delay of nineteen hours. This move is of great importance, being a means of improving the facilities for trade between Germany and the United States, and the announcement has been received in Germany with considerable enthusiasm. In addition to this feature, the reduction is another step in the aggressive competition which the Postal Telegraph Company is carrying on against the American Telephone & Telegraph Company and allied interests. The Postal has by the new schedule with Germany met the move for public favor and increased profits made by the Western Union a few weeks ago when the American Telephone & Telegraph interest announced its deferred-message schedule to Great Britain. The Western Union cannot duplicate the Postal's move, as it has no German connections. The rivalry between the Postal Telegraph Company and the American Telephone & Telegraph Company in the telegraph and cable field has extended to the telephone field, and the appointment of Minor H. Davis as superintendent of its telephone service, mentioned in these columns last week, was the first move of the Postal in open competition in this line. The second was the announcement on the Pacific Coast last week of a new rate of 25 cents for ten-minute connection between San Francisco and Sacramento, a distance of 68 miles, as against the existing rate of 40 cents asked by the Bell interests. Proportionate reductions in tolls between the prominent cities in California, Oregon, Washington, Nevada and Utah will be made by the Postal interests, it is believed, as soon as arrangements and schedules can be perfected. Competition by the Postal in the telephone field was forecast some time ago when the company began the stringing of copper wire sufficiently heavy for telephone service on its new lines in the West. The latest move by the Western Union company was its notice that it has abolished charges for delivery of messages within the corporate limits of a municipality.

Allied Machinery Company of America Establishing More Agencies.—Captain Godfrey L. Carden, general manager of the Allied Machinery Company of America, which was organized last June to sell American machinery abroad and whose home office, under the direction of C. N. Thorn, is at 55 Wall Street, New York City, as previously mentioned in these columns, is now in Brussels perfecting details for the establishment of agencies, and will proceed soon on an extended trip throughout Europe with a view to locating branches in the more important of the foreign cities. He will locate agencies in Austria-Hungary, Turkey, the Balkan States, Russia, Sweden, Denmark, Norway, Roumania and England, and will return to Paris in the course of the next five months, after which he will return to New York for a conference with the home office. Agencies have been established in Paris, Brussels, Vienna and Milan. Considerable opposition has been met with in Germany, but the company is progressing rapidly in its field and is receiving a very gratifying proportion of orders for machinery for foreign use.

Ohio Brass Company Selling Agencies.—On Jan. 1 the agency agreement for the sale of "O-B" overhead materials, rail bonds and car equipment specialties, which has been in force between the Ohio Brass Company, of Mansfield, Ohio, and the Pierson-Roeding Company, of San Francisco, for a number of years, will terminate and will not be renewed, as it was mutually agreed that separate agency agreements for "O-B hi-tension" insulators and "O-B" electric railway equipment would eventually prove unsatisfactory, and that the interests of all concerned would be better served by a single agency for the entire Ohio Brass line. On and after Jan. 1, 1912, the Holabird-Reynolds Company, of San Francisco, which for some time past has been acting as exclusive agent for "O-B hi-tension" insulators only, will become the exclusive agent for the Ohio Brass Company for the sale of its entire line in the State of California. The Holabird-Reynolds Company will carry an adequate stock of railway materials and insulators at San Francisco, and business in Los Angeles and the southern part of the State will be handled by H. C. McCutchan, of its Los Angeles office, under the personal direction of R. D. Holabird. The business in the States of Washington, Oregon and Idaho and in British Columbia will be in charge of the Ohio Brass Company's own personal representative, F. V. Cook, who will make his headquarters in Seattle, at the office of the Holabird Electric Company. An intimate and friendly business connection between that company and the Ohio Brass Company will be maintained because of its California agency for "O-B" materials. Arrangements are being made to carry an emergency stock for quick delivery in Seattle.

Boston Edison Business Growing.—A substantial increase in the sale of new energy-consuming appliances has been enjoyed this fall by the Edison Electric Illuminating Company of Boston. The general sales of appliances for September and November were about 50 per cent in excess of last year, and for October almost 100 per cent. A large holiday business has been handled, special effort having been made to encourage the purchase of goods previous to Christmas for delivery on that or the preceding day through an appropriate address card. The first year's work in developing the Boston 1912 electric show has just ended, and the management is much gratified with the results obtained. The advance advertising has stimulated the interest of all electrical manufacturers in this country as well as that of many large producers of general commodities. More than ordinary interest has been aroused by the publicity work carried on in foreign journals. Permanent headquarters have been established at the Edison Building, 39 Boylston Street, Boston. At the end of six months' operation the company's public electric garage at 476 Atlantic Avenue, Boston, which is being operated by the sales department, is in a very prosperous condition. About sixteen electric vehicles are being constantly cared for, and the financial results are satisfactory, considering the short time the garage has been open. The efficiency of many other public garages in the Boston district has been increased as a result of the work done.

News and Trade Papers in Foreign Countries.—In order to furnish those engaged in or desirous of entering the foreign field with a general idea of the cost of newspaper advertising abroad and the papers it might be advisable to use, the Bureau of Manufactures, of the Department of Commerce and Labor, is publishing in *Daily Consular and Trade Reports* a series of reports by American consular officers on foreign news and trade papers. The reports embrace such points as location and class of paper, district covered, circulation, subscription price and advertising rates. The list for England, which included the papers in fifteen districts, appeared in *Daily Consular and Trade Reports* for Nov. 27. Lists for South American countries are in course of preparation and will be published shortly.

Electrically Operated Fender for Panama Canal Locks.—A contract for forty-eight electrically operated machines for lifting and lowering the fender chains in the locks of the Panama Canal has been awarded to the United Engineering & Foundry Company for $428,005, the lowest of ten bids received. The first, or sample, machine is to be delivered within 120 days from the date of award, and if it proves satisfactory the full award of forty-seven more machines will then be made.

The Diesel Engine.—There is a rumor that one of the large electrical manufacturing companies will take over the American rights for the manufacture of the Diesel engine, in which case sizes as large as 5000 hp. will be made.

Financial.

The Week in Wall Street.

Financial markets have moved very listlessly during the year-end period and few developments of importance have taken place. Price changes have been fractional in the majority of cases and the volume of transactions has been very narrow. The trading in the main has been professional, and few of the traders have cared to make any new commitments before the first of the year. There has been a conspicuous absence of events such as usually influence the stock market, and the only development meriting attention was announcement of extension of the time for filing answers in the government suit against the Steel Corporation from Jan. 1 to Feb. 1. Prices were nearly stationary in Wednesday's market until the closing hour. The fact that no transactions took place in the majority of usually active stocks in the first four hours of Wednesday indicates the degree of stagnation that has prevailed during the week. In the absence of other topics on Wednesday, the lockout of some 150,000 operatives of the Manchester (England) cotton mills attracted some attention in the local cotton market, but had little effect upon prices. Money market conditions are slightly easier than is generally the case at this time of the year, and rates Dec. 27 were: Call, 3½@3¾ per cent; ninety days, 3¾@4 per cent. Political affairs are beginning to attract greater interest in the financial district than has been the case in the past few weeks, and the efforts of the Republican party leaders in Congress to draw up a satisfactory bill revising the wool schedule are being closely followed. Foreign markets have been very quiet this week on account of Christmas holidays, and Wednesday's trading was without noteworthy feature. The quotations in the tables are those in the New York market Dec. 27.

NEW YORK.

	Dec. 20.	Dec. 27.	Shares Sold.		Dec. 20.	Dec. 27.	Shares Sold.
All. Ch.	1½*	1⅜*	950	Int. Met., pf.	48¾	48	5,350
All. Ch., pf.	8	8	600	Mackay, Cos.	82*	80	800
Amal. Cop.	66⅜	66½	92,500	Mackay C., pf.	72*	69	100
Am. D. T.	33⅛*	33⅛*	——	Man. Elev.	134	135¼*	200
Am. Loco.	37	36½*	1,600	Met. St. Ry.	15*	15*	——
Am. Loco., pf.	104*	105	——	N.Y.&N.J.Tel.	139½*	139½*	——
Am. Tel. & C.	78*	78*	——	Steel, com.	68⅝	68	393,900
Am. T. & T.	139⅞	139⅞	4,123	Steel, pfd.	111⅜	111⅛	6,180
B. R. T.	77¼	76¾	1,240	W. U. T.	78¾	79	1,700
Gen. Elec.	155	154	2,300	W't'h, assentg	68¾	66½	8,000
Int. Met.	15⅜	15¼	3,120	West'h, pfd.	117½	117½	200

PHILADELPHIA.

	Dec. 20.	Dec. 27.		Dec. 20.	Dec. 27.
Am. Rys.	45¼	45*	Phila. R. T.	23½	23¼
El. Co. of A.	12⅛	12⅞*	Phila. Elec.	16¾	16⅞
Elec. St. Bt'y	54⅜	53⅝*	Phila. Trac.	84½	84½
Elec. St. Bt'y., pf.	30*	30*	Union Trac.	51¼	51⅜

CHICAGO.

	Dec. 20.	Dec. 27.		Dec. 20.	Dec. 27.
Chi. City Ry.	186*	186*	Com. Edison	135¼	135½
Chi. Elev. Rys.	30⅜*	30⅜*	Chi. Subway	⅞	⅞*
Chi. Elev. Rys., pf.	92*	92*	Chi. Telephone	†137¾	136½*
Chi. Rs., Ser. 1	99	99¼*	Nat'l Car	103*	103*
Chi. Rs., Ser. 2	37½	37	Nat'l Car, pfd.	118*	119*

BOSTON.

	Dec. 20.	Dec. 27.		Dec. 20.	Dec. 27.
Am. T. & T.	140	140	Mex. Tel.	3¼*	3
Cum. Tel.	156½	156*	Mex. Tel., pf.	6½*	6½*
Edison	295	290	N. E. Tel.	157	152½
Gen. Elec.	155	155*	W. T. & T.	27½*	27½*
Mass. E. Ry.	22¾	21¾	W. T. & T., pfd.	64¼*	64¼*
Mass. E. Ry., pf.	95¼	95			

*Last price quoted.
†Ex-dividend.
Shares sold for the week, Dec. 18 to Dec. 22.

Financial Notes.

Federal Light & Traction Company Enlarging.—As a result of steady growth of the territories served by its various properties, the Federal Light & Traction Company, 60 Broadway, is receiving very gratifying increases in revenue. The consolidated statement of earnings of the subsidiary companies for the month of November has been compiled, and the returns given in this statement show improvement over those for November, 1910, and over those for October, 1911, reported in these columns Dec. 2. Gross returns for the month were $147,543, as compared with $132,630 in November, 1910, an increase of 11.2 per cent. Operating expenses were $81,222, as compared with $70,019, an increase of 15.9 per cent, and net earnings were $66,320, as compared with $62,611 in November, 1910, a gain of 5.9 per cent. October net was 5.6 per cent larger than in October, 1910. Gross earnings in the eleven

months ended Nov. 30, 1911, were [illegible], as compared with $1,100,815 in the corresponding period of the previous year, a gain of [illegible] per cent. Operating expenses were [illegible] as compared with [illegible], an increase of [illegible] per cent, and net earnings were [illegible] as compared with [illegible], a gain of [illegible] per cent. Net earnings for the ten months ended Oct. 31, 1911, showed an increase of 5.4 per cent over those for the corresponding period of the previous year. The statement for the eleven months of the present year does not include the earnings of the Trinidad Electric Transmission, Railway & Gas Company, of Trinidad, Col., as this company began operations Sept. 1, 1911. Its earnings for November, however, appear in the consolidated statement for the month, as above. Progress is being made at each of the properties along the lines of improving the load-factor and the installation of additional equipment. The inauguration of day service at Rawlins, Wyo., mentioned Dec. 2, has necessitated additional equipment, and a generating set and boiler are now being erected in the station. Work has been started upon the new Walsenburg power station of the Trinidad Electric Transmission Company, the cost of which will be fully $300,000. An initial equipment of 3,500 kw will be installed. The location of this company in the heart of the Colorado coal fields permits the procuring of fuel at minimum cost, thus permitting the sale of energy at favorable prices. A campaign for selling energy to the surrounding mines is now in progress. The Gray's Harbor Railway & Light Company, which serves Aberdeen, Hoquiam and Cosmopolis, Wash., has completed an extension of its railway service to a high-class residential section in its territory, and is again supplying large amounts of energy for dredging operations, which had been temporarily discontinued on account of accident to the dredging machinery. A 2000-kw generating set and several additional passenger cars have been received by the Springfield Railway & Light Company, of Springfield, Mo., and a new carhouse, built to house additional equipment, is practically finished.

Progress of Allis-Chalmers Reorganization.—The bondholders' protective committee of the Allis-Chalmers Company, of which James N. Wallace is chairman, has been engaged in a preliminary investigation into the financial condition of the company, and finds that $13,573,000 of the $15,000,000 first-mortgage 5 per cent gold bonds authorized under the mortgage of July 2, 1906, were certified by the trustees and are accounted for as follows: In the hands of the public, $11,148,000; pledged as security for loans to the company, $800,000; originally issued but later canceled, $136,000; in the treasury of the company unissued, $1,489,000. The current assets, estimated as of Dec. 31, 1911, are as follows: Receivables, $3,900,000; inventories, $5,000,000, and cash, $900,000, making a total of $9,800,000. The current liabilities against this consist of notes payable, $1,420,000, and other liabilities amounting to $1,250,000, making a total of $2,670,000, which leaves a surplus of $7,130,000. Accrued interest on the bonds due Jan. 1, 1912, is not included in the above figures. Examination of the inventories of the company by public accountants who reported under date of Dec. 20, 1911, shows that the business and net earnings of the company have been unsatisfactory and decreasing in the past few years. The works of the company at Milwaukee, West Allis, Chicago and Scranton are very valuable, and the West Allis plant, which was built in recent years, is of large capacity and of modern construction and equipment. As soon as possible after definite information as to the action of the company in regard to approaching interest is obtained the committee will submit a plan of reorganization to the bondholders, under which the necessary working capital may be procured.

Electrical Compared with Industrial and Railroad Earnings.—Henry L. Doherty & Company, of 60 Wall Street, New York City, have prepared a series of charts which show the relative increases and decreases in the gross and net earnings of steam railroads, electric railways, gas and electric companies and of industrials for each of the nine years from 1902 to 1910. To furnish data for this purpose they compiled a record of the gross and net earnings of all the steam railroads in the United States and of all the industrials listed on the New York Stock Exchange that could be traced back to 1902. They also obtained the gross and net earnings of the electric railways in most of the larger cities of the country, together with similar figures for the gas and electric-light companies, using all figures available excepting those for New York City. The voluminous data thus obtained were standardized at unity for the year 1902, and the percentage of subsequent increase or decrease was calculated with the earnings of 1902 as a basis. These derivations were plotted with the years 1902-1910 against the percentages of increased or decreased earnings as co-ordinates, with the year 1902 as unity as above. The resulting curves show most convincingly that the gas and electric industries enjoyed the most rapid increase in gross and net earnings of all of the classes plotted, and that these returns were the only ones that were practically unaffected by the panic conditions in 1907 and 1908, or the industrial depression since that time. As a matter of fact, these curves show that the gas and electric companies were the only ones during the entire period reviewed that experienced no decrease in net earnings, while the gas, electric, and street-railway companies alone showed no decrease in gross earnings. The steady increase in the earnings of the electric railways, as compared with fluctuations in those of the steam roads and industrials, is remarkably conspicuous, and due to the fact that the electric lines, in general drawing their income from passenger travel, are not affected by dullness in general business with decreased freight tonnages, as are the steam roads. The effect of curtailment along industrial lines in hard times is shown very forcibly, the income for the industrial group showing marked contraction in 1907 and 1908, these being the first lines of endeavor at which economy is directed at such times. The comparisons shown by the curves are intended to show the superiority of the securities of gas and electric properties for investment purposes, with particular bearing upon the purchase of securities for long-time holding and not for speculation.

Public Service Company of Northern Illinois.—The Public Service Company of Northern Illinois, of Chicago, by Samuel Insull, its president, has given notice that on Feb. 1, 1912, all the first-lien collateral-trust gold debentures then outstanding of the Chicago Suburban Light & Power Company, of Oak Park, Ill., dated Feb. 1, 1911, will become due and payable at par and accrued interest. These debentures will cease to draw interest after Feb. 1, 1912. The Public Service Company of Northern Illinois is successor to the Chicago Suburban Light & Power Company. It also gives notice that on Feb. 1, 1912, all the first-mortgage gold bonds then outstanding of the Evanston (Ill.) Heating Company, dated Feb. 1, 1903, will become due and payable at par and accrued interest. In this case also the Public Service Company gives the notice as successor of the company issuing the bonds.

Kentucky Utilities Company.—A company with this name has been organized to take over the electric and gas properties in Frankfort, Owensboro, Bowling Green and Hopkinsville. No definite details regarding the capitalization of the company or its plans of operation have been announced. Chicago capitalists are said to be the principals.

DIVIDENDS

Electric Storage Battery Company, preferred and common, 1 per cent, payable Jan. 2.

Kansas Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Jan. 2.

Philadelphia Company, quarterly, 1½ per cent, payable Feb. 1.

REPORTS OF EARNINGS.

Period	Gross Earnings	Operating Expenses	Net Earnings	Fixed Charges	Net Surplus
AMERICAN LIGHT & TRACTION COMPANY					
November, 1911	[illegible]	[illegible]	[illegible]		
November, 1910	[illegible]	[illegible]	[illegible]	....	..
CENTRAL & SOUTH AMERICAN TELEPHONE COMPANY.					
November, 1911	$115,328	$9,453	$105,875	$56,625	$49,250
November, 1910	[illegible]	[illegible]	[illegible]	49,063	[illegible]
CITIES SERVICE COMPANY.					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEXICAN TELEGRAPH COMPANY					
Qtr., Dec., 1911	$210,000	$42,000	$198,498	$11,500	$186,998
Qtr., Dec., 1910	205,000	37,500	192,000	9,500	182,500
MONTREAL STREET RAILWAY COMPANY					
November, 1911	$420,476	$260,576	$159,900	$35,318	$124,582
November, 1910	366,098	227,442	138,656	32,013	106,643
NORTHERN OHIO TRACTION & LIGHT COMPANY.					
November, 1911	$214,562	$125,204	$89,359	$43,730	$45,629
November, 1910	189,705	110,718	78,987	43,336	35,620
TWIN CITY RAPID TRANSIT COMPANY.					
November, 1911	$633,968	$317,628	$316,340	$148,079	$168,261
November, 1910	619,149	319,732	299,417	137,912	161,505

*Partly estimated.

General News

Construction News.

[illegible] recently [illegible] Machinery for the plant has already been purchased. J. M. Miller, G. S. Elliott and E. T. Hendon are interested in the company.

HEFLIN, ALA.—It is reported that W. O. Grant contemplates the installation of an electric-light plant in Heflin.

DOUGLAS, ARIZ.—The Douglas Improvement, which operates the electric-light and power plant, the Douglas Electric Railway, the International Land Company and minor properties have been consolidated under the name of the Douglas Investment Company with a capital stock of $1,500,000. The new company proposes to increase the output of the electric plant and extend its railway system to the Sulphur Springs Valley district. James S. Douglas and W. H. Brophy are at the head [illegible]

PHOENIX, ARIZ.—The Pacific Gas & Electric Company has submitted a proposition to the City Council to furnish electrical energy for street lighting for a period of two and one-half years at the rate of 6 cents per kw-hour, to be registered by meter located in the company's central station. Before the expiration of the company's contract some months ago it offered to furnish the service for a period of five years at 5 cents per kw-hour, which was rejected by the Council. The service has been furnished from month to month since.

OSCEOLA, ARK.—The Light Commission has made arrangements with Abner Driver, owner of the local electric-light plant, by which the city will take over the plant on Jan. 1, the valuation to be fixed by three appraisers. The commission will build a new power plant adjoining the railroad and install new equipment. The old plant is to be used for auxiliary purposes only.

DOWNIEVILLE, CAL.—The managers of the Brown Bear mine are reported to be contemplating the installation of an electric-power plant at the mine. J. G. Jackson is interested in the property.

ELK GROVE, CAL.—The Western States Gas & Electric Company, of Stockton, Cal., has been awarded a contract for the installation of an electric-light system at Elk Grove for a period of five years. The company is to furnish the service at a rate of 8 cents per kw-hour.

HAWTHORNE, CAL.—A special election will soon be called in Hawthorne to vote on the proposition to petition the Board of County Supervisors of Los Angeles County to install 100 new arc lamps. The Southern California Edison Company has just completed the installation of seventy-five lamps.

HUNTINGTON PARK, CAL.—At an election held recently the proposition to issue bonds to the amount of $110,000, the proceeds to be used for the construction of an electric-light plant and water-works system, was defeated. E. R. Allen is city clerk.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors, Court House, Los Angeles, Cal., until Jan. 15, 1912, for furnishing and installing two water-tube boilers, a vacuum cleaning plant and a heating and ventilating plant in the county hospital. H. J. Lelande is clerk of the board.

MIDWAY, CAL.—The San Joaquin Light & Power Company, of Fresno, Cal., has entered into a contract with the Standard Oil Company for the extension of its transmission lines to the oil company's seven leases in this district.

PASADENA, CAL.—The contract for the electrical work in the new Polytechnic High School has been awarded to the Newberry-Bendheim Electric Company, Stimson Building, Los Angeles, at a cost of $20,569. C. E. Cook Electric Company, 745 South Spring Street, Los Angeles, Cal., secured the contract for an electric program clock, at $3,587.

PORTERVILLE, CAL.—The City Council has notified the Tulare County Power Company, of Lindsay, which has applied for a fifty-year franchise to supply electricity in Porterville, that its application must be for a period of twenty-five years and that it must agree to install an underground-conduit system throughout the city.

SAN FRANCISCO, CAL.—It is reported that the Pacific Gas & Electric Company has acquired the entire properties of the Mutual Electric Company and has taken over its contract with the Board of State Harbor Commissioners.

GILCREST, COL.—The Commercial Club is reported to be considering the question of establishing an electric-power plant in Gilcrest.

KERSEY, COL.—It is reported that application has been made to the Council for a franchise to install an electric-light plant in Kersey.

PUEBLO, COL.—The contract for furnishing and installing lighting fixtures for the Pueblo County court house has been awarded by the Board of County Commissioners to the Morvean Company, of Cleveland, Ohio, for $20,000.

WATERBURY, CONN.—The Board of Aldermen has appointed a committee to make investigations in connection with the installation of a municipal electric-light plant in Waterbury. An appropriation of $5,000 has been made for use of the committee.

DELMAR, DEL.—The Town Council has renewed the street-lighting contract with the Sussex Light & Power Company for a period of five years. The price for street lamps has been increased $2 each per year, with the understanding that the company is to install a new lighting system, which will improve the service.

TAKOMA PARK, D. C.—Estimates for the construction and equipment of a municipal electric-light plant in Takoma Park have been submitted to the Town Council by H. G. Fetherling, of Philadelphia, Pa., and C. R. McGahey, of Baltimore, Md. The cost of the entire work is estimated at about $12,000.

ST. AUGUSTINE, FLA.—The plant and holdings of the St. Johns Light & Power Company have been purchased by W. D. Barnett, of Jacksonville, Fla. It is said that there will not be any change in the management of the company, but extensive improvements will be made to the plant and service.

ATLANTA, GA.—The State Railroad Commission has authorized the Georgia Railway & Power Company to issue $17,000,000 in capital stock and bonds to the amount of $30,000,000. The company asked for authority to issue $27,000,000 in stock and $30,000,000 in bonds. In addition to cutting the application for stock by $10,000,000 provision is made that only $12,400,000 of the bonds can be issued immediately and the remainder not until the company has applied to the commission again.

DOUGLAS, GA.—Bonds to the amount of $15,000 are reported to have been voted, the proceeds to be used for the installation of an electric-light plant and water-works system in Douglas.

MACON, GA.—The City Council has authorized the Mayor to sign the contract with the Macon Railway & Light Company for lighting the streets of the city for a period of five years to take effect from Jan. 1, 1912. Under the new contract the company agrees to furnish electricity for 7½-amp series arc lamps at $60 each per year; 4-amp magnetite arc lamps at $60 per lamp per year; 50-cp series incandescent lamps at $24 each per year; "white way" five-lamp standards, $24 per year each, these posts to be equipped with five 40-watt Mazda lamps, to burn all night and every night; for five-lamp standards carrying five 40-watt Mazda lamps, burning six hours, $13 each per year. The standards are to be installed by the city, merchants or property holders, ready for the lamps. In consideration of the low rate the city of Macon agrees to have installed during the next year ninety additional arc lamps, making a total of 400 street arc lamps, not including the ornamental lamps. The company also agrees to supply electricity for lighting for the city buildings at 5 cents per kw-hour and for commercial lighting at 12 cents per kw-hour, with discounts ranging from 10 to 60 per cent, according to consumption, and for motors at 10 cents per kw-hour, with discount ranging from 10 to 60 per cent according to consumption and prompt payment. The Macon Railway & Light Company agrees to maintain lamps, wires and poles used in connection with the street-lighting system, including the maintenance of the lamps, globes, posts and conduits in connection with the "white way," which is not the property of the company. The company also agrees to use the new magnetite-arc lamps in all future extensions of the street-lighting system.

BOISE, IDAHO.—Plans are being considered by the Idaho-Oregon Interurban Company, which recently acquired the Boise Valley Electric Railway, for the construction of a railway in South Boise and also from Nampa to Caldwell.

TWIN FALLS, IDAHO.—Plans are being considered by the City Council and the County Supervisors for the installation of a cluster street-lighting system on Shoshone Street. Lamp standards carrying three or five lamp clusters are being considered.

CABERY, ILL.—The street-lighting committee of the Village Board and a committee from Kempton are negotiating with the Chatsworth Electric Company, of Chatsworth, Ill., as to the feasibility of erecting a transmission line from the electric plant of the company in Chatsworth to supply electricity for lamps and motors in Cullom, Kempton and Cabery.

CARBON CLIFF, ILL.—The Village Board of Carbon Cliff has appointed a committee to make investigations in regard to the installation of an electric-light plant. It is proposed to establish a municipal plant. A boiler and engine is available at any time, and all that would be necessary to equip the plant would be the purchase of a generator, at a cost of about $800.

CHAMPAIGN, ILL.—Bonds to the amount of $35,000 have been voted to install an electric street-lighting system in Champaign. Under the present plan it is proposed to purchase electrical energy of the Urbana & Champaign Railway, Gas & Electric Company to operate the system.

EAST ST. LOUIS, ILL.—The City Council has granted the East St. Louis Light & Power Company permission to extend its system to Edgemont, the eastern limits of the city, for the purpose of extend-

ing its lighting system so that [illegible] street lamps [illegible] be installed.

EDINBURG, ILL.—[illegible] J. R. [illegible]rington, is reported to have been purchased by F. Wahl, of St. Louis, Mo.

JACKSONVILLE, ILL.—[illegible] has submitted a proposition to the Village Board of South Jacksonville offering to furnish electricity for lighting the village. The street-lighting contract will include fifteen incandescent lamps of 32 cp.

LA SALLE, ILL.—The La Salle Commercial Association, which a year or two ago collected $5,900 to be used toward the improvement of the Fifth Street road, has voted to have the money turned into a fund to pay for the new lighting system for the city.

MANHATTAN, ILL.—Plans are being considered by the Commercial Club for the installation of fifteen ornamental lamp standards carrying two 60-cp lamps for the business district of the city.

NORTH CHILLICOTHE, ILL.—The village of North Chillicothe has awarded a contract to the Public Service Company of Northern Illinois for lighting the streets of the village for a period of ten years. The contract calls for the installation of sixteen lamp standards carrying four tungsten lamps and eight additional 80-cp lamps.

ST. AUGUSTINE, ILL.—Arrangements have been made whereby the Abingdon Electric Light & Power Company will extend its transmission line to St. Augustine to supply electricity for lighting the city.

ST. DAVID, ILL.—It is reported that negotiations are under way between the Village Board and the Big Creek Mining Company with a view of the latter supplying electricity for lighting the streets of the village. It is understood that it is proposed to erect a transmission line from Canton to St. David.

STEWARDSON, ILL.—The Village Board has granted a twenty-year franchise to Frank Williams to construct and operate an electric-light plant in Stewardson to supply electricity for lighting the streets of the village and for commercial lighting. The board has awarded a contract for street-lighting under which the company is to furnish thirty lamps at $25 each per year. A twenty-four-hour service will be established. The plant will be driven by a 50-hp oil engine.

VIENNA, ILL.—The City Council has decided to call a special election on Jan. 15, 1912, to vote on the proposition of using electricity or gas for lighting the city, and to issue bonds for the construction of a municipal lighting plant.

WATSEKA, ILL.—A new incorporation is being organized to take over the plants and lighting systems at Watseka, which includes Milford, Gilman and Onarga; also at Chatsworth, which includes Piper City, and at Fairbury, which also operates in Forrest. It is proposed to supply electricity from a central power plant. It is proposed to enlarge the plant in Watseka and rebuild the plant at Fairbury. The new company, it is said, will be known as the Central Illinois Utilities Company or the Central Illinois Electric Company, and will be capitalized at $325,000. The charter will give the company the privilege of supplying electricity, gas, operating ice and cold-storage plants, etc.

ANDERSON, IND.—Plans have practically been completed for the installation of a new street-lighting system in the business district of the city. The plans call for erection of 250 lamp standards.

COATESVILLE, IND.—At an election held recently the proposition to install an electric-light and power system in Coatesville was carried.

CUTLER, IND.—The Cutler Co-operative Telephone Company has increased its capital stock by $6,000, the proceeds to be used for extensions and improvements to its plant. George W. Shanklin is president.

FAIRMONT, IND.—The local electric-light plant, which was recently taken over by the American Gas & Electric Company, of New York, N. Y., will be operated in connection with the Marion (Ind.) plant. It is proposed to transmit energy from the power plant in Marion to Fairmount over high-tension lines. The present plant and distributing system will be discarded when the new system is completed.

GREENFIELD, IND.—The Citizens' Electric Company, recently organized, it is said, will submit a bid for the contract to furnish electricity to light the city. If successful, the company will build and equip a new plant. J. J. Pratt is president of the company and Elam Leary is secretary.

JEFFERSONVILLE, IND.—The United Gas & Electric Company is planning to extend its transmission lines to Claysburg to supply electricity in that town. It is said that the Town Board has decided to install street lamps. The transmission line will also be extended along the gravel road to New Albany.

MARION, IND.—Application has been made to the Board of Public Works by David Blumenthal, representing the Marion Telephone Company, for a franchise to construct and operate an automatic telephone system in Marion. The company has received permission from the Commissioners of Grant County to erect telephone lines in the public highways.

ORESTES, IND.—The Orestes Telephone Company has been granted a twenty-five-year franchise in the town of Orestes. The company, which operates a large number of rural telephones in the county west and northwest of the town, will begin at once to extend its service.

SOUTH BEND, IND.—The capital stock of the Indiana & Michigan Electric Company has been increased from $1,915,500 to $2,298,600. The proceeds will be used to make improvements to the plants of the company in South Bend and Elkhart. Charles A. Chapin is president of the [illegible]

BOUTON, IA.—At an election held recently the proposition to build [illegible] carried. Contracts for the proposed plant, it is said, will soon be let.

CARLSBAD, IA.—W. B. Kroeger, of San Antonio, Tex., is reported to have secured the contract to install an electric-light plant in Carlsbad, to cost $14,650.

[illegible] Light & Power Company, which owns the local electric-light plant and also operates the interurban railway to Iowa City, is reported to be contemplating the construction of an interurban railway between Cedar Rapids and Mount Vernon. The company has asked for an extension of its franchise for operating an electric-light plant in Cedar Rapids, as the present franchise has but four years to run.

CORYDON, IA.—Bids will be received by the city of Corydon until Jan. 9, 1912, for improvements to the municipal electric-light plant. Alternate bids will be received on oil engine and steam propositions. J. J. C. Bower is town clerk. The Iowa Engineering Company, of Clinton, Ia., has charge of the engineering work.

DALLAS, IA.—The Rock Island Railroad Company has commenced work on the construction of a large power plant in Dallas, which is on the new Rock Island line from Carlisle to Allertown, and the center of the large new coal fields which the new line will enter. It is said that the plant will supply electricity to operate the interurban freight and passenger trains over certain of the Rock Island lines radiating from Des Moines.

FARLEY, IA.—It is reported that work has been resumed on the construction of the local electric-light plant. Paul H. Kingsley is said to be interested in the project.

IOWA FALLS, IA.—The Peterson Electric Light & Heating Company, of Iowa Falls, is contemplating extending its transmission from Alden to Dows for the purpose of supplying electricity for lamps and motors in that town.

JEWELL, IA.—An election has been called to be held on Jan. 29 to vote on the proposition to issue bonds to the amount of $12,000, the proceeds to be used to install a municipal electric-light plant. M. J. Severson is city clerk.

MENLO, IA.—The proposition to grant a twenty-year franchise to G. F. Buckley to supply electricity for lamps in Menlo will be submitted to a vote of the people. Mr. Buckley has installed a dynamo to supply electricity to light his large implement store and proposes to furnish electrical service in the town.

MORNING SUN, IA.—P. A. Yohe, connected with the local telephone company, is contemplating the establishment of an electric-light plant in Morning Sun. He has submitted a proposition asking for a twenty-year franchise and offers to supply electricity for lamps at 15 cents per kw-hour.

OAKLAND, IA.—It is reported that the electric-light plant will be rebuilt.

REMSEN, IA.—Petitions are being circulated for a special election to be held to vote on the proposition to establish an electric-light plant in Remsen. M. R. Faber, of Remsen, is interested in the project.

ROLAND, IA.—It is reported that arrangements have been made whereby electricity for lighting the town of Roland will be received from the municipal electric-light plant at Story.

SHENANDOAH, IA.—The Artificial Ice, Power, Heat & Light Company is reported to have submitted a proposition to the Council offering a contract involving a new electric street-lighting system.

ABILENE, KAN.—It is reported that a special election will soon be held to vote on the proposition of extending the franchise of the Riverside Light & Power Company. If the ordinance fails, it is expected that a special election will soon be called to submit the proposition to establish a municipal electric-light plant to a vote.

LANSING, KAN.—The Leavenworth Light, Heat & Power Company is contemplating extending its transmission line to Lansing to supply electrical service in that town.

TOWANDA, KAN.—Contracts have been awarded by Ford Bolton to the United Electric Company, of Wichita, Kan., for equipment for a complete electric-light plant to be installed in Towanda.

WICHITA, KAN.—At an election held Dec. 12 the proposition to establish a municipal electric-light plant was defeated. Bonds to the amount of $1,000,000 were voted to build a municipal water-works system.

DONALDSONVILLE, LA.—The City Council, it is reported, is considering improvements to the municipal electric-light plant, including the installation of new engines, to cost approximately $30,000.

THIBODAUX, LA.—The Town Council has decided to reduce the price for electricity for lamps from 15 cents per kw-hour to 10 cents per kw-hour, the rate to take effect from Nov. 1, 1911.

BIDDEFORD, MAINE.—The Clark Power Company, recently incorporated, proposes to generate and distribute electricity for lamps, heat and motors in the towns of Buxton, Hollis and Dayton. The company is capitalized at $10,000 and the officers are: Cecil F. Clark, of Hollis, president; Lucien F. Clark, of Dayton, treasurer, and George L. Emery of Saco, clerk.

[illegible] the James Murchie & Sons Company. The street-railway company, it is said, intends to erect a modern power plant on the site to supply energy to operate the railway and for other purposes. The steam-power plant at Ferry Point will be maintained as an auxiliary when the new [illegible]

WILTON, MAINE.—The Wilton Electric Light, Gas & Power Company has filed an amendment to its charter, changing its name to the Wilton Light Company and increasing its capital stock from $10,000 [illegible]

[illegible] Leominster Electric Light & Power Company, has submitted a proposition to the town officials offering to erect and maintain a large electric sign in a prominent part of the town provided the town will furnish [illegible]

NORTH EASTON, MASS.—Preparations are being made by the Edison Electric Illuminating Company of Brockton for the erection of an electric-light system in North Easton, for which the company was granted a franchise some time ago.

SOMERVILLE, MASS.—Among the recommendations submitted to the Board of Aldermen by the aldermanic finance committee is the establishment of a municipal lighting plant to light the city hall, public library and high schools.

GRAND RAPIDS, MICH.—Mayor Campbell has appointed a committee to look into the question of installing a municipal electric-light plant. At present the Grand Rapids-Muskegon Power Company supplies the city with electric service.

JACKSON, MICH.—The State Railroad Commission has granted the petition of the Commonwealth Power Company to issue bonds to the amount of $1,860,000, the proceeds to be used for extensions and improvements to its properties in Grand Rapids, Muskegon, Owosso, Jackson and several other cities.

SPARTA, MICH.—The plant of the Sparta Milling Company, including an electric-light plant, grain elevator and coal yard, was destroyed by fire recently, entailing a loss of about $200,000.

GLENCOE, MINN.—The contract for furnishing the city with a 36-kva generator was awarded to the Electric Machinery Company, of Minneapolis, Minn. The Power Equipment Company, of Minneapolis, Minn., secured the contract for a Foos oil engine to operate the plant.

MANKATO, MINN.—The Consumers' Power Company contemplates extending its system to towns adjacent to Mankato. An electric transmission line may be erected through Vernon Center, Amboy, Winnebago and Blue Earth, one through Kasota and St. Peters, another to Lake Crystal, one to Faribault through Janesville, Waseca, Waterville and Eagle Lake, Madison Lake and Elysian. The company has already secured franchises in some of these places. Energy for operating the system will be supplied from the power plant at Rapidan dam.

SLEEPY EYE, MINN.—The contract for furnishing a 75-kw, 2300-volt, alternating-current generator for the municipal electric plant was awarded to the Electric Machinery Company, of Minneapolis, Minn.

WAYZATA, MINN.—It is reported that bonds have been voted for the installation of a municipal electric-light plant and water-works system. The cost of the electric plant is estimated at $15,000.

WOOD LAKE, MINN.—The installation of a municipal electric-light plant in Wood Lake is reported to be under consideration by the City Council.

LINCOLN, MO.—It is reported that preliminary steps have been taken by W. C. Cain for the installation of an electric-light plant in Lincoln It is proposed to erect a plant and supply electricity for lighting the streets of the city and also for commercial and residential lighting.

SKIDMORE, MO.—The Maryville Light & Power Company, of Maryville, Mo., has submitted a proposition to supply electricity in Skidmore. The cost of the proposed plan is estimated at about $8,000 and would include the erection of a transmission line 14 miles long.

BUTTE, MONT.—Plans are being considered by the North Butte Mining Company for the installation of electrically operated ore cars throughout its properties.

STANTON, NEB.—Arrangements have been made for extensions and improvements to the municipal electric-light and water plant, including the erection of a boiler room, 30 ft. x 40 ft., and the installation of one 125-hp boiler, one 100-hp steam engine and an additional generator, for which bids will be received until Jan. 8, 1912. C. A. Hickman, of Sioux City, Ia., consulting engineer, has charge of the work.

FALLON, NEV.—The Secretary of the Interior at Washington, D. C., has authorized the Reclamation Service to purchase copper wire for use in the erection of the transmission line from Lahontan to Fallon, Nev., the cost not to exceed $6,000. The proposed line will transmit electricity developed at the dam to Fallon to be used for municipal and other purposes.

TUSCARORA, NEV.—The Tuscarora Mines Company is planning to enlarge its electric-power plant. H. S. Haskins is general manager of the company.

WINNEMUCCA, NEV.—The contract for the installation of machinery at the new power plant of the Winnemucca Water & Light Company has been awarded to the C. C. Moore Company, of San Francisco, Cal.

WONDER, NEV.—The managers of the Jack Pot mine will soon [illegible] the erection of a transmission line, 1[illegible] miles in length, to its properties. E. S. Cunningham is superintendent.

ROSWELL, N. M.—The Mountain States Telephone & Telegraph Company has submitted a proposition to the City Council offering to install a fire alarm system in the city of Roswell and to maintain the same hereafter, provided the city will pay for the boxes and $300 per year for maintenance for same. The cables and wires of the Mountain States Telephone & Telegraph Company are to be put in underground conduits in the business district of the city.

BROOKLYN, N. Y.—The contract for furnishing and installing an air compressor at Williamsburg Bridge, borough of Brooklyn, has been awarded to the Blaisdell Machinery Company, of Bradford, Pa., at $6,350.

LESTERSHIRE, N. Y.—Plans are being prepared for the erection of an electric-power plant to supply electricity to operate the shoe shops owned by Endicott, Johnson & Company in Lestershire. It is expected that the service will eventually be extended to Endicott.

OSWEGO, N. Y.—The People's Gas & Electric Company is planning to extend its transmission lines to supply electricity in the suburbs. It is proposed to extend its system to the Beach and connect with the main lines at Fruit Valley.

SYRACUSE, N. Y.—Among the recommendations to the State Legislature for appropriations for the Syracuse State Institution for Feeble-Minded Children are: For the reconstruction of the local telephone system, $1,500; rewiring electric system, $3,927; electric-light plant, $8,000, etc.

WATERTOWN, N. Y.—The Watertown Light & Power Company has commenced work on the erection of a transmission line from the terminus of the present line at Brownville to the plant of the Parchment Paper Company at Dexter. The Watertown company is preparing to supply the Parchment company with electricity to operate its plant. The contract calls for 400 hp. The Watertown Light & Power Company is said to be negotiating with other companies in Dexter with a view of supplying energy to operate other industries in that town.

SHELBY, N. C.—At a special election held Dec. 5 the proposition to issue bonds to the amount of $13,000 to take over the plant and holdings of the Shelby Electric Light Company was carried. The city will take over the plant on May 1, 1912, provided the bonds are disposed of by that time.

KENMARE, N. D.—The Kenmare Light & Power Company is contemplating extensive improvements to its plant and service both in the city and at the mines.

MICHIGAN, N. D.—The question of installing an electric-light plant in Michigan is reported to be under consideration by the City Council.

REYNOLDS, N. D.—The City Council is reported to be considering the installation of an electric-light plant.

CINCINNATI, OHIO.—The City Council has adopted a resolution directing the Union Gas & Electric Company to supply electricity for lighting in Mount Washington, Carthage and Madisonville in accordance with an annexation agreement.

COLDWATER, OHIO.—William Jasperson, of St. Mary's, Ohio, has been granted a fifteen-year franchise to construct and operate an electric-light plant in Coldwater and a ten-year contract for lighting the streets of the town. It is said that a company has been formed to operate the system.

COLUMBUS, OHIO.—Arrangements have been completed whereby the power plant at the State penitentiary will supply electricity for lighting the State House. Within a short time the plant will supply electricity for lighting the State school for the blind; eventually other State institutions will be connected with the plant. Until the present time the service has been supplied by the Columbus Railway & Light Company. Arrangements have been made with the municipal electric-light plant to supply the service in case of emergency.

DELAWARE, OHIO.—The City Council has granted the Delaware Electric Light, Heat & Power Company a renewal of its franchise for a period of ten years.

EAST LIVERPOOL, OHIO.—Plans are being considered for extensive improvements to its main power plant and substations along the railway. The output of the plants at East Liverpool and Steubenville will be doubled.

MASSILLON, OHIO.—Plans have been submitted to the City Council by Public Service Director Pietzcker for the installation of an ornamental street-lighting system in the downtown district. He recommends replacing the present arc lamps with ornamental lamp standards carrying a cluster of incandescent lamps. The cost of the proposed change is estimated at $9,017, which would provide for three standards carrying five incandescent lamps and sixty-three three-lamp standards.

SIDNEY, OHIO.—The Western Ohio Electric Railway Company has secured a ten-year franchise to supply electricity for lamps, heat and motors in Sidney. The company is furnishing street-lighting service in Beaver Dam and Rawson and is preparing to install street lamps in Lockington and Mount Cory.

ZANESVILLE, OHIO.—Preparations are being made by the Southeastern Ohio Railway, Light & Power Company for the installation of a new turbine at its power plant in Zanesville.

MUSKOGEE, OKLA.—The Missouri, Oklahoma & Gulf Railway Company, which is planning to extend its lines from Wagoner, Okla., to Kansas City, and south from Sherman, Tex., to the Gulf, will equip

[illegible] line between Wa[illegible] [illegible] said. An electric railway, it is [illegible] from Wagner to the Grand River, where a large amusement park will be established.

OKLAHOMA CITY, OKLA. [illegible] contract for the construction of an electrolytic sewage-disposal plant, to be erected at Ash Street and Western Avenue, to J. A. McMahan and S. P. Bennett, to cost $46,582.

ASHLAND, ORE.—A special election will soon be held to vote on the proposition submitted by the Siskiyou Electric Light & Power Company to purchase the municipal electric-light plant at a price of $105,000, the title to remain with the city until the outstanding bond issue of $100,000 is settled. The company requests a fifty-year franchise and agrees to give the present flat rate charged for electric energy. Bonds to the amount of $75,000 were originally voted for the construction of the municipal electric plant, and this has been further increased by $30,000. While the present franchise of the Siskiyou company, in the name of the Ashland Electric Power & Lighting Company, was repealed Oct. 15, an extension has been granted, inasmuch as the company has been fulfilling its contract of emergency service on peak load period at the municipal plant.

BAKER, ORE.—The Kent Ore Reduction Company has begun work on the installation of an electric-power plant to supply electricity to operate its mining properties. H. W. Kent is manager of the company.

GALICE, ORE.—Plans are being prepared by the Cougar Consolidated Mine Company, which operates the Barr placer mines, for the installation of an electric-light plant at its properties. L. H. Medford is manager of the company.

PORTLAND, ORE.—The Stark Street Improvement Association is planning the installation of an ornamental street-lighting system on Stark and Burnside Streets. It is proposed to use the cluster lamp system.

PORTLAND, ORE.—A special meeting of the Pacific Power & Light Company will be held Dec. 29 in Augusta, Maine, to vote on the proposition to increase the capital stock of the company from $7,500,000 to $12,000,000. The proceeds of the stock will be used to liquidate floating debts and provide additional working capital.

PORTLAND, ORE.—The Oregon Electric Railway Company has filed amendments to its charter with the State Department increasing its capital stock from $100,000 to $6,000,000. The company is planning the construction of an electric railway from Natron to Ontario, with branches to Agency Plains, Klamath Falls, Lake View and Goose Lake.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 25 for furnishing automatic signal material for the relocation of the Panama Railroad. Blanks and general information relating to this circular (No. 669) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

AVONMORE, PA.—Application will be made on Jan. 2, 1912, for a charter for the Avonmore Electric Company, which proposes to supply electricity for lamps and motors in the borough of Avonmore. Interests connected with the West Penn Electric Company are concerned in the project. H. L. Mitchell, U. W. Tinker and Thomas S. Henderson are the incorporators.

INDIANA, PA.—The West Penn Electric Company, it is reported, will apply for a franchise in Indiana after Jan. 1, 1912, to erect transmission lines to supply electricty for lamps and motors. If granted a franchise the company will begin work on erection of the line as soon as the right-of-way is secured.

PHILADELPHIA, PA.—The Philadelphia Electric Company submitted the only bid to supply electricity for lighting the streets of the city. The prices given are the same as under the present contract, under which the company furnishes electricity for lamps erected on poles or fixtures connected by cable installed in pipe or conduit owned by the company at 29 cents per lamp per night, and for electricity furnished for lamps erected or transferred to ornamental poles furnished by the company and attached to underground cables in the conduits owned by city at 27 cents per lamp per night. Including 936 additional arc lamps, which were put into service about Sept. 1, the city's electric-lighting system will cost this year about $1,268,752. The estimate of the Electric Bureau for 1912 is $29,356 for electric lighting of the Southern Boulevard, and the 936 additional lamps installed last year will cost $1,356,478. The bureau asks for $25,000 for new lamps this year. The total number of street lamps now in use is 14,038.

READING, PA.—Preparations are being made by the Metropolitan Electric Company, of Reading, to supply electricity for lamps, heat and motors in Lebanon and vicinity from its new power plant at West Reading. The Edison plant at Lebanon will be kept intact for use in emergencies. The Metropolitan company will supply energy to operate the proposed electric railway to be built between Myerstown and Womelsdorf.

MENNO, S. D.—The Town Board recently granted a franchise to Skorepa & Schenk, of Menno, S. D., to install and operate an electric light plant in Menno.

EMBREEVILLE, TENN.—The Nolachuckey Power Company is planning to install a power plant and cotton mill in Embreeville. The proposed work will include a dam 90 ft. in height, which will create a lake about 6 miles in length. The company proposes to supply electricity in Embreeville and all the neighboring towns. The cost of the plant [illegible]

COLLEGE STATION, TEX.—The contract for electric wiring of the new dormitory and the new engineering building at the Agriculture and Mechanical College has been awarded to the Barden Electric Company, of Houston, Tex. F. E. Giesecke is college architect.

DALLAS, TEX.—A committee has been appointed to investigate various systems of lamps and equipment for an ornamental street-lighting system on Main and Commerce Streets and the streets between these thoroughfares. Requests from property owners indicate that the district may be enlarged. L. Blaylock is chairman of the committee.

PECOS, TEX.—The Tri-State Telephone Company, it is expected, will begin work within ninety days on the erection of a new telephone line between Midland and Pecos and from Pecos to Carlsbad, to cost approximately $120,000. The company has recently taken over a number of independent telephone lines in this section.

WACO, TEX.—Property owners on Austin Avenue and the Young Men's Business League are reported to have decided to install an ornamental lighting system on ten blocks on that thoroughfare. It is proposed to erect ornamental lamp standards, each carrying five lamps, ten to a block.

OGDEN, UTAH.—Plans are being considered by the Ogden Rapid Transit Company for an extension of its railway to the Huntsville district, a distance of about 8 miles. The cost of the work is estimated at about $300,000. J. W. Bailey is superintendent.

SALT LAKE CITY, UTAH.—The Telluride Power Company, it is reported, will apply to the City Council for a franchise to construct and operate an electric distributing plant in Salt Lake City. The company proposes to supply electricity for manufacturing plants in both large and small quantities. A complete lighting system will be installed if sufficient patronage is guaranteed.

RUTLAND, VT.—Arrangements are being made by the Rutland Railway, Light & Power Company to extend its transmission lines to South Poultney, where it will supply electricity to the quarries. The company will also extend its service south on the Granville Road as far as Donnelly Hill and will furnish electricity in the intermediate territory.

ATTALIA, WASH.—The County Commissioners have granted the Attalia Land Company a franchise to construct an electric-light and power plant and water-works system.

BELLINGHAM, WASH.—It is reported that the large cement plant which is being erected by the Balfour-Guthrie Company in Bellingham will be equipped for electrical operation.

CAMAS, WASH.—The Northwestern Electric Company, of Portland, Ore., has been granted a franchise to supply electricity for lamps and motors in Camas. A transmission line will be erected from its proposed hydroelectric power plant on the White Salmon River to Camas, work on which has commenced.

CHEHALIS, WASH.—The Washington-Oregon Corporation is reported to have applied to the Board of County Commissioners for a franchise to supply electricity in the towns of Adna and Littell.

IRONDALE, WASH.—The Irondale Light & Power Company has made application to the Board of County Commissioners for a franchise to extend its electric transmission system to various parts of Jefferson County. The company proposes to distribute energy from the main transmission line of the Olympic Power Company. A. R. Coleman and W. L. Jenkins are interested in the company.

LONGMINE SPRINGS, WASH.—Plans are being prepared by Frederick Heath, architect, of Tacoma, Wash., for the construction of a four-story hotel to be erected at Longmine Springs, to cost $800,000. An electric-power plant, it is stated, will be installed. Longmine Springs has not a post office.

OLYMPIA, WASH.—Plans are being considered by the City Council for the installation of arches, carrying tungsten lamps, on East Fourth Street.

PATEROS, WASH.—Work is progressing rapidly on the new electric-power plant, which is located on the Methow River, about 2½ miles from Pateros. The plant when completed will supply electricity for lamps and motors in Pateros, Methow and Brewster. The company is securing contracts for furnishing energy to operate pumping plants for irrigation purposes.

SEDRO-WOOLLEY, WASH.—The Council has granted the Bellingham & Skagit Interurban Railway Company an electric-light franchise in Sedro-Woolley for a period of fifty years.

SUMNER, WASH.—Plans have been prepared for the construction of a new yeast-manufacturing plant for the Fleischman Company, of New York, N. Y., at Sumner. The proposed plant will include an electric generating plant to supply electricity for lamps and motors. Robert Embleton will have charge of construction.

WALLA WALLA, WASH.—Sealed proposals will be received by the State Board of Control, Olympia, Wash., until Jan. 3, for electrical supplies for the State Penitentiary at Walla Walla, plans and specifications for which are on file at the office of John Kow, architect, Paulsen Building, Spokane, Wash.; office of superintendent of penitentiary,

[illegible] Seattle, Wash., and Bullard & Hill, architects, Provident Building, Tacoma, [illegible]

[illegible] Company, of Dayton, Ohio. The cost of the work is estimated at [illegible] A fifty-year franchise is included in the transaction. I. Tobin is interested in the enterprise.

MORGANTOWN, W. VA.—The Kuhn interests, headed by J. S. & W. S. Kuhn, of Pittsburgh, Pa., it is reported, will build large dams on the Cheat River in West Virginia for power purposes, the syndicate of English capitalists having withdrawn the contest for property rights. The Cheat River project will involve an expenditure of more than $1,000,000.

RAVENSWOOD, W. VA.—The gas engine in the municipal electric-light plant was completely wrecked on Dec. 24. The engine is a 75-hp Columbus, throttling type, and has been used about two years. C. O. Nillson is superintendent.

BELOIT, WIS.—The Beloit Water, Gas & Electric Light Company has reduced the price of electricity to large consumers for manufacturing purposes. The new rate is from 4 cents to 2 cents per kw-hour.

LAKE GENEVA, WIS.—Efforts are being made by the local business men to have the Milwaukee Electric Railway & Light Company extend its electric transmission line from Burlington to Lake Geneva to supply electrical service here.

LA CROSSE, WIS.—Receivership certificates of the La Crosse Water Power Company amounting to $150,000 are reported to have been sold. Work, it is said, will soon begin on repairing the damage to the plant in Hatfield caused by the flood last October.

MADISON, WIS.—Bids will be received by Lew F. Porter, secretary of the Capitol Commission of Wisconsin, Madison, Wis., until Jan. 16, 1912, for furnishing material and labor for the electric work of the south wing of the Wisconsin State Capitol, now under construction at Madison. Plans and specifications may be examined at the office of George B. Post & Sons, architects, 347 Fifth Avenue, New York, N. Y., office of the Capitol Commission, Madison, Wis., and the Builders & Traders' Exchange, Milwaukee, Wis. Plans may also be obtained from Lew F. Porter, secretary, upon deposit of $100, which will be refunded upon return of the plans.

SHEBOYGAN, WIS.—The controlling interest in the Sheboygan Railway & Light Company, of Sheboygan, Wis., is reported to have been acquired by F. W. Roebling, of Trenton, N. J. The company is capitalized at $600,000 and operates an interurban railway, from Sheboygan to Elkhart Lake, 23 miles long, as well as the city car line and the local lighting and power plant.

DUNSMUIR, B. C., CAN.—The Canadian Collieries, Ltd., has awarded the contract for the construction of its proposed hydroelectric power plant on the Puntledge River to Grant Smith & Company, Pacific Building, Vancouver, B. C. The cost of the plant is estimated at about $500,000.

OAK BAY, B. C., CAN.—The City Council is advertising for bids for the installation of an electric street-lighting system.

VANCOUVER, B. C., CAN.—Plans are being prepared by L. E. Geary, naval architect, for the Bell-Irving Company, Ltd., of Vancouver, B. C., Can., for three cannery boats. A separate power plant will be installed on each vessel to supply electricity for lamps, searchlight and [illegible]

VANCOUVER, B. C., CAN.—Contracts have not yet been placed for all of the machinery for the proposed hydroelectric plant of the Canadian Collieries, of Dunsmuir, to be erected on the Punledge River, Vancouver Island. As yet some of the details for construction of plant have not been decided upon. Grant, Smith & Company, of Vancouver, B. C., have secured the contract for construction of plant. H. K. Owens, Hoge Building, Seattle, Wash., is consulting engineer.

VICTORIA, B. C., CAN.—The Wellington Colliery Company has been granted permission by the government to construct a power and impounding dam on the Point Ledge River, near the outlet of Comax Lake.

SELKIRK, MAN., CAN.—It is reported that plans are being considered for the installation of a municipal electric-light plant in Selkirk, for which bonds to the amount of $25,000 will be issued.

HALIFAX, N. S., CAN.—Negotiations have been completed for the merger of the Halifax Electric Tramway Company and the MacLeod Pulp & Paper Mills Company. The last-named company controls the water-power on the Mersey River, where it is estimated that 25,000 hp can be developed, and the Halifax Electric Tramway Company owns water rights on the Gaspereau River capable of developing 5000 hp. The capital stock under the consolidation will be $6,000,000. The company proposes to supply electricity for lamps and motors. Sir Frederick Borden, R. A. Robert and J. W. McConnell, of Montreal, Que., Can.; B. F. Pearson, F. B. McCurdy, M. P., John R. MacLeod, of Halifax, and Frank Stanfield, of Truro, are interested in the company.

LONDON, ONT., CAN.—Plans are being considered by the Northwestern Radial Railway Company for the construction of a power plant and dam at Rock Glen, Arkona, Ont., work on which will probably begin next spring. The proposed work will involve an expenditure of about $3,000,000 and include the construction of a railway and power plant. Smith, Kerry & Chace, of Toronto, Ont., are engineers. D. A. Stewart is chairman.

PETERBORO, ONT., CAN.—Negotiations are under way between the Hydroelectric Power Commission and the Otonabee Power Company, of Peterboro, for the acquiring by the commission of the generating plant and distributing system of the company. This is another step toward the introduction of a public power service into the Trent Valley by the commission.

WATERFORD, ONT., CAN.—At an election held recently the ratepayers voted in favor of the proposition to issue bonds for the construction of an electric-light plant in Waterford.

EMARD, QUE., CAN.—The plant and holdings of the St. Paul Light & Power Company are reported to have been purchased by the Canadian Light & Power Company, of Montreal, Que. The consideration is said to be $100,000.

QUEBEC, QUE., CAN.—The City Council has awarded the contract for street lighting to the Dorchester Electric Company on condition that the net rates for electricity to private consumers are reduced from 10 cents to 7¼ cents per kw-hour. The franchise of the company, which expires this year, was extended. Plans have been prepared by the Dorchester company for the erection of its plant. The distribution system will include 20 miles of underground work and 50 miles of overhead lines. Ornamented lamp standards will be used on the principal streets, of which about 250 will be required. The Quebec Railway, Light, Heat & Power Company holds the present contract.

New Industrial Companies.

THE ELECTRICAL SUPPLY MANUFACTURING COMPANY, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $25,000. The incorporators are: E. Pereya and T. L. Pereya, of Brooklyn, N. Y., and M. C. Worth, of New York, N. Y. The company proposes to manufacture electrical supplies.

THE ELECTRIC WIND TURBINE COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $150,000 by J. C. Childs and B. G. Tallman, of Rochester, N. Y., and M. W. Comstock, of Buffalo, N. Y. The company proposes to manufacture electrical machinery, windmills, etc.

THE ELECTROLYTIC PROCESS COMPANY, of New York, N. Y., has been incorporated with a capital stock of $600,000 for the purpose of manufacturing alloys of metals, electroplating, etc. The incorporators are: M. C. Dobson, F. P. Burrall and F. H. Richmond, of New York, N. Y.

THE INTERNATIONAL GAS ENGINE COMPANY, of Harrison, N. J., has been incorporated with a capital stock of $100,000 by E. F. Paulu, G. R. Townsend, of East Orange, N. J., and E. M. Souza, of New York, N. Y. The company proposes to manufacture engines, machines, dynamos, motors, etc.

THE JENKS LANTERN COMPANY, of Chicago, Ill., has been incorporated by Harriet B. Jenks, Lloyd C. Spencer and W. H. Chapman. The company is capitalized at $16,000 and proposes to manufacture and deal in electrical appliances.

THE LOMBARD MANUFACTURING COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $30,000 by J. C. Lombard, P. W. Hodgkinson and S. C. Ward, of Rochester, N. Y. The company proposes to manufacture engine starters, mechanical devices, etc.

THE RELIABLE MAINTENANCE COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $2,500 to manufacture and deal in electrical equipment. The incorporators are: Samuel M. Rush, George W. Clausing and L. Jost.

New Incorporations.

FRESNO, CAL.—Articles of incorporation have been filed for the Fresno & Eastern Railway Company by George A. Aldrich, of Audubon, N. J.; Fayette M. Meigs, of Oakland, and Albert B. Dodd, of San Francisco, Cal. The company is capitalized at $1,500,000, and proposes to build an electric railway from Fresno to Shaver, in the Sierra Mountains, a distance of about 78 miles.

MARYSVILLE, CAL.—The Northern Electric Railway Company has been incorporated with a capital stock of $1,500,000 for the purpose of building the Marysville-Colusa branch. The proposed railway will be 30 miles long. The incorporators are: Leon J. De Sable, George E. Springer and Herbert W. Furlong.

SAN FRANCISCO, CAL.—The Northern Power & Water Company has been chartered with a capital stock of $25,000,000 by F. T. Boland, C. F. Willard, H. F. Atkinson, A. J. Allan and A. C. Green, all of San Francisco, Cal., and S. J. Langmaid, of Berkeley, Cal.

MARION, IND.—The Marion Telephone Company has been incorporated with a capital stock of $100,000 by David Blumenthal and Jerome Herff.

Personal.

MR. [illegible] Electric Company at [illegible], of Chicago.

MR. E. V. D. JOHNSON, manager of the Northern California Power Company at Redding, Cal., has moved his office to San Francisco, where the headquarters of the company are located.

MR. [illegible] department of the Morgan Crucible Company, Ltd., London, England, is at present on a [illegible].

MR. H. THURSTON OWENS will lecture before the New York Section, Illuminating Engineering Society, on Jan. 11, 1912, on "Modern Practice in Street Lighting, with Especial Reference to New York City."

MR. EUGENE CREED, formerly in charge of the new-business department of the Toronto Electric Light Company, will assume the management of the advertising department of the Morris Iron Company, of New York City and Frederick, Md., after the first of the year.

MR. JAMES A. DOUGHERTY, of Easton, Pa., has been appointed commercial manager of the Bristol (Tenn.) Gas & Electric Company. Mr. Dougherty succeeded Mr. A. J. Young, who has resigned to become general manager of the Galveston (Tex.) Electric Company.

MR. HENRY FLOY, consulting engineer, of New York, has been engaged by the receiver of the Twenty-eighth and Twenty-ninth Streets Crosstown Railroad Company, Mr. J. B. Mayer, to make an appraisal of the property of that railroad in New York City for use in connection with the reorganization of the company, as well as at hearings before the Public Service Commission.

MR. E. C. FOSTER has been appointed general manager of the Manchester Traction, Light & Power Company, Manchester, N. H., succeeding Mr. J. Brodie Smith, whose resignation is referred to elsewhere in this column. Mr. Foster was formerly second vice-president of the New Orleans Railway & Light Company, New Orleans, La., and more recently has been connected in a confidential and advisory capacity with Messrs. Sanderson & Porter, of New York.

MR. GEORGE W. WILDER has severed his connection with the Edison interests at Santa Barbara, Cal. During the two and one-half years in which Mr. Wilder was connected with the company he effected the consolidation of the Edison Electric Company and the Merchants' Mutual Light & Power Company into the present Santa Barbara Gas & Electric Company, rebuilt the distribution system of the two plants and enlarged the power station of one of the companies, the other station having been dismantled. Mr. Wilder is succeeded by Mr. J. H. Fisher, of Redlands.

MR. W. E. DAVIS, vice-president in charge of sales of the Goulds Manufacturing Company, Seneca Falls, N. Y., has just started on an extensive trip in the interests of the company. He is planning to visit its representatives in Boston, New York, Philadelphia, Richmond, Pittsburgh, Wheeling, Cleveland, Warren, Cincinnati, Louisville, Chicago, St. Louis, Kansas City, Joplin, Memphis, Birmingham, Montgomery, Mobile, New Orleans, Beaumont, Houston, Galveston, San Antonio, El Paso, Phœnix, Tucson, Albuquerque, Los Angeles, San Francisco, Portland, Seattle, Tacoma, Boise, Salt Lake City, Denver, Omaha. If everything goes as planned, Mr. Davis expects to complete his trip and return to Seneca Falls early in March.

MR. J. BRODIE SMITH, vice-president and general manager of the Manchester (N. H.) Traction, Light & Power Company, has resigned with the intention of entering private engineering practice with offices at Room 2, Odd Fellows' Building, Manchester. Mr. Smith has been engaged in electrical work for about twenty-five years and has been prominent in Manchester central-station circles since the organization of the Ben Franklin Electric Light Company, which was later consolidated with the Manchester Electric Light Company. Since 1901 he has been general manager of the Manchester Traction, Light & Power Company, which controls the street-railway and central-station business of the Manchester district. Under his management the properties have developed along sound and progressive lines, including the development of several hydroelectric power plants in the Merrimac Valley and important street-railway extensions and park establishments. The earnings of the company have risen during his administration from about $70,000 to $500,000 per year. Mr. Smith will take up his new work about Feb. 1, and will be succeeded at Manchester by Mr. E. C. Foster, of New York, formerly general manager of the Boston & Northern Street Railway Company, and later president of the New Orleans Railway & Light Company.

MR. CHARLES P. MADSEN, designer of the line of electrically heated appliances made by the Pelouze Electric Heater Company, of Chicago, and one of the organizers of that company, has resigned and sold his interest in the company to engage in engineering and designing work for himself, with office and laboratory at 38 North Clinton Street, Chicago. Mr. Madsen came to Chicago in 1908 from Salt Lake City, where he had been engaged in electric-heating-appliance design and manufacture in a small way for a year previous. Before entering this field he was for two years an assistant in the physics and electrical laboratories of the Utah State School of Mines, and before that was for seven years engaged in practical electrical work of various kinds at Salt Lake City. During the latter part of his studies at the Utah State School of Mines he began the investigation of the elements of electrically heated apparatus, including the properties of alloys and high temperature insulating materials. During the school year 1910 and 1911 he gave a course of lectures to the senior class at the Lewis Institute, Chicago, on the principles of duplicate manufacture. He also gave a special lecture on the design of electrically heated apparatus. He is the author of a table on the electrical properties of nichrome resistance metal, which is the result of extended investigation, and has made a special study of the insulating qualities of compounds and materials under high temperatures, resulting in the preparation of a number of such compounds for withstanding the high temperature which is common with the new nickel-chromium alloys now much used in electrically heated appliances. In his new work Mr. Madsen will act as designing and consulting engineer for those engaging in the manufacture of electrically heated appliances, and will undertake any special research necessary. He will also design apparatus for use in various industrial processes for the users of such processes.

Trade Publications.

BALL-BEARING GREASE.—The Hess-Bright Manufacturing Company, Philadelphia, Pa., has issued a booklet in which are outlined the requirements of a ball-bearing grease. Particular attention is directed to artificial grease made by blending mineral oils with soap formed from horse oil treated with caustic.

EDISON MAZDA LAMPS FOR STANDARD TRAIN-LIGHTING SERVICE.—Owing to the improvement in the manufacture of the tungsten lamp the delicacy of the filament has been overcome and the improved type of the G-E Edison "Mazda" lamp is now suitable for use in train lighting. These lamps are made in two voltage ranges, 25-34 and 57-65, and in wattages of 15, 25 and 50. Bulletin No. 4897, recently issued by the General Electric Company, illustrates and describes the new lamps in detail.

TRIPLEX PUMPS.—Bulletin No. D-205 of the Deane Steam Pump Company, Holyoke, Mass., contains an extensive discussion of the construction of its triplex power pumps of the vertical, double-acting type. It explains the advantages of the triplex machine over other forms of power pumps, principal among which is that the combined discharge from the cylinders is practically uniform in quantity and pressure. The pumps listed range in size of cylinders from 2 in. x 3 in. to 13 in. x 12 in., and in outputs from 11.5 gal. to 2475 gal. per minute.

DIRECT-CURRENT SWITCHBOARDS.—In Bulletin 4902, recently issued by the General Electric Company, are listed direct-current switchboards of 125 volts and 250 volts for controlling three-wire generators up to 200-kw rating and two-wire or three-wire feeder circuits up to 1200 amp. These panels are so designed that the appearance of both the front and back of the switchboard will be neat and uniform. The instruments, circuit-breakers, switches, etc., composing the equipment of these panels are shown, and the bulletin contains connection and dimension diagrams of various panels.

BUSINESS NOTES.

THE IMPERIAL MANUFACTURING COMPANY, maker of washing machines for electrical operation, has moved its factory to Sand Springs, Okla.

YARNALL-WARING HOUSE ORGAN.—The Yarnall-Waring Company, of Philadelphia, is putting out an interesting little magazine called the *Blow-Off*, which will be circulated gratis among stationary engineers.

LOS ANGELES ENGINEERING & EQUIPMENT COMPANY.—The Engineering & Equipment Company has been organized, with headquarters in Los Angeles, Cal. The company will have a large warehouse in that place and do both engineering and contracting work. Mr. L. G. Hooper is general manager.

THE PHILADELPHIA STORAGE BATTERY COMPANY has opened a new office in the American Building, Broadway and Columbus Circle, in New York, in order to facilitate the handling of its increasing business in electric-vehicle batteries and other types of batteries used in the automobile trade. The new office is in charge of Mr. Walter L. Thompson, the New York representative of the company.

SOOT EXTRACTOR.—A test is being made at the electric generating station of the Clinton (Mass.) Gas Light Company of a turbine driven soot extractor designed by Mr. E. J. McCarthy, Clinton. The extractor is operated by steam under boiler pressure, and is equipped with a water-jet absorber which delivers the soot from the combustion chamber suspended in liquid to facilitate piping it away from the boiler-room. About five minutes are required in cleaning a combustion chamber.

"OUR ANCIENT LINEAGE."—As a Christmas greeting to electrical men the Cutler-Hammer Manufacturing Company, of Milwaukee, distributed some clever nonsense verses written by Mr. Charles L. Benjamin, of the company, on "Our Ancient Lineage." These couplets undertake to say that "If you want to know who were the first electrical engineers, you must go back in history for years and years and years." Thus Noah "was the earliest victim of an overload of juice," this fact showing that "they had blow-outs on the ark." Moses "was the first conductor, for he led the exodus." However, the Egyptians "made resistance," but were "thoroughly water-cooled." The serpent in the Garden receives credit as "the first to wind a coil," and "this it was, in brief, that led to the invention of the laminated leaf."

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 19, 1911.

[illegible] Place, New York.]

1,011,896. FUSE; A. Akin, East Orange, N. J. App. filed May 10, 1911. [illegible] vertical and "sneak" cur- [illegible]

1,011,898 METALLURGY OF ZINC-BEARING LEAD SULPHIDES WITH OR WITHOUT SMALL ADMIXTURES OF OTHER METALS; E. A. Ashcroft, Sogn, Norway. App. filed April 9, 1910. Treatment of concentrates from refractory ores, etc., with fused metallic chlorides and electrolysis.

1,011,899. METALLURGY OF METAL SULPHIDES; E. A. Ashcroft, Sogn, Norway. App. filed April 9, 1910. Separation of zinc sulphides containing lead, silver, iron, manganese and antimony, by chlorination and electrolysis.

1,011,900. METALLURGY OF METAL SULPHIDES; E. A. Ashcroft, Sogn, Norway. App. filed April 9, 1910. Zinc sulphide is heated [illegible] and then electrolyzed.

1,011,910. FITTINGS FOR SUPPORTING ELECTRIC CONDUCTORS; T. Buchholz, Kalk, Germany. App. filed July 15, 1907. A notched bar and profile rods for insulators.

1,011,919. SYSTEM OF MOTOR CONTROL; H. W. Cheney, Milwaukee, Wis. App. filed April 15, 1909. Reversible compressible resistance type for alternating current.

1,011,925. TELEGRAPHY; P. B. Delany, South Orange, N. J. App. filed Dec. 31, 1908. Automatic chemical recording instrument using currents of opposite polarity for dots and dashes.

1,011,939. ELECTROSTATIC MACHINE; F. Ghilarducci, Rome, Italy. App. filed July 2, 1908. A Holz machine with the stationary disk in two parts.

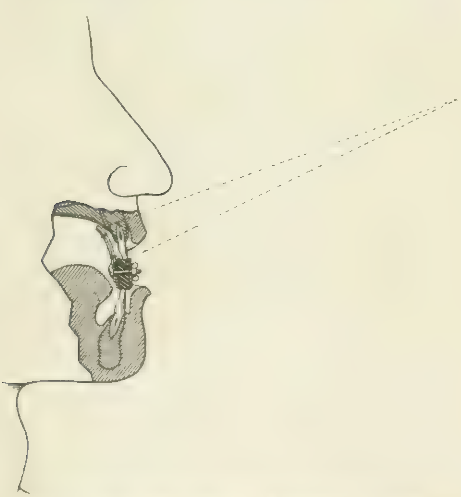
1,011,942. THERMOSTAT; J. D. Gould, New York, N. Y. App. filed Feb. 5, 1909. Tubular members. Improvement over Patent No. 774,847.

1,011,944. INDUCTION MOTOR; A. M. Gray, Milwaukee, Wis. App. filed April 3, 1909. Squirrel-cage windings; cooling and short-circuit- [illegible]

1,011,956. ELECTRIC LOCK; E. H. Hild, Philadelphia, Pa. App. filed Feb. 23, 1911. Door lock to be operated from a distance electromagnetically.

1,011,980. ILLUMINATING INSTRUMENT; H. T. Martin and J. F. Golden, Baltimore, Md. App. filed Nov. 30, 1910. A small lamp in an exploring instrument for dental and surgical use.

1,011,992. DRY BATTERY; D. L. Ordway and J. W. Brown, Lakewood, Ohio. App. filed Oct. 23, 1909. The cells are thin parallelopipeds for compactness.



[illegible] R[illegible] Skiagraphs.

1,012,010. SELF-WINDING CLOCK; T. B. Powers, London, England. App. filed March 11, 1911. Rewound by an electromotor periodically energized by automatic closing of the circuit

1,012,020. ELECTROMAGNET; C. E. Scribner, Jericho, Vermont. App. filed March 12, 1910. Adjustable support for the armature for harmonic bells.

1,[illegible] CONTROLL[illegible] Milwaukee, Wis. App. filed March 31, 1910. A switch in series with the motor for preventing arcing at the controller.

1,[illegible] RAILWAY TRAFF[illegible] APPARATUS; F. L. Dodgson, Rochester, N. Y. App. filed March 12, 1903. Fluid pressure motor and devices to avoid danger in case of crossed wires.

1,012,066. INDICATOR FOR TELEPHONE SWITCHING APPARATUS; H. W. Dunbar, Newark, N. J. App. filed April 8, 1910. An indicator slide between two tilting buttons.

1,012,077. METHOD OF MAKING HOMOGENEOUS MECHANICAL JUNCTURES; A. B. Herrick, Cleveland, Ohio. App. filed Nov. 25, 1904. Electric welding of copper bonds to rails.

1,012,07[illegible]. RELAY; W. K. Howe, Buffalo, N. Y. App. filed May 6, 1907. Railway-signaling circuit-breaker.

1,012,080. TRAFFIC-CONTROLLING DEVICE; W. K. Howe, Rochester, N. Y. App. filed Dec. 3, 1909. Semaphore electrically operated and having a centrifugal governor.

1,012,081. RELAY-CONTACT MOVEMENT; W. K. Howe, Rochester, N. Y. App. filed March 11, 1911. Reversible rigid contacts.

1,012,096. BATTERY TERMINAL; W. H. Pearce, Summit, N. J. App. filed Sept. 9, 1909. A flaring skirt to prevent creeping of the fluid.

1,012,102. COUPLING; J. Sachs, Hartford, Conn. App. filed Nov. 5, 1908. A U-clamp and nut for drawing the end of one cable or conduit to the side of another.

1,012,125. SWITCH KEY; E. B. Craft, Hackensack, N. J. App. filed May 14, 1910. Switch springs for a telephone key.

1,012,145. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y App. filed June 29, 1911. A base block with a removable fuse case with a cover.

1,012,146. ELECTRIC SYSTEM FOR DISCHARGING EXPLOSIVES; R. E. Noble, Chicago, Ill. App. filed March 22, 1909. For firing a number of shots successively and recording the fact of explosion.

1,012,149. PROCESS FOR THE PRODUCTION OF HALOGEN DERIVATIVES OF HYDROCARBONS; I. Pfeifer and E. Szarvasy, Budapest, Austria-Hungary. App. filed April 3, 1911. A gaseous mixture of the hydrocarbon and the halogen is subjected to silent electric discharge.

1,012,150. FLUSH ATTACHMENT-PLUG RECEPTACLE; C. D. Platt, Bridgeport, Conn. App. filed Oct. 14, 1910. For a reversible or a polarity plug. The plug is convertible.

1,012,198. ELECTRIC-MOTOR STARTER; C. L. Goughnour, Canton, Ohio. App. filed April 19, 1911. A centrifugal switch for a single-phase alternating-current motor.

1,012,209. TESTING APPARATUS; L. V. Lewis, Wilkinsburg, Pa. App. filed May 21, 1910. A voltmeter or ammeter with a case acting as an adjustable slide for the contained coil.

1,012,217. MICROPHONE; G. A. Nussbaum, London, England. App. filed Jan. 28, 1911. Perforated plates form a granule cell.

1,012,231 TELEGRAPHY; M. O. Anthony, Englewood, N. J. App. filed June 9, 1909. Special induction coil winding. Improvement on Patent No. 783,604.

1,012,240. ELECTRIC SWITCH; F. B. Bowers, Penn Yan, N. Y. App. filed Oct. 12, 1910. Pull socket for incandescent lamps.

1,012,257. DYNAMO-ELECTRIC MACHINE; F. Jeffrey, Milwaukee, Wis. App. filed Feb. 14, 1910. Rotating field; wedging members to prevent the field coils from bulging.

1,012,298. APPARATUS FOR INDICATING THE CONDITION OF STORAGE BATTERIES; E. M. Tormin, Newton Center, Mass. App. filed Feb. 25, 1910. A hydrometer is employed to indicate the specific gravity of the electrolyte.

1,012,326. ELECTROTHERAPEUTIC APPARATUS; C. E. Campbell, Lynn, Mass. App. filed Nov. 10, 1909. A casing with a transformer, a condenser, a high-frequency coil and a switch for obtaining differing effects.

1,012,335. FIRE-ALARM SYSTEM; O. De Champ, Everett, Mass. App filed Dec. 15, 1910. The call-box number is visually displayed and also sounded.

1,012,381. DYNAMO-ELECTRIC MACHINE OF THE HOMOPOLAR TYPE; F. H. Loring, London, England. App. filed March 13, 1911. The field is built up of corrugated rings nested together.

1,012,384. BURGLAR-PROOF KEYLESS ALARM LOCK; J. Lyon, Dayton, Ohio. App. filed Dec. 9, 1909. To co-operate with the usual door lock.

1,012,387. TREATMENT OF BRINE; G. W. Malcolm and F. T. Munton, Davenham and Winsford, England. App. filed March 25, 1910. Electrochemical method of removing magnesium and calcium salts.

1,012,456. RADIO-TELEPHONY; G. Seibt, Berlin, Germany. App. filed Dec. 20, 1907. The resistance of the microphone is made equal to that of the system in order to obtain maximum efficiency.

1,012,461. TERMINAL BUSHING FOR ELECTRIC BATTERIES; J. R. Sloan, Altoona, Pa. App. filed June 9, 1911. A cupped passage and a packing nut.

1,012,470. APPARATUS FOR ELECTROLYSIS OF FUSED ALKALI CHLORIDES; E. Steinbuch, Monthey, Switzerland. App. filed Aug. 22, 1910. A diaphragm between vertically separated electrodes.

1,012,477. ALTERNATING-CURRENT-MOTOR-CONTROLLING APPARATUS; A. Sundh, Yonkers, N. Y. App. filed Oct. 31, 1908. Acceleration of induction motors for elevators, etc.

1,012,496. WIRELESS RECEIVING ELECTRIC SYSTEM; C. Wirth, Nuremberg, Germany. App. filed Dec. 20, 1910. To prevent interference with systems for controlling automobile torpedoes, etc.

1,012,524. APPARATUS FOR AUTOMATIC REGULATION OF RECTIFIERS AND ROTARY CONVERTERS; F. B. Crocker, New York, N. Y. App. filed July 25, 1904. Inductive action; no moving parts.

1,012,525 ELECTRIC SWITCH; M. H. Cullen, Chattanooga, Tenn. App. filed Oct. 15, 1909. A locking device for motor ignition systems, etc.

1,012,531. PROCESS FOR THE MANUFACTURE OF SOLID-FASHIONED BODIES CONTAINING SILICON CARBIDE; G. Egly, Charlottenburg, Germany. App. filed Oct. 16, 1905. Silicon carbide, silicon and glycerine heated in a mold.

1,012,549. ELEMENTS FOR ELECTRIC RHEOSTATS; J. W. Hoffman and H. M. Rogers, Lansing, Mich. App. filed March 11, 1911. Two concentric tubes for dipping in a liquid.

1,012,561. MOUTH FILM HOLDER FOR ROENTGEN-RAY SKIAGRAPHS; A. H. Ketcham, Denver, Col. App. filed March 20, 1910. Ha[illegible] to be held between the teeth in taking skiagraphs of teeth [illegible]

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